Assessing the Natural Rate of Unemployment

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1 Introduction

It has long been argued (Blanchard et al., 1992; Blanchard and Katz, 1997) that shifts in local labor market conditions, geographic variation in labor force demographics (labor supply), and sectoral shifts in industrial patterns (labor demand) might influence the natural rate of unemployment. On the supply side of the labor market this could occur through divergent trends in differential attachment of age, gender, racial, or ethnic groups to the labor force. On the demand side this could occur through differential job creation and destruction associated with changing industry technologies.

As interesting as these possibilities are, they are exceedingly difficult to assess with official local labor market data because the methods used to construct official local area unemployment statistics (LAUS) ensure that at every level of aggregation the common trend and cycle components are identical to the components found in the national series. These statistics are designed, therefore, to measure how the local area deviates from the national series and not to provide a basis for assembling a national series built up from local data. By contrast, studies of the euro area (Berger, 2011) build up the aggregate labor market from the component country national statistics. In those studies the national trend and cycle components can be properly interpreted as aggregates of local (euro zone country) labor markets.

Neither studies based on U.S. official unemployment data nor studies based on Eurostat official unemployment data for the euro zone can compare the trend and cycle components of a national series, estimated from national data, and the same components aggregated from independently measured local labor market

indicators. In this paper, we take up that challenge for the U.S. using BLS national and local unemployment rates in combination with Census Bureau local labor market data called the Quarterly Workforce Indicators. Using methods that we developed elsewhere (Abowd and Vilhuber, 2011), we create national series from the edited and completed local labor market series on accessions, separations, job creations, and job destructions with industry and demographic detail. We use simple graphical methods to display the resulting series, and to show that there is very little compositional variation. The trend and cycle components of the national unemployment rate and their counterpart in the national excess accession rate are in-phase mirror images. Both series are consistent with the slow, and still relatively small upward trend in the natural rate of unemployment as estimated by the Congressional Budget Office.

Our paper is organized as follows. Section 2 describes all the inputs to our analysis and the forms used for our indices. Section 3 lays out the statistical models. Section 4 presents the results, and section 5 concludes.

2   Data sources

The U.S. Census Bureau's local labor market indicators, known as the Quarterly Workforce Indicators (QWI) cover about 92 percent of the private non-agricultural workforce. The complete set of detailed flows – job creations, job destructions, accessions, separations, churning, earnings, and earnings changes – are available for 49 states (and DC), 566 micropolitan areas and 357 Metropolitan Statistical Area (MSA)s. For most of these areas, the data are available from the mid-1990s onwards (Abowd and Vilhuber, 2011). For this article, we focus our attention on basic worker and job flow data that we convert to rates so that we can study how local labor market flow data covary with local labor market unemployment rates. In addition, we use the Abowd and Vilhuber (2011) method to construct national aggregates that can be used to predict movements in the national unemployment rates, including the trend component natural rate of unemployment.

2.1   Basic Worker and Job Flow Rates

We begin by defining the core stock variables that will be used to aggregate the worker and job flows. These are the stocks of jobs at the beginning, end and continuously throughout the quarter:

$$
\begin{aligned}
B_{agkst} &\equiv \text{beginning-of-quarter employment} \\
E_{agkst} &\equiv \text{end-of-quarter employment} \\
F_{agkst} &\equiv \text{full-quarter employment}
\end{aligned}
$$

where we use the following categories: for age groups, $a = 0, 1, ..., 8$ (all, 14-18, 19-21, 22-24, 25-34, 35-44, 45-54, 55-64, 65+); for gender groups, $g = 0, 1, 2$ (both, male, female); for industries, $k = 11, 21, ..., 81$ (19 NAICS sectors defined consistent with the Census Bureau's NAICS standard for the QWI; for race $r = 0, 1, ..., 6$ (all, American Indian or Alaska Native alone, Asian alone, Black or African American alone, Native Hawaiian or Other Pacific Islander alone, White alone, two or more race groups); for ethnicity $h = 0, 1, 2$ (all, Hispanic or Latino, not Hispanic or Latino); for geography s indexes the states including DC, by FIPS code. Formulas are illustrated for age, gender, industry, state and time cells, but the same formulas apply when we use alternative demographic characteristics.

Gross worker flows are measured by build indices from two core variables

$$CA_{agkst} \equiv \text{continuous-quarter accessions (new hires plus recalls)}$$

$$CS_{agkst} \equiv \text{continuous-quarter separations (quits, layoffs, other).}$$

In contrast to our previous work, accessions are defined in this paper as new hires or recalls who are still employed at the end of the quarter, and separations are defined as quits, layoffs, and other departures of workers who were present at the beginning of the quarter. Defining M_{agkst} as all jobs recorded during the quarter regardless of duration, and A_{agkst} and S_{agkst} as conventional accessions and separations, respectively, the continuous-quarter measures can be recovered from the identities

$$CA_{agkst} = M_{agkst} - S_{agkst} - F_{agkst}$$

$$CS_{agkst} = M_{agkst} - A_{agkst} - F_{agkst}.$$

The worker flow measures used in this paper are the distinct accession and separation rates are defined, respectively, as:

$$car_{agkst} = \frac{CA_{agkst}}{(B_{agkst} + E_{agkst})/2}$$

and

$$csr_{agkst} = \frac{CS_{agkst}}{(B_{agkst} + E_{agkst})/2}.$$

Essential details for the QWI are summarized here. When an individual/employer pair have a record in the UI wage record data, an indicator variable $m_{ijt} = 1$ is recorded for individual i at employer j in quarter t, otherwise, $m_{ijt} = 0$. Beginning-of-quarter employment is the count of all individuals working at

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a particular establishment for whom $m_{ijt-1} = 1$ and $m_{ijt} = 1$; that is, the individual and employer had a UI wage record for the current quarter (t) and the previous quarter $(t-1)$.[1] Similarly, end-of-quarter employment is the count of all individuals working at a particular establishment for whom $m_{ijt} = 1$ and $m_{ijt+1} = 1$; that is, the individual and employer had a UI wage record for the current quarter (t) and the next quarter $(t+1)$. An accession in quarter t occurs when $m_{ijt-1} = 0$ and $m_{ijt} = 1$. A separation in quarter t occurs when $m_{ijt} = 1$ and $m_{ijt+1} = 0$. Workplace characteristics are defined by the NAICS code and physical address of establishment j for the QCEW report at quarter t. Demographic characteristics are defined by the individual's gender, age, race and ethnicity as of the first day of the quarter. Accessions and separations satisfy the net job flow (JF_{agkst}) identity

$$JF_{agkst} \equiv E_{agkst} - B_{agkst} = CA_{agkst} - CS_{agkst}.$$

Gross job flows are measured in similar fashion using the definitions

$$JC_{agkst} \equiv \text{job creations}$$

$$JD_{agkst} \equiv \text{job destructions}$$

The gross job inflow and outflow rates, the job creation rate (JCR) and job destruction rate (JDR), can be defined as

$$jcr_{agkst} = \frac{JC_{agkst}}{(B_{agkst} + E_{agkst})/2}$$

and

$$jcr_{agkst} = \frac{JD_{agkst}}{(B_{agkst} + E_{agkst})/2}.$$

Gross job flow measures are defined at an establishment, not job, level. Let B_{agjt} be beginning-of-quarter employment for demographic group ag at establishment j in quarter t, and similarly let E_{agjt} be end-of-quarter employment for the same category and time period. Then,

$$JC_{agjt} \equiv \max(E_{agjt} - B_{agjt}, 0)$$

$$JD_{agjt} \equiv \max(B_{agjt} - E_{agjt}, 0)$$

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[1] The QWI tabulations consider a wage record to be present in a given quarter if and only if at least $1.00 of covered UI wages are reported in that quarter.

so that, as originally specified by Davis and Haltiwanger, job creations are the change in employment when employment is growing at the establishment and job destructions are the change in employment when employment is shrinking at the establishment. Net job flows also satisfy the identity

$$JF_{agkst} = JC_{agkst} - JD_{agkst}$$

We consider the excess flow rates, the excess of accessions over job creations and the excess of separations over job destructions, defined as

$$eir_{agkst} = CAR_{agkst} - JCR_{agkst}$$

and

$$eor_{agkst} = SR_{agkst} - JDR_{agkst}$$

where the additive and symmetric growth rate properties of the measure within categories continue to hold. Because of the net job flow identities, $eir_{agkst} \equiv eor_{agkst}$. We only report results using EIR_{agkst}. Weighting, rounding and confidentiality protection procedures can cause the identities described in this section to hold only approximately in the public-use data (Abowd et al., 2006).

2.2 Aggregates and Sub-aggregates

The national worker work and job flow rates for a given demographic group are constructed directly from the appropriate components

$$
\begin{aligned}
car_{agt} &= \frac{CA_{agt}}{(B_{agt} + E_{agt})/2} \\
&= \frac{1}{(B_{agt} + E_{agt})/2} \sum_{k,s} \left(\frac{(B_{agkst} + E_{agkst})}{2} car_{agkst} \right)
\end{aligned}
$$

and similarly for csr_{agt}, jcr_{agt} and jdr_{agt} where the elimination of a subscript means that the variable was summed over that index. We note that our definition of the national car, and other rates, equals the weighted average of the state and industry component growth rates. The national excess of accessions over creations rate is simply the difference between the worker and job rates, $eir_{agt} = car_{agt} - jcr_{agt}$.

It is critical to note that national aggregates produced by constructing weighted averages of independently estimated rates for the smaller geographic area and the individual sectors and demographic categories. This makes these series fundamentally different from the local area employment and unemployment statistics pro-

duced by the BLS. Each national time series constructed from the QWI data contains trend, cycle, seasonal and irregular components that do not automatically mimic the same components in a series developed from a national survey.

2.3 Local Area Unemployment Rates

We represent local unemployment rates as u_{st}. These state unemployment rates are produced by the Bureau of Labor Statistics using a process it describes as "real-time benchmarking" (BLS, 2013, Chapter 4). This benchmarking ensures that the seasonally unadjusted state-level unemployment rates will always aggregate exactly to the national unemployment rate when weighted by the seasonally unadjusted labor force. Benchmarking was designed to ensure consistency at the different levels of geographic aggregation. Thus, aggregating trend, cycle, seasonal, and irregular components of u_{st} over states to produce national components simply mimics the components in the national unemployment rate u_t. The local unemployment rates cannot be used to independently construct national components that can be used to model how state-level variations might have influenced the national unemployment trend.

This feature of the U.S. local area unemployment statistics contrasts with the European natural rate study performed by Berger (2011) using the data from Fagan et al. (2005). The Eurostat unemployment rates are not benchmarked to an independent euro area unemployment rate. Instead, the euro area rate is directly constructed from aggregates of the national rates using the national labor force data.

Models that use U.S. local unemployment rates to explain geographic contributions to components of the national unemployment rate have no independent variation in the common trends of the local rates as compared to the national rate. Models that use separate European national unemployment rates to explain common components of the euro area rate also lack independent variation in the components because the euro area rate was constructed from the national rates.

The data we have constructed for this study can, in principle, overcome this problem. The national trend, cycle, seasonal and irregular components of the worker and job flow rates constructed from aggregating the QWI data can display variation that is not statistically constrained to mimic exactly the same components in the national unemployment rates.

2.4 Timing of Labor Market Variables

Because the QWI are measured quarterly and the unemployment data are measured monthly, we constructed our quarterly unemployment rates so that u_{st} measures the rate as of the month after the end of the calendar

quarter. Hence, quarter 1 for the unemployment rate is the monthly rate from April; quarter 2 is the rate from July; quarter 3 is the rate from October; and quarter 4 is the rate from January of the following year. We did this because the relevant rates are measured as of the week of the month that contains the 12th. This week is closer to the beginning of the month than the end. Hence, the change $u_{st} - u_{st-1}$ very closely covers the time period t for which all of the QWI rate variables are measured. Specifically, the QWI data are designed to measure the flows between the first day of the first month of the quarter and the last day of the third month of the quarter. Our timing convention, therefore has a twelve day mismatch. The alternative definition, using the third month of the quarter, excludes a larger portion of the relevant time period–leading to an 18 day mismatch.

3 Model

3.1 Estimation of National Time Series Components

Decompose the aggregate unemployment rate, u_t

$$u_t = u_t^{NRU} + u_t^C + u_t^S + u_t^I$$

where u_t^{NRU} is the natural rate, u_t^C is the cyclical component, u_t^S is the seasonal component, and u_t^I is the irregular component. We work initially with seasonally unadjusted data because the QWI have not been officially seasonally adjusted. the natural rate, seasonal, cyclical and irregular components of this decomposition are normally identified by prior restrictions on a state-space representation of the model that treats u_t^{NRU}, u_t^C, u_t^S, and u_t^I as unobserved components of the measurement u_t. In the current analysis we use the Congressional Budget Office estimate of u_t^{NRU} as recorded in the St. Louis Fed's FRED database. Similarly, we can decompose the worker and job flow rates into long-run, cyclical, seasonal, and irregular components.

We next consider how to isolate the effects of shift in composition on the national job and worker flow rates. We do this so that we can separately analyze the relations among the flows holding local labor market and demographic conditions constant at levels they realized early in the 2000s, after the dot.com recession and before the Great Recession.

We illustrate using the local job creation rate for demographic category ag in industry k and state s

$$jcr_{agkst} = \frac{JC_{agkst}}{(E_{agkst} + B_{agkst})/2}.$$

The usual identity holds (approximately in the public-use data, exactly in the confidential micro-data)

$$jcr_{agkst} - jdr_{agkst} = ar_{agkst} - sr_{agkst}$$

Create an aggregate decomposition of these rates as

$$jcr_t = \sum \omega^0_{agks} jcr_{agkst} + \sum \left(\omega_{agkst} - \omega^0_{agks}\right) jcr_{agkst} \equiv jcr_t^{LLM} + jcr_t^{\Delta}$$

where ω^0_{agks} are the reference period weights and

$$\omega_{agkst} = \frac{(E_{agkst} + B_{agkst})}{(E_t + B_t)},$$

which is the weighting that makes the rate aggregation exact. Similar fixed-weight indices were created for the other flow variables. In all cases the reference period was 2003:2.

3.2   Estimation of Local Variation

Local variation is measured by considering the deviation of every state's rates from the value of the middle quintile (over states) of the variable at the bottom of the Great Recession trough (2009:2). The local rates are then displayed as a thermal map of the evolution over time of these deviations. The benefit of this approach is that it captures the national trend via the overall coloring of the map, which moves from green to brown as the Great Recession comes and starts to end. The local variation is captured by the contrast among the green and brown colored states at any point in time.

4   Results

Figure 1 shows the seasonally unadjusted version of all national series: u, car, csr, jcr, and jdr. The core patterns are clear without any filtering–there are substantial movements in all five series during the two recessions covered by the data with relatively little action in the other periods.

Figure 2 plots just the seasonally unadjusted unemployment, excess accession rate (eir) and job destruction rate. This figure makes clear that the primary relationship between the flow indices and the

unemployment rate is going to come through the excess accession rate.

Figure 3 isolates this relationship by plotting the Congressional Budget Office's long-run natural rate series along with the seasonally adjusted unemployment rate and excess accession rate. We can now see the first substantive conclusion. The independently measured labor market variables, unemployment and excess accessions, in their trend and cycle components are nearly phase coincident and mirror images. The downward movement in the seasonally adjusted excess accession rate and the upward movement in the seasonally adjusted unemployment rate are coincident with the upward drift in the CBO's natural rate.

Figure 4 overlays the seasonally adjusted fixed-weight version of the excess accession rate on the same series as were plotted in Figure 3. The fixed-weight and Törnqvist-weighted versions of the index are indistinguishable. This result implies that the movements in the aggregate worker and job flow rates result entirely from rate changes in the underlying geographies, industries, and demographics rather than from any compositional change in the underlying labor markets.

We next examine the sequences of colored maps that isolate the geographic trends in the deviations of the local labor markets from the benchmark 2009:2 median of the national distribution (over states) of each series.

The sequence of maps in Figure 5 shows the evolution of the local unemployment rates. In each panel, the second quarter of the indicated year is plotted. The coloring is intended to show trends in the deviation of the state unemployment rate from the national unemployment rate. The bins of the coloring are determined by the unweighted (over states) quintiles of this deviation in 2009:2. The geographic trend that the data reveal is homogeneity of local unemployment rates early in the decade followed by substantial dispersion during the Great Recession, with the Great Plains states having the lowest rates and Midwest and Pacific states the highest rates. This analysis, of course, depends only on the LAUS data.

The sequence of maps in Figure 6 shows the evolution of the excess accession rates deviated from the national average rate and colored based on the unweighted quintiles in 2009:2. The data for this figure were processed identically to those in Figure 5 with one exception. The green coloring indicates a positive, not a negative, deviation. Comparing Figures 5 and 6 shows that the local variation in excess accession rates is negatively correlated with the local variation in unemployment rates, exactly as we found for the national time series albeit with more idiosyncratic variation.

5   Conclusion

Careful application of the Abowd and Vilhuber (2011) method for creating national time series from the detailed disaggregated QWI data reveal that economy-wide movements in the trend + cycle component of the excess accession rate mirror those of the same components of the unemployment rate. The two series appear to be remarkably in phase considering that they are estimated from independent sources and are not benchmarked to each other.

The use of fixed weights to hold constant the employment distribution by state, industry and demographics revealed that there was almost no compositional change driving the aggregate movements. The fixed-weight and Törnqvist-weighted series are nearly coincident. Further investigation is required to isolate which of the component rates contribute the bulk of the Great Recession movement in the worker and job flow statistics.

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Fagan, G., Henry, J., and Mestre, R. (2005). An areawide model (AWM) for the euro area. *Economic Models*, 22:39–59.
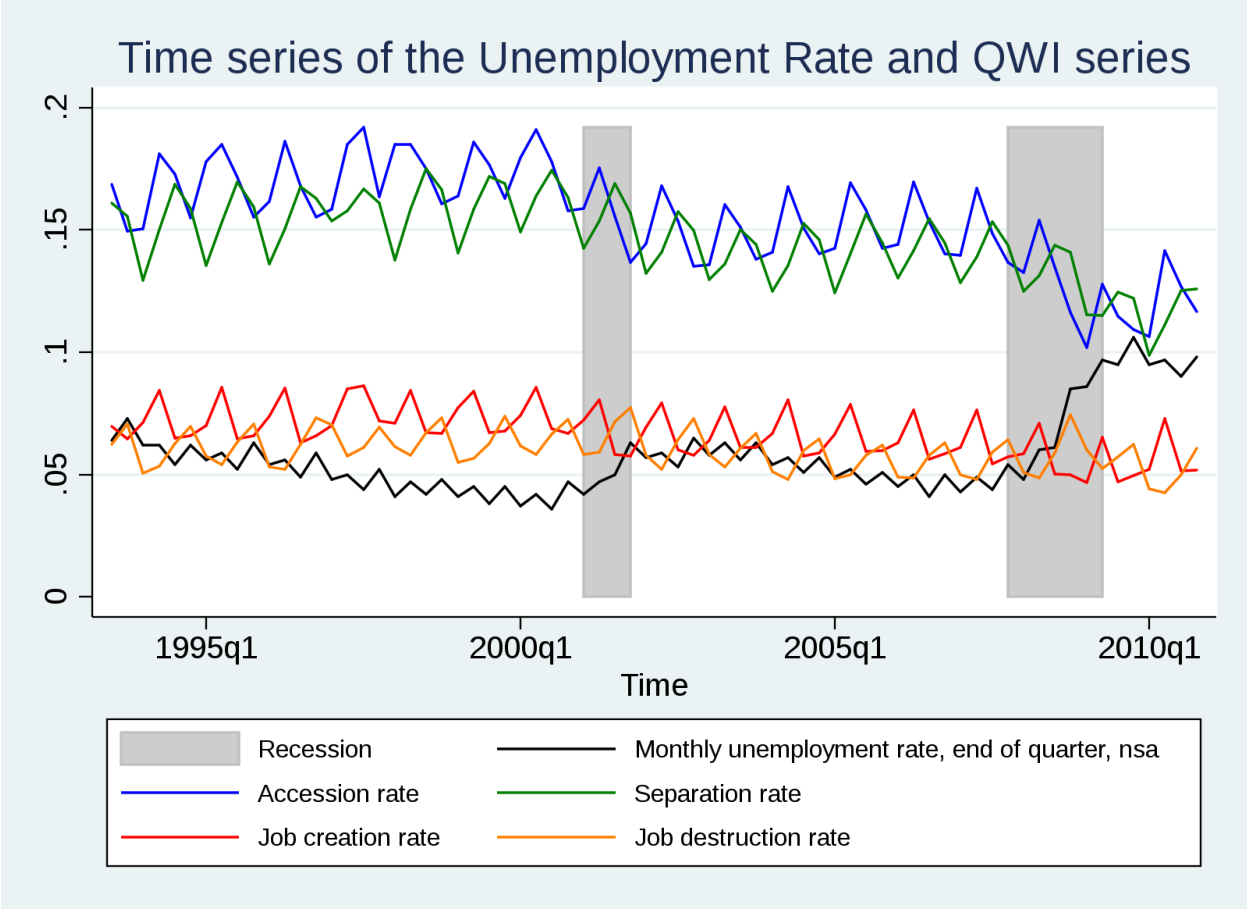
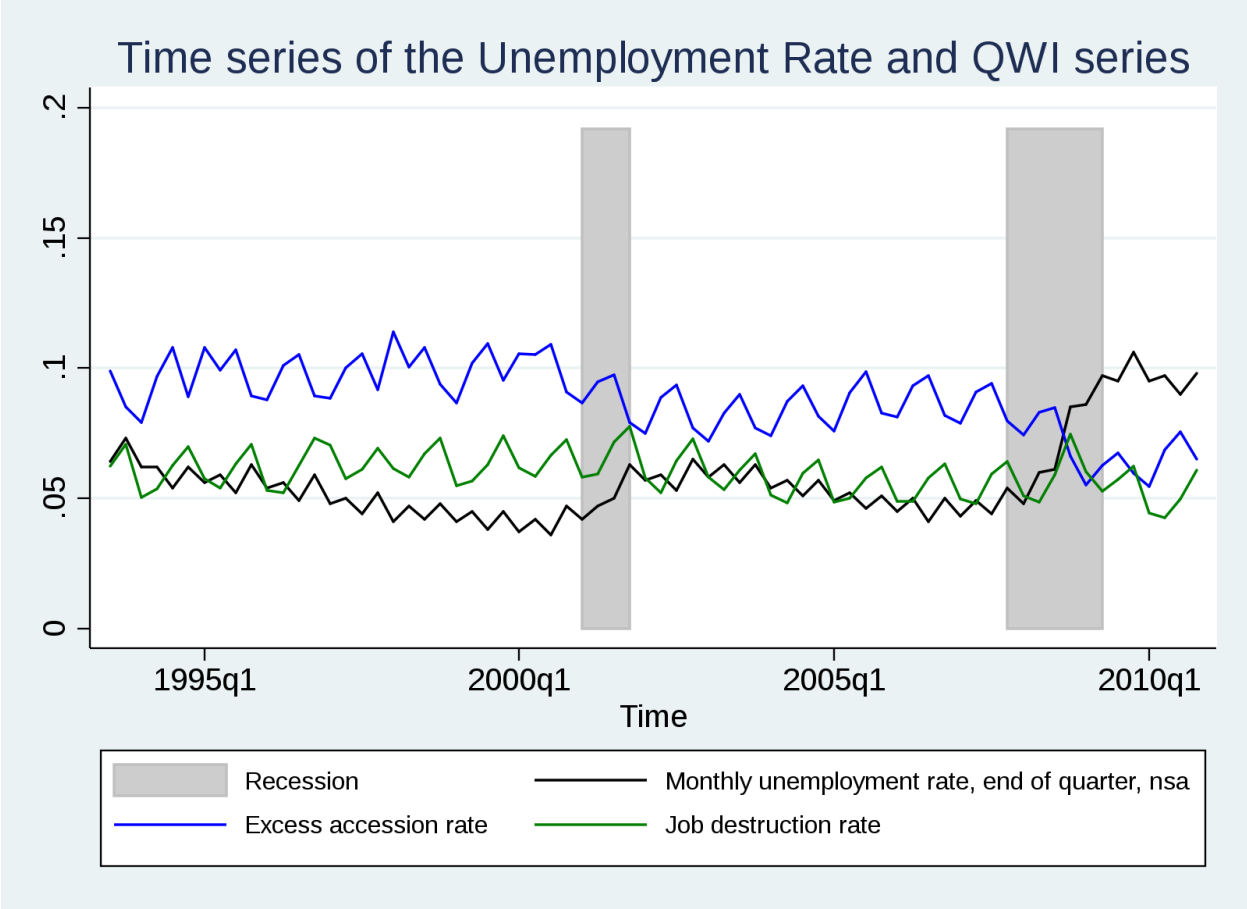Figure 1: QWI and Unemployment Rate Series, NSA

Figure 2: Excess Accession, Job Destruction and Unemployment Rates, NSA
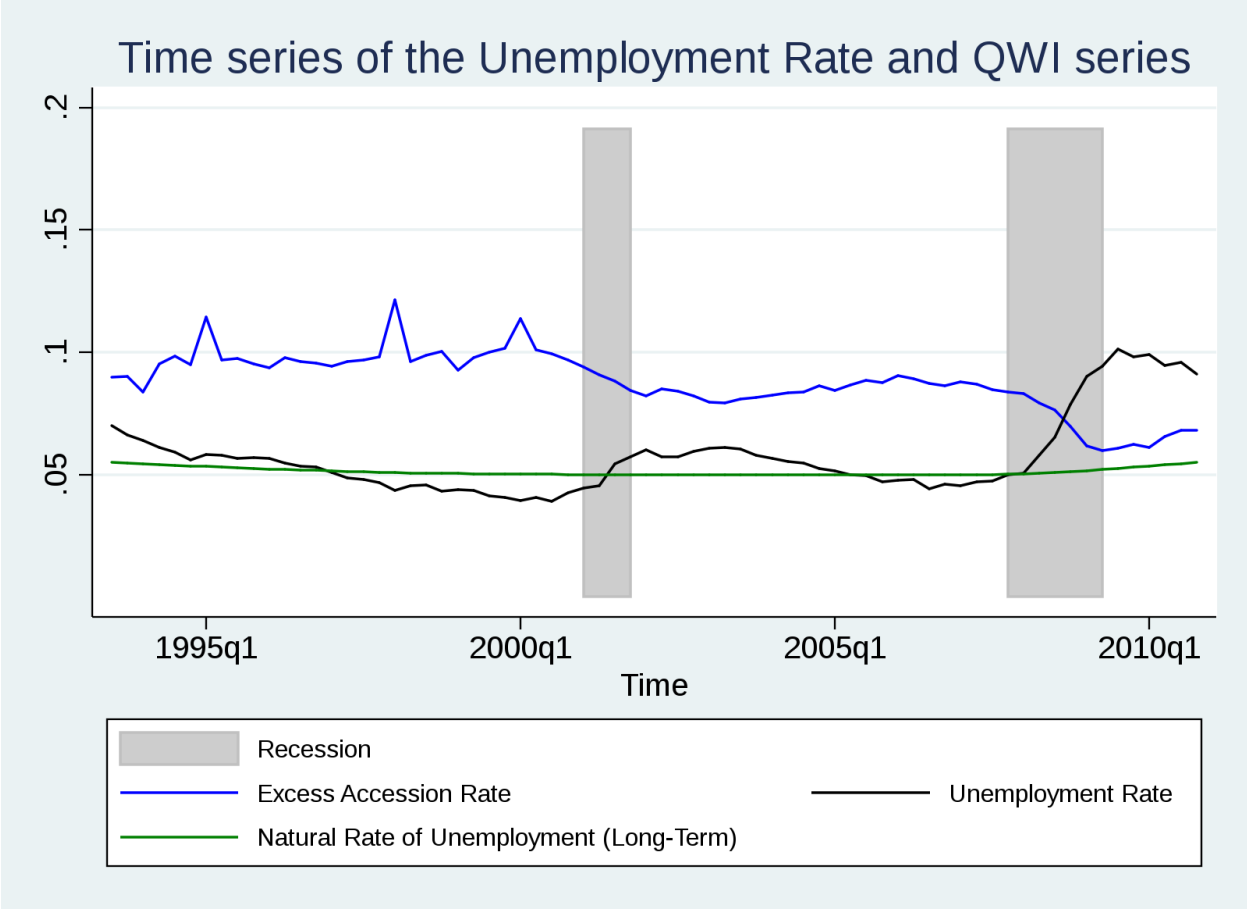
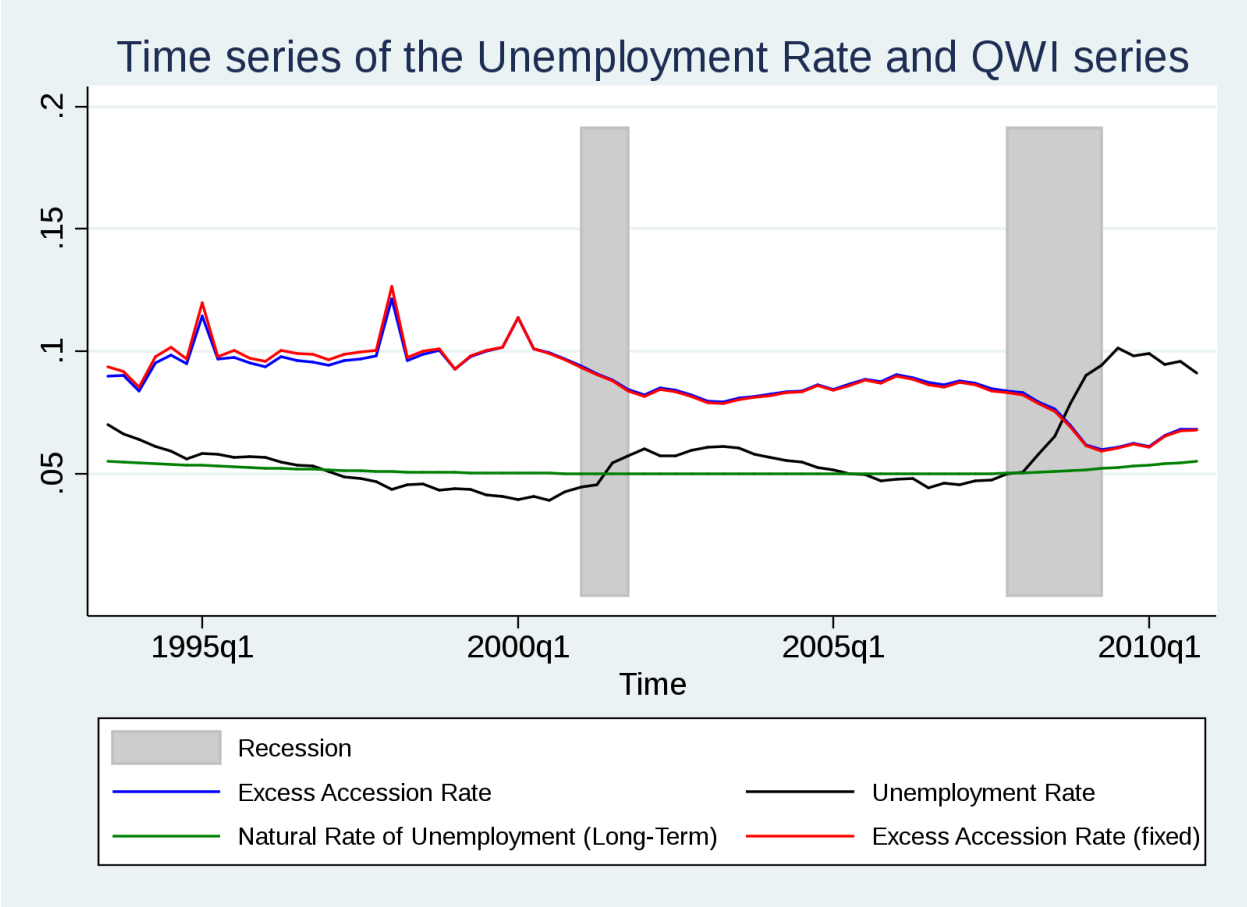Figure 3: Natural Rate, Unemployment Rate, Excess Accession Rate, SA

Figure 4: Natural Rate, Unemployment Rate, Excess Accession Rate (regular and fixed weights), SA
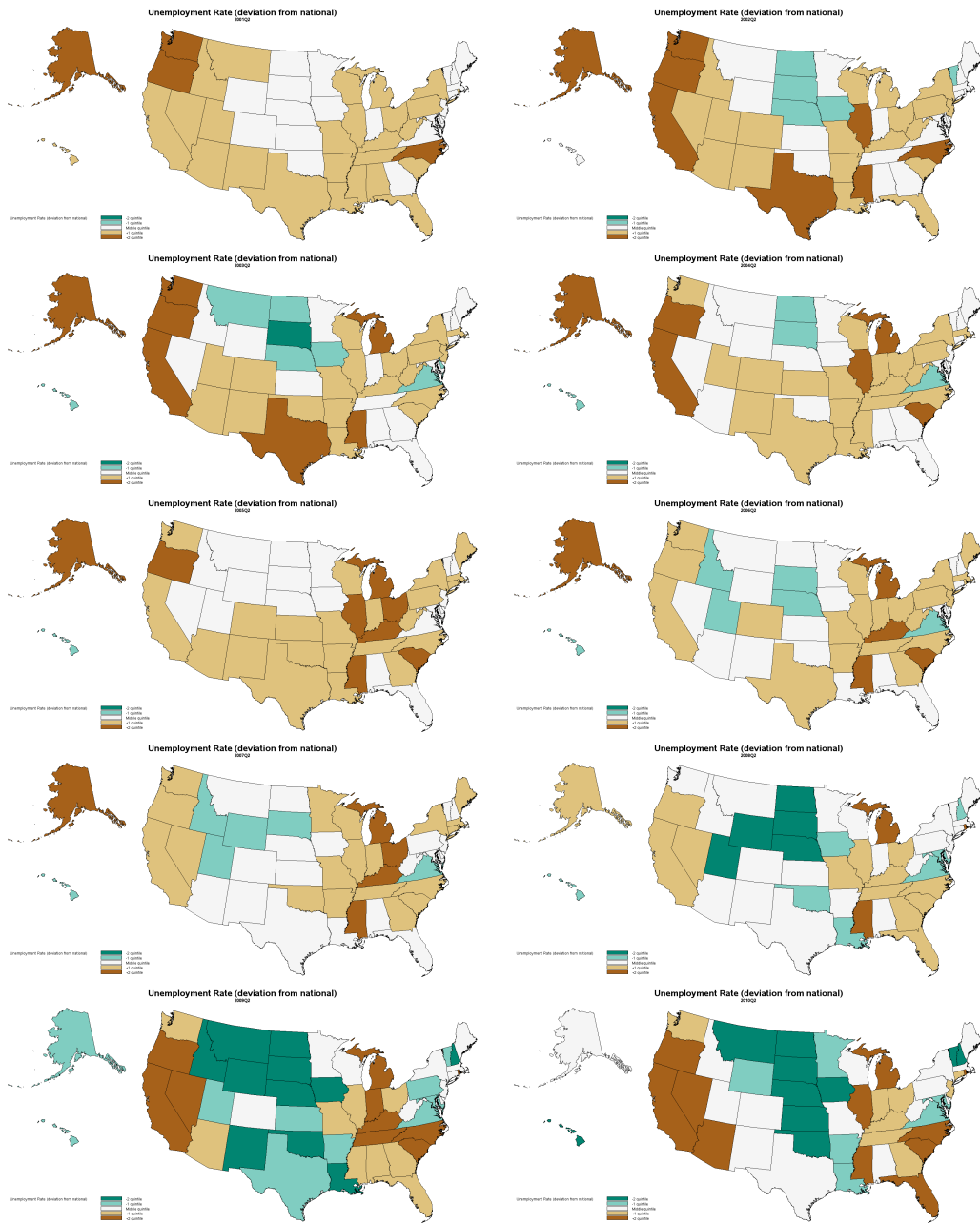
Figure 5: Unemployment Rate by State, Deviation from National Average, 2001Q2-2010Q2, Classified by Quintiles in 2009Q2
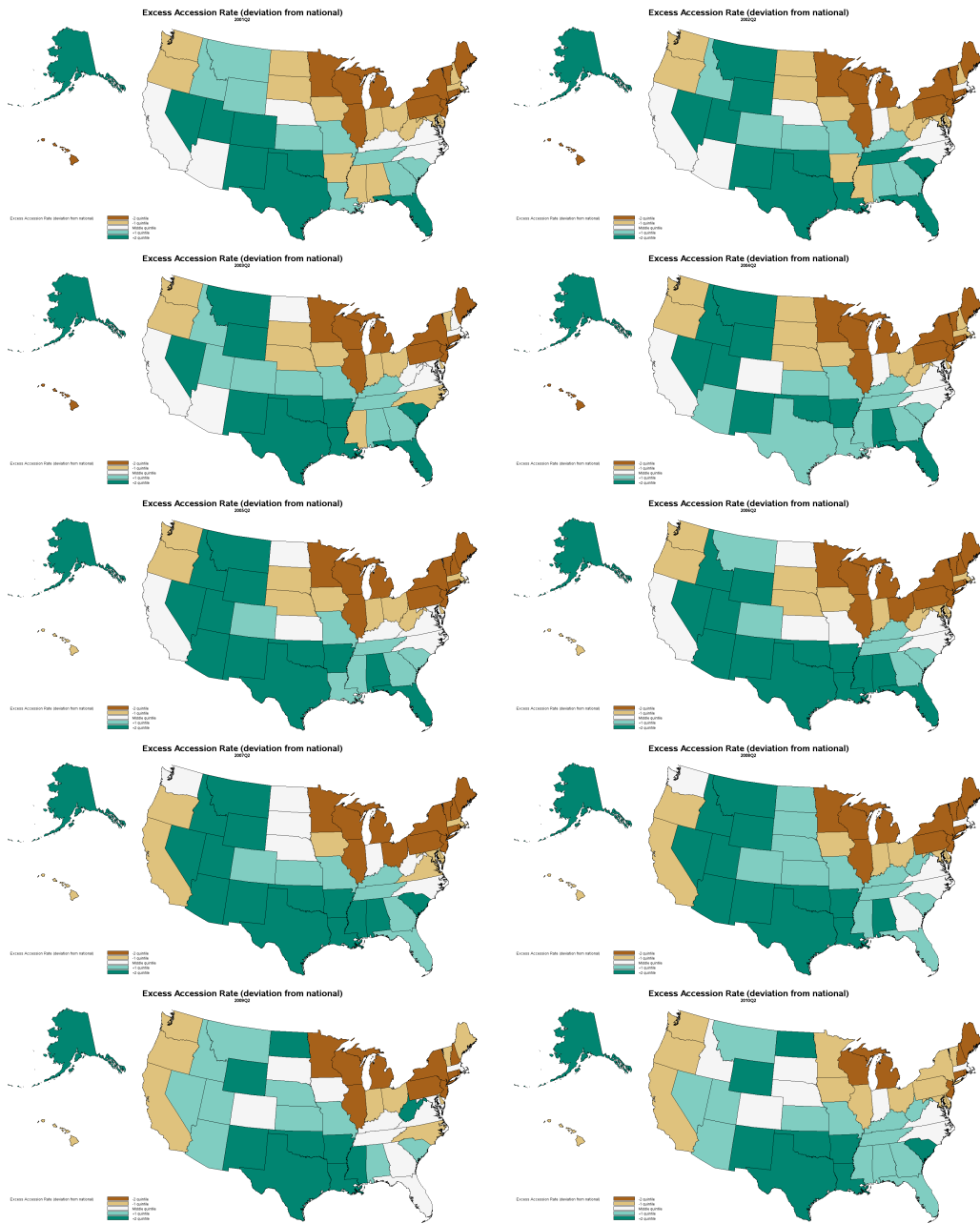
Figure 6: Excess Accession Rates by State, Deviation from National Average, 2001Q2-2010Q2, Classified by Quintiles in 2009Q2

A   Data appendix

A.1   QWI data

The U.S. Census Bureau has published its local labor market indicators, known as the QWI, since 2003. Over the course of the 2000s, these data became national and now cover 92 percent of the private non-agricultural workforce (Abowd and Vilhuber, 2011). The complete set of detailed flows – job creations, job destructions, accessions, separations, churning, earnings, and earnings changes – are available for 49 states (and DC), 566 micropolitan areas, and 357 MSAs). For most of these areas, the data are available from the mid-1990s onwards. There are very few data suppressions, and these affect only certain items – earnings data are never suppressed (see Abowd et al. (2009) for a detailed description). The data include statistics by age, sex, race, ethnicity, and education. We focus our attention on full-quarter jobs and the associated earnings. Full-quarter jobs are those for which the individual has positive earnings from a given employer in at least three consecutive quarters. From such an earnings pattern, continuous employment throughout (at least) the middle quarter is inferred (see Abowd et al. (2009) for the precise definition of this and the other QWI-related concepts used in this article). Full-quarter jobs exclude very short jobs - those lasting only portions of one or two quarters. The average full-quarter earnings zw_3 associated with full-quarter jobs f are a good approximation of a wage rate. We also use average earnings $zwfs$ associated with separations from full-quarter jobs fs, and equivalently, average earnings $zwfa$ associated with accessions to full-quarter jobs fa. Finally, the associated job creation and destruction rates $fjcr$ and $fjdr$ are also part of the QWI.

QWI are provided by the U.S. Census Bureau, and can be downloaded from the VirtualRDC[2]. The QWI are released at the county, Workforce Investment Board (WIB), and Core-Based Statistical Area (CBSA) level. The geographic definitions stem from TIGER 2006 Second Edition.

For this paper, data on the 49 states and DC were extracted from the R2012Q1 release of the QWI, covering data through 2011Q2[3]. Historical data availability varies by state, with some states only providing data from 2004Q1 (AZ) onwards, and other providing data from as early as 1990Q1 (MD). Data for MA were not available; however the missing data algorithm imputed that state.

We also use data from the prototype National QWI first developed in Abowd and Vilhuber (2011), updated to cover data through 2011Q2. The National QWI are downloadable from the VirtualRDC as well[4].

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[2]http://vrdc.cornell.edu/qwipu
[3]http://vrdc.cornell.edu/qwipu/R2012Q1. For Virginia, Rhode Island, and Louisiana, no release of data was made, and data from R2011Q4 were used.
[4]http://vrdc.cornell.edu/news/data/qwi-national-data/

The specific version of the data used in this article were created on 2013-03-30 (r3814).[5]

A.2 Unemployment data

The Bureau of Labor Statistics (BLS) provides data on national unemployment. For this paper, we used series LNU04000000Q, accessed on April 6, 2013. Local Area Unemployment Statistics (LAUS) are provided by the BLS (see Bureau of Labor Statistics (1997) and Brown (2005)), and were accessed on April 6, 2013. Data were further aggregated to quarterly values by taking the simple 3-month average for each calendar quarter.

The natural rate of unemployment is derived from the CBO's Budget and Economic Outlook, via FRED (series ID NROU, as of April 10, 2013).

A.3 Deflators

QWI earnings data are deflated by the Consumer Price Index (All Urban Consumers) (CPI-U) (series CUSR0000SA0), aggregated to quarterly indices by averaging monthly indices. House Price Index (HPI) data are deflated by the housing component of the CPI-U (U.S. city average series CUSR0000SAH), again obtaining quarterly indices by simple averaging of monthly indices.

B Abbreviations

BLS Bureau of Labor Statistics

CBSA Core-Based Statistical Area

CPI-U Consumer Price Index (All Urban Consumers)

HPI House Price Index

LAUS Local Area Unemployment Statistics

MSA Metropolitan Statistical Area

QWI Quarterly Workforce Indicators

WIB Workforce Investment Board

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[5]Data will be available at http://vrdc.cornell.edu/qwipu.national/older/r3814.