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ARTICLE

Unemployment persistence with an evolutionary perspective: job creation or destruction (or both)?

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Abstract
This study analyzes the linkage between dynamic persistence of unemployment and the demand side of the labor market—job creation and destruction with an evolutionary perspective. The Neo-Austrian model predicts that: (i) unemployment is not featured as stationary over the entire sample period. (ii) unemployment is in disequilibria if job creation or job destruction (or both) is in out-of-equilibrium adjustment; (iii) regions with more unemployment compensation benefits or co-ordination problem are featured by higher unemployment persistence compared with low unemployment insurance benefits. The empirical analysis using aggregate-level and state-level data provides empirical support to these predictions. Using a unique dataset, this study finds that the persistence in the unemployment rate is a job destruction phenomenon.

Keywords Unemployment · Hysteresis · Out-of-equilibrium dynamics · Job creation · Job destruction

JEL Classification J2 · J4

1 Introduction

Over the last 2 decades, several studies have been devoted to explain the behavior of unemployment persistence in European countries and United States.[1] One strand of literature, e.g., Blanchard and Summers (1986, 1987), argued that the high European unemployment rate for a sustained length of time is due to the bargaining power

[1] Dosi et al. (2018) provided a detail survey for the conception of hysteresis in unemployment.

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of insiders who are currently employed. Following Blanchard and Summers (1986, 1987), a number of studies empirically explored the hysteresis hypothesis in unemployment in both industrial and developing economies. For the United States, it is clear that the results from these studies show mixed support.[2] Recently, Coibion et al. (2013) first pointed out that the United States economy response to recessions has become increasingly hysteretic in the early 1990s. They explored three potential propagation factors, such as decreasing labor mobility, the evolution of demographic composition of the United States population, and the changing culture. Interestingly, they found that a changing United States perspective on claiming government benefits can help to explain the observed rise in persistence.

This article extends the existing literature along several dimensions. First, while Coibion et al. (2013) concentrated on the supply side of the labor market, the present study provides further information and evidence for the unemployment persistence puzzle from the demand side of the labor market, which pertains to job creation and destruction with an evolutionary perspective. In the first section of the present study, we develop a simple Neo-Austrian model of unemployment and job flows to organize our ideas and produce predictions on the potential channels and driving forces of labor demand on unemployment. During the Great Recession and quantitative easing period, the labor market might undergo more dynamic restructuring activity than that over the jobless recovery period.[3] In other words, the hysteresis feature might be detected in the Great Recession and quantitative easing period, while stationary evidence might be found in the jobless recovery period. We emphasize that given the fact that the United States economy experienced several significant economic shocks in last 2 decades, a modeling analysis for the different integration processes will help us to further realize the labor market restructuring activity over time. In the Neo-Austrian model, persistent unemployment reflects an out-of-equilibrium in the intertemporal structure of employment, that is co-ordination issues existence between utilization productive capacity and construction of new employment portfolio investment.[4] Firms are bounded rational and production process is time-articulated with decisions of employment construction and utilization. The first prediction of the model is that the unemployment rate should not be featured as stationary over the entire sample period. A second prediction is that persistent unemployment can work through job creation channel or job destruction channel (or both). A third

[2] For the EU countries, most studies cannot reject the null hypothesis of a unit root. See Blanchard and Summers (1986, 1987), Mitchell (1993), Roed (1996), Song and Wu (1998), and Leon-Ledesma (2002), among others.

[3] The jobless recovery considers that the GDP returns to a normal state without creating new jobs or maintaining or decreasing the level of employment.

[4] It is no doubt that the coordination issue, coordination costs, or coordination shocks may be associated with the Neo-Austrian model. Becker and Murphy (1992), for example, emphasized the coordination costs among specialization and the division of labor with different knowledge extent. Moreover, Kimura et al. (2020) studied the policy responses to the COVID-19 pandemic shock on global value chains (GVC) in East Asia. They high-lighted the importance of policy coordination in East Asia to mitigate the pending economic shock in terms of unemployment and corporate bankruptcy. We thank the Anonymous Referee for providing useful advice that improved the statements about coordination issues.

prediction is that a higher unemployment compensation benefits or co-ordination cost increases persistent unemployment.

Second, we test the predictions of the model using aggregate unemployment, job creation, and destruction U.S. data.[5] To achieve this goal, we use the dynamic unit root test introduced by Leybourne et al. (2007, hereafter LKT) to decompose switches in the order of integration between stationary and hysteresis.[6] Since unit root tests alone can provide limited evidence of the hysteresis hypothesis in regard to unemployment and job flows, this article estimates of the half-life of a shock causing deviations in unemployment and job flows. We employ the local-to-unity approximation as introduced by Gospodinov (2004). Employing Monte Carlo simulations, Gospodinov (2004) found that the respective procedures for constructing asymptotically valid confidence intervals have good coverage in finite samples. Moreover, we compute confidence intervals for the half-life of the impulse-response function, that is, the number of years required for a shock to a variable to dissipate by one-half.[7] Finally, to check the robustness of the empirical result, we also explore the median-unbiased estimates and confidence intervals using the grid-bootstrap method of Hansen (1999).

Third, the theoretical prediction examination was also employed for the unemployment across states. In October 2009, for instance, the unemployment rate in Georgia was 10.5%, the highest rate since 1990. One crucial part of the policy response to the Great Recession has been a dramatic expansion in unemployment insurance (UI) benefits. Beginning in May 2008, the federal Extended Benefits (EB) and Emergency Unemployment Compensation (EUC) extensions raised the regular 26-week limit to as many as 99 weeks in states experiencing high unemployment rates. As a result, the study of dynamic persistence of hysteresis processes across states helps in understanding the labor market evolution during active intervention. In particular, we explore whether job creation and/or job destruction explain(s) unemployment rates across states over the years of 1977 to 2013, using the cross-section augmented autoregressive distributed lag (CS-ARDL) model.

The study of the degree of persistence in job creation and destruction contains important policy implication, because the unemployment rate has become progressively limited informative about the dynamics of the labor market (Murphy and Topel 1997). If the null hypothesis of non-stationarity in the job flows is rejected, this shows that the natural rate paradigm is to be preferred to the hysteresis

[5] To our knowledge, the related studies are that of Blanchard and Summers (1986) and Coibion et al. (2013). These two studies were conducted focused on the bargaining power of insiders, aggregate shocks, or the supply side factors (declining labor mobility, changing age structures, and the decline in trust among Americans).

[6] In terms of methodology, unemployment hysteresis studies have mostly employed conventional individual and panel unit root tests that assumed a constant order of integration for the unemployment rates.

[7] We stress that our focus is measuring the degree of persistence. For example, the half-life of a shock to job creation (destruction) is the number of quarters for a unit impulse to decay by half. This focus is consistent with the hysteresis unemployment literature. However, this measure is distinct from the focus of Davis et al. (1996) that the percentage of newly created jobs at time t that remain filled at each subsequent sampling date through time $t+N$.

paradigm. If the job flow rates are stationarity, this does not necessarily mean that the unemployment rate is fixed. The time series analysis of job flows reveals a rich picture of the dynamics of the labor market in comparison to studies that focus on measures of unemployment over time. Some studies found that the pace of business dynamism, as measured by job creation and destruction, in the United States has declined after 2000 (Decker et al. 2014; 2017; 2020).[8] It follows that active policies which stimulate demand will only have a short-term impact on the job flows restructuring process. The natural rate of unemployment (NAIRU) hypothesis emphasizes that while shocks in demand and/or supply result deviations in the actual unemployment rate from the NAIRU, however, unemployment rate will return to its equilibrium level in the long run.[9] In the long term, the job flows will revert to their stationary levels. By contrast, if the job flows are non-stationary, then the unemployment hysteresis hypothesis is confirmed. The evidence will provide an empirical foundation for active policies to deal with the source of unemployment persistence.

The paper relates to two main strands of literature. One stream of studies focusses on the membership channel or the supply-side channel. According to the membership channel, insiders decide wages to make sure that they continue to be employed.[10] Since the unemployed are outsiders they cannot put forth much effect on the bargaining process. The power of insiders is influenced by the degree of labor market regulation, such as employment protection legislation (Nickell et al. 2005). Active labor policies can progress the status of the unemployed and thus decrease the influence of insiders. If the hysteresis hypothesis was correct, stabilization policies might focus on the structural features of labor markets. Coibion et al. (2013) explored the possible supply-side explanations for the rising persistence of United States unemployment puzzle. They found that the positive effect of mobility and demographics on unemployment hysteresis. In contrast, Coibion et al. (2013) found that cultural factors, such as trust, value for work and individualism, has a strong negative relationship regional unemployment hysteresis. This implies regions with less trust undergone more unemployment hysteresis. In other words, Coibion et al. (2013) suggested that the change in mobility and demographics over time have more than neutralized the influence of culture.

Another stream of literature explores the hysteresis hypothesis in unemployment from a macroeconomic system perspective (Dosi et al. 2018; Dosi and Virgillito 2021). They focused on whether the system is featured with multiple equilibria or path-dependent trajectories. Dosi et al. (2013) constructed a complex evolving system that features an ecology of hysteresis interactions that continuously changes the structure of the system itself. In particular, they united Keynesian demand generation mechanisms and a Schumpeterian innovation-fuelled growth process. Dosi et al. (2013) employed

[8] Please see Decker et al. (2014; 2017; 2020) for more details.

[9] For example, the government implement an active management policy (e.g., employment subsidy) to private businesses once they employ a new worker during the recession. During this period, applications from many enterprises are filed and new employees are subsidized. The natural rate of unemployment (NAIRU) hypothesis predicts that, on the expiration of the subsidization period, most employees left their positions and there were only a few subsidized employees still in employment.

[10] Roed (1996, 1997) launched a detail survey for the hysteresis theories.

the hysteresis model by exploring the short- and long-run effects of different monetary policies. They showed that rises in the credit multiplier caused a dramatic fall in the unemployment rate and then a phenomenon of persistent unemployment. Recently, Dosi et al. (2018) developed a "Schumpeter meeting Keynes" family of models (Dosi et al. 2017) to study the hysteresis hypothesis in gross domestic product, productivity, unemployment. In contrast to the membership channel, Dosi et al. (2018) shed new light in the hysteresis unemployment literature in terms of inter-regime and intra-regime hysteresis between Fordist and Competitive institutional labor market.

Following the theoretical model developed by Dosi et al. (2018), the main contribution of this paper is to provide empirical evidence for the job flows in persistent unemployment dynamics. In Sect. 2, we discuss the model and generates predictions on the effects of job creation and destruction on unemployment persistence and highlights the potential insights into job flows. Sect. 3 describes the data, the approach underlying the empirical analysis, and presents the empirical results. The conclusions are given in Sect. 4.

1.1 The theoretical framework

This section offers a simple model to motivate our empirical analysis. Following the Neo-Austrian approach (Hicks 1970, 1973; Amendola and Gaffard 1998, 2003, 2005), the section employs a sequential framework to model job creation and destruction with co-ordination issues. This section lays down theoretical framework with an evolutionary perspective to think about another possible dimensions of out-of-equilibrium adjustment in job creation and job destruction. Consider an economy consisting of a large number of identical risk-neutral bounded rational firms. Time is discrete. The production process is considered as sequential articulation with decision of production, consumption, and investment. The production involves steps of construction c and utilization u

$$X^c(t) = [x_1(t), x_2(t), \cdots, x_{(n^c)}(t)] \tag{2.1}$$

$$X^u(t) = \left[x_{n^c+1}(t), x_{n^c+2}(t), \ldots, x_{n^c+n^u}(t)\right], \tag{2.2}$$

where $X^c(t)$ and $X^u(t)$ present the production function along the time dimension (t). In the Neo-Austrian model, labor is considered as the main input in the production. The production decision and consumption decision in the present study is similar to that in Amendola and Gaffard (2003). For example, the present production is considered as the difference between the supply $s(t)$ and the stock o at $t\text{-}1$

$$q(t) = s(t) - o(t-1). \tag{2.3}$$

The consumption c can be present as part of the demand $d(t)$ of final output with price p

$$p(t)d(t) = w(t) + c(t) + h^h(t-1), \tag{2.4}$$

where w(t) is the wage rate and h^h is the monetary idle balance among households. Investment decision is considered as the necessary employment that maintain productivity capacity. In the following step, the total employment of construction and utilization is decided

$$E = \left[A^c X^c(t)' + A^u X^u(t)'\right]. \tag{2.5}$$

A^c and A^u represent labor input vector. The present study emphasizes that the employment construction and utilization can be considered in more detail in job creation and destruction process. In particular, firms need to deal with the co-ordination issues during the job restructuring process. We start from the cost function for the P^{th} firm in region i as follows:

$$COST\left(W_p, CO_p\right) = W_p^{\alpha} CO_p^{\beta}. \tag{2.6}$$

W_p is the wage, CO_P is the co-ordination cost. Using the Shepard's lemma, the partial derivative of the cost function with respect wage delivers the labor demand of this firm

$$L_P^d = \frac{\partial COST\left(W_p, CO_p\right)}{\partial W_p} = \alpha W_p^{\alpha-1} CO_p^{\beta}. \tag{2.7}$$

Defining the $\widehat{X} = dlnX$ the total differential of natural logarithm of Eq. 2.7

$$\hat{L}_P^d = -(1-\alpha)\hat{W}_p + \beta \widehat{CO}_p. \tag{2.8}$$

In the next step, the labor supply for the P^{th} firm in region i as assumed as

$$\hat{L}_P^s = \left(\frac{W_i}{\varphi^{\varepsilon} z^{\delta}}\right)^{\gamma}. \tag{2.9}$$

Equation (2.9) represents the labor supply for the Pth firm in the region level i. w_i is the region-level real wage. We assume that all firms within the region pay the same wage ($w_p = w_i$). $\gamma(\gamma > 0)$ presents the labor supply elasticity. φ is assumed as the homogenous prevailing wage across workers. ε presents the cross-elasticity of the labor supply between i^{th} region and the economy. While the worker becomes unemployed, he/she receives an unemployment subsidy z per unit of time. δ presents the cross-elasticity of the unemployment subsidy. The total differential of the natural logarithm of Eq. (2.9) causes to

$$\hat{L}_P^s = \gamma\left(\hat{W}_i - \varepsilon\hat{\varphi} - \delta\hat{z}\right). \tag{2.10}$$

We define that τ_p^i, $\sum_{p=1}^{n} \tau_p^i = 1$, is the relative employment size of the Pth firm in region i. The employment change in region can be presented as

$$\hat{L}_i = \sum_{p=1}^{n} \tau_p^i \hat{L}_p. \tag{2.11}$$

In similar conception, the weight average of the proportional change in the co-ordination shock among the n firms in region i presents as

$$\widehat{CO}_i = \sum_{p=1}^{n} \tau_p^i \widehat{CO}_p. \tag{2.12}$$

For the overall region i, labor demand equal to labor supply results in $\hat{W}_i$ and then $\hat{L}_p$ is formulated as

$$\hat{L}_p = \left(\beta \widehat{CO}_p - k\beta \widehat{CO}_i\right) - k\varepsilon\gamma\hat{\varphi} - k\gamma\delta\hat{z}; \tag{2.13}$$

$k = (1-\alpha)/[\gamma + (1-\alpha)]$. The Pth firm is featured as a job creation if $\hat{L}_p > 0$ and job destruction if $\hat{L}_p < 0$. Note that the employment decision for the P^{th} firm was confronted by an idiosyncratic co-ordination shock specific to that firm $\widehat{CO}_p$, a co-ordination issue specific to the region $\widehat{CO}_i$, and the change in prevailing wage φ and unemployment subsidy z. Following Davis et al. (1996), the job creation (or job destruction) rate for an overall region can be measured as weight average of employment expansion, M+, (employment contraction, M-) firms in a given year:

$$JC_i = \sum_{p \in M+} \left[\left(\beta \widehat{CO}_p - k\beta \widehat{CO}_i\right) - k\varepsilon\gamma\hat{\varphi} - k\gamma\delta\hat{z}\right] \tag{2.14}$$

$$JD_i = -\sum_{p \in M-} \left[\left(\beta \widehat{CO}_p - k\beta \widehat{CO}_i\right) - k\varepsilon\gamma\hat{\varphi} - k\gamma\delta\hat{z}\right] \tag{2.15}$$

The steady-state unemployment rate in region i is defined as the flow into unemployment with the flow out of it (Mortensen and Pissarides 1994)

$$u_i = \left[JC_i, JD_i\right]. \tag{2.16}$$

As emphasized in Amendola and Gaffard (2003), the Neo-Austrian considers adjustment as a disequilibria process response to a shock that changes in employment construction and utilization. The coexistence of equilibrium and out-of-equilibrium is possible in intertemporal processes (Baumol 2000). The 2007–09 Great Recession is considered the worst Great Recession for the United States since the 1930s Great Depression. Based on the results from the above work, we propose:

Prediction 1: The unemployment rate should not be featured as stationary over the entire sample period.

During the Great Recession period, businesses declined, closed and jobs destroyed. Quantitative easing facilitated the creation of new enterprises, employment opportunities, and business growth (Davis et al. 1996; Decker et al. 2014, 2017, 2000). These business dynamism as measured by job creation and creation offer an interesting parallel for exploring the evolutionary process in the United

States labor market response to negative and positive shocks. Based on Eq. (2.16), this study proposes:

Prediction 2: Job creation or job destruction causes persistence in the unemployment rate.

The third theme of this study is that the literature has not addressed the dynamic persistence in the state unemployment rate. During the Great Recession, two types of labor market policies in addition to regular unemployment compensation benefits were typically available during these periods: Extended Benefits (EB) and Emergency Unemployment Compensation Act of 2008 (EUC08). The EB provides either 13 or 20 weeks of benefits to unemployed workers who exhausted their entitlements to regular UI benefits, and was in a state that had an unemployment rate both above a certain threshold and at least a certain amount higher than the state's recent historical levels. Historically, states and the federal government have divided EB benefit payments equally. However, the American Recovery and Reinvestment Act (ARRA) of 2009 permitted the federal government to pay for overall Extended Benefits (EB) benefits costs instead of only half. During this period, 42 states triggered on to Extended Benefits (EB) for at least a part of time (Whittaker and Isaacs 2013; Nicholson, et al. 2014).

The Emergency Unemployment Compensation Act of 2008 (EUC08) program initially provided up to 13 weeks of federally financed benefits to UI claimants who exhausted their entitlements. The ARRA passed in February 2009, and in November 2009 the Worker, Homeowner, and Business Assistance Act expanded EUC08 to contain four tiers of benefits: 20 weeks to all states (tier 1), 14 weeks to all states (tier 2), 13 weeks in states with total unemployment rates at least 6% or insured unemployment rate of at least 4% (tier 3), and 6 weeks in states with total unemployment rate at least 8.5% or insured unemployment rate of at least 6% (tier 4) (Rothstein 2011).[11] Based on the results from the Eq. (2.14), (2.15) and (2.16), we propose:

Prediction 3: During the Great Recession, states with more unemployment compensation benefits are featured by the higher unemployment persistence.

The theoretical framework provides some useful predictions for the potential sources for persistent unemployment phenomenon. In other words, persistent unemployment may come from job creation channel or job destruction channel (or both). Co-ordination issues at both the firm level and region level play an important role in the out-of-equilibrium adjustment. It is not doubt that Schumpeterian technology change contributes co-ordination issue at the firm level $\widehat{CO}_p$.[12] The change in prevailing wage φ and unemployment subsidy z may contribute a distortion of productive capacity and then unemployment disequilibria. The Great Recession broke the

[11] More detail information available from U.S. Department of Labor, Employment and Training Administration, http://www.ows.doleta.gov/unemploy/euc.asp.

[12] Silverberg and Verspagen (1994) constructed a multi-firm evolutionary model in which businesses have influence from each other. They showed that the evolutionary technology change processes reflect learning trial and error with selection, both at the intra and interfirm levels. The linkage between technology change and unemployment has some empirical support (see, for example, Brouwer et al. 1993; Carlaw and Lipsey 2012; Feldmann 2013).

productive capacity structure which implies the labor market no longer sustains a steady state and is linked with the economic activity co-ordination problems over time, that is, with the appearance of market disequilibria. In other words, the evolutionary labor market trajectory is path-dependent, because the Great Recession and quantitative easing events have persistent effects. In the next step, we empirical examine these predictions.

2 Empirical analysis

2.1 Data

The quarterly unemployment rates were collected from the Bureau of Labor Statistics (BLS). The different integration and persistence properties in the United States private sector job reallocation process are shown. We used the unique quarterly nonfarm private sector job flows dataset between the second quarter of 1990 and ending in the second quarter of 2013 (yielding 93 observations).[13] The unique quarterly job flows measures time series are derived from Business Employment Dynamics (BED) micro-data.[14] Finally, the monthly and annual total unemployment rates by state are drawn from the Local Area Unemployment Statistics (LAUS), conducted by Bureau of Labor Statistics (BLS). The annual job creation and destruction data are drawn from the Business Dynamics Statistics (BDS) from 1977 to 2013 conducted by the Center for Economic Studies in the U.S. Census Bureau.

2.2 Estimation framework

Following Leybourne et al. (2007), the LKT test is proposed below. We assume that y_t is generating as AR(1) process, observed for $t = 1, \ldots, T$

$$y_t = d_t + u_t \tag{3.1}$$

$$u_t = \rho_i u_{t-1} + \varepsilon_t, \tag{3.2}$$

where y_t is considered as unemployment or job flows. The deterministic kernel, $d_t = z_t'\beta$, is defined as either a constant or a constant with linear time trend. The ρ_i represents the different regimes I(1) and I(0). The null hypothesis is proposed as y_t is non-stationary all over the sample period. The alternative hypothesis, H_1, is proposed as y_t is undergoing one or more regime changes between stationary and non-stationary behavior. The purpose of the LKT test is to identify the existence

[13] We are particularly grateful to Professor John Haltiwanger for allowing public access to the job flows data.

[14] See Davis and Haltiwanger (1999), Davis et al. (2006), Faberman (2008) and Davis, Faberman and Haltiwanger (2012) for more details.

of multiple regime shifts and to estimate the associated switch-point fractions. This study seeks to explore whether the active intervention of the United States Federal Reserve during the 2007–09 recession introduced the hysteresis behavior into unemployment. The study of hysteresis phenomenon carries crucial policy implications, since it indicates that high unemployment will continue to be a serious co-ordination issue in the long run. Accordingly, the hysteresis hypothesis offers an empirical basis for active government policies to flight recessions. The test statistic is developed with a local GLS detrended ADF unit root test of Elliott et al. (1996) that aims to find a single switch in persistence.

Our testing procedure will be based on this statistic

$$M(\lambda) \equiv \inf_{\tau \in (\lambda,1)} DF_G(\lambda, \tau). \tag{3.3}$$

Once detected the stationarity regime $[\hat{\lambda}, \hat{\tau}]$, we can investigate the presence of any existence stationarity periods by continuously exploring the appropriate data subintervals. We will search for extra regime switches in the two subintervals $[0, \hat{\lambda}]$ and $[\hat{\tau}, 1]$. The similar process, based on M of Eq. (3.3), employed to respective of these two subsamples will then allow us to obtain the possible stationary (if any) period existing in each.

Since the unit root tests offer a limit information of the persistence of unemployment (or job flows) series, we proceed to employ the method introduced by Gospodinov (2004) to construct confidence intervals for impulse-response functions and to estimate the half-life of a shock that leads to deviation from the natural rate of unemployment. As the shock effect on y_{t+h} resulting from one-standard-deviation change in ε_t in the impulse-response function framework is defined as $IRF_h = \partial y_{t+h}/\partial \varepsilon_t$, Gospodinov (2004) introduced local-to-unity approximations of the greatest root of the process to find improved finite sample approximations. The advantage of Gospodinov's (2004) approach over the conventional bootstrap method is that the confidence intervals are correctly measured for the total of the autoregressive (AR) coefficients rather than for separate coefficients of the AR(p) model.[15]

In theoretical perspective terms, unemployment is considered a hysteresis phenomenon involving the job flows associated with the co-ordination process (Amendola and Gaffard 2003). Moreover, job creation is a costly and time-consuming process and job destruction occurs immediately once the reservation productivity falls below the threshold level (Mortensen and Pissarides 1994). In other words, job flows might respond to both stationary and hysteresis evolutionary process and productivity changes caused by positive and negative shocks.

It is well known that conventional bootstrapped confidence intervals are not effective if the data are featured with a nearly integrated process (Andrews and Chen 1994). As a robustness check, this study employed the grid-bootstrap approach proposed by Hansen (1999) to build confidence intervals for the sum of the AR coefficients. Based on Monte Carlo simulations, Hansen (1999) found that the grid-bootstrap procedure produces confidence intervals with sound coverage in finite samples.

[15] Interested readers are referred to Gospodinov (2004) for more technical details.

Table 1 Result of LKT test

Sample	M	I(0) regime
Unemployment		
1990:Q2-2013:Q2	– 3.863*	2003:Q4-2008:Q3
1990:Q2-2003:Q3	– 9.114**	1998:Q3-2001:Q2
Job creation		
1990:Q2-2013:Q2	– 6.125**	1993:Q2-1998:Q2
1998:Q3-2013:Q2	– 6.873**	2008:Q1-2011:Q1
Job destruction		
1990:Q2-2013:Q2	– 4.063*	1994:Q1-2003:Q1
CPS inflow		
1990:Q2-2013:Q2	– 3.979*	1994:Q1-2011:Q4
UI inflow		
1990:Q2-2013:Q2	– 3.824*	1994:Q1-2012:Q4

*and **denote statistical significance at the 10% and 5% levels, respectively

Finally, the study explores the potential links between unemployment rate and job creation (or destruction). To do so, the cross-section augmented regressive distributed lag (CS-ARDL) framework provided by (Chudik et al. 2016) is employed

$$U_{it} = c_i + \theta_i' x_{it} + \sum_{l=1}^{p} \gamma_{il}' U_{i,t-l} + \sum_{l=1}^{3} w_{i,Ul}' \overline{U}_{t-l} + \sum_{l=1}^{3} w_{i,xl}' \overline{x}_{t-l} + e_{it}, \quad (3.4)$$

where $U_{i,t}$ is the unemployment rate of state i at time t, x_{it} is the explanatory variables, including job creation and destruction rates, and e_{it} is the error term. The present study employed both mean group and pooled estimators to estimate the mean long-run coefficients. As addressed in the original (Chudik et al. 2016), the θ_i measures the long-term linkage between explanatory variables and unemployment rate. Moreover, the average coefficient vector across N states are measures as $\overline{\theta} = N^{-1} \sum_{i=1}^{N} \theta_i$. Chudik et al. (2016) emphasize that the CS-ARDL framework has advantages to account for the issues of whether the variables are I(0) or I(1) with a high degree of economic correlation across states. As a result, the CS-ARDL model was employed to explore whether the unemployment rates across states can be linked with job creation or destruction over the 1977–2013 period.

2.3 Testing Prediction 1 and Prediction 2

In this section, we test Prediction 1: The unemployment rate should not be featured as stationary over the entire sample period and Prediction 2: Job creation or job destruction causes persistence in the unemployment rate. The M(λ) test results are reported in Table 1; Fig. 1 shows the regime switching behavior of the U.S. unemployment rate during the 1990:Q2-2013:Q2 period. In Fig. 1, the piece-wise red linear lines represent the stationary regime period. For the

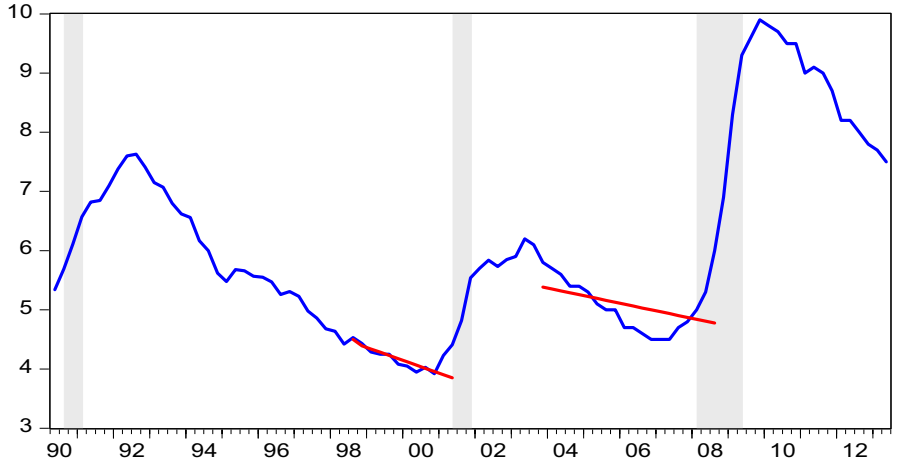

Fig. 1 U.S. unemployment rate, 1990:Q2-2013:Q2

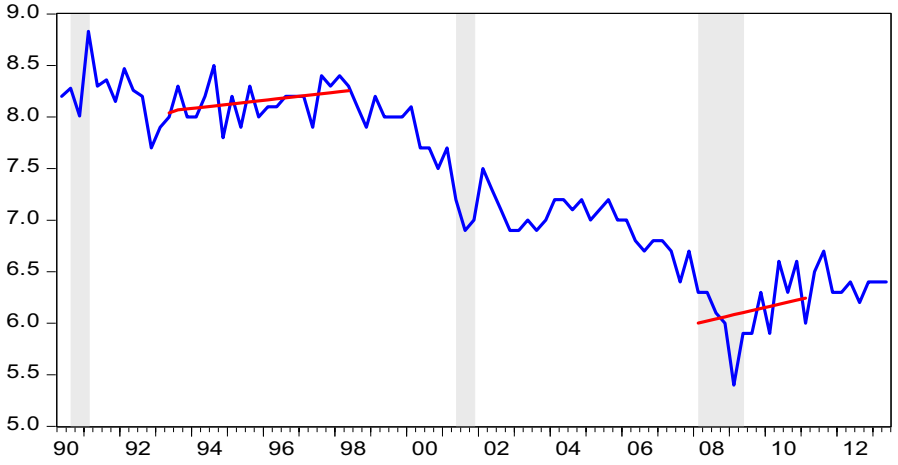

Fig. 2 Job creation rate for U.S. private sector, 1990:Q2-2013:Q2

unemployment rate, we first explored the whole sample (1990:Q2-2013:Q2) and found an interior I(0) period between 2003:Q4-2008:Q3. In the following step, the 1990:Q2-2003:Q3 sample period is considered and one stationary regime (1998:Q3-2001:Q2) is detected. As a result, the unemployment time series can be presented an I(1)-I(0)-I(1)-I(0)-I(1) regime pattern. It is worthwhile stressing that the LKT test seems to provide relatively good representations of the United States labor market dynamics, since this regime switching coincides with important events and economic episodes. The first I(0)-I(1) is located in 1990:Q2-2001:Q2, which is associated with the Great Moderation and the end of the 1990s boom. The second I(0)-I(1) is detected in 2001:Q3-2008:Q3, corresponding to the

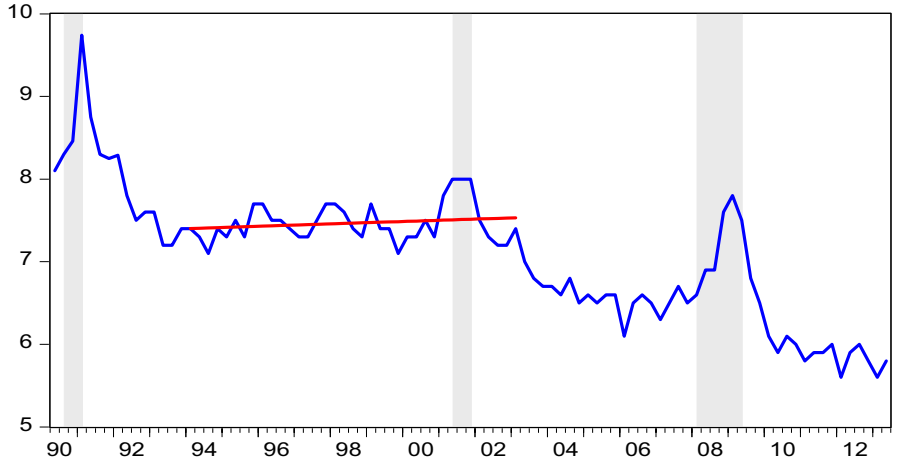

Fig. 3 Job destruction rate for U.S. private sector, 1990:Q2-2013:Q2

dot-com collapse and the following jobless recovery period. The sequential procedure detected a I(1) dated in 2008:Q3-2013:Q2 is linked to the Great Recession and quantitative easing period.

In the following step, we explored the job flows rates in the whole sample (1990:Q2-2013:Q2). Of interest is the significantly different regime switching behavior of across the job flows processes, as shown in Figs. 2 and 3. While job creation experienced in the I(1)-I(0)-I(1)-I(0)-I(1) phase, job destruction in the private sector underwent an I(1)-I(0)-I(1) regime pattern. We next look at the timing of the regime switches in job flows. We found some evidence of a clustering of breaks as can be seen from the graphs. In Figs. 2 and 3, we observe that there is a commonality in regime switching points for job flows around the end of 1993, which corresponds to the beginning of the Great Moderation in the United States. According to the LKT test, the job creation rate switched from stationary to non-stationary at the end of the Great Moderation, while the job destruction rate switched from stationary to non-stationary at the end of the dot-com recession. One possible explanation is that employers tend to reduce job opportunity and postpone additional job destruction in light of the need for employment adjustment due to the economic shock.

In the final step, the confidence intervals and the degree of persistence were measured for each of the stationary and non-stationary periods named by the M-statistic.[16] In Table 2, we found that the lower bound of the grid-bootstrap confidence interval is greater than 0.76 for every I(1) regime. The upper bound of the 95% confidence interval is greater than 0.88. Interestingly, the sum of the AR coefficients is greater than 0.84 for the I(1) periods. An alternative measure of persistence proposed by Gospodinov (2004), the half-life based on the impulse-response function and the 95% confidence interval for the half-life, is reported in column (6) and (7)

[16] Following Fosten and Ghoshray (2011), only regimes with more than 20 observations are presented.

Table 2 The speed of persistence

	Sample	Order of integration	Alpha[1]	Hansen 95% CI[2]	HL_{IRF}[3]	95% CI[3]
Unemployment	1990:Q2-1998:Q2	I(1)	0.979	[0.959–1.013]	6.766	[3.664–8.107]
	2008:Q4-2013:Q4	I(1)	0.933	[0.909–1.015]	2.621	[1.547–3.784]
Job creation	1998:Q3-2007:Q4	I(1)	0.900	[0.819–0.931]	1.498	[0.698–2.322]
Job destruction	1994:Q1-2003:Q1	I(0)	0.534	[0.415–0.637]	0.342	[0.297–1.340]
	2003:Q2-2013:Q2	I(1)	0.849	[0.765–0.881]	1.169	[0.769–2.485]

[1]OLS estimate for the sum of the AR coefficients

[2]The grid-bootstrap approach (Hansen 1999)

[3]Estimate of the half-life (measured in years based on the impulse-response function)

of Table 2. Note that the half-lives for unemployment and job creation are measured as 6.766 and 1.498 years for 1990:Q2-1998:Q2 and 1998:Q3-2007:Q4, respectively. This evidence highlights the issue that the unemployment rate has become limit informative about the dynamics of the labor market (Murphy and Topel 1997). In Figs. 1, 2 and 3, we found enormous job creation and destruction underlying the relatively declining trend in unemployment. It is crucial to emphasize that some job churning is part of a healthy economy (Haltiwanger 2012). The churning flow indicates shifting resources away from less productive to more productive businesses. Haltiwanger et al. (2013) found that young firms play a disproportionate role in the economy's churning. The degree of persistence among job creation and destruction shed light into the pace of creative destruction. For example, the relatively smaller sum of AR coefficients for the I(0) period in job destruction implies that shocks would not have a long-lasting impact on the shrinking and closing of young establishments and firms.

To shed more light for the nature of global Great Recession and quantitative easing period restructuring the degree of persistence was also measured for 2008:Q1-2013:Q2 as shown in Table 3. Note that the lower bound of the 95% confidence interval for Alpha for unemployment is 0.762, while the upper bound is greater than unity, indicating that United States unemployment was highly persistent during the global Great Recession and quantitative easing period. An upper bound larger than one (corresponding to a non-stationary) is found for unemployment (1990:Q2-1998:Q2 and 2008:Q4-2013:Q4). Bound values larger than one imply explosive stochastic processes, so the process is not only highly persistence, but the persistence increases as we move back to the past. Again, the findings are not inconsistent with a high degree of persistence. Interesting, the grid-bootstrap confidence interval for job creation is (0.403, 0.587), while the 95% confidence intervals for job destruction is (0.754, 0.904). This evidence is in line with the theoretical

Table 3 The speed of persistence in 2008:Q1-2013:Q2

	Alpha	Hansen 95% CI	HL_{IRF}	95% CI
Unemployment	0.841	[0.762 1.025]	1.376	[1.014–1.828]
Job creation	0.559	[0.403 0.587]	0.250	[0.133–0.359]
Job destruction	0.842	[0.754 0.904]	1.214	[0.839–1.917]

model prediction in Sect. 2 that posits a close relationship between job destruction and unemployment.

In Table 3, the main finding is that the causes of unemployment persistence are job destruction rather than job creation. The possible explanation is that it is costly and time-consuming to find a new worker. The stronger intensity of idiosyncratic shocks leads to higher job destruction rate for given labor market tightness (Mortensen and Pissarides 1994; Davis et al. 2010). Another possible explanation is that the co-ordination issues take into account the financial resources and human resources allocation. Re-settling the consistency over time of human capital utilization disturbed by the Great Recession stimulates a hysteresis process through sequentially interacting disequilibria (Amendola and Gaffard 2003). Thus, the combination of co-ordination problems with heterogeneity costs induces a tight unemployment-job destruction relationship.

Our findings are not consistent with the studies of Romero-Ávila and Usabiaga (2007), Alicia and Silvestro (2011), and Sephton (2009, 2012) which found that the U.S. unemployment rates were well characterized by hysteresis over the entire sample period.[17] For example, this study does find stationary unemployment regime during the jobless recovery period. Nevertheless, the findings indicate that unemployment has undergone an I(1) process over the late-2000s Great Recession, which was triggered by the housing bubble and strongly impacted the United States labor market.[18] Comparing the unemployment panel and the job flows panels, we find a relatively smooth trend in job flows underlying the enormous fluctuations in unemployment rate. For example, job destruction was classified as I(0) over the period 1994:Q1-2003:Q1 (see Table 1). Meanwhile, both the unemployment rate is classified in the I(1)-I(0)-I(1) regime.

A crucial feature revealed from Fig. 2 is that beneficial regime shifts in job creation coincided with a period of active monetary policy changes executed by the Federal Reserve System. For example, job creation switched from the I(0) regime to the I(1) regime after the Federal Reserve System implemented an easy monetary policy in 2008–2014.

[17] Romero-Ávila and Usabiaga (2007) measured the half-lives of shocks in impulse-response functions and found a high degree of persistence in the United States unemployment rate. They suggested that these results are closer to the hysteresis paradigm than to the natural rate paradigm. Following Romero-Ávila and Usabiaga (2007), Sephton (2009, 2012) considered the issue of fractional integration in the unemployment rate trend function and showed that when two breaks are considered, unemployment rates were not stationary.

[18] The unemployment rate increased to 10.1% by October 2009, the highest rate since 1983. The crisis slapped some sectors particularly hard, including manufacturing and parts of the financial industry.

2.4 Testing prediction 3

In this section, we test Prediction 3: During the Great Recession, states with more unemployment compensation benefits are featured by the higher unemployment persistence. Based on the Extended Benefits (EB) and Emergency Unemployment Compensation Act of 2008 (EUC08), this study categorized the U.S. into two groups of states: states with total unemployment rate at least 8.5% (tier 4) are considered as high unemployment insurance benefits group and the rest states is classified as low unemployment insurance benefits. Table 4 reports the LKT test estimation results for state unemployment rates in the fifty United States and the District of Columbia. Figures 4 and 5 graphically display the results, where stationary regimes are depicted as straight lines through the data. Of interest is the significantly different regime switching behavior of the unemployment rates across states. In Fig. 4, for example, unemployment in Arkansas, Hawaii, Kansas, Louisiana, Maryland, Minnesota, Nebraska, New Hampshire, Texas, Virginia, and Wyoming mainly experienced I(1)-I(0)-I(1)-I(0)-I(1) changing process. In contrast, unemployment in Alaska, Iowa, Maine, Montana, North Dakota, Oklahoma, South Dakota, Utah, and Virginia can be fully described as I(1)-I(0)-I(1).

In the next step, we focus on the speed of the evolution process across state labor markets during the Great Recession and quantitative easing period. As reported in column 4 of Tables 5 and 6, the estimated half-lives indicate the existence of considerable difference in unemployment persistence among states. In the high unemployment insurance benefits, nine states were detected with a half-life in the range of 4–5 years, and 18 states were found with a half-life greater than 5 years. Half-lives appear to be lower than four years in only three states (Oregon, Tennessee and Wisconsin). In contrast, for the low unemployment insurance benefits as reported in Table 6, nine states featured by the lowest persistence, with a half-life lower than 2 years, are Arkansas, Iowa, Louisiana, Maine, Maryland, Montana, New Mexico, South Dakota, and Utah.

The switching behavior dynamics in Figs. 4 and 5 and the empirical results in Tables 5 and 6 reveal a crucial feature that states with more unemployment compensation benefits are featured by higher unemployment persistence compared with low unemployment insurance benefits states. The possible explanation is that unemployment compensation benefits programs (EB and EUC08) work together with the adjustment process co-ordination mechanisms contributing the differences in unemployment persistence dynamics in the state labor market (Silverberg and Verspagen 1994; Amendola and Gaffard 2003; Nicholson, et al. 2014). The co-ordination problems result from constraints and limited information coupled with the irreversibility of production and investment decisions. Co-ordination problems arise in the distortion of productive capacity resulting from a shock leading the economy into hysteresis. Importantly, money, in both quantitative easing and unemployment compensation benefits programs, has a role to play in the different persistence processes. Unemployment compensation (EB and

Table 4 Result of LKT test by state

State	Sample	M	I(0) regime	State	Sample	M	I(0) regime
Alabama	1990:Q2-2013:Q2	– 3.35*	2004:Q4-2008:Q2	Michigan	1990:Q2-2013:Q2	– 5.96**	2000:Q3-2007:Q2
	1990:Q2-2003:Q1	– 4.50*	1997:Q4-2001:Q3	Mississippi	1990:Q2-2013:Q2	– 3.99*	1998:Q1-2008:Q4
Alaska	1990:Q2-2013:Q2	– 4.94**	1991:Q2-2001:Q1	Missouri	1990:Q2-2013:Q2	– 4.29*	2002:Q1-2007:Q4
Arizona	1990:Q2-2013:Q2	– 5.37**	1991:Q4-2000:Q4	Montana	1990:Q2-2013:Q2	– 5.10**	1995:Q4-2008:Q1
Arkansas	1990:Q2-2013:Q2	– 5.32**	2002:Q3-2007:Q2	Nebraska	1990:Q2-2013:Q2	– 5.80**	1993:Q3-1998:Q4
	1990:Q2-2002:Q2	– 8.43**	1993:Q4-1998:Q2		1999:Q1-2013:Q2	– 6.01**	2005:Q1-2008:Q2
California	1990:Q2-2013:Q2	– 6.91**	2003:Q3-2008:Q1	Nevada	1990:Q2-2013:Q2	– 4.98**	1993:Q1-2007:Q3
	1990:Q2-2003:Q2	– 15.45**	1991:Q4-1994:Q3	New Hampshire	1990:Q2-2013:Q2	– 3.45*	1998:Q1-2000:Q4
Colorado	1990:Q2-2013:Q2	– 5.51**	1995:Q4-2000:Q3		2001:Q1-2013:Q3	– 3.56*	2004:Q2-2008:Q1
	2000:Q4-2013:Q2	– 14.21**	2005:Q4-2008:Q2	New Jersey	1990:Q2-2013:Q2	– 4.42*	1994:Q1-2000:Q3
Connecticut	1990:Q2-2013:Q2	– 4.44*	1991:Q4-1999:Q4	New Mexico	1990:Q2-2013:Q2	– 6.46**	1990:Q2-1997:Q3
	2000:Q1-2013:Q3	– 13.65**	2002:Q2-2005:Q1	New York	1990:Q2-2013:Q2	– 3.52*	1994:Q4-1998:Q4
Delaware	1990:Q2-2013:Q2	– 5.12**	1991:Q4-2005:Q2		1999:Q1-2013:Q3	– 4.71**	2001:Q4-2004:Q3
District of Columbia	1990:Q2-2013:Q2	– 5.39**	1992:Q2-1998:Q4	North Carolina	1990:Q2-2013:Q2	– 4.04*	1993:Q3:1999:Q1
	1999:Q1-2013:Q3	– 8.27**	2005:Q3-2008:Q1	North Dakota	1990:Q2-2013:Q2	– 4.23*	1997:Q2-2011:Q3
Florida	1990:Q2-2013:Q2	– 8.53**	1994:Q4-1999:Q4	Ohio	1990:Q2-2013:Q2	– 4.05*	1994:Q3-2001:Q1
	2000:Q1-2013:Q2	– 6.44**	2005:Q3-2008:Q2	Oklahoma	1990:Q2-2013:Q2	– 5.18**	2003:Q1-2008:Q1
Georgia	1990:Q2-2013:Q2	– 4.62**	2003:Q1-2007:Q4	Oregon	1990:Q2-2013:Q2	– 4.17*	1994:Q2-2001:Q2
	1990:Q2-2002:Q4	– 29.03**	2008:Q2-2011:Q1	Pennsylvania	1990:Q2-2013:Q2	– 5.63**	1994:Q3-2000:Q1
Hawaii	1990:Q2-2013:Q2	– 5.71**	2001:Q3-2006:Q4		2000:Q2-2013:Q2	– 9.61**	2005:Q4-2008:Q3
	1990:Q2-2001:Q2	– 4.29*	1995:Q2-1998:Q4	Rhode Island	1990:Q2-2013:Q2	– 4.12*	1990:Q2-2006:Q4
Idaho	1990:Q2-2013:Q2	– 3.98*	1993:Q4-2000:Q3	South Carolina	1990:Q2-2013:Q2	– 5.40**	1994:Q2-1999:Q1
Illinois	1990:Q2-2013:Q2	– 4.88**	1994:Q2-1999:Q1		1999:Q2-2013:Q2	– 11.38**	2002:Q3-2007:Q2
	1999:Q2-2013:Q2	– 4.29*	2003:Q3-2007:Q1	South Dakota	1990:Q2-2013:Q2	– 4.744**	2001:Q3-2006:Q4
Indiana	1990:Q2-2013:Q2	– 4.81**	2004:Q1-2009:Q1	Tennessee	1990:Q2-2013:Q2	– 3.06*	1991:Q1-2006:Q2

Table 4 (continued)

State	Sample	M	I(0) regime	State	Sample	M	I(0) regime
Iowa	1990:Q2-2013:Q2	– 4.71**	1993:Q3-2000:Q1	Texas	1990:Q2-2013:Q2	– 5.49**	1994:Q3-2000:Q3
Kansas	1990:Q2-2013:Q2	– 4.89**	1993:Q4-1999:Q2		2000:Q4-2013:Q2	– 6.31**	2004:Q4-2007:Q3
	1999:Q3-2013:Q2	– 5.92**	2003:Q4-2007:Q1	Utah	1990:Q2-2013:Q2	– 8.66**	1993:Q4-1999:Q1
Kentucky	1990:Q2-2013:Q2	– 5.28**	2002:Q4-2008:Q1	Vermont	1990:Q2-2013:Q2	– 4.66**	2002:Q3-2007:Q4
	1990:Q2-2002:Q3	– 8.70**	1997:Q1-2000:Q1	Virginia	1990:Q2-2013:Q2	– 4.75**	1994:Q1-1997:Q3
Louisiana	1990:Q2-2013:Q2	– 4.83**	1992:Q3-1999:Q4		1997:Q4-2013:Q2	– 4.46*	2002:Q1-2007:Q4
	2000:Q1-2013:Q3	– 10.94**	2005:Q4-2007:Q4	Washington	1990:Q2-2013:Q2	– 5.06**	1997:Q2-2000:Q2
Maine	1990:Q2-2013:Q2	– 8.25**	2003:Q1-2006:Q3		2000:Q3-2013:Q2	– 7.49**	2001:Q3-2004:Q3
Maryland	1990:Q2-2013:Q2	– 6.40**	2003:Q2-2008:Q1	West Virginia	1990:Q2-2013:Q2	– 4.21*	1994:Q3-2000:Q4
	1990:Q2-2003:Q3	– 6.69**	1998:Q3-2001:Q2	Wisconsin	1990:Q2-2013:Q2	– 4.79**	2001:Q4-2008:Q1
Massachusetts	1990:Q2-2013:Q2	– 5.78**	2002:Q4-2007:Q3	Wyoming	1990:Q2-2013:Q2	– 4.21*	1992:Q4-1999:Q4
	1990:Q2-2002:Q3	– 10.30**	1997:Q4-2000:Q2		2000:Q1-2013:Q2	– 8.51**	2006:Q3-2009:Q2
Minnesota	1990:Q2-2013:Q2	– 3.89*	1992:Q1-1999:Q2				
	1999:Q3-2013:Q3	– 3.85*	2002:Q4-2006:Q4				

*and **denote statistical significance at the 10% and 5% levels, respectively

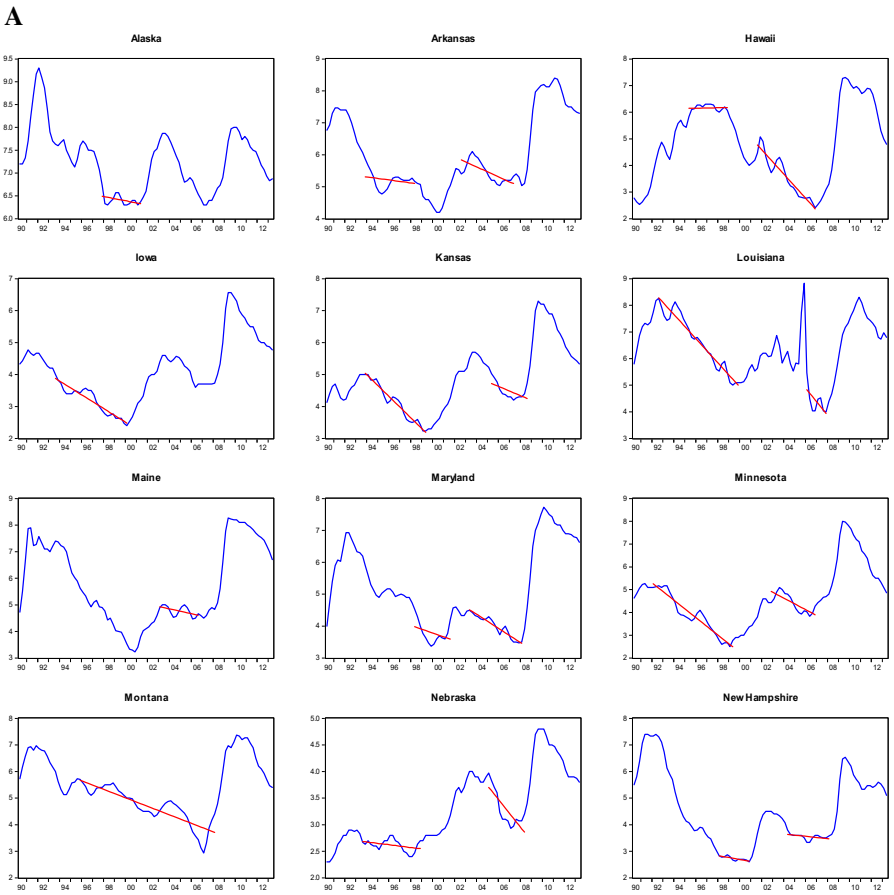

Fig. 4 **A**, **B** Unemployment rate by low unemployment compensation benefits, 1990:Q2-2013:Q2

EUC) might create undesirable incentives for individuals in the high unemployment compensation benefits.[19]

[19] Based on the search and matching model (Mortensen and Pissarides 1994), each firm endogenously selects an optimum productivity level in equilibrium, where the marginal job is unprofitable. High unemployment compensation might cause the unemployed to have less incentive to search for an employment opportunity. In the matching theory, job creation results from costly, time-consuming matching job vacancies to job seekers. As a result, the high extent of unemployment insurance benefits may decrease the search and matching process (job creation and destruction) and then affect the steady state unemployment level. There are a few literatures studying the impact of unemployment compensation on the labor market. Rothstein (2011), for example, employed the Current Population Survey to build unemployment exit hazards that differ across states. Moreover, the author employed these hazards to distinguish the effects of unemployment insurance (UI) extensions from other factors of employment outcomes. The author found that UI extensions increased the unemployment rate in 2011 by about 0.1 to 0.5 percentage points.

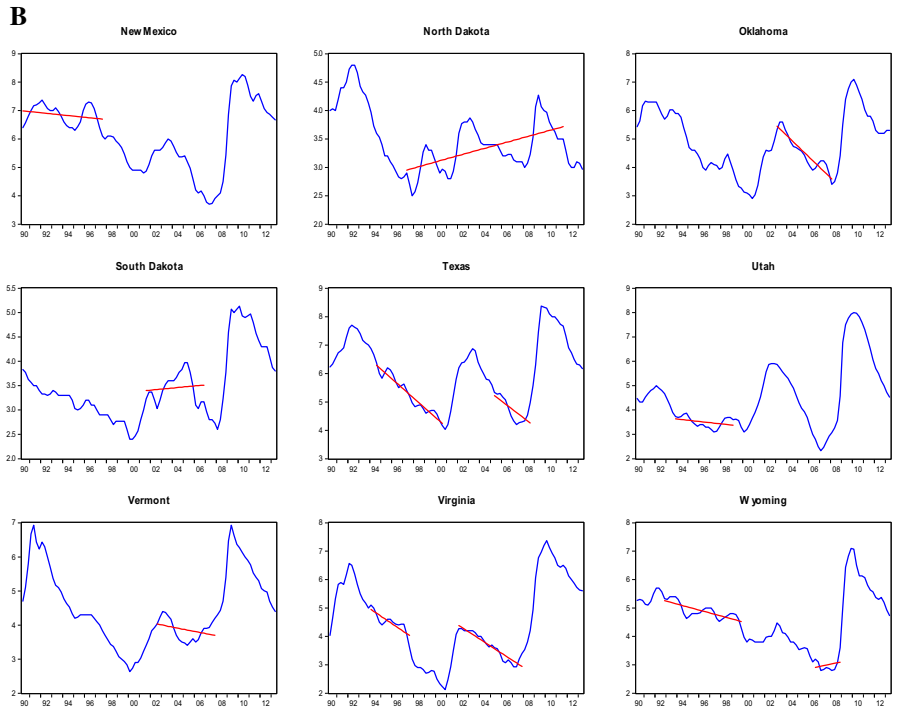

Fig. 4 (continued)

Finally, Table 7 shows the empirical results from the CS-ARDL model. Both the mean group and pooled estimators imply a negative link between the unemployment rate and job creation. This finding is consistent with the theory prediction that suggests higher employment opportunity creation decreases the unemployment rate. Moreover, Table 7 reports positive parameter estimates between the unemployment rate and job destruction. After taking into account cross-sectional dependence, job destruction impels the unemployment rate to increase.

The original motivation of this study was to explore whether the Great Recession and quantitative easing might work to impart a different integration process to unemployment and job flows. We found that quantitative easing coincides with the regime changes behavior of job creation. We found that beneficial regime changes in job creation is associated in time with active monetary policy changes executed by the Federal Reserve System. Moreover, the empirical results in CS-ARDL model provided an iron linkage between job creation (or destruction) and unemployment.

3 Conclusion

This paper simultaneously explored the different integration processes and persistence behavior in unemployment and job flows with an evolutionary perspective in the United States. The present study has first developed a Neo-Austrian model of

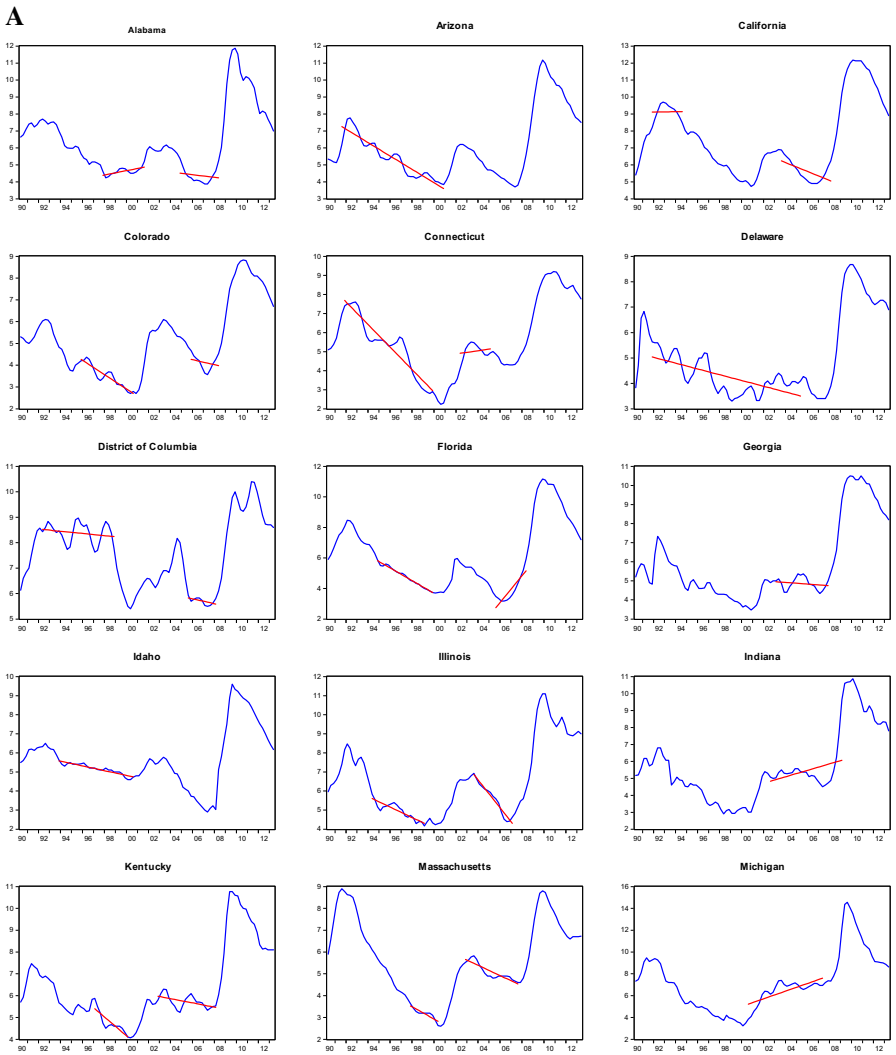

Fig. 5 **A**, **B** unemployment rate by high unemployment compensation benefits, 1990:Q2-2013:Q2

unemployment and job creation (destruction) to make predictions on how unemployment compensation benefits or co-ordination problem affect unemployment. Our main empirical findings are consistent with the theoretical predictions: namely: (i) the United States labor market should not be featured as stationary over the entire sample period; (ii) job creation or destruction (or both) is an important channel of out-of-equilibrium unemployment adjustment; and (iii) during the Great Recession, states with more unemployment compensation benefits are featured by the higher unemployment persistence.

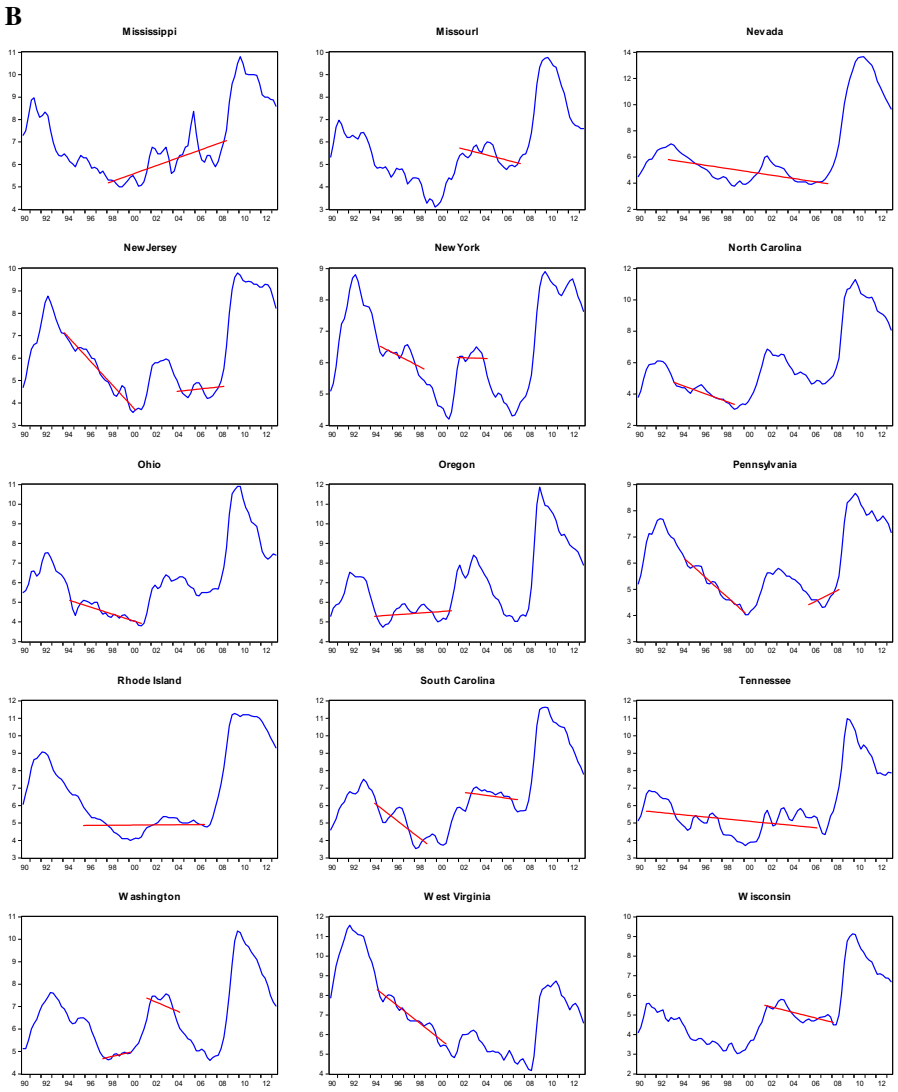

Fig. 5 (continued)

Importantly, the unemployment rate was featured with a stationary regime during the end of the Great moderation and jobless recovery periods, and was undergoing a hysteresis regime in the Great Recession and quantitative easing periods. Based on the grid-bootstrap confidence intervals, our results imply a high degree of persistence in the unemployment and job destruction, while job creation is featured with a less persistent process. In other words, the sources of persistence in the unemployment regime as we detected in the Great Recession and quantitative easing periods are job destruction channel rather than job creation channel. Our

Table 5 The speed of persistence by state, 2008:Q1-2013:Q2

State	Alpha	Hansen 95% CI	HL_{IRF}	95% CI
High unemployment compensation benefits				
Alabama	0.840	[0.742–0.897]	4.423	[3.568–5.646]
Arizona	0.893	[0.859–0.926]	5.039	[4.854–6.796]
California	0.914	[0.887–0.935]	5.628	[4.161–7.467]
Colorado	0.901	[0.856–0.943]	5.510	[4.456–7.800]
Connecticut	0.904	[0.862–0.929]	6.066	[5.457–7.966]
Delaware	0.844	[0.812–0.875]	4.644	[3.190–5.624]
District of Columbia	0.840	[0.776–0.879]	4.385	[3.139–5.690]
Florida	0.903	[0.867–0.942]	5.234	[4.617–7.352]
Georgia	0.865	[0.813–0.918]	5.185	[4.195–7.178]
Idaho	0.937	[0.790–0.970]	5.778	[4.958–7.167]
Illinois	0.822	[0.756–0.898]	5.279	[3.989–6.591]
Indiana	0.814	[0.727–0.878]	5.238	[3.898–6.647]
Kentucky	0.827	[0.763–0.900]	4.811	[3.026–5.913]
Massachusetts	0.869	[0.854–0.888]	5.311	[4.479–6.212]
Michigan	0.838	[0.753–0.889]	4.068	[3.210–5.508]
Mississippi	0.862	[0.814–0.912]	4.490	[3.045–5.633]
Missouri	0.887	[0.854–0.914]	5.851	[5.018–6.029]
Nevada	0.917	[0.886–0.939]	5.718	[4.743–7.680]
New Jersey	0.855	[0.815–0.896]	5.507	[4.067–6.071]
New York	0.840	[0.805–0.877]	5.235	[4.041–7.574]
North Carolina	0.808	[0.710–0.878]	5.191	[3.858–6.000]
Ohio	0.863	[0.797–0.907]	4.870	[3.725–7.511]
Oregon	0.768	[0.688–0.835]	3.528	[2.400–5.561]
Pennsylvania	0.816	[0.770–0.868]	5.234	[3.907–7.488]
Rhode Island	0.869	[0.846–0.895]	5.450	[4.270–7.793]
South Carolina	0.852	[0.793–0.893]	4.376	[4.414–6.723]
Tennessee	0.814	[0.745–0.865]	1.225	[0.576–1.799]
Washington	0.882	[0.846–0.911]	5.528	[4.146–6.065]
West Virginia	0.814	[0.711–0.885]	4.235	[3.863–7.709]
Wisconsin	0.808	[0.746–0.862]	3.936	[2.915–5.753]

results suggest that the persistence in the unemployment rate is a job destruction phenomenon.[20] Comparing against states with more unemployment compensation benefits, low unemployment compensation benefits' states are featured by the lower unemployment persistence. In terms of policymaking, this calls for economic policy

[20] Coibion et al. (2013) found that decreasing labor mobility and the United States population demographic composition evolution and the changing culture can account for the unemployment persistence. The present study focuses on the demand side—job creation and destruction. We do not deny the possibility that job creation and destruction was associated with supply side factors which could also have caused the unemployment hysteresis. There is need for a more detailed study into the quantitative contribution of demand and supply channels in the unemployment hysteresis dynamics.

Table 6 The speed of persistence by state, 2008:Q1-2013:Q2

State	Alpha	Hansen 95% CI	HL_{IRF}	95% CI
	Low unemployment compensation benefits			
Alaska	0.872	[0.843–0.881]	5.705	[4.722–7.533]
Arkansas	0.821	[0.759–0.840]	1.272	[0.940–1.325]
Hawaii	0.852	[0.802–0.905]	4.352	[3.835–5.985]
Iowa	0.819	[0.758–0.880]	4.336	[3.165–5.689]
Kansas	0.850	[0.803–0.894]	4.307	[3.842–5.811]
Louisiana	0.883	[0.837–0.920]	1.689	[1.245–2.250]
Maine	0.811	[0.752–0.849]	5.703	[3.957–6.412]
Maryland	0.856	[0.792–0.906]	1.469	[1.003–1.962]
Minnesota	0.895	[0.844–0.928]	5.135	[4.781–6.831]
Montana	0.875	[0.830–0.912]	1.645	[1.289–2.263]
Nebraska	0.848	[0.820–0.882]	4.308	[5.040–6.238]
New Hampshire	0.745	[0.685–0.809]	3.664	[1.795–5.219]
New Mexico	0.813	[0.741–0.876]	1.231	[0.908–1.616]
North Dakota	0.846	[0.786–0.900]	1.395	[1.114–2.129]
Oklahoma	0.842	[0.785–0.890]	4.158	[3.454–5.383]
South Dakota	0.816	[0.741–0.875]	1.230	[0.916–2.126]
Texas	0.860	[0.797–0.903]	6.190	[3.141–8.010]
Utah	0.849	[0.685–0.917]	1.435	[0.977–2.158]
Vermont	0.822	[0.760–0.873]	4.456	[3.333–6.957]
Virginia	0.845	[0.790–0.892]	7.646	[5.044–8.279]
Wyoming	0.810	[0.667–0.882]	5.601	[3.789–7.6909]

Table 7 The effects of job creation and destruction on unemployment rate based on the Cross-Sectional Augmented Autoregressive Distribution Lag (CS-ARDL) model, 1977–2013

Panel A: pooled estimates			
Model (lags)	$P=1$	$P=2$	$P=3$
Job creation	– 0.361**	– 0.414**	– 0.485**
	(0.039)	(0.043)	(0.044)
Job destruction	0.278**	0.377**	0.486**
	(0.044)	(0.049)	(0.048)
Panel B: mean group estimates			
Model (lags)	$P=1$	$P=2$	$P=3$
Job creation	– 0.348**	– 0.402**	– 0.475**
	(0.041)	(0.043)	(0.063)
Job destruction	0.299**	0.401**	0.497**
	(0.048)	(0.058)	(0.075)

Standard deviation in parentheses. **denote statistical significance at the 5% level

aimed at improving the adjustment mechanism on the demand side—job creation and destruction. In particular, the government should stimulate more entrepreneurship, since start-ups and young businesses are crucial contributors to job creation and productivity growth (Decker, et al. 2014; 2017; 2020).

Finally, the results presented in this study provided conceptual insights into United States labor market operations by contributing to the literature on persistent unemployment in terms of job creation and destruction. The job creation and destruction process contain important information into the labor market demand side. Similar implications from this study's analysis can be used for other countries with labor market institutional features that are different from the United States, such as European countries with high labor union density and may allow us to obtain further interesting findings on unemployment persistence.

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Declarations

Conflict of interest The author has no competing interests to declare that are relevant to the content of this article.

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