Online job search and unemployment insurance during the Great Recession

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[PRELIMINARY; DO NOT QUOTE WITHOUT AUTHOR'S PERMISSION.]

Abstract

The 2007-2009 U.S. recession was accompanied by large increases in the maximum duration of unemployment benefits. I use an event study and discontinuities in benefit duration to identify the impact of unemployment benefit duration on applications received for jobs on Careerbuilder.com, the largest American employment website. A one-week increase in maximum benefit duration decreases state-level applications by 0.4%, implying that the median state saw a 29% decline in applications due to extended benefits. There is no consistent evidence for an increase in jobseeker pickiness about jobs, suggesting that longer benefit duration increases unemployment chiefly through decreased job search effort.

1. Introduction

The Great Recession (2007-2009) in the US was accompanied by an increase in unemployment that significantly exceeded what could have been predicted on the basis of the drop-off in job vacancies. In other terms, although job vacancies declined steeply, unemployment increased even more than what could have been expected on the basis of past data. Macroeconomists refer to this phenomenon as a shift in the Beveridge curve that relates job vacancies to unemployment. The reason for this shift in the Beveridge curve is not well understood. Some have proposed that mismatch has increased: the skills and location of jobseekers match less well the skills and locations of job vacancies. However, it seems that mismatch played a limited role in the increase in unemployment during the Great Recession (Sahin et al. 2011; R. Barnichon and Figura 2011). Another potential explanation is that the matching between the unemployed job seekers and job vacancies has become less efficient due to a decrease in employer recruiting intensity (Davis, Faberman, and Haltiwanger 2012) and possibly a decline in job search intensity on the worker side (comment by Steve Davis in KRUEGER et al. 2011).

The large extensions in unemployment benefit duration during the Great Recession may explain why job search intensity declined, contributing to the shift in the Beveridge curve. Theoretically, more generous unemployment benefits are predicted to decrease search effort and increase the reservation wage. Empirical evidence has shown that reservation wages are generally not affected by unemployment benefits (Card, Chetty, and Weber 2007; Krueger and Mueller 2011). Therefore, the impact of unemployment benefits on unemployment is likely explained by job search effort. While a large literature has documented the negative impact of unemployment benefits on job finding (Katz and Meyer 1990, Schmieder, Wachter, and Bender 2010), there is currently little investigation of the impact of unemployment benefits on a direct measure of job search effort. Krueger and Mueller (2010) are a recent exception. They examine the impact of unemployment benefits on time spent on job search activities using cross-state variation in the generosity of unemployment benefits. While they do find that higher unemployment benefits decrease the time devoted to job search, their identification strategy is limited by omitted state-level covariates and endogeneity, since high unemployment states may choose to enact more generous benefits.

This paper investigates the impact of unemployment benefits on job search using plausibly exogenous variation in unemployment benefit duration during 2008-2011. I measure search effort at the state-month level by the number of applications received for jobs on CarreerBuilder.com, the largest American employment website. Unemployment benefits recipients allocate the majority of their time to browsing and answering job ads (Krueger and Mueller 2011), implying that applications on a job search website are a good measure of job search effort. To identify the impact of unemployment insurance on applications, I use variation in potential unemployment benefits duration (PBD) induced by the Emergency Unemployment Compensation 2008 (EUC) and extended benefits (EB). I start with an event study and show that state-level job applications significantly decline in the first month of a benefit extension, and continue to decline for several months thereafter. I also investigate the impact of PBD on applications per job view, which is a measure of how picky workers are about jobs for a given level of search. I find no impact of benefit extensions on the number of applications per job view in the first few months following the extension. A second identification strategy uses the fact that benefit extensions (EUC and EB) depend, among other things, on state-level unemployment rates reaching specific thresholds. I exploit this source of variation by using a fuzzy regression discontinuity design, as well as an extension to a panel specification. My preferred estimate indicates that a one-week increase in unemployment benefits leads to a 0.4% decline in applications at the state level. This effect is large since it implies that the median benefit extensions between 2008 and 2009 (26 weeks to 99 weeks) led to a 29% decline in applications for the median state. These results are consistent with an increase in the maximum duration of unemployment benefits decreasing job search effort and having no consistent impact on jobseeker pickiness.

As mentioned above, there is a sparse and recent literature examining the impact of unemployment benefits on a direct measure of job search. Krueger and Mueller (2010) use cross-state variation to investigate the impact of benefit levels on time spent on job search. Krueger and Mueller (2011) show results that are consistent with a negative impact of unemployment benefit extensions on time spent on job search during the Great Recession. However, given that their data comes from a single state (New Jersey), the identification is based only on time variation. In comparison, this paper is able to identify the impact of unemployment insurance on job search by using data on multiple states that saw different extensions in benefits at different times. This paper is thus the first to my knowledge to credibly identify the impact of unemployment benefit duration on a direct measure of job search effort.

Second, this paper contributes to the literature on the impact of unemployment insurance on reservation wages. As mentioned above, this literature finds no impact of unemployment insurance on reservation wages. I find that an increase in unemployment benefit duration does not have a robust effect on applications per job view, suggesting that unemployment benefits not only fail to affect reservation wages, but also do not seem to affect workers' pickiness about non wage attributes.

Finally, this paper is also related to the literature on the impact of unemployment benefits on job finding. A recent working paper (Rothstein 2011) examines the impact of EUC 2008 and EB on job finding rates using the Current Population Survey and finds that extensions indeed significantly decrease job finding rates. My paper's innovation is to examine the impact of benefit extensions on job search effort directly, while also examining the supply of jobs, i.e. job vacancies. Using job applications as an outcome instead of job finding has important advantages. Indeed, the impact of benefit extensions on job search effort is direct while the impact on job finding is mediated by job search effort, reservation wages, and the state of the labor market. This direct relationship between unemployment benefits and job search allows me to focus on thresholds in unemployment rate that determine large changes in benefit duration, which strengthens my identification strategy.

The remainder of the paper is organized as follows. Section 2 discusses how unemployment benefit extensions were decided, describes the data and the identification strategy. Section 3 presents the key results. Section 4 discusses the results. Finally, Section 5 concludes.

2. Policy background and data

Policy background

The maximum unemployment benefit duration in the United States is 26 weeks by default. However, during times of high unemployment, this duration can be extended based on state-level determinants. The extended benefits (EB) program activates in a state under one of two conditions:

- if the state's 13-week average insured unemployment rate (IUR) in the most recent 13 weeks is at least 5.0 percent and at least 120 percent of the average of its 13-week IURs in the last 2 years for the same 13-week calendar period; or
- *at state option*, if its current 13-week average IUR is at least 6.0 percent, and regardless of the experience in previous years. I will say that the **IUR option** is in place for the months when a state chose this option.

States have the option of electing an alternative trigger authorized by the Unemployment Compensation Amendments of 1992 (Public Law 102-318). I will say that the **TUR option** is in place for the months when a state chose this option. This trigger is based on a 3-month average total unemployment rate (TUR) using seasonally adjusted data:

- If this TUR average exceeds 6.5 percent and is at least 110 percent of the same measure in either of the prior 2 years, a State can offer 13 weeks of EB.
- If the average TUR exceeds 8 percent and meets the same 110-percent test, 20 weeks of EB can be offered.

Normally, extended benefits are financed 50% by states and 50% by the federal government. Under the American Recovery and Reinvestment Act of 2009 (ARRA) passed on Feb. 17, 2009, the benefits are financed entirely by the federal government. This provided many states with an incentive to choose the TUR option (the IUR option is mostly irrelevant because few states reach 6% IUR without already having EB under the regular IUR condition). Federal funding of EB is currently set to expire on December 31, 2012.

The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 (P.L. 111-312, passed on Dec. 16 2010 and signed on Dec. 17, 2010) temporarily changed the look-back timeframe to three years, as unemployment indicators in most states have been consistently high for the past two years and would have resulted in many states being unable to meet the 120% IUR or 110% TUR conditions. This three-year look-back exception is set to end on December 31, 2011.

As of January 2011, Arkansas, Iowa, Louisiana, Maryland, Mississippi, Montana, Oklahoma, Utah, and Wyoming could qualify for extended benefits under TUR but chose not to use that option. Legislators in these states were afraid of adopting extended benefits under TUR since 100% federal funding would eventually expire, and if they kept the TUR trigger on their books the states would have to match federal funding 50/50. This would likely require a tax hike on businesses in order to replenish depleted state unemployment trust funds. Many politicians also believed that existing state benefits were sufficient, and did not want to spend federal tax dollars on extended benefits that would reduce incentives for unemployed workers to find a job[1].

Another reason why unemployment benefits were extended during the Great Recession is the federal Emergency Unemployment Compensation (EUC) 2008. EUC08 is an emergency federal benefits program that is payable to individuals who have exhausted all rights to regular compensation with respect to a

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[1] Another concern was that although the federal government paid for 100% of normal extended benefits claims, state governments would be responsible for paying extended benefits to state and local government employees who had been laid off.

benefit year that ended on or after May 1, 2007. Typically, EUC benefits come into play before EB benefits.

- The EUC08 program, signed into law on June 30, 2008, provides up to 13 weeks of 100 percent federally-financed compensation to eligible individuals in all states. Public Law (P.L.) 110-449 expanded the EUC08 program on November 21, 2008 to provide up to 20 weeks of 100 percent federally-funded unemployment compensation to eligible individuals in all states. This constitutes tier 1 or EUC1.
- Tier 2 of EUC (EUC2) was created by Public Law (P.L.) 110-449. It provides 13 weeks of benefits to eligible individuals in states where TUR (defined as for EB) is above 6% or IUR (defined as for EB) is above 4%.
- Public Law No. 111-92, enacted on November 6, 2009, expanded the EUC08 program, in the following ways:
    - It increased the maximum EUC2 entitlement from 13 weeks to 14 weeks of benefits in all states, and this Tier is no longer triggered on by a state reaching a specified rate of unemployment;
    - It created EUC3 providing up to 13 additional weeks of benefits in states with IUR above 4 percent or TUR above 6 percent;
    - It created EUC4 providing up to 6 additional weeks of benefits in states with IUR above 6 percent or TUR above 8.5 percent.

Just as in the case of EB, the TUR conditions are much more likely to be satisfied than the IUR conditions. For example, EUC2 and EUC3 require that TUR be above 6% or IUR above 4%. In my sample, when TUR is above 6%, IUR is above 4% in 97% of the cases. On the other hand, when IUR is below 4%, TUR is nonetheless above 6% in 54% of the cases.

This overview of the policies suggests that one can use sharp changes in benefit duration at 6.5% and 8% TUR (for EB) and 6% and 8.5% TUR (for EUC) to identify the impact of benefit duration on applications. I will discuss below how I make use of these in practice.

Data

The data on applications and job vacancies comes from proprietary data provided to me by CareerBuilder.com. Job vacancies are the total number of job ads posted in a given state during a given month. The data spans September 2007 to July 2011. An application is defined as a person clicking on the “Apply Now” button in a job ad. Applications are the number of applications received by all jobs in a given state and month. These applications can therefore partially come from out-of-state jobseekers. However, jobseekers overwhelmingly apply in state, so in first approximation we can consider the applications to come from jobseekers in the state where the job is posted. Additionally, when an individual state experiences an increase in benefit duration, there is no strong reason to expect that applications from out of state will also decline. One should also note that the recorded applications are not coming from unemployment benefit recipients only. According to CarrerBuilder’s applicant survey, about half of the applicants are employed[2]. As such, applications measure job search effort for individuals in a given state, whether or not they are employed. Employed individuals may also react to increases in the duration of unemployment benefits by searching less; this would particularly apply to employed individuals who engage in job search because they think they may lose their job soon. However, since the end of unemployment benefits is further away for a currently employed worker who envisions becoming unemployed than for a currently unemployed worker, discounting predicts that the impact of benefit duration on employed workers’ search effort should be lower (see Card, Chetty and Weber, 2007, for a discussion of the role of discounting in estimating the impact of benefit duration on unemployment duration). Therefore, the estimated impact of unemployment benefits on applications is a lower bound on the impact of unemployment benefits on the job search effort of unemployed workers. This estimate is interesting in its own right because it constitutes a measure of the impact of unemployment benefits on overall labor market tightness at the state level.

I use data from the Department of Labor EB and EUC trigger notices to determine how many weeks of extended benefits are effectively available for each state and week. I refer to these weeks of benefit as “maximum weeks of UI” or PBD, which stands for potential benefit duration. Indeed, not all jobseekers are eligible for the maximum weeks of UI, and additionally, even those who are eligible do not have to use up all of these weeks of benefits. This data also contains the TUR, IUR and applicable look-back criteria. This allows me to determine when the conditions for each extension are realized. Since this data is at weekly frequency, I take the monthly average of the maximum weeks of benefit, IUR and TUR to merge it with the monthly data on applications and vacancies.

Finally, data on the total number of unemployed people by state and month comes from the Bureau of Labor Statistics.

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[2] This statistic is interesting but cannot be taken at face value since it is based on the selected sample of those applicants who were willing to answer the survey

Table 1 shows summary statistics for key variables. Notice in particular the large number of applications per state. The number of applications is about twice as high as the number of unemployed individuals, and about 30 times as high as vacancies, implying that each vacancy receives about 30 applications on average. Other statistics on the unemployment rate are familiar. Figure 1 shows the evolution of the unemployment rate, job vacancies (from Job Openings and Labor Turnover Survey) and maximum weeks of benefits at the national level. From September 2007 to July 2009, vacancies plummet, unemployment increases and at the same time the maximum weeks of benefits also increase. Subsequently, vacancies start increasing again, but unemployment barely decreases and maximum weeks of benefit continue to increase until December 2009. This graph makes it clear that maximum weeks of benefit and unemployment are positively correlated. However, given the regulations, there is a mechanical positive correlation between unemployment and maximum weeks of benefits. The next section discusses how we can identify the causal impact of maximum weeks of unemployment benefits on job applications using an event study.

3. Event study

Methodology

I identify for each state the largest increase in maximum benefit duration that is not due to a regime change (i.e. does not occur in the first month where a new benefit schedule is in place, such as December 2008) nor to a temporary lapse in EUC. During my sample period, there were two lapses in extended benefits due to legislators struggling to reach an agreement to further extend federal funding of the benefits. These two lapses were in April to July 2010 and in November-December 2010. Ultimately, any benefits lost from these lapses were reinstated once the legislative agreement was reached. I excluded EUC lapses because there seems to be little reaction of job applications to these EUC lapses (results not shown): presumably, jobseekers were expecting these EUC lapses to be temporary indeed. As for the exclusion of regime changes, it is to allow for benefit duration increases to occur at different times for different states.

Because the data on applications is at the monthly level while the maximum benefit duration is defined weekly, the largest increase in benefit duration defined as above will typically occur over three months, with the first month having the lower potential benefit duration (PBD), the second month having a mix of lower and higher PBD, and the third month having the higher PBD. Therefore, I look for the largest increase in benefit duration relative to two months prior, and not one month prior. Finally, for each state, I only keep observations around the largest increase in PBD that do not involve any further change in PBD: as a result of this restriction, benefit duration is constant during the months prior to the largest PBD increase[3], and also constant during the months after the largest PBD increase. I then use the following specification to estimate the impact of the largest increase in benefit duration on various outcomes:

$$y_{st} = \sum_{i=-8}^{7} \beta_i D_{ist} + q_t + \delta_t + \gamma_s + \epsilon_{st}$$

where y_{st} is the outcome of interest in state s and month t. D_{ist} is a dummy equal to 1 in month i relative to the largest increase in the maximum weeks of benefits in a given state, where $i = 0$ is the first month when the higher PBD is available during all weeks of the month. The dummy for month $i = -2$ is the omitted category. q_t is a quarter fixed effect to capture seasonality. δ_t is a year fixed effect and γ_s is a state fixed effect. I cluster standard errors at the state level.

This event study specification identifies the impact of maximum weeks of benefit on outcomes using within state variation in benefits, and the specific timing of the PBD increase. The key identification assumption is that there is no other variable that evolves according to the same monthly timing as PBD and affects the outcomes of interest. This assumption is made more likely by the fact that these PBD increases occur at different times in different states and are mostly driven by states crossing thresholds in the state unemployment rate that qualify them for additional weeks of benefits[4].

Results

Figure 2 shows the impact of the largest increase in maximum weeks of UI (as defined above) on log applications. While there is no significant trend in applications prior to the increase in benefit duration (in 5 out of 7 months, the level of applications is not statistically significantly different from the baseline period), there is a significant drop in applications during the first month (month 0) after the increase in benefit duration. Given that the average increase in benefit duration is 15 weeks, the estimated effect implies that a 1 week increase in maximum benefit duration leads to a 0.4% decline in applications. This in turn implies that the median state saw a 31% decline in applications due to benefit extensions during the Great Recession (+73 weeks). Applications continue to decline after the first period post benefit increase, and the impact in the third month (month 2) is significantly higher than the impact in the first

[3] Months that contain a mix of lower and higher PBD are excluded.
[4] In a minority of states (20%), the largest increase is due to the state adopting the TUR option.

month, implying that a 1 week increase in maximum benefit duration leads to a 1% decline in applications. This decline in applications after the PBD increase is not due to sample selection: indeed, if we restrict the sample to states that are present in month 2 (23 states), the impact in month 2 is still significantly larger than the impact in month 0. It is likely that the decline in applications happens gradually because some jobseekers realize that PBD has increased earlier than others.

One concern with these results is that a change in other key variables may be driving the results. In particular, if there are fewer job vacancies, this could explain why job applications decline. In Figure 3, I plot the event study for state-level log vacancies. The plot shows that there is no significant trend in job vacancies around the largest increase in PBD. This is an important result since it implies that the significant decline in job applications cannot be explained by a decline in job availability.

Another variable that could be responsible for a spurious negative impact of PBD on applications is unemployment. Indeed, if there are fewer unemployed people, then all other things equal, we expect a decrease in the number of applications. I plot the path of the three-months average total unemployment rate (TUR) around the largest increase in PBD (Figure 4). TUR does not decrease but rather significantly increases around the PBD extension. This is inconsistent with the decline in applications being driven by a decline in the number of jobseekers, and suggests that benefit extensions may have increased unemployment, a topic I further explore in another paper (Marinescu and Rathelot 2012). Since the number of unemployed people increases and job vacancies do not budge around the PBD increase, the fact that applications decline strongly suggests that PBD has a negative impact on job search effort.

But to what extent can the decline in job applications be interpreted as a reduction in job search effort? An alternative interpretation is that jobseekers send fewer applications because their reservation wage or other demands have increased, making fewer jobs suitable for application. To test this alternative interpretation, I use data on the number of times that a job vacancy snippet was viewed as part of a listing that comes out after a job search query. By adding up these job views for all jobs in a state, I get an alternative estimate of how hard jobseekers were looking for jobs. I also look at log applications per view, which is a measure of how picky jobseekers are. Figure 5 shows that job views declined after the largest increase in PBD and overall followed a similar pattern to job applications. By contrast, applications per view are flat around the largest increase in PBD (Figure 6): there is no significant decline in applications per view in the first 4 months after the largest increase in PBD. There is some evidence for a significant decline 5 months out and beyond, but these estimates are based on a small number of states (13 states or fewer, versus 51 states in the first month after the PBD increase) and are therefore less representative. This suggests that increasing PBD has a negative impact on job search effort as measured by applications or job views, but doesn't have a robust impact on job seeker pickiness[5]. This result is consistent with the lack of evidence for an impact of PBD on the reservation wage found in previous literature (e.g. Card, Chetty, and Weber 2007; Krueger and Mueller 2011). At the same time, this result brings new light to the literature. Indeed, even if the reservation wage does not react to an increase in PBD, jobseekers could become pickier about other job characteristics besides the wage. My results are inconsistent with the idea that PBD increases jobseeker selectivity on non-wage job characteristics. Instead, my results suggest that an increase in PBD really chiefly affects job search effort with no significant impact on jobseeker selectivity on either wage *or* non wage job attributes.

Using the event study methodology, I have shown that an increase in PBD has a large, significant and negative impact on job applications. Since there is no robust impact of PBD on applications per job view, I conclude that the key channel through which an increase in PBD affects unemployment duration is a decrease in job search effort. In the next section, I use an alternative identification strategy relying on sharp changes in PBD when a state crosses certain TUR thresholds.

4. Fuzzy regression discontinuity and extensions

Methodology

My second identification strategy is a fuzzy regression discontinuity design. As explained above, crossing a threshold in the total unemployment rate (TUR) is much more likely to actually lead to an increase in benefit than crossing a threshold in the insured unemployment rate (IUR). I therefore focus on TUR thresholds. Among all the TUR thresholds, the one at 6% TUR for EUC is the best candidate for a regression discontinuity design. This is because it applies to all states, and, around 6% TUR, states would typically not have extended benefits (EB). Indeed, TUR must be above 6.5% in the states with a TUR option for EB to be turned on. By contrast, for 8.5% TUR, which is the other threshold for EUC, some states would have EB, which would considerably complicate the use of a fuzzy regression discontinuity design.

Figure 7 plots PBD as a function of the unemployment rate (TUR). This is for December 2008 to October 2009, and using week by state data. The chosen period corresponds to a given PBD schedule as a

[5] Using the fuzzy regression discontinuity design discussed in the next section, I also find small and statistically insignificant estimates.

function of TUR. Prior to December 2008, EUC did not depend on TUR, and after October 2009, benefits increased at all TUR values. Additionally, after October 2009, there were very few states with TUR just below 6%, making that latter period unsuitable for a regression discontinuity design. If we focus on 1 percentage point around 6% TUR, i.e. 5.5% TUR to 6.4% TUR, we can see that there is no clean discontinuity in weeks of benefits (Figure 7). This is because some states are eligible for EB or EUC under IUR conditions, which means that PBD can be at a higher level even when TUR is below 6%. Additionally, even when TUR is above 6%, some states have the lower PBD level because there is usually a delay between when a state crosses the threshold and when benefits become available. In order to be able to apply a fuzzy regression discontinuity design, I drop state-week observations where any EB is available. I also drop state-week observations where TUR is below 6% and the IUR condition for EUC is satisfied. This leaves me with the diamond dots in Figure 7: these dots will be used for a fuzzy regression discontinuity design. The discontinuity is fuzzy because some states have more than 6% TUR yet their PBD may not have increased due to delays in implementation.

The points selected for the fuzzy regression discontinuity design are therefore state-week observations where TUR is between 5.5% and 6.4%, but with some exclusions as described above. The excluded observations represent only 20% of observations below 6% TUR and only 11% of observations above 6% TUR, or a total of 15% of observations within that TUR interval. Substantively, what these exclusions do is drop state-week observations where IUR is unusually high compared to TUR. Assessing to what extent this sample restriction may affect the external validity of results from the fuzzy regression discontinuity is difficult. However, given that the there are very few observations dropped, it is to be hoped that any resulting bias is small.

Figure 8 plots the distribution of the unemployment rate (TUR), i.e. the forcing variable, in the sample selected for the fuzzy regression discontinuity design. There is no evidence for states manipulating TUR to qualify for extended benefits.

If I had weekly data on the outcomes of interest, I would estimate the following instrumental variables regression:

$$y_{sw} = \beta b_{sw} + \alpha' X_{sw} + \delta_t + \gamma_s + \epsilon_{sw}$$

where y_{sw} is the outcome of interest in state s and week w, b_{sw} is the PBD in weeks, X_{sw} is a vector of controls that can include TUR and log job vacancies, δ_t is a year fixed effect and γ_s is a state fixed effect, and ϵ_{sw} is the error term. Given that this is a fuzzy regression discontinuity design, b_{sw} is instrumented with the weeks of benefits that should be available given rules. This application of a fuzzy regression discontinuity design is very similar to the work by Angrist and Lavy (1999). Standard errors are clustered at the state level. The instrument is therefore the maximum weeks of benefits if the PBD determined by rules would be made available by states without delays. While it is typical to include the forcing variable (here TUR) as a control in a regression discontinuity design, I report results both with and without this control. Indeed, the unemployment rate (TUR) is endogenous in a regression with applications on the left-hand side: if jobseekers send in fewer applications, then all other things equal unemployment will increase. Finally, I control for log vacancies since it is likely that the more vacancies there are, the more applications will be sent to these vacancies. Yet vacancies are also endogenous because if fewer applications are sent by jobseekers, vacancies will last longer, and therefore the number of vacancies present in any given month will increase.

Unfortunately, I cannot estimate the above specification in my data because the outcomes of interest (e.g. applications) are aggregated at the monthly level. Instead, I run the above regression using monthly averages. For the monthly data to yield meaningful results, only months where TUR lies between 5.5% and 6.4% in *each and every* week are used. Then, using the monthly average of each variable, and as long as the linearity assumption holds, I can get a consistent estimate of β using the same specification as above. In this specification, the underlying source of identification is the discontinuous jump in PBD at 6% TUR.

One important drawback of this fuzzy regression discontinuity design is that the sample size I end up with is very small (only 44 state-month observations). The estimates are therefore likely to be quite noisy. It would therefore be useful to select a larger sample, though it will not be possible to use the regression discontinuity framework. Figure 7 illustrates why this is the case: while states crossing TUR thresholds plays an important role in the determination of PBD, the relationship between PBD and TUR does not present sharp discontinuities. Instead, what we have in the data is a nonlinear relationship between TUR and PBD, with PBD increasing more steeply around TUR thresholds.

To exploit this nonlinear relationship, I will plot a smoothed version of PBD and applications residuals as a function of TUR. The applications residuals are from regressing log applications on state fixed effects. I then apply a kernel-weighted local polynomial smoothing with a 0.2 bandwidth. Additionally, I restrict TUR to be between 4% and 10%, as to include some data prior to any TUR threshold being reached and past the highest TUR threshold, but yet not include data that is very far away from the TUR thresholds that are my main source of identification. Second, I run an instrumental variable regression that corresponds to these plots and is very similar to the fuzzy regression discontinuity specification, but uses a much larger sample. Specifically, I estimate the following specification, restricting to state-month observations with TUR between 4 and 10%:

$$y_{st} = \beta b_{st} + \alpha' X_{st} + q_t + \delta_t + \gamma_s + \epsilon_{st}$$

where y_{st} is log applications in state s and month t, b_{st} is the average PBD over the month, X_{st} is a vector of controls which can include a quadratic in TUR and IUR and log job vacancies, q_t is a quarter fixed effect to capture seasonality, δ_t is a year fixed effect and γ_s is a state fixed effect, and ϵ_{st} is the error term. b_{st} is instrumented with the weeks of benefits that should be available given rules, and standard errors are clustered at the state level. The instrument is therefore the maximum weeks of benefits if the PBD determined by rules would be made available by states without delays; it is the same instrument that was used for the fuzzy regression discontinuity design. Additionally, the instrument does not take into account temporary EUC lapses. Since, as argued above, the unemployment rate and vacancies are endogenous, I use specifications both with and without these controls.

I also report the results from running the above specification with an alternative instrument. This second instrument is the same as the first instrument, except that all states are assumed to have elected the TUR option, so that PBD according to rules now assumes that the TUR option is in place for all states. The point of using this second instrument instead of the first is to account for the potential endogeneity of states' decision to take up the TUR option. States have a strong incentive to enact the TUR option after ARRA was passed in February 2009 because ARRA makes EB fully federally funded. Table 2 lists the states that took up the TUR option after March 2009 ("switcher states"), states that always had a TUR option during my sample frame ("always TUR"), and states that never had a TUR option during my sample frame ("never TUR"). Importantly, no state switches status between September 2007 and March 2009, so all switches happen after ARRA. Second, a little more than half the states are in the switcher category.

Figure 9 suggests that states' take-up of the TUR option depends on the level and changes in their unemployment rate. The solid line shows the evolution of unemployment for states that always had a TUR option ("always TUR"). The two dashed line show the difference between the unemployment rate of switcher states and those that always had a TUR option (short dash), and the difference in unemployment rate between never TUR states and those that always had a TUR option (long dash). The two vertical lines represent February 2009 and November 2009, i.e. the period during which switcher states adopt the TUR option. The figure shows that switcher states start with roughly the same level of unemployment as always TUR states but experience a larger increase in unemployment in 2008, i.e. before adoption of the TUR option. By contrast, states that choose not to take up TUR have a lower level of unemployment to start with and experience a smaller increase in unemployment during 2008 than always TUR states. Additionally (not shown), early adopters of the TUR option have a higher increase in their unemployment rate in 2008 than late adopters of the TUR option. Since I am using state fixed effects, any levels difference is accounted for. However, the fact that switchers experience higher increases in unemployment than always TUR states and never TUR states experience lower increases in unemployment than always TUR states suggests a possible source of bias since panel regressions do not allow for state-specific time-varying components. One likely source of bias here is regression to the mean unemployment rate post adoption. Figure 9 is consistent with this since, during 2010-2011, never TUR states' unemployment rate gets closer to always TUR states, and switchers' unemployment rate no longer increases relative to always TUR states (and therefore regresses to the mean[6] if we compare it to both always TUR and never TUR states). To conclude, states' take up of the TUR option is likely endogenous to state level trends in economic conditions. It is therefore important to probe the sensitivity of the results to instrumenting by the PBD according to rules if one assumes that all states take up the TUR option. Additionally, this suggests that results may be sensitive to the inclusion of state-specific trends, and I will therefore also report results that include such trends as controls.

To summarize, the fuzzy regression discontinuity design complements the event study and allows us to determine the impact of PBD on job applications. Since applying the fuzzy regression discontinuity design requires a drastic sample reduction, I also use nonlinearities in PBD as a function of TUR to identify the impact of PBD on job applications.

Results

Fuzzy regression discontinuity

Figure 10 plots log applications residuals and PBD as a function of TUR. The data is averaged over 0.1 percentage point TUR bins. As we can see (circles), there is a strong increase in average PBD around 6% TUR. However, because the data is averaged at the monthly level, there is no sharp discontinuity as in

[6] We cannot directly assess regression to the mean by looking at the figure because the maximum number of weeks of unemployment benefits after November 2008 changes differentially for different groups of states. Before November 2008, only always TUR states may get more weeks of benefits than other states. Therefore, the fact that the unemployment rate increases faster in switcher states than in always TUR states prior to November 2008 cannot be attributed to switcher states having a larger number of weeks of benefits.

Figure 7. The applications residuals (squares) show a strong negative slope, suggesting that the increase in PBD did indeed reduce applications.

Figure 11 is similar to Figure 10 but explores the impact of PBD on job vacancies residuals. The increase in PBD is associated with relatively stable job vacancies residuals, and possibly a small increase in vacancies. Therefore, the observed decline in applications as PBD increases cannot be attributed to a decline in available job vacancies; if anything, the number of job vacancies increased.

Table 3 presents the fuzzy regression discontinuity results. In column 1, without controls, the impact of PBD on applications is negative and significant: a 1-week increase in PBD decreases applications by 1.36%. This estimate is very large, since it would imply that the median state, with a 73 weeks increase in PBD, has seen a 99% decline in applications. If we compare this estimate to the results from the event study, a 1.36% decrease in applications corresponds to the impact of PBD on applications 4 months after the largest PBD increase. Indeed, in the event study, the estimated impact in month 3 (see Figure 2) is -0.21, which is for a 15 weeks increase in PBD: this implies that a one week increase in PBD decreases applications by 1.4%. Therefore, while the impact estimated by the fuzzy regression discontinuity design is very large, it within the range of what was found for the event study.

In columns 2 and 3 of Table 3, I add additional controls. When controlling for job vacancies (col. 2), the impact of PBD on applications becomes larger and more significant. Finally, when controlling for both job vacancies and the unemployment rate, which is the forcing variable, I find an effect that is of the same magnitude than in the absence of controls but statistically insignificant. At the same time, the unemployment rate itself does not have a significant impact on applications. Additionally, as pointed out in the methodology section, the unemployment rate and vacancies are both potentially endogenous. Therefore, I take the results from the regression discontinuity design to imply a strong negative effect of PBD on job applications. Still, with 44 observations, power is limited and it is therefore useful to turn to a specification that allows me to use more observations by exploiting nonlinearities in PBD as a function of TUR rather than discontinuities in PBD.

Using nonlinearities in maximum weeks of UI as a function of TUR

I start with a graphical analysis. Figure 12 plots log applications residuals as a function of TUR, and PBD as a function of TUR. The sample is restricted to December 2008 and later, so that TUR thresholds due to EUC indeed exist. The plots represent the average of PBD or applications residuals in state-months that have a given TUR. When we look at PBD as a function of TUR, we can see that PBD indeed increases steeply around 6 to 6.5% TUR, which are the thresholds for EUC and EB respectively. Then again PBD increases around 8 to 8.5% TUR, which are the thresholds for EB and EUC respectively (though the EUC threshold only exists after November 2009). If PBD has a negative impact on applications, we expect applications residuals to decrease especially steeply around these same TUR thresholds. The plot shows that this is indeed the case: application residuals tend to increase with the unemployment rate, but they decrease over the same range of TUR values where PBD increases. The fact that application residuals tend to increase with the unemployment rate in the absence of a PBD increase can be explained by the fact that a higher TUR means more unemployed jobseekers, who, all other things equal, should be collectively sending more applications.

One can also exploit nonlinearities in PBD as a function of TUR prior to December 2008. During that period, EUC did not depend on TUR. As a result only EB creates nonlinearities in PBD as a function of TUR. Additionally, these nonlinearities are only present for the "always TUR" states (see Table 2). In Figure 13, I plot the PBD and applications residuals for the always TUR states, who therefore had the TUR option. We can see that as PBD increases around 6.5% TUR, applications decrease. Because of large standard errors, that decrease is not statistically significant, but it does happen at the same time as the PBD increase. The figure also plots the applications residuals for states without a TUR option at the time, and who therefore did not have a marked PBD increase around 6% TUR. We can see that, for these states, applications are gently increasing with TUR throughout, without any decrease around 6.5% TUR. This confirms that the PBD increase is the likely reason why we note a decrease in applications around 6.5% TUR for those states with a TUR option.

In Table 4, I regress log applications on PBD and a number of controls, using the whole available time period (September 2007 to July 2011), but restricting to TUR between 4 and 10%. PBD is instrumented with maximum weeks of UI as determined by rules and not taking into account EUC lapses: this is the same instrument as for the fuzzy regression discontinuity design (Table 3). In column 1, where only quarter, year and state fixed effects are used, I find a significant and negative impact of PBD on log applications, implying that a one week increase in PBD yields a 0.46% decline in applications. In column 2, I add controls for vacancies and a quadratic in TUR and IUR. The impact of PBD on applications declines slightly but remains highly significant. In column 3, I add state-specific trends: this yields a larger impact of PBD than in column 2, so that a one week increase in PBD yields a 0.4% decline in applications. This implies that the median state saw a 29% decline in applications due to PBD extensions during the Great Recession (+73 weeks).

In columns 4-6 of Table 4, I use an alternative instrument for PBD, namely the maximum weeks of UI that would be available according to rules, and assuming that all states have the TUR option. The impact of PBD on applications using this instrument is larger and less dependent on the specification used. The fact that the impact is larger than with the first instrument suggests that states that endogenously chose the TUR option have a lower impact of PDB on applications. In the specification with unemployment and vacancies controls and state-specific trends, I find that a one week increase in PBD yields a 0.57% decrease in applications.

The point estimates in Table 4 are in the same ballpark as what I found from the event study using the first month post PBD increase. In fact, the estimate in column 3, which should be fairly robust as it includes state-specific trends, is essentially identical to the event study estimate for the first month (month 0). My preferred estimate is then that a one week increase in PBD yields a 0.4% decline in applications, implying that the median state saw a 29% decline in applications due to PBD extensions during the Great Recession (+73 weeks). This is likely to be a conservative estimate for three different reasons. First, the event study shows that the impact of PBD on applications significantly increases with time elapsed since the PBD increase, and the effect is three times larger in month 3 compared to month 0. Second, the fuzzy regression discontinuity design yields estimates that are also three times larger than my preferred estimates. Third, using an instrument that takes into account endogenous take-up of the TUR option by states increases the estimated impact of PBD by 42% compared to my preferred estimate (-0.57% versus -0.4%).

I conclude that the increase in maximum weeks of unemployment benefits during the Great Recession led to a substantial decline in applications. My preferred estimate indicates that a one-week increase in the duration of benefits yields a 0.4% decline in job search effort as measured by applications.

5. Discussion

Robustness tests

One may wonder whether applications on CareerBuilder.com are a good measure of search effort. Unemployment benefit recipients during the Great Recession spent between 24 and 38% of their job search time sending applications and answering job ads (Krueger and Mueller, 2011). Additionally, 27% of job search time is spent browsing job ads. Nowadays, the overwhelming majority of vacancies are posted on the Internet (Regis Barnichon 2010). Therefore, it is plausible to think that more than two thirds of job search time is spent on the Internet. Another way to investigate whether applications capture job search effort is to gauge whether more applications lead to more hires. The idea is that, if job search effort increases, this should all other things equal lead to more hires, and therefore applications should have a positive effect on hires. To test this, I merge monthly national data on hires and vacancies from JOLTS with data on monthly national applications in CareerBuilder, and data on the total number of unemployed people from the BLS. In Table 5, column 1, I regress the log number of hires on the log number of vacancies and the log number of unemployed people (restricting data to September 2007 and later). I find that more vacancies are associated with more hires, and that more unemployment is associated with fewer hires. However, surprisingly, none of the coefficients is significant. In column 2, I add log applications from CareerBuilder to this specification, and I find that applications have a positive and significant impact on hires. Remarkably, this is the only variable that has a significant impact on hires, as the number of vacancies and the number of unemployed people remain insignificant. In as much as higher job search effort should lead to more hires, this exercise suggests that applications are a good measure of search effort.

Interpretation of the results

I have shown that the increase in the generosity of unemployment benefits during the Great Recession led to a substantial drop in job search effort. Does this make the extension of benefits a wrong-headed policy? Was the large unemployment rise during the Great Recession caused by overly generous unemployment benefits?

One can ask whether the decline in job search effort induced by higher unemployment benefits is socially harmful. There are two elements to this question: are more generous unemployment benefits socially harmful in general, and are even more generous unemployment benefits during a recession socially harmful? Independently of any business cycle consideration, there are two reasons why the duration of unemployment benefits affects job search effort: liquidity constraints and moral hazard (Card, Chetty and Weber, 2007). Assume that benefits do not affect the reservation wage, only search effort; and assume search effort is costly. Unemployment benefits decrease the income differential between employment and unemployment, and therefore reduce job search effort (liquidity effect). This liquidity effect is the unavoidable side effect of providing income support to unemployed individuals, which is the main aim of unemployment insurance. This liquidity effect occurs even if income support to the newly unemployed was not conditional on their remaining unemployed (e.g. a severance pay). Additionally, since unemployment insurance is conditional on remaining unemployed, taking a job would make one lose unemployment benefits, and hence the benefits of working are diminished relative to the case where no unemployment benefits were offered (moral hazard effect). (Chetty 2008) shows that 60% of the effect of unemployment benefits duration on unemployment duration can be explained by liquidity constraints. Therefore, liquidity constraints play an important role, and given that the Great Recession was also a credit crisis, these liquidity constraints probably played an even greater role in jobseekers' decisions. If liquidity constraints are the key reason why extended unemployment benefits decreased search effort, then the decrease in search effort can be seen as the unavoidable side effect of unemployment insurance playing its income support role at a time where such support was particularly needed due to the situation of the credit and labor markets.

Based on previous research on the reasons behind the effect of unemployment benefits on unemployment duration, I conclude that the impact of unemployment benefits on job search is not necessarily welfare decreasing. But one should also consider a newer strand of research that focuses on the idea that unemployment benefits should be higher during recessions because the impact of unemployment benefits on unemployment duration is lower during recessions (Kroft and Notowidigdo 2011; Landais, Michaillat, and Saez 2011). In particular, a working paper by Landais, Michaillat and Saez (2011) develops a model with job rationing during recessions. In their model, job search has negative externalities: if a larger number of unemployed workers search for jobs, it makes it harder for each one of them to find one of the rationed jobs. Therefore, providing a more generous UI in recessions reduces search effort, which improves welfare by addressing the negative externality. From this perspective, it is therefore possible that, by reducing the negative externality of job search effort during recessions, some of the reduction in job search effort that I document here was actually socially beneficial.

6. Conclusion

This paper has used state-level variation in the maximum weeks of unemployment benefit during the Great Recession to investigate the impact of unemployment benefits on job search effort. I measure job search effort by the number of applications received by jobs on CareerBuilder.com, the largest American employment website. I show that a one-week increase in the duration of unemployment benefits leads to a 0.4% decline in applications. This estimate implies that the average increase in benefit duration at the state-level in 2008-2009 led to a 29% decrease in applications in the median state. I find no consistent evidence for longer benefit duration increasing jobseekers' pickiness, which is consistent with prior findings of no effect of unemployment insurance on reservation wages. Additionally, my results suggest that unemployment benefit duration does not affect workers' selectivity on non wage job characteristics. My findings imply that the key mechanism through which unemployment insurance can increase unemployment duration is a reduction in job search effort.

Even if benefit extensions increased unemployment by decreasing job search effort during the Great Recession, this does not imply that this policy was socially harmful. Indeed, unemployment benefits' income replacement role entails a decline in search efforts in as much as jobseekers are credit constrained. Given the large tightening of credit during the Great Recession, income support was particularly important to help smooth consumption, and the decline in job search effort may have been a necessary evil to achieve enough consumption smoothing. Whether benefit extensions during the Great Recession were in fact higher than was necessitated by the consumption smoothing goal of unemployment insurance is an open question for future research.

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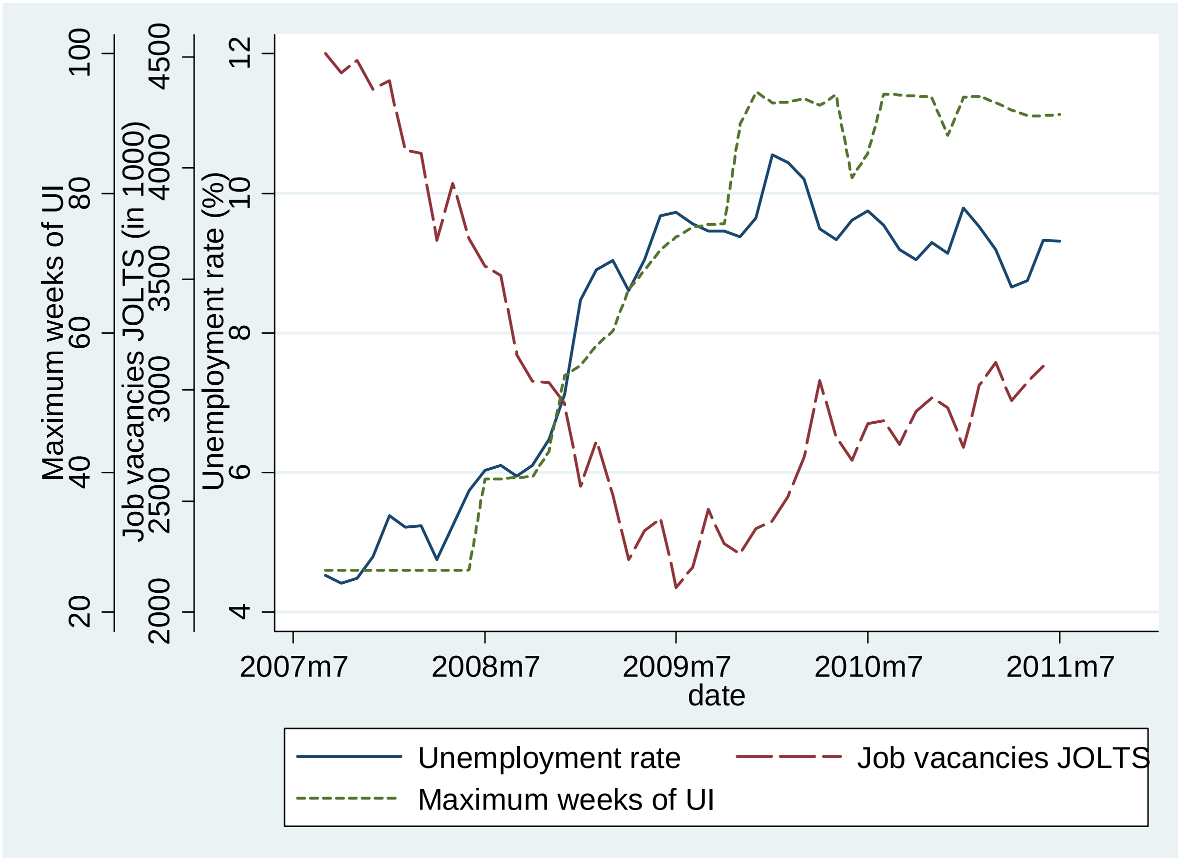
Table 1: Summary statistics

	N	mean	sd	min	max
Applications	2,397	431,725	584,975	2,424	3.179e+06
Vacancies	2,397	13,357	15,455	438	123,090
Job views (snippet)	2,397	7.560e+07	9.336e+07	1.547e+06	6.528e+08
Maximum weeks of UI	2,397	61.90	26.12	26	99
BLS unemployed numbers	2,397	242,798	319,992	5,922	2.349e+06
Unemployment rate (%)	2,397	7.138	2.557	2.325	15.20
Insured unemployment rate (%)	2,397	3.042	1.326	0.303	7.870

Note: Maximum weeks of UI are weeks of UI available in the BLS trigger notices. The unemployment rate is, for each month and state, the average of the weekly three-months seasonally adjusted unemployment rate. The insured unemployment rate is the 13-weeks insured unemployment rate.

Source: Department of Labor, and CareerBuilder.com for applications and vacancies.

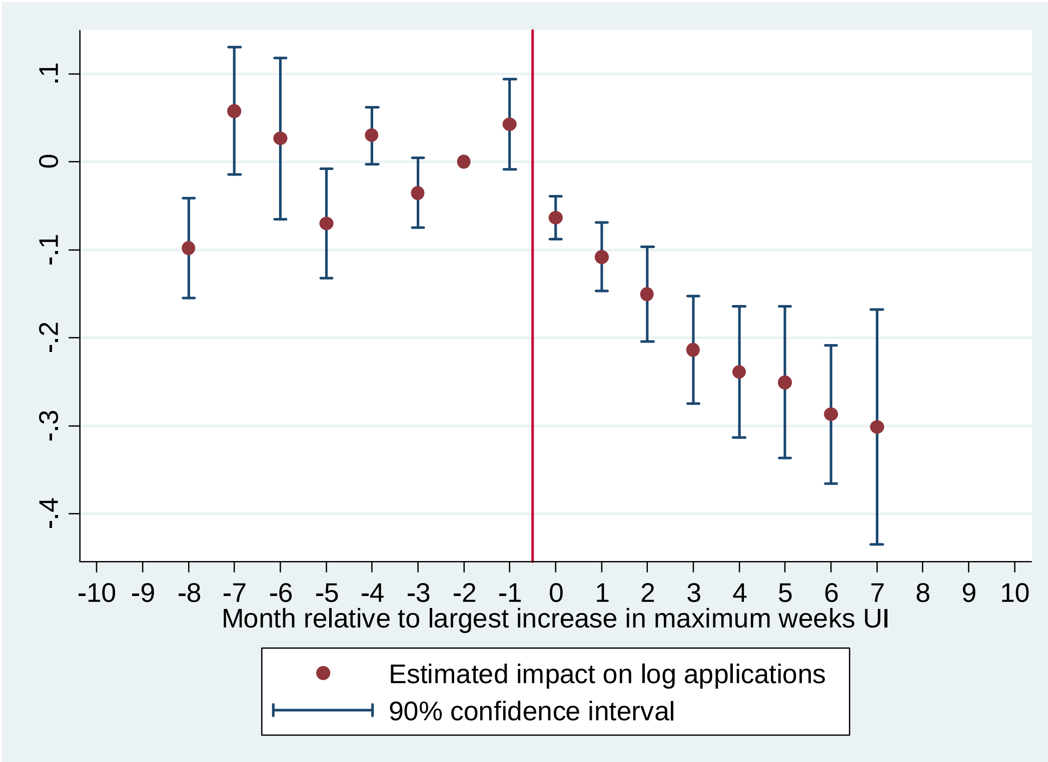
Figure 1: The evolution of the unemployment rate, job vacancies and maximum weeks of unemployment benefits at the national level



Note: Maximum weeks of unemployment benefits are calculated as an average over states, where each state is weighted accorded to the size of its labor force.

Source: Department of Labor.

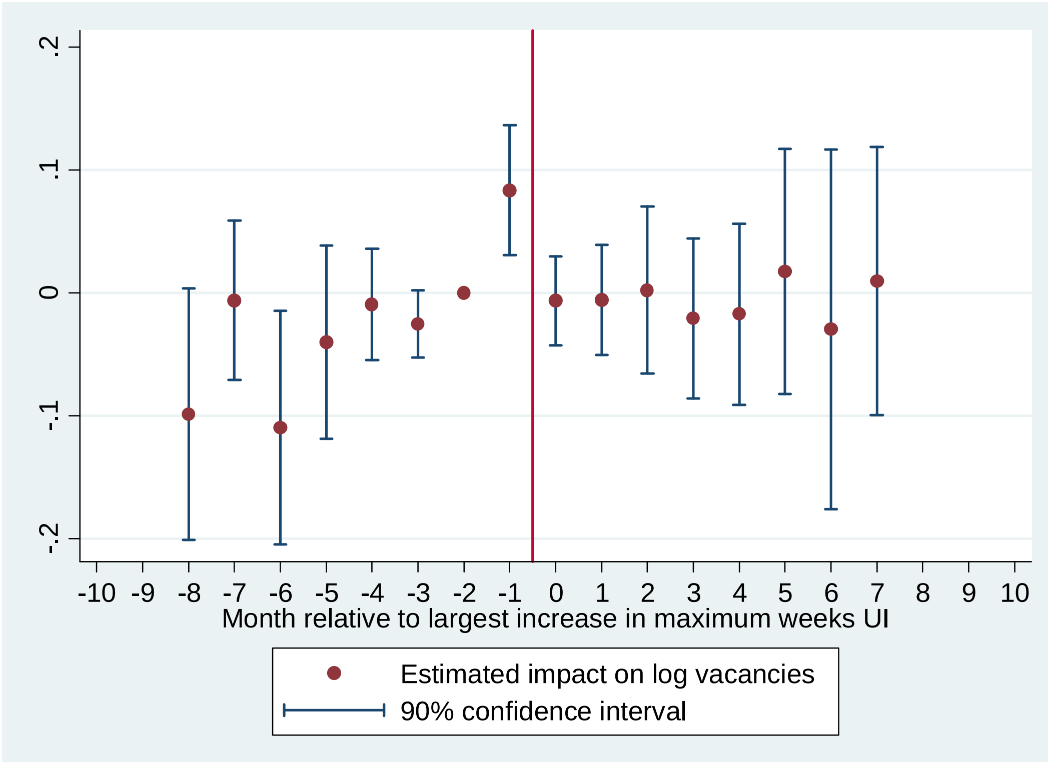
Figure 2: The impact of maximum weeks of UI on applications, event study



Note: The estimates are from a regression of log applications on relative month dummies, state, year and quarter of the year fixed effects. Standard errors are clustered by state. There are 318 observations. The largest increase in maximum weeks of UI is defined, for each state, as the largest increase that does not correspond to a change in the schedule, and is not due to a temporary interruption of EUC.

Source: Department of Labor, and CareerBuilder.com for applications.

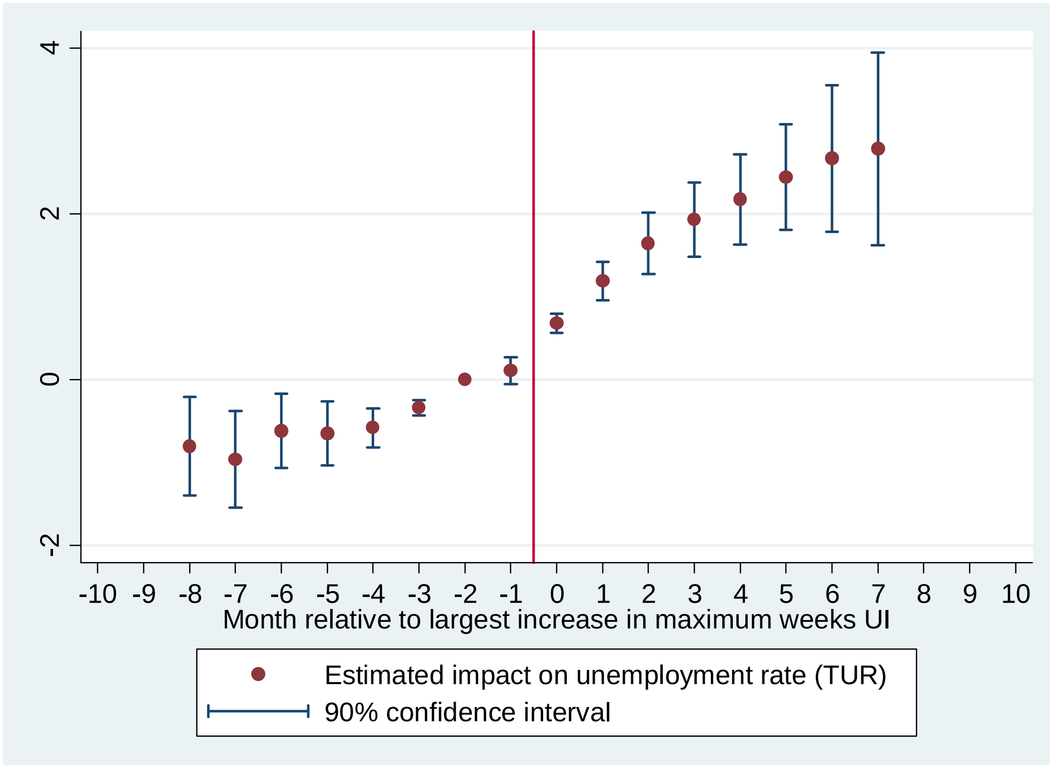
Figure 3: The impact of maximum weeks of UI on vacancies, event study



Note: The estimates are from a regression of log vacancies on relative month dummies, state, year and quarter of the year fixed effects. Standard errors are clustered by state. There are 318 observations. The largest increase in maximum weeks of UI is defined, for each state, as the largest increase that does not correspond to a change in the schedule, and is not due to a temporary interruption of EUC.

Source: Department of Labor, and CareerBuilder.com for vacancies.

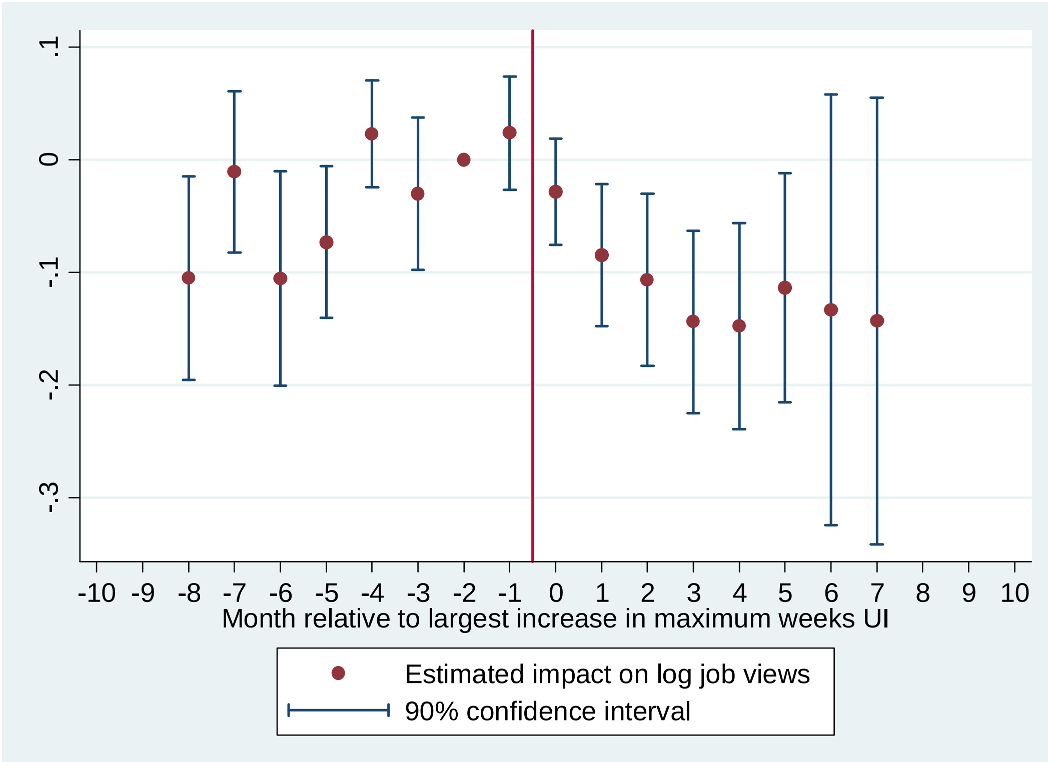
Figure 4: The impact of maximum weeks of UI on the unemployment rate, event study



Note: The estimates are from a regression of the 3-month average total unemployment rate on relative month dummies, state, year and quarter of the year fixed effects. Standard errors are clustered by state. There are 318 observations. The largest increase in maximum weeks of UI is defined, for each state, as the largest increase that does not correspond to a change in the schedule, and is not due to a temporary interruption of EUC.

Source: Department of Labor.

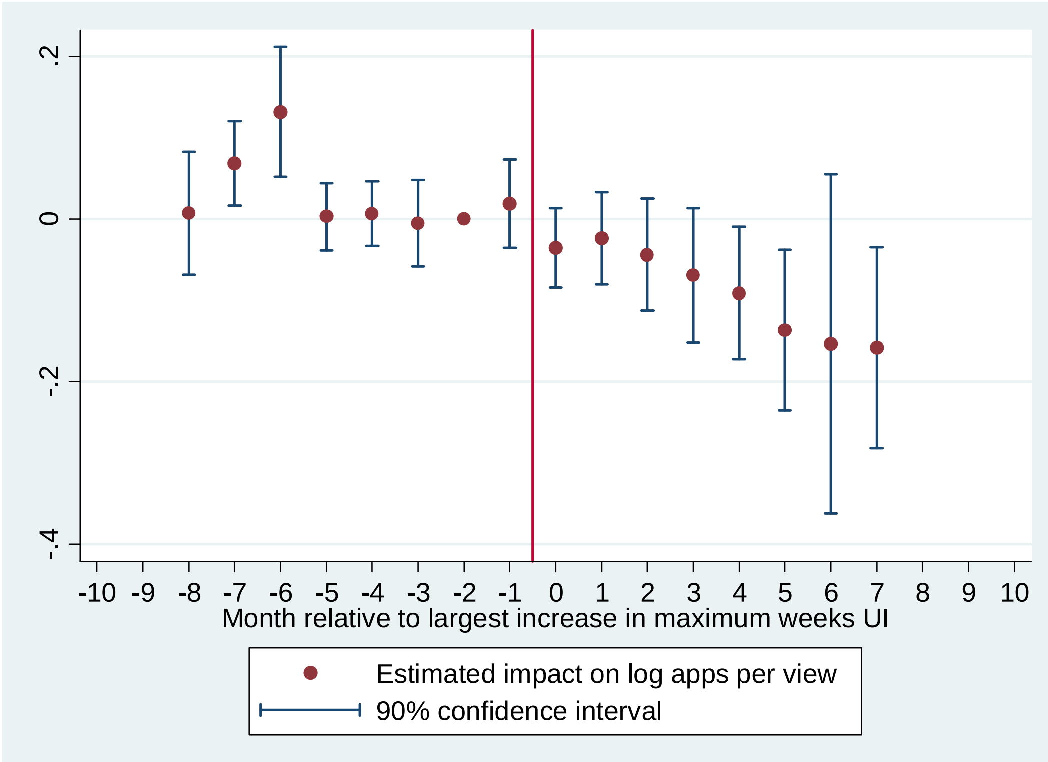
Figure 5: The impact of maximum weeks of UI on job views, event study



Note: The estimates are from a regression of log job views on relative month dummies, state, year and quarter of the year fixed effects. Standard errors are clustered by state. There are 318 observations. The largest increase in maximum weeks of UI is defined, for each state, as the largest increase that does not correspond to a change in the schedule, and is not due to a temporary interruption of EUC.

Source: Department of Labor, and CareerBuilder.com for job views.

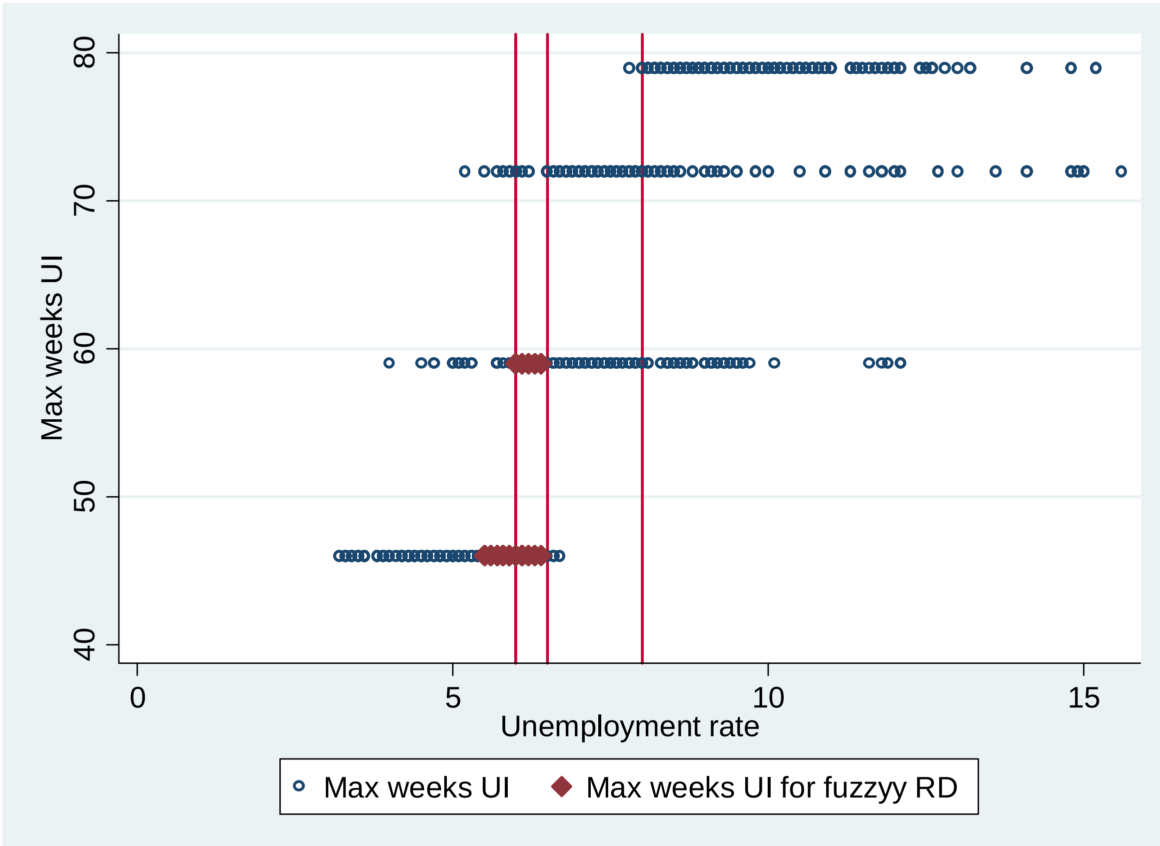
Figure 6: The impact of maximum weeks of UI on applications per job view, event study



Note: The estimates are from a regression of log applications per job view on relative month dummies, state, year and quarter of the year fixed effects. Standard errors are clustered by state. There are 318 observations. The largest increase in maximum weeks of UI is defined, for each state, as the largest increase that does not correspond to a change in the schedule, and is not due to a temporary interruption of EUC.

Source: Department of Labor, and CareerBuilder.com for applications and job views.

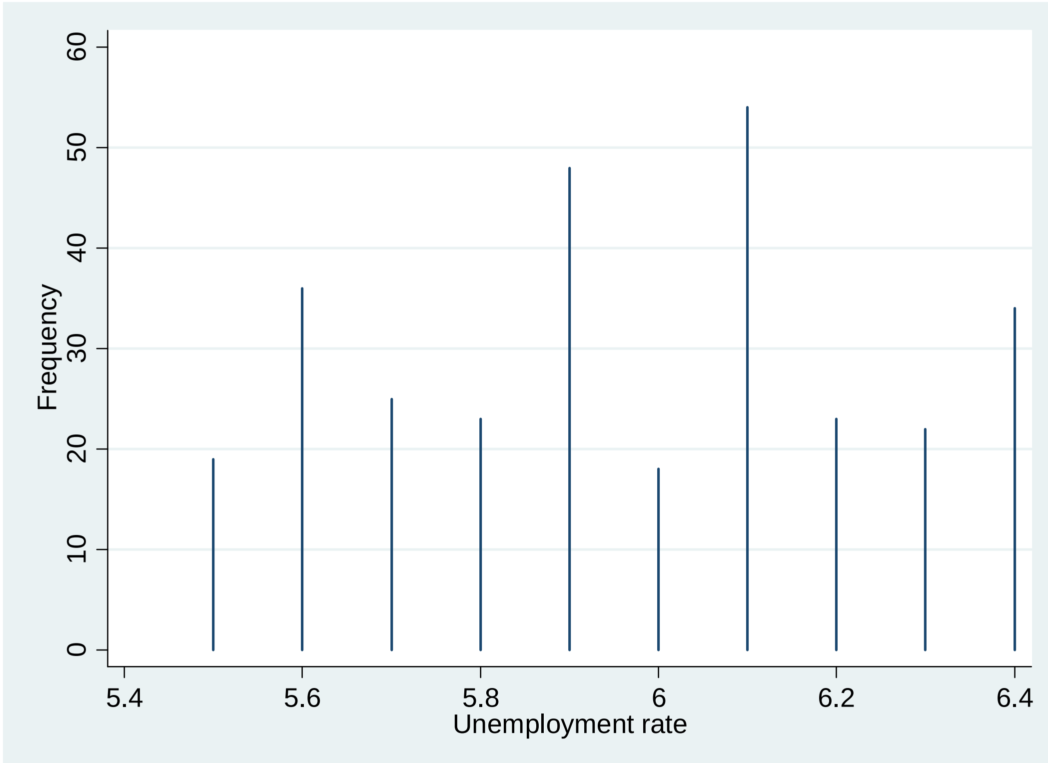
Figure 7: Maximum weeks of UI as a function of TUR, weekly level data, December 2008 to October 2009



Note: Each circle corresponds to a state and week. The unemployment rate is the three-months seasonally adjusted total unemployment rate (TUR). The diamonds correspond to the states and weeks that are retained for the fuzzy regression discontinuity graphs and regressions.

Source: Department of Labor.

Figure 8: The distribution of the unemployment rate (TUR) in the fuzzy RD sample, weekly level data



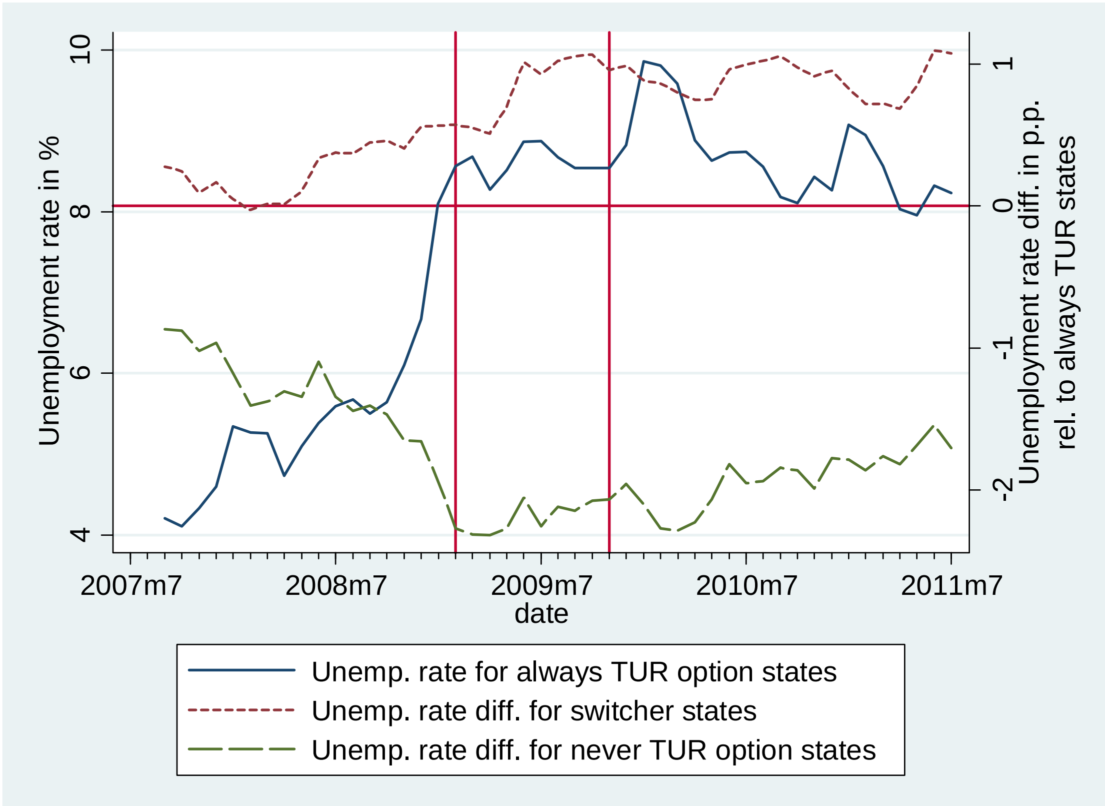
Note: The unemployment rate is the three-months seasonally adjusted total unemployment rate (TUR).

Source: Department of Labor.

Table 2: States' choice of the TUR option for extended benefits

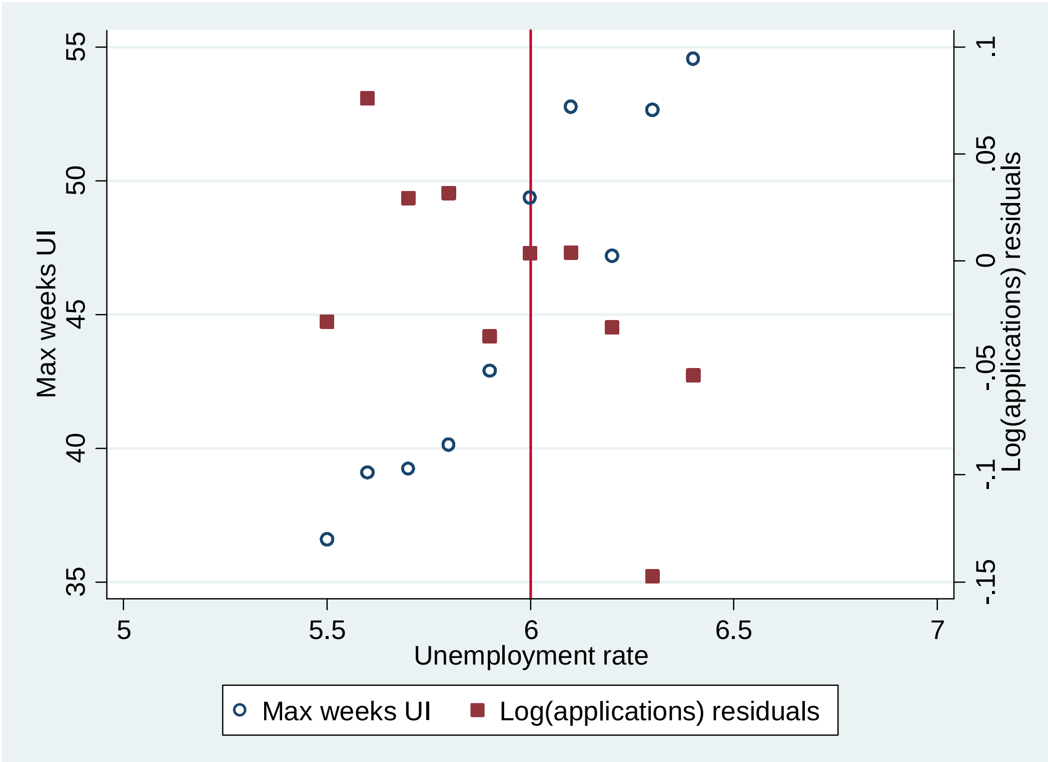
Always TUR option for extended benefits	Early switcher: March 2009 to May 2009	Late switcher: June 2009 to November 2009	Never TUR option for extended benefits
Alaska	Arizona	Alabama	Arkansas
Connecticut	California	Colorado	Hawaii
Kansas	District Of Columbia	Delaware	Iowa
New Hampshire	Georgia	Florida	Louisiana
New Jersey	Idaho	Illinois	Maryland
New Mexico	Kentucky	Indiana	Mississippi
North Carolina	Maine	Massachusetts	Montana
Oregon	Michigan	Missouri	Nebraska
Rhode Island	Minnesota	New York	North Dakota
Vermont	Nevada	Pennsylvania	Oklahoma
Washington	Ohio	South Carolina	South Dakota
	Virginia	Tennessee	Utah
		Texas	Wyoming
		West Virginia	
		Wisconsin	

Figure 9: The selection of states into the TUR option for extended benefits and the unemployment rate



Source: Department of Labor.

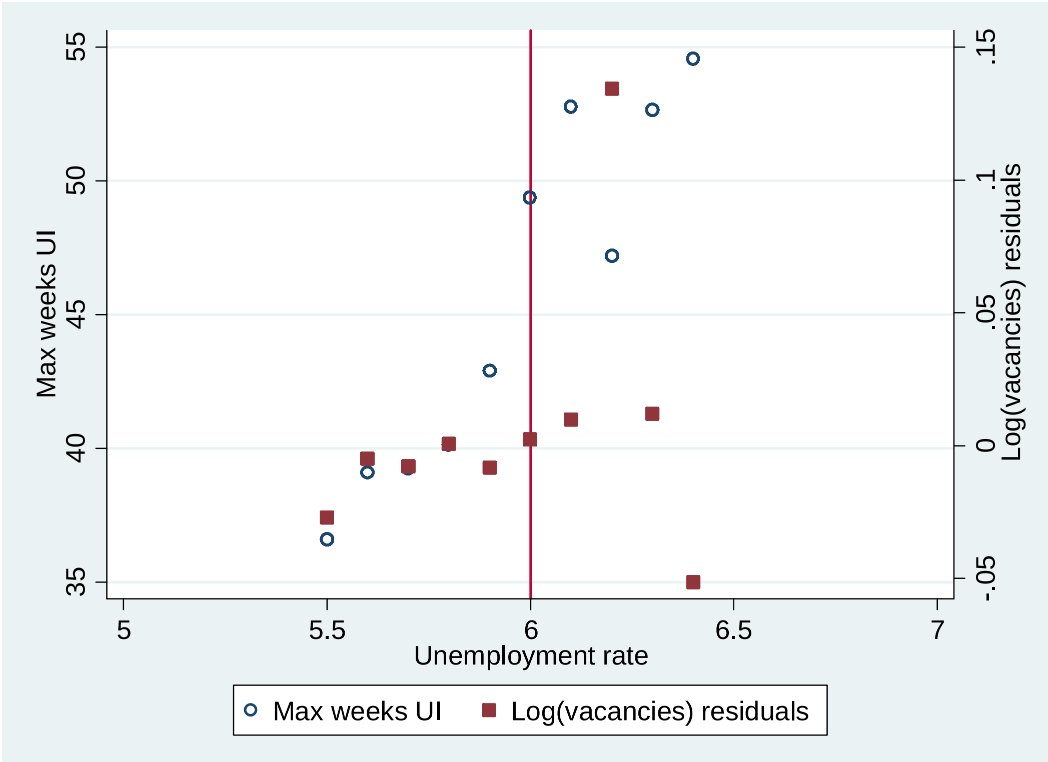
Figure 10: Maximum weeks of UI and applications around 6% unemployment rate (TUR), monthly data



Note: The applications residual is obtained after regressing log applications on state fixed effects. The unemployment rate is the monthly average of the three-months seasonally adjusted total unemployment rate (TUR). The applications residuals and the maximum weeks of UI are averaged over 0.1 percentage point TUR bins.

Source: Department of Labor, and CareerBuilder.com for applications.

Figure 11: Maximum weeks of UI and vacancies around 6% unemployment rate (TUR), monthly data



Note: The vacancies residuals are obtained after regressing log applications on state fixed effects. The unemployment rate is the monthly average of the three-months seasonally adjusted total unemployment rate (TUR). The vacancies residuals and the maximum weeks of UI are averaged over 0.1 percentage point TUR bins.

Source: Department of Labor, and CareerBuilder.com for vacancies.

Table 3: The impact of maximum weeks of UI on applications, fuzzy regression discontinuity

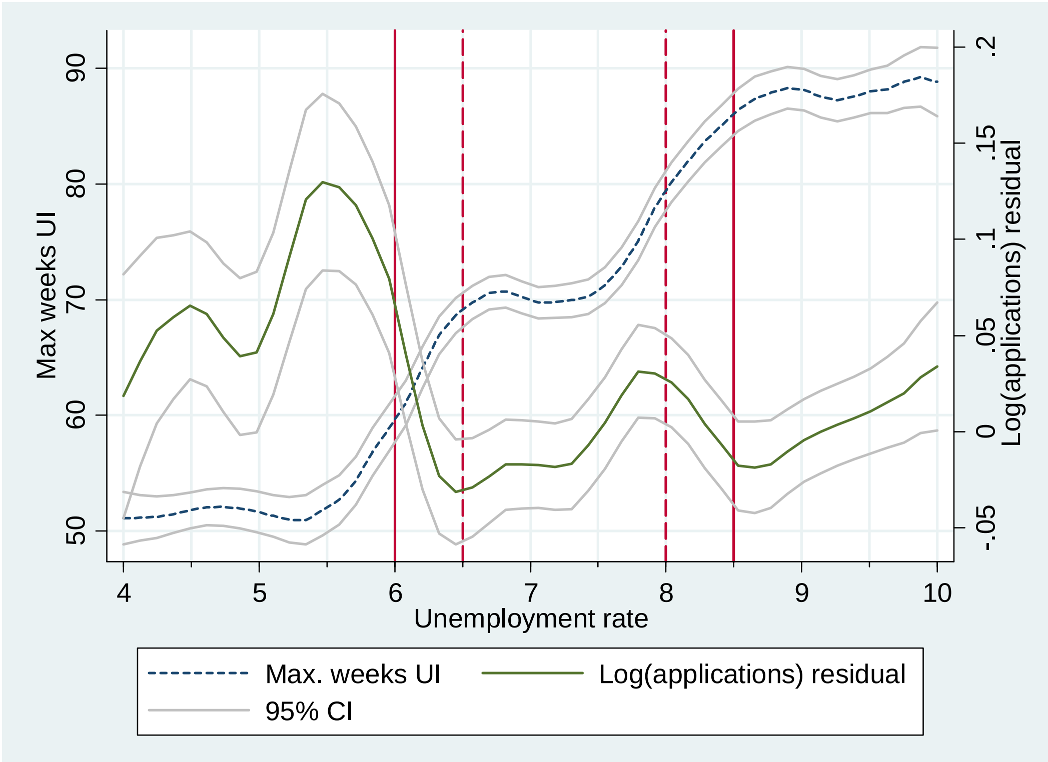
	(1)	(2)	(3)
Maximum weeks of UI	-0.0136*	-0.0197***	-0.0123
	(0.0076)	(0.0054)	(0.0124)
Log(vacancies)		0.9539***	0.9104***
		(0.2594)	(0.2787)
Unemployment rate			-0.1471
			(0.2627)
Observations	44	44	44
R-squared	0.997	0.999	0.999

Robust standard errors clustered by state in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include state and year fixed effects.

Note: Instrumental variables regressions. The instrument is maximum weeks of UI according to statutory rules.

Source: Department of Labor, and CareerBuilder.com for applications and vacancies.

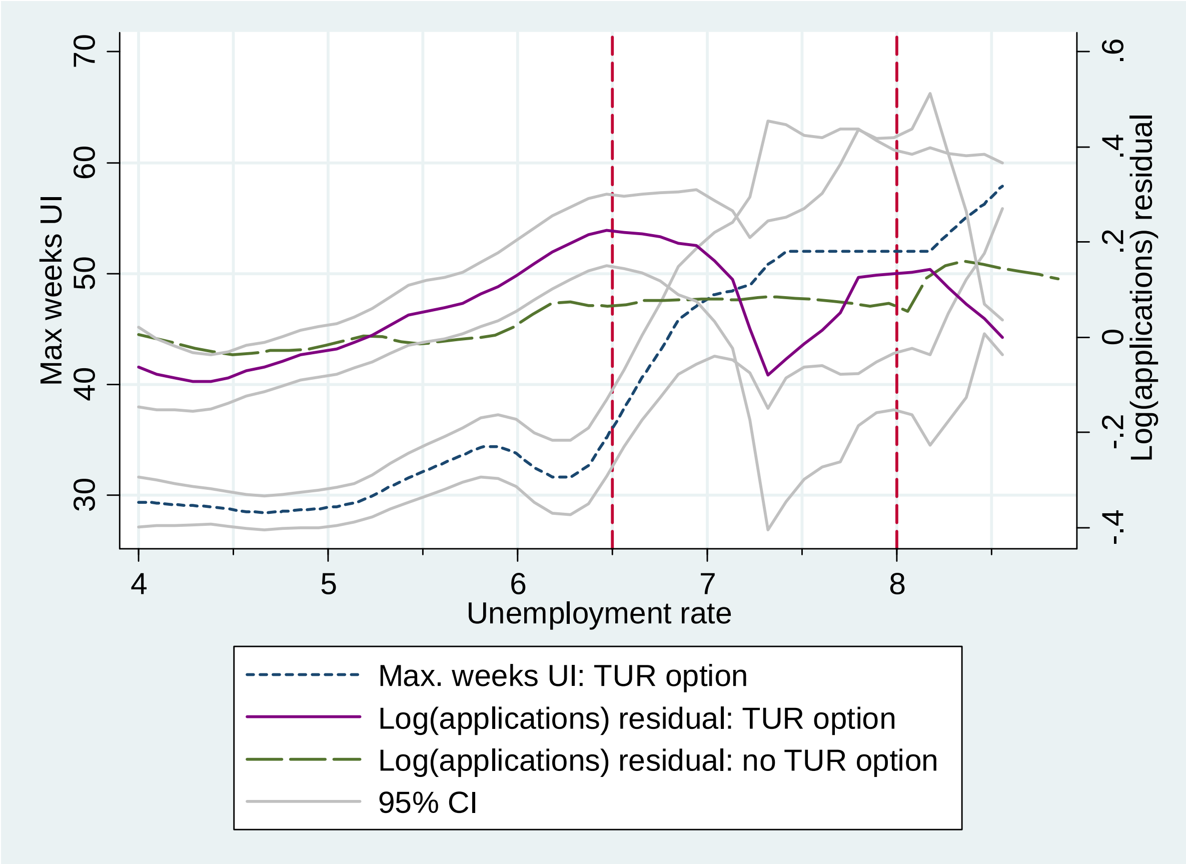
Figure 12: Maximum weeks of UI and applications as a function of the unemployment rate (Dec. 2008 onwards)



Note: Data is smoothed using kernel-weighted local polynomial smoothing with a 0.2 bandwidth. The applications residual is obtained after regressing log applications on state fixed effects. The unemployment rate is, for each month and state, the maximum of the weekly three-months seasonally adjusted unemployment rate. The two solid vertical lines correspond to 6% unemployment rate (threshold for EUC2 when it was conditional, and for EUC3), and 8% unemployment rate (threshold for EUC4). The two dashed vertical lines correspond to 6.5% unemployment rate (threshold for 13 weeks extended benefits when the TUR option is active) and 8% unemployment rate (threshold for 20 weeks extended benefits when the TUR option is active).

Source: Department of Labor, and CareerBuilder.com for applications.

Figure 13: Maximum weeks of UI and applications residuals as a function of the unemployment rate (before Dec. 2008)



Note: Data is smoothed using kernel-weighted local polynomial smoothing with a 0.2 bandwidth. States that had a TUR option before Dec. 2008 are the following: Alaska, Connecticut, Kansas, New Hampshire, New Jersey, New Mexico, North Carolina, Oregon, Rhode Island, Vermont, Washington. The applications residual is obtained after regressing log applications on state fixed effects. The unemployment rate is, for each month and state, the maximum of the weekly three-months seasonally adjusted unemployment rate. The two dashed vertical lines correspond to 6.5% unemployment rate (threshold for 13 weeks extended benefits when the TUR option is active) and 8% unemployment rate (threshold for 20 weeks extended benefits when the TUR option is active).

Source: Department of Labor, and CareerBuilder.com for applications.

Table 4: The Impact of maximum weeks of UI on log applications, TUR discontinuity samples

	IV1			IV2		
	(1)	(2)	(3)	(4)	(5)	(6)
Maximum weeks of UI	-0.0046***	-0.0030***	-0.0040***	-0.0063***	-0.0053***	-0.0057***
	(0.0007)	(0.0009)	(0.0006)	(0.0010)	(0.0016)	(0.0009)
Log(vacancies)		0.2988***	0.2639***		0.2833***	0.2436***
		(0.0451)	(0.0332)		(0.0471)	(0.0358)
Total Unemployment Rate (TUR)		0.0316	0.0439		0.0373	0.0402
		(0.0620)	(0.0443)		(0.0653)	(0.0452)
TUR^2		-0.0017	-0.0047		-0.0011	-0.0041
		(0.0037)	(0.0029)		(0.0038)	(0.0029)
Insured Unemployment Rate (IUR)		-0.0293	-0.0796***		-0.0298	-0.0906***
		(0.0415)	(0.0284)		(0.0418)	(0.0305)
IUR^2		0.0010	0.0113***		0.0020	0.0141***
		(0.0057)	(0.0034)		(0.0058)	(0.0037)
State-specific trends			X			X
Observations	1,804	1,804	1,804	1,804	1,804	1,804
R-squared	0.9929	0.9938	0.9957	0.9926	0.9936	0.9955

Robust standard errors clustered by state in parentheses
*** p<0.01, ** p<0.05, * p<0.1
All regressions include state, year and quarter fixed effects.

Note: In columns 1-3, the instrument is maximum weeks of UI according to statutory rules, and not taking into account temporary EUC expirations. In columns 4-6, the instrument is maximum weeks of UI according to statutory rules, not taking into account temporary EUC expirations, and assuming that all states take up the TUR option. The total unemployment rate (TUR) is, for each month and state, the average of the weekly three-months seasonally adjusted unemployment rate. The insured unemployment rate (IUR) is, for each month and state, the average of the weekly 13-weeks insured unemployment rate.

Source: Department of Labor, and CareerBuilder.com for applications and vacancies.

Table 5: Hires, unemployment and applications: national data, September 2007 to July 2011

	(1) Hires	(2) Hires
Vacancies	0.2747	0.2552
	(0.1925)	(0.1748)
Applications		0.3425**
		(0.1366)
Unemployed count	-0.1370	-0.1749
	(0.1477)	(0.1395)
Constant	8.3490**	3.3230
	(3.8132)	(4.0137)
Observations	46	46
R-squared	0.2950	0.3914

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: All variables are in logs. Hires and vacancies are from JOLTS. Unemployed is the number of unemployed people nationally.

Source: Department of Labor, and CareerBuilder.com for applications.