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Citation

Davidson, Carl, and Stephen A. Woodbury. 1996. "Unemployment Insurance and Unemployment: Implications of the Reemployment Bonus Experiments." In Advisory Council on Unemployment Compensation: Background Papers. Washington, DC: The Council, 1995-1996, Vol. 3, pp. [KK1]-KK37. https://research.upjohn.org/bookchapters/103

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Draft, February 1995

Paper prepared for the Advisory Council on Unemployment Compensation, whose support is gratefully acknowledged. We are grateful to Richard Deibel, Kenneth Kline, Ellen Maloney, and Claire Vogelsong for help in preparing the manuscript. Davidson is Professor of Economics, Michigan State University, East Lansing, MI 48824; Woodbury is Professor of Economics, Michigan State University and senior economist, W.E. Upjohn Institute.

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Abstract

We translate the results of the three reemployment bonus experiments that were conducted during the 1980s into (a) impacts of a 10-percentage point increase in the Unemployment Insurance (UI) replacement rate on the expected duration of unemployment; and (b) impacts of adding 1 week to the potential duration of UI benefits on the expected duration of unemployment. Our approach is to use an equilibrium search and matching model, calibrated using data from the bonus experiments and secondary sources. The results suggest that a 10-percentage point increase in the UI replacement rate increases the expected duration of unemployment by .3 to 1.1 week (a range consistent with, but only somewhat narrower than, the existing range of estimates), and that adding 1 week to the potential duration of UI benefits increases the expected duration of unemployment by .05 to .2 week (which is toward the low end of existing estimates).

I. Introduction

During the last 20 years, perhaps the most researched question about Unemployment Insurance (UI) has been whether and to what degree increases in the UI replacement rate lengthen UI recipients' jobless spells. Yet estimates of the effect of UI on unemployment have varied over a wide range. For example, Hamermesh (1977) provided an early (and much-quoted) "best estimate" that a 10-percentage point increase in the UI replacement rate (defined as the ratio of the weekly UI benefit to the average weekly wage) increases the duration of unemployment by about one-half week. But this "best estimate" was based on studies that found impacts ranging from approximately zero to over 1.5 weeks. More recent studies have continued to produce a wide range of estimates: Moffitt and Nicholson (1982) found that a 10-percentage point increase in the replacement rate increases unemployment duration by about 1 week; Solon (1985) found an impact of between one-half and one week; and Meyer (1990) found an impact on the order of 1.5 weeks. Clearly, this is a rather broad range -- one that gives relatively little guidance in deciding whether claims that UI is a serious deterrent to job search should be taken seriously and used as a basis for reforming the UI system.

A related issue that has received less attention in the literature concerns the degree to which extending the potential duration of UI benefits affects job search behavior. A number of studies have estimated the impact of adding 1 week to the potential duration of benefits on the expected duration of unemployment. All find evidence that an increase in potential duration reduces search effort and increases the average length of unemployment spells. But again the estimates vary widely: Newton and Rosen (1979) find that an additional week of potential benefits raises the expected duration of unemployment by .4 to .5 week; Moffitt and Nicholson (1982) find an impact of .1 week; Solon (1985) finds an impact of .3

week; Ham and Rea (1987) find an impact of .33 week; and Katz and Meyer (1990) find an impact of .16 to .2 week. The differences among these estimates may seem small, but they do matter. A typical UI benefit extension of 10 weeks would increase the expected duration of unemployment by as little as 1 week, or as much as 4 weeks, depending on which of these estimates is correct.

In the last decade, three social experiments have been performed in the United States that have the potential to narrow the range of estimates of how UI affects the behavior of unemployed workers (Woodbury and Spiegelman 1987; Corson, Decker, Dunstan, and Kerachsky 1992; Spiegelman, O'Leary, and Kline 1992). Each of the experiments tested one or more variants of the so-called reemployment bonus -- a cash bonus paid to UI recipients who find rapid reemployment and cut short their spell of insured unemployment. Because each of the three experiments randomly assigned UI claimants either to a control group or to a bonus-offered group, the experiments offer a potentially powerful way of discerning whether (and to what extent) UI benefits are a benign or nondistortionary income transfer.

The reemployment bonus experiments provide clear evidence that UI benefits are not merely a benign transfer. All three of the experiments found that bonus offers reduce the duration of insured unemployment of bonus-offered UI recipients. But unfortunately, there is no simple "back-of-the-envelope" way to translate the results of the reemployment bonus experiments into estimates of the effects of UI replacement rates or potential duration on unemployment duration. The essence of the reemployment bonus is the offer of cash for rapid reemployment, not a direct change in the weekly UI benefit amount or the potential duration of benefits.

Nevertheless, the reemployment bonus experiments provide convincing evidence of the effect of financial incentives on unemployment behavior. Accordingly, it is tempting to devise

a way to use the observed reemployment bonus effects to infer how unemployment behavior would be altered by changes in either UI benefit amounts or potential duration.

In this paper, we attempt to solve the problem of translating the observed effects of the reemployment bonus into the effects that have been of most concern to economists and policy-makers -- that is, the effects of changes in the UI replacement rate and in the potential duration of UI benefits on unemployment duration. In section II, we offer a brief review of the three reemployment bonus experiments that have been carried out. In section III, we develop an equilibrium search/matching model that incorporates the relevant institutional characteristics of the UI system in the United States. In section IV, we describe how we make use of the results of the reemployment bonus experiments to infer key unobservable parameters of the model. Finally, in section V, we apply the model to our main question -- what are the implications of the results of the reemployment bonus experiments for the relationship between UI benefits and unemployment duration?

In addition to yielding estimates of how increasing the UI replacement rate and potential duration increase the expected duration of unemployment, the method we use yields estimates of spillover effects of the UI system. That is, UI has the potential to affect the behavior and employment outcomes of workers other than UI claimants -- for example, workers who are ineligible for UI (or "UI-ineligibles"). Because the model we use considers the effect of UI benefits on these other groups of workers -- as well as on UI claimants -- we can estimate the potentially important effect of changes in the replacement rate and potential duration of benefits on workers other than UI claimants. Such spillover effects have only rarely been considered -- Levine's work (1993) is a recent exception.

II. The Reemployment Bonus Experiments

Table 1 summarizes the three reemployment bonus experiments and their results. Central to each of the experiments is the notion of random assignment: One or more randomly chosen groups of new UI claimants were offered a reemployment bonus, and another randomly chosen group -- the control group -- received no special treatment. Random assignment was made in each of the reemployment bonus experiments by referring to the last two digits of the Social Security number. In the Illinois experiment, for example, UI claimants with a Social Security number ending in 00 through 33 were assigned to the control group, whereas those with a Social Security number ending in 34 through 66 were offered a bonus. The power of random assignment is that, if it is effectively carried out, then on average the observable and unobservable characteristics of workers in the experimental and control groups will be identical. Accordingly, the only difference between the experimental and control groups is that the experimental groups receives a "treatment," and comparing the outcomes of the control and experimental groups is sufficient to obtain an unbiased estimate of the effect of the experimental treatment on behavior.[1]

The earliest of the three reemployment bonus experiments, in Illinois, was also the simplest in that it had just one treatment -- a $500 bonus offered to new UI claimants who found a job within 11 weeks and held that job for four months. Note that the base period earnings of workers assigned to the treatment and control groups are essentially similar[2] (see column 3 of Table 1), suggesting that the random assignment was successful. (Similarly, the weekly benefit amounts of the treatment and control groups, shown in column 4, are the

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[1]This is, of course, a rather rosy accounting of the virtues of social experimentation. For a discussion of the possible pitfalls of experimentation, see Spiegelman and Woodbury (1990).

[2]That is, we cannot reject the hypothesis that the difference between the base period earnings of the treatment and control groups is zero at conventional significance levels.

same.) Column 5 shows the duration of insured unemployment for the experimental and control groups -- specifically, the weeks of insured unemployment during the full year of eligibility following the initial claim for UI (the benefit year).[3] Comparing the weeks of insured unemployment received by the Illinois treatment group with the Illinois control group suggests that the $500 bonus reduced the duration of insured unemployment by .71 week (19.27 - 18.56 = .71).[4] This treatment effect, shown in column 6, suggests that financial incentives do influence the job search behavior of unemployed workers.

Further, it is clear from data on earnings after reemployment (column 7) that the jobs accepted by the bonus-offered workers did not pay significantly less than the jobs accepted by the control group. The implication is that the bonus-offered workers did not lower their reservation wages, cut short productive job search, and accept a poor job match (which would be evidenced by a lower wage) simply to qualify for the bonus. Rather, the results suggest that to qualify for the bonus, bonus-offered workers increased the intensity of their job search.

The two experiments that followed Illinois -- one in Pennsylvania and the other in Washington State -- each tested several bonus offers. These new treatments varied in two ways. First, the length of the qualification period -- the time within which a worker needed

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[3]We focus on the duration of insured unemployment during the full benefit year on the assumption that this best captures the overall impact of the bonus on a worker's propensity to become and remain reemployed.

[4]Note that this is the bonus effect for workers who were eligible for 26 weeks of state-regular UI benefits. About half of the workers enrolled in the Illinois experiment were eligible for an additional 12 weeks of Federal Supplemental Compensation (FSC). The bonus impact for these FSC-eligible workers appears to have been greater: for state-regular eligibles and FSC-eligibles combined the bonus impact was 1.13 weeks (Woodbury and Spiegelman 1987), and for FSC-eligibles alone the bonus impact was 1.8 weeks (Davidson and Woodbury 1991). In this paper, we restrict our attention to Illinois claimants who were eligible only for state-regular benefits. This makes the Illinois results comparable with the Pennsylvania and Washington results, in which UI claimants were eligible only for state-regular benefits.

to find reemployment in order to qualify for a bonus -- varied across the treatments. In Pennsylvania, qualification periods of 6 and 12 weeks were tried (see column 1 of Table 1). In Washington, qualification periods of 20% and 40% of a claimant's potential duration of UI plus 1 week -- or about 6 and 11 weeks -- were tried. Second, the size of the bonus offer varied across the treatments. In Pennsylvania, bonus offers equal to 3 times and 6 times the weekly UI benefit amount were tried -- that is, about $500 and $1,000 on average (see column 2 of Table 1). In Washington, bonus offers of 2 times, 4 times, and 6 times the weekly UI benefit amount were tried -- that is, roughly $300, $600, and $900 on average. In both Pennsylvania and Washington (as in Illinois), a worker had to hold the new job for 4 months in order to receive a bonus.

The results of the Pennsylvania and Washington experiments are not entirely consistent, but do suggest that larger bonus offers and longer qualification periods tend to reduce insured unemployment by more than smaller bonus offers and shorter qualification periods (see column 7 of Table 1). One inconsistency arises in Washington, where the long qualification period/low bonus treatment had a greater effect than would be expected based on the results of the other Washington treatments. (Alternatively, the long qualification period/medium bonus treatment could be viewed as anomalously low.) In Pennsylvania, the short qualification period/low bonus treatment had nearly the same effect as the short qualification period/high bonus treatment, which is also inconsistent.[5]

Comparing results across the three experiments poses additional puzzles. Mainly, the Illinois treatment effect of .71 week is larger than one would expect given the results of

[5]Note that is both cases, the formal statistical tests fail to reject the hypothesis that the treatments had no effect. We take the point estimates at face value, however, on the assumption that large enough samples would reveal effects of the magnitude reflected by the point estimates.

similar treatments in Pennsylvania (the long qualification period/low bonus treatment) and Washington (the long qualification period/medium bonus treatment), although this latter treatment, as already noted, is anomalously low in comparison with the other Washington results.

Although providing a full explanation of the differences among the various bonus offers is beyond the scope of this paper, the differences across experiments may be explained in part by reference to features of the experiments other than the bonus offers themselves. For example, base period earnings were highest in Washington State and lowest in Illinois, but UI benefit levels were highest in Pennsylvania. As a result, the mean replacement rate (defined simply as the ratio of the average weekly UI benefit to the average weekly base period earnings) was highest in Pennsylvania at about .6, and lower in both Illinois and Washington at about .5 (the replacement rates are not shown in Table 1). Also, workers' weekly earnings before and after the spell of insured unemployment were nearly identical in Illinois, but in Pennsylvania, post-unemployment earnings were somewhat lower than pre-unemployment earnings, whereas in Washington post-unemployment earnings were higher than pre-unemployment earnings. Finally, average spells of insured unemployment were considerably longer in Illinois (over 19 weeks on average for controls) than in either Pennsylvania or Washington (about 16 and 15 weeks respectively). Some of these differences could influence the experimental outcomes, and one advantage of the model developed next is that it accounts for these differences in translating the bonus effects into other behavioral impacts.

In summary, two results are consistent across all three bonus experiments. First, all three experiments provide evidence that financial incentives do influence job search behavior and the duration of unemployment, with larger bonus offers and longer qualification periods tending to induce workers to shorten their unemployment spells by more than smaller bonus

offers and shorter qualification periods. Second, the shorter spells of insured unemployment that resulted from the bonus offers did not come at the expense of lower earnings after reemployment. This latter is arguably the most important finding of the reemployment bonus experiments because it suggests that bonus-offered workers shortened their spells of unemployment by increasing their search intensity rather than by lowering their reservation wages. By inference, the finding suggests that UI lengthens unemployment spells mainly by reducing job search intensity rather than by increasing the reservation wage.

III. The Model

Our goal is to translate the experimental results of the reemployment bonus experiments into impacts of UI generosity on unemployment duration. To do this, we employ a partial equilibrium matching model of the labor market in which unemployed workers search randomly among firms for employment. After workers have applied for a job, firms with vacancies randomly select workers from their pool of applicants. Each unemployed worker chooses his or her optimal search effort -- the number of firms to contact -- by equating the marginal benefit from increasing search effort with the associated marginal cost. To obtain results on the impact of changes in the UI replacement rate and potential duration of UI benefits, we solve the model for different replacement rates and potential benefit durations, and compare outcomes. The basic structure of our model is similar to the one used in Davidson and Woodbury (1993, 1995).

We require a model that is institutionally rich, yet tractable. Accordingly, we introduce three categories of unemployed workers. The first consists of workers who are ineligible for unemployment insurance. We refer to such workers as UI-ineligibles and use U_i to denote the number of such workers in the steady-state equilibrium. UI-ineligibles are generally workers with relatively weak attachments to the labor force -- new labor force entrants and reentrants -- and typically account for roughly 60% of the unemployed (Blank and Card 1991). We denote the proportion of the unemployed who are UI-ineligibles by q, and set it equal to .6.

The second category of unemployed workers consists of those who are eligible for UI, but do not bother to claim their benefits. We refer to these workers as UI-eligible non-claimants and use U_k to denote the number of them in the steady-state equilibrium. We include these workers in the model because the fraction of UI-eligible workers who claim benefits -- the UI take-up rate -- is less than 100%. If we denote the UI take-up rate by k,

then the proportion of UI-eligible workers who fail to claim their benefits is 1 - k. Recent work by Blank and Card (1991) indicates that k falls in a range between .65 and .75. (We set k = .75 in our model. This choice is somewhat arbitrary, but the results are insensitive to changes in k in the range of .65 to .75.) Although there are probably a variety of reasons why workers who are eligible for benefits do not claim those benefits, we assume that they expect to be reemployed rapidly, so that the expected benefit from claiming their benefits falls short of the cost of doing so. This assumption is not crucial for what follows.

Finally, we refer to the remainder of the unemployed as UI-eligible claimants and use U_t to denote the number of such workers who are receiving benefits and are in their t^{th} period of search. We assume that these workers exhaust their eligibility after T periods of unemployment and use U_e to denote the number of UI-eligible claimants who have exhausted their benefits in the steady-state equilibrium.

We describe the model in four steps. First, we introduce three accounting identities that describe the distribution of the workforce (between employment and unemployment), the distribution of jobs (between employment and vacancies), and the distribution of unemployed workers (among UI-ineligibles, UI-eligible non-claimants, and UI-eligible claimants, both recipients and exhaustees). In the second step, we equate the flows into and out of each state of unemployment to yield a steady-state. Third, we demonstrate how search effort translates into reemployment probabilities. Finally, we define optimal search effort for each unemployed worker.

A. Identities

Since UI-claimants must be certified for benefits every two weeks, we measure time in two-week intervals. Let F denote the total number of jobs available, J represent the total

number of available jobs that are filled, and V represent the number of job vacancies in the steady-state equilibrium. Then, since all jobs are either filled or vacant, we have:

(1) $F = V + J.$

In addition, since all workers in the labor force must be either employed or unemployed, we have:

(2) $L = U + J$

where L denotes the total number of workers and U represents total unemployment.

The final identity divides unemployed workers into UI-ineligibles, UI-eligible non-claimants, and UI-eligible claimants who are receiving benefits, and UI-eligible claimants who have exhausted their benefits:

(3) $U = U_i + U_k + \Sigma_{t=1,T} U_t + U_e.$

B. Steady-State Conditions

The second set of equations equates the flows into and out of each employment state. These equations must hold to insure that total unemployment and its composition remain constant in steady-state. Let s denote the rate of job separation or turnover -- that is, the probability that a randomly chosen employed worker will lose his or her job in any given period. Thus, sJ worker lose their job in each period. Of these, qsJ are UI-ineligible. It follows that the flow into state U_i is qsJ. To calculate the flow out of this state, let m_i denote

the reemployment (or job match) probability for a typical UI-ineligible worker. Then the flow out of U_i is m_iU_i. Equating these flows yields the first steady-state condition:

(4) $qsJ = m_iU_i$

Applying the same logic to the class of UI-eligible non-claimants yields

(5) $(1-q)(1-k)sJ = m_kU_k$

where m_k denotes the reemployment probability for UI-eligible non-claimants.

Next, turn to the UI-eligible claimants. Let m_t denote the reemployment probability for a UI-eligible claimant in the t^{th} period of search and let m_e play the same role for UI-eligible claimants who have exhausted their benefits. Then, of the U_t workers in their t^{th} period of search, m_tU_t find jobs and the remaining $(1- m_t)U_t$ do not. Those who find jobs move to state J while those who do not move on to state U_{t+1}. It follows that all workers who begin the period in state U_t flow out of that state at the end of the period and that the flow into state U_{t+1} is given by $(m_t-1)U_{t-1}$. Equating these flows yields the following steady-state conditions

(6) $(1-q)ksJ = U_1$

(7) $(1-m_{t-1})U_{t-1} = U_t$ for $2 \leq t \leq T$

UI-eligible claimants who have exhausted their benefits leave state U_e if and only if they find a job, which happens with probability m_e. Entry into state U_e occurs if workers fail to find employment after T periods of search. Thus, the flows into and out of state U_e are equal if:

$$(8) \qquad (1-m_T)U_T = m_eU_e$$

If equations (4)-(8) hold, unemployment and its composition remain constant over time; that is, a steady-state exists.

C. Reemployment Probabilities

The probability that a searching worker finds a job is a function of his or her own search effort, the search effort of other workers, and the slackness or tightness of the labor market. We use p_t to denote the search effort of a UI-eligible claimant in the t^{th} period of search. The terms p_i, p_k, and p_e denote the search effort of UI-ineligible workers, UI-eligible non-claimants, and UI-eligible claimants who have exhausted their benefits, respectively. Each of the p terms gives the probability that a worker contacts a firm and applies for a job (or, if $p > 1$, the number of firms contacted by the worker) in any given period. Assuming that workers choose firms at random, the probability that any given firm has a vacancy is V/F. Thus, the probability that a worker contacts a firm with a vacancy is p(V/F). If we let λ denote the average number of applications filed per firm, then the probability that a worker gets a job <u>conditional</u> on applying to a firm with a vacancy is $(1 - e^{-\lambda})/\lambda$ (see Davidson and Woodbury 1993). Thus, the probability of a UI-eligible claimant in the t^{th} period of search finding a job is given by:

(9) $m_t = p_t(V/F)[(1 - e^{-\lambda})/\lambda]$ for $1 \leq t \leq T$.

where $\lambda = (1/F)[p_i U_i + p_k U_k + \Sigma_{t=1,T} p_t U_t + p_e U_e]$. The analogous conditions for the UI-ineligibles, UI-eligible non-claimants, and UI-exhaustees are:

(10) $m_i = p_i(V/T)[(1 - e^{-\lambda})/\lambda]$

(11) $m_k = p_k(V/F)[(1 - e^{-\lambda})/\lambda]$

(12) $m_e = p_e(V/F)[(1 - e^{-\lambda})/\lambda]$.

Note that the search effort of other workers enters into each workers reemployment probability through λ.

D. Optimal Search Effort

We assume that workers choose search effort to maximize expected lifetime income. Workers can increase the probability of reemployment by increasing search effort, but doing so is costly. We assume that the cost of search is a function of search effort, p, and specify the search cost function as cp^z, where c and z are search cost parameters. Note that z (> 1) denotes the elasticity of search costs with respect to search effort. We assume that the parameter c differs between UI-eligible and UI-ineligible workers (we refer to it as c for UI-eligibles and c_i for UI-ineligibles), but that z is the same for all.

To calculate expected lifetime income we must consider both the current and future prospects faced by the each worker. For example, let V_t denote the expected lifetime income

of an unemployed UI-eligible claimant in the t^{th} period of search; let V_w denote the expected lifetime income of an employed UI-eligible claimant; let w represent the wage earned by such a worker when employed; and let x denote unemployment benefits. Then, an unemployed UI-eligible claimant in the t^{th} period of search earns $x - c(p_t)^z$ currently. With probability m_t this worker finds a job and can expect to earn V_w in the future. With the remaining probability, $1-m_t$, the worker remains unemployed and can expect to earn V_{t+1} in the future. Therefore,

$$(13) \quad V_t = x - c(p_t)^z + [m_t V_w + (1 - m_t)V_{t+1}]/(1 + r) \quad \text{for } 1 \leq t \leq T.$$

Note that future income is discounted, with r denoting the interest rate. An analogous condition describes the expected lifetime income of workers in every other state of unemployment. If we let $V_\bullet$ and V_i denote the expected lifetime incomes of a UI-claimant who has exhausted benefits and an unemployed UI-ineligible worker, then we have:

$$(14) \quad V_\bullet = - c(p_\bullet)^z + [m_\bullet V_w + (1 - m_\bullet)V_\bullet]/(1 + r)$$

$$(15) \quad V_i = - c_i(p_i)^z + [m_i V_{wi} + (1 - m_i)V_i]/(1 + r)$$

Recall that V_w is the expected lifetime income of an employed UI-eligible worker, and let V_{wi} denote the expected lifetime income of an employed UI-ineligible worker. To calculate V_w and V_{wi} we follow the procedure outlined already. Current income equals the worker's wage, w (or w_i if UI-ineligible). With probability (1 - s) this worker keeps his job for another period and continues to earn V_w (or V_{wi} if UI-ineligible). With probability s the worker loses

his job and has to search for new employment, resulting in a future income of V_1 (or V_i if UI-ineligible). Therefore,

$$(16) \quad V_w = w + [sV_1 + (1 - s)V_w]/(1 + r)$$

$$(17) \quad V_{wi} = w_i + [sV_i + (1 - s)V_{wi}]/(1 + r).$$

For each unemployed worker, search effort is chosen to maximize expected lifetime income. Therefore, we have the following equations defining optimal search effort for all but one possible state of unemployment

$$(18) \quad p_t = \arg\max V_t \qquad \text{for } 1 \leq t \leq T$$

$$(19) \quad p_e = \arg\max V_e$$

$$(20) \quad p_i = \arg\max V_i.$$

The one exception is made for UI-eligible non-claimants. Presumably, these workers do not claim UI benefits because they do not expect to be unemployed for a significant length of time -- that is, they expect to be able to find jobs relatively easily and with little effort. Therefore, we treat these workers differently, by assigning them a high reemployment probability and ignoring their search decision. Provided that their reemployment probability is set high enough (so that their expected duration of unemployment is roughly half the

expected duration faced by UI-eligible claimants), our results are not sensitive to this assumption.

IV. Calibration

In order to solve the model, we must first set values of its parameters. We begin by dividing the model's parameters into three categories. First, we have parameters that have either been estimated directly in previous work or that can be inferred from estimates of other variables in previous work. These include the separation rate (s), total jobs available (F), the size of the labor force (L), the fraction of unemployed workers who are ineligible for UI benefits (q), the UI take-up rate (k), and the interest rate (r).

The second set consists of variables that are observable and can be taken directly from the data collected to analyze the three reemployment bonus experiments. Included in this set are wages or earnings (w and w_i) and unemployment benefits (x).

The third set consists of variables that have not been previously estimated and that cannot be observed directly -- the search cost parameters c, c_i, and z.

The reasoning used to obtain values of parameters in the first category is described in detail elsewhere (Davidson and Woodbury 1993, 1995). Here, we simply report the range of values considered and cite the sources used to support our choices. Recall that we measure time in 2-week intervals since UI claimants are typically certified for 2 weeks of benefits at a time. With that in mind, we use values of s (the bi-weekly separation rate) ranging from .006 to .014, with s = .010 considered to be the best estimate (Eherenberg 1980; Clark and Summers 1982; and Murphy and Topel 1987). Since the system of equations is homogeneous of degree zero in F and L, we can set L = 100 without loss of generality. We consider values for F ranging from 95 to 97.5, with F = 96.25 considered the

best estimate (inferred from values of the ratio of unemployment to vacancies reported in Abraham 1983). As mentioned above, we set q (the fraction of unemployed workers who are ineligible for UI benefits) equal to .6 and k (the UI take-up rate) equal to .75 (Blank and Card 1991). For the interest rate, we consider values ranging from .002 to .020 with r = .008 considered the best estimate. Thus, we have a "reference case" in which s = .01, r = .008, and T = 96.25. As we show below, as long as these parameters remain in the ranges described above, our results are remarkably robust to changes in the parameter values.

The wages and UI benefit levels used for each bonus treatment are displayed in Table 1. (Since Table 1 reports values in weekly terms, we multiply by 2.) For each treatment, we use the average of the control group and the treatment group. For example, in Pennsylvania the bi-weekly UI benefit amount for the control group was approximately $328, and the bi-weekly UI benefit amount for the long qualification period/high bonus treatment group was $330. Therefore, when analyzing the Pennsylvania long qualification period/high bonus treatment, we set x = $329.[6]

We use the information we have on bonus effects to infer values of the search cost parameters. For a given set of search cost parameters, the model predicts an expected duration of unemployment for each class of worker and a bonus effect for UI-eligible claimants. Let D denote the expected duration of unemployment predicted by the model in the absence of the bonus for UI-eligible claimants, and let ΔD denote these workers' bonus-induced change in unemployment duration, again as predicted by the model. The actual values of D and ΔD for each experiment are reported in Table 1. For example, in Illinois D = 19.27 and ΔD = -.71. For each experiment, we choose search cost parameters such that

[6]The proper wage to use in implementing the model is arguably the reemployment wage (column 7 of Table 1) rather than the base period wage. As it turns out, the base period wage and the reemployment wage are close enough that use of either yields similar results.

the values of D and ΔD predicted by the model match those reported in Table 1.[7] This yields a vector of search cost parameters that makes the model's prediction as close as possible to the actual outcome of each experimental treatment.

To investigate the impact of varying x (the level of UI benefits), and T (the potential duration of UI benefits), we solve the model for a variety of x and T values and compare the outcomes. Increasing x or T decreases the opportunity cost of unemployment for UI-eligible claimants, resulting in a decrease in search effort. The decrease in search effort increases their duration of unemployment, decreases steady-state employment, and may increase the number of jobs held by other workers. By solving the model for different values of x and T, we can estimate the magnitude of these different impacts.

[7]The expected durations of unemployment and the treatment impacts shown in Table 1 are actually in terms of durations of insured unemployment and changes in insured unemployment. Our model, on the other hand, is stated in terms of spells of actual joblessness (not just insured unemployment). Accordingly, we have adjusted the treatment effects shown in Table 1 so as to reflect the expected durations of unemployment and changes in unemployment duration induced by each bonus offer. These adjustments are described in Davidson and Woodbury (1991).

V. Results

Table 2 displays the main results of our efforts to translate the reemployment bonus effects into (a) impacts of a 10-percentage point increase in the UI replacement rate on unemployment duration; and (b) impacts of adding 1 week to the potential duration of UI benefits.

Column 1 of Table 2 shows the estimated impact of a 10 percentage point increase in the UI replacement rate -- the ratio of weekly UI benefits to pre-unemployment wage -- on the expected duration of unemployment of UI-eligible claimants. The estimates cover a range of roughly .5 to 1.1 weeks. That is, a 10 percentage point increase in the UI replacement rate is predicted to increase the expected duration of UI-eligible workers by between .5 and 1.1 weeks. This range is in the middle of the existing empirical estimates reviewed in the introduction -- that range runs from a low of about zero to a high of over 1.5 weeks. However, most of the range lies above Hamermesh's (1977) "best estimate" of one-half week. The range we obtain is more in keeping with some of the more recent findings, such as Solon's (1985), whose estimates are in the range of .5 to 1 week.

The second column of Table 2 shows that increases in the UI replacement rate can be expected to shorten the unemployment spells of UI-ineligibles. That is, since an increase in the UI replacement rate reduces the search effort of UI claimants, the competition for jobs is reduced so that UI-ineligibles (whose search effort is essentially unchanged by the increase in the UI replacement rate) have a higher probability of getting a job offer when they apply for a job. The estimates suggest that a 10 percentage point increase in the UI replacement rate shortens the expected unemployment spells of UI-ineligibles by about half a day to a day (that is, on the order of one-tenth to two-tenths of a week). Although this is not a large effect, it

does suggests that UI benefit increases reduce job competition and make it easier for UI-ineligibles to find work.

We have omitted three of the six Washington treatments from the results shown in Table 2 -- the short qualification period/low bonus treatment, the short qualification period/medium bonus treatment, and the long qualification period/medium bonus treatment. These three bonus treatments produced relatively small effects and thus generated small predicted impacts on the expected duration of unemployment. For all three, the estimated impact of a 10 percentage point increase in the replacement rate on D falls in the range of .3 to .4 week, and the impact on D_i falls in the range of -.1 to -.05.

Whether we should expand the range of estimates to include these Washington treatments is a judgement call. The treatment effects in question were so small that they are inconsistent with the findings from the other bonus offers in Washington as well as in Illinois and Pennsylvania. On the other hand, excluding findings of a small treatment effect in three cases out of a total of 11 is quite arbitrary -- we may be throwing away real information here. In any case, if we include these three Washington treatments in our range of estimates, then we would conclude that a 10 percentage point increase in the UI replacement rate is predicted to increase the expected duration of UI-eligible workers by between .3 and 1.1 weeks. This range is consistent with existing estimates of the disincentive effects of UI, but the extent to which it narrows that range is disappointing. Indeed, from the viewpoint of policy, a range of .3 to 1.1 weeks is hardly more informative than a range of 0 to 1.5 weeks.

The third column of Table 3 shows the estimated impact of a 1-week increase in the potential duration of UI benefits on the expected duration of unemployment for UI-eligible claimants. The estimates fall in the range of .1 to .2 week, implying that a 10-week benefit extension would increase the expected duration of unemployment by between 1 and 2 weeks.

These estimates are clearly toward the low end of the existing empirical estimates of the impact of extending benefits -- recall that those estimates fall in the range of .1 to .4 week.

The fourth column of Table 2 shows that extending the potential duration of benefits can be expected to make it slightly easier for UI-ineligibles to find jobs. Specifically, the estimates suggest that a 1-week increase in the potential duration of benefits shortens the expected duration of unemployment of UI-ineligibles by about one-quarter of a day. This is a very small effect, but it illustrates that job competition is reduced when UI benefits are extended.

The three omitted Washington treatments yield relatively small estimates of the impact of extending the potential duration of UI benefits. For those three treatments, the estimated impact of a 1-period increase in the potential duration of UI benefits on D is in the range of .05 to .08, and the impact on D_i is in the range of -.02 to -.01. If we include these three treatments, then our range of estimates widens, and we would conclude that a 1 week increase in the potential duration of benefits increases the expected duration of unemployment by between .05 and .2 week. The implication is that a 10-week benefit extension would increase the expected duration of unemployment by between one-half and 2 weeks. Again, this is clearly at the low end of existing estimates, and suggests that the disincentive effects UI extensions may be less than previously believed.

It is important to determine whether the impacts found above vary depending on the initial replacement rate or the initial potential duration of unemployment. That is, if the replacement rate were .1 or .9 to begin with (rather than .5 or .6), would the impacts that we estimate be different? Similarly, if the potential duration of benefits were 16 or 40 weeks to begin with (rather than 26 weeks), would the results differ? Table 3 shows that the estimated impacts do not vary much with the initial UI replacement rate or with the initial

potential duration of benefits. For example, the results shown suggest that, depending on the initial replacement rate, a 10 percentage point increase in the replacement rate would lengthen unemployment by as little as .761 week or as much as .816 week (see the first and second columns of Table 3). This is a variation of only a quarter of a day (.055 week) in response to dramatic variation in the initial replacement rate. Similarly, the variation in response to a 1 week benefit extension that results from changing the initial potential duration of benefits is of little significance (see the right three columns of Table 3). Similar results were found for Pennsylvania and Washington. We conclude that the results are largely insensitive to the initial replacement rate or initial potential duration of benefits.

It is also important to examine the sensitivity of the results to variation in some of the key parameters that we have obtained from secondary sources. Table 4 shows how the main estimates vary with changes in the separation rate (s) and total available jobs (F). We show results for the reference case (s = .01, F = 96.25), for high and low values of s (.006 being low and .014 being high), and for high and low values of F (95 being low and 97.5 being high). The sensitivity analysis is shown for the Illinois treatment, for one treatment in Pennsylvania (the long qualification period/high bonus treatment), and for one Washington treatment (the short qualification period/high bonus treatment). (The Pennsylvania and Washington treatments selected each gave results that were in the middle of the range of their respective experiment.)

The main finding of the sensitivity analysis shown in Table 4 is that the results are generally quite insensitive to changes in F (total available jobs), but somewhat sensitive to change in s (the separation rate). Consider first the impact of a 10 percentage point increase in the replacement rate. The Pennsylvania reference case shown suggests that such an increase would lengthen unemployment by .627 week. For low F, the estimate is .629, and

for high F, the estimate is .627. Hence, the results are robust to variation in F. (Similar results obtain for the Illinois and Washington cases shown.) But for low s, the estimate is .677, whereas for high s, it is .577. Thus, we have variation of about one-half day (.1 week) in response to varying s between .006 and .014. (Again, the Illinois and Washington cases shown give similar results.) Based on this finding, it might be wise to widen further (perhaps by .1 week on each side) the range discussed above for the impact of a 10 percentage point increase in the UI replacement rate. But doing so would not basically alter our conclusions.

Consider next the impact of a 1 week extension of the potential duration of UI benefits. The Pennsylvania reference case suggests that a 1 week extension would lengthen unemployment by .15 week. For low F, the estimate is .178, and for high F, the estimate is again .15. For low s, the estimate is .177, whereas for high s, it is .144. These variations -- about .03 week in each case, or less than a quarter of a day -- are probably too small to worry about (the Illinois and Washington cases shown give similar results.) However, they may suggest a need to broaden slightly the range discussed above for the impact of a 1 week extension of UI benefits.

In short, the results shown in Table 4 suggest that choosing different values of the s and F parameters might widen slightly the estimated ranges of UI impacts, but would not change our basic inferences.

VI. Discussion and Conclusions

Our main goal has been to translate the effects of reemployment bonus offers, as estimated in three separate UI field experiments, into estimates of the disincentive effects of UI that have been of most concern to economists and policy-makers -- that is, the effects of changes in the UI replacement rate and the potential duration of UI benefits on unemployment duration. An advantage of the findings presented here is that the logic of verification underlying them is quite different from that underlying earlier empirically-based findings on the incentive effects of the UI system. Yet the estimates presented clearly fall within the ranges of the earlier estimates, and arguably narrow those ranges.

We have four main findings. First, a 10 percentage point increase in the UI replacement rate can be expected to increase the unemployment duration of UI claimants by between .3 and 1.1 weeks (see Table 2 and the accompanying discussion). Existing empirical work offers a somewhat broader range than this, placing the expected increase in unemployment duration anywhere from zero to slightly over 1.5 weeks. The estimates presented here might be viewed as providing evidence that the range may be somewhat narrower -- but not much narrower -- than previously estimated. However, from a policy perspective, there is some question whether a range of .3 to 1.1 weeks is any more informative than a range of 0 to 1.5 weeks.

Second, we find that a 1 week increase in the potential duration of benefits increases the expected duration of unemployment by between .05 and .2 week (see again Table 2 and the accompanying discussion). The implication is that a 10-week benefit extension would increase the expected duration of unemployment by between one-half week and 2 weeks. This is clearly at the low end of existing estimates of the disincentive effects of UI benefit extensions.

Third, increases in the UI replacement rate and the potential duration of benefits reduce the job search intensity of UI claimants so that unemployed workers who are ineligible for UI face less competition for jobs. The result is shorter spells of unemployment for UI-ineligibles. We estimate that a 10 percentage point increase in the UI replacement rate shortens the expected unemployment spells of UI-ineligibles by about one-half day to a day. Also, a 1-week increase in the potential duration of benefits shortens the expected duration of unemployment of UI-ineligibles by about one-quarter of a day. These are admittedly very small effects, but they do illustrate that increasing the generosity of UI benefits reduces job competition and has benefits for workers who are ineligible for UI.

Fourth, we find that the disincentive effects of increases in the UI replacement rate and extensions of UI benefits are invariant to the initial replacement rate or the initial potential duration of benefits. That is, at least when they are averaged over fairly large groups, the disincentive effects of UI appear to be similar whether the initial replacement rate is high or low, and whether the initial potential duration of benefits is high or low (see Table 3 and the accompanying discussion).

Because these estimates are based on randomized trials, they are arguably free of many of the complicating and contaminating factors that plague nonexperimental estimates. Moreover, there is no particular reason to favor or disfavor any of the estimates, in that each arises from a similar experimental design that was implemented and monitored with some care. In that respect, it is striking that we find a range of estimates that is nearly as broad as that in the existing literature. Existing studies are based on various data and various econometric techniques, each of which might be expected to add variation to the range of estimates independent of variation in the actual behavior underlying those estimates. In other words, the results presented here suggest substantial variation in the behavior of unemployed

workers, even when measurement of that behavior is averaged over rather large groups. At the least, the results suggest that it is unwise -- and perhaps futile -- to try to concoct summary "best estimates" of the disincentive effects of increasing the UI replacement rate or extending the potential duration of UI benefits.

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Table 1

Basic Features of the Reemployment Bonus Experiments:
Means (with Standard Errors in Parentheses)

Experimental Treatment	Qualification Period (1)	Bonus Amount (2)	Weekly Base Period Earnings (3)	Weekly Benefit Amount (4)	Weeks of Insured Unemployment (Benefit Year) (5)	Treatment Effect in weeks (6)	Weekly Reemployment Earnings (7)
Illinois Experiment							
Treatment (FSC-ineligible)	11 (0)	$500 (0)	$261 (4.8)	$121 (1.0)	18.56 (.25)	-.71* (.34)	$240 (6.1)
Control (FSC-ineligible)	--	--	250 (4.5)	122 (1.0)	19.27 (.23)	--	247 (5.7)
Pennsylvania Experiment							
Short qualification period/low bonus	6 (0)	500 (5.6)	279 (5.6)	167 (1.9)	15.54 (.28)	-.40 (.34)	252 (6.7)
Short qualification period/high bonus	6 (0)	1003 (9.4)	276 (4.6)	167 (1.6)	15.44 (.25)	-.50* (.31)	267 (7.0)
Long qualification period/low bonus	12 (0)	499 (4.3)	281 (4.4)	166 (1.4)	15.51 (.22)	-.43 (.28)	268 (5.4)
Long qualification period/high bonus	12 (0)	991 (7.6)	267 (4.4)	165 (1.3)	15.02 (.19)	-.93* (.27)	273 (3.7)
Control	--	--	272 (3.5)	164 (1.2)	15.94 (.18)	--	263 (4.7)
Washington Experiment							
Short qualification period/low bonus	5.7 (.02)	302 (2.2)	296 (4.3)	151 (1.1)	15.14 (.23)	-.07 (.30)	317 (6.9)
Short qualification period/medium bonus	5.8 (.02)	610 (4.3)	302 (4.3)	153 (1.1)	15.05 (.22)	-.16 (.30)	324 (6.7)
Short qualification period/high bonus	5.7 (.02)	917 (7.8)	298 (5.1)	153 (1.3)	14.61 (.27)	-.61* (.34)	315 (7.3)
Long qualification period/low bonus	11.0 (.04)	308 (2.1)	302 (4.1)	154 (1.1)	14.71 (.23)	-.50* (.30)	321 (6.6)
Long qualification period/medium bonus	11.0 (.04)	612 (4.3)	306 (4.5)	153 (1.1)	15.08 (.23)	-.14 (.30)	319 (6.5)
Long qualification period/high bonus	11.1 (.04)	923 (8.0)	307 (5.4)	154 (1.3)	14.50 (.28)	-.72* (.34)	326 (8.8)
Control	--	--	296 (3.6)	151 (0.9)	15.21 (.20)	--	321 (6.5)

Notes: Authors' tabulations of the Illinois, Pennsylvania, and Washington Reemployment Bonus Public Use Data files.

* denotes rejection of the hypothesis that the treatment effect is zero using a 10-percent significance level.

Table 2

Change in Expected Duration of Unemployment
in Response to Changes in the UI Replacement Rate
and Potential Duration of UI Benefits, Reference Case

Experimental Treatment	Response of Expected Duration of Unemployment to:			
	10 percentage point increase in the replacement rate		1 week increase in potential duration of UI benefits	
	ΔD (UI-eligible claimants)	ΔD_i (UI-ineligible)	ΔD (UI-eligible claimants)	ΔD_i (UI-ineligibles)
Illinois (FSC-ineligible)	.815	-.203	.194	-.051
Pennsylvania				
Short qualification period/low bonus	.777	-.211	.184	-.052
Short qualification period/high bonus	.481	-.121	.114	-.030
Long qualification period/low bonus	.532	-.136	.125	-.033
Long qualification period/high bonus	.627	-.125	.150	-.041
Washington*				
Short qualification period/high bonus	.653	-.177	.128	-.036
Long qualification period/low bonus	1.113	-.348	.219	-.071
Long qualification period/high bonus	.575	-.152	.111	-.031

*For other Washington treatments, see text.

Notes: ΔD is the change in expected duration of unemployment of UI-eligible claimants (in weeks); ΔD_i is the change expected duration unemployment of UI-Ineligible workers (in weeks).

Table 3

Variation in Response to Changes in the UI Replacement Rate and Potential Duration of UI Benefits: Results Based on Illinois Experiment

Initial Replacement Rate	Response to a 10 percentage point increase in the replacement rate		Initial Potential Duration of UI Benefits	Response to a 1 week increase in potential duration of UI benefits	
	ΔD (UI-eligible claimants)	ΔD_i (UI-ineligible)		ΔD (UI-eligible claimants)	ΔD_i (UI-ineligible)
.000	.761	-.195	16	.180	-.049
.100	.778	-.198	18	.185	-.050
.200	.791	-.201	20	.190	-.050
.300	.803	-.202	22	.193	-.051
.400	.811	-.203	24	.194	-.051
.500	.816	-.203	26	.194	-.051
.600	.816	-.201	28	.194	-.050
.700	.811	-.198	30	.192	-.050
.800	.801	-.194	32	.191	-.049
.900	.784	-.188	34	.186	-.049
			36	.183	-.048
			38	.179	-.047
			40	.175	-.046

Notes: See Table 2.

Table 4

Sensitivity of Results to Changes in the Separation Rate (s)
and Number of Jobs Available (F)

	Response of Expected Duration o Unemployment to:			
	10 percentage point increase in replacement rate		1 week increase in potential duration of UI benefits	
	ΔD (UI-eligible claimants)	ΔD_i (UI-ineligibles)	ΔD (UI-eligible claimants)	ΔD_i (UI-ineligibles)
Illinois (FSC-ineligible)				
s low	.879	-.303	.211	-.076
F low	.819	-.229	.215	-.050
Reference Case	.815	-.203	.194	-.051
s high	.747	-.157	.182	-.040
F high	.817	-.225	.195	-.046
Pennsylvania (Long qualification period/high bonus)				
s low	.677	-.156	.177	-.057
F low	.629	-.141	.178	-.040
Reference Case	.627	-.125	.150	-.041
s high	.577	-.101	.144	-.036
F high	.627	-.143	.150	-.039
Washington (short qualification period/high bonus)				
s low	.679	-.209	.143	-.048
F low	.653	-.193	.128	-.035
Reference Case	.653	-.177	.128	-.036
s high	.615	-.159	.124	-.032
F high	.655	-.197	.128	-.035

Notes: See Table 2.

* U.S. G.P.O.:1996-403-281:40538 VOL.III