Optimal Monitoring of Unemployment Insurance Recipients

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Abstract

This paper studies the optimal government monitoring of job search effort by unemployment insurance recipients. The theoretical model is a labor search economy with imperfectly observable search effort. The government observes a signal that is correlated with job search effort and must decide the threshold level of the signal that determines continued UI eligibility. The results of the numerical analysis show that the government increases this threshold level at each duration of the unemployment spell. Further, an increasing threshold profile can generate a sharp increase and subsequent drop-off in search effort near the expiration of benefits as observed in the data.

Keywords: Unemployment Insurance; Job Search; Government Policy.

JEL Classification Numbers: I38, J64, J65

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1 Introduction

A fundamental issue in the public provision of unemployment insurance (UI) is understanding how to help unemployed individuals maintain a standard of living while avoiding the creation of disincentives to job search efforts. These disincentives exist because job search generally requires a measurable effort which is not perfectly observed by the government. Government is generally left with at least three policy tools to influence the trade-off between insurance and incentives. First, the government can influence job search by changing the amount of the unemployment benefit. An increase in weekly benefit amount generally decreases the incentives to search for a job by increasing the value of remaining unemployed. Second, the government can change the maximum duration of UI eligibility. Increasing the maximum duration also decreases the incentives to search for a job by increasing the value of remaining unemployed. Finally, the government can influence job search behavior by attempting to monitor job search requirements against the threat of discontinued eligibility. This paper studies the optimal monitoring policy throughout the unemployment spell.

While much of the UI literature has prescribed decreasing the amount of the benefit throughout the unemployment spell, none has offered a reasonable model for implementing such a system. Conceptually, however, that line of research suggests that in order to achieve the best policy, the incentives created by government policy should encourage increasing job search effort in each additional period of the UI-eligible unemployment spell[1]. Shavell and Weiss (1979) and Hopenhayn and Nicolini (1997) show that the optimal benefit level decreases throughout the duration of the unemployment spell when search effort is not observable by the government. In practice, however, implementability of a decreasing benefit profile is institutionally difficult, and effort is at least partially observable. Given these constraints, this essay complements the literature by showing that the government can still improve expected welfare by increasing minimum job search requirements as unemployment duration increases.

The model economy in this paper extends Hopenhayn and Nicolini (1997) by allowing the government to imperfectly observe job search effort. The government observes a noisy signal and

[1]That is, the duration of the unemployment spell preceding the expiration of UI eligibility.

chooses whether to allow an individual to remain eligible for UI in the next period. Individuals can increase the expected value of this signal by increasing job search effort. The government chooses the threshold value of this signal that determines continued UI-eligibility. By choosing this value at each duration of UI eligibility, the government is able to influence job search effort. The results of the numerical analysis show that an increasing sequence of threshold signals maximizes the expected welfare of individuals. In other words, the optimal government policy requires stricter job search requirements in each consecutive period of the UI-eligible unemployment spell.

The individual agent's problem in this paper follows an extensive unemployment insurance literature, in which costly job search effort affects the individual's probability of finding a job. Shavell and Weiss (1979), Phelan and Townsend (1991), Hopenhayn and Nicolini (1997), and Wang and Williamson (1996) each apply this concept in the determination of the optimal insurance policy in a moral hazard model. Shavell and Weiss (1979) and Hopenhayn and Nicolini (1997) each show that the optimal profile of unemployment benefits is decreasing throughout the duration of unemployment. I assume that a decreasing benefit profile is not implementable and instead show that the optimal threshold level of observed search effort is increasing.

Several papers have studied the effects of changes in UI policy parameters such as benefit amount, benefit duration, job search monitoring, and job search assistance. Meyer (1990) finds that a 10 % increase in the benefit amount leads to a 9 % decrease in the exit rate from unemployment. Moffitt (1985) finds that a 1 % increase in the benefit level is associated with a .36 % increase in the unemployment spell, and a one week increase in the maximum duration of UI leads to an increase in the unemployment spell by .15 weeks. With regards to changes in work search requirements, Klepinger (2002) studies the results of a controlled experiment in the State of Maryland and finds that an increase of 2 required job contacts per week reduces the unemployment spell by three quarters of a week. McVicar (2008) estimates the effects of job monitoring suspensions in Northern Ireland and finds that zero monitoring (relative to various individualized job contact requirements) increases average duration of unemployment by 16 %.

This paper proceeds as follows. Section 2 discusses the relevant features of unemployment insurance provision in the United States. The theoretical model is presented in Section 3. Section

4 shows how the model is calibrated and presents the numerical results. Section 5 shows how the model can explain observed search behavior, and Section 6 concludes the essay. The computational algorithm and sensitivity analysis are provided in Appendix B.

2 Unemployment Insurance in the United States

In the United States, unemployment insurance is administered by the individual state governments, subject to federal guidelines. States choose the payment structure of UI benefits, UI eligibility, and maximum duration.[2] Almost every state provides UI for a maximum of 26 weeks. Most states choose the amount of the benefit to be some fraction of previous wages up to some maximum. While the fraction of previous wages doesn't change much across states, the maximum payment varies significantly.

UI recipients are generally required to provide the state government with evidence of job search activities to remain eligible. Job search can include a wide variety of activities including spending time searching for job advertisements, filling out job applications, attending job counselling, contacting employers, and interviewing. Out of the various job search activities, states generally require UI recipients to provide evidence of employer contacts per week.[3] If the minimum number of job contacts is not satisfied, then the individual can become ineligible for continued UI receipt. Because contacting employers is only one of several potential job search activities, the search effort observed by the government is limited.

Most state governments use the threat of discontinued UI eligibility to increase job search standards as the duration of unemployment increases. In Pennsylvania, for example, UI recipients are required to show evidence of at least two job applications in each of the first eight weeks of unemployment and at least three job applications thereafter. South Carolina increases the minimum number of weekly contacts from 4 to 5 after several weeks of unemployment, depending

[2]For a more complete overview of unemployment insurance policy across US states, see Hamermesh (1977) or Anderson (2001).

[3]States are required to publish a handbook describing UI benefits and eligibility. Information about each state's UI eligibility requirements mentioned in this paper was obtained from the respective state's handbook. Links to each state's UI information are listed at http://www.servicelocator.org/OWSLinks.asp .

on the eligibility for federally expended benefits. In Arkansas, UI recipients are required to begin reporting contacts weekly after the thirteenth consecutive week of unemployment. Other states, such as Iowa, Indiana, Kentucky, and Maine require that UI recipients accept lower paying jobs, jobs that are geographically further from the UI recipient's residence, or jobs that are less matched to the recipient's skill set as unemployment duration increases. Each of these requirements induces higher search effort as the unemployment duration increases. Finally, some states, such as Maryland and West Virginia, simply state that job search effort should increase throughout the duration of unemployment. Although this seems subjective, UI recipients are generally required to provide evidence of job search at scheduled interviews with state government officials. If the individual has not shown evidence of increasing search effort, he may become ineligible for continued UI receipt.

3 Model

This section presents a model of moral hazard and imperfect monitoring of job search effort in the provision of unemployment insurance. The model economy is populated by a unit measure of infinitely-lived individuals who are either employed and receiving wage w, unemployed and receiving unemployment benefit b, or unemployed and receiving no income. Each individual has preferences:

$$E\sum_{t=0}^{\infty}\beta^t[u(z_t)-\phi a_t], \tag{1}$$

where E is the expectation operator, β is the personal discount factor, t indexes the period, z is consumption, a is a measure of search effort, ϕ is the marginal disutility of search effort, and $u(\cdot)$ is strictly increasing, strictly concave, twice continuously differentiable over $\mathbb{R}_+$, and satisfies $u(0)=0$, $\lim_{z\to 0^+} u'(z)=\infty$, and $\lim_{z\to\infty} u'(z)=0$. With probability δ, an employed individual becomes separated from his job and becomes eligible for UI for a maximum of T periods. Individuals are indexed by j as follows: $j=1$ are employed, $j=2,\dots,T+1$ are unemployed for the $(j-1)^{th}$ consecutive period, and $j=T+2$ have exhausted UI for the current unemployment spell. All unemployed individuals must exert some search effort to find a job. For a given search effort

$a \in [0, \infty)$, an unemployed person finds a job with probability $p(a)$, where $p(\cdot)$ satisfies $p(0) = 0$, $p'(\cdot) > 0$, $p''(\cdot) < 0$ and $\lim_{a\to\infty} p(a) = 1$. This search effort is not fully observable by the government, which creates a moral hazard problem. Instead, the government receives a noisy signal, $\tilde{\theta}$ that has probability distribution function $f(\tilde{\theta}; \mu, \epsilon)$, where μ and ϵ are the first and second moments of the distribution, respectively. Search effort affects the signal in that $\mu = a$, so that $E(\tilde{\theta}) = a$. The government chooses some threshold level, θ^* such that all signals observed above θ^* remain eligible for unemployment compensation in the following period, and all signals observed below θ^* become ineligible for UI for the remainder of the unemployment spell. For a given θ^* and search effort a, the probability that an individual will remain eligible for UI will be:

$$q(a, \theta^*) \equiv \int_{\theta^*}^{\infty} f(\tilde{\theta}; a, \epsilon)\, d\tilde{\theta}. \tag{2}$$

Then with probability $1 - q(a, \theta^*)$, the government receives a signal below the threshold, and the unemployed individual becomes ineligible for UI for the remainder of the unemployment spell. Suppose the government chooses this threshold level of the signal for each UI-eligible unemployed individual, and let $\boldsymbol{\theta} = \{\theta_2^*, \ldots, \theta_T^*\}$ be the sequence of threshold signals.[4] Finally, suppose that UI is financed by a lump-sum tax τ, so that employed individuals have after-tax consumption $c = w - \tau$. Then, the value function can be written as follows[5]:

$$V_1 = u(c) + \beta((1-\delta)V_1 + \delta V_2) \tag{3}$$

$$V_j = \max_{a_j} \{u(b) - \phi a_j + \beta(p(a_j)V_1 + (1 - p(a_j))Q_{j+1}\}, \tag{4}$$

$$Q_{j+1} = q(a_j, \theta_j^*)V_{j+1} + (1 - q(a_j, \theta_j^*))V_{T+2} \tag{5}$$

$$\text{for } j = 2, \ldots, T+1 \text{ and } q(a, \theta_{T+1}^*) \equiv 1$$

$$V_{T+2} = \max_{a_{T+2}} \{u(0) - \phi a_{T+2} + \beta(p(a_{T+2})V_1 + (1 - p(a_{T+2}))V_{T+2})\}. \tag{6}$$

[4]Note that search effort in period T of the unemployment spell will not be affected by monitoring, since UI will subsequently expire regardless.

[5]Notation is suppressed here so that $V_j = V_j(c, b, \boldsymbol{\theta})$ for $j = 1, \ldots, T+2$.

The associated policy functions are the solutions to the value functions and can be represented by the following equations:

$$a_j(c,b,\boldsymbol{\theta}) = \underset{a_j\in[0,\infty)}{\text{argmax}} \left\{u(b) - \phi a_j + \beta(p(a_j)V_1 + (1-p(a_j))Q_{j+1}\right\} \tag{7}$$

$$\text{for } j = 2,\ldots,T+1$$

$$a_{T+2}(c,b,\boldsymbol{\theta}) = \underset{a_{T+2}\in[0,\infty)}{\text{argmax}} \left\{u(0) - \phi a_{T+2} + \beta(p(a_{T+2})V_1 + (1-p(a_{T+2}))V_{T+2})\right\}. \tag{8}$$

Equations (7) and (8) show how optimal search effort depends on employed consumption, the level of the benefit, and the threshold signal. An increase in the employed consumption level increases the payoff to finding a job, so search effort is increasing in c. Conversely, an increase in the benefit level increases the payoff to remaining unemployed, so search effort is decreasing in b. Finally, increases in threshold signal can induce higher search effort by increasing the probability that an individual with low search effort becomes ineligible for UI. For a given threshold signal, θ^*, Figure 1 shows how changes in effort level affect the distribution of signals by increasing the first moment. The graph shows how an increase in the effort level increases the probability that the observed signal is greater than the threshold. Figure 2 shows how the probability that the government observes a

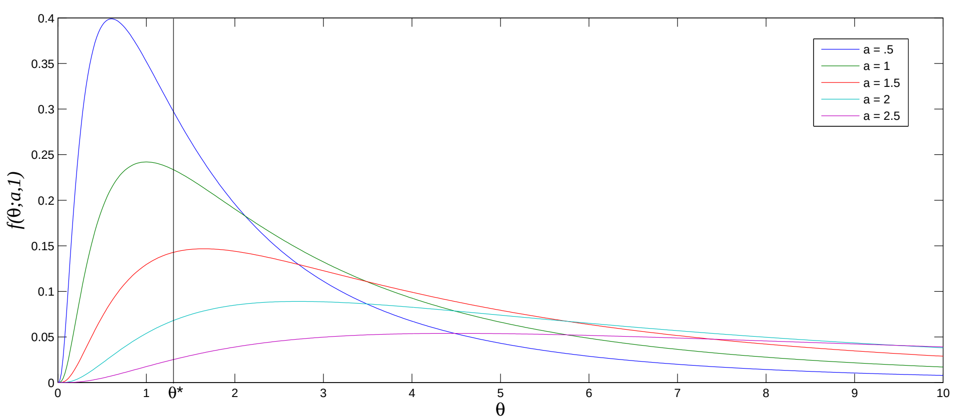

Figure 1: This figure shows how a log-normal distribution with $\epsilon = 1$ changes with changes in the effort level. For a given threshold signal, θ^*, the entire area underneath the curve and to the right of θ^* represents the probability of the government receiving a "good" signal.

good signal, $q(a, \theta^*)$, changes with changes in search effort for a fixed θ^*.

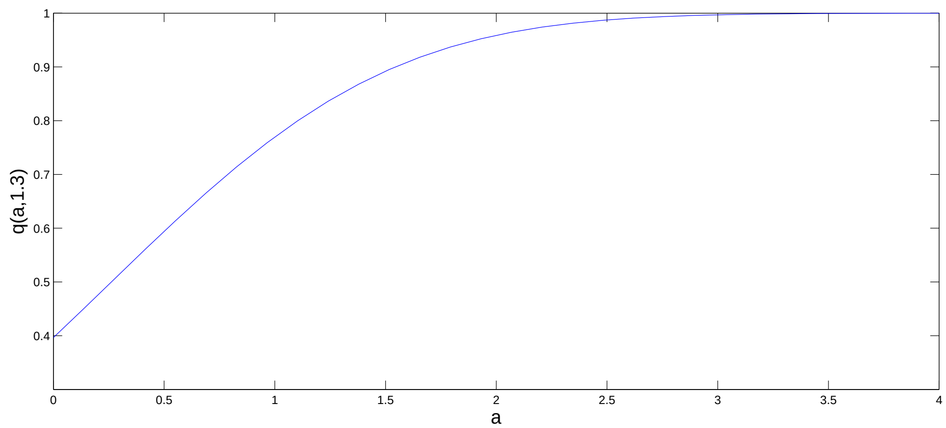

Figure 2: This figure shows how search effort affects the probability of the government observing a "good" signal for $\theta^* = 1.3$.

Finally, Figure 3 shows a series of functions $q(a, \theta^*)$ for various threshold signals, θ^*. For a given search effort, the graph also shows how increases in the threshold signal reduce the probability that the government observes a good signal. This can be seen by fixing a point on the horizontal axis and noticing how the functions decrease with increases in θ^*.

For a given consumption level, benefit, and threshold signal, the transition function can be derived from the optimal search efforts $\{a_2(c, b, \boldsymbol{\theta}), \ldots, a_{T+2}(c, b, \boldsymbol{\theta})\}$ and the functions p and q. Let $\{\lambda_{1,t}, \ldots, \lambda_{T+2,t}\} = \Lambda_t$ be the distribution of all individuals at time t. Then for any distribution of individuals in period t, the distribution in period $t+1$ is determined by the following set of equations:

$$\begin{aligned}
\lambda_{1,t+1} &= (1-\delta)\lambda_{1,t} + \sum_{j=2}^{T+2} p(a_j)\lambda_{j,t} \\
\lambda_{2,t+1} &= \delta\lambda_{1,t} \\
\lambda_{j+1,t+1} &= (1-p(a_j))q(a_j, \theta_j^*)\lambda_{j,t} \qquad \text{for } j = 2, \ldots, T \\
\lambda_{T+2,1} &= (1-p(a_{T+1}))\lambda_{T+1,t} + (1-p(a_{T+2}))\lambda_{T+2,t} + \sum_{j=2}^{T}(1-q(a_j, \theta^*))\lambda_t^j.
\end{aligned} \tag{9}$$

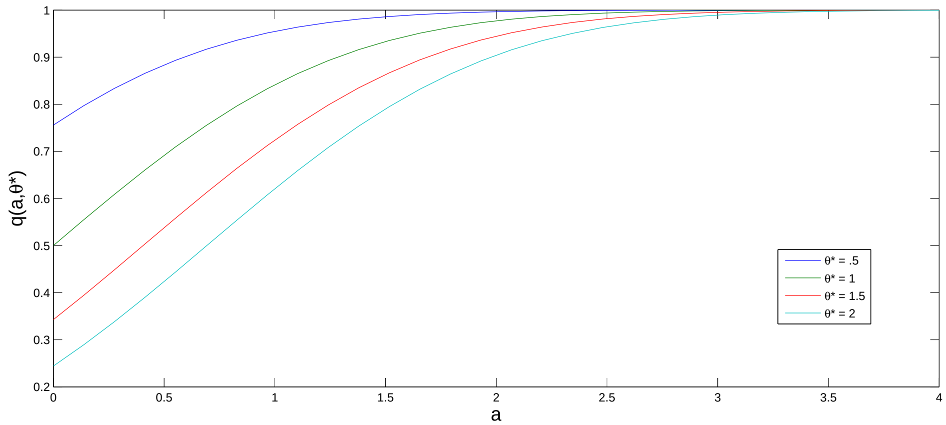

Figure 3: This graph shows how changes in search effort affect the probability of the government observing a "good" signal for different threshold levels of the signal (θ^*).

The first equation in (9) states that the measure of employed individuals in period $t+1$ equals the measure of individuals that remain employed plus the measure of individuals exiting unemployment at each duration. The second equation in (9) shows that the measure of individuals entering the first period of unemployment equals the measure of individuals that have lost their job. The third equation in (9) gives the transition for those remaining unemployed and eligible for UI. Finally, the fourth equation in (9) shows how the measure of uncovered unemployed individuals includes those remaining in the state plus individuals whose UI has expired plus individuals who have become ineligible for continued UI receipts.

Let $\Gamma(\cdot)$ be the transition function that satisfies Equations (9), so that:

$$\Gamma(\Lambda_t) = \Lambda_{t+1}. \tag{10}$$

Define Γ_t as the t^{th} application of the function Γ so that $\Gamma_1(\Lambda_0) = \Gamma(\Lambda_0)$, $\Gamma_2(\Lambda_0) = \Gamma(\Gamma(\Lambda_0))$, and so on. Then, from any initial distribution, Λ_0, the stationary distribution $\Lambda(c, b, \boldsymbol{\theta})$ can be determined by taking the infinite limit of the function Γ_t:

$$\Lambda(c, b, \boldsymbol{\theta}) \equiv \lim_{t\to\infty} \Gamma_t(\Lambda_0). \tag{11}$$

3.1 Stationary Equilibrium and Optimal Government Policy

The government budget constraint in any stationary economy without government debt must satisfy the following equation:

$$\lambda_1(c, b, \boldsymbol{\theta})\ \tau = \sum_{j=2}^{T+1} \lambda_j(c, b, \boldsymbol{\theta})\ b. \tag{12}$$

The left-hand-side of Equation (12) represents total tax payments by employed individuals and the right-hand-side represents total UI payments made. A stationary equilibrium can be defined now as follows:

Definition 1. *A stationary equilibrium is a set of functions* $\{V_j(c, b, \boldsymbol{\theta}), a_j(c, b, \boldsymbol{\theta}), \lambda_j(c, b, \boldsymbol{\theta})\}_{j=1}^{T+2}$ *and government policy* $(\tau, \{\theta_2^*, \ldots, \theta_T^*\})$ *such that:*

1. *For a given government policy,* $(\tau, \{\theta_2^*, \ldots, \theta_T^*\})$*:*
   (a) $\{V_j(c, b, \boldsymbol{\theta})\}_{j=1}^{T+2}$ *and* $\{a_j(c, b, \boldsymbol{\theta})\}_{j=1}^{T+2}$ *solve the individual's optimization problem.*[6]
   (b) *The stationary distribution is determined by the policy functions* $\{a_j(c, b, \boldsymbol{\theta})\}_{j=1}^{T+2}$ *and the associated transition function* Γ*.*
2. *Government policy* $(\tau, \{\theta_2^*, \ldots, \theta_T^*\})$ *satisfies the government budget constraint* (12)*.*

The objective of the government is to use the policy tools to maximize the expected welfare of individuals in the economy. Define the welfare function W as follows:

$$W(c, b, \boldsymbol{\theta}) = \sum_{j=1}^{T+2} \lambda_j(c, b, \boldsymbol{\theta})\ V_j(c, b, \boldsymbol{\theta}). \tag{13}$$

Then the optimal government policy is a Stationary Equilibrium that satisfies the government objective:

$$\max_{\tau, \theta_2, \ldots, \theta_T} W(c, b, \boldsymbol{\theta}) \tag{14}$$

$$s.t.\ (12)\ .$$

[6]Since employed individuals do not search for a job, $a_1(c, b, \boldsymbol{\theta}) = 0$.

The government's objective (14) shows how the government will set the threshold signal in each period in a way that optimizes welfare. To understand the decision of the government, suppose the government sets the threshold signal to $\left\{\hat{\theta}_2^*, \ldots, \hat{\theta}_T^*\right\} >> 0$. Then consider a marginal reduction in $\hat{\theta}_j^*$ for some $j \in \{2, \ldots, T\}$. The decrease in the threshold signal decreases induced search effort, which increases the value function of individual j. But this decrease in search effort decreases the exit rate from unemployment for at least period-j individuals *and* increases the measure of UI-eligible individuals in period $j+1$. Then this increase in the measure of unemployed individuals and UI-eligible unemployed individuals causes an increase in benefit payments, which causes an increase in the tax level needed to finance the increase in benefit payments. This increase in the tax level decreases the consumption of employed individuals, which decreases the value function of employed individuals. Further, the increase in overall unemployment implies a decrease in the measure of employed individuals, reducing the measure of individuals available to finance the unemployment benefit system.

Conversely, increases in the threshold signal increase search efforts, which decreases unemployment, increases employment, and reduces the government-budget-constraint-clearing tax level, which increases the value of being employed. However, since the government imperfectly observes search effort, some individuals become ineligible for continued UI receipt. This creates an inefficiency in government policy by distorting the consumption-smoothing benefits of UI. The magnitude of this inefficiency rises with increases in θ_j^*. The optimal decision of the government will then balance employment, search incentives, insurance value of the benefit, and inefficiencies that arise from imperfect monitoring.

4 Quantitative Analysis

This section presents the calibration of the model and the numerical results. The first part of this section shows how the theoretical model is calibrated, and the second part presents the results of the numerical analysis.

4.1 Functional Forms and Parameters

This subsection describes the functional forms and parameter choices used in the numerical analysis. Utility from consumption takes the form of constant relative risk aversion: $u(c) = \frac{c^{1-\sigma}}{1-\sigma}$. The hazard function that determines the probability of finding a job for a given job search effort, a, takes the form: $p(a) = 1 - \exp(-ra)$. Both the utility and hazard functions take the same functional form as Hopenhayn and Nicolini (1997). Since search effort is truncated at zero, a log-normal distribution represents the distribution of search effort signals. Then the function determining the probability of remaining eligible for UI (here on referred to as the *eligibility hazard*) is:

$$q(a, \theta^*) = \int_{\theta^*}^{\infty} \frac{1}{\frac{\tilde{\theta}}{s}\epsilon\sqrt{2\pi}} \exp\left(\frac{-(\ln\frac{\tilde{\theta}}{s} - \frac{a}{s})^2}{2\epsilon}\right) d\tilde{\theta}, \tag{15}$$

where s is scaling factor so that job search effort occurs in a relevant portion of the distribution.

In the numerical analysis, time is scaled so that one period is equal to approximately 3.25 weeks. The coefficient of relative risk aversion, σ is set to .75, which is slightly higher than the one-week value set to .5 in Hopenhayn and Nicolini (1997). The marginal disutility of effort, ϕ, is set to 1, which is also the value that the parameter takes in the same paper. The time discount factor, β is set to .995, which is slightly lower than the weekly value of .999 often used in the literature. The maximum duration of UI eligibility T is 12 periods, which implies an actual duration of 39 weeks. This amount exceeds the maximum duration of 26 weeks provided by most states, but does not exceed the 39 weeks that are provided when states provide extended benefits. Further, using a higher number of periods increases the dimension of the solution space, which provides more information about the shape of the threshold signal profile. The wage w is set to 100 so that the benefit level b is naturally a gross replacement ratio. The benefit b is set to 40, which equals the average replacement ratio across US states.[7] In choosing the variance, ϵ, of the signal distribution, $f(\tilde{\theta}; a, \epsilon)$, and the scaling factor, s, special consideration was given to the properties of the log-normal distribution. Such a distribution is only suitable for small but positive values of observed data. Accordingly,

[7]Replacement ratio here is defined here as the state's average weekly benefit payment divided by average gross weekly earnings.

$\epsilon = 1$ and $s = 20$ was chosen to scale the model to the relevant portion of the distribution. The remaining parameters are the unemployment hazard function parameter, $r = .0035$, and job separation rate, $\delta = .982$. The unemployment hazard rate parameter was calibrated to match the hazard rate estimations in Meyer (1990). Finally, the job separation parameter was calibrated so that an annualized probability of job separation is 25 percent. According to the Job Opening and Labor Turnover Survey data from the Bureau of Labor Statistics, the annualized average percentage of job separations from December 2000 to February 2012 is approximately 35 percent. Because the sample period reflects a period of unusually high job separation, the model is calibrated to match an annualized average of 25 percent.

4.2 Numerical Results

This section presents the results from the computational analysis. Figure 4 shows how the optimal profile of threshold signal is increasing. This is consistent with profile of incentives created when

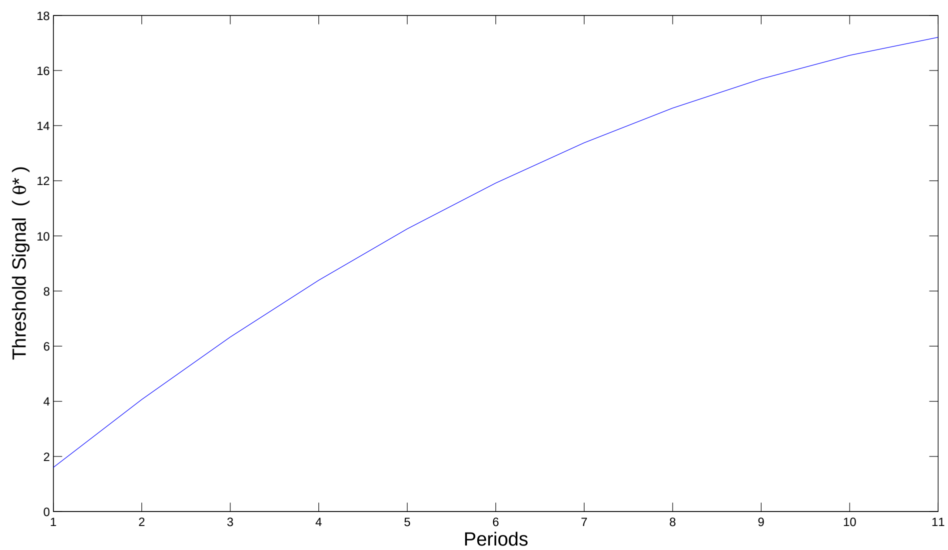

Figure 4: This graph shows how the optimal threshold signal changes with unemployment duration.

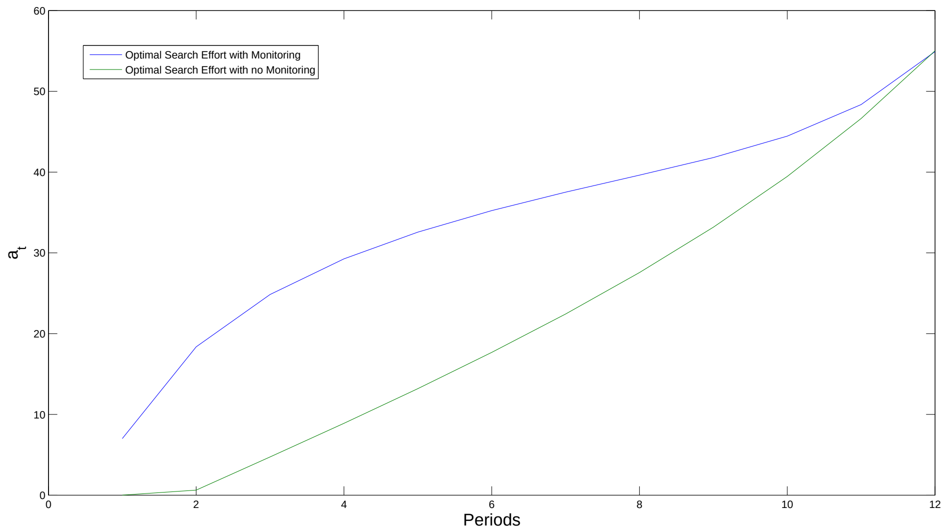

Figure 5: This graph compares the effect of the optimal threshold signal profile on search effort to an economy without job search monitoring.

the government chooses the level of the benefit in each period instead of imperfectly monitoring.[8] In both cases, the government is using policy tools to increase the incentives to search for a job in each consecutive period of the UI-eligible unemployment spell. Figure 5 shows the effectiveness of the monitoring by comparing the optimal search effort with and without monitoring.

The government induces higher search effort by choosing the threshold level of the job search signal, θ^* that determines continued eligibility. Then for a given job search effort, a, the probability of remaining eligible for UI is $q(a, \theta^*)$. Figure 6 shows the equilibrium eligibility hazard function $q(a_t, \theta_t^*)$. The slope of the equilibrium eligibility hazard function $q(a_t, \theta_t^*)$ is negative throughout the first half of the eligible period, implying that the probability of losing UI eligibility is increasing for that period. This decrease in $q(a_t, \theta_t^*)$ early in the unemployment spell reflects a steeper increase in θ_t^*, relative to the increase in a_t. Although θ_t^* is strictly increasing throughout the unemployment spell, search effort rises sharply as the individual nears the expiration of UI eligibility, causing a sharp increase in $q(a_t, \theta_t^*)$ in the latter periods of UI eligibility.

[8]As in Shavell and Weiss (1979) and Hopenhayn and Nicolini (1997).

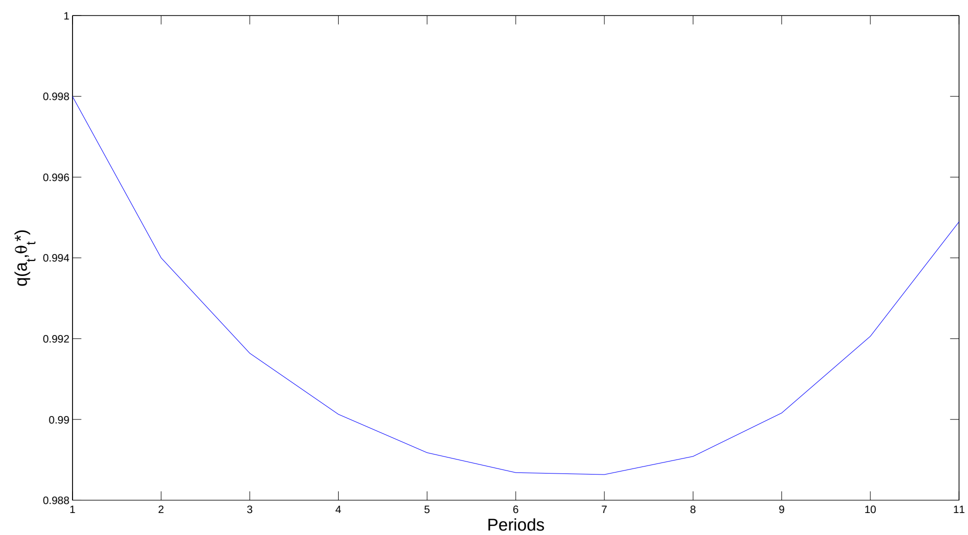

Figure 6: This graph shows the equilibrium eligibility hazard.

5 Monitoring and Search Effort: Model vs. the Data

One of the primary contributions of this paper is to show how the optimal job search requirements increase throughout the unemployment spell, even if the government cannot perfectly monitor job search. Section 2 provided several examples of US states that increase job search requirements with the unemployment duration. This section shows that increasing job search requirements throughout the unemployment spell can potentially explain search behavior observed in the data. Specifically, a reasonable government policy is tested to determine whether the model can generate the increase and subsequent drop-off in job search effort near the expiration of UI eligibility as shown in Krueger and Mueller (2010).

Several US state UI policies keep the job search requirements constant for the first several weeks of unemployment and increase standards as UI eligibility reaches expiration. Accordingly, the function chosen (shown in Figure 7), $\theta_t^* = .0003t^5 + 10$, is increasing but flat for first several periods.

The corresponding search effort shown in Figure 8 shows how the model is able to generate

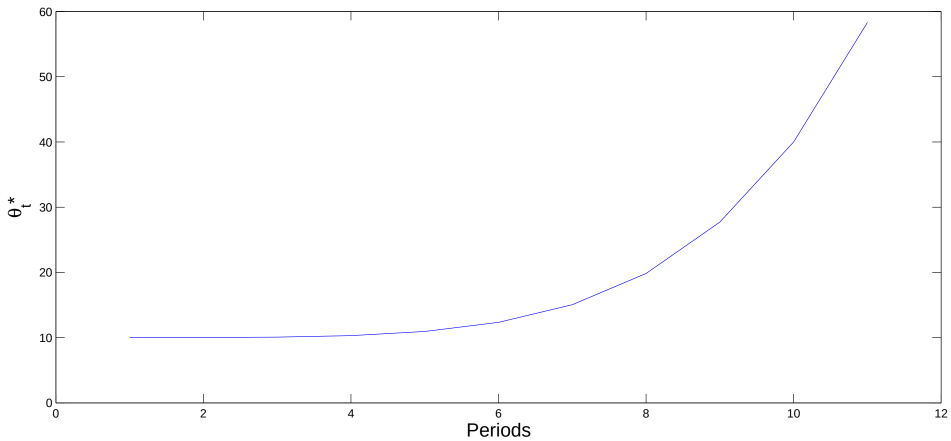

Figure 7: This figure shows the profile of the threshold signal applied in this numerical experiment.

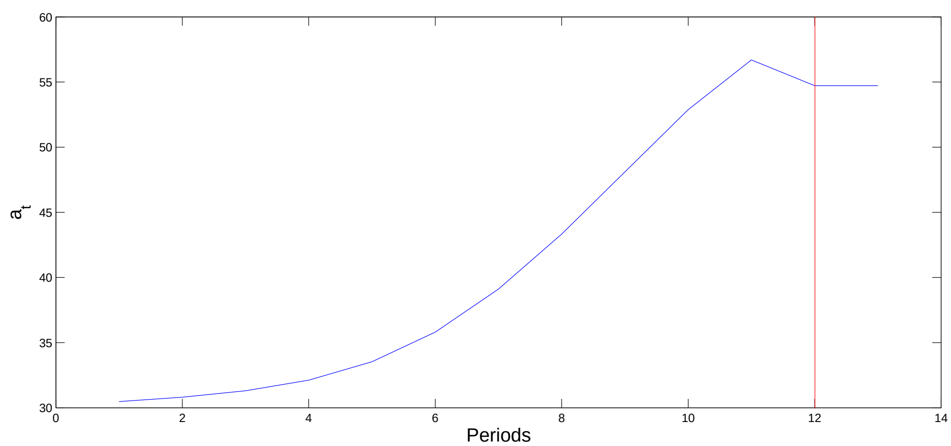

Figure 8: This figure shows the job search effort over the unemployment spell when the government chooses the threshold signal in Figure 7. The vertical line designates the expiration of UI eligibility.

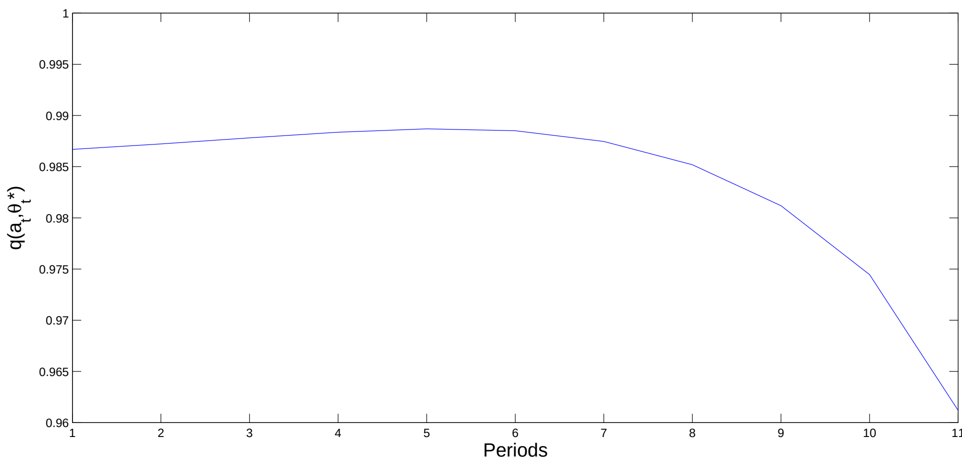

Figure 9: This figure shows the profile of the equilibrium eligibility hazard when the government chooses the threshold signal in Figure 7.

exactly the pattern of search behavior observed in the data. The drop-off near the expiration of UI eligibility (period 12 in the graph) occurs because the value of retaining UI eligibility remains high enough near expiration to exceed search effort by ineligible unemployed individuals.

6 Conclusion

Much of the literature on the optimal provision of UI has shown that policy should encourage increasing job search with unemployment duration. This paper extends the literature by showing that the optimal profile of work search requirements increases with unemployment duration, even if search effort is not perfectly observed. The evidence presented suggests that many U.S. states have already implemented UI policy that promotes increasing job search requirements throughout the unemployment spell, which implies consistency between the model's prediction and the observed actions of UI policy-makers.

After showing that the optimal profile of job search requirements is increasing and providing evidence of this policy by U.S. state governments, I show how the model can explain an empirical puzzle regarding the profile of job search effort. Specifically, an example shows that increases in job search requirements throughout the unemployment spell can generate a steep increase and subsequent drop-off in job search effort near the expiration of UI eligibility, as observed in Krueger and Mueller (2010). The computational experiment showed that job search monitoring provides a feasible explanation for the observed behavior.

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Appendix 1: Computational Algorithm

This section provides the computational algorithm used to solve the numerical model. The goal is to find the values $\{\theta_2^*, \dots, \theta_T^*\}$ that maximize the welfare function. The optimization routine solves the following algorithm over the values of $\boldsymbol{\theta}$.

For a given $\{\boldsymbol{\theta_2^*, \dots, \theta_T^*}\}$:

1. Create a grid of consumption values, $[\boldsymbol{c_1, c_2, \dots, c_N}]$.
2. For each $\boldsymbol{c_i}$ in the consumption grid and for $\boldsymbol{j = 1, \dots, T+2}$, use value function iteration to solve for the value functions and policy functions, $\boldsymbol{V_j(c_i)}$ and $\boldsymbol{a_j(c_i)}$. Save these functions.
3. Guess a tax, $\boldsymbol{\tau_0}$, so that $\boldsymbol{c_0 = w - \tau_0}$, and use this value to interpolate the individual's policy function over the consumption grid.
4. Use the policy function to solve for the stationary equilibrium. If the tax clears the government budget constraint, then the loop is complete. Otherwise, if government revenue exceeds payments, reduce the tax rate (and vice versa) and iterate to convergence.
5. The program should return the objective function as sum of the value functions weighted by the respective measures of the distribution.

Appendix 2: Sensitivity Analysis

This section presents the results of the sensitivity analysis. The goal of the sensitivity analysis is to understand how changes in the model's key parameters change the optimal profile of the threshold signal and the equilibrium eligibility hazard function, $\boldsymbol{q(a_t, \theta_t^*)}$. The key parameters studied in this section are the coefficient of relative risk aversion ($\boldsymbol{\sigma}$), the job separation rate ($\boldsymbol{\delta}$), and the benefit level ($\boldsymbol{b}$).

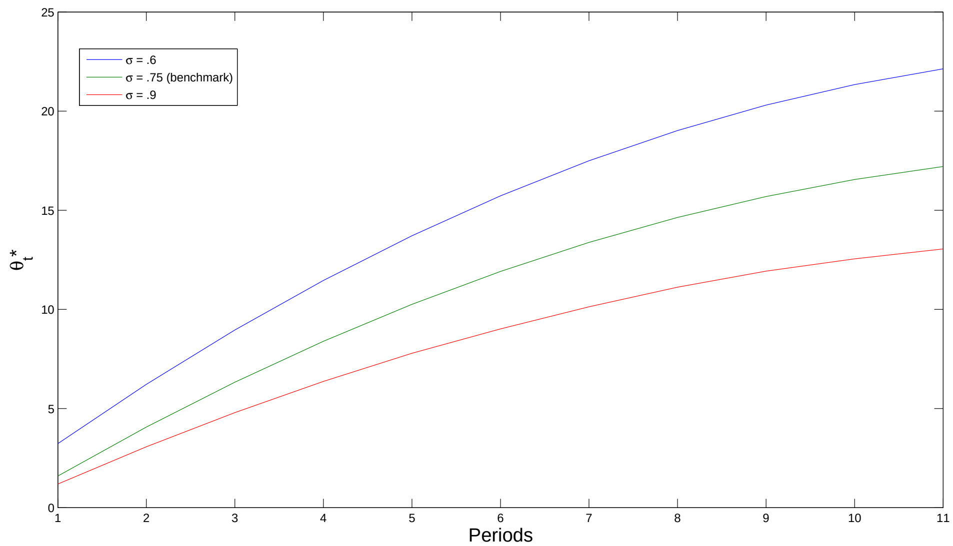

Figure 10: This graph shows variations in optimal signal threshold for changes in the coefficient of relative risk aversion ($\boldsymbol{\sigma}$).

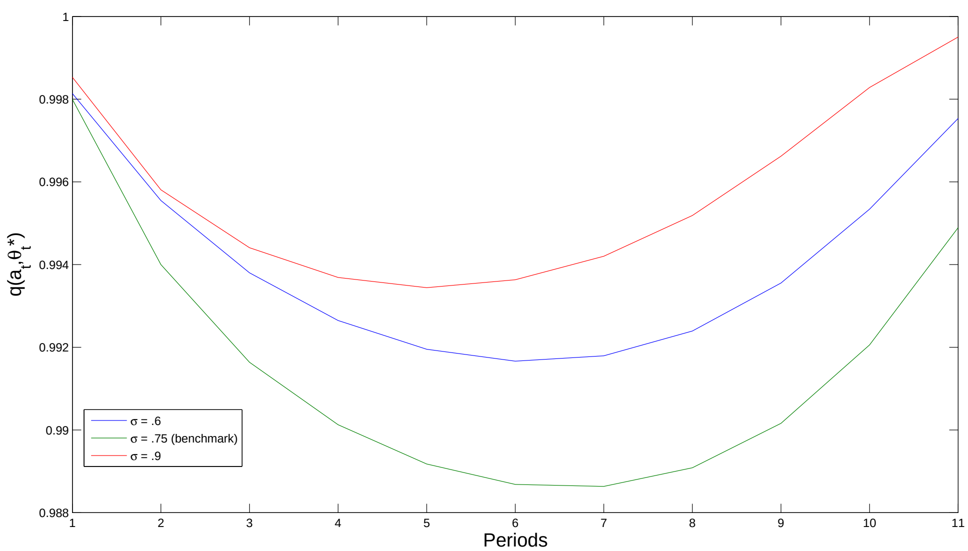

Figure 11: This graph shows the eligibility hazards corresponding to the changes in $\boldsymbol{\sigma}$.

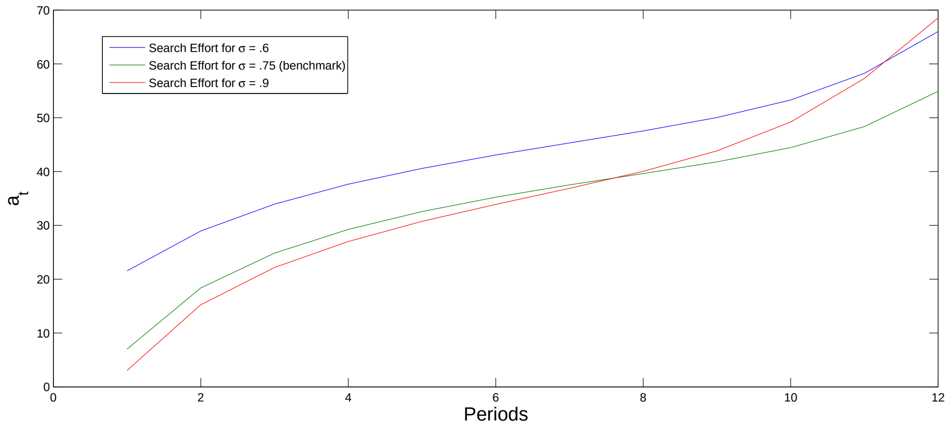

Figure 12: This graph shows the changes in search effort resulting from changes in σ.

Figure 10 shows how the optimal threshold signal is decreasing in the coefficient of relative risk aversion. This can be explained by the rising inefficiency cost of ineligibility as risk aversion increases. The equilibrium eligibility hazard in Figure 11, however, appears non-monotone in σ. The decrease in the function $q(a_t, \theta_t^*)$ from $\sigma = .6$ to $\sigma = .75$ can be explained by a fall in search effort resulting from the reduction in the threshold signal, as shown in Figure 12. However, the sharp increase in the function $q(a_t, \theta_t^*)$ from $\sigma = .75$ to $\sigma = .9$ can be explained by a significant increase in search effort. As σ becomes arbitrarily close to 1, the cost of losing UI eligibility (through UI expiration or the experience of the government receiving a "bad" signal) becomes very high, which leads to increasingly higher search effort throughout the unemployment spell.

Figure 13 shows how the threshold signal decreases with the job separation rate. This implies that the job search requirements are higher in an economy with lower unemployment. Search effort in a low unemployment economy will be higher for two reasons - the pay-off to finding a job and job search requirements will be higher. However, Figure 14 shows how the equilibrium eligibility hazard is lower for an economy with higher job separation. In other words, even though work search requirements are lower in an economy with higher job separation, the equilibrium probability of losing UI eligibility is higher.

Figure 15 shows how changes in the benefit change the optimal threshold signal. The optimal

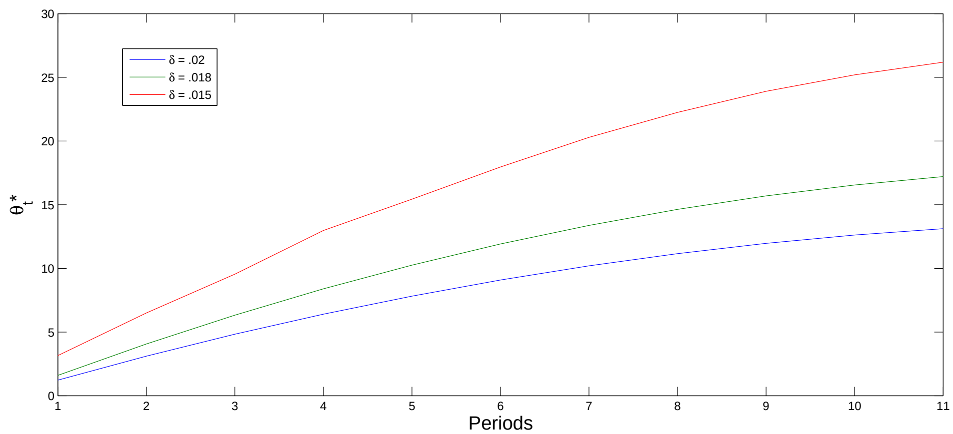

Figure 13: This graph shows variations in optimal signal threshold for changes in the job separation rate ($\boldsymbol{\delta}$).

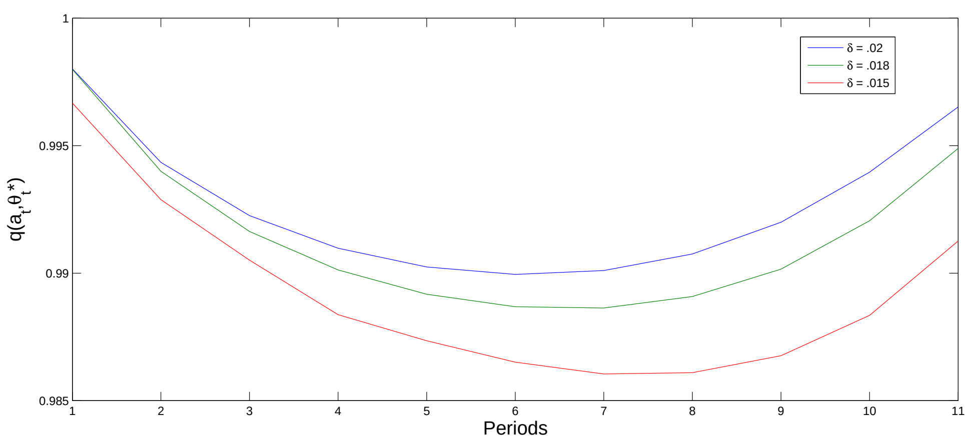

Figure 14: This graph shows the eligibility hazards corresponding changes in $\boldsymbol{\delta}$.

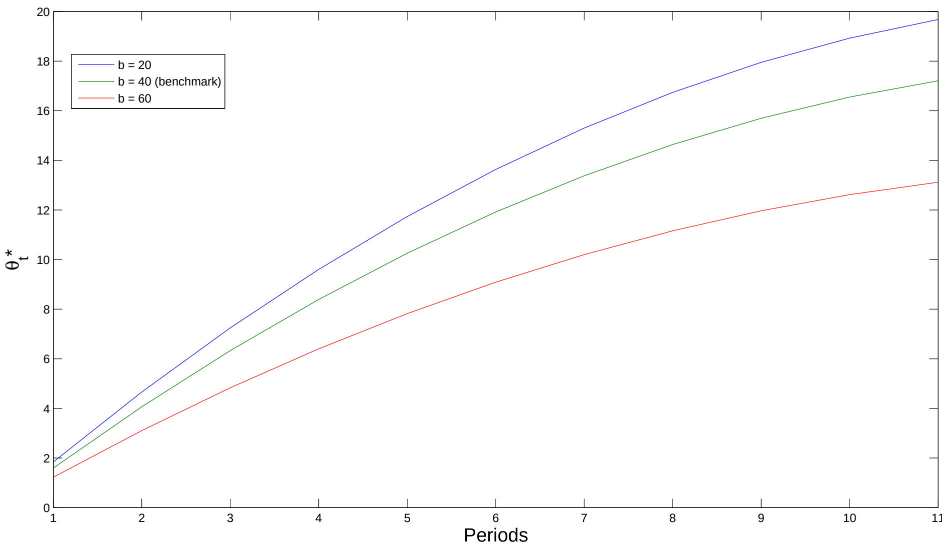

Figure 15: This graph shows variations in optimal signal threshold for changes in the benefit level (***b***).

threshold signal is decreasing in the benefit level. Although this may seem counter-intuitive, a closer look at the eligibility hazard in Figure 16 shows a stricter equilibrium policy for higher levels of the benefit. In the first half of the unemployment spell, the equilibrium eligibility hazards are quite close, but in the latter half, the eligibility hazard is clearly decreasing in the benefit level.

The sensitivity analysis showed that the model is robust to variations in the coefficient of relative risk aversion, the job separation rate, and the benefit level. In each case, the profile of the optimal threshold signal remained strictly increasing.

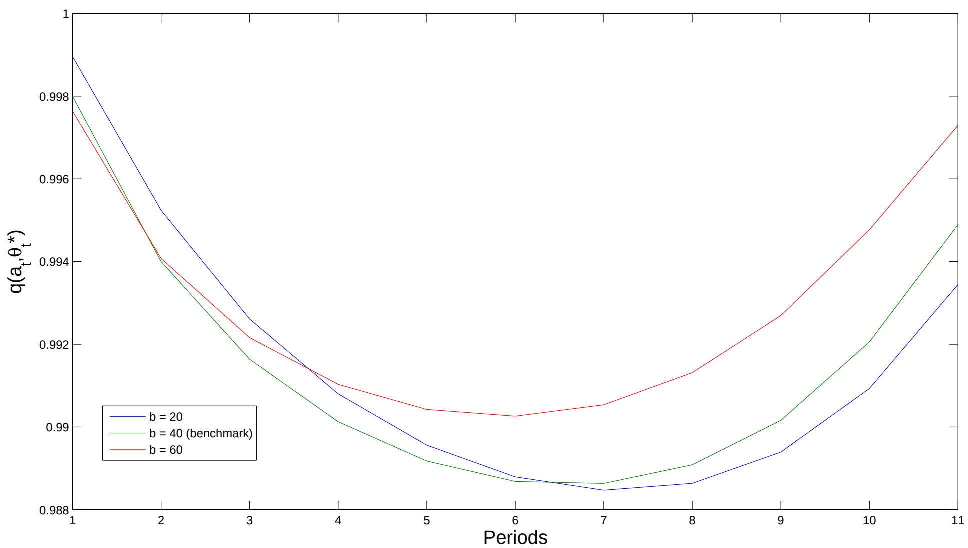

Figure 16: This graph shows the eligibility hazards corresponding changes in $\boldsymbol{b}$.