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by

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Abstract

This paper explores whether reemployment bonuses--cash payments made to insured unemployed workers who find reemployment quickly--have the unintended consequence of displacing workers who are not covered by the bonus program. We develop two partial equilibrium matching models of the labor market, patterned after the work of Diamond (1982), Mortensen (1982), and Pissarides (1984). In the first model, wages are assumed exogenous, in the second endogenous. In both, we find that the direct substitution of covered for uncovered workers (which constitutes displacement) is countered by two offsetting effects: a gross job creation effect, which results from thee increased search effort of covered workers; and a relatively small rivalry effect, in which uncovered workers search harder because of the increased difficulty they face in finding jobs. Both models suggest that, on net, the displacement effect is small to nonexistent.

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The reemployment bonus is a cash payment made to an Unemployment Insurance (UI) recipient who finds a job within a relatively short period after filing for UI benefits. Two randomized trials of the reemployment bonus have already been completed, one in Illinois (Woodbury and Spiegelman 1987), the other in New Jersey (Mathematica Policy Research 1989), and both have suggested that a reemployment bonus program could substantially reduce the duration of insured unemployment without adverse consequences for workers covered by the bonus program.[1] Additional, more refined, experiments with the reemployment bonus are currently in progress in Washington State and Pennsylvania.

Nevertheless, an important concern surrounding the reemployment bonus is that it could reduce the number of steady-state jobs held by workers who are not covered by the program. To take the extreme case, if each new job obtained by a covered worker were at the expense of an uncovered worker, then the program's effect would simply be distributional and there would be no real effect on total unemployment. This "displacement effect," if large, would greatly decrease the attractiveness of the reemployment bonus.

The purpose of this paper is to develop a simple partial equilibrium matching model of the labor market that allows us to investigate the nature and size of the displacement effect. We accomplish this by assuming that it takes time and effort for unemployed workers and firms with vacancies to find each other. Workers can increase the probability of finding employment by increasing their search effort, but increased search effort is costly. In equilibrium, workers choose a level of search activity that equates the expected gain from additional search with marginal cost. The bonus program increases the expected payoff to search for covered workers and therefore results in an increase in their search effort. This increase in search activity has three effects. First, if we hold search effort by uncovered workers constant, then there will be an immediate increase in the number of jobs held by covered workers. Some of these new jobs may come at the expense of uncovered workers but others will simply be due to the fact that greater search activity allows the economy to make better use of the existing search technology and therefore operate closer to full employment. The new jobs created will eventually benefit uncovered workers as well since when the worker needs to be replaced, both covered and uncovered workers will be free to compete for the job opening. We refer to the increase in overall employment due to the change in the covered workers' search effort as the "gross job creation effect" of the bonus program. The fact that some of the increase in covered employment comes at the expense of uncovered workers is referred to as the "direct substitution effect."

[1]Throughout the paper, we refer to workers who are eligible to receive a bonus and are attempting to make use of that eligibility as "covered." Workers who are inelgible for the bonus because they are ineligible for UI, because they fail to find a job within the bonus qualification period, or because they chose not to participate in the program are referred to as "uncovered."

The third effect of the bonus program is generated by the change in the search behavior of uncovered workers. Since the increased search effort of covered workers will make it more difficult for uncovered workers to find employment, the bonus program will trigger an increase in search effort of uncovered workers as well. This "rivalry effect" will increase the number of jobs held by uncovered workers and will tend to neutralize the direct substitution effect. The result is increased employment for both covered and uncovered workers. Moreover, even in cases in which the direct substitution effect dominates, we find that the displacement effect is relatively small.

The paper divides into three additional sections. In the first section we introduce a simple version of a partial equilibrium matching model that is patterned after the work of Diamond (1982), Mortensen (1982) and Pissarides (1984). This model incorporates the elements of the Illinois reemployment bonus experiment, which offered a $500 cash bonus to insured workers who were reemployed within 11 weeks of filing for UI. In this simple version of the model, wages are assumed to be exogenous and unaffected by the program (this is consistent with empirical evidence gathered during the Illinois experiment). Data gathered in the course of evaluating the experiment are then used to infer values for the unobservable parameters of the model. Finally, estimates of the displacement effect are obtained by solving the model assuming that the program is in effect. In the second section, the model is extended to allow wages to be determined endogenously. We demonstrate that although this complicates the analysis considerably, it does not affect that qualitative nature of our results. That is, we show that the result that the displacement effect is small (or non-existent) is robust. In the final section, we begin by summarizing our results. We then go on to argue that while our model is rich enough to capture many of the essential features of frictional unemployment, it is also simple enough to be used to study the displacement effects of a variety of government programs. The analysis provided in this paper serves as an example of its potential value.

I. The Displacement Effect with Fixed Wages

A. The model

To investigate the nature of the displacement effect we need a model with the following characteristics: (a) there must be two classes of workers-those covered by the bonus program and those uncovered; (b) there must be an equilibrium level of unemployment; and (c) each unemployed worker should choose search effort to maximize expected income. In the model developed in this section, the set of covered workers consists of all jobless workers who have been unemployed for fewer than twelve weeks (as in the Illinois experiment). No other jobless worker is eligible for the bonus. To capture (b) it is necessary to assume that jobs do not last forever. That is, in each period some jobs dissolve (creating unemployment) and new ones form. In equilibrium, the rate of job creation and job dissolution are equal. To capture (c) we assume that it takes time and effort for firms with vacancies and unemployed workers to find each other

(thus, unemployment is frictional). Jobless workers can reduce the time it takes to find employment by searching more intensely, although increasing one's search effort is costly.

The fact that we employ an equilibrium model of the labor market distinguishes our work from other studies of the Illinois experiment. For example, Mortensen (1987) and Levine (1989) each use a search-model of labor supply to investigate the impact of the bonus program on the search behavior of covered workers. Their models do not consider labor demand (in that the distribution of wage offers is exogenous and does not change once the program is implemented) or allow analysis of how changes in the behavior of covered workers affect the behavior and welfare of uncovered workers. Our equilibrium model allows us to determine the direct impact of the program (through its effect on covered workers' search behavior) as well as its indirect effect (through its effect on equilibrium unemployment and the search behavior of uncovered workers). This is especially true of our model in section II where wages are treated as endogenous variables.

The model is explained in two stages. First, we discuss the steady-state conditions and the search technology. These conditions describe the dynamics of the labor market including the manner in which jobs are created and destroyed. In addition, these conditions guarantee that the flows into and out of employment are equal (so that we have an equilibrium). Second, we solve the problem of a typical unemployed worker who must choose search effort to maximize expected lifetime income. To do so, we must first derive the expected income of workers who are employed and the expected income for unemployed workers. Search effort is then chosen to maximize the expected lifetime income of unemployed workers.

1. Steady State Conditions. Let J denote the steady state number of jobs held in the economy and V, the number of vacancies. Then, by definition, F denotes full employment where

(1) $\quad F = J + V.$

We also interpret F as the number of firms in the economy. This is equivalent to an assumption that each firm employs at most one worker (i.e., there is no distinction between a firm and a vacancy). This modeling abstraction is used to keep the analysis as simple as possible.[2]

Next, let L denote the total number of workers in the labor force (employed and unemployed); U_t, the number of unemployed workers who are in the t^{th} week of search where $t \leq 11$; and U_n, the number of workers who have been unemployed for more than eleven weeks. Then the number of workers covered by the program at any point in time is $\sum_{t=1} U_t$ while U_n

[2]Equivalency, we could assume that each firm consists of several job opportunities but recruits and fills each job separately.

represents the number of uncovered workers.[3] Since all workers are either employed or unemployed, it follows that

(2) $$L = J + \sum_{t=1}^{11} U_t + U_n = J + U$$

where U is defined as total unemployment.

Equations (1) and (2) are simple accounting identities. We now turn to a description of the evolution of the labor market overtime. There are thirteen employment states: (employment (i.e., state J), covered unemployment (i.e., one state each for U_t with $t \leq 11$), and uncovered unemployment (i.e., state U_n). Movements into and out of these states depend on the rates at which jobs are found and destroyed. Let m_t denote the probability that a jobless covered worker in the t^{th} period of search finds employment and let m_n play the same role for uncovered workers. Note that m_t and m_n are conditional reemployment probabilities - or conditional probabilities of creating a job match - often referred to as hazard rates. We use s to denote the separation (or "break-up") rate. That is, s represents the probability that a job will dissolve at any point in time. The determination of m_t, m_n, and s will be s discussed in detail below, but for now they will be treated as parameters.

The evolution of the labor market is depicted in Figure 1. Consider first the flows into each state of unemployment. In any given period there are J employed workers. At the end of the period sJ of these workers lose their jobs and must reenter the search process. The remainder, (1-s)J, retain their jobs and remain in state J. Thus, the flow into state U_1 is sJ. Workers enter state U_t (with $t \leq 11$) if and only if they were in their $(t-1)^{st}$ period of search in the previous period and failed to find a job. Thus, the flow into state U_t is $(1-m_{t-1})U_{t-1}$. Finally, workers previously covered by the program lose their eligibility if they fail to find employment in their eleventh week of search. The flow into U_n is therefore equal to $(1-m_{11})U_{11}$.

The flows out of each state are even easier to characterize. In each period, successful searchers in state U_t find employment and enter state J while unsuccessful ones move on to state U_{t+1}. Thus, all jobless covered workers flow out of their current state. This implies that the flow out of U_t is simply U_t. Jobless uncovered workers leave their state only when they find employment. Thus the flow out of U_n is equal to m_nU_n.

In a steady-state equilibrium the flows into and out of each employment state must be equal so that the unemployment rate and the composition of the unemployment pool do not vary over time. Equating these flows yields the following steady-state conditions[4]

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[3]In this section, uncovered workers are those workers who failed to find reemployment sufficiently fast. Of course, there are some workers who are never covered by the program. We analyze the impact of the bonus program on this second type of "uncovered worker" in section II of the paper.

[4]We assume throughout that the separation rate (s) is not affected by the program so that it may be treated as exogenous.

(3) $sJ = U_1$

(4) $(1-m_{t-1})U_{t-1} = U_t$ for $t=2, \ldots, 11$

(5) $(1-m_{11})U_{11} = m_n U_n$.

If (3)-(5) hold then J, U_t, and U_n will not vary over time.

2. The Search Technology. The conditional reemployment (or matching) probabilities, m_t and m_n, depend on the nature of the search process and the level of search effort expended by unemployed workers. In each period, jobless workers choose their level of search effort to maximize expected lifetime income. This search effort determines the probability that the worker contacts a firm and applies for a job (search effort may be fruitless). The firms hires the worker at a wage of w if it has a vacancy and if no other applications are filed. If more than one worker applies, the firm chooses randomly among all applicants. A worker's reemployment probability therefore depends on the probability of contacting a firm, the probability that the contacted firm has a vacancy, and the probability of getting the job over all other applicants.

Formally, let p_t denote the probability that, in any given period, a covered worker who has been unemployed for t weeks contacts a firm (p_n plays the same role for uncovered workers).[5] This contact probability can be interpreted as search effort since it can be increased only by searching more intensely. The determination of p_t is discussed in the next subsection; for now, we treat it as a parameter. Once a firm has been contacted, the probability that this randomly chosen firm has a vacancy is $\frac{V}{F}$. Finally, if the firm does have a vacancy, the probability of receiving a job offer is $\frac{1}{N+1}$ where N denotes the number of other applications filed. Since each other worker either does or does not apply at the firm in question (i.e., there are only two possibilities), N is a random variable distributed according to a Poisson distribution with parameter λ, defined as the average number of applications filed at each firm. Thus, the probability that the worker gets the job, conditional on having applied at a firm with a vacancy is

$$\sum_{t=0}^{\infty} \frac{1}{(N+1)n!} e^{-\lambda}\lambda^{N} = \frac{1}{\lambda}[1-e^{-\lambda}]$$

[5]If $p_t < 1$ then p_t represents a contact probability. If $p_t > 1$ then we interpret p_t as the number of firms contacted by the worker per period. For example, if $p_t = 1.5$ then we assume that the worker contacts one firm with probability 1 and a second firm with probability .5. We ignore the possibility that any given worker may contact the same firm twice in any given period.

The product of these three probabilities yields the conditional reemployment probability for each worker[6]

(6) $$m_t = \frac{p_t}{\lambda}\frac{V}{F}[1-e^{-\lambda}] \qquad \text{for } t=1, \ldots, 11$$

(7) $$m_n = \frac{p_n}{\lambda}\frac{V}{F}[1-e^{-\lambda}]$$

with

(8) $$\lambda = \frac{1}{F}\left\{\sum_{t=1}^{11} p_t U_t + p_n U_n\right\}$$

Note that equation (8) provides the mechanism for displacement in the model. As the search effort of covered workers (p_t) increases in response to the bonus, the number of contacts per firm (the term in brackets in equation 8) increases. Hence, the probability of receiving a job offer from a contacted firm with a vacancy falls.

3. Search Effort. Search effort is chosen to maximize expected lifetime income. It is clear from (6) and (7) that by searching harder an unemployed worker can increase the probability of reemployment. Of course, there is a cost associated with increased search effort. The optimal search effort results from equating the expected marginal benefit from an increase in search effort with its marginal cost.

To be precise, let V_t denote the expected lifetime income for an unemployed covered worker currently in the t^{th} week of search (V_n plays the same role for an uncovered worker). In addition, let V_e represent the expected lifetime income for a worker who is currently employed. Then, if we assume that search costs are quadratic,[7] V_t, V_n, and V_e satisfy

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[6]This is equivalent to assuming that all job contacts are made by workers and that the underlying search technology is quadratic (see Diamond and Maskin, 1979 for details).

[7]The assumption that the marginal cost of search increases with effort is consistent with the empirical finding that the net return to search is decreasing in effort (see, for example, Barron and Gilley, 1981 or Chirinko, 1982). For the importance of this assumption, see Seater (1979).

$$V_t = x - cp_t^2 + \frac{1}{1+r}\{m_t(V_e + b) + (1-m_t)V_{t+1}\} \tag{9}$$

$$V_{11} = x - cp_{11}^2 + \frac{1}{1+r}\{m_{11}(V_e + b) + (1-m_{11})V_n\} \tag{10}$$

$$V_n = x - cp_n^2 + \frac{1}{1+r}\{m_n V_e + (1-m_n)V_n\} \tag{11}$$

where x denotes the weekly unemployment insurance benefit, b represents the bonus paid to covered workers when they find a job, and r is the weekly interest rate. Equation (9) states that a covered unemployed worker currently collects unemployment insurance benefits (x) and pays out search costs (cp_t^2). With probability m_t search is successful and the worker collects a bonus of b and begins working (so that expected lifetime income increases to V_e). With probability ($1-m_t$) search is unsuccessful and the worker continues to search in the next period (so that expected lifetime income becomes V_{t+1}). These last two terms are discounted since they reflect income collected in the next week. Equation (10) is the analogous condition for a covered worker about to lose eligibility for a bonus and (11) is the appropriate expression for an uncovered worker. Note that when an uncovered worker finds a job no bonus is collected. Finally, (12) describes the situation faced by an employed worker. Current income is w but, with probability s the worker becomes unemployed and must begin searching for a new job (so that expected income drops to V_1). With probability (1-s) the worker remains employed and continues to earn V_e.

Each unemployed worker chooses p_t. the contact probability, to maximize expected lifetime income. Therefore, p_t can be interpreted as search effort. Applying Bellman's Principle of Optimally an maximizing each expression yields the following optimal levels of search effort (the reader is reminded that the m's are functions of the p's through (6) and (7))[8]

$$V_e = w + \frac{1}{1+r}\{sV_1 + (1-S)V_e\} \tag{12}$$

$$P_t = \sqrt{\frac{m_t}{2c(1+r)}[V_e + b - V_{t+1}]} \quad \text{for } t = 1,\ldots,10 \tag{13}$$

$$P_{11} = \sqrt{\frac{m_{11}}{2c(1+r)}[V_e + b - V_n]} \tag{14}$$

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[8]In maximizing V_t over p_t we treat λ as a parameter. The rationale for this is that since each worker is small relative to the market, each individual can ignore his/her own effect on λ.

(15) $$P_n = \sqrt{\frac{m_n}{2c(1+r)}\,[V_e - V_n]}$$

To summarize, in each period unemployed workers choose search effort (as measured by p_t, the contact probability) to maximize expected lifetime income. The optimal values for search intensity are given by (13)-(15). These contact probabilities then determine the average number of applications filed at each firm (λ as given in (8)) and the conditional reemployment probabilities (as given in (6) and (7)). Jobs are created as unemployed workers find firms with vacancies and production takes place. Finally, at the end of the period, a fraction s of all jobs break-up and the newly unemployed workers start searching for new jobs. The steady-state condition (3)-(5) guarantee that the flows into and out of each employment state are balanced so that the unemployment rate and the composition of the unemployment pool (i.e., the distribution of U_t over t) are time invariant.

The model consists of fifty-two equations (one each in (1) - (3), (5), (7), (8), (10) - (12), (14), and (15); ten each in (4) and (9); and eleven each in (6) and (13)), fifty-two unknowns (J, V, U_t, for $t \leq 11$, U_n, m_t for $t \leq 11$, m_n, p_t for $t \leq 11$, p_n, λ, V_t for $t \leq 11$, V_n, and V_e) and seven parameters (F, L, s, c, x, w, and r). Once the model has been solved, the unemployment rate (μ) and the expected duration of unemployment (d) can be calculated using (16) and (17).

(16) $$\mu = \{\sum_{t=1}^{11} U_t + U_n\}\,/L = \frac{U}{L}$$

(17) $$d = \{\sum_{T=1}^{11} tm_t U_t + m_n^2 U_n \sum_{t=12}^{\infty} t(1-m_n)^{t-12}\}\,/U_1$$

Equation (16) states that the unemployment rate is equal to total unemployment divided by the size of the labor force. The duration of unemployment is calculated by following one cohort of newly unemployed workers and calculating the average number of periods it takes these workers to find employment.

B. The Solution Algorithm

To determine the impact of the bonus program we need to solve the model for b = 0 and 500 and compare the unemployment rates and conditional reemployment probabilities. To accomplish this, we need estimate of the parameters for the model. Unfortunately, the cost parameter (c) and full employment (f) are not observable. We therefore proceed in two steps. First, we arbitrarily choose a labor force size of 100, and note that for values of F ranging from

99 to 101 the model predicts an equilibrium unemployment rate in the range 5% to 12%, which seems appropriate given the time period in which the experiment was conducted. We therefore carry out the analysis for ratios of F to L falling in the range of 0.99 to 1.01 and demonstrate that our results are robust with respect to this ratio (since the model is homogeneous for degree zero in F and L, there is no loss of generality involved in this procedure). Next, we obtain values for x, w, and d from data gathered to evaluate the experiment. We then choose appropriate ranges of values for r and s, relying on the literature for guidance. By treating d as a parameter, we are then able to add equation (17) to the model and solve for the endogenous variables treating c as endogenous. For each pair (s,r) this gives us as a values for c that is consistent with the data. We demonstrate below that our results hold for all values of r and s that seem reasonable.

In the Illinois bonus experiment, the average weekly wage earned by reemployed workers was $240. During the experiment, the average weekly unemployment insurance benefit equaled $137 (see Spiegelman and Woodbury, 1987). The average spell of insured unemployment for controls during the experiment was 20.1 weeks. We therefore set $w=240$, $x=137$, and $d=20.1$. In addition, we begin by setting b-0.

For values of s, the weekly separation rate, and r, the weekly discount rate, we turn to the literature. Research by Eherenbert [1980], Clark and Summers [1982], and Murphy and Topel [1987] suggest that s falls somewhere in the range of .003 to .007 (the mean appears to be about .005 with as a standard error of .002). We therefore focus on the case s = .003 or .007. For r we consider values from zero to .01. This translates into annual discount rates ranging from zero to 67% and therefore should include most relevant values. While the value for c is sometimes sensitive to the values chosen for r and s, as we show below, our overall results concerning displacement are remarkably robust.

2. Step Two. In step one we obtained as as a value for c for each vector (s,r). In step two, we use these values to estimate the impact of the bonus program. To do so, we continue to assume that $w=240$ and $x=137$ (the importance of the assumption that the wage is not affected by the bonus is discussed at length in Section 2 below). In addition, we set $b=500$. We then choose values for s and r, and set c according to the step one computations. The mode can then be solved for all endogenous variables including the unemployment rate (μ) and the expected duration of unemployment (d).

C. Results

1. Search Effort and Reemployment Probabilities. The model's implications for search effort and the conditional reemployment probabilities can be described as follows (see Figures 2 and 3 for details of the case where $s=.005$, $r=.004$, and F-100). Since the bonus payment increases the expected return to search during the first eleven weeks of unemployment, its immediate impact is to increase the search effort of covered workers (p_t). The size of the impact is related to the number of weeks the worker has been unemployed, with newly unemployed workers responding less than those about to lose bonus coverage (see Figure 2). This follows

from the fact that newly unemployed workers responding less than those about to lose bonus coverage (see Figure 2). This follows from the fact that newly unemployed workers face as a longer time horizon over which to search and (possibly) collect the bonus. As the spell of unemployment grows longer, workers begin to worry about losing eligibility and respond by searching wit greater effort.

The effect on uncovered workers (weeks 12 and higher) is more subtle. The increase in search effort of covered workers reduces thee conditional reemployment probability faced by uncovered workers (m_n, see equation 7). This follows from the fact that the increased search effort by covered workers increases the expected number of job applicants at each firm (that is, λ rises) making it harder for uncovered workers to secure employment (see equation 8). At the same time, however, that fall in the conditional reemployment probability (m_n) widens the gap between expected lifetime income for employed and uncovered unemployed workers (that is, V_e - V_n increases). Intuitively, the reduction in the conditional reemployment probability makes the future for uncovered unemployed workers less appealing and increases the benefit (in terms of expected income) from employment. From (15) it appears that the overall impact on the search effort of uncovered workers (p_n) is ambiguous, since m_n falls while V_e - V_n rises). However, our computed results indicate that the second effect (V_e - V_n rising) dominates for all relevant parameter values so that uncovered search intensity (p_n) increases when the bonus program begins. The increase in search effort by these workers is always less than the increase by covered workers (in Figure 2, the dashed line is only slightly above the solid line in weeks 12 and higher).

Increased search activity does not necessarily translate into higher employment probabilities. After all, all workers are induced to search harder by the bonus program. While this greater search effort will, in general, result in as a lower equilibrium unemployment rate, the rivalry for jobs may produce an environment in which some classes of workers are less likely to find as a job even though they are searching harder. Figure 3 shows how the bonus program affects the conditional reemployment probabilities in as a typical case. Covered workers are rewarded for their increased search effort by brighter reemployment prospects while uncovered workers (weeks 12 and higher) face as a somewhat bleaker future than they would in the absence of the bonus program.

2. Duration and the Level of Unemployment. The changes n the reemployment probabilities induced by the bonus program affect the following variables of interest: the duration of unemployment (d), the number of both covered and uncovered unemployed workers (U_c and U_n), the overall unemployment rate (μ),[9] and the composition of the pool of unemployed ($\frac{U_n}{U}$). We consider each in turn, and consider in the next subsection the implications of these findings for job creation and displacement.

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[9]Because we have set the size of the labor force at 100, U can be interpreted both as the total number of unemployed workers, and as the unemployment rate.

Our model predicts that overall - that is, including both covered and uncovered workers - expected unemployment duration should fall by between .41 and .89 weeks in response to the bonus program (see the rows labeled Δd in Table 1). This prediction, which results because unemployed workers increase their search effort under the bonus program, is consistent with the direction of the findings of the Illinois claimant experiment, although somewhat smaller in magnitude.[10] Note that the size of the duration reduction predicted by our model depends on the interest rate and the separation rate, the increases in either resulting in greater reduction in duration.

Although the bonus program reduces unemployment duration for uncovered workers (see the rows labeled Δd_n in Table 1). This result stems from the (slightly) decreased reemployment probability faced by uncovered workers, discussed above. note that as a worker who is not covered by the bonus program finds it more difficult to find employment even though she is searching slightly harder than she would in the absence of the bonus program.[11] The results shown in Table 1 suggest that the bonus program increases uncovered workers' unemployment durations by between .36 and .65 weeks. Overall duration (d) falls despite this increase for uncovered workers (d_n) because decreases for covered workers more than offset the increase for uncovered workers.

Regarding unemployment, the model predicts that the bonus program reduces the equilibrium number of both covered and uncovered unemployed workers (see the rows labeled ΔU and ΔU_n in Table 1). These results occur because the increased search efforts of both covered and uncovered workers result in the creation of jobs (see below). The decreases in unemployment tare small in both proportional and absolute terms: for relevant values of r, s, and F, the decrease in total unemployment this about one-tent to one-third of one percent, and the decrease in uncovered unemployment ranges from less than one-tenth to about one-quarter of one percent. Note that these quantitative effects, although small, are insensitive to changes in the parameters. Note also that, since U can be interpreted as the unemployment rate (since $L = 100$), the decreases in unemployment simply equal decreases in the unemployment rate. Finally, the fraction of the unemployment pool consisting of uncovered workers ($\frac{U_n}{U}$) actually decreases slightly from 57.0 to 56.7 percent (this result is not shown in the table).

3. Job Creation and Displacement. The results to this point suggest that the number of both covered and uncovered unemployed workers falls (and the unemployment rate falls)

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[10]The reductions in duration predicted by our model are larger (and hence closer to the experimental findings) than those predicted by Levine (1988), Meyer (1988), and Mortensen (1987). Elsewhere (Davidson and Woodbury 1989), we have found that the reduction in insured unemployment among experimental (bonus-covered)workers who were not eligible to receive Federal supplemental Compensation (12 weeks for benefits in addition to the 26 weeks of regular benefits) was .54 weeks, over the full benefit year. This actual reductionis bracketed by the range of .41 to .69 predicted by our model.

[11]Recall that as a worker is uncovered if she is ineligible for UI benefits, has been unemployed beyond the bonus qualification period, or decides not to use the bonus opportunity.

because jobs are created under the bonus program as as a result of workers' increased search effort. The number of jobs created depends on the values of the parameters. A summary is provided in Table 2, which suggests that job creation is for the most part independent of the discount rate but varies directly with the separation rate. Intuitively, higher values of s imply faster job turnover and as a greater return to search. Therefore, the increase in search activity has as a bigger impact on the economy when jobs are not very enduring. In all cases, however, the number of jobs created by the program is rather small, ranging from 114 per 100,000 (the sum of 38 and 76, for $r=0$, $s=.003$, $F=99$) to 424 per 100,000 (for $r=.01$, $s=.007$, $F=101$). Note that uncovered workers actually gain more jobs than covered workers. This is due to the fact that the reemployment probability for covered workers rises as as a result of the program so that fewer workers fail to find as a job in the first eleven weeks of search. This result highlights the importance of the gross job creation effect.

From the point of view of policy, as a central concern is whether improvements experienced by covered workers come at the expense of uncovered workers - that is, whether the bonus program results in displacement of uncovered by covered workers. In the sense that the higher reemployment probabilities for covered workers lower the reemployment probabilities of uncovered workers, the underlying mechanism exists for such displacement. Indeed, as noted above, as a worker who becomes unemployed and is uncovered by the bonus program can expect as a longer spell of unemployment as as a result of the bonus program.

Nevertheless, unemployment of both covered and uncovered workers falls as a as a result of the bonus program (Table 1), and jobs are created for both covered and uncovered workers (Table 2). It follows that, as as a result of the bonus program, any worker is more likely to be employed at as a given time, and is better off as as a result. Accordingly, we conclude that reductions in covered unemployment do not come at the expense of increased uncovered unemployment, and in this sense the bonus program entails no displacement effect. The result that the bonus program fails to generate displacement is remarkable robust. We obtain roughly the same quantitative results for all values of r and s used (see Table 1, rows labeled ΔU and ΔU_n).

4. Displacement and Rivalry. For two reasons, the increased search effort of covered workers which is generated by the bonus, fails to displace uncovered workers n our model. First, although increased search effort by covered workers reduces somewhat the reemployment probability of uncovered workers, it also improves the performance of the economy by creating new jobs (with increased search activity, the economy is able to produce more new jobs in each period). These new jobs will eventually break-up and produce vacancies that can be filled either with covered or uncovered workers. This naturally benefits all unemployed workers. Second, increased search effort by covered workers triggers an increase in search effort by uncovered workers. This rivalry effect also tends to neutralize the displacement effect.

Whether the rivalry effect is important can be appraised by solving he model with the bonus program in effect holding uncovered search effort fixed at its pre-bonus level. Tables 3

and 4 are equivalent to Tables 1 and 2, but omit the rivalry effect. A comparison of these tables makes it clear that the rivalry effect is actually extremely small. The implication is that the job creation effect drives our result that there is no displacement effect of the bonus program.

II. Displacement with Endogenous Wages

The Illinois bonus experiment had virtually no impact on the earnings of workers who were covered by the bonus (Woodbury and Spiegelman 1987, Table 5). This provides at least one defense for our treatment of wages as exogenous in section I. Nevertheless, it seems important to verify that the empirical finding that wages are unaffected by the bonus program is consistent with as a matching model in which wages are endogenous. Accordingly, in this section we extend the model to allow for endogenous wage determination. The main finding of the section is that wages vary very little when they are treated as a endogenous. It follows that the results derived in section I are qualitatively unchanged when wages are allowed to vary.

A. The Model

The model is patterned after the one introduced in Section I with two minor exceptions. First, for simplicity we work in continuous rather than discrete time. Interims of interpreting the model, this makes little difference. It does, however, simplify the link between the contact and reemployment probabilities, making the model somewhat more manageable (in continuous time the probability that two applications for employment are filed at the same time is zero so that we need not worry about ties). The second change concerns the modeling of the bonus program. In Section I, the set of covered workers consisted of insured unemployed workers in the first eleven weeks of search. Any worker unemployed for more than eleven weeks was classified as uncovered. In this section, we assume that the worker collects the bonus whenever reemployment occurs. In other words, bonus coverage is not tied to length of search. Nevertheless, there will still be as a class of uncovered workers since some workers are ineligible for UI (and hence uncovered by the bonus program) and others may choose not to participate (this was actually as a non-trivial problem in the Illinois experiment, see Spiegelman and Woodbury, 1987). Since covered workers discount the future, they will still respond to the program by increasing search effort (to collect the bonus sooner). Therefore the only real distinction between the two models is that there is no longer as a flow of workers from covered to uncovered status. As we will see below, this change has little impact on the results. However, this way of modeling the program greatly simplifies he task of making wages endogenous (for reasons discussed below).

1. Steady State conditions. One of the advantages of working in this simplified framework is that the number of employment states is reduced from thirteen to three - employed, unemployed and covered, and unemployed and uncovered. We let U_i denote the number of type i unemployed workers where i = c or n for covered and uncovered, respectively. L_c represents the number of workers in the labor force (employed and unemployed) who are covered by the

bonus program, and L_n is the number of uncovered workers in the labor force. Finally, λ denotes the proportion of steady state jobs held by uncovered workers.

The analogues of equations (1) and (2) are listed below.

(18) $$F = J + V$$

(19) $$L_n = \gamma J + U_n$$

(20) $$L_c = (1-\gamma)J + U_c$$

Equation (18) defines full employment and is identical to (1). Equation (19) simply states that, at each point in time, each uncovered worker is either employed or unemployed. Equation (20) makes the same statement for covered workers.

The steady state conditions are derived (as in Section I) by equating the flows into and out of each employment state. Let m_i denote the reemployment probability for type i unemployed workers. Then, at each point in time, m_cU_c covered workers and m_nU_n uncovered workers find employment. The flow into unemployment depends on the break-up rate and the composition of the work force. Since s represents the separation rate and since λ is the fraction of jobs held by uncovered workers, $s\lambda J$ uncovered workers lose their jobs at each point in time. j By as a similar argument, $s(1-\lambda)J$ covered workers enter the unemployment pool each instant. Equating the flows into and out of each state yields the following steady-state conditions.

(21) $$s\gamma J = m_n U_n$$

(22) $$s(1-\gamma)J = m_c U_c.$$

If (21) and (22) hold, the unemployment rate and the composition of unemployment (i.e.., $\frac{U_n}{U_n+U_c}$) remain constant over time.

2. <u>The Search Technology</u>. Our assumptions concerning the search technology were discussed in Section I. The only adjustment that must now be made is due to the difference between the continuous and discrete time frameworks. In Section I we worked with discrete time and therefore needed to take into account the fact that more than one worker could apply for the same job at the same time. This possibility cannot arise in continuous time since the probability of two workers arriving at the same firm at exactly the same time is zero. This implies that the probability that as a typical worker finds reemployment its simply equal to the probability of

contacting as a firm times the probability that the firm has as a vacancy. Letting p_c and P_n denote the contact probabilities (which as before may be interpreted as search effort), we have

(23) $$m_n - p_n \frac{V}{F}$$

(24) $$m_c - p_c \frac{V}{F}$$

3. Wage Determination. When frictions are present in the labor market, workers and firms each possess some degree of monopoly power. After all, if they cannot reach agreement n the terms of employment, then they each must re-enter the search process in pursuit of as a new trading partner. Since search is costly and time-consuming they would prefer, if possible, to settle on as a contact and begin production. It seems reasonable to assume that the outcome of eh negotiation will reflect the tightness of the labor market. For example, when unemployment is high and vacancies are easy to fill, the firm will possess much bargaining power and should be able to force the worker to accept as a low wage. If, on the other hand, the economy is operating at close to full employment, the worker should be able to extract as a high wage from the firm.

To capture the notion that agents may have market power, we assume that wages are determined though as a bargaining process in which the firm and worker exchange wage offers until one side makes an offer the other side finds acceptable. The tightness of the labor market affects the relative bargaining positions of the agents and therefore has as a direct impact on the negotiated wage.

To solve the bargaining problem, we begin by describing the expected lifetime income of each worker in the economy and the expected future profit of each firm. We use V_u^i to denote the expected lifetime income for as a type i unemployed worker and V_e^i represents the expected lifetime income for the employed counterpart (i = c and n). In addition, we use Π_i to denote the expected future profit earned by as a firm employing as a type i worker and Π_v to represent the expected future profit of as a firm with as a vacancy. finally, w_i denotes the wage earned by type i workers.

Consider first the position of an unemployed worker who is covered by the bonus program. In each small unit of time (Δt) the probability of finding employment is $m_c(\Delta t)$, in which case the worker changes status and can expect to earn V_e^c in the future. In addition, the worker collects as a bonus payment equal to b. With probability $[1-m_c(\Delta t)]$ the worker remains unemployed and continues to expect to earn V_u^c in the future. Finally, this worker collects x in unemployment compensation and incurs search costs of cp_c^2 in each instant of time. Therefore,

(25) $$V_u^c = \frac{m_c(\Delta t)\ (v_e^c + b) + [1 - m_c(\Delta t)]\, V_u^c + [x - cp_c^2]\ (\Delta t)}{1 + r(\Delta t)}$$

Note that the right-hand side is discounted to reflect the fact that payment occurs in the future. the analogous condition for unemployed workers not covered by the program is

(26) $$V_u^n = \frac{m_n(\Delta t) V_e^n + [1 - m_n(\Delta t)] V_u^n + [X - CP_n^2](\Delta t)}{1 + r(\Delta t)}$$

Next we consider the position for type i employed workers. With probability s(Δt) the worker becomes unemployed and expects to earn V_u^i in the future. With probability [1 - s(Δt)] the worker remains employed and continues to expect to earn V_e^i in the future. Finally, over this interval of time, the worker is paid w_i for each instant on the job. Therefore,

(27) $$V_e^i = \frac{s(\Delta t) V_u^i + [1 - s(\Delta t)] V_e^i + w_i(\Delta t)}{1 + r(\Delta t)} \qquad i = c,n.$$

To find expected profit let q_i represent the probability of filling as a vacancy with as a type i worker at any point in time. That is, over as a small interval of time (Δt), the probability of filling as a vacancy with a type i worker is $q_i(\Delta t)$ and the probability that the vacancy will remain unfilled is $[1 - (q_c + q_n)(\Delta t)]$. In the former case, the firm changes status and expects to earn Π_i in the future. If the vacancy remains open, the firm continues to expect to earn Π_v in the future. Therefore,

(28) $$\Pi_v = \frac{q_c(\Delta t)\Pi_c + q_n(\Delta t)\Pi_n + [1 - (q_c + q_n)(\Delta t)]\Pi_v}{1 + r(\Delta t)}$$

Once again, the right-hand side must be discounted to reflect the fact that these profits are collected in the future.

Now, consider the position of as a firm that has filled its vacancy with as a type i worker. With probability s(Δt) the job dissolves and the firm's expected future profit drops to Π_v. With probability [1-s(Δt)] the job remains intact and the firm continues to expect to earn Π_i in the future. Finally, over this short interval of time the firm earns P-w_i where P denotes marginal revenue product. Therefore,

(29) $$\Pi_i = \frac{s(\Delta t)\Pi_v + [1 - s(\Delta t)]\Pi_i + (P - w_i)(\Delta t)}{1 + r(\Delta t)} \qquad i = c,n.$$

Finally, since $m_i U_i$ type i workers find employment at each moment in time and since V denotes the total number of vacancies, it follows that

(30) $$q_i = \frac{m_i U_i}{V} \qquad i = c,n.$$

We are now in position to describe the solution t the bargaining problem. We assume that wages are determined by as a bargaining process in which the firm and the worker exchange wage offers until one sides makes an offer the other side finds acceptable. It is by now well known that the equilibrium of this game is equivalent to he Nash Cooperative Bargaining solution (see, for example, Rubinstein, 1982). This solution splits the surplus generated by the job evenly. For the worker, employment increases expected lifetime income from V_u^i to V_e^i while for the firm, filling as a vacancy increases expected future profits form Π_v to Π_i. Therefore, since the surplus must be split evenly, w_i solves

(31) $$V_e^i - V_u^i = \Pi_i - \Pi_v \qquad \text{for } i = c,n.$$

4. Search Intensity. A type i unemployed worker expects to earn V_u^i in the future. Each worker chooses search effort (p_i, which also represents the probability of contacting as a firm) to maximize this value. Solving (25)-(27) we obtain

(32) $$V_u^c = \frac{[x - cp_c^2 + bm_c](r + s) + m_c w_c}{r(r + s + m_c)}$$

(33) $$V_u^n = \frac{[x - cp_n^2](r + s) + m_n w_n}{r(r + s + m_n)}$$

Maximizing (32) and (33) over p_c and p_n yields optimal search effort (the reader is reminded that m_i is as a function of p_i through (23) and (24)). Applying Bellman's Principle of Optimaly and differentiating we obtain[12]

(34) $$P_c = \frac{1}{c}\sqrt{c^2(r+s)^2 - c[x - w_c - b(r+s)]} - c(r+s).$$

(35) $$P_n = \frac{1}{c}\sqrt{c^2(r+s)^2 - c[x - w_n]} - c(r+s).$$

In summary, the extended model consists of twenty equations (two each in (27), (29), (30) and (31), and (18)-(26), (28), (34), and (35)) in twenty unknowns (J, V, U_C, U_N, λ. m_n, m_c, p_n, p_c, V_u^c, V_u^n, V_e^c, V_e^n, w_n, w_c, Π_V, Π_c, Π_n, q_n, and q_c). There are nine parameters (F, L_c, L_n, s, c, x, b, P, and r). Once the model has been solved, the unemployment rate (μ) and the expected duration of unemployment for each class of workers (d_i for type i workers) can be calculated using (36) and (37).

(36) $$\mu = \frac{U_c + U_n}{L_c + L_n}$$

(37) $$d_i = \frac{1}{m_i}$$ i = c,n.

Equation (36) is self-explanatory. Equation (37) applies the well-known fact that the reciprocal of the reemployment probability equals the expected duration of unemployment in continuous time models.

B. The Solution Algorithm

We apply the same two-step procedure described in Section I to determine the impact of the bonus program. We allow F to vary between 99 and 101 and we use the same data discussed in Section I to infer values for c and P (the marginal revenue product of labor). The only difference is that L, the total labor force in Section I, is now divided into two sub-groups - covered and uncovered workers. Since slightly over one-third of all unemployed workers in Illinois during the bonus experiment were eligible for UI, we set L_c = 35 and L_n = 65. As before, since our estimates for s and r are taken from other sources, the analysis is carried out

[12]In maximizing expected lifetime income over p_i we treat w_i as as a parameter. The rationale for this is that since each worker is small relative to the market, each individual can ignore his/her own effecton the wage. This is similar to our assumption concerning λ in the discrete time model (see footnote 8).

for as a variety of combinations of these values. Our results are not very sensitive to small changes in these parameters.

Once we have estimates for F, c, and P, we allow b to vary and trace out the effect on employment and the duration of unemployment.

C. Results

As n Section I, the immediate impact of the bonus program is to increase the search effort of covered workers. This triggers and increase in the search effort of uncovered workers and generates an increase in the level of steady state employment. With the economy operating closer to full employment, the bargaining positions of both firms and workers are strengthened so that the overall impact on wages is ambiguous. For the values of the parameters that we have chosen, we find that the bonus program always increases wages by as a small amount (less than one-half of one percent) with wages earned by covered workers rising (roughly) twice as much as those earned by uncovered workers. The small magnitude of these changes is consistent with the results reported by Woodbury and Spiegelman (1987), who found no statistically significant change in wages resulting from the Illinois bonus.

With such as a small change in wages, we would not expect the results in this section to differ much from those obtained in Section I. They do not, as the results in Table 5 show. Covered unemployment duration (d_c) falls by between 0.34 and 1.29 weeks, with as a decrease of about 0.75 weeks for s = .005 and r = .004. In general, these impacts are somewhat larger than those found above in the model with fixed wages. For workers not covered by the bonus program, unemployment duration (d_n) actually falls slightly in some cases (those with low interest and separation rates), although it increases somewhat in most of the cases we examine. For s = .005 and r = .004, for example, d_n increases by about .06 weeks. But even in the cases where d_n increases, the increase is less in this model than in the fixed-wage model.

Regarding unemployment (U), the bonus program lowers both the overall level and rate of unemployment, although the decrease is smaller here than in the model with fixed wages (the range is between .04 and .16 percentage point). Unemployment of uncovered workers (U_n) actually falls in most cases in this model, although the decreases are small; again for s - .005, r = .004, and f = 100, the decrease is .016 percentage point.

The impact of the program on job creation is summarized in Table 6. As in Section I, the program increases the steady-state number of jobs. However, unlike the fixed-wage case, there are some instances in which the number of jobs held by uncovered workers falls (including s = .005 and r - .004). Yet, even in such cases the displacement effect is quite small.

When the rivalry effect is removed, the qualitative nature of our results remains the same. This is demonstrated in Tables 7 and 8 which are equivalent to Tables 5 and 6 except that they are generated by holding the search effort of uncovered workers fixed at its pre-bonus program

level. A comparison across tables reveals that, as in Section I, the rivalry effect is small and the job creation effect tends to dominate and drive the results.

III. Conclusion

Three groups of workers would not be covered by as a bonus reemployment program: Workers ineligible for UI, workers who fail to find as a job within the bonus qualification period, and workers who, for some reason, simply don't participate (in the sense of trying to obtain as a bonus). Our results strongly suggest that none of these groups of workers is likely to be made significantly worse off by as a reemployment bonus program. As the results shown in Tables 2, 4, 6, and 8 illustrate, the displacement effect of uncovered by covered workers is nonexistent of very small in magnitude. In other words, the jobs gained by workers who make use of the reemployment bonus do not appear to come at the expense of workers who are not covered by the program.

This is not to say that the underlying mechanism for displacement of uncovered by covered workers does not exist in our model - it does. The bonus program decreases the reemployment probability of uncovered workers, and as as a result, uncovered workers face as a longer expected duration of unemployment. But the bonus program also has as a job-creation effect. Because the bonus program increases workers' search effort, jobs come into existence that would not have existed in the absence of the program. Our results suggest that both covered and uncovered workers benefit, in the sense that there will be fewer unemployed workers - both covered and uncovered - under the bonus program. Because the model predicts that the probability of unemployment for both covered and uncovered workers is lower under the bonus program, we conclude that the bonus program entails no displacement effect. In effect, the bonus program induces job creation as the labor market makes better use of its search technology. With the economy producing closer to capacity, both covered and uncovered workers benefit.

Finally, it is worth noting that our model could be used to investigate the displacement effect of as a variety of government policies, such as training programs intensive job-search assistance, and targeted job tax credits. While the model is relatively simple in structure (in that workers and firms are both homogeneous), it is rich enough to capture many important labor market features (job turnover, search behavior, and so on). Moreover, it is an <u>equilibrium</u> model in the sense that we model both sides of the labor market. This allows one to determine both the direct and indirect effects (through, for example, unemployment) of as a government program.

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Table 1

Bonus-Induced Changes in Unemployment Duration and Unemployment,

Job Matching Model with Rivalry Effect

	s = 0.006		s = 0.010			s = 0.014		
	T=96.25	T=97.5	T=95	T=96.25	T=97.5	T=95	T=96.25	T=97.5
Δd	-.714	-.714	-.714	-.714	-.714	-.714	-.714	-.714
Δd_i	.414	.286	.331	.269	.225	.262	.228	.202
ΔU	-.010	-.031	-.038	-.053	-.065	-.073	-.084	-.093
ΔU_i	.071	.050	.093	.077	.065	.102	.090	.081
ΔU_n	.015	-.008	.000	-.018	-.031	-.027	-.040	-.050
z (for r=.002)	1.087	1.122	1.164	1.196	1.226	1.270	1.297	1.323
z (for r=.008)	1.149	1.204	1.238	1.280	1.319	1.352	1.387	1.418
z (for r=.020)	1.269	1.357	1.378	1.447	1.489	1.510	1.553	1.593

Notes: s = bi-weekly separation rate; T = total available jobs; Δd = change in expected duration of unemployment for UI-eligible workers (in weeks); Δd_i = change in expected duration for UI-ineligible workers (in weeks); ΔU = change in total number of unemployed workers (= change in unemployment rate); ΔU_i = change in number of UI-ineligible unemployed workers; ΔU_n = change in number of unemployed workers not offered the bonus; z = parameter in the search-cost function; r = bi-weekly interest rate.

Estimates of Δd, Δd_i, ΔU, ΔU_i, and ΔU_n are nearly invariant to changes in r; figures shown are for r = .008. Computed values of z vary with respect to r as shown.

In the absence of the bonus, unemployment (U) equals 4.6 when s = 0.006, 7.43 when s = 0.01, and 10.1 when s = 0.014. Also in the absence of the bonus, d is set to 22.7 weeks and d_i to 12.3 weeks.

Table 2

Employment Changes for UI-eligible and UI-ineligible Workers,

Model with Rivalry Effect

Employment Change (per 100,000 in labor force) for:	s = 0.006		s = 0.010			s = 0.014		
	T=96.25	T=97.5	T=95	T=96.25	T=97.5	T=95	T=96.25	T=97.5
UI-eligible workers	213	212	353	351	349	488	485	484
UI-ineligible workers	-124	-87	-168	-138	-116	-190	-168	-150

Notes: s = bi-weekly separation rate; T = total available jobs. Estimates are nearly invariant to changes in the bi-weekly interest rate (r); figures shown are for r = .008.

Table 3

Bonus-Induced Changes in Unemployment Duration and Unemployment,

Job Matching Model without the Rivalry Effect

	s = 0.006		s = 0.010			s = 0.014		
	T=96.25	T=97.5	T=95	T=96.25	T=97.5	T=95	T=96.25	T=97.5
Δd	-.655	-.697	-.676	-.689	-.693	-.682	-.684	-.685
Δd_i	.356	.243	.279	.226	.188	.218	.190	.168
ΔU	-.013	-.036	-.044	-.060	-.070	-.080	-.091	-.098
ΔU_i	.061	.043	.079	.065	.055	.086	.076	.068
ΔU_n	.010	-.015	-.009	-.025	-.038	-.036	-.047	-.056

Notes: s = bi-weekly separation rate; T = total available jobs; Δd = change in expected duration of unemployment for UI-eligible workers (in weeks); Δd_i = change in expected duration for UI-ineligible workers (in weeks); ΔU = change in total number of unemployed workers (= change in unemployment rate); ΔU_i = change in number of UI-ineligible unemployed workers; ΔU_n = change in number of unemployed workers not offered the bonus.

Estimates of Δd , Δd_i, ΔU , ΔU_i, and ΔU_n are nearly invariant to changes in the bi-weekly interest rate (r); figures shown are for r = .008.

In the absence of the bonus, unemployment (U) equals 4.6 when s = 0.006, 7.43 when s = 0.01, and 10.1 when s = 0.014. Also in the absence of the bonus, d is set to 22.7 weeks and d_i to 12.3 weeks.

Table 4

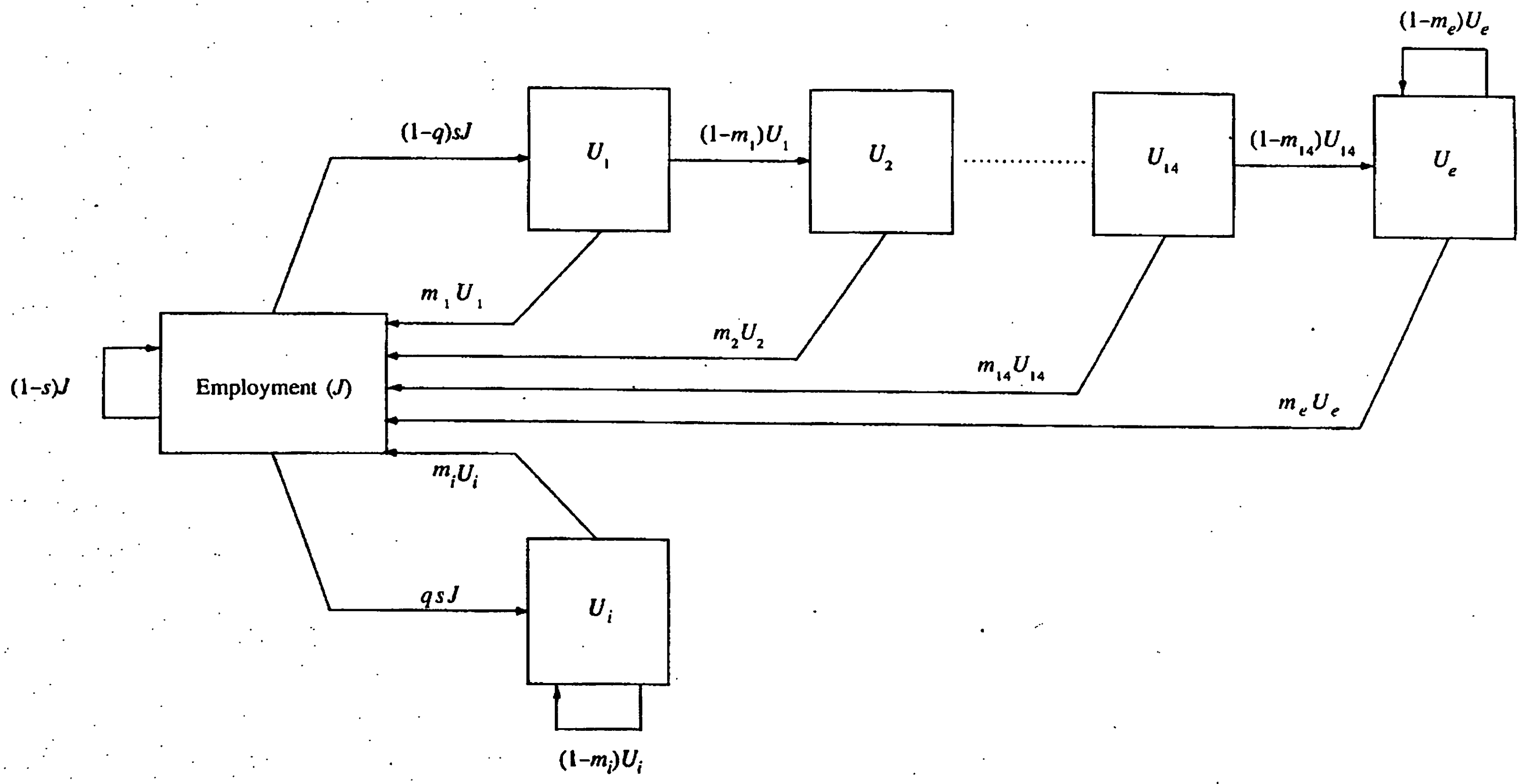
Employment Changes for UI-eligible and UI-ineligible Workers,

Model without the Rivalry Effect

Employment Change (per 100,000 in labor force) for:	s = 0.006		s = 0.010			s = 0.014		
	T=96.25	T=97.5	T=95	T=96.25	T=97.5	T=95	T=96.25	T=97.5
UI-eligible workers	196	207	332	337	338	463	464	463
UI-ineligible workers	-107	-74	-142	-117	-99	-160	-141	-127

Notes: s = bi-weekly separation rate; T = total available jobs. Estimates are nearly invariant to changes in the bi-weekly rate (r); figures shown are for r = .008.

Figure 1



$(1-m_e)U_e$
$(1-q)sJ$
U_1
$(1-m_1)U_1$
U_2
U_{14}
$(1-m_{14})U_{14}$
U_e
m_1U_1
m_2U_2
$m_{14}U_{14}$
$(1-s)J$
Employment (J)
m_eU_e
m_iU_i
qsJ
U_i
$(1-m_i)U_i$

Figure 2
Predicted Search Effort
with and without Reemployment Bonus Program

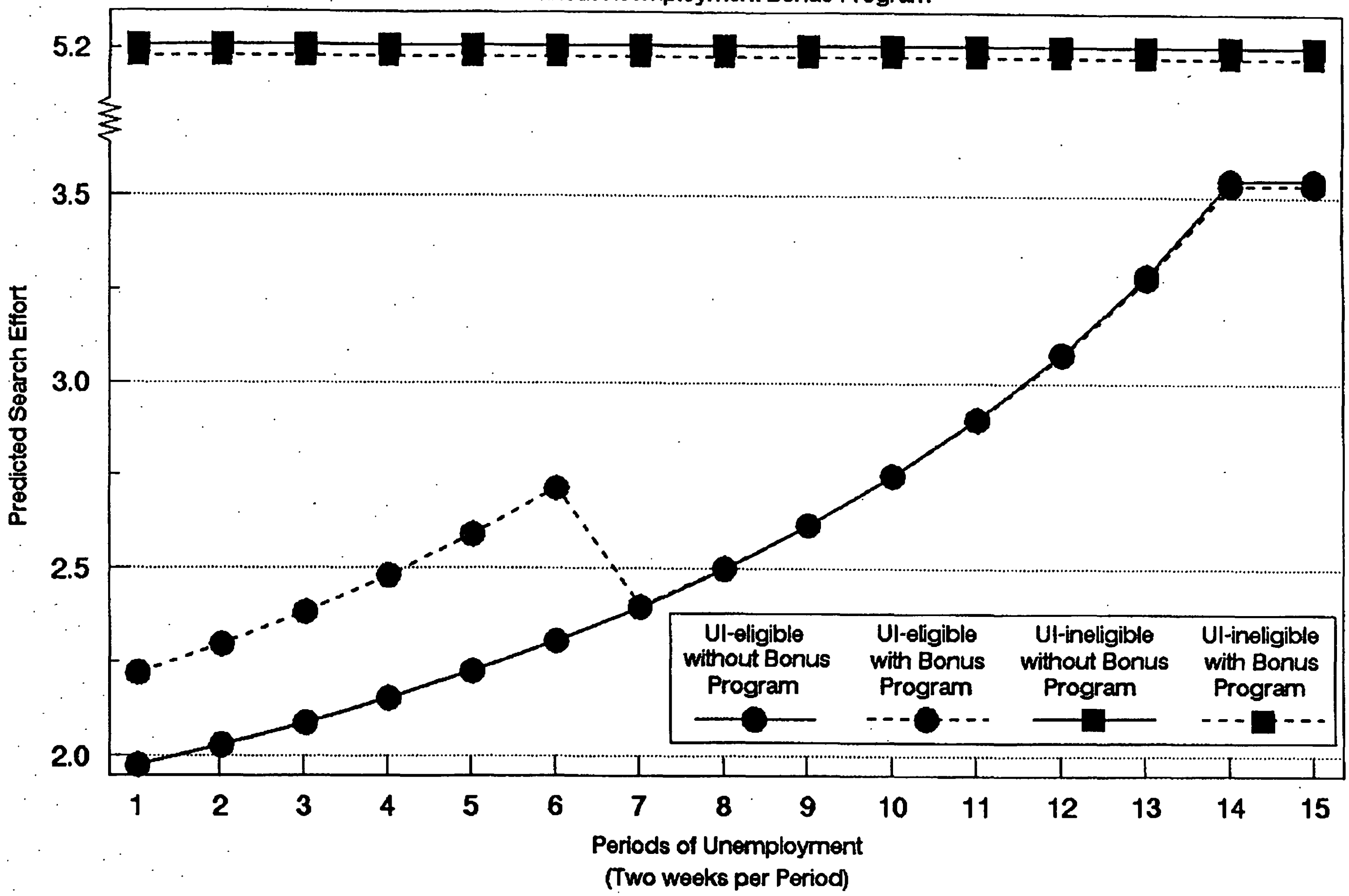


Figure 3

Predicted Reemployment Probabilities
with and without Reemployment Bonus Program