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## UNEMPLOYMENT INSURANCE PAYMENTS AS A SEARCH SUBSIDY: A THEORETICAL ANALYSIS

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ABSTRACT

In recent years much interest has been shown in studying the effects of unemployment insurance (UI) payments on the labor supply decisions of workers. In most previous work job search models have been used to analyze individual labor supply reactions to changes in UI payments when demand factors are held constant. Using such models it has been shown that an increase in UI payments makes unemployed workers more selective when evaluating job offers which, in turn, leads to an increase in the expected duration of completed spells of unemployment. The purpose of the study is to extend the theoretical analysis of this topic. It is shown that the result obtained from the job search models rest on two assumptions that cannot be justified empirically. Further, if these assumptions are replaced by more reasonable ones, a new and significantly different theory results. This theory leads to a much richer set of predictions than previously presented.

## Introduction

In recent years interest has been shown in studying the relationship between unemployment insurance (UI) payments and the level of unemployment in an economy. Most interest has centered on determining the effects of UI payments on the individual labor supply decision.[1] Job search models have been used to analyze the individual labor supply reactions to changes in UI payments when demand factors are held constant. Using such models it has been shown that an increase in UI payments makes unemployed workers more selective when evaluating job offers, which, in turn, leads to an increase in the expected duration of completed spells of unemployment.[2] Due to this prediction it is said UI payments have an <u>adverse incentive effect</u> on the individual labor supply decision. The purpose of this study is to extend the theoretical analysis of this topic. It will be shown that the results presented above rest on two assumptions that cannot be justified empirically. Further, if these assumptions are replaced by more reasonable assumptions, a new, and significantly different, theory results. This theory leads to a much richer set of predictions than previously presented.

The two assumptions made in the job search models that lead to the conclusion UI payments have an adverse incentive effect are (a) UI payments are received by a worker in each period in a spell of unemployment, and (b) employed workers are not laid off. In the present study both these assumptions will be dropped. First, it will be assumed there is a maximum period of time, termed the UI duration, during which an unemployed worker receives UI payments. Workers who have been unemployed more than the UI duration in a spell of unemployment receive no further UI payments. Most, if not all, UI schemes used in the United States utilize a UI duration as specified above. Second, it will be assumed employed workers may be laid off, and unemployed workers take this into account when evaluating job offers.

When the two new assumptions are used in a job search model it can be shown that UI payments have an adverse incentive effect on those workers who have been unemployed a short period of time, but a positive incentive effect on the long-term unemployed. Hence a change in UI payments is predicted to change the composition of the unemployed. Another consequence of this prediction is that an increase in UI payments can increase or decrease the expected duration of completed spells of unemployment. However, there are good reasons to suspect that in most actual economies an increase in UI payments will increase the expected duration of unemployment. Nevertheless, this conclusion does go some way in explaining the ambiguous results in the empirical literature.

The intuition behind the results presented in this study is relatively easy to understand. The new assumptions imply that there are two separate effects that result from a change in UI payments. First, an increase in UI payments changes the expected payoff to remaining unemployed. Specifically, an increase in UI payments increases the expected payoff from remaining unemployed to workers who have been unemployed no more than the UI duration in a spell of unemployment. This increase is greater the shorter time a worker has been unemployed. Workers who have been unemployed longer than the UI duration do not receive UI payments and hence an increase in UI payments will not change the expected payoff to remaining unemployed to these workers. The second effect of an increase in UI payments is an increase in the expected payoff to an unemployed worker from accepting any job offer. This follows as an increase in UI payments increases the expected payoff to being laid off. Hence if there is a strictly positive probability an employed worker will be laid off, a change in UI payments is positively related to the expected payoff from any job offer. Now, if the expected payoff to remaining unemployed increases less (more) than the expected payoff to becoming unemployed, a worker becomes more (less) selective in evaluating job offers. This leads directly to the major result of this study.

Most of the empirical studies in this area have attempted to estimate the relationship between UI payments and (a) the expected duration of completed spell of unemployment, and (b) the expected post-unemployment wage rate obtained. It has been found that the first element is positively related to UI payments, whereas the relationship between post-unemployment wage rates and UI payments has been more difficult to discover. The results presented in this study predict a positive relationship between UI payments and the variables mentioned above. However, there are several more predictions implied by the theory presented that have not been considered in the empirical literature to date.

In the next section the basic model is outlined. In Section 2 the predictions of this model when the parameters are held constant are specified. In the final section the effects of changes in the parameters of the model are considered. The most important parameter change for our purposes is the change in the form of the UI scheme.

## 1. FORMAL MODEL

In this section a job search model is specified that is similar in most respects to those previously in the literature.[3] However, two new features, mentioned in the Introduction, are included. To save on space only a brief description will be given of those aspects of the model previously presented.

Suppose time can be divided into periods of equal length, termed search periods. Each search period there is a known probability a given unemployed worker obtains a job offer. Let k denote this probability. The length of each search period is selected so that at most one job offer will be received by a worker in a period. Each job offer has a wage rate per search period associated with it. However, a worker may receive job offers with different wage rates from different firms. Let $F(w)$ denote the distribution function describing the wage rates associated with job offers in the market. Due to imperfect information in the market it is assumed that a job offer obtained by a worker can be perceived as a random draw from the distribution of wage rates. Hence, $k[1-F(w')]$ denotes the probability an unemployed worker receives a job offer with a wage rate at least as great as $w'$ in a period. To simplify the exposition, but without any real loss of generality, it will be assumed k and $F(w)$ remain the same in each search period.

If a worker accepts an offer it is assumed that worker begins employment in the following search period. This worker will continue to work at the firm that made the acceptable offer, at the offered wage rate, until either the worker retires or is laid off. Let s indicate the probability an employed worker is laid off in any given search period. A worker who rejects an offer is assumed to be unable to return and accept that offer in a later period.

Let $x_t(z)$ denote the UI payment received by a worker in search period t of a spell of unemployment, where z indicates the pre-unemployment wage rate faced by that worker. Assume

$$x_t(z) = \begin{cases} u(z) & \text{if } t \leq \hat{t} \\ 0 & \text{if } t > \hat{t}, \end{cases} \tag{1}$$

for any z. Hence a worker obtains u(z) in each of the first $\hat{t}$ periods of a spell of unemployment. Any worker who has been unemployed more than $\hat{t}$ periods in a spell of unemployment receives no further UI payments. In what follows $\hat{t}$ will be termed the UI duration. The scheme outlined above is similar to most schemes used in the United States. The one simplifying assumption is that a worker becomes eligible for the full UI duration of UI payments any time that worker is laid off. Most schemes require that a worker be employed for a given period of time before being laid off to be eligible for the full UI duration of UI payments.[4] As the inclusion of such detail complicates the analysis without affecting the basic results, the simplifying assumption will be used. The relationship between the pre-unemployment wage rate of a worker and UI payments will be discussed in detail in a later section. For the present it is sufficient to assume that UI payments are a nondecreasing function of pre-unemployment wage rate.

If a worker accepts an offer, the expected future discounted lifetime income that accrues depends on

(a) the wage rate per period offered,

(b) the probability of being laid off per period,

(c) the discount rate utilized by the worker,

(d) the number of periods remaining until the worker retires, and

(e) the UI scheme faced if laid off.

To simplify the exposition it will be assumed that the expected payoff to any job offer is independent of the number of periods remaining until the worker retires. This appears to be a reasonable approximation to make for younger workers, and one that has been most frequently used in the job search literature. Let $\lambda(w';s,u(z),\hat{t})$ denote the expected discounted lifetime income to a worker who accepts a job offer with wage rate $w'$, given the parameter $s$ and the UI scheme described by $u(z)$ and $\hat{t}$. The expected payoff is also conditional on the discount rate used, $r$. This fact has been suppressed in the above to simplify the notation.

What is the expected discounted lifetime income to a worker who selects, or is constrained, to remain unemployed at least one more period? The answer to this question depends on how long the worker has been unemployed and what future job offers, if received, will be accepted, i.e., the search strategy of the worker. It has been demonstrated many times in the literature that the strategy that maximizes the expected payoff involves the worker selecting a reservation wage in each search period of unemployment. A job offered in a period will be accepted if and only if the wage rate offered is at least as great as the relevant reservation wage. Of course, different reservation wages imply different expected payoffs. The object is to determine the reservation wages, one for each possible search period of unemployment, that maximizes the expected discounted lifetime income, i.e., the optimal reservation wage (ORW) for each possible period of unemployment.

Suppose a worker is about to begin search period t of a spell of unemployment. Assume this worker will use reservation wage $\bar{w}$ in that period but then use the relevant ORW in each future search period of unemployment. Let $\psi_t(\bar{w};k,s,u(z),\hat{t})$ indicate the expected discounted lifetime income to the worker from this strategy, given the parameters, k, s, u(z), $\hat{t}$. From the above it follows

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) = x_t(z) + \frac{k(1-F(\bar{w}))}{1+r}E\{\lambda(w;s,u(z),\hat{t})|w \geq \bar{w}\} + \frac{\{1 - k(1-F(\bar{w}))\}}{1+r}\psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t}) \quad (2)$$

for any $t > 0$, where $w^*_{t+1}$ is the ORW in period t+1 of unemployment.

As the probability of being laid off, s, is the same in each search period of unemployment, it is possible to use (2) to rewrite the expected payoff to accepting a job offer with wage rate w' as

$$\lambda(w';s,u(z),\hat{t}) = w' + \frac{s\psi_1(w_1^*;k,s,u(z),\hat{t})}{1+r} + \frac{(1-s)\lambda(w';s,u(z),\hat{t})}{1+r}$$
$$= \frac{(1+r)w'}{s+r} + \frac{s}{s+r}\psi_1(w_1^*;k,s,u(z),\hat{t}) \quad (3)$$

for any w'. Hence the expected payoff to accepting an offer can be expressed as a function of the wage rate offered and the maximum expected payoff from being laid off from the job, $\psi_1(w_1^*;k,s,u(z),\hat{t})$. The weight given to each of these depends on the probability of being laid off. Substituting (3) into (2) yields

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) = x_t(z) + \frac{k(1-F(\bar{w}))}{1+r}E\{\frac{w(1+r)}{s+r} + \frac{s}{s+r}\psi_1(w_1^*;k, s,u(w),\hat{t})|w \geq \bar{w}\}$$
$$+ \frac{\{1-k(1-F(\bar{w}))\}}{1+r}\psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t}) \quad (4)$$

for any $t > 0$. If $F(w)$ is assumed to be differentiable, then (4) is differentiable with respect to $\bar{w}$ and the calculus can be used to establish the OEW in period t of unemployment. The first order condition is

$$\frac{d\psi_t}{d\bar{w}} = \frac{kf(\bar{w})}{1+r}[\psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t}) - \frac{\bar{w}(1+r)}{s+r} - \frac{s}{s+r}\psi_1(w^*_1;k,s,u(\bar{w}),\hat{t})]$$
$$= 0 \tag{5}$$

for any $t > 0$, where $f(\bar{w}) = F'(\bar{w})$. Assuming an interior solution exists, i.e., $kf(w^*_t) \neq 0$, it follows

$$w^*_t = \psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t})\frac{s+r}{1+r} - \psi_1(w^*_1;k,s,u(z),\hat{t})\frac{s}{(1+r)} \tag{6}$$

for any $t > 0$. Hence, given an interior solution, the ORW for a worker in period t of unemployment is the wage rate, that if offered and accepted in the period, yields the same expected payoff to that of continuing to be unemployed at least one more period. If an interior solution does not exist in period t of unemployment, then $f(w^*_t) = 0$. In this case an unemployed worker will either accept any offer made or reject any offer made, depending if $F(w^*_t) = 0$ or $F(w^*_t) = 1$. It will be assumed in the sequel that an interior solution does exist. This does not imply the noninterior solution cases are not interesting, only that the results follow directly from the results presented here. The second order condition guarantees the wage rate obtained in (6) is the ORW as

$$\frac{d^2\psi_t}{d\bar{w}^2} = \frac{kf(w^*_t)}{1+r}\{-\frac{1+r}{s+r} - \frac{s}{s+r}\frac{\partial\psi_1}{\partial u(\bar{w})}\frac{du}{d\bar{w}}\} < 0$$

as $\frac{du}{d\bar{w}} \geq 0$ by assumption.

How will the ORW change as the duration of unemployment changes? The following Proposition demonstrates that the ORW will fall in the first $\hat{t}$ periods of unemployment and then remain constant in each future period.

Proposition 1

(a) $w^*_{t-1} > w^*_t$ if $t \leq \hat{t}$.

(b) $w^*_{t-1} = w^*_t$ if $t > \hat{t}$.

Proof

The proof of this Proposition is presented in the Appendix.

In the previous literature on job search those studies that concluded the ORW falls with duration of unemployment did so because workers were assumed to have a finite working life.[5] In those studies which assumed workers have an infinite life, as in the present study, the ORW did not change with duration of unemployment. The reason the ORW falls in the present study is that the UI payments are stopped after $\hat{t}$ periods of unemployment.

## 2. IMPLICATIONS OF OPTIMAL SEARCH STRATEGY

In this short section the basic predictions from the model described in the previous section are presented. Specifically, the probability a worker suffers any particular duration of unemployment before a job is found, and the expected post-unemployment wage rate, are calculated. It must be stressed that throughout this section the parameters k, s, u(z), and $\hat{t}$ are assumed to be fixed. Even if the search strategy of an unemployed worker is known precise predictions about what will happen to that worker cannot be made, as the job offers to be received are random drawings from a distribution of wage rates. Nevertheless, probability statements about the future of a worker can be made.

Let $\alpha_t$ denote the probability a given worker who has been unemployed t-1 periods obtains an acceptable offer in period t of his/her unemployment. From (6) it follows

$$\alpha_t = [1 - F(w_t^*)]k. \tag{7}$$

A consequence of Proposition 1 is that

$$\begin{aligned} &\alpha_{t-1} < \alpha_t \quad \text{if } t \leq \hat{t}, \text{ and} \\ &\alpha_{t-1} = \alpha_t \quad \text{if } t > \hat{t}. \end{aligned} \tag{8}$$

Therefore the probability an unemployed worker receives an acceptable offer increases in the first $\hat{t}$ periods of unemployment. The probability a worker obtains an acceptable offer after $\hat{t}$ periods in a spell of unemployment is the same in each period. Let p indicate the number of search periods a worker is unemployed. The probability density function of this variable implied by (8) is such that

$$g(p') = \alpha_{p'} \prod_{j=1}^{p'-1} (1 - \alpha_j) \qquad p' = 1,2,3,\ldots .$$

Note that $g(p')$ declines as $p'$ increases for any $p' > 0$.

The expected wage rate obtained by a worker who receives an acceptable job offer in period t of a spell of unemployment is indicated by $\beta_t$. From (6) it follows

$$\beta_t = E(w \mid w \geq w_t^*) = \frac{\int_{w_t^*}^{\infty} wf(w)dw}{\int_{w_t^*}^{\infty} f(w)dw} . \tag{9}$$

From Proposition 1 we have

$$\begin{aligned} &\beta_{t-1} > \beta_t \quad \text{if } t \leq \hat{t}, \text{ and} \\ &\beta_{t-1} = \beta_t \quad \text{if } t > \hat{t}. \end{aligned} \tag{10}$$

Hence the expected acceptable wage rate decreases in the first $\hat{t}$ periods of a spell of unemployment and then remains constant in each future period. Note that the distribution of acceptable wage rates for (identical) workers who suffer t search periods of unemployment is the right hand side of the distribution of wage rate offers truncated at $w_t^*$.

## 3. THE EFFECTS OF CHANGES IN THE UI SCHEME

How are the above predictions affected if UI payments are changed, or $\hat{t}$ is increased? To discover the effects of changes in UI payments it first has to be established how the ORW changes as UI payments change. Taking the total derivative of (5) with respect to u(z) yields

$$\frac{dw_t^*}{du(z)} = - \frac{\partial^2\psi_t/\partial\bar{w}\partial u(z)}{\partial^2\psi_t/\partial\bar{w}^2}$$

for any t. As it was established in the previous section that the denominator above is negative, the sign of the expression will be the same as the sign of the numerator. But from (5) and (6) it follows

$$\frac{\partial^2\psi_t}{\partial w\partial u(z)} = \frac{kf(w_t^*)}{1+r}\left\{\frac{\partial\psi_{t+1}}{\partial u(z)} - \frac{\partial\psi_1}{\partial u(z)}\right\} \tag{11}$$

and

$$zt = \frac{\partial x_t}{\partial u(z)} + \frac{k(1-F(w_t^*))sz_1}{(1+r)(s+r)} + \frac{\{1-k[1-F(w_t^*)]\}}{1+r}\, z_{t+1} \tag{12}$$

where

$$zt = \frac{\partial\psi_t^*}{\partial u(z)} = \frac{\partial\psi_t(w_t^*;k,s,u(z),\hat{t})}{\partial u(z)} .$$

The following Proposition establishes a result of considerable importance in the rest of this section

Proposition 2

$$\frac{dw_t^*}{du(z)} > 0 \text{ if } t \leq t^+ \text{ and } \frac{dw_t^*}{du(z)} < 0 \text{ if } t > t^+, \text{ where } t^+ < \hat{t}.$$

Proof

The proof of this Proposition is established in the Appendix.

A direct consequence of (7) and (9) is that

$$\frac{d\alpha_t}{dw_t^*} < 0 \quad \text{and} \quad \frac{d\beta_t}{dw_t^*} > 0. \tag{13}$$

Hence the relationship between changes in UI payments and the predictions about duration of unemployment and post-unemployment wage rate follow from Proposition 2 and (13).

Proposition 3

(a) An increase in UI payments

(i) reduces (increases) the probability for obtaining an acceptable offer in the next period if the worker has been unemployed less than (at least as many as) $t^+$ periods;

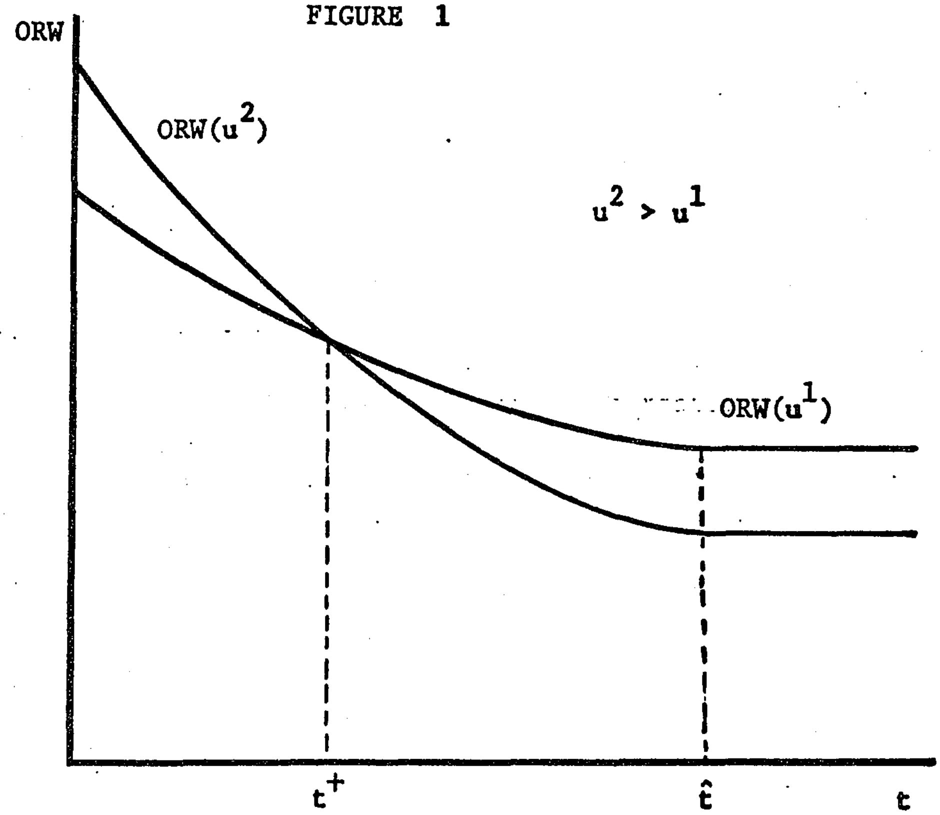
(ii) increases (reduces) the expected wage rate obtained if an acceptable offer is made in (after) the first $t^+$ periods of unemployment.

(b) A reduction in UI payments has the opposite effects as those stated in (i) and (ii) above.

(c) $t^+$ is negatively related to the probability of an employed worker being laid off, s.

The proofs of the above claims are not presented as they can be seen directly from Proposition 2 and (13). Figure 1 illustrates claim (a)(i). Two consequences of the above claims should be noted here. First, the expected duration of completed spells of unemployment can increase or

FIGURE 1



decrease with an increase in UI payments. Nevertheless, as the number of short-term unemployed workers is usually great relative to the number of long-term unemployed, an increase in UI payments will usually increase the expected duration of completed spells. This prediction does go some way in explaining the lower than expected observed increase in duration when UI payments increase. Second, the distribution of durations of unemployment will change with changes in UI payments. Workers are less likely to become re-employed after a short period of unemployment, but more likely to obtain an acceptable offer if they are long-term unemployed. Hence an increase in UI payments is predicted to reduce the number of long-term unemployed relative to the total amount of unemployed. The "spread" of the distribution of durations of unemployment is reduced if the distribution is normalized for the change in mean. This result rests heavily on the assumption that demand factors are not influenced by (or influence) UI payments.

Suppose the UI duration is increased, holding UI payment per period constant. Specifically, assume the number of possible periods a worker is eligible for UI payments is increased by one period. It follows from (3) that

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) = \psi_{t+1}(\bar{w};k,s,u(z),\hat{t}+1) \quad \text{for any } \bar{w} \text{ if } t \leq \hat{t}$$

and

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) = \psi_t(\bar{w};k,s,u(z),\hat{t}+1) \quad \text{for any } \bar{w} \text{ if } t > \hat{t}.$$

Using the above and (6) it can be seen an increase in UI duration will increase the ORW of a worker in the first $\hat{t}$ periods of unemployment. However, this change will have no effect on the workers who have been unemployed more than $\hat{t}$ periods in a spell of unemployment. Hence, an increase of UI duration will

(a) increase the expected duration of unemployed workers,

(b) reduce the probability of obtaining an acceptable offer in the next period if a worker has been unemployed less than $\hat{t}$ periods, and

(c) increase the expected post-unemployment wage rate of a worker, given a job is found in the first $\hat{t}$ periods.

The above results hold as an increase in UI duration has an adverse incentive effect on all workers who have been unemployed no more than $\hat{t}$ periods. Workers who have been unemployed longer than $\hat{t}$ periods are not affected by the change.

So far the effects of changes in the UI scheme on a given individual have been considered. In the final part of this study we consider the consequences of a UI scheme on a group of unemployed workers. Previously in this study it has been assumed that pre-unemployment wage rate had a non-negative effect on UI payments. The form of the scheme used in most states imply

$$\frac{du(z)}{dz} = \begin{cases} \theta > 0 & \text{if } z < w^{+} \\ 0 & \text{if } z \geq w^{+}. \end{cases}$$

Hence UI payments are positively related to pre-unemployment wage rate if the wage rate is less than $w^{+}$. Workers with a pre-unemployment wage rate at least as great as $w^{+}$ receive the same UI payments.

Consider a group of unemployed workers who are identical except in the fact that they have had different pre-unemployment wage rates. It is assumed that all members of this group are looking for a job and the distribution of wage rates faced by each worker is the same. Clearly this is a strong assumption but one required if any progress is to be made given the framework developed. If workers are identical except for the fact they are searching for a job in different markets they will, in general, have different reservation wages because of the different distribution of wage offers they face. Given the above assumption two workers will have a different sequence of reservation wages only if they had different pre-unemployment wage rates, and one of them was less than $w^+$. Note there is no wealth effect by assumption. The only reason a higher pre-unemployment wage rate is important is that there exists a positive relationship between UI payments and pre-unemployment wage rates.

From the previous results presented in this study it follows that, considering only those workers with pre-unemployment wage rates less than $w^+$, increases in pre-unemployment wage rates increase the ORW of workers in each of the first t periods of unemployment. Workers with pre-unemployment wage rates at least as great as $w^+$ have the same ORW in each period of unemployment. Hence it is predicted that the higher the pre-unemployment wage rate of a worker, if it is less than $w^+$, the greater the expected duration of unemployment and the greater the expected post-unemployment wage rate received.

APPENDIX

Proof of Proposition 1

To prove this Proposition the following claims are first established:

(i) $\psi_t(\bar{w};k,s,u(z),\hat{t}) = \psi_{t+1}(\bar{w};k,s,u(z),\hat{t})$ for any $\bar{w}$ if $t > \hat{t}$, and

(ii) $\psi_t(\bar{w};k,s,u(z),\hat{t}) > \psi_{t+1}(\bar{w};k,s,u(z),\hat{t})$ for any $\bar{w}$ such that

$$0 < F(\bar{w}) < 1 \quad \text{if } t \leq \hat{t}.$$

Claim (i) follows from the assumption that the number of searches an unemployed can make is unbounded, and no UI payments will be received in any future period of unemployment. This claim has been demonstrated formally many times in the search literature (see, for example, DeGroot (1971)), and will therefore not be repeated here. To establish claim (ii) note

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) - \psi_{t+1}(\bar{w};k,s,u(z),\hat{t}) =$$

$$\frac{(1 - k(1-F(w))}{1 + r}\{\psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t}) - \psi_{t+2}(w^*_{t+2};k,s,u(z),\hat{t})\}$$

if $t < \hat{t}$. Hence for $t < \hat{t}$,

$$\psi_t(\bar{w};k,s,u(z),\hat{t}) - \psi_{t+1}(\bar{w};k,s,u(z),\hat{t}) > 0 \quad \text{if}$$

$$\psi_{t+1}(w^*_{t+1};k,s,u(z),\hat{t}) - \psi_{t+2}(w^*_{t+2};k,s,u(z),\hat{t}) > 0$$

and

$$0 < F(\bar{w}) < 1.$$

Note the last condition will always be satisfied if $\bar{w} = w^*_t$, as it has been assumed that the ORW in each period satisfies this condition. But, from (1) and (4), it follows

$$\psi_t(w_t^*;k,s,u(z),\hat{t}) - \psi_{t+1}(w_{t+1}^*;k,s,u(z),\hat{t}) = u(z) > 0, \text{ if } t = \hat{t}.$$

Hence the Claim (ii) is established. Claims (a) and (b) of the Proposition follow from inspection of claims (i) and (ii) and (6).

Proof of Proposition 2

From (11) and (12) it follows

$$\text{sign } \frac{dw_t^*}{du(z)} = \text{sign } \{y_{t+1} - y_1 \frac{s}{s + r} \equiv Q(t)\}, \tag{A1}$$

where $y_t$ is defined in (12). A consequence of (1) and (12) is

$$y_t = \begin{cases} 1 + \dfrac{y_1 k(1-F(w_t^*))s}{(1+r)\ (s+r)} + \dfrac{y_{t+1}(1-k(1-F(w_t^*)))}{1 + r} & \text{if } t \leq \hat{t} \\[2ex] \dfrac{y_1 k(1-F(w_t^*))s}{(1+r)\ (s+r)} + \dfrac{y_{t+1}(1-k(1-F(w_t^*)))}{1 + r} & \text{if } t > \hat{t}. \end{cases}$$

From Proposition 1 it can be shown that

$$y_{\hat{t}+1} = z_{\hat{t}+1+\tau} \quad \text{for any } \tau > 0.$$

Using this fact in the definition of $y_t$ it follows

$$y_{\hat{t}+1} = \frac{ks(1 - Fw_{\hat{t}+1}^*))}{r + k(1-F(w_{\hat{t}}^*\quad))} y_1.$$

Therefore, from (A1), we have $Q(t) < 0$ if $t > \hat{t}$ and if $y_1 > 0$. Further, it follows directly from the above that

$$y_{\hat{t}} = y_{\hat{t}+1} + 1.$$

For fixed $t < \hat{t}$

$$y_t - y_{t+1} = \frac{(1 - k)}{1 + r}(y_{t+1} - y_{t+2}) + \frac{k}{1 + r}\{F(w_t^*)Q(t)$$

$$- F(w_{t+1}^*)Q(t+1)\}. \tag{A2}$$

It can be seen from inspection of (A2) that if $y_t < 0$, then $z_t > z_{t+1}$ for all t. Hence $y_1 > 0$. Suppose $t^+$ is the largest t such that $Q(t) \geq 0$. From (A2) it can be seen $y_{t^+} - y_{t^++1} > 0$. Therefore $Q(t^+-1) > 0$ if $Q(t^+) \geq 0$. Hence the Proposition follows from inspection of (A1).

## NOTES

[1]There is a large empirical and theoretical literature on the subject. A good survey is presented by Lippman and McCall (1976). Several interesting ideas have been considered by Feldstein (1973, 1974).

[2]See Mortensen (1971) for one of the first derivations of this result. This result is in direct conflict with the prediction derived by Stigler (1961).

[3]There are many alternative possible specifications that can be made which do not disturb the basic result.

[4]It should be noted that if a worker voluntarily quits a job no UI payments are received.

[5]See Gronau (1971).

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