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

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Introduction

In a forthcoming paper, we focus on time allocated to job search and unemployment insurance (UI) exclusively in the U.S.A. We will discuss a few results from that paper. Below we briefly discuss the main predictions of Mortensen's search model (1977) and summarize the main findings of our companion paper.

Theoretical considerations

Mortensen (1977) develops a search model with variable search effort and analyzes the effects of unemployment insurance on search effort and, more generally, on the escape rate from unemployment. In his model, the individual has two choice variables, the search effort s_t and the reservation wage w_t. On-the-job search is allowed for workers. Search effort is modeled as time allocated to job search and thus the opportunity cost of search is foregone leisure. Given search effort, the arrival rate of job offers is constant (αs_t) and the wage is drawn from a known distribution F(w) with upper bound $\overline{w}$. The value function of the unemployed is

$$V(t,b) = \frac{1}{1+rh} \max_{0 \le s_t \le 1, w_t \ge 0} \left[hu(b,1-s_t) + V(t-h,b) + \alpha s_t h \int_{w_t}^{\overline{w}} \left[U(x) - V(t-h,b) \right] dF(x) \right]$$

where t is the time till benefit exhaustion, h the length of each period, b the unemployment benefit and U(w) is the value of a job with wage w. The FOCs are

$$(s_t): u_2(b,1-s_t) = \alpha \int_{w_t}^{\overline{w}} \left[U(x) - V(t-h,b) \right] dF(x)$$

$$(w_t): U(w_t) = V(t-h,b)$$

The optimal choice of search effort trades off the cost of foregone leisure against the increase in the probability of a job offer (times the expected gain from such an offer) and the optimal reservation wage strategy is to accept any wage offer that yields a value higher or equal as the value of being unemployed.

The major predictions of Mortensen's model are:

- An unemployed who is eligible for benefits will increase his search effort along the unemployment spell up to the point where his benefits exhaust (at time T). This is illustrated in Figure 1 (see also Mortensen (1977)).[1] An unemployed worker who is not eligible for benefits or has exhausted his benefits will devote a constant amount of search effort over the length of the unemployment spell.
- Search effort is decreasing in T, the maximum benefit duration, for those eligible.

[1] If leisure and consumption are complements search effort jumps up at the moment of benefit exhaustion and if they are substitutes search effort jumps down. Figure 1 draws the case where the marginal utility of leisure is independent of consumption.

- For a newly laid-off worker, search effort is decreasing in the benefit level b if consumption and leisure are complements (i.e. if $u_{12}(.) \geq 0$).[2]
- For an ineligible unemployed or for an unemployed who has exhausted his benefits, search effort is increasing in the benefit level. This is called the entitlement effect: higher benefits raise the value of being unemployed in the future and thus raise the value of a worker. As a consequence, it is optimal to search more if the unemployed does not receive any benefits in his current unemployment spell (see Figure 1a).
- The wage offer distribution also is an important determinant of job search. In particular, one can show that search effort is increasing in the average wage (higher returns to search) and wage dispersion (higher returns for searching for a high paying job).

Extensions

There are number of possible extensions of the standard search model. Katz (1986) extends the standard search model to allow for the possibility of recall to the previous job. He shows that in a model with binary choice of search and probability p of recall, the unemployed decide not to search if the probability of recall is above a certain level. Therefore, we expect that the unemployed with an expectation of recall to search less on average.

The tax system has an impact on the job search through the wage offer distribution. Ljungqvist and Sargent (1995) show that progressive taxation reduces search effort. The reason is that progressive taxation leads to after-tax wage compression and lowers the value of all jobs, and thus reduces search effort.

Data

We use data from 4 consecutive years (2003-06) of the American Time Use Survey (ATUS), which is the first continuous time-use survey, produced by the Bureau of Labor Statistics (BLS). The ATUS consists of a random sample selected from the 8th outgoing rotation group of the Current Population Survey (CPS), where the selected respondents are interviewed within the 2-5 months after their last CPS interview.

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), except that the reference week consists of the 7 days prior to the interview (which includes the diary day) as opposed to the week prior to the interview in the CPS. There are 1,824 unemployed, 35,717 employed and 9,273 classified as out of the labor force in our sample.

Job search: a descriptive analysis

Table 1 shows descriptive statistics of average minutes of job search by labor force status and a more detailed breakdown by type of employed, unemployed and out of the labor force. It also shows the participation rates in job search, which is defined as the fraction

[2] If leisure and consumption are complements, a decrease in the unemployment benefit reduces the marginal cost of search. At the same, it increases the gains from a new job (because the value of being unemployed is lower) and therefore job search unambiguously increases.

of those who search for a job on the diary day. Several regularities are apparent. First, the unemployed search around 32 minutes a day for a job, whereas the employed and those classified as out of the labor force devote less than a minute a day on average to job search. 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), the employed search only 3.3 and those out of the labor force only 1.8 minutes. This suggests that the conventional labor force categories represent meaningful different states.

Second, job search is heavily concentrated on weekdays. 24.6% of the unemployed engage in job search activities on an average weekday compared to 7.1% on a weekend day.

Third, there are large differences in job search effort across different types of unemployed. Job losers search 31.6 minutes more on average than those with an expectation of recall to their previous job and around 20.2 minutes more than re- or new entrants. Job leavers have a very high intensity of search, with over an hour of job search a day.

Fourth, those eligible for UI search 8.6 minutes more on an average day than those who are not eligible. Note, however, that this difference shrinks to about 2 minutes when we control for observables characteristics of the unemployed such as age, education, sex, marital status and children. We define as eligible for UI job losers and those on temporary layoff with an expectation of recall to their previous job[3], and as ineligible re- or new entrants and voluntary job leavers.

Unemployment insurance in the U.S.

To qualify for unemployment benefits all states require a worker to have earned a certain amount of wages during a reference period. The replacement rate is typically around 50% to 60% of the wage earned on the previous job, subject to a maximum benefit amount.

The maximum weekly benefit amount varies from $210 in Mississippi to $528 in Massachusetts, in 2006.[4] Moreover, some states provide dependence allowance beyond the maximum benefit.

In most states, the maximum benefit duration is 26 weeks, although there are some exceptions: MA (30 weeks), MT (28 weeks) and WA (30 weeks).

Job search and unemployment benefits

We exploit the variation of maximum benefit amounts across states and family types and regress the reported job search in minutes on the log of the maximum weekly benefit amount and controls for type of unemployed, age, education, sex, marital status, a dummy for children as well as interactions terms. Moreover, we include the predicted log hourly wage from a wage regression of the log hourly wage on age, education, sex

[3] In states where part-time workers do not qualify for UI, we define those who reported that they were part-time workers on their previous job as ineligible.

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

and a state dummy. We also include the residual wage dispersion by state as measured by the standard deviation of the residual of the wage equation. Standard errors are robust to correlated residuals within states.

Table 2 reports the results for 5 different samples. Column 1 shows the results for the full sample of unemployed aged 20-65. The coefficients on the log of the maximum weekly benefit amount and the log predicted hourly wage are significant at the 5% and 1% level, respectively. The implied elasticity is -0.8 for the maximum weekly benefit amount and over 5 for the predicted wage. The elasticity for the weekly benefit is larger when we restrict the sample to those who are eligible for UI benefits and with unemployment duration of equal or less than 26 weeks.

The term for residual wage dispersion is positive in 4 out of 5 regressions, but significant only in the subsample of ineligible. Moreover, our regressions show that those with an expectation of recall search significantly less than job losers, consistent with Katz's (1986) prediction.[5]

Job search and benefit duration

Figure 2 plots the fitted values of a locally weighted regression (called LOWESS) of job search on unemployment duration. Note that the ATUS interview does not contain a question related to unemployment duration. Unemployment duration is derived from the reported unemployment duration in the last CPS interview plus the number of weeks between the last CPS and the ATUS interview. As mentioned above, the last CPS interview was conducted 2-5 months prior to the ATUS interview (with only 15% with 4-5 months). For those who were not unemployed in the CPS interview, we impute an unemployment duration equal to the number of weeks between the CPS and the ATUS interview divided by two.

Figure 3 shows that job search strongly increases between week 15 and week 26 of the unemployment spell, from below 20 to above 70 minutes, and then falls back to around 30. The strong increase in job search in the weeks prior to benefit exhaustion is consistent with the Mortensen's search model outlined above. However, the decline in job search after week 26 is not. The model predicts that it remains constant.

Note, however, that there is a potential selection issue: unemployed people with a high intensity to search are more likely find a job and exit the sample, whereas those with a low intensity to search remain in the sample. This creates a possible "length based sampling" bias. (Notice that the bias could also go in the opposite direction if people who search very little become discouraged and leave the labor force.)

To address possible bias from "length based sampling", we perform non-parametric Monte Carlo simulations of selection out of unemployment. These calculations are meant to be illustrative. For this purpose we estimate a linear job search technology (see below for details):

$P = a + b*S$

[5] Also Katz and Meyer (1990) show that the unemployed with an expectation of recall have a distinct pattern of exit from unemployment.

where P is the probability of exit from unemployment (i.e. finding a job) and S is time allocated to job search. Given our estimates for the intercept 'a' and the slope 'b', we use the pool of unemployed with a duration of unemployment of 1-12 weeks and simulate their (random) job finding in weeks 13-39. More specifically, we use the following algorithm:

1. We set d = 13 where d stands for the weeks of duration of unemployment
2. For each unemployed in the sample at duration d, we draw a random number e from the uniform distribution (0,1).
3. If $e < P = a + b*S$, the unemployed finds a job and exits the sample. If $e >= P$, the unemployed does not find a job and remains in the sample.
4. We reset d = d + 1 and, for those remaining in the sample, we compute the average search time. Repeat (2.)-(4.) until d=39.
5. We iterate (1.)-(4.) 50 times.

Figure 6 plots the fraction of survivors for each week of unemployment duration. A survivor is defined as an unemployed who has not found a job yet. Only 33% of those unemployed in week 13 "survive" unemployment until week 39. This suggests that selection could be an important issue. Our simulations (see Figure 5), however, indicate that despite the large number of those who find a job between week 13 and 39, length based sampling is a minor problem and cannot account for the large decrease in average search time after week 26 in the LOWESS. The decrease in average search due to length based sampling is only about 7 minutes (between week 13 and 39).

How did we estimate the linear job search technology?

We use data from the National Longitudinal Survey of Youth 1979 (NLSY79) to estimate 'b' of our linear job search technology. Specifically, we use the 1981 additional questions on job search, which include questions on how much time job searchers have looked for jobs in the 7 days prior to the interview and what kind of job search methods they used in their current unemployment spell (e.g. asking friends, placing or answering ads, direct contacts with employers and using state or private employment services). We restrict the NLSY sample to the unemployed of age 18-24.[6] The sample size is 1,162.

We model the likelihood that an unemployed worker finds a job with a linear probability model. The dependent variable equals 1 if the unemployed worker has found a job and 0 if she or he has not. We regress this indicator variable on the number of minutes searched in the 7 days prior to the interview, controlling for age, sex and education. As Table 3 reports, the estimated coefficient is low: increasing search by 1 hour increases the probability of finding a job by one third of a percentage point. We suspect, however, that our model specification does not capture the full effect of search effort on the probability of finding a job because of impact lags from search effort to job finding. For this reason, we instrument for the number of minutes searched in the last seven days using the number of job search methods used in the current unemployment spell. This is done with the intention of capturing the full effect of search effort on job finding.

[6] The NLSY79 in 1981 contains only young people of age 16-24.

Our results (Column 3 in Table 3) show that the number of job search methods is a strong instrument for minutes of job search. The coefficient is significant at the 1% level and the t-stat is 5.45.

The results of the second-stage regression indicate that the estimated coefficient on minutes of job search is much larger than in the baseline OLS regression: increasing search by 1 hour in the week prior to the interview raises the probability of finding a job by 1.83 percentage points.

To obtain the slope coefficient 'b' used in the simulation of length based sampling, we divide this estimate by 7 to adjust for the fact that in ATUS we observe time allocated to job search only on one day of the week.

We obtain the intercept 'a' of our linear job search technology by matching the fraction of survivors at week 39 to the fraction of survivors in the ATUS sample. Given our estimate for 'a' and 'b', we simulate our model of job finding for weeks 13 to week 39 of the unemployment spell, as explained above.

References

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Ljungqvist, Lars and Thomas Sargent. 1995. “Welfare States and Unemployment”. *Economic Theory*, Vol. 6, No. 1, pp. 143-160.

Mortensen, Dale. 1977. “Unemployment Insurance and Job Search Decisions.” *Industrial and Labor Relations Review*, Vol. 30, No. 4., pp. 505-517.

Fig 1a. Search and unemployment benefits

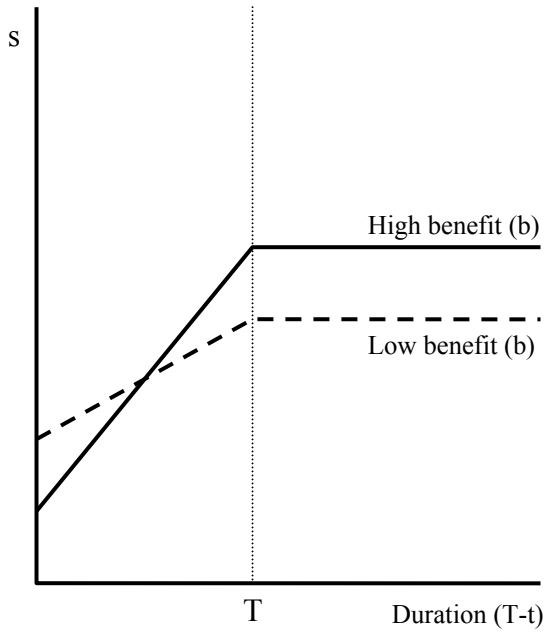
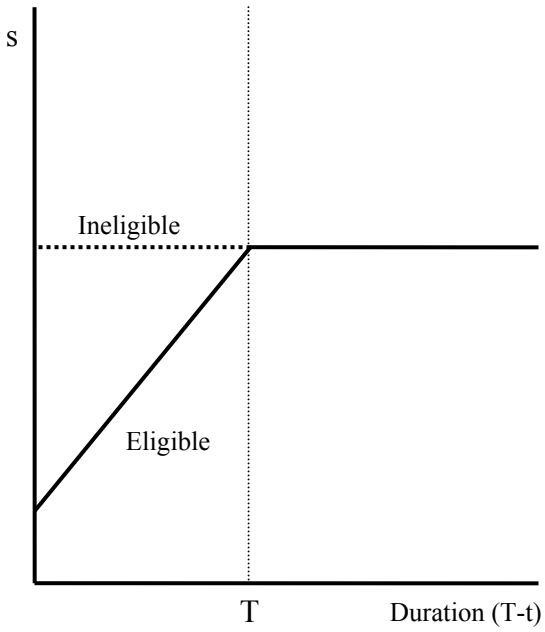
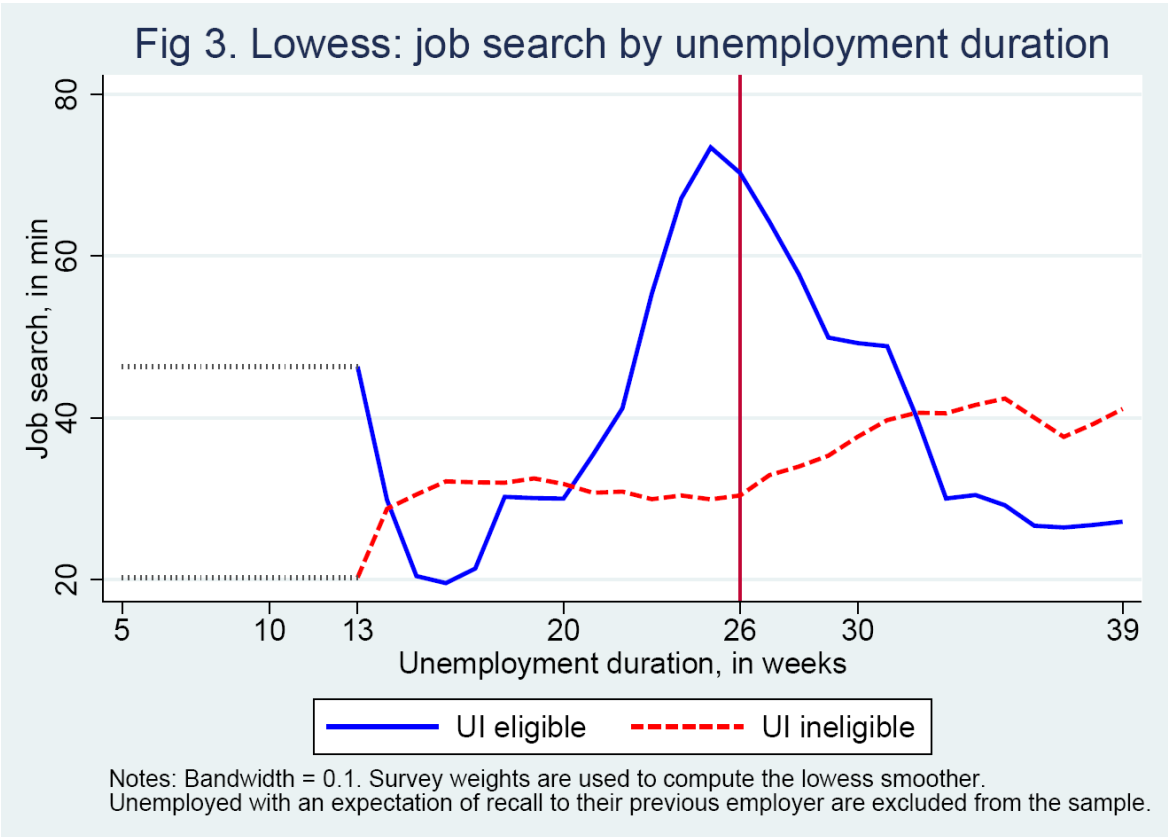


Fig 1b. Search and eligibility status





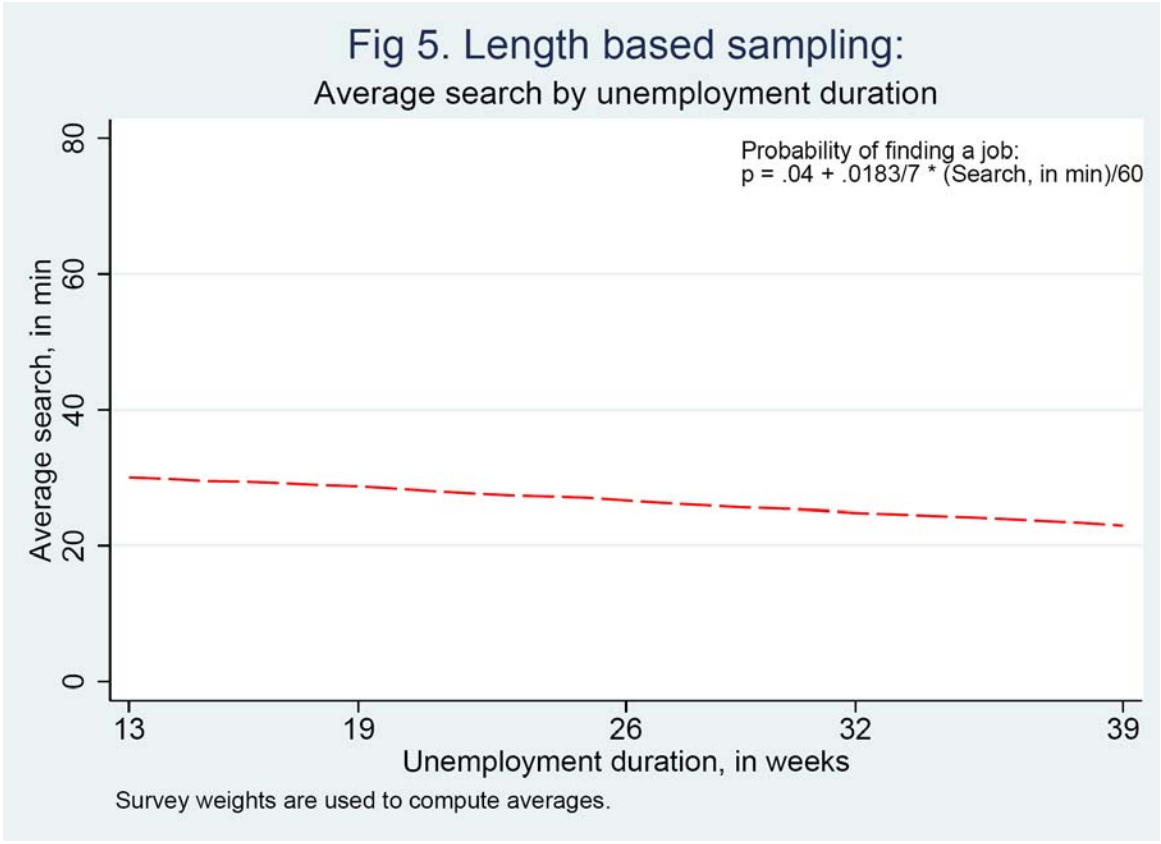


Fig 5. Length based sampling:
Average search by unemployment duration
Probability of finding a job:
p = .04 + .0183/7 * (Search, in min)/60
Average search, in min
0
20
40
60
80
13
19
26
32
39
Unemployment duration, in weeks
Survey weights are used to compute averages.

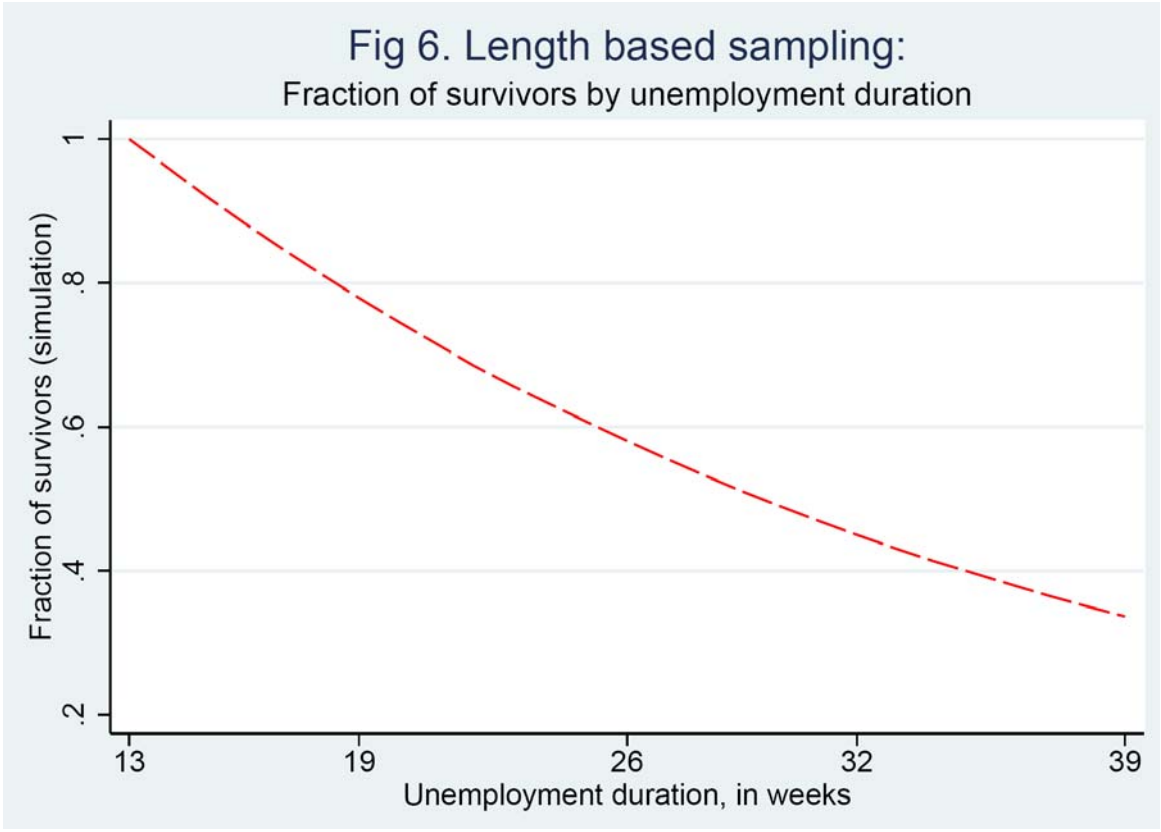


Fig 6. Length based sampling:
Fraction of survivors by unemployment duration
Fraction of survivors (simulation)
.2
.4
.6
.8
1
13
19
26
32
39
Unemployment duration, in weeks

Table 1. Descriptive statistics ATUS 2003 - 2006, by labor force status

	# respondents	% of total	Average job search, in min	Participation in job search	Average job search (participants), in min
By labor force status					
Employed	35,717	76.3%	0.6	0.6%	95.6
Unemployed	1,824	3.9%	31.8	19.8%	160.4
Not in labor force	9,273	19.8%	0.7	0.6%	122.0
By type of employed		(% of employed)			
Working in CPS	33,708	94.4%	0.5	0.5%	102.6
Unemployed in CPS	700	2.0%	3.3	2.7%	123.7
Not in labor force in CPS	1,309	3.7%	0.8	2.0%	42.6
By type of unemployed		(% of unemployed)			
Jobloser	811	44.5%	43.6	27.1%	161.0
On temporary layoff w/ recall expectation	286	15.7%	12.0	7.3%	164.5
Jobleaver	58	3.2%	62.8	29.6%	212.3
Re- or new entrant	669	36.7%	23.4	15.4%	151.3
By UI eligibility status		(% of unemployed)			
UI eligible	1,000	54.8%	35.8	21.8%	164.3
UI ineligible	824	45.2%	27.2	17.6%	154.8
By type of "not in labor force"		(% of not in labor force)			
Working in CPS	988	10.7%	2.6	2.0%	128.2
Unemployed in CPS	262	2.8%	1.8	2.5%	73.5
Not in labor force in CPS	8,023	86.5%	0.4	0.3%	130.9

Notes: Averages and participation rates are computed with survey weights. Universe: Civilian, noninstitutional population, age 20-65.

Table 2. Results of linear regressions

Dependent variable: time allocated to job search, in min	Mean (Std)	Full sample (1)	Subsample (2): eligible	Subsample (3): eligible & udur <= 26	Subsample (4): ineligible	Subsample (5): ineligible & not jobleaver	Wage equation - dependent variable: log(hourly wage)
Mean of dependent variable		**31.8**	**35.8**	**36.1**	**27.2**	**24.9**	**2.74**
Log(maximum weekly benefit amount)	5.89	-26.593	-35.072	-47.711	-22.127	-9.371	
	(0.214)	(12.319)**	(21.551)	(25.655)*	(20.458)	(20.396)	
Fitted log(hourly wage)	2.60	171.279	137.099	201.538	201.453	171.745	
	(0.330)	(53.543)***	(82.168)	(99.397)**	(61.759)***	(60.006)***	
Std(residual of wage equation) - by state	0.49	59.004	38.853	-37.893	187.232	222.487	
	(0.023)	(93.294)	(149.012)	(191.560)	(138.641)	(119.118)*	
Jobloser	0.45	---	---	---	---	---	
On temporary layoff w/ recall expectation	0.15	-32.462	-35.598	-39.419	-16.117	-13.9	
		(5.097)***	(5.891)***	(6.961)***	(14.662)	(15.342)	
Jobleaver	0.03	22.084			20.477		
		(17.602)			(23.555)		
Re- or new entrant	0.38	-12.983			-9.477	-9.392	
		(6.332)**			(13.575)	(13.561)	
Age	36.50	-8.822	-6.64	-10.383	-10.997	-10.092	0.061
		(3.791)**	(5.319)	(6.614)	(4.025)***	(3.970)**	(0.001)***
Age^2		0.093	0.078	0.119	0.108	0.1	-0.001
		(0.040)**	(0.057)	(0.072)	(0.042)**	(0.041)**	(0.000)***
High school degree or less	0.55	---	---	---	---	---	---
Some college or associate degree	0.29	-20.987	-11.388	-26.701	-29.271	-26.857	0.209
		(13.638)	(20.429)	(23.939)	(12.832)**	(13.666)*	(0.002)***
College degree (BA, MA or PhD)	0.16	-82.679	-48.874	-88.136	-125.478	-105.841	0.573
		(30.675)***	(47.424)	(56.825)	(35.965)***	(34.861)***	(0.003)***
Female	0.51	27.083	35.129	54.953	16.101	9.23	-0.231
		(12.914)**	(21.135)	(24.911)**	(16.578)	(16.659)	(0.002)***
Female*partner	0.28	-14.352	-31.828	-35.112	13.227	14.397	
		(10.413)	(12.708)**	(12.795)***	(17.563)	(17.676)	
Female*children	0.31	13.834	12.89	19.582	2.653	-0.069	
		(11.680)	(16.561)	(18.969)	(15.750)	(14.237)	
Partner	0.50	-8.748	3.152	-0.369	-20.9	-20.3	
		(10.252)	(10.744)	(12.922)	(19.122)	(17.886)	
Children	0.50	-0.663	10.89	9.104	-7.816	-6.301	
		(8.654)	(10.111)	(10.552)	(12.083)	(12.458)	
Weekend	0.27	-30.903	-33.848	-33.572	-23.947	-22.735	
		(3.935)***	(5.010)***	(5.812)***	(4.260)***	(4.138)***	
Constant		-58.749	14.02	37.254	-154.176	-191.867	1.212
		(58.289)	(94.195)	(117.418)	(123.777)	(125.705)	(0.013)***
Year and month dummies		x	x	x	x	x	
State dummies							x
Observations		1,824	1,000	817	824	766	319,813
R-squared		0.11	0.13	0.14	0.19	0.17	0.29
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. 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.

Table 3. Linear probability model of job finding

Dependent variable:	Mean (Std)	Job accepted	2SLS: 2nd stage Job accepted	2SLS: 1st stage Job search, in hrs
Mean of dependent variable		0.16	0.16	3.97
Job search, in hrs	3.97	0.0031	0.0183	
	(8.49)	(0.0019)*	(0.0066)***	
# of jobsearch methods used	3.33			1.556
	(1.63)			(0.2786)***
Female	0.44	-0.020	0.006	-1.225
		(0.0290)	(0.0321)	(0.5296)**
Age	20.20	0.000	-0.002	0.009
	(1.82)	(0.0092)	(0.0095)	(0.1523)
Years of school	11.67	0.019	0.022	-0.197
	(1.60)	(0.0100)*	(0.0107)**	(0.1447)
Constant		-0.013	0.780	5.609
		(0.2229)	(0.2146)***	(4.2748)
Month dummies				
Observations		1,162	1,162	1,162
R-squared		0.02		0.12

Robust standard errors in parentheses

* significant at 10%; ** significant at 5%; *** significant at 1%

Notes: Survey weights are used for the estimates. Universe: Unemployed, age 18-24.

Source: Authors' calculations and National Longitudinal Survey of Youth 1979 (NLSY79), 1981.