Online Appendix for "Should Unemployment Insurance Vary With the Unemployment Rate? Theory and Evidence"

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Contents

A.1 Characterizing Agent Behavior

A.1.1 Reservation Wage

The job search model in the main text delivers a reservation wage, $\overline{w} = \overline{w}(b, \tau)$ satisfying:

$$U(\overline{w} - \tau) = U(b) - \psi(e) + \frac{\lambda(e, \alpha)}{\rho + s}\varphi(\overline{w}) \tag{1}$$

where $\varphi(\overline{w}) \equiv \int_{\overline{w}}^{\infty}[U(w - \tau) - U(\overline{w} - \tau)]dF(w)$ is the expected surplus from a match. An alternative representation of the reservation wage equation is the following:

$$U(\overline{w} - \tau) = u\left(U(b) - \psi(e)\right) + (1 - u)E[U(w - \tau)|w \geq \overline{w}] \tag{2}$$

where $u \equiv \frac{\rho+s}{\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w})}$ and $E[U(w - \tau)|w \geq \overline{w}] \equiv \frac{1}{\overline{F}(\overline{w})}\int_{\overline{w}}^{\infty} U(w - \tau(b))dF(w)$.

A.1.2 Search Intensity

The optimal level of effort, e, is found by maximizing $U(\overline{w} - \tau)$. The first-order condition, assuming an interior optimum, is

$$\psi'(e) = \frac{\lambda_1(e, \alpha)}{\rho + s}\varphi(\overline{w}) \tag{3}$$

Substituting equation (3) into equation (1) yields the following expression for the reservation wage:

$$U(\overline{w} - \tau) = U(b) + \frac{\lambda(e, \alpha)}{\lambda_1(e, \alpha)}\psi'(e) - \psi(e)$$

A.2 Elasticity Decomposition

For ease of notation, we define $\theta(\overline{w}) \equiv \frac{f(\overline{w})}{\overline{F}(\overline{w})}$, the hazard rate (or failure rate) of the wage offer distribution, evaluated at the reservation wage, where $\overline{F}(w) \equiv 1 - F(w)$. Next, let $\delta(e, \alpha) \equiv \frac{d \log \lambda(e,\alpha)}{de}$ represent the *percentage change* in the job offer arrival rate from an additional unit of search, evaluated at the optimal search effort. In this model, expected duration is the inverse of the job finding probability, $D \equiv 1/[\lambda(e, \alpha)\overline{F}(\overline{w})]$. Define the total elasticity of expected unemployment duration with respect to the UI benefit level as $\varepsilon \equiv \frac{d \log D}{d \log b}$. Note that:

$$\begin{aligned}
\varepsilon &= -\left[\frac{\lambda_1(e, \alpha)\frac{de}{db}\overline{F}(\overline{w}) - \lambda(e, \alpha)f(\overline{w})\frac{d\overline{w}}{db}}{\left(\lambda(e, \alpha)\overline{F}(\overline{w})\right)^2}\right]\frac{b}{D} \\
\varepsilon &= \theta(\overline{w}) \times \overline{w} \times \frac{d \log \overline{w}}{d \log b} - \delta(e, \alpha) \times e \times \frac{d \log e}{d \log b}
\end{aligned} \tag{4}$$

The first term in (4), $\varepsilon_{\overline{w}} \equiv \theta(\overline{w}) \times \overline{w} \times \frac{d \log \overline{w}}{d \log b}$, is the duration elasticity in a reservation model with exogenous job offer arrivals (Shimer and Werning 2007). The second term in (4), $\varepsilon_e \equiv -\delta(e, \alpha) \times e \times \frac{d \log e}{d \log b}$, is the duration elasticity in a search effort model with a fixed wage (Chetty 2008). This decomposition is useful in characterizing how the duration elasticity varies over the cycle.

A.3 Proposition 1

Let $V_u(b, \tau)$ and $V(w)$ denote the value functions of an unemployed and employed agent, respectively. The social planner's problem is stated formally as:

$$\max_{b,\tau} V_u(b, \tau)$$

$$s.t.\ D(b, \tau(b))b = \frac{\tau}{r + s}$$

The following proposition characterizes the money-metric marginal welfare gain of increasing benefits by \$1.[1]

Proposition 1 *With $r = \rho = 0$, the money-metric welfare gain of raising b is given by*

$$\frac{dW}{db} = \frac{u}{1-u} \left\{ \frac{U'(b) - E[U'(w-\tau)|w \geq \overline{w}]}{E[U'(w-\tau)|w \geq \overline{w}]} - \varepsilon \right\} \tag{5}$$

At the optimum,

$$\frac{U'(b) - E[U'(w-\tau)|w \geq \overline{w}]}{E[U'(w-\tau)|w \geq \overline{w}]} = \varepsilon \tag{6}$$

Proof. (i) We first consider the first-best case where the planner sets b, $\overline{w}$, and e simultaneously. The flow value of unemployment is

$$\rho V_u(b) = U(b) - \psi(e) + \frac{\lambda(e, \alpha)}{\rho + s} \int_{\overline{w}}^{\infty} U(w - \tau(b)) dF(w) - \rho V_u(b) \frac{\lambda(e, \alpha)\overline{F}(\overline{w})}{\rho + s}$$

where $\tau(b) = (\rho + s)Db$. First, holding fixed $\overline{w}$ and e, differentiate with respect to b:

$$\rho \frac{dV_u}{db} = U'(b) - \lambda(e, \alpha) D \int_{\overline{w}}^{\infty} U'(w - \tau(b)) dF(w) - \frac{\rho}{\rho + s} \lambda(e, \alpha) \overline{F}(\overline{w}) \frac{dV_u}{db}$$

[1] We solve the planner's problem by substituting the budget constraint $\tau(b)$ into the objective function and solve the unconstrained problem.

Next, differentiate with respect to $\overline{w}$:

$$\rho \frac{dV_u}{d\overline{w}} = -\frac{\lambda(e,\alpha)}{\rho+s} f(\overline{w}) U(\overline{w}-\tau(b)) - \lambda(e,\alpha)\frac{\partial D}{\partial \overline{w}} b \int_{\overline{w}}^{\infty} U'(w-\tau(b))dF(w)$$
$$-\frac{\rho}{\rho+s}\lambda(e,\alpha)\overline{F}(\overline{w})\frac{dV_u}{d\overline{w}} - \frac{\rho}{\rho+s} V_u(b)\frac{\partial}{\partial \overline{w}}[\lambda(e,\alpha)\overline{F}(\overline{w})]$$

Finally, the FOC with respect to e satisfies:

$$\rho \frac{dV_u}{de} = \frac{\lambda_1(e,\alpha)}{\rho+s} \int_{\overline{w}}^{\infty} U(w-\tau(b))dF(w) - \lambda(e,\alpha)\frac{\partial D}{\partial e} b \int_{\overline{w}}^{\infty} U'(w-\tau(b))dF(w)$$
$$-\frac{\rho}{\rho+s}\lambda(e,\alpha)\overline{F}(\overline{w})\frac{dV_u}{de} - \frac{\rho}{\rho+s} V_u(b)\frac{\partial}{\partial e}[\lambda(e,\alpha)\overline{F}(\overline{w})] - \psi'(e)$$

At the optimum, $\frac{dV_u}{db} = \frac{dV_u}{d\overline{w}} = \frac{dV_u}{de} = 0$. Thus, the optimal benefit level satisfies

$$U'(b) = \frac{1}{\overline{F}(\overline{w})} \int_{\overline{w}}^{\infty} U'(w-\tau(b))dF(w)$$
$$U'(b) = E[U'(w-\tau(b))|w \geq \overline{w}] \tag{7}$$

This is the standard "Borch condition" for full insurance, generalized to allow for stochastic wage offers.

(ii) Next, consider the optimal benefit level in a second-best world. Formally, the problem is stated as:

$$\max_b V_u(b) = \max_b \left\{ \max_{\overline{w},e} \frac{1}{\rho} \left\{ U(b) - \psi(e) + \frac{\lambda(e,\alpha)}{\rho+s} \int_{\overline{w}}^{\infty} [U(w-\tau(b)) - \rho V_u(b)]dF(w) \right\} \right\}$$

Let us consider the welfare-gain associated with a revenue-neutral benefit increase. Exploiting the envelope theorem,

$$\rho \frac{dV_u}{db} = U'(b) - \frac{\rho}{\rho+s}\lambda(e,\alpha)\overline{F}(\overline{w})\frac{dV_u}{db} - \frac{d\tau}{db}\frac{\lambda(e,\alpha)}{\rho+s}\int_{\overline{w}}^{\infty} U'(w-\tau)dF(w)$$

Rearranging this expression gives

$$\rho \frac{dV_u}{db}\left(\frac{\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w})}{\rho+s}\right) = U'(b) - \frac{d\tau}{db}\frac{\lambda(e,\alpha)}{\rho+s}\int_{\overline{w}}^{\infty} U'(w-\tau(b))dF(w)$$

or

$$\frac{dV_u}{db} = \frac{1}{\rho}\left[uU'(b) - \frac{d\tau}{db}(1-u)\, E[U'(w-\tau(b))|w \geq \overline{w}]\right]$$

We follow Chetty (2008) and get a money-metric expression for the welfare gain of UI by normalizing by the welfare gain from raising wages in the high state by \$1. Let w_m be the location of the wage offer distribution. Decompose the offered wage as $w = w_m + \varepsilon$ and let F be the distribution function for ε. The value of unemployment becomes

$$\rho V_u = U(b) + \frac{\lambda(e,\alpha)}{\rho+s}\int_{\varepsilon(\overline{w})}^{\infty}[U(w_m+\varepsilon-\tau) - \rho V_u]dF(\varepsilon) - \psi(e)$$

It follows that

$$\rho\frac{dV_u}{dw_m} = \frac{\lambda(e,\alpha)}{\rho+s}\int_{\varepsilon(\overline{w})}^{\infty}[U'(w_m+\varepsilon-\tau) - \rho\frac{dV_u}{dw_m}]dF(\varepsilon)$$

or

$$\frac{dV_u}{dw_m} = \frac{1}{\rho}(1-u)\, E[U'(w-\tau(b))|w \geq \overline{w}]$$

Therefore,

$$\begin{aligned}
\frac{dW}{db} &\equiv \frac{dV_u/db}{dV_u/dw_m} \\
\frac{dW}{db} &= \frac{u}{1-u}\frac{U'(b)}{E[U'(w-\tau(b))|w \geq \overline{w}]} - \frac{d\tau}{db}
\end{aligned} \tag{8}$$

Finally, note that the balanced-budget constraint $\tau = (r+s)Db = (\rho+s)Db$ implies that:

$$\begin{aligned}
\frac{d\tau}{db} &= D(\rho+s)(1+\varepsilon) \\
\frac{d\tau}{db} &= \frac{u}{1-u}(1+\varepsilon)
\end{aligned} \tag{9}$$

where the last equality follows if $\rho \to 0$. Plugging (9) into expression (8) yields

$$\frac{dW}{db} = \frac{u}{1-u}\left\{\frac{U'(b) - E[U'(w-\tau(b))|w \geq \overline{w}]}{E[U'(w-\tau(b))|w \geq \overline{w}]} - \varepsilon\right\} \tag{10}$$

Setting $\frac{dW}{db} = 0$ yields the first-order condition for the optimal benefit level:

$$\frac{U'(b) - E[U'(w-\tau(b))|w \geq \overline{w}]}{E[U'(w-\tau(b))|w \geq \overline{w}]} = \varepsilon \tag{11}$$

In contrast to the first-best benefit level that solves equation (7), we see that the optimal benefit level that satisfies equation (11) will be lower due to moral hazard characterized by

ε. This establishes the proof of Proposition 1. ■

A.4 Connection to Shimer and Werning (2007)

The expression for the welfare gain of UI in (5) is different from the welfare gain expression in Shimer and Werning (2007). In Shimer and Werning,

$$\frac{d\widetilde{W}}{db} = \frac{d\overline{w}}{db} - \frac{d\tau}{db} \tag{12}$$

which is presented purely in terms of "sufficient statistics". We now show how expressions (5) and (12) are connected. Expected utility is

$$V_u = \frac{U(\overline{w} - \tau)}{\rho}$$

Therefore,

$$\frac{dV_u}{db} = \frac{U'(\overline{w} - \tau)}{\rho}\left[\frac{d\overline{w}}{db} - \frac{d\tau}{db}\right]$$

Shimer and Werning normalize $\frac{dV_u}{db}$ by $\frac{U'(\overline{w}-\tau)}{\rho}$. In other words,

$$\frac{d\widetilde{W}}{db} \equiv \frac{dV_u/db}{U'(\overline{w} - \tau)/\rho} = \frac{d\overline{w}}{db} - \frac{d\tau}{db}$$

Since we use a different normalization – one that follows Baily (1978) and Chetty (2008) – we will get a slightly different expression for the welfare gain of UI. We now formally show the connection between the two expressions below. We do this by deriving expression (12) from expression (5).

A.4.1 Expressing Marginal Utilities in Terms of Observables

We first exploit the fact that the ratio of marginal utilities can be calculated using the comparative statics for the agent's reservation wage. This is step four in the six step rubric for calculating the welfare gain from raising the benefit level using sufficient statistics (Chetty 2009). To see this, let us exploit the agent's reservation wage equation which is defined as:

$$\begin{aligned} U(\overline{w} - \tau(b)) &= \rho V_u \\ U(\overline{w} - \tau(b)) &= U(b) + \frac{\lambda(e,\alpha)}{\rho + s}\int_{\overline{w}}^{\infty}[U(w - \tau(b)) - U(\overline{w} - \tau(b))]dF(w) - \psi(e) \end{aligned}$$

First, note that raising wages by \$1 in the employed state yields[2]

$$\frac{\partial\overline{w}}{\partial w_m} = \frac{\frac{\lambda(e,\alpha)}{\rho+s}\int\limits_{\overline{w}}^{\infty} U'(w-\tau(b))dF(w)}{U'(\overline{w}-\tau(b))}u$$

Next, differentiating this expression with respect to b holding taxes constant, one can show that:

$$\frac{\partial\overline{w}}{\partial b} = \frac{U'(b)}{U'(\overline{w}-\tau)}u$$

Hence, combining the previous two expressions, we get

$$\begin{aligned}
\frac{U'(b)}{\frac{\lambda(e,\alpha)}{\rho+s}\overline{F}(\overline{w})E[U'(w-\tau(b))|w\geq\overline{w}]} &= \frac{U'(b)}{U'(\overline{w}-\tau(b))\left(\frac{\rho+s+p}{\rho+s}\right)\frac{\partial\overline{w}}{\partial w_m}} \\
\frac{u}{1-u}\frac{U'(b)}{E[U'(w-\tau(b))|w\geq\overline{w}]} &= \frac{\partial\overline{w}/\partial b}{\partial\overline{w}/\partial w_m} \qquad (13)
\end{aligned}$$

A.4.2 Welfare Gain of UI in terms of "Sufficient Statistics"

Substituting the expression for the ratio of marginal utilities in (13) into equation (5), we can re-express the welfare gain of UI as

$$\frac{dW}{db} = \frac{\partial\overline{w}/\partial b}{\partial\overline{w}/\partial w_m} - \frac{d\tau}{db} \qquad (14)$$

Thus, the welfare gain of UI may be written as a function of comparative statics of the agent's problem. It is illustrative to note the connection to Chetty (2008) who derives a very similar expression in a search effort model. Chetty's expression replaces the comparative statics of the optimal reservation wage with comparative statics of search effort.

To see the connection between this "sufficient statistics" formula and the formula in Shimer and Werning, let us express $\frac{dW}{db}$ in terms of $\frac{d\overline{w}}{db}$, the total derivative. First, differentiate the reservation wage equation with respect to taxes, holding benefits constant:

$$\begin{aligned}
U'(\overline{w}-\tau(b))\left(\frac{\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w})}{\rho+s}\right)\left(\frac{\partial\overline{w}}{\partial\tau}-1\right) &= -\frac{\lambda(e,\alpha)}{\rho+s}\int\limits_{\overline{w}}^{\infty}U'(w-\tau(b))dF(w) \\
\frac{\partial\overline{w}}{\partial\tau} &= 1-\frac{d\overline{w}}{dw_m}
\end{aligned}$$

[2] As in Chetty (2008), can think of $w \sim w_m + F(w)$.

Putting this all together,

$$\begin{aligned}\frac{d\overline{w}}{db}-\frac{d\tau}{db} &= \frac{\partial\overline{w}}{\partial b}+\frac{\partial\overline{w}}{\partial\tau}\frac{d\tau}{db}-\frac{d\tau}{db}\\ \frac{d\overline{w}}{db}-\frac{d\tau}{db} &= \frac{\partial\overline{w}}{\partial b}-\frac{d\tau}{db}\frac{\partial\overline{w}}{\partial w_m}\end{aligned}$$

Hence,

$$\frac{\partial\overline{w}/\partial b}{\partial\overline{w}/\partial w_m}-\frac{d\tau}{db}=\frac{d\overline{w}/db-d\tau/db}{\partial\overline{w}/\partial w_m} \tag{15}$$

Substituting (15) into (14), we may express the welfare gain from UI as

$$\begin{aligned}\frac{dW}{db} &= \frac{d\overline{w}/db-d\tau/db}{\partial\overline{w}/\partial w_m}\\ \frac{dW}{db} &= \frac{d\widetilde{W}/db}{\partial\overline{w}/\partial w_m}\end{aligned}$$

This formally establishes the connection between $\frac{dW}{db}$ and $\frac{d\widetilde{W}}{db}$.

A.5 Theoretical Results

In this section, we present analytical results on how the duration elasticity and consumption smoothing benefit of UI vary over the business cycle.

A.5.1 Duration Elasticity Over the Cycle

Equation (4) demonstrates that the moral hazard cost of UI is determined by the magnitude of the total duration elasticity, ε. To see how ε varies over the cycle, we start by differentiating the agent's reservation wage and optimal search intensity with respect to b, holding taxes constant, to obtain the following lemma[3]:

Lemma 1 *The marginal effects with endogenous search intensity satisfy*

$$\frac{\partial\overline{w}}{\partial b}=\frac{U'(b)}{U'(\overline{w}-\tau)}u>0 \tag{16}$$

$$\frac{\partial e}{\partial b}=\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}<0 \tag{17}$$

[3]We assume that $\frac{\partial\overline{w}}{\partial\tau}=\frac{\partial e}{\partial\tau}=0$ and focus on the partial derivatives of a benefit change. We do this for analytical tractability and we have verified in simulations that this has a negligible quantitative impact on the results.

Proof. Start by differentiating the optimal condition for search with respect to b

$$\begin{aligned}
0 &= \frac{\lambda_{11}(e,\alpha)}{\rho+s}\frac{\partial e}{\partial b}\varphi(\overline{w}) + \frac{\lambda_1(e,\alpha)}{\rho+s}\frac{\partial \varphi(\overline{w})}{\partial b} \\
\frac{\partial e}{\partial b} &= -\frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)}\frac{\frac{\partial \varphi(\overline{w})}{\partial b}}{\varphi(\overline{w})}
\end{aligned}$$

Next, totally differentiating the reservation wage equation with respect to b yields

$$\begin{aligned}
U'(\overline{w}-\tau)\frac{\partial \overline{w}}{\partial b} &= U'(b) - \frac{\partial e}{\partial b}\frac{\lambda(e,\alpha)}{\lambda_1(e,\alpha)}\left(\psi'(e)\frac{\lambda_{11}(e,\alpha)}{\lambda_1(e,\alpha)}\right) \\
U'(\overline{w}-\tau)\frac{\partial \overline{w}}{\partial b} &= U'(b) - \frac{\partial e}{\partial b}\frac{\lambda(e,\alpha)}{\lambda_1(e,\alpha)}\left(\frac{\lambda_{11}(e,\alpha)}{\rho+s}\varphi(\overline{w})\right)
\end{aligned}$$

where the last line made use of the effort FOC. Substitution using the the equation above:

$$\begin{aligned}
U'(\overline{w}-\tau)\frac{\partial \overline{w}}{\partial b} &= U'(b) + \frac{\lambda(e,\alpha)}{\lambda_1(e,\alpha)}\frac{\lambda_1(e,\alpha)}{\rho+s}\frac{\partial \varphi(\overline{w})}{\partial \overline{w}}\frac{\partial \overline{w}}{\partial b} \\
U'(\overline{w}-\tau)\frac{\partial \overline{w}}{\partial b} &= U'(b) - \frac{\lambda(e,\alpha)\overline{F}(\overline{w})}{\rho+s}U'(\overline{w}-\tau)\frac{\partial \overline{w}}{\partial b} \\
\frac{\partial \overline{w}}{\partial b} &= \frac{U'(b)}{U'(\overline{w}-\tau)}\frac{\rho+s}{\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w})} \\
\frac{\partial \overline{w}}{\partial b} &= \frac{U'(b)}{U'(\overline{w}-\tau)}u
\end{aligned}$$

Next,

$$\begin{aligned}
\frac{\partial e}{\partial b} &= -\frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)}\frac{\frac{\partial \varphi(\overline{w})}{\partial b}}{\varphi(\overline{w})} \\
\frac{\partial e}{\partial b} &= \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)}\frac{\overline{F}(\overline{w})U'(b)u}{\int_{\overline{w}}^{\infty}[U(w-\tau)-U(\overline{w}-\tau)]dF(w)} \\
\frac{\partial e}{\partial b} &= \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)}\frac{\overline{F}(\overline{w})U'(b)/(\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w}))}{\int_{\overline{w}}^{\infty}[V(w)-V_u(b)]\,dF(w)}
\end{aligned}$$

Note that

$$\begin{aligned}
\int_{\overline{w}}^{\infty}[V(w)-V_u(b)]\,dF(w) &= \int_{\overline{w}}^{\infty}\frac{[U(w-\tau)-U(\overline{w}-\tau)]}{\rho+s}dF(w) \\
&= \frac{1}{\rho+s}\int_{\overline{w}}^{\infty}[U(w-\tau)-U(\overline{w}-\tau)]dF(w) \\
&= \frac{1}{\rho+s}\overline{F}(\overline{w})\left[E[U(w-\tau)|w\geq\overline{w}]-U(\overline{w}-\tau)\right]
\end{aligned}$$

Next, using the reservation wage equation,

$$E[U(w-\tau)|w \geq \overline{w}] - U(\overline{w}-\tau) = u\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right]$$

Thus,

$$\begin{aligned}\left(\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})\right)\int_{\overline{w}}^{\infty}\left[V(w) - V_u(b)\right]dF(w) &= \overline{F}(\overline{w})\frac{1}{u}\left[E[U(w-\tau)|w \geq \overline{w}] - U(\overline{w}-\tau)\right] \\ &= \overline{F}(\overline{w})\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right]\end{aligned}$$

Substitution yields

$$\frac{\partial e}{\partial b} = \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)}\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}$$

■

Corollary 1 *In a fixed wage,* ***dynamic*** *search effort model, the marginal effect for search effort is*

$$\frac{\partial e}{\partial b} = \left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{U'(b)}{U(w-\tau) - U(b) + \psi(e)} < 0 \qquad (18)$$

Corollary 2 *In a fixed wage,* ***static*** *search effort model, the marginal effect for search effort is*

$$\frac{\partial e}{\partial b} = \left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{U'(b)}{U(w-\tau) - U(b)} < 0 \qquad (19)$$

The next proposition characterizes the cyclical behavior of $\frac{\partial \overline{w}}{\partial b}$ and $\frac{\partial e}{\partial b}$.[4] Denote the coefficient of relative risk aversion evaluated at the after-tax reservation wage by $\gamma(\overline{w}-\tau)$. For arbitrary x and y, let $\varepsilon_{x,y} \equiv \frac{d\log x}{d\log y}$.

Proposition 2 *Cyclical Behavior of Marginal Effects.*

(i)

$$\frac{d}{d\alpha}\left[\frac{\partial \overline{w}}{\partial b}\right] > 0 \iff \varepsilon_{u,\alpha} + \gamma(\overline{w}-\tau)\varepsilon_{\overline{w},\alpha} > 0 \qquad (20)$$

(ii)

$$\frac{d}{d\alpha}\left[\left|\frac{\partial e}{\partial b}\right|\right] > 0 \iff \varepsilon_{\frac{d\log\lambda_1}{de},\alpha} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\alpha} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha} < 0 \qquad (21)$$

[4] For expositional purposes, we focus on exogenous variation in α, but the conditions we provide are essentially identical if we consider exogenous variation in the separation rate, s. Intuitively, this is because increases in α and decreases in s have similar effects on the agent's behavior. In Extension 3 below, we derive analogous results for a change in the mean of the wage offer distribution. We show that the conditions are very similar to the conditions we derive in this section.

Proof. (i) Recall that

$$\frac{\partial \overline{w}}{\partial b} = \frac{U'(b)}{U'(\overline{w}-\tau)} u \tag{22}$$

Differentiating equation (22) with respect to α:

$$\begin{aligned}
\frac{d}{d\alpha}\left[\frac{\partial \overline{w}}{\partial b}\right] &= \frac{U'(b)}{U'(\overline{w}-\tau)}\frac{du}{d\alpha} - \frac{U''(\overline{w}-\tau)}{U'(\overline{w}-\tau)}\frac{U'(b)}{U'(\overline{w}-\tau)}\frac{d\overline{w}}{d\alpha}u \\
\frac{d}{d\alpha}\left[\frac{\partial \overline{w}}{\partial b}\right] &= \frac{U'(b)}{U'(\overline{w}-\tau)}\left(\frac{du}{d\alpha} + \frac{\gamma(\overline{w}-\tau)}{\overline{w}-\tau}\frac{d\overline{w}}{d\alpha}u\right) \\
\frac{d}{d\alpha}\left[\frac{\partial \overline{w}}{\partial b}\right] &= \frac{U'(b)}{U'(\overline{w}-\tau)}\frac{u}{\alpha}\left(\varepsilon_{u,\alpha} + \gamma(\overline{w}-\tau)\varepsilon_{\overline{w},\alpha}\right)
\end{aligned}$$

where $\gamma(\overline{w}-\tau) \equiv -\left(\overline{w}-\tau\right)\frac{U''(\overline{w}-\tau)}{U'(\overline{w}-\tau)}$ and $\varepsilon_{X,\alpha} \equiv \frac{dX}{d\alpha}\frac{\alpha}{X}$. Therefore, a sufficient condition for $\frac{d}{d\alpha}\left[\frac{\partial \overline{w}}{\partial b}\right] > 0$ is $\varepsilon_{u,\alpha} + \gamma(\overline{w}-\tau)\varepsilon_{\overline{w},\alpha} > 0$.

(ii) Recall that

$$\frac{\partial e}{\partial b} = \frac{1}{\frac{d\log\lambda_1(e,\alpha)}{de}}\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}$$

Thus,

$$\begin{aligned}
\frac{d}{d\alpha}\left[\frac{\partial e}{\partial b}\right] &= -\frac{\frac{d}{d\alpha}\left[\frac{d\log\lambda_1}{de}\right]}{\left[\frac{d\log\lambda_1}{de}\right]^2}\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)} \\
&\quad - \frac{\psi'(e)\frac{de}{d\alpha}U'(b)}{\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right]^2}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1} \\
&\quad - \frac{\frac{dE[U(w-\tau)|w \geq \overline{w}]}{d\alpha}U'(b)}{\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right]^2}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}
\end{aligned} \tag{23}$$

Note that

$$\begin{aligned}
\frac{dE[U(w-\tau)|w \geq \overline{w}]}{d\alpha} &= \frac{d}{d\alpha}\left[\frac{1}{\overline{F}(\overline{w})}\int_{\overline{w}}^{\infty} U(w-\tau)dF(w)\right] \\
&= \frac{f(\overline{w})\frac{d\overline{w}}{d\alpha}}{\left[\overline{F}(\overline{w})\right]^2}\int_{\overline{w}}^{\infty} U(w-\tau)dF(w) - \frac{f(\overline{w})}{\overline{F}(\overline{w})}\frac{d\overline{w}}{d\alpha}U(\overline{w}-\tau) \\
&= -\frac{f(\overline{w})}{\overline{F}(\overline{w})}\frac{d\overline{w}}{d\alpha}\left[U(\overline{w}-\tau) - E[U(w-\tau)|w \geq \overline{w}]\right] \\
&= \frac{f(\overline{w})}{\overline{F}(\overline{w})}\frac{d\overline{w}}{d\alpha}u\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right] \\
&= \frac{\lambda(e,\alpha)f(\overline{w})\frac{d\overline{w}}{d\alpha}}{\lambda(e,\alpha)\overline{F}(\overline{w})}u\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right] \\
&= \frac{\lambda(e,\alpha)f(\overline{w})\frac{d\overline{w}}{d\alpha}}{\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})}\frac{\rho + s}{\lambda(e,\alpha)\overline{F}(\overline{w})}\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right] \\
&= \frac{\lambda(e,\alpha)f(\overline{w})\frac{d\overline{w}}{d\alpha}}{\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})}\frac{u}{1-u}\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right] \qquad (24)
\end{aligned}$$

Also, the FOC for search effort may be re-expressed as:

$$\begin{aligned}
\psi'(e) &= \frac{\lambda_1(e,\alpha)}{\rho + s}\varphi(\overline{w}) \\
\psi'(e) &= \frac{\lambda_1(e,\alpha)}{\rho + s}\overline{F}(\overline{w})\left[E[U(w-\tau)|w \geq \overline{w}] - U(\overline{w}-\tau)\right] \\
\frac{\psi'(e)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)} &= \frac{\lambda_1(e,\alpha)}{\rho + s}\overline{F}(\overline{w})u \\
\frac{\psi'(e)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)} &= \frac{\lambda_1(e,\alpha)\overline{F}(\overline{w})}{\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})} \qquad (25)
\end{aligned}$$

Substituting (24) and (25) into (23) yields:

$$\begin{aligned}
\frac{d}{d\alpha}\left[\frac{\partial e}{\partial b}\right] &= -\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}\frac{1}{\frac{d\log\lambda_1}{de}} \\
&\times \left[\frac{\frac{d}{d\alpha}\left[\frac{d\log\lambda_1}{de}\right]}{\frac{d\log\lambda_1}{de}} + \frac{de}{d\alpha}\frac{\lambda_1(e,\alpha)\overline{F}(\overline{w})}{\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})} + \frac{d\overline{w}}{d\alpha}\frac{\lambda(e,\alpha)f(\overline{w})}{\rho + s + \lambda(e,\alpha)\overline{F}(\overline{w})}\frac{u}{1-u}\right]
\end{aligned}$$

Simplifying,

$$\begin{aligned}
\frac{d}{d\alpha}\left[\frac{\partial e}{\partial b}\right] &= -\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{1}{\alpha} \\
&\times \left[\varepsilon_{\frac{d\log\lambda_1}{de},\alpha} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\alpha} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha}\right]
\end{aligned}$$

where $\varepsilon_{X,\alpha} \equiv \frac{dX}{d\alpha}\frac{\alpha}{X}$. Note that $\frac{d\log\lambda_1}{de} < 0$. Therefore, a sufficient condition for $\frac{d}{d\alpha}\left[\left|\frac{\partial e}{\partial b}\right|\right] > 0$ is $\varepsilon_{\frac{d\log\lambda_1}{de},\alpha} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\alpha} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha} < 0$. ■

A.5.1.1 Interpretation and Discussion

Condition (20) illustrates that two effects determine the cyclicality of the responsiveness of reservation wages to UI benefits:

Discount Effect ($\varepsilon_{u,\alpha} < 0$) – Intuitively, when u is low, the agent does not expect to be unemployed in the future and thus, attaches little weight to future UI benefits. Thus, an increase in b has a smaller effect on the agent's reservation wage in a recession.

Risk Aversion Effect ($\gamma(\overline{w} - \tau)\varepsilon_{\overline{w},\alpha} > 0$) – An increase in λ raises the option value of search and therefore increases $\overline{w}$, as agents become more choosy about which jobs to accept when times are good. If the agent's utility function is highly curved at the existing reservation wage, an increase in $\overline{w}$ can substantially lower the marginal utility of consumption for the employed relative to the unemployed. This exacerbates the reservation wage response to UI benefits.

Condition (21) again illustrates a tension between several opposing economic forces in shaping how search effort varies with UI benefits over the cycle:

Static Effort Effect ($\varepsilon_{\frac{d\log\lambda_1}{de},\alpha} < 0$) – This term reflects the degree of complementarity between e and α. This expression shows that if search effort complementarities are sufficiently strong ($\lambda_{12} >> 0$), then benefits are more distortionary in good times, consistent with the Krueger and Meyer intuition. Intuitively, a boost to labor demand raises the marginal efficiency of search and the behavioral response to UI benefits. Andersen and Svarer (2009) consider a static, fixed wage model of search with a linear search cost and show that the cyclicality of $\partial e/\partial b$ depends entirely on the sign of this effect; thus, we label it a "static effect."

Dynamic Effort Effect ($\varepsilon_{\rho+s+\lambda,e} \times \varepsilon_{e,\alpha} > 0$) – This term arises in a fixed wage, dynamic search effort model. In a dynamic model, a permanent increase in benefits raises the value of unemployment in all future periods. The agent's behavioral response in a dynamic model is pinned down by the discounted value of this increase. A positive and permanent labor demand shock lowers the probability that the agent is unemployed in all future periods, since it raises search effort. This acts to effectively reduce the agent's discount factor and attenuates the behavioral response to UI benefits.

Dynamic Reservation Wage Effect ($\frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha} > 0$) – Finally, in a model with stochastic wages, one also needs to additionally account for the effect of benefits on reservation wages. When the arrival rate of job offers is high, agents search with a higher reservation wage and this acts to reduce the discount factor and attenuate their behavioral response.

The main result of this section is to show that how the marginal effects vary over the cycle depends on the precise specification and structural parameters of the search model. We now study the consequences for the elasticity of expected duration with respect to the benefit level. Let $\frac{d\varepsilon}{d\alpha} = \frac{d\varepsilon_{\overline{w}}}{d\alpha} + \frac{d\varepsilon_e}{d\alpha}$. We consider each of these in turn.

Proposition 3 *Cyclical Behavior of $\varepsilon_{\overline{w}}$ and ε_e.*

(i)

$$\frac{d\varepsilon_{\overline{w}}}{d\alpha} > 0 \iff \varepsilon_{u,\alpha} + \left(\gamma(\overline{w}-\tau) + \varepsilon_{\theta,\overline{w}}\right)\varepsilon_{\overline{w},\alpha} > 0 \tag{26}$$

where $\theta(\overline{w}) \equiv \frac{f(\overline{w})}{\overline{F}(\overline{w})}$.

(ii)

$$\frac{d\left|\varepsilon_e\right|}{d\alpha} > 0 \iff \varepsilon_{\frac{d\log\lambda_1}{de},\alpha} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\alpha} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha} - \left(\varepsilon_{\delta,e}\varepsilon_{e,\alpha} + \varepsilon_{\delta,\alpha}\right) < 0 \tag{27}$$

where $\delta(e,\alpha) \equiv \frac{d\log\lambda(e,\alpha)}{de}$.

Proof. *Let's focus on* $\frac{d\varepsilon_{\overline{w}}}{d\alpha}$:

$$\begin{aligned}
\frac{d\varepsilon_{\overline{w}}}{d\alpha} &= \frac{d\theta(\overline{w})}{d\alpha}\frac{\partial\overline{w}}{\partial b}b + \frac{d}{d\alpha}\left[\frac{\partial\overline{w}}{\partial b}\right]\theta(\overline{w})b \\
\frac{d\varepsilon_{\overline{w}}}{d\alpha} &= \frac{d\theta(\overline{w})}{d\overline{w}}\frac{d\overline{w}}{d\alpha}\frac{\partial\overline{w}}{\partial b}b + \frac{d}{d\alpha}\left[\frac{\partial\overline{w}}{\partial b}\right]\theta(\overline{w})b \\
\frac{d\varepsilon_{\overline{w}}}{d\alpha} &= \frac{d\theta(\overline{w})}{d\overline{w}}\frac{d\overline{w}}{d\alpha}\frac{U'(b)}{U'(\overline{w}-\tau)}ub + \frac{U'(b)}{U'(\overline{w}-\tau)}\left(\frac{du}{d\alpha} + \frac{\gamma(\overline{w}-\tau)}{\overline{w}-\tau}\frac{d\overline{w}}{d\alpha}u\right)\theta(\overline{w})b \\
\frac{d\varepsilon_{\overline{w}}}{d\alpha} &= \theta(\overline{w})\frac{U'(b)}{U'(\overline{w}-\tau)}ub\left(\frac{d\theta(\overline{w})}{d\overline{w}}\frac{1}{\theta(\overline{w})}\frac{d\overline{w}}{d\alpha} + \frac{du}{d\alpha}\frac{1}{u} + \frac{\gamma(\overline{w}-\tau)}{\overline{w}-\tau}\frac{d\overline{w}}{d\alpha}\right) \\
\frac{d\varepsilon_{\overline{w}}}{d\alpha} &= \theta(\overline{w})\frac{U'(b)}{U'(\overline{w}-\tau)}\frac{u}{\alpha}b\left(\varepsilon_{u,\alpha} + \left(\gamma(\overline{w}-\tau) + \varepsilon_{\theta,\overline{w}}\right)\varepsilon_{\overline{w},\alpha}\right)
\end{aligned}$$

Therefore,

$$\frac{d\varepsilon_{\overline{w}}}{d\alpha} > 0 \iff \varepsilon_{u,\alpha} + \left(\gamma(\overline{w}-\tau) + \varepsilon_{\theta,\overline{w}}\right)\varepsilon_{\overline{w},\alpha} > 0$$

Next, consider $\frac{d\varepsilon_e}{d\alpha}$:

$$\frac{d\varepsilon_e}{d\alpha} = \frac{d\delta(e,\alpha)}{d\alpha}\frac{\partial e}{\partial b}b + \frac{d}{d\alpha}\left[\frac{\partial e}{\partial b}\right]\delta(e,\alpha)b$$

Let us focus on each term. First,

$$\begin{aligned}
\frac{d}{d\alpha}\left[\frac{\partial e}{\partial b}\right]\delta(e,\alpha)b &= -\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{1}{\alpha}\delta(e,\alpha)b \\
&\quad \times \left[\varepsilon_{\frac{d\log\lambda_1}{de},\alpha} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\alpha} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \varepsilon_{\overline{w},\alpha}\right]
\end{aligned}$$

Next,

$$\frac{d\delta(e,\alpha)}{d\alpha}\frac{\partial e}{\partial b}b = \left[\frac{d\delta(e,\alpha)}{de}\frac{de}{d\alpha}+\frac{\partial\delta(e,\alpha)}{\partial\alpha}\right]\frac{\partial e}{\partial b}b+$$

$$\frac{d\delta(e,\alpha)}{d\alpha}\frac{\partial e}{\partial b}b = \left[\frac{d\delta(e,\alpha)}{de}\frac{de}{d\alpha}+\frac{\partial\delta(e,\alpha)}{\partial\alpha}\right]\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}b$$

$$\frac{d\delta(e,\alpha)}{d\alpha}\frac{\partial e}{\partial b}b = [\varepsilon_{\delta,e}\varepsilon_{e,\alpha}+\varepsilon_{\delta,\alpha}]\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{1}{\alpha}\delta(e,\alpha)b$$

where $\varepsilon_{\delta,e}\equiv\frac{d\delta}{de}\frac{e}{\delta}$*. Putting both terms together:*

$$\frac{d\varepsilon_e}{d\alpha} = -\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\left[\frac{d\log\lambda_1(e,\alpha)}{de}\right]^{-1}\frac{1}{\alpha}\delta(e,\alpha)b \times\left[\varepsilon_{\frac{d\log\lambda_1}{de},\alpha}+\varepsilon_{\rho+s+\lambda\overline{F},e}\times\varepsilon_{e,\alpha}+\frac{u}{1-u}\times\varepsilon_{\rho+s+\lambda\overline{F},\overline{w}}\times\varepsilon_{\overline{w},\alpha}-(\varepsilon_{\delta,e}\varepsilon_{e,\alpha}+\varepsilon_{\delta,\alpha})\right]$$

Therefore,

$$\frac{d\,|\varepsilon_e|}{d\alpha}>0\Longleftrightarrow\varepsilon_{\frac{d\log\lambda_1}{de},\alpha}+\varepsilon_{\rho+s+\lambda\overline{F},e}\times\varepsilon_{e,\alpha}+\frac{u}{1-u}\times\varepsilon_{\rho+s+\lambda\overline{F},\overline{w}}\times\varepsilon_{\overline{w},\alpha}-(\varepsilon_{\delta,e}\varepsilon_{e,\alpha}+\varepsilon_{\delta,\alpha})<0$$

■

Comparing condition (26) to condition (20), we see that there is an additional term $\varepsilon_{\theta,\overline{w}}$ which reflects how the hazard rate of the wage offer distribution varies with the wage, evaluated at the reservation wage. According to Van den Berg (1994), most of the distributions used in structural job search analysis have hazards that are decreasing in the wage, $\varepsilon_{\theta,\overline{w}}<0$. This would tend to attenuate the "risk aversion effect" and therefore make $\varepsilon_{\overline{w}}$ more likely to be countercyclical.

Next, comparing condition (27) to condition (21), we see that the condition is augmented by the factor $\varepsilon_{\delta,e}\varepsilon_{e,\alpha}+\varepsilon_{\delta,\alpha}$. Under the stated assumptions on $\lambda(e,\alpha)$, $\varepsilon_{\delta,e}<0$. This acts to make ε_e more likely to be countercylical. However, the sign of $\varepsilon_{\delta,\alpha}$ is ambiguous, making it hard to sign the term $\varepsilon_{\delta,e}\varepsilon_{e,\alpha}+\varepsilon_{\delta,\alpha}$. In practice, if $\lambda(e,\alpha)$ increases with α at a faster rate than $\lambda_1(e,\alpha)$ does, which we argue most plausible specifications for the job offer arrival rate will satisfy, the term will be negative.

In summary, we see that taking into account how the technical aspects of $\varepsilon_{\overline{w}}$ and ε_e vary with the cycle (e.g., how $\theta(\overline{w})$ and $\delta(e,\alpha)$ vary with α) make *both* of them more likely to be countercyclical. It follows that the total duration elasticity, ε, is also likely to be more countercylical. Ultimately, whether ε is procyclical or countercyclical depends on the precise specification of the primitives and functional forms of the model. We next analyze how the insurance value of UI varies over the cycle.

A.5.2 Consumption Smoothing Over the Cycle

Define $\overline{g} = \frac{U'(b)}{E[U'(w-\tau)|w \geq \overline{w}]}$ as the money-metric amount such that, the government is indifferent between giving \$1 to someone who is unemployed and $\overline{g}$ to someone who is employed.

Proposition 4 *Cyclicality of Insurance Value of UI.*

$$\frac{d\overline{g}}{d\alpha} = \frac{d\overline{g}}{d\overline{w}}\frac{d\overline{w}}{d\alpha} + \frac{d\overline{g}}{d\tau}\frac{d\tau}{d\alpha} > 0$$

Proof. *Define* $\overline{g} = \frac{U'(b)}{E[U'(w-\tau)|w \geq \overline{w}]}$. *Differentiating* $\overline{g}$ *with respect to* $\overline{w}$ *yields:*

$$\frac{d\overline{g}}{d\overline{w}} = -\frac{\frac{f(\overline{w})}{\overline{F}(\overline{w})}E[U'(w-\tau)|w \geq \overline{w}] - \frac{F(\overline{w})}{\overline{F}(\overline{w})}U'(\overline{w}-\tau)}{E[U'(w-\tau)|w \geq \overline{w}]}\overline{g}$$

Thus,

$$\begin{aligned}
\frac{d\overline{g}}{d\overline{w}} &> 0 \Longleftrightarrow \frac{F(\overline{w})}{\overline{F}(\overline{w})}U'(\overline{w}-\tau) - \frac{f(\overline{w})}{\overline{F}(\overline{w})}E[U'(w-\tau)|w \geq \overline{w}] > 0 \\
\frac{d\overline{g}}{d\overline{w}} &> 0 \Longleftrightarrow F(\overline{w})U'(\overline{w}-\tau) - f(\overline{w})E[U'(w-\tau)|w \geq \overline{w}] > 0 \\
\frac{d\overline{g}}{d\overline{w}} &> 0 \Longleftrightarrow U'(\overline{w}-\tau) - \frac{f(\overline{w})}{F(\overline{w})}E[U'(w-\tau)|w \geq \overline{w}] > 0
\end{aligned}$$

which has to hold since $\frac{f(\overline{w})}{F(\overline{w})} < 1$ *and* $U'(\overline{w}-\tau) > E[U'(w-\tau)|w \geq \overline{w}]$. *We assume that* $\frac{d\overline{w}}{d\alpha} > 0$ *which is a standard assumption in the literature. This establishes the first part of Proposition 3, that the insurance effect is procyclical. Next,*

$$\frac{d\overline{g}}{d\tau} = \frac{E[U''(w-\tau)|w \geq \overline{w}]}{E[U'(w-\tau)|w \geq \overline{w}]}\overline{g} < 0$$

since $U'' < 0$. *Also,*

$$\frac{d\tau}{d\alpha} = (\rho + s)\, b\frac{dD}{d\alpha} < 0$$

This establishes the second part of Proposition 3, that the budget effect is procyclical. ■

A.5.2.1 Interpretation and Discussion

Reservation Wage Effect ($\frac{d\overline{g}}{d\overline{w}}\frac{d\overline{w}}{d\alpha} > 0$) – The first term comes from the fact that the reservation wage varies over the business cycle. Intuitively, an agent searching for a job with a higher reservation wage expects a higher wage during employment and thus values insurance more.[5] This effect is positive and therefore calls for procyclical UI benefits. Clearly, in a search effort model with a fixed wage, this term will not appear. Thus, relative

[5]Note that this does not say that individuals with higher reservation wages value publicly provided insurance more. In practice, workers with access to liquidity will tend to have higher reservation wages and

to Andersen and Svarer (2009), our results suggest a new way that the insurance effect can vary over the cycle.

Budget Effect ($\frac{d\bar{g}}{d\tau}\frac{d\tau}{d\alpha} > 0$) – The second term represents an effect that operates through the balanced-budget constraint. Intuitively, when α is high, fewer taxes need to be raised to finance a given level of benefits. This increases the marginal utility of consumption for the employed relative to marginal utility of consumption for the unemployed since the net wage is $w - \frac{u}{1-u}b$; in order to restore optimality, benefits need to be increased. This effect is positive and ceteris paribus, implies that benefits should be procyclical. In Extension 2 in the Appendix, we relax the budget balance condition and allow the planner to run deficits in bad times and surpluses in good times. We show that the this eliminates the budget effect and the insurance value of UI only depends on the reservation wage effect. In summary, we see that both the reservation wage effect and the budget effect imply that the insurance value of UI varies positively with α in this model.

Liquidity Effect – As discussed above and in relation to Chetty (2008), UI can be very valuable if it affects agents' search behavior primarily through a non-distortionary "liquidity effect", rather than through a substitution effect. It is possible that in a bad labor market, workers have fewer means to smooth consumption; for instance, one's spouse may also be out of work, and so a secondary source of income cannot be relied on. In this case, UI would be more valuable in a downturn since it has a larger liquidity effect. We develop this intuition more formally in Extension 4 below where we consider a fully credit constrained model where individuals set consumption equal to income in each period. We assume individuals have access to exogenous, non-labor income A each period, in addition to the UI benefit or the net wage. We show that the consumption smoothing benefit of UI – the left-hand side of equation (6) – is identified by the ratio of the liquidity effect in search effort to the substitution effect in search effort. This shows that how the consumption smoothing benefit of UI in our model varies over the cycle additionally depends on how A varies with α. We explore this question empirically below and consider the implications for our welfare analysis.

In summary, both the reservation wage effect and the budget effect imply that the insurance value of UI varies positively with α in this model, while the liquidity effect is theoretically ambiguous. This implies that the insurance value of UI is theoretically ambiguous and also implies that the optimal UI benefit level over the cycle is theoretically ambiguous.

A.6 Model Extensions

A.6.1 Extension 1: Search Cost Formulation

Here we relax the assume that workers do not value leisure. Let leisure be given by l and assume that search effort has both a monetary cost, $v(e)$, and a time cost since effort e reduces leisure l. The instantaneous utility function of an unemployed worker is given by

better means to smooth consumption. Rather, this statement applies to two similar individuals, with one having a higher reservation wage solely because his job opportunities are more plentiful.

$U(b - v(e), l - e)$.[6] The FOC for the reservation wage, equation (1), becomes

$$U(\overline{w} - \tau) = U(b - v(e), l - e) + \frac{\lambda(e, \alpha)}{\rho + s}\varphi(\overline{w})$$

where $\varphi(\overline{w}) = \int_{\overline{w}}^{\infty} [U(w - \tau) - U(\overline{w} - \tau)]dF(w)$.[7]

Similarly, the FOC for search effort, equation (3), becomes

$$U_1(b - v(e), l - e)v'(e) + U_2(b - v(e), l - e) = \frac{\lambda_1(e, \alpha)}{\rho + s}\varphi(\overline{w})$$

One interesting implication of this model is that the benefit level b now enters the FOC for search effort, not only through the marginal gain of search (the RHS), but also through the marginal cost of search (the LHS). Consider the first term on the left-hand side, the marginal utility of consumption. An increase in b reduces the marginal utility of consumption given $U_{11} < 0$ and hence, the marginal cost of effort. This tends to *increase* search effort at the margin. Next, consider the second term on the left-hand side, the marginal utility of leisure. How an increase in benefits affects search effort depends on the complimentarity between consumption and leisure during unemployment, as shown in Mortensen (1977). If consumption and leisure are complements ($U_{12} > 0$), an increase in benefits increases the marginal utility of leisure, raising the opportunity cost of search, and lowering search effort. Thus, the effect of an increase in benefits on search effort depends on the worker's preferences over consumption and leisure.

In terms of the social planner's problem, we can exploit the envelope theorem to show that

$$\rho\frac{dV_u}{db} = U_1(b - v(e), l - e) - \frac{\rho}{\rho + s}\lambda(e, \alpha)\overline{F}(\overline{w})\frac{dV_u}{db} - \frac{d\tau}{db}\frac{\lambda(e, \alpha)}{\rho + s}\int_{\overline{w}}^{\infty} U'(w - \tau(b))dF(w)$$

Similarly,

$$\rho\frac{dV_u}{dw_m} = \frac{\lambda(e, \alpha)}{\rho + s}\int_{\varepsilon(\overline{w})}^{\infty} [U'(w_m + \varepsilon - \tau) - \rho\frac{dV_u}{dw_m}]dF(\varepsilon)$$

Thus, for $r = 0$

$$\frac{dW}{db} = \frac{u}{1 - u}\left\{\frac{U_1(b - v(e), l - e) - E[U'(w - \tau)|w \geq \overline{w}]}{E[U'(w - \tau)|w \geq \overline{w}]} - \varepsilon\right\}$$

[6] Shimer and Werning (2007) consider a monetary cost of search, so that utility is given by $U(b - v(e))$.

[7] Given labor supply l_0 when employed, one could express the instantaneous utility of an employed worker as $U(\overline{w} - \tau, l - l_0)$. However, the assumption of inelastic labor supply implies $l - l_0$ is fixed, so we therefore suppress notation.

There are several things to note about this equation relative to equation (5). First, in a model with a monetary and time cost of search, ε will be a slightly more complicated function since the marginal cost of search effort depends on UI benefits, as explained above. However, the key point is that *conditional* on ε, dW/db is the same. Moreover, since our approach is to estimate how ε varies with the unemployment rate, u, we do not need to know why ε varies with u. This is the essence of the sufficient statistics approach.

Second, with leisure, the consumption smoothing benefit of UI depends on the complimentarity between consumption and leisure during unemployment. Presumably, if unemployment has large leisure benefits, so that $l - e$ is large, and consumption and leisure are complements, then an increase in UI benefits will be more valuable to the individual, than if unemployment had no leisure value. Thus, all else equal, greater leisure benefits of unemployment tend to imply a higher benefit level.

Last, the monetary cost of search will also affect the marginal value of social insurance. A higher cost of search, ceterus paribus, increases the marginal value of social insurance due to diminishing marginal utility.

A.6.2 Extension 2: Relaxing Balanced-Budget Condition

We consider the scenario where there are a finite number of states, λ_i, $i = 1, 2, ..., N$. The separation rate s is independent of the state. Denote the job finding rate in state i, $p_i = \lambda_i(e_i, \alpha)\overline{F}(\overline{w}_i)$. The budget condition is stated as follows:

$$\sum_{i=1}^{N} \frac{\tau_i T - b_i D_i}{T + D_i} = 0$$

where $T = 1/s$. We assume that the planner maximizes the unweighted sum of expected utilities subject to the budget constraint:

$$\max_{\{b_i,\tau_i\}_{i=1}^{N}} \sum_{i=1}^{N} V_u^i$$

$$s.t. \sum_{i=1}^{N} \frac{\tau_i T - b_i D_i}{T + D_i} = 0$$

Recall the "permanent-income" form for unemployment utility:

$$\rho V_u^i = u_i \left(U(b_i) - \psi(e_i)\right) + (1 - u_i)E[U(w - \tau_i)|w \geq \overline{w}_i]$$

The FOC for the planner is

$$b_i \quad : \quad u_i U'(b_i) - \lambda \left[\frac{D_i}{T+D_i} + b_i \frac{\partial \left[\frac{D_i}{T+D_i} \right]}{\partial b_i} \right] = 0 \tag{28}$$

$$\tau_i \quad : \quad -(1-u_i) E[U'(w-\tau_i) | w \geq \overline{w}_i] - \lambda \left[-\frac{T}{T+D_i} \right] = 0 \tag{29}$$

where λ is the lagrange multiplier on the budget constraint. Under the assumption that $\rho = 0$, $u_i = \frac{D_i}{T+D_i}$. In this case, it follows from (28) that

$$U'(b_i) = \lambda \left[1 + \varepsilon_i \right]$$

where $\varepsilon_i = \frac{b_i}{u_i} \frac{\partial u_i}{\partial b_i}$. Thus, we see that if the distortion is independent of the state, $\varepsilon_i \equiv \varepsilon$, $b_i \equiv b$, and benefits are state-independent.

A.6.3 Extension 3: A Change in the Wage Offer Distribution

Burdett and Ondrich (1985) discuss how a shift in labor demand conditions can arise additionally from a change in the wage offer distribution. They label such a shift a "type 2" change and define a "type 1" change to be a shift in labor demand due to a change in the job offer arrival rate. This extension considers the effects of a type 2 change on the behavioral response to UI. Specifically, we consider the effects of a shift in the mean of the wage offer distribution from $F(w)$ to $F(w-\mu)$.

(i) First, consider $\partial^2 \overline{w} / \partial b \partial \mu$:

$$\frac{\partial^2 \overline{w}}{\partial b \partial \mu} = \frac{U'(b)}{U'(\overline{w}-\tau)} u \frac{1}{\mu} \left(\varepsilon_{u,\mu} + \gamma(\overline{w}-\tau) \varepsilon_{\overline{w}-\tau,\mu} \right)$$

Differentiating the reservation wage equation, under the new distribution $F(w-\mu)$, with respect to μ, evaluating it at $\mu = 0$ and solving for $\frac{\partial \overline{w}}{\partial \mu}$, we obtain:

$$\frac{\partial \overline{w}}{\partial \mu} = \frac{E[U'(w-\tau) | w \geq \overline{w}]}{U'(\overline{w}-\tau)} \frac{\lambda \overline{F}(\overline{w})}{\rho + s + \lambda \overline{F}(\overline{w})} > 0$$

Note that with risk-neutrality and $s = 0$, this collapses to the expression in Mortensen (1986). Note that $\frac{\partial \overline{w}}{\partial \mu} < 1$. This implies that $du/d\mu < 0$. In other words, a type 2 improvement in the labor market always has a predictable consequence on the unemployment escape probability and reduces the unemployment rate. This is in contrast to a type 1 improvement, which depends on functional form assumptions on $F(w)$. We see again that whether benefits raise the reservation wage more or less in good times depends on the strength of the "discount effect" ($\varepsilon_{u,\mu} < 0$) relative to the "risk aversion effect" ($\gamma(\overline{w}-\tau)\varepsilon_{\overline{w}-\tau,\mu} > 0$).

(ii) Next, consider $\partial^2 e/\partial b \partial\mu$:

$$\frac{d}{d\mu}\left[\frac{\partial e}{\partial b}\right] = -\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)} \frac{1}{\frac{d\log\lambda_1}{de}} \times \left[\frac{\frac{d}{d\mu}\left[\frac{d\log\lambda_1}{de}\right]}{\frac{d\log\lambda_1}{de}} - \frac{de}{d\mu}\frac{\lambda_1(e,\alpha)\overline{F}(\overline{w})}{\rho+s+\lambda(e,\alpha)\overline{F}(\overline{w})} - \frac{\frac{dE[U(w-\tau)|w\geq\overline{w}]}{d\mu}}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}\right] \tag{30}$$

Using integration by parts, we can show under a translation (at $\mu = 0$) that:

$$\frac{dE[U(w-\tau)|w \geq \overline{w}]}{d\mu} = \frac{1}{\overline{F}(\overline{w})}\left[\int_{\overline{w}}^{\infty} U'(w-\tau)dF(w) + \theta(\overline{w})\left(\frac{\partial\overline{w}}{\partial\mu} - 1\right)\varphi(\overline{w})\right] \tag{31}$$

Substituting (31) into (30) yields

$$\frac{d}{d\mu}\left[\frac{\partial e}{\partial b}\right] = -\frac{U'(b)}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)} \frac{1}{\frac{d\log\lambda_1}{de}}\frac{1}{\mu} \times \left[\varepsilon_{\frac{d\log\lambda_1}{de},\mu} + \varepsilon_{\Delta U,\mu} + \varepsilon_{\rho+s+\lambda\overline{F},e} \times \varepsilon_{e,\mu} + \frac{u}{1-u} \times \varepsilon_{\rho+s+\lambda\overline{F},\overline{w}} \times \left(\varepsilon_{\overline{w},\mu} - \frac{\mu}{\overline{w}}\right)\right]$$

where $\Delta U \equiv E[U(w-\tau)|w \geq \overline{w}] - (U(b) + \psi(e))$. We see that this expression contains a new term $\varepsilon_{\Delta U,\mu}$, which arises in a static model of search effort, since a change in the wage increases the returns to search.

(iii) Now consider $\frac{d\varepsilon_{\overline{w}}}{d\mu}$:

$$\frac{d\varepsilon_{\overline{w}}}{d\alpha} = \frac{d\theta(\overline{w})}{d\mu}\frac{\partial\overline{w}}{\partial b}b + \frac{d}{d\mu}\left[\frac{\partial\overline{w}}{\partial b}\right]\theta(\overline{w})b$$

Consider a translation. The new hazard rate is $\theta(\overline{w}-\mu) = \frac{f(\overline{w}-\mu)}{F(\overline{w}-\mu)}$. Thus, at $\mu = 0$, $\frac{\partial\theta(\overline{w})}{\partial\mu} = \left(\frac{\partial\overline{w}}{\partial\mu} - 1\right)\frac{\partial\theta(\overline{w})}{\partial\overline{w}}$. Substitution yields

$$\frac{d\varepsilon_{\overline{w}}}{d\mu} = \frac{U'(b)}{U'(\overline{w}-\tau)}ub\theta(\overline{w})\frac{1}{\mu}\left[\left(\varepsilon_{\overline{w},\mu} - \frac{\mu}{\overline{w}}\right)\varepsilon_{\theta,\overline{w}} + \gamma(\overline{w}-\tau)\varepsilon_{\overline{w},\mu} + \varepsilon_{u,\mu}\right]$$

(iv) Next, consider $\frac{d\varepsilon_e}{d\mu}$:

$$\frac{d\varepsilon_e}{d\mu} = \frac{d\delta(e,\alpha)}{d\mu}\frac{\partial e}{\partial b}b + \frac{d}{d\mu}\left[\frac{\partial e}{\partial b}\right]\delta(e,\alpha)b \tag{32}$$

Let focus on each term. First,

$$\frac{d}{d\mu}\left[\frac{\partial e}{\partial b}\right]\delta(e,\alpha)b = -\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\frac{1}{\frac{d\log\lambda_1}{de}}\frac{1}{\mu}\delta(e,\alpha)b\times \left[\varepsilon_{\frac{d\log\lambda_1}{de},\mu}+\varepsilon_{\Delta U,\mu}+\varepsilon_{\rho+s+\lambda\overline{F},e}\times\varepsilon_{e,\mu}+\frac{u}{1-u}\times\varepsilon_{\rho+s+\lambda\overline{F},\overline{w}}\times\left(\varepsilon_{\overline{w},\mu}-\frac{\mu}{\overline{w}}\right)\right] \quad (33)$$

Next,

$$\frac{d\delta(e,\alpha)}{d\alpha}\frac{\partial e}{\partial b}b = \varepsilon_{\delta,e}\varepsilon_{e,\mu}\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\frac{1}{\frac{d\log\lambda_1}{de}}\frac{1}{\alpha}\delta(e,\alpha)b \quad (34)$$

where $\varepsilon_{\delta,e}\equiv\frac{d\delta}{de}\frac{e}{\delta}$. Substituting (33) and (34) into (32) yields:

$$\frac{d\varepsilon_e}{d\mu} = -\frac{U'(b)}{E[U(w-\tau)|w\geq\overline{w}]-U(b)+\psi(e)}\frac{1}{\frac{d\log\lambda_1}{de}}\frac{1}{\mu}\delta(e,\alpha)b\times \left[\varepsilon_{\frac{d\log\lambda_1}{de},\mu}+\varepsilon_{\Delta U,\mu}+\varepsilon_{\rho+s+\lambda\overline{F},e}\times\varepsilon_{e,\mu}+\frac{u}{1-u}\times\varepsilon_{\rho+s+\lambda\overline{F},\overline{w}}\times\left(\varepsilon_{\overline{w},\mu}-\frac{\mu}{\overline{w}}\right)-\varepsilon_{\delta,e}\varepsilon_{e,\mu}\right]$$

Therefore,

$$\frac{d\left|\varepsilon_e\right|}{d\alpha}>0 \Longleftrightarrow \left[\varepsilon_{\frac{d\log\lambda_1}{de},\mu}+\varepsilon_{\Delta U,\mu}+\varepsilon_{\rho+s+\lambda\overline{F},e}\times\varepsilon_{e,\mu}+\frac{u}{1-u}\times\varepsilon_{\rho+s+\lambda\overline{F},\overline{w}}\times\left(\varepsilon_{\overline{w},\mu}-\frac{\mu}{\overline{w}}\right)-\varepsilon_{\delta,e}\varepsilon_{e,\mu}\right]<0$$

(v) Finally, consider the insurance effect. We are interested in $\frac{d\overline{g}}{d\mu}$:

$$\frac{d\overline{g}}{d\mu}=\frac{-dE[U'(w-\tau)|w\geq\overline{w}]}{d\mu}\frac{\overline{g}}{E[U'(w-\tau)|w\geq\overline{w}]}$$

We can show that at $\mu=0$:

$$\frac{-dE[U'(w-\tau)|w\geq\overline{w}]}{d\mu}=\frac{1}{\overline{F}(\overline{w})}\left[\begin{array}{c}\theta(\overline{w})\left(\frac{\partial\overline{w}}{\partial\mu}-1\right)\int_{\overline{w}}^{\infty}\left(U'(w-\tau)-U'(\overline{w}-\tau)\right)dF(w)\\ -\int_{\overline{w}}^{\infty}U''(w-\tau)f(w)dw\end{array}\right]$$

Therefore,

$$\frac{d\overline{g}}{d\mu}=\frac{1}{\overline{F}(\overline{w})}\left[\begin{array}{c}\theta(\overline{w})\left(\frac{\partial\overline{w}}{\partial\mu}-1\right)\int_{\overline{w}}^{\infty}\left(U'(w-\tau)-U'(\overline{w}-\tau)\right)dF(w)\\ -\int_{\overline{w}}^{\infty}U''(w-\tau)f(w)dw\end{array}\right]\frac{\overline{g}}{E[U'(w-\tau)|w\geq\overline{w}]}$$

Note that $\frac{\partial\overline{w}}{\partial\mu}-1<0$, $U'(w-\tau)-U'(\overline{w}-\tau)<0$ for $w\in[\overline{w},\infty)$ and $U''<0$. Therefore, $\frac{d\overline{g}}{d\mu}>0$. Also, we showed above that $\frac{\partial u}{\partial\mu}<0$. Therefore, there is a "reservation wage effect" and a "budget effect" when there is a positive shift in the wage offer distribution.

A.6.4 Extension 4: Assets

Let us introduce non-labor income A into our job search model. In each period and in each state, the agent has A available. One can think of A as spousal income. Incorporating non-labor income into the model, it is easy to show that the first-order condition for search holds:

$$\psi'(e) = \frac{\lambda_1(e,\alpha)}{\rho + s}\varphi(\overline{w})$$

A simple manipulation of the FOC shows that:

$$\frac{\partial e}{\partial b} = \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{U'(A+b)}{E[U(A+w-\tau)|w \geq \overline{w}] - U(A+b) + \psi(e)}$$

Next,

$$\frac{\partial e}{\partial A} = -\frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{\frac{\partial \varphi(\overline{w})}{\partial A}}{\varphi(\overline{w})}$$

Note that

$$\begin{aligned}
\frac{\partial \varphi(\overline{w})}{\partial A} &= \frac{\partial}{\partial A}\left[\int_{\overline{w}}^{\infty} [U(A+w-\tau) - U(A+\overline{w}-\tau)]dF(w)\right] \\
\frac{\partial \varphi(\overline{w})}{\partial A} &= \int_{\overline{w}}^{\infty} [U'(A+w-\tau) - U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right)]dF(w) \\
\frac{\partial \varphi(\overline{w})}{\partial A} &= \overline{F}(\overline{w})\left(E[U'(A+w-\tau)|w \geq \overline{w}] - U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right)\right)
\end{aligned}$$

Let us try to solve for $U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right)$. We will make use of the reservation wage equation:

$$U(A+\overline{w}-\tau) = U(A+b) + \frac{\lambda(e,\alpha)}{\rho + s}\int_{\overline{w}}^{\infty} [U(A+w-\tau) - U(A+\overline{w}-\tau)]dF(w)$$

Thus,

$$\begin{aligned}
U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right) &= U'(A+b) + \\
&\quad \frac{\lambda(e,\alpha)\overline{F}(\overline{w})}{\rho + s}\left(E[U'(A+w-\tau)|w \geq \overline{w}] - U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right)\right) \\
U'(A+\overline{w}-\tau)\left(1 + \frac{\partial \overline{w}}{\partial A}\right) &= uU'(A+b) + (1-u)E[U'(A+w-\tau)|w \geq \overline{w}]
\end{aligned}$$

Substitution yields

$$\frac{\partial \varphi(\overline{w})}{\partial A} = u\overline{F}(\overline{w})\left(E[U'(A+w-\tau)|w \geq \overline{w}] - U'(A+b)\right)$$

Thus,

$$\frac{\partial e}{\partial A} = -\frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{\overline{F}(\overline{w})\left(E[U'(A+w-\tau)|w \geq \overline{w}] - U'(A+b)\right)u}{\varphi(\overline{w})}$$

Next, using fact that $\varphi(\overline{w}) = u\overline{F}(\overline{w})\left[E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)\right]$ delivers:

$$\frac{\partial e}{\partial A} = \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{U'(A+b) - E[U'(A+w-\tau)|w \geq \overline{w}]}{E[U(w-\tau)|w \geq \overline{w}] - U(b) + \psi(e)}$$

Finally, let us translate the wage offer distribution by μ, so that the new distribution is $F(w-\mu)$ and consider the effect of a change in μ on effort:

$$\frac{\partial e}{\partial \mu} = -\frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{\frac{\partial \varphi(\overline{w})}{\partial \mu}}{\varphi(\overline{w})}$$

Let us try to solve for $\frac{\partial \varphi(\overline{w})}{\partial \mu}$. First, one can show using integration by parts that $\varphi(\overline{w}(\mu)) = E[U(A+w+\mu-\tau)] - U(A+\overline{w}(\mu)-\tau) + \int_0^{\overline{w}(\mu)} U'(A+w-\tau)F(w-\mu)dw$. Thus,

$$\frac{\partial \varphi(\overline{w}(\mu))}{\partial \mu} = E[U'(A+w+\mu-\tau)] - U'(A+\overline{w}(\mu)-\tau)\frac{\partial \overline{w}(\mu)}{\partial \mu}\overline{F}(\overline{w}-\mu) - \int_0^{\overline{w}(\mu)} U'(A+w-\tau)f(w-\mu)dw$$

At $\mu = 0$, this is

$$\begin{aligned}
\frac{\partial \varphi(\overline{w})}{\partial \mu} &= E[U'(A+w-\tau)] - U'(A+\overline{w}-\tau)\frac{\partial \overline{w}}{\partial \mu}\overline{F}(\overline{w}) - \int_0^{\overline{w}} U'(A+w-\tau)f(w)dw \\
\frac{\partial \varphi(\overline{w})}{\partial \mu} &= \overline{F}(\overline{w})\left[E[U'(A+w-\tau)|w \geq \overline{w}] - U'(A+\overline{w}-\tau)\frac{\partial \overline{w}}{\partial \mu}\right] \\
\frac{\partial \varphi(\overline{w})}{\partial \mu} &= \overline{F}(\overline{w})\left[E[U'(A+w-\tau)|w \geq \overline{w}] - E[U'(A+w-\tau)|w \geq \overline{w}](1-u)\right] \\
\frac{\partial \varphi(\overline{w})}{\partial \mu} &= u\overline{F}(\overline{w})E[U'(A+w-\tau)|w \geq \overline{w}]
\end{aligned}$$

where the third line follows from the results in Extension 3. Therefore,

$$\frac{de}{d\mu} = \frac{\lambda_1(e,\alpha)}{\lambda_{11}(e,\alpha)} \frac{E[U'(A+w-\tau)|w \geq \overline{w}]}{E[U(A+w-\tau)|w \geq \overline{w}] - U(A+b) + \psi(e)}$$

Thus,

$$\frac{\frac{de}{dA}}{\frac{de}{d\mu}} = \frac{U'(A+b) - E[U'(A+w-\tau)|w \geq \overline{w}]}{U'(A+w-\tau)}$$

We see that the consumption smoothing benefit of UI is identified by the ratio of the liquidity effect to the substitution effect, a result that carries over from Chetty (2008) to our reservation wage model. One might expect non-labor income, A, to covary with α. For example, if A represents spousal income, then a couple that is hit by a bad labor market shock ($d\alpha < 0$) where both become unemployed, will suffer a fall in assets, $dA < 0$. In this case, the liquidity effect of UI, and hence the consumption smoothing benefit, could increase due to diminishing marginal utility.

A.7 Extended Benefits Policy Simulations

A.7.1 Comparing Optimal UI Policy to Extended Benefits Policy in the U.S.

Table 10 shows, at $\gamma = 4$, the weekly optimal benefit level increases from \$147 to \$197. Given a mean unemployment duration of roughly 18 weeks based on Table 1, this implies total expected benefits paid out to a given individual increase by \$900 ($= 18 \times (\$197 - \$147)$), assuming no behavioral response. A duration elasticity with respect to the benefit level of 0.563 increases the total expected payout to \$1072 ($= (\$197 - \$147) \times (18 + 0.563 \times 18 \times \frac{\$197-\$147}{\$147})$).

Next, consider instead a benefit extension of 13 weeks. The expected increase in payments to an individual, assuming a potential duration of 26 weeks for the regular UI program, is given by

$$\$147 \sum_{t=1}^{13} t \times \Pr\{duration = 26 + t\} + \$147 \times 13 \times \Pr\{duration > 39\}$$

For simplicity, let's assume that $\Pr\{duration = 26 + t\} = \Pr\{duration = 26\}$ for all t. In our SIPP sample, we calculated that the average frequency that a spell lasts exactly t weeks where $t \in [27, 39]$ is roughly 0.009 and $\Pr\{duration > 39\} = .12$. Roughly 76% of the unemployment spells in our data end at 26 weeks or less. Therefore, the expected increase in total payments paid to an individual are \$350 ($= 0.009 \times 91 \times \$147 + 0.12 \times 13 \times \$147$), assuming no behavioral response. The results from Card and Levine (2000) suggest that an extra 13 weeks of benefits raise durations by 1 week. If we assume that this one week increase would result in receipt of a full week's worth of benefits, the total expected payout incorporating behavioral responses is \$497. Thus, based on this simple illustration, the actual UI policy appears to be less generous in terms of expected payouts as the optimal policy from adjusting the replacement rate would imply.

A.7.2 Implications of Extending Benefits During Recessions

To fix ideas, we focus on the recent extension in potential duration from 26 weeks to 104 weeks in the U.S. Card and Levine (2000) estimate during normal economic times that a 13-week extension increases unemployment duration by 1 week. Extrapolating from their estimate, a 78 week increase in potential duration is expected to prolong durations on average by 6 weeks in normal times. We now compute how much the UI benefit *level* has to increase to raise durations by 1 week, based on our estimates. We know that unemployment duration is 18 weeks at the mean unemployment rate in our sample of 6.2%. Further, the duration elasticity is 0.563. Thus, 1 extra week of unemployment duration would require a percent increase in benefits equal to $.10 = (1/18)/.563$.

Now suppose that the unemployment rate has increased to 8.8%. Our estimates imply that a 10% increase in benefits would increase durations by roughly 1.65% or .0165*18 = 0.3 weeks. Using our estimates, and assuming that the potential duration elasticity is also lower in bad times, a 13-week extension would raise durations by 0.3 weeks in bad times, compared to the 1 week from Card and Levine. Thus, a 78 week increase in potential duration leads to a 1.8 week increase in durations, rather than the 6 week increase one would obtain based on Card and Levine's estimate.

To see what this implies for the aggregate unemployment rate, we make use of the steady-state relationship, $u = s/(p + s)$, where s is the separation rate and p is the job finding rate. For the monthly job separation rate, we set $s = .0125$, which is similar to the estimate in Shimer (2007). At this separation rate, $p = 0.19$ gives you an unemployment duration of roughly 22.8 weeks and an unemployment rate of 6.2%. After the benefit extension, durations rise to $24.6 = 22.8 + 1.8$ weeks or 5.7 months, giving a new unemployment rate of $u = .0125/(.0125 + 1/4.95) = 6.65\%$. Thus, our calculations imply that extended benefits can account for roughly 17% of the observed increase in the aggregate unemployment rate during the recession in the U.S..

A.8 Data Documentation

Survey of Income and Program Participation (SIPP) Sample

We use the 1985, 1986, 1987, 1990, 1991, 1992, 1993, and 1996 SIPP panels. We follow Chetty (2008) and impose the following sample restrictions: (a) drop Maine, Vermont, Iowa, North Dakota, South Dakota, Alaska, Idaho, Montana, and Wyoming due to non-unique state identifiers, (b) only prime-age males (age between 18 and 65), (c) are not on temporary layoff, (d) have three-months of work history in the survey, and (e) took up UI benefits within one month after job loss. For several alternative specifications, we expand Chetty's baseline sample by adding back in unemployed individuals who were eligible for UI (according to the UI beneift calculator) but did not report receiving UI. See Appendix B in Chetty (2008) for more details on construction of the SIPP sample used in this paper.

UI Benefit Level Variables Used in the SIPP

We utilize several proxies for an individual claimant's actual UI benefit level. All proxies for UI benefits (and all nominal dollar values in the data) are adjusted to real dollars using the 2000 CPI-U series.

Average UI Weekly Benefit Amount (WBA)– This annual measure is defined as total benefits paid divided by weeks compensated in a state. We use the variable in the data from Chetty (2008), which was found via the Department of Labor.

Maximum UI WBA– This is the statutory maximum UI benefit level as reported semi-annually in the "Significant Provisions of State UI Laws."

Simulated Average UI WBA– This semi-annual measure is constructed by using a fixed 20% 1993 (national) sample and computing the average weekly UI benefit in this fixed sample for every state-year combination in the data set following Currie and Gruber (1996).

Average UI Replacement Rate– This is the Average UI WBA divided by the average weekly wage for prime-age males, where the average weekly wages is computed using the IPUMS CPS.

Maximum potential duration of UI benefits– This is the (statutory) maximum number of weeks an individual can collect UI benefits as reported in the Chetty (2008) data.

Unemployment Rates

State Unemployment Rates– We use seasonally-adjsuted, monthly unemployment rates from the Local Area Unemployment Statistics (LAUS) program of the BLS.

National Unemployment Rates– We use annual national unemployment rates from the BLS.

Metropolitan Area (MSA) Unemployment Rates– We use seasonally-adjusted, monthly unemployment rates from the Local Area Unemployment Statistics (LAUS) program of the BLS. We use state unemployment rates for all SIPP spells without an MSA identifier or with an identifier that is not matched in LAUS data.

Merging Unemployment Rates to SIPP Data

We define the relative unemployment rate as follows: $\log(u_{s,m,y}) - \log(u_y)$, where $s = state$, $m = month$, and $y = year$. We merge the relative unemployment rate by year, month and state to the SIPP. The key unemployment rate that we use in our empirical specifications is the unemployment rate in the month at the start of an individual's unemployment spell.

Panel Study of Income Dynamics (PSID) Sample

We use data from the PSID between 1968 and 1987. We follow Gruber (1997) and impose the following sample restrictions: (a) drop observations where food consumption is imputed, (b) drop observations with three-fold change in total food consumption, (c) drop temporary layoffs. The sample consists of all heads of household who are employed at time $t-1$ and unemployed at time t. Unlike in the SIPP data, we include all households whether or not the household reported receiving UI, in order to replicate the Gruber (1997) results as closely as possible. See Gruber (1994) and Gruber (1997) for more details on the sample construction.

UI Benefit Level Variable Used in the PSID

After-tax Replacement Rate– This variable is defined as the fraction of prior net earnings replaced by UI benefits. It is constructed by applying Jonathan Gruber's UI calculator to the PSID sample; see Gruber (1994) and Gruber (1997) for details of the construction of this calculator.

Merging Unemployment Rates to PSID

We merge the relative unemployment rate by state and year to the PSID. The PSID only provides the month of the interview as a bracketed variable, making it difficult to merge unemployment rates at the monthly level. Thus, we use the previous year's unemployment rate because we do not observe individuals at the start of their spell, and we want to ensure that the unemployment rate is predetermined, for reasons discussed in the main text. Lastly, we do not have state unemployment rates between 1968 and 1975, so we linearly interpolate and extrapolate the state unemployment rate using the 1970 state unemployment rate computed using the IPUMS Census and the 1976-1980 state unemployment rates from the

LAUS data. Results are extremely similar using a variety of other interpolation procedures (e.g., quadratic interpolation and/or interpolating using 1976-1987 unemployment data).

Shift-Share Proxy for Local Labor Demand Following Bartik (1991)

We use annual data from the County Business Patterns to construct a valid instrumental variable for local labor demand following the procedure in Bartik (1991). This variable is constructed by interacting cross-sectional differences in industrial composition in a given state-year with year-over-year national changes in industry employment shares. This creates a predicted annual change in state employment based on previous year's industrial composition. We use three-year historical average of annual predicted employment growth rates, and we use this average predicted change in employment to construct a predicted employment-to-population ratio, dividing predicted employment by total prime-age population. We use annual state population estimates from the CPS.

Appendix Table A1
(Reproducing Table 4 With Maximum UI WBA)
Allowing UI Benefits to Respond Flexibly to the Unemployment Rate and Flexibly Controlling for Unobserved Trends

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
log(**Maximum** UI WBA)	**(A)**	-0.228	-0.220	-0.255	-0.227	-0.232	-0.243	-0.164	-0.290	-0.176	-0.348
		(0.253)	(0.252)	(0.263)	(0.250)	(0.236)	(0.261)	(0.207)	(0.205)	(0.231)	(0.216)
		[0.368]	[0.382]	[0.333]	[0.365]	[0.326]	[0.352]	[0.428]	[0.158]	[0.444]	[0.107]
log(Maximum UI WBA) ×	**(B)**	**1.219**	**1.263**	**1.444**	**1.546**	**3.199**	**1.133**	**3.451**	**1.301**	**1.358**	**1.278**
log(State Unemp. Rate / National Unemp. Rate)		**(0.469)**	**(0.432)**	**(0.413)**	**(0.429)**	**(1.282)**	**(0.416)**	**(1.360)**	**(0.493)**	**(0.847)**	**(0.480)**
		[0.009]	**[0.003]**	**[0.000]**	**[0.000]**	**[0.013]**	**[0.006]**	**[0.011]**	**[0.008]**	**[0.109]**	**[0.008]**
Quadratic in State Unemployment Rate		N	Y	N	N	N	N	N	N	N	N
Cubic in State Unemployment Rate		N	N	Y	N	N	N	N	N	N	N
Quartic in State Unemployment Rate		N	N	N	Y	N	N	N	N	N	N
State FEs x State Unemployment Rate		N	N	N	N	Y	N	Y	N	N	N
Year FEs x State Unemployment Rate		N	N	N	N	N	Y	Y	N	N	N
Region-specific linear time trends		N	N	N	N	N	N	N	Y	N	N
Region × Year FEs		N	N	N	N	N	N	N	N	Y	N
State-specific linear time trends		N	N	N	N	N	N	N	N	N	Y
Post-estimation: **(A)** + σ × **(B)**		0.022	0.039	0.041	0.090	0.424	-0.011	0.543	-0.023	0.102	-0.086
		(0.239)	(0.236)	(0.243)	(0.225)	(0.294)	(0.241)	(0.284)	(0.203)	(0.215)	(0.226)
		[0.927]	[0.870]	[0.865]	[0.689]	[0.150]	[0.963]	[0.056]	[0.908]	[0.635]	[0.703]
Post-estimation: **(A) -** σ × **(B)**		-0.477	-0.479	-0.551	-0.543	-0.887	-0.475	-0.871	-0.557	-0.455	-0.610
		(0.299)	(0.294)	(0.306)	(0.300)	(0.403)	(0.305)	(0.400)	(0.252)	(0.347)	(0.248)
		[0.110]	[0.104]	[0.072]	[0.070]	[0.028]	[0.119]	[0.029]	[0.027]	[0.190]	[0.014]

Notes: All columns report semiparametric (Cox proportional) hazard model results from estimating equation (5). Data are individual-level unemployment spells from 1985-2000 SIPP. Number of spells = 4307. See Table 2 for more details on the baseline specification. The final two rows reports linear combinations of parameter estimates to produce the duration elasticity when the state unemployment rate is one standard deviation above/below the mean. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state over time, are in parentheses and p-values are in brackets.

Appendix Table A2

Other Robustness Tests: Alternative Controls, Nonlinear Direct Effects, Extended Benefits, Control Function

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
log(Average UI WBA) **(A)**	-0.563	-0.573	-0.369	-0.323	-0.491	-0.229	-0.532	-0.819
	(0.300)	(0.299)	(0.123)	(0.128)	(0.415)	(0.516)	(0.246)	(0.430)
	[0.060]	[0.056]	[0.003]	[0.012]	[0.237]	[0.658]	[0.030]	[0.057]
log(Average UI WBA) × (B)	**1.262**	**1.244**	**0.905**	**0.771**	**1.273**	**1.714**	**1.370**	**1.074**
log(State Unemp. Rate / National Unemp. Rate)	**(0.434)**	**(0.447)**	**(0.543)**	**(0.535)**	**(0.465)**	**(0.440)**	**(0.418)**	**(0.613)**
	[0.004]	**[0.005]**	**[0.095]**	**[0.149]**	**[0.006]**	**[0.000]**	**[0.001]**	**[0.080]**
Stratified baseline hazard	Y	N	N	N	N	Y	Y	Y
State, Year, Occupation, Industry FEs	Y	Y	N	N	Y	Y	Y	Y
Age, Marital Dummy, Education, Wage Spline	Y	Y	Y	N	Y	Y	Y	Y
Quadratic in State Unemp. Rate, Average UI WBA	N	N	N	N	Y	Y	N	N
Cubic in State Unemp. Rate, Average UI WBA	N	N	N	N	N	Y	N	N
Controls for potential duration and extended benefits	N	N	N	N	N	N	Y	N
Instrument log(Avg. UI WBA) with log(Simulated Avg. UI WBA)	N	N	N	N	N	N	N	Y
Post-estimation: **(A)** + σ × **(B)**	-0.304	-0.318	-0.183	-0.165	-0.230	0.123	-0.251	-0.599
	(0.300)	(0.300)	(0.138)	(0.150)	(0.399)	(0.524)	(0.262)	(0.435)
	[0.310]	[0.289]	[0.183]	[0.272]	[0.564]	[0.815]	[0.337]	[0.169]
Post-estimation: **(A) -** σ × **(B)**	-0.822	-0.828	-0.554	-0.481	-0.752	-0.580	-0.813	-1.039
	(0.325)	(0.325)	(0.190)	(0.185)	(0.451)	(0.525)	(0.258)	(0.460)
	[0.011]	[0.011]	[0.004]	[0.009]	[0.096]	[0.269]	[0.002]	[0.024]

Notes: All columns report semiparametric (Cox proportional) hazard model results from estimating equation (5). Data are individual-level unemployment spells from 1985-2000 SIPP. Number of spells = 4307. See Table 2 for more details on the baseline specification. Column (7) controls for maximum potential duration of benefits by setting log(Average UI WBA) to 0 for all weeks beyond the maximum number of weeks (where the maximum accounts for extended benefits programs). Column (8) reports results from a two-stage instrumental variables specification using log(Simulated Average UI WBA) as an instrument for log(Average UI WBA), where in the second stage a fifth-order polynomial in the first stage residuals is used as a control function. See text for details on the simulated instrument. The final two rows report linear combinations of parameter estimates to produce the duration elasticity when the state unemployment rate is one standard deviation above/below the mean. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state over time, are in parentheses and p-values are in brackets. In column (8), the standard errors are bootstrapped standard errors based on 1000 replications, sampling states with replacement.

Appendix Table A3
Measuring Selection on Observables Using Demographics as Dependent Variable

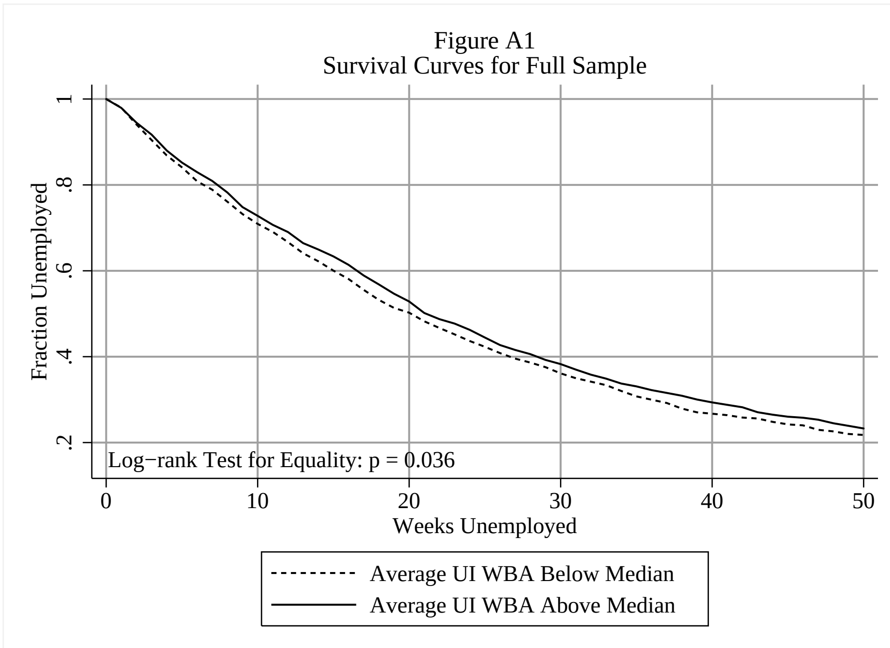
Dependent variable:	Age in Years	Marital Dummy	Years of Education	Log Annual Wage	Liquid Wealth ≥ Median	Liquid Wealth ≥ 75th Percentile
	(1)	(2)	(3)	(4)	(5)	(6)
log(State Unemp. Rate / National Unemp. Rate)	0.295	0.018	0.069	0.013	0.004	-0.001
	(0.259)	(0.012)	(0.089)	(0.013)	(0.013)	(0.011)
	[0.261]	[0.146]	[0.443]	[0.301]	[0.779]	[0.909]
R^2	0.029	0.027	0.025	0.036	0.031	0.034

Notes: All columns report OLS regressions of the dependent variable, and all columns include state fixed effects and year fixed effects. The baseline SIPP data set is collapsed to one observation per unemployment spell, leaving N = 4307 in all columns. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state over time, are in parentheses and p-values are in brackets.

Appendix Table A4
(Reproducing Table 6 With Maximum UI WBA)
How Much Do Demographics Explain Why Moral Hazard Varies with the State Unemployment Rate?

Dependent variable:		Unemployment Duration								Take-up Dummy
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
log(Average UI WBA)	**(A)**	-0.228	-0.227	-0.215	-0.226	-0.230	-0.217	-0.219	-0.208	0.105
		(0.253)	(0.253)	(0.263)	(0.249)	(0.251)	(0.241)	(0.254)	(0.264)	(0.079)
		[0.368]	[0.369]	[0.414]	[0.365]	[0.360]	[0.367]	[0.389]	[0.432]	[0.192]
log(Average UI WBA) ×	**(B)**	**1.219**	**1.219**	**1.235**	**1.202**	**1.214**	**1.213**	**1.129**	**1.144**	**-0.313**
log(State Unemp. Rate /		**(0.469)**	**(0.469)**	**(0.471)**	**(0.466)**	**(0.462)**	**(0.473)**	**(0.456)**	**(0.452)**	**(0.134)**
National Unemp. Rate)		**[0.009]**	**[0.009]**	**[0.009]**	**[0.010]**	**[0.009]**	**[0.010]**	**[0.013]**	**[0.011]**	**[0.024]**
log(State Unemp. Rate /		0.010	0.010	0.009	0.013	0.008	0.008	0.006	0.009	0.117
National Unemp. Rate)		(0.130)	(0.130)	(0.131)	(0.129)	(0.130)	(0.131)	(0.130)	(0.132)	(0.023)
		[0.940]	[0.941]	[0.943]	[0.922]	[0.953]	[0.948]	[0.961]	[0.945]	[0.000]
log(Avg. UI WBA) × Age			0.001						0.000	
			(0.008)						(0.009)	
			[0.936]						[0.993]	
log(Avg. UI WBA) × **1**{Married}				-0.099					-0.160	
				(0.139)					(0.168)	
				[0.475]					[0.340]	
log(Avg. UI WBA) ×					0.039				0.037	
Years of Education					(0.037)				(0.038)	
					[0.298]				[0.325]	
log(Avg. UI WBA) ×						0.097			0.059	
log(pre-unemp. wage)						(0.092)			(0.109)	
						[0.295]			[0.586]	
Number of Spells		4307	4307	4307	4307	4307	4307	4307	4307	16322
log(Avg. UI WBA) × Occupation FEs		N	N	N	N	N	Y	N	Y	Y
log(Avg. UI WBA) × Industry FEs		N	N	N	N	N	N	Y	Y	Y
Post-estimation: **(A)** + σ × **(B)**		0.022	0.023	0.038	0.021	0.019	0.031	0.013	0.027	0.036
		(0.239)	(0.239)	(0.250)	(0.237)	(0.237)	(0.226)	(0.237)	(0.247)	(0.064)
		[0.927]	[0.925]	[0.880]	[0.931]	[0.936]	[0.890]	[0.958]	[0.913]	[0.579]
Post-estimation: **(A) -** σ × **(B)**		-0.477	-0.477	-0.468	-0.472	-0.478	-0.466	-0.450	-0.442	0.174
		(0.299)	(0.299)	(0.308)	(0.294)	(0.296)	(0.289)	(0.301)	(0.309)	(0.100)
		[0.110]	[0.110]	[0.129]	[0.108]	[0.107]	[0.107]	[0.135]	[0.153]	[0.083]

Notes: Columns (1) through (8) report semiparametric (Cox proportional) hazard model results from estimating equation (5) using individual-level unemployment spells from 1985-2000 SIPP. See Table 2 for more details on the baseline specification. Column (9) reports OLS estimates of take-up elasticity on a broader sample of all individuals deemed eligible for UI. The final two rows reports linear combinations of parameter estimates to produce the marginal effects when the state unemployment rate is one standard deviation above/below average. Standard errors, adjusted to allow for an arbitrary variance-covariance matrix for each state over time, are in parentheses and p-values are in brackets.



Notes: Data are individual-level unemployment spells from 1985-2000 SIPP. The figure plots (Kaplan-Meier) survival curves for two groups of individuals based on whether or not Average UI Weekly Benefit Amount (WBA) in individual's state is above or below the median. The survival curves are adjusted following Chetty (2008), which parametrically adjusts for "seam effect" by fitting a Cox proportional hazard model with a seam dummy and then recovering the baseline hazard.

Figure A2
Survival Curves Under High Unemployment Rate

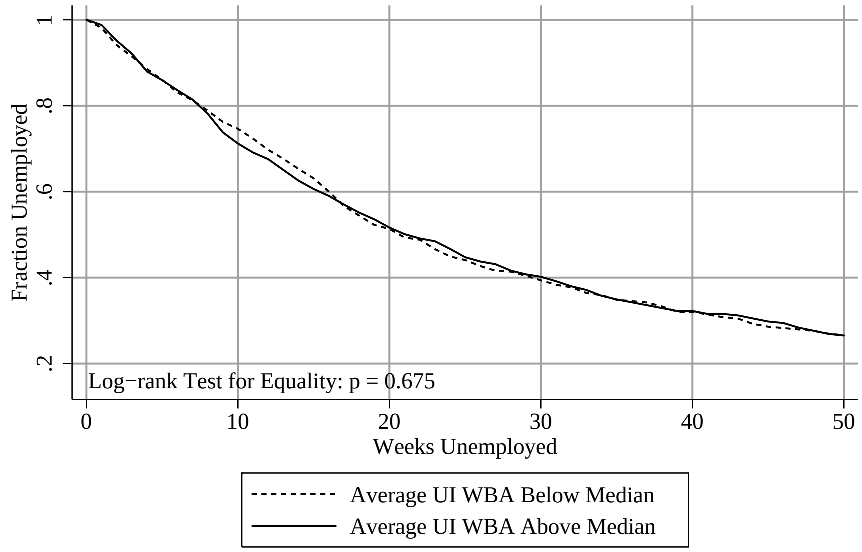
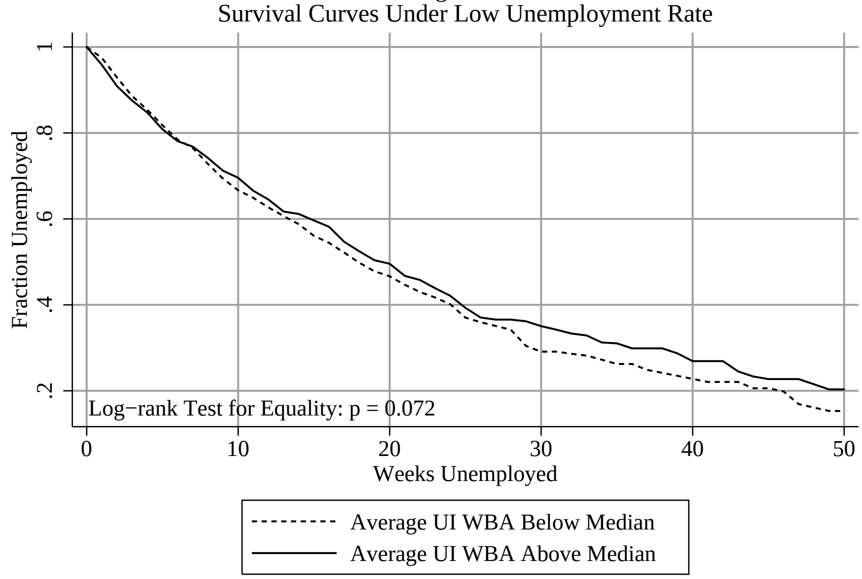


Figure A3
Survival Curves Under Low Unemployment Rate



Notes: Data are individual-level unemployment spells from 1985-2000 SIPP. In order to minimize liquidity effects, the sample is limited to individuals with net liquid wealth above the median. Each figure plots (Kaplan-Meier) survival curves for two groups of individuals based on whether or not Average UI Weekly Benefit Amount (WBA) in individual's state is above or below the median. The survival curves are adjusted following Chetty (2008), which parametrically adjusts for "seam effect" by fitting a Cox proportional hazard model with a seam dummy and then recovering the baseline hazard.

Figure A4
Survival Curves Under Low Predicted Emp−to−Pop

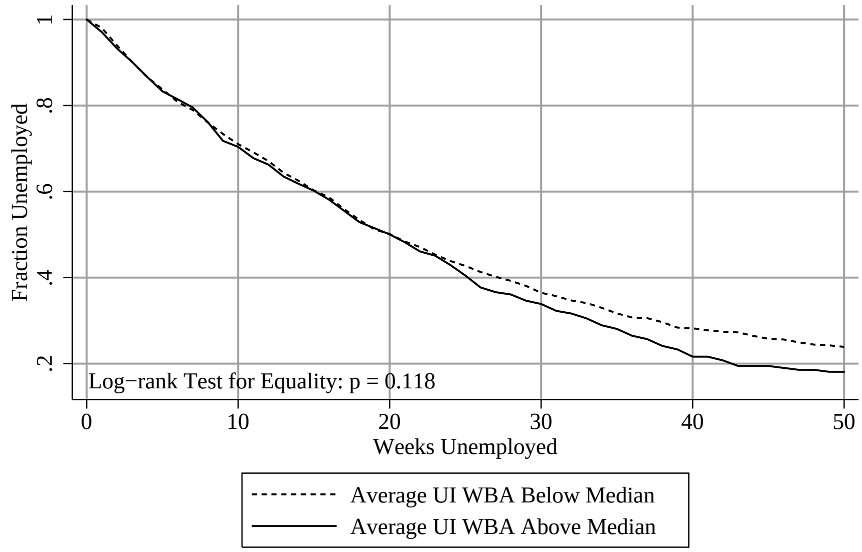
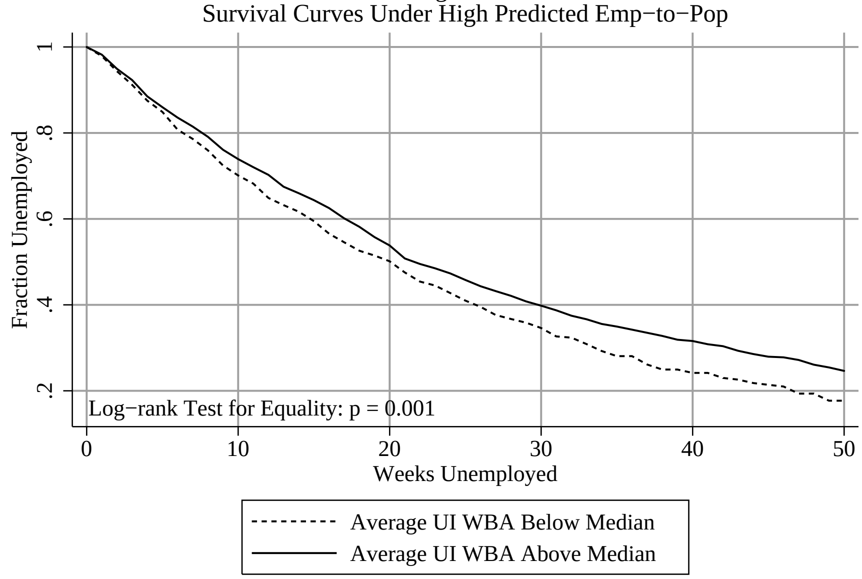


Figure A5
Survival Curves Under High Predicted Emp−to−Pop



Notes: Data are individual-level unemployment spells from 1985-2000 SIPP. Each figure plots (Kaplan-Meier) survival curves for two groups of individuals based on whether or not Average UI Weekly Benefit Amount (WBA) in individual's state is above or below the median. The survival curves are adjusted following Chetty (2008), which parametrically adjusts for "seam effect" by fitting a Cox proportional hazard model with a seam dummy and then recovering the baseline hazard. The employment-to-population ratio is predicted following Bartik (1991); see text for details.

Figure A6
Survival Curves Under High Unemployment Rate
(Within−state variation)

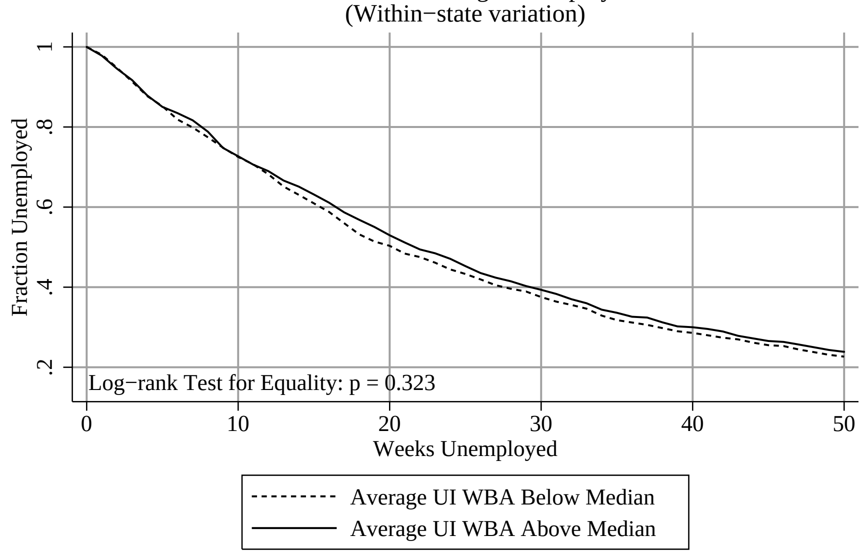
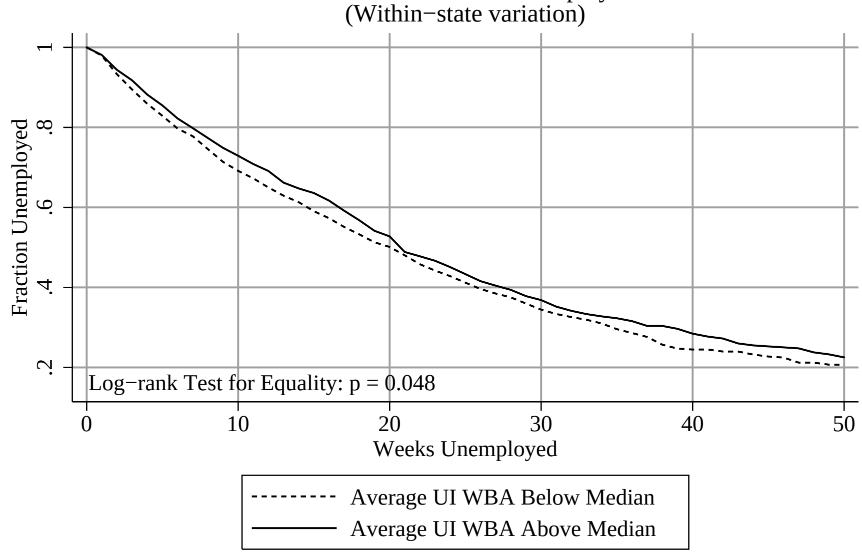
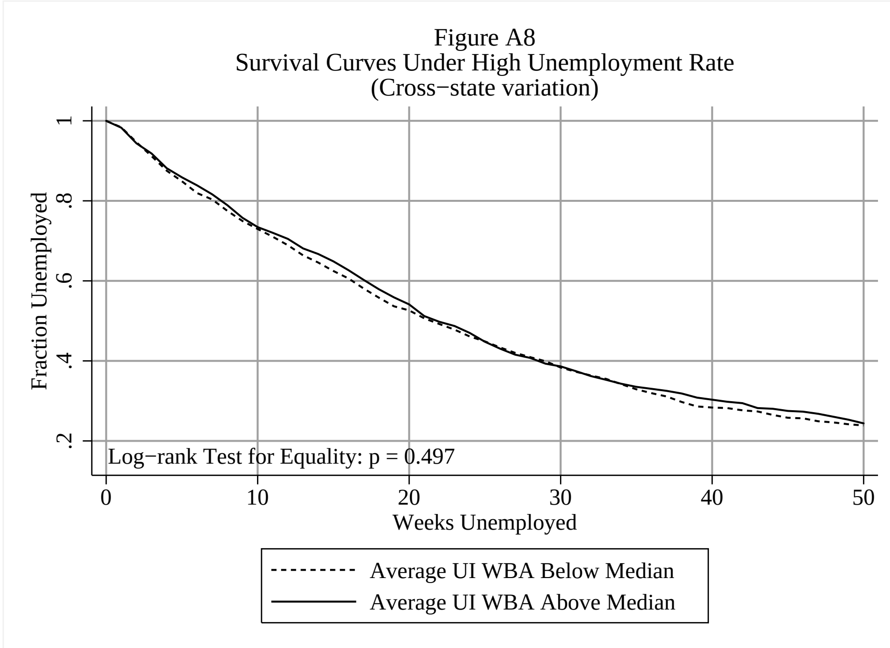
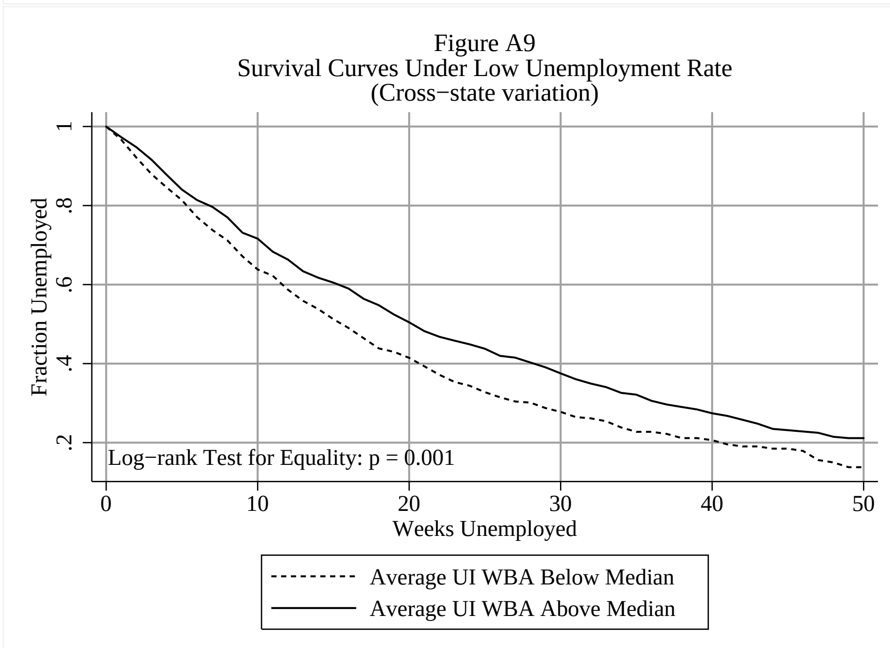


Figure A7
Survival Curves Under Low Unemployment Rate
(Within−state variation)



Notes: Data are individual-level unemployment spells from 1985-2000 SIPP. Each figure plots (Kaplan-Meier) survival curves for two groups of individuals based on whether or not Average UI Weekly Benefit Amount (WBA) in individual's state is above or below the median. The survival curves are adjusted following Chetty (2008), which parametrically adjusts for "seam effect" by fitting a Cox proportional hazard model with a seam dummy and then recovering the baseline hazard. The figures report results for sub-samples defined depending on whether the unemployment rate is above or below the median unemployment rate in the state during the sample period.





Notes: Data are individual-level unemployment spells from 1985-2000 SIPP. Each figure plots (Kaplan-Meier) survival curves for two groups of individuals based on whether or not Average UI Weekly Benefit Amount (WBA) in individual's state is above or below the median. The survival curves are adjusted following Chetty (2008), which parametrically adjusts for "seam effect" by fitting a Cox proportional hazard model with a seam dummy and then recovering the baseline hazard. The figures report results for sub-samples defined depending on whether the average unemployment rate in the state during the sample period is above or below the median across all states in the sample.