Job Search and Unemployment Insurance: New Evidence from Time Use Data

Alan B. Krueger
Princeton University and NBER

and

Andreas Mueller
Stockholm University and Princeton University

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ABSTRACT

This paper provides new evidence on job search intensity of the unemployed in the U.S., modeling job search intensity as time allocated to job search activities. The major findings are: 1) the average U.S. unemployed worker devotes about 41 minutes to job search on weekdays, which is substantially more than their European counterparts; 2) workers who expect to be recalled by their previous employer search substantially less than the average unemployed worker; 3) across the 50 states and D.C., job search is inversely related to the generosity of unemployment benefits, with an elasticity between -1.6 and -2.2; 4) job search intensity for those eligible for Unemployment Insurance (UI) increases prior to benefit exhaustion; 5) time devoted to job search is fairly constant regardless of unemployment duration for those who are ineligible for UI.

JEL: J64, J65

Key words: unemployment, unemployment insurance, job search, time use, unemployment benefits, inequality

Alan B. Krueger
Woodrow Wilson School
and Economics Department
Princeton University
Princeton, NJ 08540

Andreas Mueller
Institute for International Economic Studies
Stockholm University
SE-106 91 Stockholm
Sweden

1. Introduction

It is well known that since the early 1980s the unemployment rate has been lower in the U.S. than in Europe. Our tabulations of international time use data (circa 1998-2007) also indicate that unemployed Americans tend to devote much more time to searching for a new job than their European counterparts (see Figure 1). On weekdays, for example, the average unemployed worker spent 41 minutes a day searching for a job in the U.S., compared with just 12 minutes in the average European country with available data. One explanation for the comparatively low unemployment rate and high search time in the U.S. is the relatively modest level and short duration of Unemployment Insurance (UI) benefits in most states in the U.S. In this paper we examine the effects of UI on the amount of time devoted to job search by unemployed workers in the U.S., using features of state UI laws for identification.

A large and related literature examines the effects of UI on the duration of unemployment spells. For example, more generous UI benefits have been found to be associated with longer spells of unemployment, with an elasticity of about 1.0 (see Krueger and Meyer (2002) for a survey). In addition, the job finding rate jumps up around the time benefits are exhausted (Moffitt, 1985, Katz and Meyer, 1990a; see Card, Chetty and Weber, 2007 for a critical review). UI is expected to affect the duration of unemployment through its effect on the amount of effort devoted to searching for a job and the reservation wage of the unemployed, yet these variables have rarely been studied directly.[1] We attempt to fill this void by modeling the amount of time that unemployed

[1]An exception is Barron and Mellow (1979), who used the May 1976 CPS supplement on job search activities in the last month, and find that the unemployed searched an average of 7 hours a week. See Feldstein and Poterba (1984) for related evidence on self-reported reservation wages and unemployment in the U.S. based on the same CPS data.

individuals devote to searching for a new job over the course of unemployment spells using data from the American Time Use Surveys (ATUS) from 2003 to 2007.

Section 2 describes the ATUS data and presents summary statistics. In Section 3, we evaluate the predictions of Mortensen's (1977) canonical model of UI and job search.[2] The Mortensen model predicts that for a newly laid-off worker, search effort is decreasing in the level of UI benefits, whereas for those unemployed who are not eligible for UI or who have exhausted their UI benefits, search effort is increasing in the benefit level. This latter implication is called the entitlement effect, as higher benefits raise the value of being unemployed in the future and thus raise the value of obtaining a job.[3] Furthermore, the model predicts that search effort is increasing in the mean wage offer and the dispersion of potential wage offers. The intuition for the latter is that, with a higher dispersion of potential wages, there is a greater benefit from searching for a high paying job.[4] We also expect search effort to be lower for those unemployed who expect to be recalled to their previous job (see Katz, 1986).[5] We empirically test these predictions and estimate the effect on job search of the generosity of UI benefits, job seekers' predicted wages, within-state residual wage dispersion, recall expectations and other variables. Most importantly, we find that job search intensity is inversely related to UI benefit generosity for those who are eligible for UI.

In Section 4, we evaluate the predictions of the Mortensen model regarding job search intensity and unemployment duration. The model predicts that for an eligible

[2] Labor supply models such as, e.g., Moffitt and Nicholson (1982) yield similar predictions.
[3] Levine (1993) provides some evidence on the entitlement effect.
[4] See also Stigler (1962) for a seminal discussion of how wage dispersion affects the payoff from search effort, and Ljungqvist and Sargent (1995) for how progressive taxation affects job search effort through after-tax wage compression.
[5] See also Feldstein (1976) and the empirical work of Katz and Meyer (1990a,b) on recall and job finding hazards.

unemployed, job search effort increases over the unemployment spell as benefits are exhausted. After benefits are exhausted, job search effort is predicted to remain constant. An unemployed individual who is ineligible for benefits is predicted to devote a constant amount of time to job search because of the absence of learning and the assumption of stationarity in the Mortensen model. In the ATUS data, we find a striking contrast in the profiles of job search activity across those with different durations of unemployment: search activity increases as week 26 (benefit exhaustion) approaches for the UI eligible, while the profile is fairly flat for those who are ineligible for UI.

Section 5 offers some concluding thoughts as to how our results relate to search theory and how time-use data can be used to further study UI and job search behavior.

2. Data and Descriptive Statistics

We use data from five consecutive years (2003-07) of the ATUS, which is a nationally representative time-use survey covering the whole civilian non-institutional population of age 15 and older. The sample is drawn from the 8th outgoing rotation group of the Current Population Survey (CPS). Respondents are interviewed within 2-5 months of their last CPS interview. The ATUS collects detailed information on the amount of time respondents devoted to various activities in the previous day. Job search activities include contacting a potential employer, calling or visiting an employment agency, reading and replying to job advertisements, job interviewing, etc. The Appendix Table provides a detailed list of activities that are identified as job search.

We restrict our sample to the population of age 20-65 to abstract from issues related to youth unemployment and retirement. The ATUS *labor force recode* defines unemployment in the same way as the CPS (not working in the reference week, actively

looking for a job in the 4 weeks prior to the interview, and available for work in the reference week). The CPS/ATUS definition of unemployed also includes those on temporary layoff with an expectation of recall to their previous employer, regardless of whether they looked for work in the four weeks prior to the survey. Our sample consists of 2,171 unemployed individuals, of which 344 were on temporary layoff. Sample weights are used in all of our estimates. The sample unemployment rate is 5.2%, which exactly matches the official unemployment rate over the same period.

We can disaggregate the unemployed into four groups: job losers, those expecting to be recalled to their previous employer, voluntary job leavers, and re-/new entrants into the labor force. The ATUS questionnaire, however, only contains a question on whether the unemployed expect to be recalled. Thus, we use information from the final CPS interview to classify individuals into the other three groups. Specifically:

- Job losers are defined as those on layoff in the CPS, those who report in the CPS that their temporary job has ended and those who are employed at the time of the CPS interview (and subsequently became unemployed).
- Re- or new entrants are defined as those unemployed who indicate that they were re- or new entrants in the CPS. Those who are classified as out of the labor force in the CPS but as unemployed in the ATUS are also included in this category.
- Voluntary job leavers are defined as those who indicate in the CPS that they quit their job. Note that we were able to identify voluntary job leavers only when they were already unemployed at the time of the CPS interview. We classify people who were employed in CPS and unemployed in ATUS as job losers because the share of voluntary job leavers among the unemployed in CPS is much lower than that of job

losers (43% vs. 12% in our period). Consequently, compared with the CPS the proportion of the unemployed classified as job leavers is relatively low in our sample.

Because the ATUS lacks information on UI receipt, we infer UI eligibility from the type of unemployment and the workers' full-time/part-time status on the previous job. We classify job losers and those on temporary layoff as eligible for UI, and re-entrants, new entrants and voluntary job leavers as ineligible. In states where part-time job seekers do not qualify for UI, we classify those who worked part-time as ineligible.

We undoubtedly have some classification errors when it comes to assigning UI eligibility in our sample. Such misclassification errors are likely to lead us to underestimate the effects of UI in Sections 3 and 4 below, as the effects are expected to be of opposite sign for the UI eligible and ineligible.

Descriptive statistics of job search activities

Table 1a reports descriptive statistics on the average number of minutes devoted to job search by labor force status. It also shows the participation rate in job search, defined as the fraction of those with nonzero search time on the diary day. Several results are worth highlighting. First, the unemployed spend around 32 minutes a day (including weekends) searching for a job, whereas the employed and those classified as out of the labor force devote less than a minute a day to job search, on average.[6] Even if we restrict the sample to those who were classified as unemployed in the CPS interview (2-5 months prior to the ATUS interview), those classified as out of the labor force in ATUS searched

[6] In a companion paper (Krueger and Mueller, 2008a) we found similar evidence across 14 countries.

for only 4.2 minutes. This suggests that the conventional labor force categories represent meaningfully different states.[7]

Second, job search is heavily concentrated on weekdays (see Table 1b). Nearly a quarter of the unemployed engage in job search activities on any given weekday, compared with 6.7% on weekends. Third, those who participate in job search on the diary day tend to devote a great deal of time to it. Figure 2 shows a kernel density diagram for the duration of job search conditional on searching on the diary day. The average duration of job search among those who searched is 167 minutes, and a quarter of job searchers spent more than 240 minutes searching for a job on the diary day. Fourth, there are large differences in job search effort depending on the reason for unemployment. Job losers search 32 minutes more than those who expect to be recalled to their previous job, and around 22 minutes more than re- or new entrants. Job leavers also have a high intensity of search, devoting almost an hour to job search a day, on average. Finally, we report average minutes of job search by UI eligibility status. Those eligible for UI search 13 minutes more on an average day than those who are not eligible. This difference, however, falls to 6 minutes when we control for observable characteristics such as age, education, sex, marital status, and a dummy for the presence of children.

Unemployment Insurance

To qualify for unemployment benefits all states require a worker to have earned a certain amount of earnings during a reference period or to have worked for a certain period of time. Most states in the US require active job search, such as a certain number of employer contacts per week, to continue to qualify for UI benefits. Monitoring in the

[7] Corroborating evidence from job finding rates is in Flinn and Heckman (1983).

US, however, is not very strict as most states rely on postal or phone reports to enforce these job search requirements (see Anderson, 2001). The replacement rate is typically around 50% to 60% of the wage earned on the previous job, subject to a maximum benefit. The maximum weekly benefit varies widely across states, ranging from $210 in Mississippi to $575 in Massachusetts in 2007.[8] Ten states provide dependents allowances beyond the maximum benefit.

In most states, the maximum duration of benefits is 26 weeks, although there are some exceptions: Massachusetts (30 weeks), Montana (28 weeks) and Washington (30 weeks until 2007). The maximum duration of benefits may be less than 26 weeks for UI claimants who had insufficient earnings during the reference period. According to Krueger and Meyer (2002) around half of the recipients qualify for the full 26 weeks.

During 2003, UI recipients were able to receive up to 13 additional weeks of benefits through the federal Temporary Extended Unemployment Compensation Act of 2002, and benefits were extended for 26 weeks in a small number of "high" unemployment states. We exclude observations from 2003 when we examine job search behavior around 26 weeks of unemployment for the UI eligible because of complications caused by the extended benefits program.

As described below, our regression model exploits variation in the maximum weekly benefit amounts across states and number of dependents. The main source of variation in maximum benefits comes from variation across states as we take into account dependents' allowances only in those ten states that provide these allowances beyond the

[8] According to Krueger and Meyer (2002) around 35% of the unemployed receive the maximum benefit.

maximum benefit.[9] The data for maximum weekly benefit amounts is taken from the U.S. Department of Labor's *Comparison of State UI Laws*.[10] Except for New Mexico, which introduced dependents' allowances in 2004, we take the average of maximum weekly benefit amounts across the 5 years of the ATUS by state and number of dependents. In 2003 in New Mexico, for unemployed with dependents, we set the maximum weekly benefit to the maximum weekly benefit of a single earner.

3. Relationship between Unemployment Benefits and Job Search

To evaluate the predictions of the models outlined in the introduction, we estimated micro regressions in which the total amount of time allocated to job search on the diary day was the dependent variable and the explanatory variables included the maximum weekly UI benefit, the respondent's predicted wage, a measure of wage dispersion in the state, and personal characteristics. We proceeded in two steps. We first estimated the predicted wage and residual wage dispersion facing each job seeker, and then used these estimates as explanatory variables in the job search equation. Specifically, the regression models we estimated are:

$$\log(w_{is}) = a + bX_i + d_s + \varepsilon_{is} \quad (1)$$

$$s_{ist} = \alpha + \beta_1 \log(wba_{ist}) + \beta_2 \log(\hat{w}_{is}) + \beta_3 \text{std(resid. w)}_s + \gamma_1 X_i + \gamma_2 Z_i + d_t + \mu_{ist} \quad (2)$$

where w_{is} is the hourly wage of worker i in state s, s_{ist} is time allocated to job search (in minutes per day) of individual i in state s and time t, wba_{ist} is the maximum weekly benefit amount, X_i is a set of controls such as education and sex, which are included in

[9] These states are AK, CT, IA, IL, MA, ME, NM, OH, PA and RI. The number of dependents usually includes children of age 17 and younger, and in some cases the spouse. We took differences across states in the definition of the spouse as a dependent into account.
[10] See http://workforcesecurity.doleta.gov/unemploy/statelaws.asp#Statelaw.

the wage and job search equations, Z_i is a set of controls exclusively included in the search equation, d_t a time effect (month and year) and d_s a state effect. Z_i includes dummies for each group of unemployed workers (job loser, on temporary layoff, job leaver and re-/new entrant), married or cohabiting with a partner, the presence of children under age 18 in the household, interaction terms of partner and children with female, and a dummy for whether the diary day was a weekend. The maximum weekly benefit amount varies with individual characteristics in the states where dependents' allowances are provided beyond the maximum weekly benefit of a single earner. The maximum benefit varies with time only for unemployed with dependents in New Mexico. Standard errors are robust to correlated residuals within states and heteroskedasticity.

The wage equation was estimated using a sample of 319,813 workers from the CPS outgoing rotation group files for 2004 and 2005. [11] We predicted each ATUS respondent's expected log wage, denoted $\log(\hat{w}_{is})$, using the coefficients from the wage regression (1). We computed the standard deviation of residuals from the wage equation for each state (denoted std(resid. w)) as an indicator of the dispersion in the potential wage offer distribution.[12]

Table 2 reports the results of estimating equation (2) for three separate samples. Column 1 shows the results for the full sample of unemployed individuals aged 20-65.

[11] The results of the wage regressions are reported in column 4 in Table 2. The hourly wage is adjusted for top coding and overtime earnings/tips. We exclude from the sample self-employed and self-incorporated, full-time and part-time students and employed with hourly earnings of less than $1 or more than $200.
[12] The coefficient on the fitted log hourly wage in our regression Tables 2 and 3 shows that the fitted wage is a strong and significant predictor of job search, with an elasticity in excess of 2.5. The residual wage dispersion term is insignificant but usually positive in most of the OLS and Tobit models. This is a contrast to Krueger and Mueller's (2008a) cross-country study, which found that job search is higher in countries with higher wage dispersion, controlling for benefits and other factors. One reason might be that residual wage dispersion is lower across the U.S. states than across countries, and therefore conveys less signal than in the cross-country data.

Columns 2 and 3 report the same regressions for UI eligible and ineligible. In the full sample the coefficient on the log of the maximum weekly benefit amount is negative but not statistically significant. When we restrict the sample to those who appear eligible for UI benefits, are not on temporary layoff, and have been unemployed for 26 weeks or less (column 2), the elasticity for the maximum weekly benefit is -1.2 (the elasticity is computed by dividing the coefficient estimate by the mean of the dependent variable); this is the only sample for which the coefficient on benefits is statistically significant at the 10% level. To gauge the magnitude of this elasticity, consider the effect of changing the WBA from the state with the lowest to the highest benefit (for a person without dependents). Time devoted to job search is predicted to decrease by 54 minutes a day.

For those not eligible for benefits in column 3 the elasticity is positive but not significant. A test of the equality of the benefit coefficients for those eligible and ineligible for UI rejects at the 10 percent level, suggesting a different response to benefit generosity.

We also estimated Tobit models for the same four samples to account for the mass of workers with 0 minutes of job search on the diary day. Table 3 reports estimated coefficients of the Tobit model as well as an adjustment factor that allows one to compute the marginal effect of each variable. The marginal effect of a Tobit model is $dE(y|x)/dx_i = \beta_i * \Phi(x\beta/\sigma)$ where $\Phi(.)$ is the standard normal cdf and, to make the Tobit estimates comparable to the linear regression models, we evaluate the adjustment factor at the mean values of x.[13] In the full sample in column 1, the coefficient on benefits is positive and not significant at conventional levels. In the subsample of eligible unemployed with spells of 26 weeks or less (column 2), the coefficient on benefits is significant at the 5%

[13] Note that the effect of dummy variables is different because of the non-linear nature of the Tobit model.

level and the implied elasticity is -0.8. Again, the contrast between the benefit effect for those eligible (column 2) and ineligible (column 3) is statistically significant.

Note that the reported elasticities are all calculated with respect to the legislated maximum weekly benefit amount. To estimate the elasticity of job search with respect to actual UI benefits, we estimated a linear and a Tobit model with the log of the state average weekly benefit in place of the maximum weekly benefit.[14] We instrument for the actual average benefit with the log maximum weekly benefit. Table 4 reports the marginal effects of the log average weekly benefits. Taking the IV estimates from column 2, the implied elasticity is -2.2 for the linear model and around -1.6 for the Tobit model. The difference between the OLS and IV estimates is small, which is not surprising given the high correlation between state average and state maximum benefit amounts (0.92).

To put our estimates in perspective, we can calculate the differential search time between the U.S. and the 11 European countries shown in Figure 1 that is predicted by the difference in benefit generosity and the benefit coefficients. Based on Krueger and Mueller (2008a), benefits are 0.114 log points lower in the U.S. than in the 11 European countries over the first 26 weeks of a spell of unemployment.[15] The IV-Tobit estimate in column 2 of Table 4 therefore implies that job search time would be 9 minutes longer in the U.S., and the Two-Stage Least Squares model predicts that it would be 13 minutes longer. American job seekers search about 23 minutes more per day than European job seekers (this number is slightly lower than the differences shown in Figure 1, because Figure 1 shows time spent on job search on weekdays only). The lower benefit levels in

[14] The state average weekly benefit is defined as benefits paid for total unemployment divided by weeks compensated for total unemployment. We take the average of the state average weekly benefit over the years 2003-07 from http://workforcesecurity.doleta.gov/unemploy/content/data.asp.

[15] The benefit indicator they use is the net replacement rate, which is the after-tax value of UI benefits, social assistance, food stamps and housing benefits relative to after-tax earnings.

the U.S. could therefore account for from 38 percent to 54 percent of the difference in search time. Although there are some obvious limitations of this calculation – such as the fact that we were not able to restrict the European sample to UI recipients – the results suggest that UI benefit generosity can potentially explain a nontrivial share of the difference in search behavior of the unemployed in the U.S. and Europe.

The coefficient on "on temporary layoff with recall expectation" in Tables 2 and 3 also shows that unemployed workers with an expectation of recall search significantly less than job losers, consistent with Katz's (1986) prediction. Indeed, other things equal, those with an expectation of recall hardly search at all.

In results not presented here, we tested the robustness of the findings in Tables 2 and 3 by including the state-level unemployment rate, which had a negative coefficient but was not statistically significant.[16] Because of concern about simultaneous causation – a high unemployment rate could cause fewer people to search for a job and could be caused by low job search intensity – we excluded the unemployment rate and its interaction with benefits from the models in Tables 2 and 3. We also excluded the duration of unemployment because it is endogenously determined with search time. It is nonetheless reassuring that none of the variables of interest had a qualitatively different effect if these variables were included.

We also probed the robustness of our results by excluding those older than 55, as the unemployed may take into account the option to retire already in their late 50s. The coefficients on the log weekly benefit remained of similar size and significance.

Finally, we used the number of job search methods used during the last 4 weeks as a dependent variable in our linear regressions of Table 2. The point estimates were

[16] See Shimer (2004) for an analysis of how search intensity varies with the business cycle.

consistent with our results above: For the UI eligible in column 2, a one log point increase in the weekly benefit is associated with a decrease of 0.44 methods used over the last 4 weeks, compared to a decrease of 0.05 methods for the ineligible in column 3.[17] Both coefficient estimates, however, were insignificant with p-values in excess of 0.2. This highlights the utility of time use data for research on job search intensity.

Overall, the regression results provide support for Mortensen's (1977) model to varying degrees. Differences across states in the level of benefits have a negative relationship with job search in the subsample of UI eligible job seekers with unemployment duration of 26 weeks or less. Also, for the UI ineligible, the effect of benefits on job search is predicted to be positive (the entitlement effect). The coefficient has the expected sign but is not significant. However, we can reject at the 10% level the null hypothesis that the coefficient on benefits is equal for the UI eligible and ineligible (i.e., contrasting the coefficients on benefits in columns 2 and 3 in Table 2 or 3).

One word of caution, however, is warranted as our identification strategy relies on cross-state variation of maximum benefits and omitted state-level covariates could lead to biases in our estimates. Moreover, one might be concerned about endogeneity of our benefit variable as, e.g., states with high unemployment rates might enact more generous benefits. For these reasons, we would prefer to identify the effects of UI benefits on job search intensity from variation of benefits across time rather than states. Unfortunately, over the 5 years of the ATUS, changes in maximum benefits were small, providing too little variation to identify the effects of UI benefits with any reasonable precision. We leave this task for the future when more years of the ATUS become available.

[17] The ATUS has the same categorical measures of job search as the CPS. The average number of methods used over the last four weeks is 2.4 for the UI eligible in column 2 and 2.0 for the ineligible in column 3.

Despite these limitations, we would like to mention that we control for state-level characteristics of the wage distribution and that our results are robust to the inclusion of the state-level unemployment rate. We also expect that the differential effect of UI benefits on eligible and ineligible subjects is less likely due to state-level omitted variables; this provides some indirect support for our identification strategy.

Moral hazard versus liquidity effects of UI

One way to interpret our findings regarding the effects of UI benefit generosity is as a "moral hazard" effect: UI indirectly subsidizes leisure while unemployed and thus reduces the incentives to search for a new job and return to work. However, in the presence of borrowing constraints and, more generally, in the absence of insurance markets for unemployment risk, UI also enables job seekers to smooth consumption and thus reduces the pressure for them to rush back to work.

To evaluate the importance of such "liquidity effects" we follow Chetty (2008) and split the sample of UI eligible job seekers into those with a working partner (married or unmarried) and those without. Those with access to a secondary income source are more likely to maintain consumption during a spell of unemployment and thus should be less responsive to unemployment benefits. We find support for this hypothesis as the coefficient on benefits for those with a working partner is positive and statistically insignificant whereas the elasticity for those without a working partner is -2.1 and significant at the 5% level (t-ratio 2.02). Moreover, the difference between the benefit coefficients in the two samples is statistically significant at the 10% level (t-ratio 1.98).

We also split the UI eligible sample into those with annual household income below and above $25,000. We find that the unemployed with low annual household

income are more responsive to benefits with an elasticity of -2.7 (t-ratio 1.78) compared to -0.8 (t-ratio 1.29) for those with household income higher than $25,000, but the difference is not statistically significant at the 10% level.

Although not definitive, these results suggest that liquidity constraints have a potentially important impact on many job seekers, as the search intensity of those who have less access to financial resources appears to respond more strongly to UI benefits. We also would like to estimate the elasticity of job search with respect to increases in cash on hand, such as, for example, due to severance payments. Unfortunately, there is no such information currently available in the ATUS. Future research with time-use data might be able to distinguish the liquidity effect from the moral hazard effect.

4. Relationship between Unemployment Duration and Job Search

The standard search model makes strong predictions regarding the amount of time spent searching for a job by duration of unemployment. In particular, for those eligible for benefits, job search intensity should increase as benefits approach the exhaustion date. By contrast, search intensity by the ineligible should remain constant throughout the unemployment spell. Although it would be preferable to examine these relationships with longitudinal data, we can use ATUS data to examine the cross-sectional patterns of job search across those with different durations of unemployment at the time of the survey.

To nonparametrically estimate the unemployment duration-job search profile we utilize LOWESS to plot the fitted values of a locally weighted regression of minutes

spent in job search on unemployment duration at the time of the ATUS.[18] We exclude those who have an expectation of recall to their previous employer, as their search behavior is different and affected by the recall strategy of the employer.

Unfortunately, the ATUS interview does not collect information on unemployment duration. Consequently, we derive unemployment duration by taking the unemployment duration reported in the last CPS interview and adding the number of weeks that elapsed between the CPS interview and the ATUS interview. The large majority of the ATUS interviews were conducted 3 months after the last CPS interview, with only 14% after 4 months or more. For those who were not unemployed at the time of the CPS interview, we impute duration of unemployment by taking half the number of weeks between the CPS and the ATUS interviews. We do not show the weekly LOWESS plot for 13 weeks or less, but simply report the average time allocated to search, as the imputed unemployment duration are quite noisy for those who become unemployed after their last CPS interview.[19]

Figure 3 shows the LOWESS plot separately for those eligible and ineligible for UI benefits.[20] The unemployment duration-search profile for the UI ineligible group is fairly flat, consistent with standard search models. For the UI eligible, however, job search increases sharply between week 15 and 26 of unemployment, from less than 20 minutes to greater than 70 minutes, and then falls back to around 25 minutes.

[18] Note that STATA does not allow the use of survey weights for LOWESS. For this reason, we duplicate each observation x number of times where x corresponds to the survey weight (with the "expand" command in STATA). This generates a dataset representative of the population.
[19] About one third of our sample of unemployed individuals (excluding those on temporary layoff) has an unemployment duration of 14 weeks or more.
[20] Note that we exclude observations on eligible individuals from 2003 because the federal extended benefits program was in effect that year.

One problem with our measure of unemployment duration is that it does not take into account the possibility of job spells between the CPS and the ATUS interview. To assess the validity of our assumption, we matched the CPS waves 1 to 4 over the years 2003 to 2007 and looked at individuals who were unemployed and without an expectation of recall both in wave 1 and wave 4 three months later. We find that 11,8% of these individuals were employed in wave 2 and/or wave 3. To assess how this source of mismeasurement could affect our LOWESS plots, we performed simulations with our ATUS sample in which we randomly assigned job spells to 11.8% of individuals who were unemployed in the CPS as well as in the ATUS. For each individual with a simulated interim job spell we subtracted 15 weeks from unemployment duration in the ATUS. We iterated this procedure 400 times and found, on average, a slightly smaller increase of time spent on job search before week 26 for the UI eligible (from 20 to 65 minutes). The profile of search time for the UI ineligible group was hardly affected in these simulations.

As a further robustness check, we probed the robustness of the profiles in Figure 3 by removing the effects of age, sex, and other characteristics (i.e., the explanatory variables in column 1 of Table 2), and then used the residuals in the LOWESS analysis. Figure 4 provides LOWESS plots of the residuals. The general patterns in the duration-search profiles are fairly similar to those in Figure 3, although the increase in time devoted to job search between week 15 and 26 for the UI eligible sample is somewhat smaller after removing the effects of the explanatory variables.

Finally, for both the UI eligible and ineligible, we introduced quadratic polynomials for duration of unemployment with breaks at weeks 14 and 39 into the linear

regression model in column 1 of Table 2.[21] For the UI eligible, the linear and quadratic terms were jointly significant at the 10% level and the predicted patterns of job search by unemployment duration looked similar to the LOWESS in Figure 4: job search increases by 24 minutes between week 14 and 26 and then strongly decreases by 66 minutes as week 39 approaches. For the UI ineligible, however, the standard errors on the coefficients for the linear and quadratic terms were large, and we couldn't statistically distinguish their pattern of job search from a constant nor from the pattern of the UI eligible (i.e., we could not reject either null hypothesis).

The increase in job search in the weeks prior to benefit exhaustion for the UI eligible sample and the fairly constant amount of time devoted to job search for the UI ineligible are both consistent with Mortensen's (1977) search model. However, the decline in job search after week 26 is unexpected, as the model predicts that workers allocate a constant amount of time to job search after benefits are exhausted.

One explanation for the decline after week 26 is a potential selection issue due to unobserved heterogeneity in the propensity to search for a job: job seekers who devote a lot of effort to searching for a job are more likely to find one and exit the sample, whereas those with a low proclivity to search remain in the sample. This creates a possible "length-based sampling" bias that would tend to cause the search profiles to slope down with unemployment duration. A similar issue affects studies of the effect of UI on exit rates (e.g., Katz and Meyer, 1990a,b) and the reservation wage (e.g., Feldstein and Poterba, 1984), which analyze one unemployment spell per person or reservation wages for a cross-section of job seekers. The fact that the relationship between spell duration

[21] In order to be consistent with the sample used for the LOWESS, we excluded those on temprorary layoff with an expectation of recall and observations on UI eligible individuals from 2003.

and job search is fairly flat for the UI ineligible sample is an indication that bias due to length-based sampling is probably small, as this group would also be subject to length-based sample bias if workers have heterogeneous commitments to job search.[22]

5. Summary and Conclusion

This paper provides new evidence on job search intensity and Unemployment Insurance. We use data from the American Time Use Survey and model job search intensity as time allocated to job search activities, consistent with theoretical models. We find that time allocated to job search is inversely related to the maximum weekly benefit amount for UI eligible workers, with an elasticity of -1.6 to -2.2, which is large enough to account for much of the gap in job search time between the U.S. and Europe. Moreover, job seekers who likely have less access to financial resources (e.g., because they do not have a working spouse) tend to respond more to UI benefits than do those with greater financial wherewithal, consistent with a role for liquidity constraints. Furthermore, we find that job search increases sharply in the weeks prior to benefit exhaustion, in line with Mortensen's (1977) model. These findings highlight the utility of simple search models for understanding job search behavior and UI.

A finding that is inconsistent with Mortensen's (1977) search model, however, is that search effort appears to decline after week 26, when benefits run out, rather than remain constant. This finding deserves further attention. One possible explanation is that the unemployed become discouraged if they fail to find a job despite substantially increasing their search effort before UI benefits run out at 26 weeks, and consequently

[22] See also the nonparametric Monte Carlo technique in the working paper version (Krueger and Mueller, 2008b), which suggests that the relationship between job search effort and the duration of unemployment for a cross-section of job seekers is only slightly biased by length-based sampling.

stop searching. A related explanation is that the unemployed may feel that they have explored all of their plausible job opportunities after they sharply raised their search effort in the weeks leading up to the exhaustion of their UI benefits, and rationally feel they have little to gain from maintaining the same level of search effort over the next few months.

Our findings suggest that time-use data offer a fruitful approach for research on job search intensity. In particular, if future ATUS surveys collect data on unemployment duration, one could further investigate the link between unemployment duration and job search. Longitudinal time-use data would help to control for length-based sampling and individual heterogeneity in job search activity. Moreover, data on severance payments and asset positions of the unemployed could allow one to determine the relative importance of moral hazard and liquidity effects of unemployment benefits.

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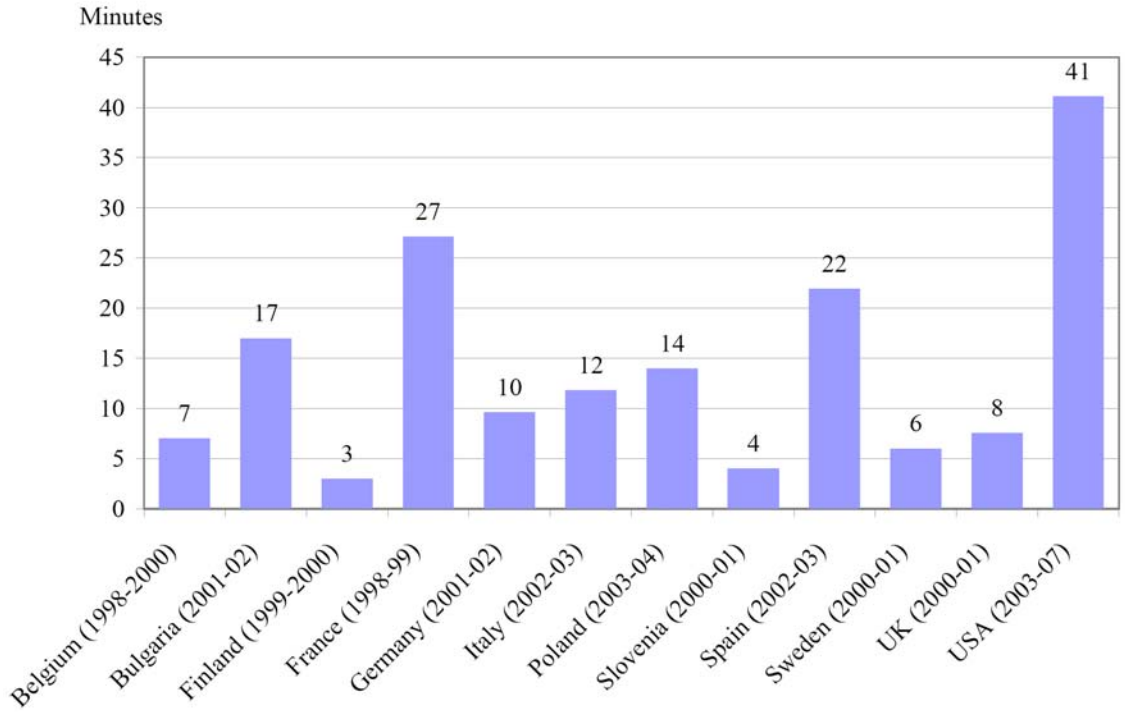
Appendix Table. Definition and examples of job search activities in ATUS 2006

Job search activities (050401), e.g.:
contacting employer
making phone calls to prospective employer
sending out resumes
asking former employers to provide references
auditioning for acting role (non-volunteer)
auditioning for band/symphony (non-volunteer)
placing/answering ads
researching details about a job
filling out job application
asking about job openings
reading ads in paper/on Internet
checking vacancies
researching an employer
submitting applications
writing/updating resume
meeting with headhunter/temp agency
picking up job application

Interviewing (050403), e.g.:
interviewing by phone or in person
scheduling/canceling interview (for self)
preparing for interview

Other activities related to job search, e.g.:
waiting associated with job search interview (050404)
security procedures rel. to job search/interviewing (050405)
travel related to job search (180504)
job search activities, not elsewhere specified (050499)

Figure 1. Average number of minutes devoted to job search per day on weekdays by unemployed workers in various countries



Notes : See Krueger and Mueller (2008a) for details about the underlying time use data.

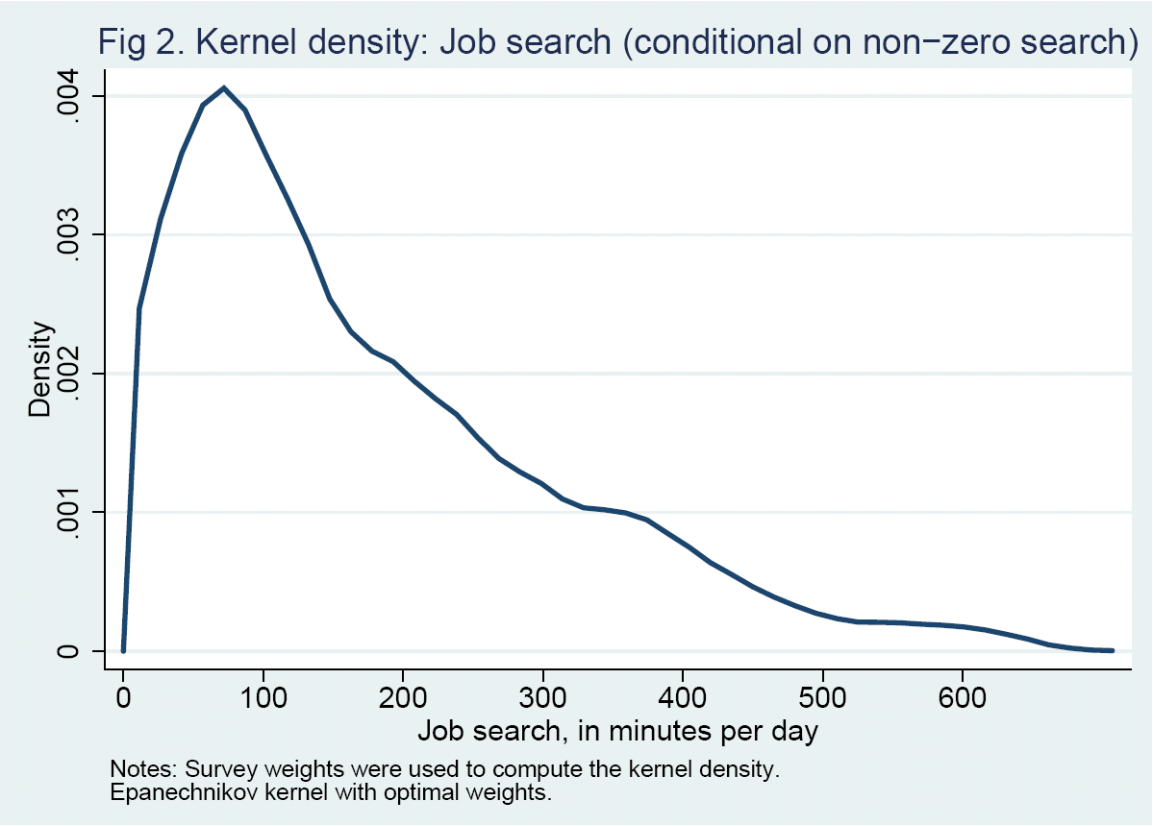
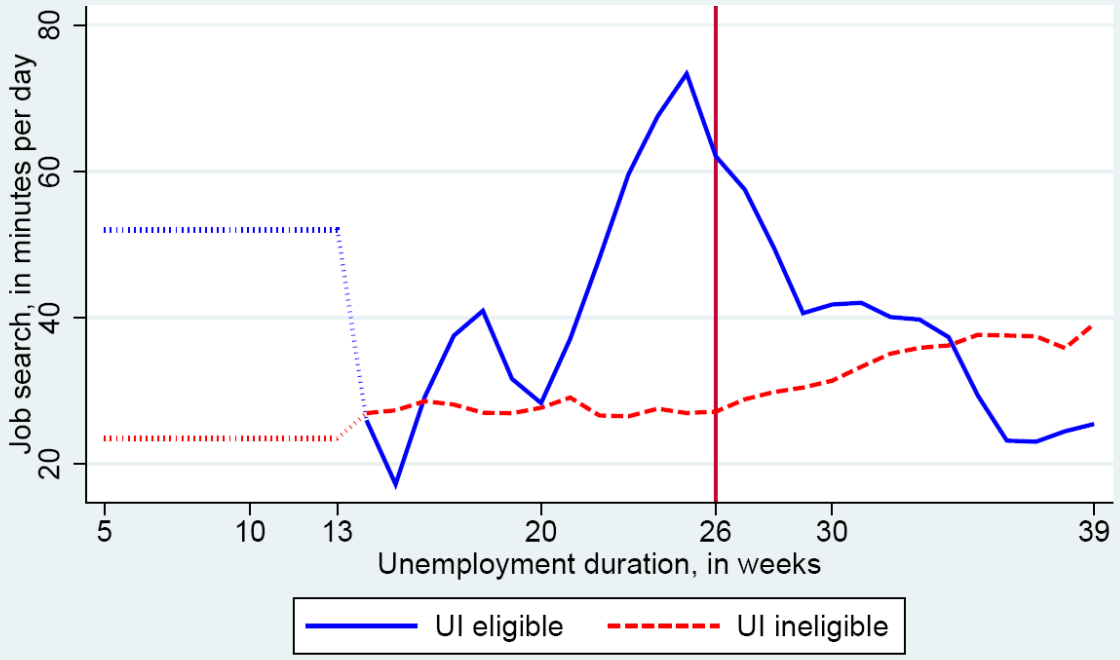


Fig 2. Kernel density: Job search (conditional on non−zero search)
Density
0
.001
.002
.003
.004
0
100
200
300
400
500
600
Job search, in minutes per day
Notes: Survey weights were used to compute the kernel density.
Epanechnikov kernel with optimal weights.

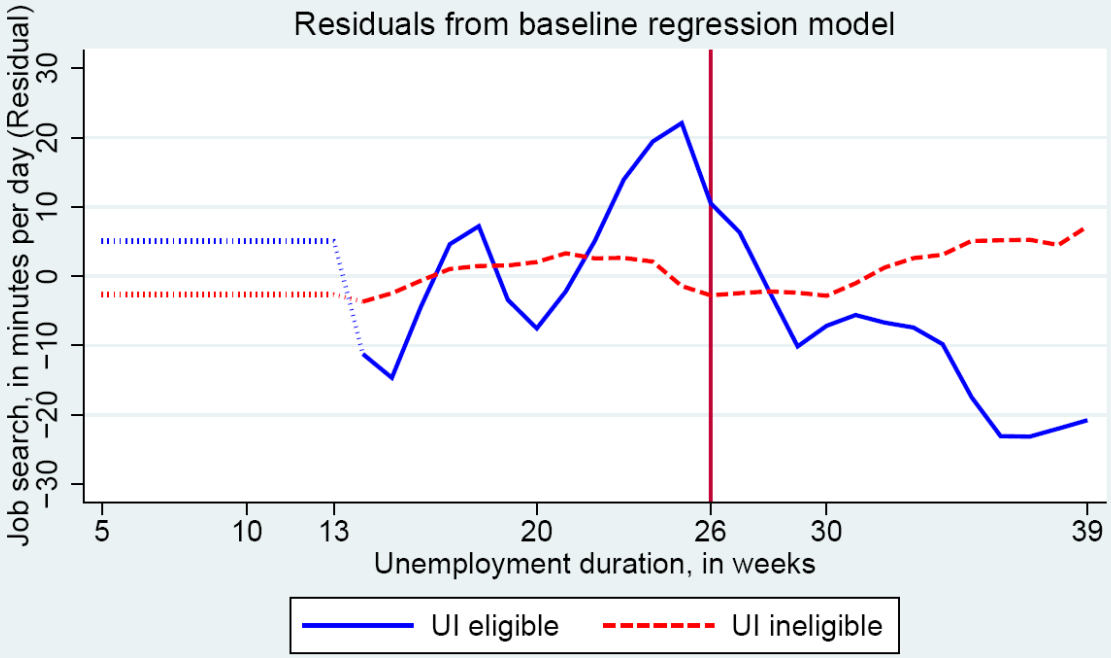
Fig 3. Lowess: job search by unemployment duration



Notes: Bandwidth = 0.1. Survey weights are used to compute the lowess smoother.
Unemployed with an expectation of recall to their previous employer are excluded from the sample.
The dotted lines refer to the average of time spent on job search before week 14.

Fig 4. Lowess: job search by unemployment duration

Residuals from baseline regression model



Notes: Bandwidth = 0.1. Survey weights are used to compute the lowess smoother.
Unemployed with an expectation of recall to their previous employer are excluded from the sample.
The dotted lines refer to the average of time spent on job search before week 14.

Table 1a. Descriptive statistics ATUS 2003 - 2007, by labor force status (weekdays and weekends)

	# respondents	% of total	Average job search, in min. per day	Participation in job search	Average job search (participants), in min. per day
By labor force status					
Employed	42,934	76.4%	0.6	0.6%	101.0
Unemployed	2,171	3.9%	32.1	19.3%	166.9
Not in labor force	11,091	19.7%	0.8	0.5%	152.9
By type of employed		(% of employed)			
Working in CPS	40,576	94.5%	0.5	0.5%	107.6
Unemployed in CPS	824	1.9%	2.8	2.5%	115.4
Not in labor force in CPS	1,534	3.6%	0.8	1.7%	49.7
By type of unemployed		(% of unemployed)			
Jobloser	943	43.4%	45.2	27.5%	164.2
On temporary layoff w/ recall expectation	344	15.8%	13.2	7.1%	185.8
Jobleaver	65	3.0%	52.9	24.9%	212.3
Re- or new entrant	819	37.7%	23.1	14.1%	163.6
By UI eligibility status		(% of unemployed)			
UI ineligible	1,000	46.1%	25.4	15.6%	163.4
UI eligible	1,171	53.9%	38.0	22.5%	169.1
By type of "not in labor force"		(% of not in labor force)			
Working in CPS	1,181	10.6%	2.4	1.8%	134.1
Unemployed in CPS	305	2.7%	4.2	3.2%	130.8
Not in labor force in CPS	9,605	86.6%	0.5	0.3%	176.7

Notes: Averages and participation rates are computed with survey weights. Both weekdays and weekends are included in the sample. Universe: Civilian, noninstitutional population, age 20-65.

Table 1b. Descriptive statistics ATUS 2003 - 2007, by labor force status (weekdays only)

	# respondents	% of total	Average job search, in min. per weekday	Participation in job search	Average job search (participants), in min. per weekday
By labor force status					
Employed	21,291	76.4%	0.7	0.7%	99.7
Unemployed	1,076	3.9%	41.1	24.1%	170.8
Not in labor force	5,495	19.7%	1.1	0.7%	159.8
By type of employed		(% of employed)			
Working in CPS	20,141	94.6%	0.6	0.6%	106.0
Unemployed in CPS	395	1.9%	3.7	3.0%	123.3
Not in labor force in CPS	755	3.5%	0.8	1.9%	40.8
By type of unemployed		(% of unemployed)			
Jobloser	488	45.4%	56.2	33.6%	167.0
On temporary layoff w/ recall expectation	171	15.9%	16.7	8.9%	188.9
Jobleaver	25	2.3%	69.6	33.7%	206.4
Re- or new entrant	392	36.4%	30.5	17.8%	171.3
By UI eligibility status		(% of unemployed)			
UI ineligible	473	44.0%	33.2	19.6%	169.5
UI eligible	603	56.0%	47.9	27.9%	171.5
By type of "not in labor force"		(% of not in labor force)			
Working in CPS	572	10.4%	3.5	2.4%	143.6
Unemployed in CPS	159	2.9%	5.6	4.1%	136.6
Not in labor force in CPS	4,764	86.7%	0.7	0.4%	181.4

Notes: Averages and participation rates are computed with survey weights. The estimates are based on weekdays only. Universe: Civilian, noninstitutional population, age 20-65.

Table 2. Results of linear regressions

Dependent variable: time allocated to job search, in minutes per day	Mean (Std)	Full sample (1)	Subsample (2): eligible w/o recall expectation & unempl. dur. <= 26	Subsample (3): ineligible	Wage equation - dependent variable: log(hourly wage)
Mean of dependent variable		**32.1**	**49.1**	**25.4**	**2.76**
Log(maximum weekly benefit amount)	5.89	-6.86	-57.275	10.096	
	(0.220)	(11.971)	(30.663)*	(19.864)	
Fitted log(hourly wage)	2.60	110.066	174.048	105.099	
	(0.329)	(48.715)**	(120.772)	(64.247)	
Std(residual of wage equation) - by state	0.490	92.868	274.379	83.161	
	(0.023)	(101.732)	(196.089)	(111.950)	
On temporary layoff w/ recall expectation (1)	0.15	-32.884		-11.497	
		(4.973)***		(12.479)	
Jobleaver	0.03	12.876		21.507	
		(16.585)		(20.857)	
Re- or new entrant	0.38	-13.656		-3.456	
		(5.280)**		(10.363)	
Age	36.75	-5.12	-6.816	-5.605	0.061
		(3.198)	(7.966)	(3.691)	(0.001)***
Age^2		0.053	0.078	0.052	-0.001
		(0.034)	(0.086)	(0.039)	(0.000)***
Some college or associate degree (2)	0.29	-13.133	-16.282	-14.284	0.209
		(12.991)	(32.615)	(14.991)	(0.002)***
College degree (BA, MA or PhD)	0.16	-46.877	-59.764	-68.348	0.573
		(28.113)	(72.634)	(37.407)*	(0.003)***
Female	0.51	14.021	52.805	-6.649	-0.231
		(13.543)	(33.296)	(16.080)	(0.002)***
Female*partner	0.28	-11.09	-34.334	9.703	
		(8.400)	(16.167)**	(17.016)	
Female*children	0.30	-7.925	-26.06	6.872	
		(14.362)	(26.744)	(17.905)	
Partner	0.50	0.176	7.652	-11.682	
		(8.911)	(13.632)	(18.347)	
Children	0.49	7.113	39.751	-14.717	
		(12.786)	(18.914)**	(17.389)	
Weekend	0.28	-30.883	-53.138	-21.693	
		(3.797)***	(6.492)***	(4.676)***	
Constant		-115.341	-71.375	-169.555	1.2
		(66.062)*	(128.577)	(100.181)*	(0.013)***
Year and month dummies		x	x	x	Year dummy
State dummies					x
Observations		2,171	671	1,000	319,813
R-squared		0.09	0.16	0.13	0.29

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%,

(1) The base group consists of Job losers. (2) The base group consists of those with a high school degree or less.

Notes: Regressions are weighted using survey weights; Errors are clustered at state level. Universe: Unemployed, age 20-65. Source for wage equation: CPS outgoing rotation group extract, 2004 and 2005. The CEPR version of the ORG contains hourly wage series that adjust for topcoding and overtime earnings/tips. We exclude from the sample self-employed and self-incorporated, full-time and part-time students and employed with hourly earnings of less than $1 or more than $200.

The results shown in columns 1 to 3 are based on the following regression equation: $s_{ist} = \alpha + \beta_1 \log(wba_{ist}) + \beta_2 \log\hat{(w}_{is}) + \beta_3 std(resid.\ w)_s + \gamma_1 X_i + \gamma_2 Z_i + d_t + \mu_{ist}$ where $\log\hat{(w}_{is})$ is the fitted wage based on the coefficients estimated in the wage equation and std(resid. w)$_s$ denotes the standard deviation of the residuals from the wage equation by state.

Column 2 reports the results for the subsample of eligible without an expectation of recall to their previous employer and with a duration of unemployment of 26 weeks or less. Column 3 reports the results for the subsample of ineligible. As described in the text, we classify job losers and those on temporary layoff as eligible for UI, and re-entrants, new entrants and voluntary job leavers as ineligible. In states where part-time job seekers do not qualify for UI, we classify those who worked part-time as ineligible.

The results shown in column 4 (the wage equation) are based on the following regression equation : $\log(w_{is}) = a + bX_i + d_s + \varepsilon_{is}$.

Table 3. Tobit model regressions

Dependent variable: time allocated to job search, in minutes per day	Mean (Std)	Full sample (1)	Subsample (2): eligible w/o recall expectation & unempl. dur. <= 26	Subsample (3): ineligible
Mean of dependent variable		**32.1**	**49.1**	**25.4**
Adjustment factor for marginal effects		**0.153**	**0.256**	**0.115**
Log(maximum weekly benefit amount)	5.89	24.344	-156.8	117.917
	(0.220)	(46.807)	(78.173)**	(110.082)
Fitted log(hourly wage)	2.60	548.212	652.484	801.735
	(0.329)	(205.572)***	(315.049)**	(334.230)**
Std(residual of wage equation) - by state	0.49	-12.808	380.496	-456.146
	(0.023)	(572.653)	(648.979)	(709.477)
On temporary layoff w/ recall expectation (1)	0.15	-239.506		(2)
		(38.298)***		
Jobleaver	0.03	10.194		98.642
		(58.054)		(88.601)
Re- or new entrant	0.38	-80.834		12.685
		(24.674)***		(47.770)
Age	36.75	-24.237	-25.049	-44.41
		(15.895)	(23.579)	(20.642)**
Age^2		0.245	0.271	0.421
		(0.173)	(0.259)	(0.216)*
Some college or associate degree (3)	0.29	-53.855	-77.851	-119.538
		(53.329)	(88.886)	(82.067)
College degree (BA, MA or PhD)	0.16	-241.132	-269.902	-437.329
		(113.629)**	(188.471)	(189.517)**
Female	0.51	87.409	201.337	75.857
		(57.036)	(95.916)**	(77.953)
Female*partner	0.28	-66.344	-88.332	-34.636
		(42.073)	(52.342)*	(73.483)
Female*children	0.30	-38.338	-111.368	30.277
		(59.715)	(81.905)	(69.874)
Partner	0.50	-4.038	0.006	-14.787
		(37.283)	(46.859)	(66.825)
Children	0.49	12.663	120.419	-93.485
		(40.987)	(52.645)**	(60.902)
Weekend	0.28	-218.167	-223.945	-175.855
		(20.653)***	(25.780)***	(31.905)***
Constant		-1062.408	-530.797	-1590.845
		(332.084)***	(503.571)	(574.960)***
sigma		264.087	230.892	261.18
		(15.127)***	(11.709)***	(26.881)***
Year and month dummies		x	x	x
Observations		2,171	671	1,000
Pseudo R-squared		0.04	0.04	0.06

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

(1) The base group consists of Job losers. (2) We exclude the dummy for temporary layoff w/ expectation of recall for this regression, because there are only 27 of them in the sample of ineligible (part-time workers in states were part-time workers are not eligible for UI) and they all have zero search on the diary day. (3) The base group consists of those with a high school degree or less.

Notes: Regressions are weighted using survey weights; Errors are clustered at state level. Universe: Unemployed, age 20-65.

Column 2 reports the results for the subsample of eligible without an expectation of recall to their previous employer and with a duration of unemployment of 26 weeks or less. Column 3 reports the results for the subsample of ineligible. See the notes in Table 2 for details about the estimated regression equation.

Table 4. Instrumental variables (IV) regressions, marginal effect of log(average weekly benefit)

Dependent variable: time allocated to job search, in minutes per day	Full sample (1)	Subsample (2): eligible w/o recall expectation & unempl. dur. <= 26	Subsample (3): ineligible
Mean of dependent variable	**32.1**	**49.1**	**25.4**
OLS			
Log(state average weekly benefit)	12.564	-99.696	50.649
	(16.562)	(42.273)**	(24.731)**
IV - 2SLS (Instrument: log(maximum weekly benefit amount))			
Log(state average weekly benefit)	-12.612	-109.74	18.109
	(22.504)	(58.433)*	(35.004)
Tobit			
Log(state average weekly benefit)	20.458	-71.004	41.583
	(11.620)*	(34.473)**	(18.008)**
IV - Tobit (Instrument: log(maximum weekly benefit amount))			
Log(state average weekly benefit)	7.909	-77.511	28.312
	(13.126)	(39.489)**	(22.004)
Observations	2,171	671	1,000
Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.			

Notes: Regressions are weighted using survey weights; Errors are clustered at state level. Universe: Unemployed, age 20-65.

The average weekly benefit is defined as benefits paid for total unemployment divided by weeks compensated for total unemployment.

Column 2 reports the results for the subsample of eligible without an expectation of recall to their previous employer and with a duration of unemployment of 26 weeks or less. Column 3 reports the results for the subsample of ineligible. See the notes in Table 2 for details about the estimated regression equation.