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Abstract

We develop a method to jointly measure the response of worker search effort (individual effect) and vacancy creation (market-level effect) to changes in the duration of unemployment insurance (UI) benefits. To implement this approach, we exploit an unexpected cut in UI durations in Missouri and provide quasi-experimental evidence on the effect of UI on the labor market. The data indicate that the cut in Missouri significantly increased job finding rates by both raising the search effort of unemployed workers and the availability of jobs. The latter accounts for at least a third and up to 100 percent of the total effect.

Key words: unemployment insurance, unemployment, vacancies, search

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1 Introduction

Extending unemployment insurance (UI) benefits is one of the most commonly used macroeconomic stabilization tools in the United States. In nearly every post-War recession policymakers have increased the potential maximum duration of UI benefits. After the unemployment rate eclipsed 10% in late 2009, UI benefits were extended to an unprecedented 99 weeks. Total UI payments exceeded one percent of GDP in 2009 and 2010.

Not surprisingly, this dramatic policy response renewed interest in studying the effects of UI benefits and the mechanisms through which they operate. Early Great Recession studies (Rothstein, 2011) followed the classic labor literature in focusing on identifying the search responses of individuals in response to changes in benefits. Hagedorn et al. (2013) pointed out that equilibrium labor market theory implies that vacancy creation decisions of firms, in addition to worker search behavior, respond to changes in UI benefits. A simple decomposition they provide helps illustrate these margins:

$$\text{Job finding rate}_{it} = \underbrace{s_{it}}_{\text{search behavior}} \times \underbrace{f(\theta_t)}_{\text{job finding rate per unit of search}}$$

The first channel operates through labor supply by altering job search behavior s_{it}, which captures the search intensity and pickiness of unemployed workers. A large literature has estimated negative effects on labor supply of varying magnitudes in response to UI extensions. We label this channel as the individual effect. The second captures changes in labor demand for all workers. Firms reduce labor demand if workers search less, because lower search effort implies a lower probability of finding a worker for the firm. Moreover, benefit extensions generate upward pressures in wages, reduce profits and therefore reduce the demand for labor in equilibrium. We label this channel that alters the job finding rate of all workers in the same market as the market-level effect. Thus, a complete evaluation of the effect of UI policies requires measurement of both margins.

The study by Hagedorn et al. (2013) provided the genesis for a large literature trying to identify the total effect of the policy (Chodorow-Reich et al., 2018; Farber et al., 2015; Hagedorn et al., 2015) that has reached conflicting conclusions. However, none of that literature has attempted to separately measure the market-level and individual effects, only the sum of the total effect of UI on labor market outcomes.

Understanding the relative contribution of the individual and market-level effects is essential for the normative evaluation of UI policies. As Mitman and Rabinovich (2015) and Landais et al. (2018) show, the optimal generosity of UI depends critically on the relative response of job search and vacancy creation. If vacancy creation responds more to a change in

UI relative to worker search effort, labor-market tightness will fall, implying that UI policy should be pro-cyclical, and vice-versa. Therefore, the design of an appropriate policy response to adverse macroeconomic shocks relies on understanding the quantitative relevance of these two channels. The objective of this paper is to provide the first such decomposition.

We start by developing a methodology for decomposing the total effect of UI policies on job finding rates into individual and market-level effects by imposing minimal assumptions. We assume that hires are determined by a matching function that combines a given number of vacancies V_t and aggregate search $S_t = s_t U_t$ into H_t hires. If the matching function exhibits constant returns to scale, the (log) change of the vacancy filling rate can be expressed as a weighted sum of the changes in search effort s_t and the vacancy-unemployment ratio V_t/U_t. Our two-step decomposition strategy first measures the effect of UI extensions on the vacancy-filling rate H_t/V_t and the vacancy-unemployment ratio separately, and then uses the relationship derived from the matching function to infer the response of search effort and market tightness.[1] With these estimates at hand, we can then quantify the effect of benefit extensions on the job finding rate and to unemployment through the job finding margin.

To this end, we follow innovative work by Johnston and Mas (2018), and exploit an unexpected 6-week cut in the maximal UI duration in Missouri in 2011. That reduction in state-funded UI triggered an additional 10-week cut in federally-financed benefits from the Emergency Unemployment Compensation Act of 2008. Importantly, as Johnston and Mas (2018) document, this policy change was sudden and unanticipated, and therefore provides a quasi-experimental setting to study the labor market implications of UI extensions.[2]

The key challenge for estimating the effect of the policy change in Missouri is inferring the counterfactual dynamics of labor-market outcomes in Missouri in the absence of the cut. We follow the synthetic control method of Abadie and Gardeazabal (2003) and Abadie et al. (2010) and construct a synthetic control state for Missouri, given by a weighted average of other states. During the Great Recession, states varied in the timing, magnitude and types of shocks they faced. These weights are chosen optimally so that the control state mimics a number of outcomes in Missouri in the period leading up to the unexpected UI cut in April 2011. We verify the robustness of our results to alternative implementations of the synthetic control methodology and an average of all other U.S. States excluding Missouri.

To implement this synthetic control approach, we construct a quarterly state-level dataset of hires from the Quarterly Workforce Indicators (QWI), vacancies from the Help Wanted

[1] We also provide a discussion of how firm search effort or *recruiting intensity* would affect our decomposition.

[2] Johnston and Mas (2018) focus on identifying the effect of worker search effort using a regression discontinuity design (RDD) by comparing individuals that were laid off just before and after the policy change. We see our approach as complementary to theirs.

Online (HWOL) and the unemployment rate from the Local Area Unemployment Statistics (LAUS), which we supplement with data on the maximum duration of unemployment benefits for states during the Great Recession constructed using weekly trigger reports published by the Bureau of Labor Statistics.[3]

Our baseline results indicate that the UI cut in April 2011 led to a gradual increase of 13% in the vacancy-unemployment ratio. Consistent with our findings, Hagedorn et al. (2013) compare the evolution of the vacancy-unemployment ratio in Missouri with states that border it and find that relative to those states the ratio jumps after the cut. Assuming that the cut lasts until the end of the EUC at the end of 2013, the elasticity of the vacancy-unemployment ratio with respect to a one-quarter cut in UI duration of -0.1 estimated in Hagedorn et al. (2013) implies an increase in the vacancy-unemployment around 16%, which is consistent with the evidence here. Following the policy change, the vacancy filling rate dropped immediately by 5% relative to the synthetic control—signifying a tightening of the labor market in Missouri, as the vacancy-filling rate is inversely related to labor market tightness. In standard labor market theory, vacancies are a jump variable, so we would expect tightness to jump immediately, even if unemployment as a stock variable evolves more slowly in response to the policy change.

We then implement our decomposition to infer the response of search effort and market tightness. We find that market tightness rose by 8%. This estimate corresponds to an elasticity of market tightness of around -0.3. Our preferred estimate infers that search effort rose in response to the UI cut as well, by around 1.8%, consistent with Johnston and Mas (2018). The tightening of the labor market and the increase in search effort led to a higher job finding rate in Missouri. We find that this increase induced by the policy change was 11.1%. Under our most conservative estimate of the increase in the job finding rate, we conclude that at least one third is due to market-level effects through tightness and the remaining part is due to higher search effort.

This paper contributes to a large literature that studies the labor market effects of unemployment benefit policies (see, for example, Feldstein (1978), Ham and Rea Jr (1987), Katz and Meyer (1990), Meyer (1990) and Card and Levine (2000)). Despite the importance of separating micro and macro effects for optimal design, we know little about the relative magnitudes of these channels with a few notable exceptions. Johnston and Mas (2018) identify the effect on worker search effort directly using a regression discontinuity design, whereas we use a synthetic control approach to measure the effect on market tightness and measure the

[3] We verify that the dynamics of unemployment at the state level in LAUS are consistent with those measured in micro data from the Current Population Survey (CPS). See Appendix B. The data on unemployment benefit duration were constructed by Hagedorn et al. (2013).

effect on search effort as a residual. Lalive et al. (2015) argue that unemployment insurance policies create sizable market externalities, whereby extensions of UI durations raise the job finding rate of workers not eligible for UI. It is worthwhile to note that they study a policy change in Austria, which effectively served as a bridge early-retirement program for workers in the steel industry. Finally, Marinescu (2017) uses state-level variation in potential UI durations and finds that UI extensions lead to lower search at the state level and no change in the number of vacancies. See Hagedorn et al. (2016) for a more thorough review of recent quasi-experimental studies on the effects of UI benefit extensions.

The rest of the paper is organized as follows. Section 2 develops the methodology, Section 3 discusses the data and the findings, and Section 4 concludes.

2 Measuring individual and market-level effects

We assume that matches between vacancies and unemployed workers are formed via a constant returns to scale matching function $M(V_t, S_t)$, where V_t is vacancies and $S_t = s_t \times U_t$ is the effective units of search.[4] The number of hires in a given period is given by the number of matches, $H_t = M(V_t, S_t)$.

The job-finding rate per effective unit of search is given by

$$f(\theta_t) = \frac{M(V_t, S_t)}{S_t} = M(\theta_t, 1),$$

where $\theta_t = V_t/S_t$ is the labor market tightness. The vacancy filling rate can be analogously expressed as:

$$q(\theta_t) = \frac{M(V_t, S_t)}{V_t} = M\left(1, \frac{1}{\theta_t}\right) = \frac{f(\theta_t)}{\theta_t}.$$

The constant returns assumption implies that labor market tightness is also given by the ratio of the job finding rate per unit of search to the vacancy filling rate: $\theta_t = f(\theta_t)/q(\theta_t)$. It is exactly this relationship that we exploit to infer the response of search effort. We further assume that the matching function has a Cobb-Douglass form $M(V, S) = \chi V^\alpha S^{1-\alpha}$, where χ is the efficiency of the matching function and α is its elasticity with respect to vacancies. Taking logs of the θ_t expression and recognizing that $q_t = H_t/V_t$, we obtain:

$$\log\left(\frac{H_t}{V_t}\right) = \log(\chi) - (1-\alpha)\log\left(\frac{V_t}{U_t}\right) + (1-\alpha)\log(s_t). \tag{1}$$

Our main empirical specification compares the evolution of H_t/V_t and V_t/U_t in Missouri,

[4] s_t is the average search effort per unemployed worker.

which featured a plausibly exogenous cut in UI benefits, to a synthetic control that did not experience a similar cut. Assuming the elasticity of the matching function is common across states and that the (potentially state-specific) matching efficiency is invariant to UI durations, this difference is given by

$$\Delta \log \left(\frac{H_t}{V_t} \right) = (1-\alpha)\Delta \log (s_t) - (1-\alpha)\Delta \log \left(\frac{V_t}{U_t} \right). \tag{2}$$

Here Δ denotes the difference operator between Missouri and the synthetic control. Note that we observe V_t, H_t, and U_t directly in the data. Thus, conditional on a value for α, we can measure the effect of the policy change on search effort as a residual using equation (2).[5] Specifically,

$$\beta_s = \frac{1}{1-\alpha}\beta_{H/V} + \beta_{V/U}. \tag{3}$$

Here, β_s, $\beta_{V/U}$ and $\beta_{H/V}$ are the effect of the policy change on job search effort, the vacancy-unemployment ratio and the vacancy filling rates, respectively. Equation 3 exploits the fact that the vacancy filling rate is only a function of market tightness, whereas unemployment is also a function of search effort. Therefore, we infer a change in search effort to the extent that the vacancy-unemployment ratio responds by more than the vacancy filling rate (scaled appropriately as in equation (3)).

The effect of policy on tightness β_θ can be inferred from its effect on the vacancy filling rate. Because the matching efficiency does not respond to policy, changes in the vacancy filling rate are driven only by tightness; i.e. $\Delta \log \theta = \Delta \log(H/V)/(\alpha - 1)$. It follows that

$$\beta_\theta = -\frac{\beta_{H/V}}{1-\alpha}. \tag{4}$$

Finally, we can calculate the impact of the policy on the job finding rate as the sum of the

[5] Davis et al. (2013) have recently highlighted the importance of *recruiting effort* or firm search effort in explaining aggregate fluctuations in the labor market. Gavazza et al. (2018) show quantitatively that this channel was important for labor market dynamics during the Great Recession. Adapting our methodology to accommodate recruiting intensity (where now effective vacancies $V_t^* = e_t V_t$) would yield:

$$\Delta \log \left(\frac{H_t}{V_t} \right) = (1-\alpha)\Delta \log (s_t) + \alpha \Delta \log (e_t) - (1-\alpha)\Delta \log \left(\frac{V_t}{U_t} \right).$$

Thus, what we attribute to search effort can be interpreted as the combination of worker search and recruiting intensity. Theory implies that both move in the same direction in response to a change in UI, thus the sign of the empirical response is indicative for both worker effort and recruiting intensity and the magnitude can be interpreted as the total "search effort" (by both workers and firms) response.

individual and equilibrium effects.

$$\beta_{\text{job finding rate}} = \underbrace{\beta_s}_{\text{individual}} + \underbrace{\alpha\beta_\theta}_{\text{market-level}} = \beta_{V/U} + \beta_{H/V} \tag{5}$$

Note that the effect on the job finding rate is independent of the matching function elasticity. We use Equation (5) to calculate and decompose this effect into the individual and market-level components.

3 Empirical Analysis

We begin this section by giving a brief overview of the sudden cut in UI durations in Missouri. Next we describe the data sources followed by the details of the empirical analysis.

3.1 Institutional Background

Unemployment insurance in the U.S. is a federally-regulated program administered by the individual states. Eligible jobless workers ordinarily receive UI benefits for up to 26 weeks while unemployed.[6]

During the Great Recession, two programs provided extended benefits: Extended Benefits (EB) and Emergency Unemployment Compensation (EUC). EB allows for 13 to 20 extra weeks of benefits to workers that have exhausted their regular benefits. At the onset of the recession, half of the cost of the program was paid for by the federal government, which included a set of triggers that the states can adopt. Initially, many states including Missouri adopted high triggers. As a result of the American Recovery and Reinvestment Act, which made EB fully federally funded through December 2013, Missouri (and other states) enacted legislation that would increase EB duration from 13 to 20 weeks. EUC, on the other hand, was federally funded from the onset. The program eventually had 4 tiers, providing potentially 53 weeks of additional benefits. The availability of each tier depended on state unemployment rates.

Four Missouri state senators filibustered the receipt of additional funds through the EB program. To end the filibuster, the legislature brokered a compromise which would cut regular benefits from 26 to 20 weeks in exchange for the state accepting federal funds and maintaining extended benefits for the long-term unemployed. Effectively, Missouri instituted shorter UI-durations in the long run while allowing extended benefits for the already-long term unemployed. As Johnston and Mas (2018) describe, the unanticipated legislation was

[6] Some states can offer longer durations.

passed and took effect a mere five days after media first reported of a compromise including potential cuts to regular benefits.

Because federal regulations calculate federal benefits administered during times of high unemployment relative to regular state UI benefits, the cut triggered an additional 10-week reduction in emergency benefits. Thus, claimants approved for UI by April 13, 2011 could receive benefits for a maximum of 73 weeks. Those approved after April 13 were only eligible for a maximum of 57 weeks. Johnston and Mas (2018) note that the shortened potential UI duration did not coincide with any other change in the state's UI system, such as change in program administration or search requirements.

3.2 Data

We compile state level data on unemployment, hires, vacancies and unemployment benefit durations for the period 2008-2013. Data on number of unemployed residents come from the Local Area Unemployment Statistics (LAUS) provided by the Bureau of Labor Statistics.[7] Data on hires are obtained from the Quarterly Workforce Indicators (QWI).[8] Total hires equal the number of workers who started a new job in the specified quarter, while "new hires" are hires who were not employed by that employer in any of the previous four quarters. Additionally, QWI also records the number of stable hires in a quarter, defined as hires which last at least one full quarter with a given employer. Thus, our data include corresponding measures for total stable hires and new stable hires. Unlike monthly unemployment counts, hires data is only available at a quarterly frequency. The QWI is constructed using micro data from the Longitudinal Employer-Household Dynamics (LEHD), which covers over 95% of U.S. private sector jobs via a partnership between state labor market information agencies and the Census Bureau. The QWI supplies data for all states since at least 2010, although some states entered the partnership as early as 1990.

We obtain vacancy data from the Help Wanted OnLine (HWOL) dataset provided by The Conference Board (TCB). This monthly series covers the universe of unique vacancies advertised on around 16,000 online job boards and online newspaper editions.[9] The data, which begin in May 2005, measure newly created vacancies in a given month as well as total vacancies—the sum of all openings, both extant and new. Each observation in the HWOL database refers to a unique online advertised vacancy. Our analysis is based only on approximately 98% of all online vacancies that are uniquely matched by TCB to a county

[7] https://download.bls.gov/pub/time.series/la/
[8] https://lehd.ces.census.gov/data/qwi/
[9] Duplicate postings are identified and removed by TCB.

of prospective employment.[10] One advantage of the HWOL compared to the Job Openings and Labor Turnover Survey is geographic granularity—while JOLTS is aggregated to four broad Census regions, vacancies are documented at the county level by HWOL (Şahin et al., 2014).

Due to the frequency of the QWI, monthly data on the employed and unemployed stocks from the CPS and vacancies from HWOL must be aggregated to a quarterly frequency. We then seasonally adjust these series, along with the hires data, using a Signal Extraction in ARIMA Time Series (SEATS) method.

3.3 Synthetic Control

We implement the synthetic control method developed by Abadie and Gardeazabal (2003) and extended by Abadie et al. (2010). The method uses relevant characteristics from other states prior to the policy intervention to construct a "synthetic Missouri" that serves as a control group. Specifically, weights are assigned to each state to minimize the mean squared prediction error between the treatment and control groups prior to the benefit cut.

As explained in section 2, to estimate the effect of the UI cut in Missouri on job finding rates, we estimate the effect separately on V/U and H/V using the synthetic control method, and then use equation 5.

We exclude from the donor pool states which cut UI duration around the time of Missouri's policy change, as the synthetic control must be a weighted average of untreated units.[11] We list the resulting weights for individual states that comprise the synthetic Missouri in Appendix Tables A.1 and A.2.

Following previous synthetic control studies, we use variables which describe the demographic, industrial, and economic composition of the state as valid predictors to obtain weights to construct a synthetic Missouri. Our preferred set of predictors include the change in house prices from 1999-2006 as well as from 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009Q1 and 2010Q1.

[10] We do not use approximately 2% of HWOL vacancies that are coded as "nationwide."

[11] These states are Arkansas, Florida, Georgia, Michigan, and South Carolina. Massachusetts is also excluded from the donor pool because they did not begin sharing administrative records with the Census Bureau for purposes of the QWI until 2010, while our time-varying outcomes used in synthetic control begin in 2009.

3.4 Results

The policy change in Missouri had a drastic effect on UI durations. Following this policy change, UI durations in Missouri fell by almost 28 log points relative to the synthetic control and stayed low for at least 4 quarters. This decline is similar to the actual cut in Missouri of $\log(73) - \log(56) \approx 0.265$ log points (Figure 1a). As shown by Johnston and Mas (2018), which we replicate in Figure 1b, the 16-week cut in Missouri triggered a full percentage point decline in the unemployment rate in Missouri.

We now implement our methodology in Section 2 to estimate the effect of this policy change on the job finding rate using equation (5). To do so, we first estimate the effect on the vacancy-unemployment ratio for two measures of vacancies: new vacancies—positions that do not exist in the previous quarter and are newly created in a given quarter—and total vacancies, which include both new vacancies and remaining vacancies from previous quarters that could not be filled. When running the synthetic control on different outcome variables, we reestimate the weights, which implies that the synthetic control to which we compare Missouri can potentially differ across outcomes. We report the states and their relative weights for each outcome variable in Appendix A.1. To verify that our results are not driven by the set of states in the synthetic control or the changing weights, we conduct a set of robustness tests that we discuss later.

Figure 2 shows the effect of the UI cut on the vacancy-unemployment ratio and the vacancy filling rate. Figure 2a shows that for both measures of vacancies this ratio picks up gradually following the cut in UI durations. The increase is sizable: the ratio of vacancies to unemployed rose 13% to 15% for total and new vacancies, respectively, over the course of four quarters following the policy change. These changes correspond to elasticities -0.5 and -0.6.

Figure 2b shows that the vacancy filling rate H/V falls precipitously in the first quarter following the policy change and remains low through 2012Q1. The magnitude of the fall is sizable—around 5 log points—indicating a tightening of the labor market in Missouri. The immediate adjustment in the labor market is consistent with equilibrium search models, where market tightness is a jump variable and responds immediately to changes in fundamentals. Table 1 lists the cumulative effect through 2012Q1 on the vacancy-unemployment ratio and the vacancy filling rate using alternative measures of vacancies from HWOL and hires from QWI, all of which yield consistent results. The rise in the vacancy-unemployment ratio ranges from 13% to 15% and the decline in the vacancy filling rate tends to be between 4% and 6%.

Using equation (5) we calculate the change in the job finding rate in the third column of Table 1. Our baseline calculations (using new hires and new vacancies) suggest that the cut in

UI durations resulted in an 11.1% increase in the job finding rate, which implies an elasticity of roughly -0.45. Different measures of vacancies and hires agree on what happened to the availability of jobs in Missouri. Across different measures and matching function elasticities, we estimate an increase in the job finding rate ranging between 7.3% (corresponding to an elasticity of -0.30) and 11.1%.

How big is the effect on the job finding rate? To quantify this, we compute a flow-balance unemployment rate for Missouri using the observed job finding and separation rates in Missouri and compare it to a counterfactual one that would have arisen, had UI durations not been cut. The difference between these two rates is the effect of the UI cut on unemployment through the job finding margin. To implement this, we calculate monthly employment-to-unemployment and unemployment-to-employment transition rates using data from the CPS and seasonally adjust them. We follow Elsby et al. (2015) in adjusting these transition rates for time aggregation to obtain continuous time inflow and outflow rates, which we refer to as separation (s) and job finding rates (f). Finally, we take a quarterly average of these rates prior to the policy change; i.e. over the three months in 2011Q1. These series are shown in Figure B.5 in Appendix B.1. The flow balance unemployment rate is given by $u_{ss} = s/(s+f)$ and the counterfactual unemployment in the absence of the UI cut is $u_c = s/(s+(1-\beta_f)f)$, where β_f is the estimated change in the job finding rate reported (0.111 in the baseline). The last column of Table 1 shows that in our baseline the this difference is 0.55 percentage points. This result implies that the increased availability of jobs (higher θ) and an increased search effort (s) combined, lowered unemployment by 0.55 percentage points. Note that this accounts for 55% of the full percentage point decline in the unemployment rate caused by the policy change in Missouri (Figure 1b).

There are two other margins that can account for the remaining 45% of the decline in unemployment. The first is separations into unemployment. If making UI less generous raises job creation by raising profits, it would be plausible to also expect lower separations into unemployment. Thus, lowering benefit durations may reduce unemployment through reducing inflows into unemployment. The second is the participation margin. When UI becomes less generous, some unemployed workers may leave the labor force, which further reduces the unemployment rate. In fact, Karahan and Mercan (2019) provide evidence that over this episode, labor force participation fell in Missouri and applications for disability insurance spiked. While potentially important, quantifying these margins is beyond the scope of this paper.[12]

Using the estimated effects on the vacancy-unemployment ratio and the vacancy filling

[12] See Hagedorn et al. (2019) for a discussion on how cuts in UI affect labor supply and demand in a three-state (N-U-E) labor market model.

rate (cumulative effect through 2012Q1), we can now use equation (3) to infer the response of search effort β_s and market tightness β_θ that justify the joint behavior of the vacancy-unemployment ratio and the vacancy filling rate. To do so, we need to pick a value for the matching function elasticity α. Based on a survey of matching function estimates in Petrongolo and Pissarides (2001), we consider three alternative values for α: 0.50, 0.55 and 0.60. For each of these values, we report the imputed effects on market tightness, search effort and the share of the change in job finding rate that is due to market-level effects in Table 2.

We choose new hires and new vacancies as our benchmarks. We focus on new hires instead of total hires, the distinction being primarily recalls, because hiring through a recall likely does not operate through the same matching process as in our framework (Fujita and Moscarini, 2017). For vacancies, the case is less clear. Recent work shows that a large chunk of vacancies on online boards from which our data are derived could be "phantom-like," meaning they are not taken off the boards immediately after the job is filled or when the search is cancelled for some other reason (Albrecht et al., 2017). Given that both of these choices are somewhat subjective, we provide decomposition results for all four combinations of these measures.

Panel A of Table 2 shows the benchmark results. We find an increase in market tightness θ ranging from 8.0% to 10.0%, depending on the elasticity of the matching function. Given that the cut in benefits was around 26 log points, these estimates imply that the elasticity of market tightness with respect to unemployment benefit duration ranges between -0.32 and -0.40.

Workers reacted to the cut in UI durations by raising their search effort. In fact, we find an effect of comparable magnitude—ranging from 5.2% to 7.2% in our baseline in Panel A. These estimates correspond to elasticities of search effort of -0.21 and -0.29, respectively.

As we discussed before, combined with the effect on market tightness, these estimates imply a sizable increase in the job finding rate of 11.1%. In other words, the elasticity of the job finding rate with respect to UI durations is around -0.45. Of this increase, our decomposition implies that between 36% to 54% is due to the market-level effect—a tightening of the labor market due to increased demand for labor in response to the UI cut.

As noted before, the focus on new hires and new vacancies was intended to try to reduce possible measurement error. Therefore, Panels B, C and D explore the robustness of our results to the other combinations of these measures. In terms of the estimated effect on the search effort, the effect ranges from 7.2% in our baseline for $\alpha = 0.5$ to -1.0% for $\alpha = 0.6$. Therefore, our analysis suggests that the elasticity of search with respect to UI durations could be close to zero. However, a robust result that stands out is the prevalence of the equilibrium effect. We estimate that in Missouri, market tightness increased by at least 8.0% and at most 13.9%. The higher end of the estimates corresponds to an elasticity of roughly -0.57.

We conclude that in response to the unexpected cut in UI durations, job finding rates improved in Missouri. This improvement reflects contributions both from changing search effort as well as market-level effects due to labor demand with the latter accounting for at least one third of the total effect, and as an upper bound the entire effect.

Robustness When estimating the effect of the policy change on any variable—such as the unemployment rate, vacancy unemployment ratio or the vacancy filling rate—we allow the procedure pick different weights for control states each time. One might be concerned that then the results on the various margins cannot be compared since each corresponds to a different control. Therefore, we check the sensitivity of our estimates to using a fixed set of weights. More specifically, we fix the weights of the synthetic control for a given outcome variable (H/V and V/U) and construct a control state using those weights for all the other outcomes of interest. We then report the entire set of results corresponding to that synthetic control. Our analysis presented in Appendix A.2 shows that our results are robust.

As an additional robustness, we construct a control state as the average of all the U.S. states except Missouri, weighted by the size of their labor force. Once again, we reach the same broad conclusions regarding the labor market effects of the UI cut in Missouri and the contributions of the individual and market-level effects (see Appendix A.3).

Finally, we assess the robustness of our results to the hires measure. QWI counts all workers who start a job in a given quarter as a hire for that quarter. Therefore, these counts include hires that do not even last a full quarter. Because temporary hires may come through different recruiting methods than the other hires and may not be subject to the same search process, we conduct the same analysis using a measure of "stable hires," workers who start a job that last at least one full quarter. This analysis is reported in Appendix A.4 and confirms the validity of our baseline results.

4 Conclusions

Given the prominent role of UI benefit extensions as a countercyclical automatic stabilizer, it is critical for policymakers and economists to understand their effects and the channels through which they operate. While the micro labor literature historically has primarily focused on the worker search effort channel, Hagedorn et al. (2013) demonstrated that the job creation decisions of firms also respond to changes in UI policies, affecting the job prospects of all workers within a market. Despite the sizable literature that emerged in response to that paper, to the best of our knowledge, no paper has provided a simultaneous investigation of both the individual and market level channels.

The contribution of this paper is to fill that gap by implementing a unified methodology that allows the joint measurement of the individual and market-level effects. Our approach relies on minimal, standard assumptions and requires data on the vacancy-unemployment ratio and the vacancy filling rate. Following Johnston and Mas (2018), we apply this method to Missouri, which experienced a large and unanticipated cut in potential UI durations in April 2011. We find that about 50% of the decline in unemployment following this policy change is attributable to higher exits from unemployment. Importantly, we estimate market-level effects to be sizable—about 36% of the total effect according to our most conservative estimate and up to 100%.

Our findings have important implications for the design of optimal UI policies over the business cycle. The estimated elasticity of tightness with respect to UI duration is quantitatively consistent with the calibrated model of Mitman and Rabinovich (2015). Their findings suggest that in response to a recession, policymakers should raise the duration of UI benefits in the short run, but commit to cutting them once the recovery begins.

5 Tables and Figures

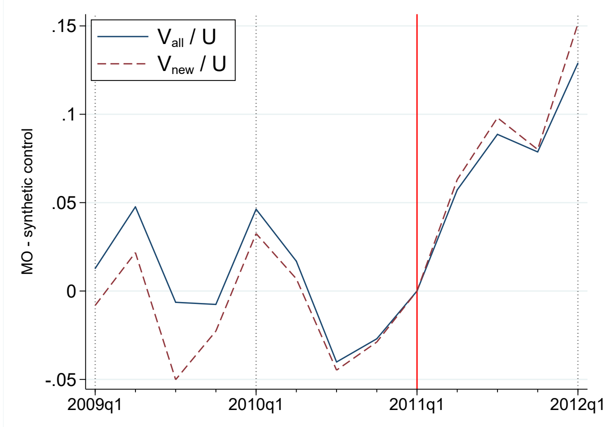
Figure 1: Effects on Unemployment Rate and Unemployment Insurance Duration

(a) Maximum Weeks of UI Benefits

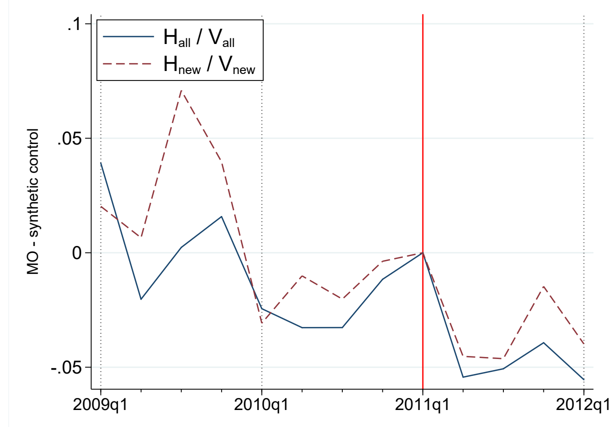
(b) Unemployment Rate (LAUS)

Note: Panels (a) and (b) plot the difference between Missouri's observed log of average duration of unemployment insurance benefits or unemployment rate and those of its synthetic control, respectively. We consider 2011q1 to be the time of treatment given the policy change affected outcomes in nearly all of 2011q2. Both synthetic control approaches use the following predictors: the change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; and percent of the state that is rural. The synthetic control for log of the average UI duration also includes the unemployment rate in 2009q1 and 2010q1 as a predictor.

Figure 2: Effects on Vacancy-Unemployment Ratio and the Vacancy Filling Rate



(a) V/U



(b) H/V

Note: Plot represents the difference between Missouri's observed log(vacancies/unemployed) (panel (a)) and log(hires/vacancies) (panel (b)) and that of its synthetic control. We consider 2011q1 to be the time of treatment given the policy change affected outcomes in nearly all of 2011q2. Predictors used in synthetic control include the change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009q1 and 2010q1.

Table 1: Estimated Effects of the UI cut on Missouri Labor Market

	Change from pre-policy to 2012Q1			
Measure of V, H	$\Delta \log(V/U)$	$\Delta \log(H/V)$	$\Delta \log(f)$	Δu_{ss}
New Hires, New Vacancies	0.151	-0.040	0.111	-0.54
New Hires, All Vacancies	0.129	-0.039	0.090	-0.43
All Hires, New Vacancies	0.151	-0.061	0.091	-0.43
All Hires, All Vacancies	0.129	-0.055	0.073	-0.35

Note: This table presents the change in the vacancy-unemployment ratio V/U and the vacancy filling rate H/V in Missouri as a result of the cut in UI duration cut estimated using a synthetic control, as well as the imputed response of the job finding rate and steady-state unemployment rate (p.p.). The table displays results for different measures of hires and vacancies. A common set of predictors are used for synthetic control: the change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; rural populations share; unemployment rate in 2009q1 and 2010q1.

Table 2: Decomposition of Individual and Market-Level Effects

Matching function elasticity, α	Search effort Δs_t	Market tightness $\Delta\theta_t$	% Equilibrium effect in $\Delta\log(f)$
	Panel A. New Hires, New Vacancies		
0.50	0.072	0.080	36%
0.55	0.063	0.089	44%
0.60	0.052	0.100	54%
	Panel B. New Hires, All Vacancies		
0.50	0.051	0.078	44%
0.55	0.042	0.087	53%
0.60	0.031	0.098	65%
	Panel C. All Hires, New Vacancies		
0.50	0.030	0.121	67%
0.55	0.017	0.135	82%
0.60	0.000	0.151	100%
	Panel D. All Hires, All Vacancies		
0.50	0.018	0.111	75%
0.55	0.006	0.123	92%
0.60	-0.010	0.139	113%

Note: This table decomposes the effect of the UI cut into individual and market-level effects for different matching function elasticities α. Columns 2 and 3 show the estimated change in search effort, s_t, and market tightness, θ_t, in Missouri between 2011q1 and 2012q1, respectively. Column 4 shows the relative contribution of the market-level effect ($\Delta\theta_t$) to the change in job finding rate. These effects are calculated using the methodology described in Section 2 given the estimated effect of the policy on V/U and H/V from Table 1.

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Online Appendix—Not for Publication

A Further Results

This section includes several results not provided in the main text. In Section A.1, we document the states that are assigned positive weights in the synthetic control for the different outcomes of interest. Because the weights differ across outcomes, we then conduct robustness analyses regarding the specific implementation of the synthetic control method. In particular, in Section A.2, we construct synthetic controls using a fixed set of weights across all outcomes and in Section A.3 we use all states except Missouri weighted by their labor force. Finally, in Section A.4 we evaluate the robustness of our results to alternative measures of hires.

A.1 State Weights

The synthetic control method used in Section 3 assigns weights to non-treated states to construct a "synthetic Missouri" which allows us to assess the effect of the policy. Below we identify the states used to construct the synthetic control and proceed with robustness exercises. We exclude from the donor pool states that likewise cut UI benefit duration during the period of our analysis.[13] Further, the QWI—derived from a partnership between labor market information divisions of state governments and the Census Bureau Local Employment Dynamics—supplies data for all states since at least 2010 (although most entered much earlier). Because Massachusetts entered the QWI only in 2010, we drop it from the donor pool as well. Lastly, we exclude Washington, D.C.

Tables A.1 and A.2 present the weights assigned to different states when constructing the synthetic control based on H/V and V/U, respectively. The group of states which comprise Missouri's synthetic control is essentially invariant to the specific construction of the tightness measure with the different measures of vacancies or hires. The group only changes slightly because Colorado is assigned weights for V/U but not for H/V, while the opposite holds for Maine.

[13]These states are Arkansas, Florida, Georgia, Michigan, and South Carolina.

Table A.1: State Weights for Synthetic Control: Hires/Vacancies

State	(1)	(2)	(3)	(4)
Connecticut	0.044	0.136	0.000	0.000
Maine	0.022	0.051	0.000	0.000
Mississippi	0.074	0.044	0.041	0.051
Nebraska	0.074	0.080	0.089	0.092
Nevada	0.024	0.017	0.030	0.034
New York	0.186	0.091	0.228	0.226
North Carolina	0.114	0.184	0.142	0.105
Ohio	0.162	0.164	0.124	0.176
Tennessee	0.300	0.233	0.345	0.317
Vacancies Measure				
New		✓		✓
Hires Measure				
New		✓		✓
Stable			✓	✓

Note: This table presents the state-level weights which result from synthetic control for different measures of $\log(H/V)$ beginning in 2009q1 with treatment beginning in 2011q2. Columns 1-4 correspond to four possible constructions of H/V, depending on usage of (a) all or new vacancies and (b) all, new, all stable, and new stable hires. Other predictors used in synthetic control include change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009q1 and 2010q1.

Table A.2: State Weights for Synthetic Control: Vacancies/Unemployed

State	(1)	(2)
Colorado	0.081	0.011
Connecticut	0.032	0.032
Mississippi	0.088	0.101
Nebraska	0.068	0.095
Nevada	0.023	0.026
New York	0.155	0.190
North Carolina	0.116	0.192
Ohio	0.057	0.006
Tennessee	0.382	0.346
Vacancies Measure		
New		✓

Note: This table presents the state-level weights which result from synthetic control for different measures of $log(V/U)$ beginning in 2009q1 with treatment beginning in 2011q2. The two columns correspond to the two possible constructions of V/U: one using all vacancies and one using new vacancies. Other predictors used in synthetic control include change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009q1 and 2010q1.

A.2 Results Using Fixed State Weights

While the set of states that comprise the synthetic Missouri are invariant, the state weights nevertheless differ across the two labor market outcomes (V/U and H/V). To ensure our results are not driven by the changing weights, we check the sensitivity of our results with a "weight fixing" approach. Here, we use a fixed set of states-specific weights across outcomes to construct the control group. Specifically, the state-weights are derived from the synthetic control of *either* $\log(V/U)$ or $\log(H/V)$ and are used to construct a control group for both measures.

Figure A.1 compares the baseline results for the vacancy-to-unemployment ratio to that for the weight-fixing approach. The estimated effects track each other very closely. Regardless of the measure of vacancies used (all or new), we estimate the vacancy-to-unemployment ratio in Missouri to have increased roughly 13-15 log points by the fourth quarter after the UI cut. The same comparison for the vacancy filling rate shows that our estimates are robust to the weight-fixing approach (Figure A.2). By 2012q1, the vacancy filling rate fell in Missouri by 4-6 log points as a result of the policy change, regardless of the specific measure.

Table A.3 illustrates the effect on the job finding rate and the steady state unemployment rate. Similar to our baseline results in Table 1, we estimate that the job finding rate in

Missouri increased by 7-10 log points. This translates to a decrease in the steady state unemployment rate u_{ss} of 0.34 to 0.46 percentage points, consistent with the reported range in our baseline results.

Table A.4 decomposes the effect of the UI cut into individual and equilibrium effects for three different matching function elasticities α. Despite the differences in weights, the synthetic control results for various measures match the baseline results very closely. For α of 0.5, our baseline results estimate a search effort increase of 2-7 log points in response to the policy change, depending on the specific measure of hires and vacancies. The weight-fixing approach yields a similar range of 2-6 log point increase in search effort. For market tightness θ_t, the weight-fixing approach estimates an increase of 8-12 log points given α of 0.5, the same range as in the baseline results. The share of the increase in the job finding rate attributable to equilibrium effects similarly matches the results from Table 2.

Table A.3: Estimated Effects of UI cut on Missouri Labor Market using Fixed Weights

	Change from pre-policy to 2012Q1			
Measure of V, H	$\Delta \log(V/U)$	$\Delta \log(H/V)$	$\Delta \log(f)$	Δu_{ss}
Panel A. V/U weights for synthetic MO				
New Hires, New Vacancies	0.151	-0.058	0.093	-0.45
All Hires, All Vacancies	0.129	-0.056	0.073	-0.34
Panel B. H/V weights for synthetic MO				
New Hires, New Vacancies	0.136	-0.040	0.096	-0.46
All Hires, All Vacancies	0.139	-0.055	0.083	-0.40

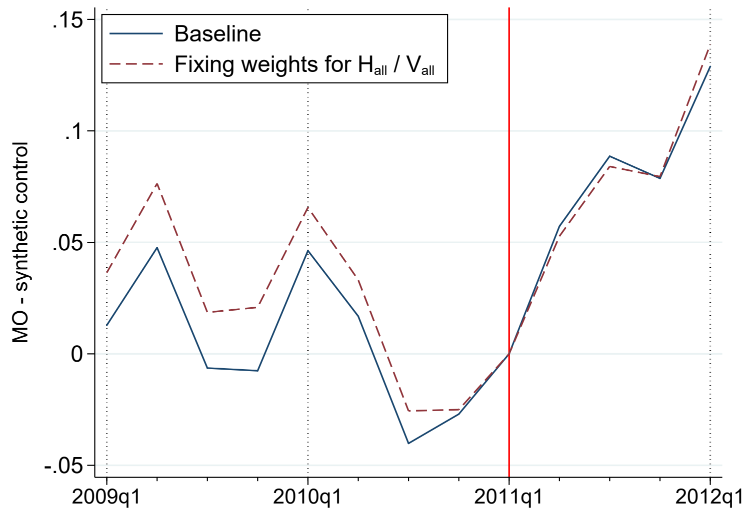
Note: Analogous to Table 1, this table presents the change in the vacancy-unemployment ratio (V/U) and the vacancy filling rate (H/V) in Missouri as a result of the cut in UI duration cut. We estimate these effects with "fixed weight" synthetic control. Panels A and B present results when fixing state-specific weights that result from synthetic control for $\log(V/U)$ and $\log(H/V)$, respectively. From these measures, we calculate the imputed response of the job finding rate and steady-state unemployment rate (percentage points). The table displays results for different measures of hires and vacancies.

Table A.4: Decomposition using Fixed Weights

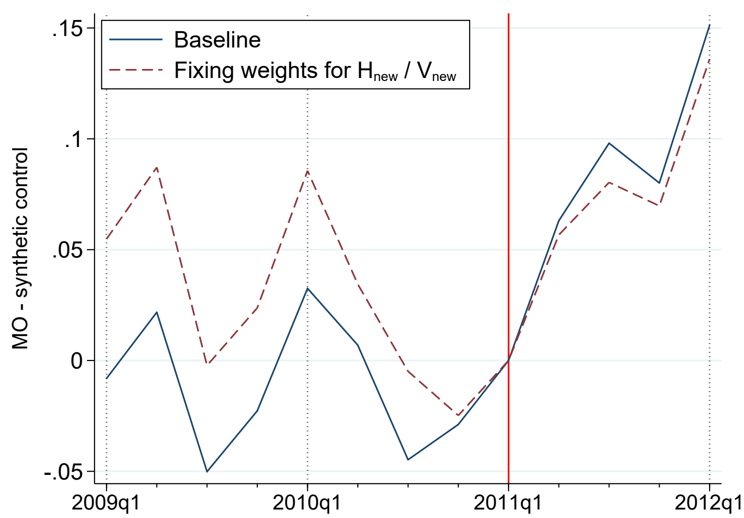
Matching function elasticity, α	Search effort Δs_t	Market tightness $\Delta\theta_t$	% Equilibrium effect in $\Delta\log(jfr)$
	Panel A. New Hires, New Vacancies: V/U synthetic weights		
0.50	0.035	0.116	62%
0.55	0.023	0.129	76%
0.60	0.006	0.145	93%
	Panel B. All Hires, All Vacancies: V/U synthetic weights		
0.50	0.016	0.113	78%
0.55	0.004	0.125	95%
0.60	-0.012	0.141	116%
	Panel C. New Hires, New Vacancies: H/V synthetic weights		
0.50	0.056	0.080	41%
0.55	0.047	0.089	51%
0.60	0.036	0.100	62%
	Panel D. All Hires, All Vacancies: H/V synthetic weights		
0.50	0.028	0.111	66%
0.55	0.016	0.123	81%
0.60	0.000	0.139	100%

Note: This table decomposes the effect of the UI cut into individual and market-level effects for different matching function elasticities α. Columns 2 and 3 show the estimated change in search effort, s_t, and market tightness, θ_t, in Missouri between 2011q1 and 2012q1, respectively. Column 4 shows the relative contribution of the market-level effect ($\Delta\theta_t$) to the change in job finding rate. Figures are calculated given the estimated effect of the policy on V/U and H/V from Table A.3. Panels A through D correspond to the measures of vacancies and hires used as well as the state-specific weights from the synthetic control from either V/U or H/V which were held constant to construct counterfactual outcomes.

Figure A.1: Effects on Vacancy-Unemployment Ratio: Fixing Weights from H/V



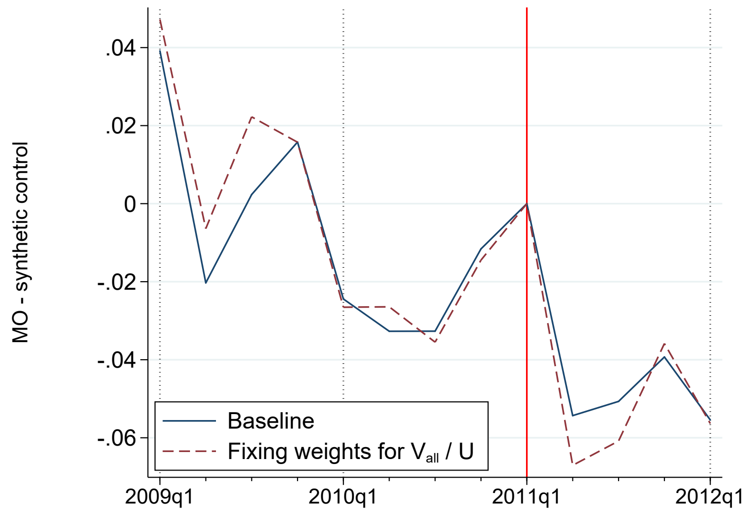
(a) $\log(V_{all}/U)$



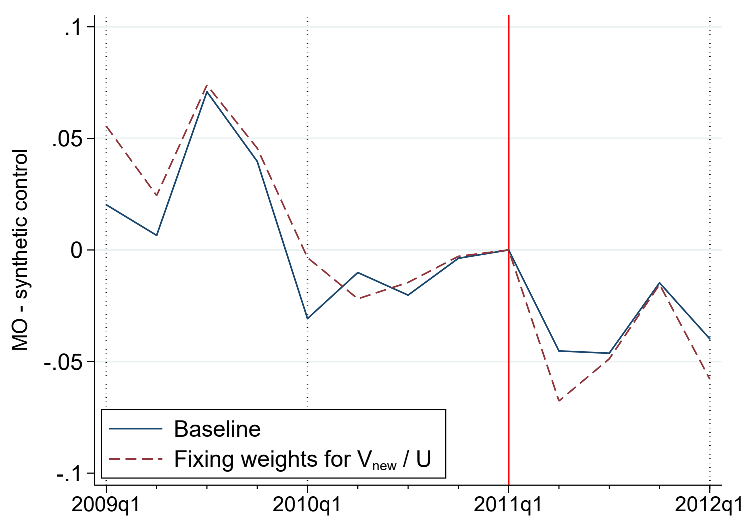
(b) $\log(V_{new}/U)$

Note: The solid blue lines plot baseline results synthetic control for Missouri's log vacancy-to-unemployment ratio (V/U). The dashed red lines plot the difference between Missouri's observed $\log(V/U)$ to that of a counterfactual constructed with the state-specific weights derived from synthetic control for the log of the vacancy filling rate (H/V). Panel (a) uses all vacancies while panel (b) uses new vacancies. Differences are normalized to zero in 2011q1. Synthetic control predictors include change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009q1 and 2010q1.

Figure A.2: Effects on Vacancy Filling Rate: Fixing Weights from V/U



(a) $\log(H_{all}/V_{all})$



(b) $\log(H_{new}/V_{new})$

Note: The solid blue lines plot baseline results synthetic control for Missouri's log vacancy filling rate (H/V). The dashed red lines plot the difference between Missouri's observed $\log(H/V)$ to that of a counterfactual constructed with the state-specific weights derived from synthetic control for the log of the vacancy-to-unemployment ratio (V/U). Panel (a) uses all vacancies and all hires while panel (b) uses new vacancies and new hires. Differences are normalized to zero in 2011q1. Synthetic control predictors include change in house prices from 1999-2006 and 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; percent of the state that is rural; and unemployment rate in 2009q1 and 2010q1.

A.3 Using the Average of All Other U.S. States

The synthetic control method systematically assigns weights to donor states such that the resulting counterfactual mimics certain outcomes of the treated unit in the period leading up to the policy change. As a further check on our estimates, we replicate our main results by instead comparing Missouri's labor market outcomes to an average of all other states in the U.S. weighted by their labor force in January 2011 (derived from LAUS). As in section 3, we drop states that likewise cut UI duration around the time of Missouri's policy change – Arkansas, Florida, Georgia, Michigan, and South Carolina. We also exclude Massachusetts because data on hires for that state do not appear in the QWI until 2010.

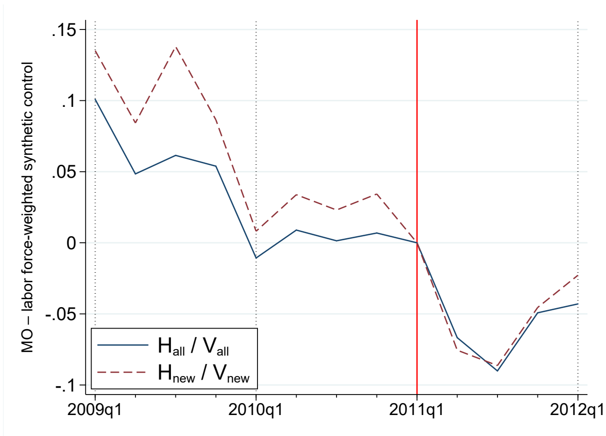
Figure A.3 plots the difference between Missouri's vacancy filling rate and the weighted average of all other states for H/V. As in the baseline, the vacancy filling rate responds immediately to the cut. One year after the policy change, the vacancy filling rate has decreased roughly 7 log points, slightly larger than but not substantially different compared to our baseline estimates.

Figure A.4 conducts the same exercise for the vacancy-to-unemployment ratio (V/U) in Missouri, analogous to Figure 2a, using the labor force weighted average of U.S. states. Relative to this control, Missouri's vacancy-to-unemployment ratio increased 22 log points one year after the policy change, a bit larger than our baseline estimates.

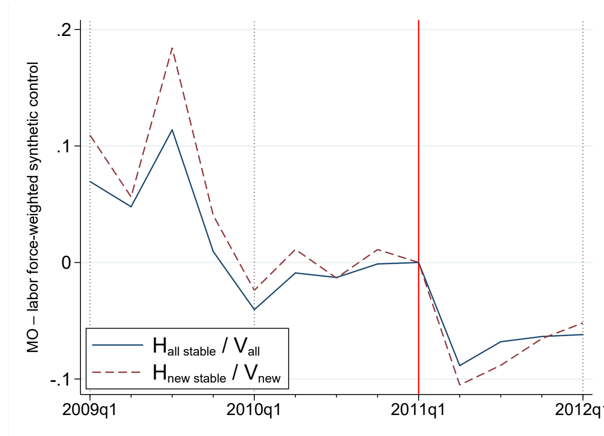
The changes in V/U and H/V increased the job finding rate by roughly 14 log points after the cut (Table A.5). Given the steady state unemployment rate (u_{ss}) in Missouri at the time (calculated from job finding and separation rates), we estimate u_{ss} fell by 0.6 to 0.7 percentage points due to the UI cut, slightly larger than the baseline results in Table 1.

Despite slightly larger labor market responses when we compare Missouri to a labor force-weighted average of other U.S. states, Table A.6 shows that the decomposition of the increase in the job finding rate matches our baseline estimates. For a matching function elasticity α of 0.5, for example, equilibrium effects account for between 40% and 58% of the increase in the job finding rate, with the rest explained by increased search effort. When α equals 0.6, this estimate ranges from 60% to 86%.

Figure A.3: Effects on Vacancy Filling Rate (H/V) using the Rest of the U.S. Weighted by Labor Force



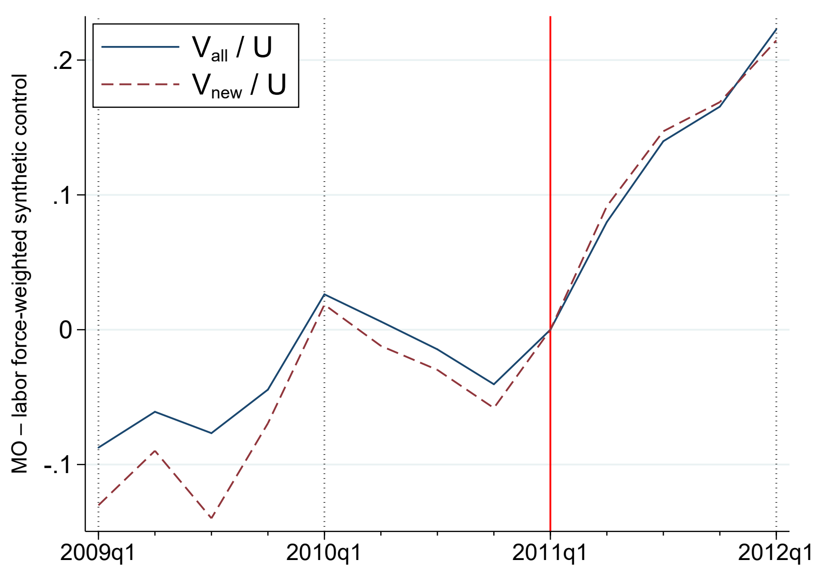
(a) H/V



(b) Stable H/V

Note: Graph plots the difference between Missouri's observed log(hires/vacancies) and that of an average of all other U.S. states weighted by their national labor force share in January 2011 (excluding AR, FL, GA, MA, MI, and SC). Difference is normalized to zero in 2011q1, which we consider to be the time of treatment because the UI cut affected outcomes in nearly all of 2011q2. Panel (b) constructs the vacancy filling rate restricting to only stable hires (both new and total), while panel (a) does not make this restriction.

Figure A.4: Effects on Vacancy-to-Unemployment Ratio (V/U) using the Rest of the U.S. Weighted by Labor Force



Note: Graph plots the difference between Missouri's observed log(vacancies/unemployment) and that of an average of all other U.S. states weighted by their national labor force share in January 2011 (excluding AR, FL, GA, MA, MI, and SC). Difference is normalized to zero in 2011q1, which we designate the time time of treatment because the UI cut affected outcomes in nearly all of 2011q2. Solid blue line shows the response of all vacancies over unemployment. Dashed red line shows the response of new vacancies over unemployment.

Table A.5: Effects of the UI cut on Missouri Labor Market using the Rest of the U.S. Weighted by Labor Force

	Change from pre-policy to 2012Q1			
Measure of V, H	$\Delta\log(V/U)$	$\Delta\log(H/V)$	$\Delta\log(f)$	Δu_{ss}
New Hires, New Vacancies	0.215	-0.076	0.139	-0.68
New Hires, All Vacancies	0.223	-0.064	0.159	-0.78
All Hires, New Vacancies	0.215	-0.078	0.136	-0.66
All Hires, All Vacancies	0.223	-0.067	0.156	-0.77

Note: Columns 1 and 2 of this table presents the change in the vacancy-unemployment ratio V/U and the vacancy filling rate H/V in Missouri as a result of the cut in UI duration cut comparing Missouri's outcomes to that of an average of all other U.S. states (excluding AR, FL, GA, MA, MI, and SC) weighted by state labor force in January 2011. Columns 3 and 4 calculate the imputed response of the job finding rate and steady-state unemployment rate (in percentage points). The table displays results for different measures of hires and vacancies.

Table A.6: Decomposition using the Rest of the U.S. Weighted by Labor Force

Matching function elasticity, α	Search effort Δs_t	Market tightness $\Delta\theta_t$	% Equilibrium effect in $\Delta\log(f)$
	Panel A. New Hires, New Vacancies		
0.50	0.064	0.151	54%
0.55	0.047	0.168	66%
0.60	0.026	0.189	81%
	Panel B. New Hires, All Vacancies		
0.50	0.095	0.128	40%
0.55	0.081	0.142	49%
0.60	0.063	0.160	60%
	Panel C. All Hires, New Vacancies		
0.50	0.058	0.157	58%
0.55	0.040	0.174	70%
0.60	0.019	0.196	86%
	Panel D. All Hires, All Vacancies		
0.50	0.089	0.133	43%
0.55	0.075	0.148	52%
0.60	0.056	0.167	64%

Note: This table decomposes the effect of the UI cut into individual and market-level effects for different matching function elasticities α. Columns 2 and 3 show the estimated change in search effort, s_t, and market tightness, θ_t, in Missouri between 2011q1 and 2012q1, respectively. Column 4 shows the relative contribution of the market-level effect ($\Delta\theta_t$) to the change in job finding rate. These effects are calculated using the methodology described in Section 2 and with weighting described in section A.3, given the estimated effect of the policy on V/U and H/V from Table A.5.

A.4 Results Using Stable Hires

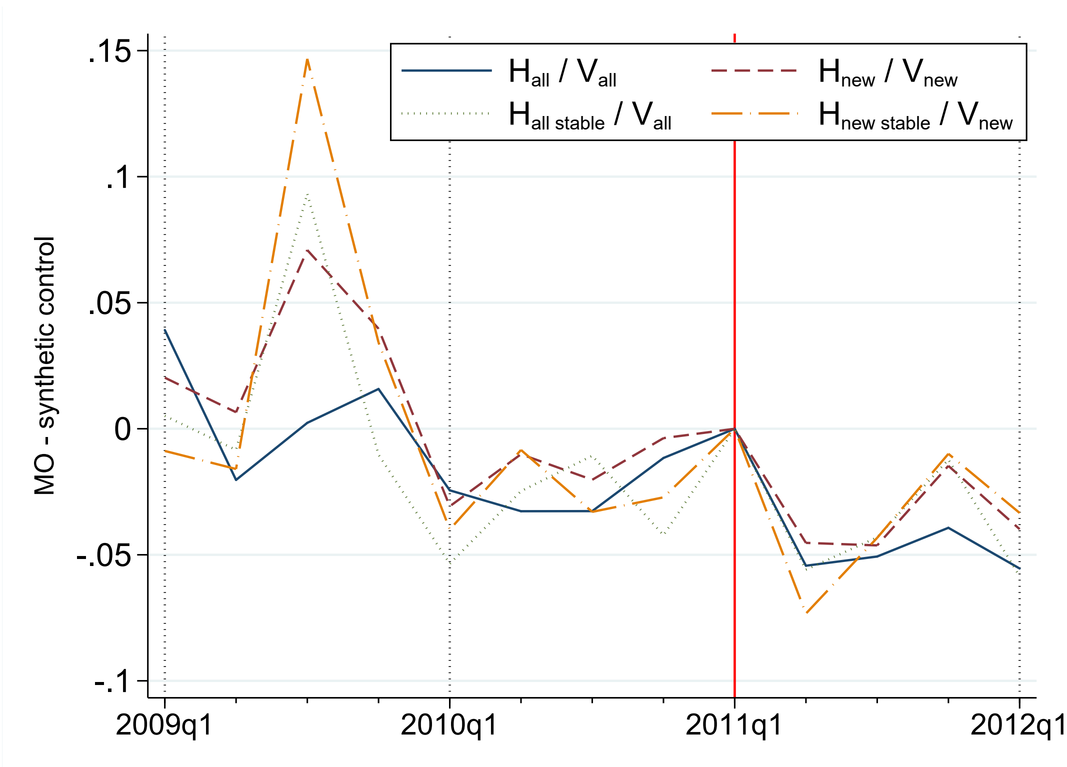
Our main results use a measure of hires from the QWI that counts the number of all workers who start a job with an employer in a given quarter. This number may include hires that do not last a full quarter or longer. Temporary hires may not be subject to search frictions. To assess if our results are robust to measures with hires that last longer, we use "stable hires.". The QWI defines stable hires as workers who start a job that lasted at least one full quarter with a given employer. More specifically, according to the Quarterly Workforce Indicators 101 Guide, a stable hire occurs in the second of three consecutive quarters when an individual first receives earnings from the same employer.[14] This contrasts with the regular measure, which considers a hire to occur in the first quarter of positive earnings with a new employer when an individual had no earnings with that employer in the prior quarter. To distinguish the relative contribution of recalls, the QWI reports both "total stable hires" and "new stable hires" using the same criteria as the primary measure, with the difference between the two being stable recall hires.

Figure A.5 presents the results of the synthetic control for the vacancy filling rate for four alternative versions of H/V. The list of predictor variables is similar to those used for the synthetic control results in the baseline. Four quarters after the policy change, all measures indicate that the vacancy filling rate fell in response to the benefit duration cut between 3 and 6 log points.

Table A.7 summarizes the post-UI cut labor market responses using stable hires. The responses of H/V, combined with the baseline effects on the vacancy-to-unemployment ratio in Table 1, imply an increase in the job finding rate by 7-12 log points, nearly identical to the baseline results. Given this increase in f, the policy led to a drop in the steady state unemployment rate between 0.33 and 0.57 percentage points (compared to the baseline effects of 0.35 to 0.54 p.p., respectively). According to Table A.8, when we use the stable hires measure, the lower bound of equilibrium effects still account for around one-third of the increase in the job finding rate. For higher elasticities of the matching function ($\alpha = 0.6$), these market-level effects explain essentially the entire effect on the job finding rate.

[14] See https://lehd.ces.census.gov/doc/QWI_101.pdf.

Figure A.5: Synthetic Control for Multiple Measures of Vacancy Filling Rate



Note: Graph plots the difference between Missouri's observed and synthetic log(hires/vacancies). Lines represent four different H/V constructions: all hires over all vacancies, new hires over new vacancies, all stable hires over all vacancies, and new stable hires over new vacancies.

Table A.7: Estimated Effects of the UI cut on Missouri Labor Market using Stable Hires

	Change from pre-policy to 2012Q1			
Measure of V, H	$\Delta \log(V/U)$	$\Delta \log(H/V)$	$\Delta \log(f)$	Δu_{ss}
New Hires, New Vacancies	0.151	-0.033	0.118	-0.57
New Hires, All Vacancies	0.129	-0.033	0.096	-0.46
All Hires, New Vacancies	0.151	-0.062	0.090	-0.43
All Hires, All Vacancies	0.129	-0.059	0.070	-0.33

Note: This table presents the change in the vacancy-unemployment ratio V/U and the vacancy filling rate H/V in Missouri as a result of the cut in UI duration cut estimated using a synthetic control, as well as the imputed response of the job finding rate and steady-state unemployment rate (p.p.). The table displays results for different measures of hires and vacancies. The common set of predictors used for synthetic control are listed in Table 1.

Table A.8: Decomposition using Stable Hires

Matching function elasticity, α	Search effort Δs_t	Market tightness $\Delta\theta_t$	% Equilibrium effect in $\Delta\log(f)$
	Panel A. New Stable Hires, New Vacancies		
0.50	0.084	0.067	28%
0.55	0.077	0.074	35%
0.60	0.068	0.083	43%
	Panel B. New Stable Hires, All Vacancies		
0.50	0.063	0.066	34%
0.55	0.056	0.073	42%
0.60	0.047	0.082	51%
	Panel C. All Stable Hires, New Vacancies		
0.50	0.028	0.123	69%
0.55	0.014	0.137	84%
0.60	-0.003	0.154	103%
	Panel D. All Stable Hires, All Vacancies		
0.5	0.012	0.117	83%
0.55	-0.001	0.130	102%
0.6	-0.017	0.146	125%

Note: This table decomposes the effect of the UI cut into individual and market-level effects for different matching function elasticities α. Columns 2 and 3 show the estimated change in search effort, s_t, and market tightness, θ_t, in Missouri between 2011q1 and 2012q1, respectively. Column 4 shows the relative contribution of the market-level effect ($\Delta\theta_t$) to the change in job finding rate. These effects are calculated using the methodology described in Section 2 given the estimated effect of the policy on V/U and H/V from Table 1.

B Measures in LAUS and CPS

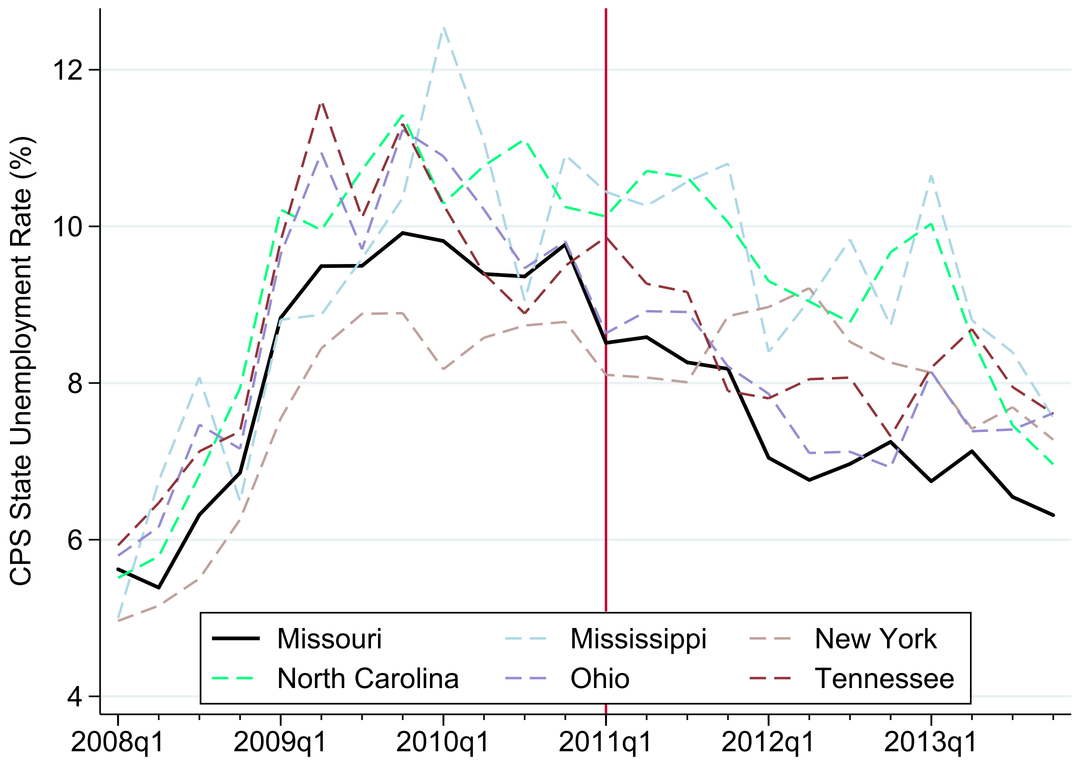
In this section we first show how measures of unemployment rates constructed from the the CPS compare to the measure used to construct the vacancy-unemployment ratio, which come from the BLS Local Area Unemployment Statistics (LAUS). To this end, we compare these two measures in the states that get positive weights in the synthetic control (Section B.1). We then show the labor market flow rates computed using the panel structure of the CPS (Section B.2).

B.1 Unemployment Rate

Because the CPS is not designed to be representative at the state level, the LAUS program estimates state-level unemployment and employment by drawing on a variety of data sources such as quarterly census of payroll employment data from administrative records, including the universe of UI claims. While our main analysis relies on unemployment data from LAUS, we can measure a state-level unemployment rate (albeit noisily) using the survey-based CPS.

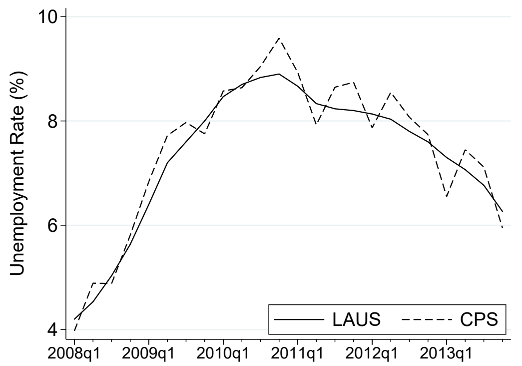
Figure B.1 plots the quarterly unemployment rate according to the CPS for Missouri and five of the nine states used for synthetic control for the vacancy-to-unemployment ratio. Consistent with Johnston and Mas (2018), Missouri's unemployment rate declined sharply relative to states used for synthetic control in the quarters following the UI cut. Figures B.2 and B.3 compare the unemployment rates according to LAUS and CPS for Missouri and the 10 states that were assigned non-zero weights in our synthetic control analysis.

Figure B.1: Unemployment Rates for Missouri and Control States (Derived from CPS)

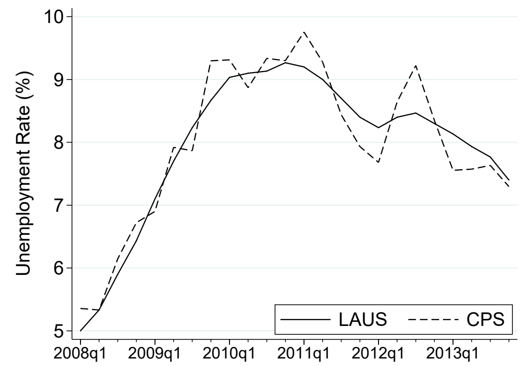


Note: Plot shows unemployment rates calculated from the Current Population Survey (CPS) for Missouri and five of the ten states which are assigned positive weights to construct synthetic control for a given construction of either H/V or V/U, with many being weighted to construct multiple synthetic measures. The unemployment rate for each state is calculated as a simple quotient of the count of unemployed and the count of those in the labor force.

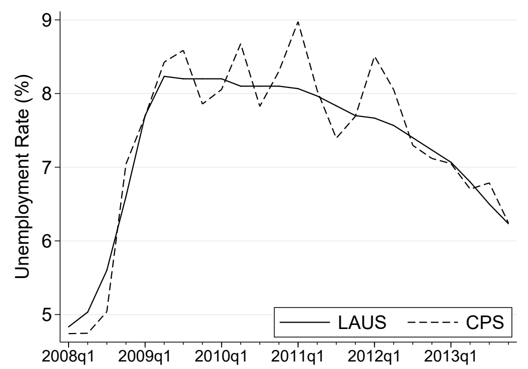
Figure B.2: State Unemployment Rates: LAUS and CPS Comparisons



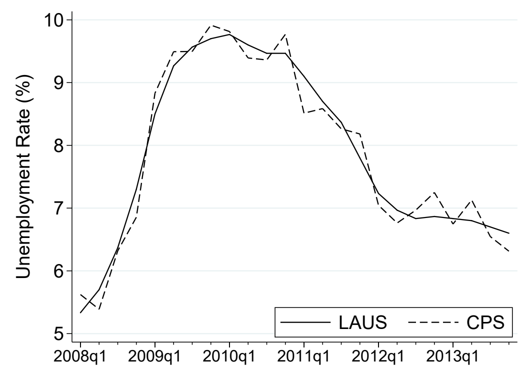
(a) Colorado



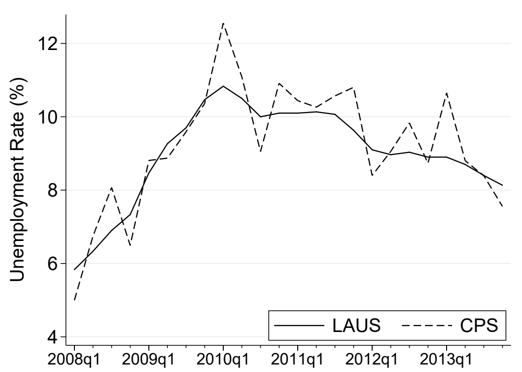
(b) Connecticut



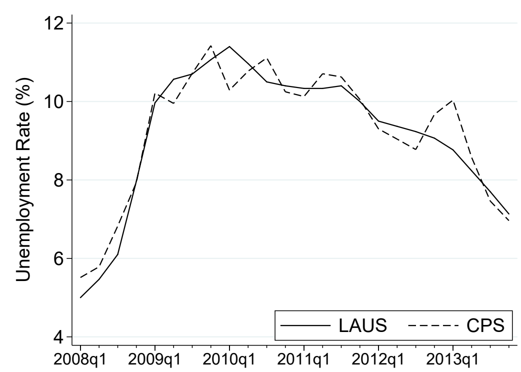
(c) Maine



(d) Missouri



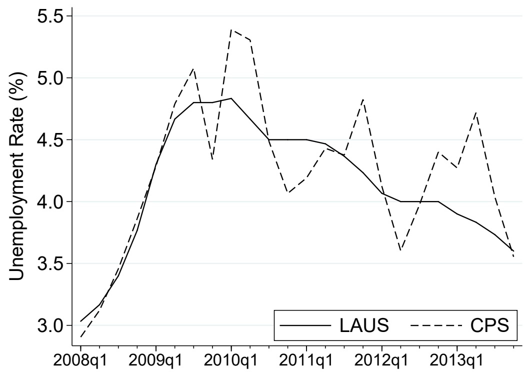
(e) Mississippi



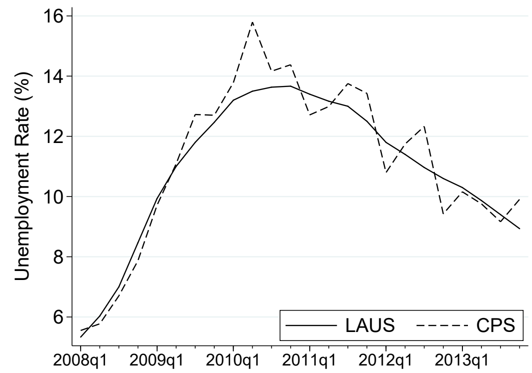
(f) North Carolina

Note: Figure presents unemployment rates for states that are weighted to construct a synthetic Missouri. Solid lines report the official unemployment rate as reported by LAUS, while the dashed line is the unemployment rate as constructed from the monthly CPS alone.

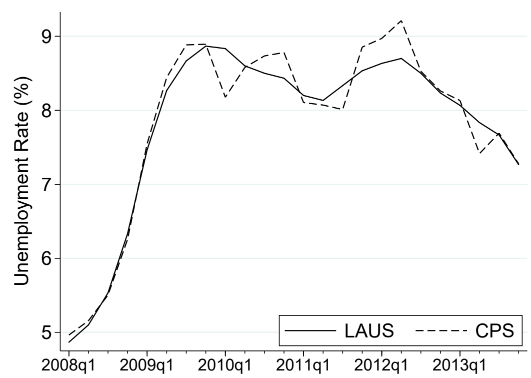
Figure B.3: State Unemployment Rates: LAUS and CPS Comparisons



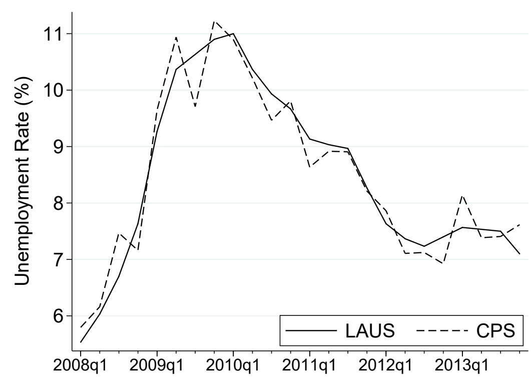
(a) Nebraska



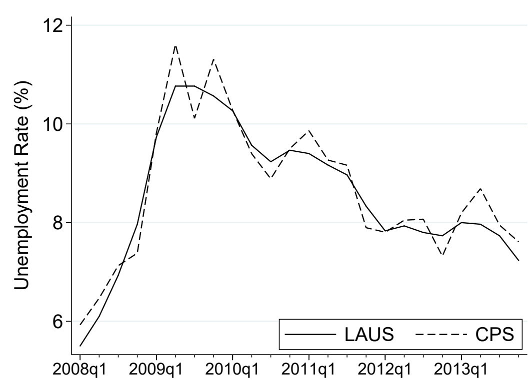
(b) Nevada



(c) New York



(d) Ohio

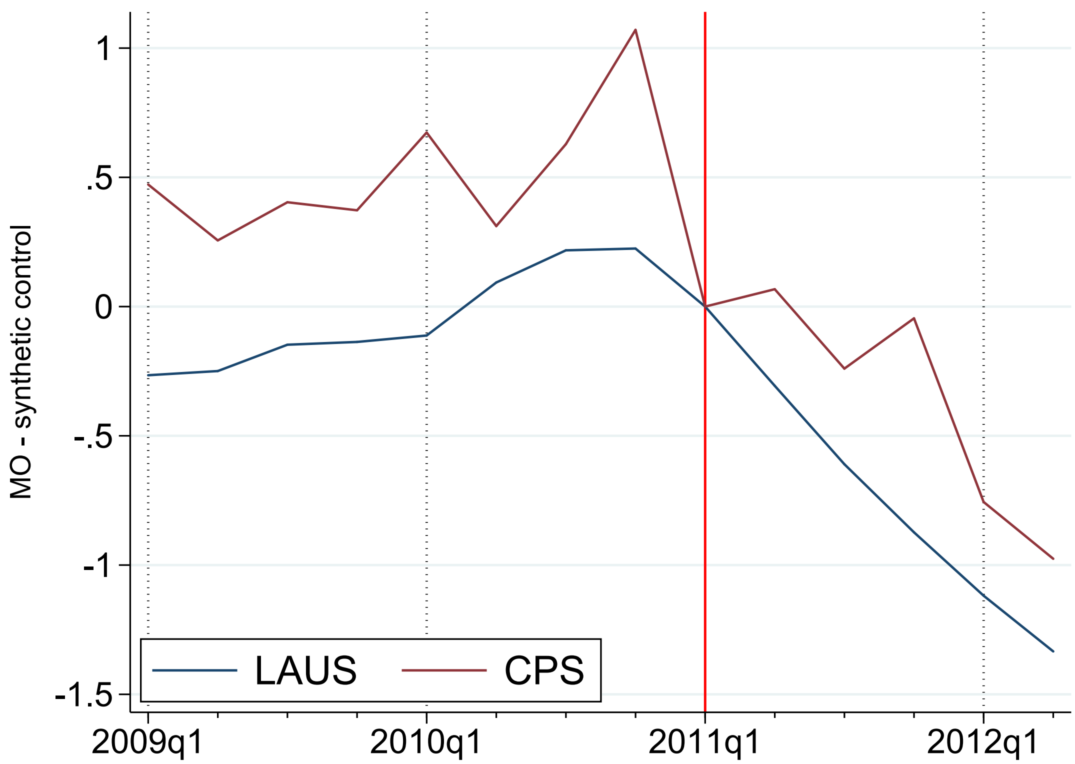


(e) Tennessee

Note: Figure presents unemployment rates for states that are weighted to construct a synthetic Missouri. Solid lines report the official unemployment rate as reported by LAUS, while the dashed line is the unemployment rate as constructed from the monthly CPS alone.

Figure B.4 plots the results of synthetic control approach for Missouri's quarterly unemployment rate according to LAUS (result from Figure 1b) and the CPS for the same set of predictor variables, showing the effect of the duration cut on unemployment is similar regardless of the measure.

Figure B.4: Synthetic Control for Missouri Unemployment Rate: LAUS and CPS



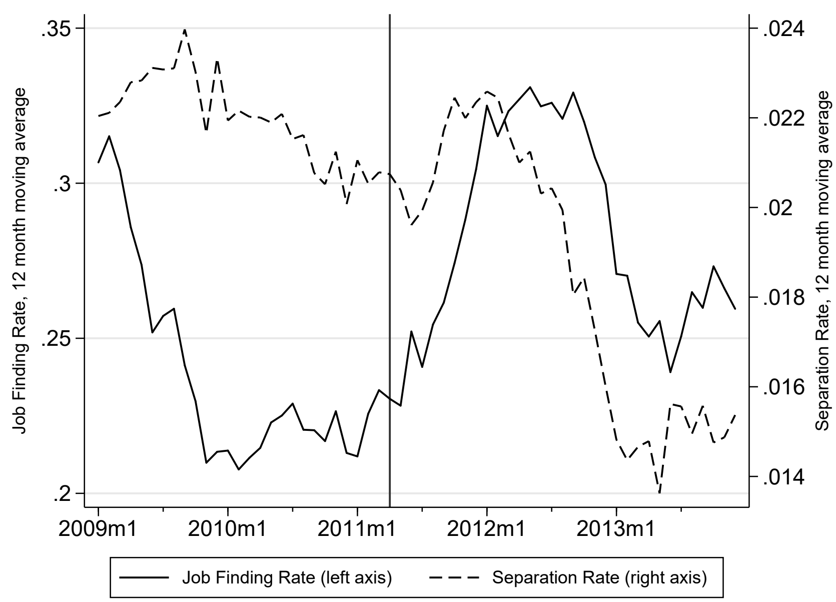
Note: Graphs plots the results of synthetic control approach for two different measures of Missouri's unemployment rate: the official reported unemployment rate from the BLS's Local Area Unemployment Statistics (LAUS, solid line) and the computed unemployment rate from the Current Population Survey, which equals the unemployed count divided by the number in the labor force. States which cut UI benefits around the time of Missouri's policy change are excluded from the donor pool. Predictors include the change in house prices from 1999-2006 as well as from 2007-2010; shares of employment in (i) agriculture, utilities, and mining, (ii) manufacturing, (iii) wholesale, retail trade, and transportation, (iv) education and healthcare services, and (v) arts, entertainment, recreation, accommodation, and food services; and percent of the state that is rural.

B.2 Labor Market Flows

Top panel of Figure B.5 shows monthly labor market transition rates for Missouri from the CPS between 2009 and 2013. We adjust these transition rates for time aggregation to obtain continuous time inflow and outflow rates, which we refer to as job finding (f) and separation (s) rates (Shimer, 2012; Elsby et al., 2015). These rates are plotted in the bottom panel.

Figure B.5: Labor Market Flows in Missouri from CPS

(a) UE and EU flow rates



(b) s and f rates

Note: Graph plots the 12-month moving averages of labor market flow rates in Missouri from the Current Population Survey. Panel (a) plots raw UE/U and EU/E as measured in the CPS monthly files. Panel (b) plots the job finding rate (f) and separation rate (s) after adjustment for time-aggregation bias as outlined by Shimer (2012). All data are seasonally adjusted at a monthly frequency.