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Original Paper

Fluctuations in State-Level Monthly Unemployment Rates: A Descriptive Analysis of the Effect of Geographic Location and U.S. Unemployment Rates

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Abstract

This study examines fluctuations in state-level monthly unemployment rates from January 1976 to December 2016, a period of 492 months. Using data from the Bureau of Labor Statistics (BLS) Local Area Unemployment Statistics series, patterns in the monthly seasonally adjusted unemployment rates of the 50 states and the District of Columbia are examined. The study focuses on two unemployment-related issues. First, the relationship between a state's unemployment rate and the U.S. unemployment rate is examined. Second, we explore the extent to which a state's geographic location, using Census regions and Census divisions, affects its monthly unemployment rate.

Keywords

geographic, location, state, unemployment rates

1. Introduction

The analysis of U.S. state unemployment rates has received considerable attention from researchers in the past. In this paper we extend the literature by examining how state unemployment rates are impacted by the national unemployment rate and by geographic location. Specifically, using data from the Bureau of Labor Statistics (BLS), we analyze fluctuations in monthly state-level unemployment rates from January 1976 to December 2016.

From these data, we examine patterns in the monthly seasonally adjusted unemployment rates for the fifty states and the District of Columbia. The focus of this paper is two-fold. First, we determine the effect of U.S. unemployment rates on state-level unemployment rates. Second, we determine how strongly a state's unemployment rate is affected by its geographic location, using Census regions, Census divisions, and state dummy variables to indicate its location. The focus of this paper is fairly narrow; it examines how a state's monthly unemployment rate relative to the U.S. unemployment rate is affected by the state's geographic location. It does not attempt to determine which social, economic, and demographic characteristics of a state affect its unemployment rate relative to the U.S. unemployment rate. Many of these issues would be difficult to examine using monthly unemployment rates, however, since data pertaining to them are generally not available on a monthly basis and, for the most part, they generally change little, if at all, from one month to the next. As such, this paper is descriptive in nature rather than explanatory.

Nonetheless, the findings of this study provide useful lessons for economists, policymakers, and other social scientists engaged in studying state-level unemployment trends If we can identify those states that have a propensity to experience relatively high unemployment rates and, conversely, identify those that have a propensity to experience relatively low unemployment rates, then we can better understand which states are likely to perform either better or worse than the national economy over an extended period. If policymakers and government officials acknowledge that they're in a state that's prone to experiencing relatively high unemployment rates, they can implement policies to attract jobs to their state. Such policies might include enacting favorable corporate tax policies or building infrastructure that businesses deem attractive.

The structure of the paper will proceed as follows. In the next section, we review the literature on the relationship between state-level unemployment rates and national economic conditions. We will focus on empirical studies that explain state-level unemployment as a function of U.S. business cycles, U.S. unemployment rates, and labor market stationarity. Following the literature review, we discuss the BLS data used in this study and provide descriptive statistics. In this section, we describe the following variables: the mean monthly state unemployment rate, the mean monthly difference between the state and the U.S. unemployment rate, the monthly state means by Census region, and the monthly state means by Census division. After reviewing the data, we describe the econometric models that are estimated and discuss the regression results. In the following section, we calculate predicted state unemployment rates, given various U.S. unemployment rates. The paper ends with a summary and concluding remarks and offers some suggestions for future research related to state unemployment rates.

2. Literature Review

In this section we examine the literature that considers American state and regional unemployment and its relationship to national business cycles, unemployment, and labor market stationarity. Two common approaches to studying state versus national unemployment rates include examining the econometric properties of these comparative unemployment rates and exploring the industrial conditions of individual states to determine the extent to which this impacts state unemployment during business cycles. An example of this first line of research is Payne, Ewing, and George (1999). In this paper the authors explore the time series properties of state and national unemployment rates. In particular, the authors attempt to determine the nature of stationarity among the state unemployment rates. They also try to detect whether a common trend exists between a state's unemployment rate and the national unemployment rate. The authors conclude state unemployment rates are first-difference stationary, and that there tends not to be long run co-movement among state unemployment rates the national unemployment rate. In a study of a related issue, Ewing and Thompson (2012) examine asymmetry in state-level business cycles, using monthly State-level Coincident Indexes (SCI) for January 1979 to July 2008, which are reported by the Federal Reserve Bank of Philadelphia, as the measure of a state's economic performance. They find that "economic growth is a mean-reverting stationary process in over two-thirds of the U.S. states, while in 14 states it is non-stationary" (p. 374). They further find evidence of differences in stationarity across the regions of the United States, using the Bureau of Economic Analysis (BEA) definitions of region. Romero-Avila and Usabiaga (2007) examine the existence of infrequent shocks and the degree of persistence of state unemployment rates. Using unit root tests, these authors conclude that state unemployment rates tend to be stationary and follow the hysteresis paradigm. The authors suggest that their findings have significant policy implications. They believe that because of the degree of stationarity of state unemployment rates, stabilization policy may have more long-lasting effects on state unemployment rates than previously understood.

An extension of Romero-Avila and Usabiaga's (2007) work is found in Sephton (2009). His evidence suggests that both the hysteresis and structuralist models of state unemployment can be useful in explaining state unemployment, but that the time period under consideration accounts heavily into which view is more accurate. He concludes that over the last 30 years most state unemployment rates were characterized by stationarity fluctuations around a shifting trend. A paper that presents an interesting comparison of US state unemployment rates and European Union unemployment rates is Romero-Avila and Usabiaga (2009). The authors employ panel stationarity tests to examine the main unemployment paradigms, looking specifically at data from the US states and the EU over roughly the last 30 years. The authors' findings also suggest that US state unemployment is characterized by stationarity, whereas EU unemployment rates exhibit more closely the hysteresis paradigm, and they conclude that adverse macroeconomic shocks, such as interest rates and oil prices, cause permanently higher unemployment rates in the EU than in the states.

Owyang, Piger, and Wall (2005) use the state coincident index, like Ewing and Thompson (2012), to present evidence regarding the timing and characteristics of state-level business cycles. They use monthly data from January 1979 through June 2002 and determine that there are large differences across states in both the contraction phases and expansions phases of the cycle. They further find that the differences in recession growth rates among states tend to depend on differences in the employment-mix characteristics of the states, but that differences in expansion growth rates tend to depend on differences in demographic characteristics across states. Their findings also indicate that national recessions "are less reflective of middle America and more indicative of the East and Far

West" (p. 615).

Previous research has also studied state unemployment rates relative to national economic conditions based on the industrial characteristics of the states. Partridge and Rickman (1997) explore the differences in state unemployment rates as a function of national economic variables and state equilibrium and disequilibrium variables. The authors define state equilibrium variables as those that affect state unemployment differentials after state growth rates are equalized (i.e., normalized to a national trend), thus reducing the flow of resources from state to state. Disequilibrium variables cause state unemployment rates to diverge because of state industry mix factors and competitive shift between states. The authors conclude that the relative importance of equilibrium versus disequilibrium differs dramatically across states and regions, and knowledge of these differences could aid policy makers

Hyclak and Lynch (1980) use a version of Okun's Law to measure the impact of the U.S. business cycle on state unemployment rates. Their empirical results show a high degree of variability and sensitivity of state unemployment rates to the national output gap. In addition, they find that the industrial mix of states has a significant effect on unemployment sensitivity. States with large manufacturing and tourism sectors have higher unemployment sensitivity than states that have large cities, or significant agricultural sectors. Izraeli and Murphy (2003) examine the impact of industrial diversity on state unemployment rates and per-capita income. The authors argue that industrial diversification can serve as a type of unemployment insurance during downturns in the business cycle. Using panel data for seventeen states, they find a strong link between industrial diversity and reduced unemployment. Walden (2012) examines industrial composition and its impact on state unemployment. He concludes that during the Great Recession industrial composition (manufacturing in particular), falling housing prices, and household in-migration contributed to state unemployment. Walden further finds that the states most severely impacted by these three economic characteristics were geographically clustered in three regions, the Far West, the Southeast, and the Midwest. Beyers (2013) also examines the industrial characteristics of states and how these conditions contributed to state unemployment during the Great Recession. He finds that states with higher concentrations of manufacturing tended to suffer higher rates of unemployment during the recession.

Nistor (2009) also attempts to identify state-level factors that affect a state unemployment rates, using state-level annual unemployment data for 1990 and 2000, and finds that human capital investment in a state negatively affects its unemployment rate. Vedder and Gallaway (1996) investigate state unemployment differentials and find significant spatial variations in the states' natural rates of unemployment. The authors focus on labor market conditions, including such factors as wage rates, unionization, welfare payments, and tax policy, in explaining these variations. Karaki (2018) explores the impact of oil shocks on state unemployment rates and finds that oil supply shocks increase unemployment in all states except the oil-producing states of Texas, Colorado, and Wyoming. Positive demand shocks in the crude market tend to lower unemployment in all states. Cebula (2019) considers state unemployment as a function of the labor market freedom in individual states. He finds that states with greater labor market freedom tend to have lower unemployment rates. According to Cebula, in order to increase labor market freedom (and therefore lower unemployment), states should reconsider policies regarding minimum wages, government employment, and right-to-work laws.

This paper differs from the previous literature in that it focuses only on the relationship between state-level unemployment rates and national unemployment rate, and on the effect that a state's geographic location has on its unemployment rate. It also determines how the effect of the U.S. unemployment rate on a state unemployment rates differs across states.

3. The Data and Descriptive Statistics

The state-level data used in this study are obtained from the U.S. Bureau of Labor Statistics, "Local Area Unemployment Statistics" series (www.bls.gov/lau/). The series contains the monthly unemployment rate for each state and the District of Columbia as far back as January 1976. The unemployment rates are available in both seasonally adjusted and not seasonally adjusted formats. For this study we chose the seasonally adjusted format. The national unemployment data are obtained from the U.S. Bureau of Labor Statistics, "Labor Force Statistics from the Current Population Survey" series (www.bls.gov/cps/#data). The seasonally adjusted format was also selected for the national unemployment rate.

To determine the effect of geographic location on a state's unemployment rate, Census regions and Census divisions were used as geographic definitions. The description of regions and divisions are available at "Census Regions and Divisions of the United States" (www.census.gov/geo/maps-data/maps/pdfs/reference/us_regdiv.pdf). A map of the United States that shows its regions and divisions is presented in the Appendix.

Table 1 reports the mean seasonally adjusted unemployment rate for each state and for the United States. The standard deviation is also reported, along with the Census region and Census division in which the state is located. The states are sorted in order of the mean monthly unemployment rate, from highest to lowest. There is substantial discrepancy in the mean unemployment rates. The mean rates vary from a low of 3.56 percent (Nebraska) to a high of 8.25 percent (West Virginia). Twenty-one states have a mean rate higher than that of the United States and 30 have a mean rate that's lower. Of the twenty-one that have a higher mean rate than the U.S., nine are in the South Census region and six are in the West Census region. Further, 11 states have a mean rate that's at least 7.0 percent (five are in the South Census region and four are in the West Census region). At the opposite end of the distribution, 12 states have a mean rate that's below 5.0 percent. Six of the twelve are in the Midwest Census region, two are in the Northeast Census region, and three are in the West Census region.

Table 1 also indicates that there is substantial discrepancy in the standard deviations of the monthly unemployment rates, varying from a high of 3.0 percent (West Virginia) to a low of .80 percent (South Dakota). Nine states have a standard deviation that's 2.0 percent or higher (four are in the South

Census region and three are in the Midwest Census region), and four have a standard deviation that's below 1.0 percent (all are in the Midwest Census region). Lower standard deviations, of course, indicate lower volatility in a state's monthly unemployment rate.

Table 2 reports the results for the mean difference between a state's monthly unemployment rate and the U.S. unemployment rate. The difference in the two unemployment rates for a given month can be either positive or negative. As such, the mean value for a state can either be positive, negative, or even zero. A positive value indicates that, on average, the state has a higher unemployment rate that the U.S. during a given month, while a negative value indicates that, on average, a state has a lower unemployment rate than the U.S. during a given month. The mean difference ranges from a high of 1.84 percent (West Virginia) to a low of -2.85 percent (Nebraska). Twenty-one states have a mean with a positive value. Nine of these states are in the South Census region and six are in the West Census region.

Table 2 also indicates that there is substantial discrepancy in the standard deviations of the State – U.S. unemployment rate differences, varying from a high of 2.35 percent (West Virginia) to a low of .56 percent (Virginia). Five states have a standard deviation that exceeds 1.50 percent (two are in the South Census region and two are in the West Census region), and seven have a standard deviation that's below .75 percent (three are in the Midwest Census region and two are in the South Census region).

Table 1. Mean Monthly Unemployment Rate: Jan. 1976-December 2016 (Sorted from Highest to Lowest)

State	Census Division	Census Region	Mean	Std. Dev.
WV	South Atl.	South	8.25	3.00
MI	ENC	Midwest	8.07	2.91
AK	Pacific	West	7.96	1.38
DC	South Atl.	South	7.70	1.53
MS	ESC	South	7.64	1.89
CA	Pacific	West	7.38	1.94
LA	WSC	South	7.36	2.09
AL	ESC	South	7.28	2.46
OR	Pacific	West	7.22	1.91
WA	Pacific	West	7.08	1.79
IL	ENC	Midwest	7.00	1.97
KY	ESC	South	6.83	1.96
NM	Mountain	West	6.79	1.40
OH	ENC	Midwest	6.79	2.14

NY	Mid. Atl.	Northeast	6.62	1.53
NV	Mountain	West	6.62	2.49
SC	South Atl.	South	6.62	1.96
RI	New Eng.	Northeast	6.59	2.20
AR	WSC	South	6.59	1.54
PA	Mid. Atl.	Northeast	6.53	1.75
TN	ESC	South	6.51	1.97
NJ	Mid. Atl.	Northeast	6.39	1.87
AZ	Mountain	West	6.37	1.84
IN	ENC	Midwest	6.28	2.29
FL	South Atl.	South	6.28	1.88
GA	South Atl.	South	6.10	1.70
TX	WSC	South	6.07	1.27
ID	Mountain	West	6.06	1.65
MO	WNC	Midwest	6.04	1.58
ME	New Eng.	Northeast	5.92	1.60
NC	South Atl.	South	5.86	2.00
MT	Mountain	West	5.84	1.30
WI	ENC	Midwest	5.62	1.82
MA	New Eng.	Northeast	5.59	1.75
CT	New Eng.	Northeast	5.55	1.75
DE	South Atl.	South	5.47	1.82
CO	Mountain	West	5.46	1.54
MD	South Atl.	South	5.34	1.30
OK	WSC	South	5.20	1.36
HI	Pacific	West	4.98	1.61
WY	Mountain	West	4.95	1.49
UT	Mountain	West	4.92	1.54
MN	WNC	Midwest	4.92	1.33
VA	South Atl.	South	4.79	1.25
VT	New Eng.	Northeast	4.73	1.32
KS	WNC	Midwest	4.71	0.94
IA	WNC	Midwest	4.67	1.45
NH	New Eng.	Northeast	4.37	1.38
ND	WNC	Midwest	3.90	0.92
SD	WNC	Midwest	3.71	0.80

NE	WNC	Midwest	3.56	0.88
USA			**6.41**	**1.56**

Source: Monthly unemployment rate data are obtained at www.bls.gov/lau/#data, "Local Area Unemployment Statistics"

Table 2. Mean Monthly Difference in State–US Unemployment Rate: Jan. 1976-December 2016 (Sorted from Highest to Lowest)

State	**Census Division**	**Census Region**	**Mean**	**Std. Dev.**
WV	South Atl.	South	1.84	2.35
MI	ENC	Midwest	1.66	1.66
AK	Pacific	West	1.56	1.45
DC	South Atl.	South	1.30	0.99
MS	ESC	South	1.24	1.14
CA	Pacific	West	0.97	0.89
LA	WSC	South	0.95	1.86
AL	ESC	South	0.87	1.28
OR	Pacific	West	0.81	0.83
WA	Pacific	West	0.68	0.71
IL	ENC	Midwest	0.60	0.74
KY	ESC	South	0.42	1.03
NM	Mountain	West	0.38	1.07
OH	ENC	Midwest	0.38	0.93
NV	Mountain	West	0.22	1.34
NY	Mid. Atl.	Northeast	0.22	0.90
SC	South Atl.	South	0.22	0.88
RI	New Eng.	Northeast	0.18	1.33
AR	WSC	South	0.18	0.88
PA	Mid. Atl.	Northeast	0.12	0.68
TN	ESC	South	0.10	0.80
NJ	Mid. Atl.	Northeast	-0.02	1.05
AZ	Mountain	West	-0.03	0.79
IN	ENC	Midwest	-0.12	1.07
FL	South Atl.	South	-0.13	0.81
GA	South Atl.	South	-0.31	0.82

TX	WSC	South	-0.34	1.21
ID	Mountain	West	-0.35	0.83
MO	WNC	Midwest	-0.36	0.57
ME	New Eng.	Northeast	-0.49	0.86
NC	South Atl.	South	-0.54	1.01
MT	Mountain	West	-0.57	1.02
WI	ENC	Midwest	-0.79	0.80
MA	New Eng.	Northeast	-0.82	1.22
CT	New Eng.	Northeast	-0.86	1.17
DE	South Atl.	South	-0.94	1.08
CO	Mountain	West	-0.94	0.88
MD	South Atl.	South	-1.07	0.72
OK	WSC	South	-1.21	1.26
HI	Pacific	West	-1.42	1.54
WY	Mountain	West	-1.46	1.53
UT	Mountain	West	-1.49	0.81
MN	WNC	Midwest	-1.49	0.62
VA	South Atl.	South	-1.62	0.56
VT	New Eng.	Northeast	-1.67	0.98
KS	WNC	Midwest	-1.70	1.06
IA	WNC	Midwest	-1.74	0.95
NH	New Eng.	Northeast	-2.03	1.10
ND	WNC	Midwest	-2.50	1.31
SD	WNC	Midwest	-2.70	1.03
NE	WNC	Midwest	-2.85	1.11

Source: Monthly unemployment rate data are obtained from www.bls.gov/lau/#data, "Local Area Unemployment Statistics"

Table 3 and Table 4 report the mean monthly state unemployment rates by Census region and by Census division, respectively. Table 3 indicates that the mean monthly rate of states in the South Census region is higher than that of states in the other Census regions, and that of states in the Midwest Census region is lower than that of states in the other Census regions. Additionally, the mean State – U.S. rate difference for all regions except the South is negative, with the Midwest Census region being the most negative. Table 4 indicates that the mean monthly rate of states in the East South Central Census division is higher than that of states in the other Census divisions, and that of states in the West North Central Census division is lower than that of states in the other Census divisions. Additionally, the mean State-U.S. rate difference is highest (i.e., the most positive) for states in the East South

Central Census division and is lowest (i.e., the most negative) for states in the West North Central Census division.

Table 3. Monthly State Means by Census Region

Census Region	Number of States	Mean State Rate	Mean State – US Rate Difference
Midwest	12	5.44	-.97
		(2.19)	(1.71)
Northeast	9	5.81	-.60
		(1.87)	(1.31)
South	17	6.46	.06
		(2.10)	(1.51)
West	13	6.28	-.13
		(1.96)	(1.46)

Note. Standard deviations are in parenthesis.

Table 4. Monthly State Means by Census Division

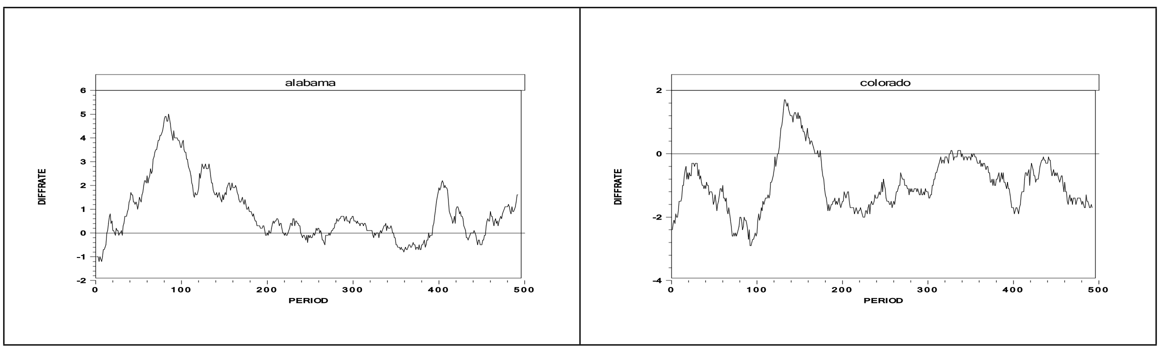
Census Division	Number of States	Mean State Rate	Mean State – US Rate Difference
East North Central (ENC)	5	6.75	0.34
		(2.40)	(1.36)
East South Central (ESC)	4	7.07	0.66
		(2.13)	(1.16)
Mountain	8	5.88	-0.53
		(1.82)	(1.26)
Middle Atlantic	3	6.51	0.11
		(1.73)	(.90)
New England.	6	5.46	-0.95
		(1.84)	(1.34)
Pacific	5	6.93	0.52
		(2.02)	(1.52)
South Atlantic	9	6.27	-0.14
		(2.16)	(1.55)
West North	7	4.50	-1.91

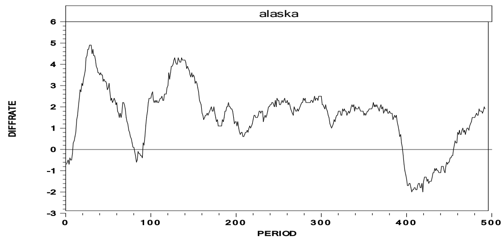
Central (WNC)		(1.41)	(1.27)
West South	4	6.30	-0.10
Central (WSC)		(1.78)	(1.56)

Note. **S**tandard deviations are in parenthesis**.**

A set of graphs that plots the difference between each state's unemployment rate and the U.S. unemployment rate for each month is shown in Figure 1. The solid horizontal line in each graph represents a difference of zero. Points above the line therefore indicate months where the state unemployment rate exceeds the U.S. rate, while points below the line indicate months where the U.S. rate exceeds the state rate.

Figure 1 is quite helpful in that it provides a quick visual indication of which states tend to have unemployment rates that are generally higher than the U.S. rate, and which states tend to have unemployment rates that are generally lower than the U.S. rate. It also provides an indication of how the difference in each state has changed over the 492-month period. The graphs in Figure 1 indicate that some states have an unemployment rate that is almost always higher than the U.S. rate. States in this category include, but aren't limited to, Alabama, Alaska, the District of Columbia, California, Michigan, Mississippi, and West Virginia. Four of the seven are in the South Census region. The graphs also indicate that some states have an unemployment rate that is always, or almost always, lower than the U.S. rate. States in this category include, but aren't limited to, Colorado, Connecticut, Delaware, Iowa, Kansas, Maryland, Nebraska, Minnesota, New Hampshire, North Dakota, South Dakota, Utah, Vermont, and Virginia. Six of the 14 are in the Midwest Census region. North Dakota, Nebraska, South Dakota, and Virginia had an unemployment rate that was below the U.S. rate during all 492 months.

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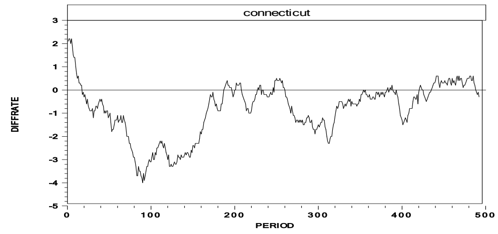
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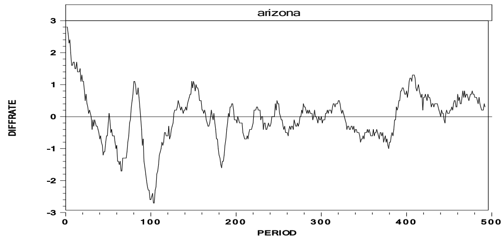
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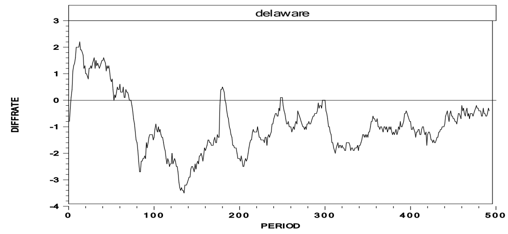
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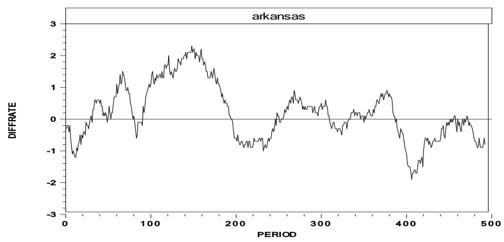
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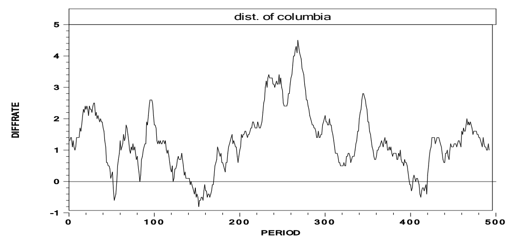
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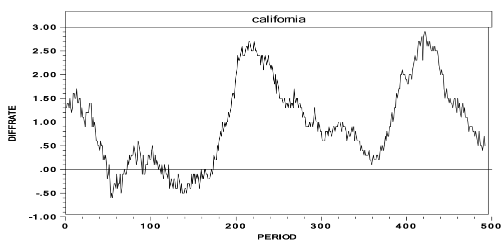
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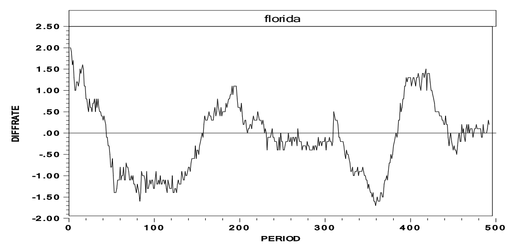
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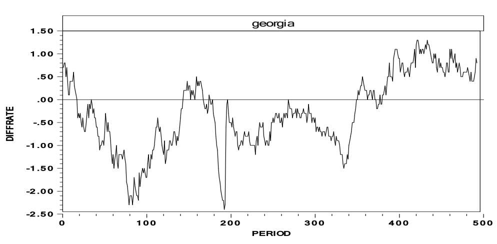
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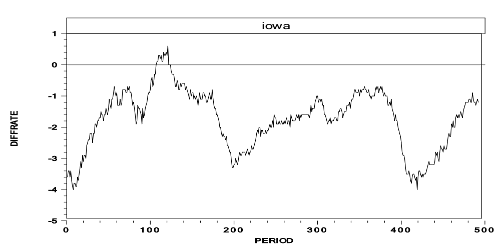
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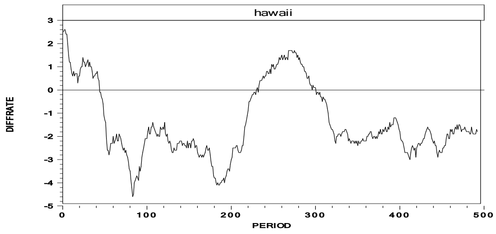
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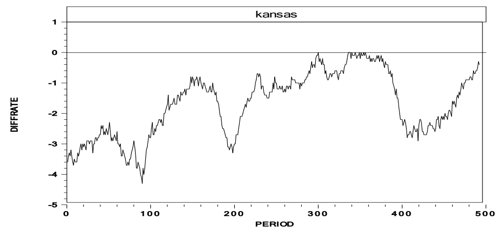
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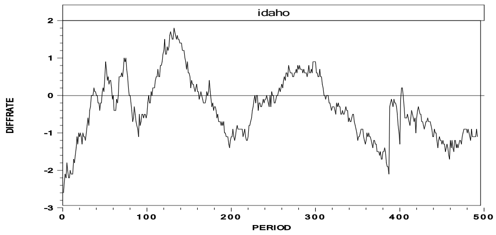
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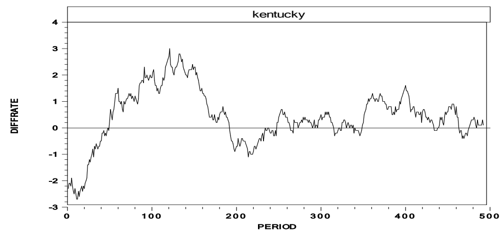
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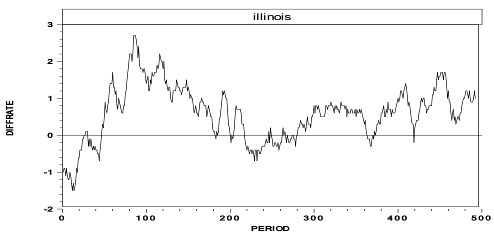
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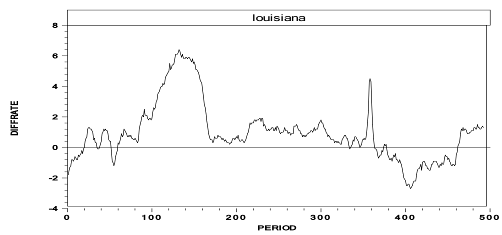
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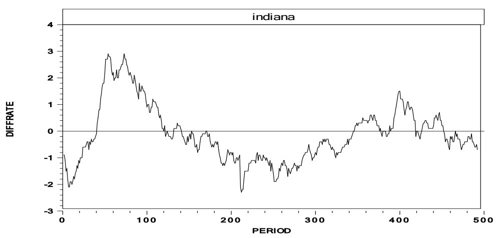
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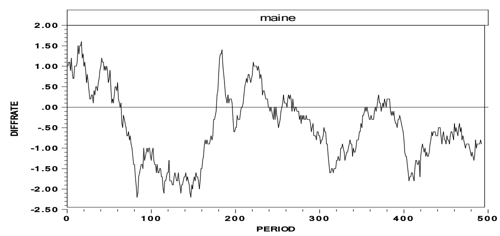
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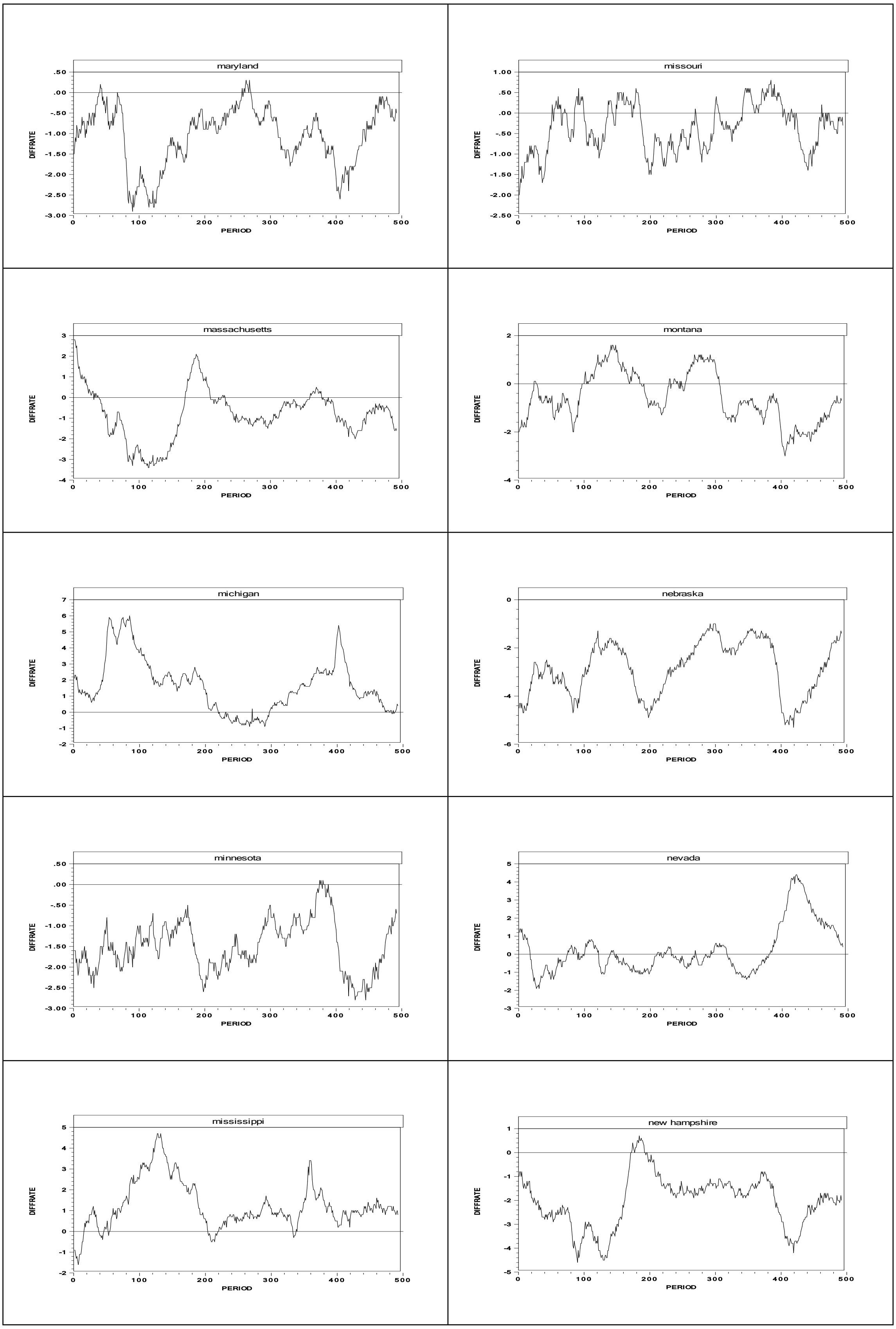
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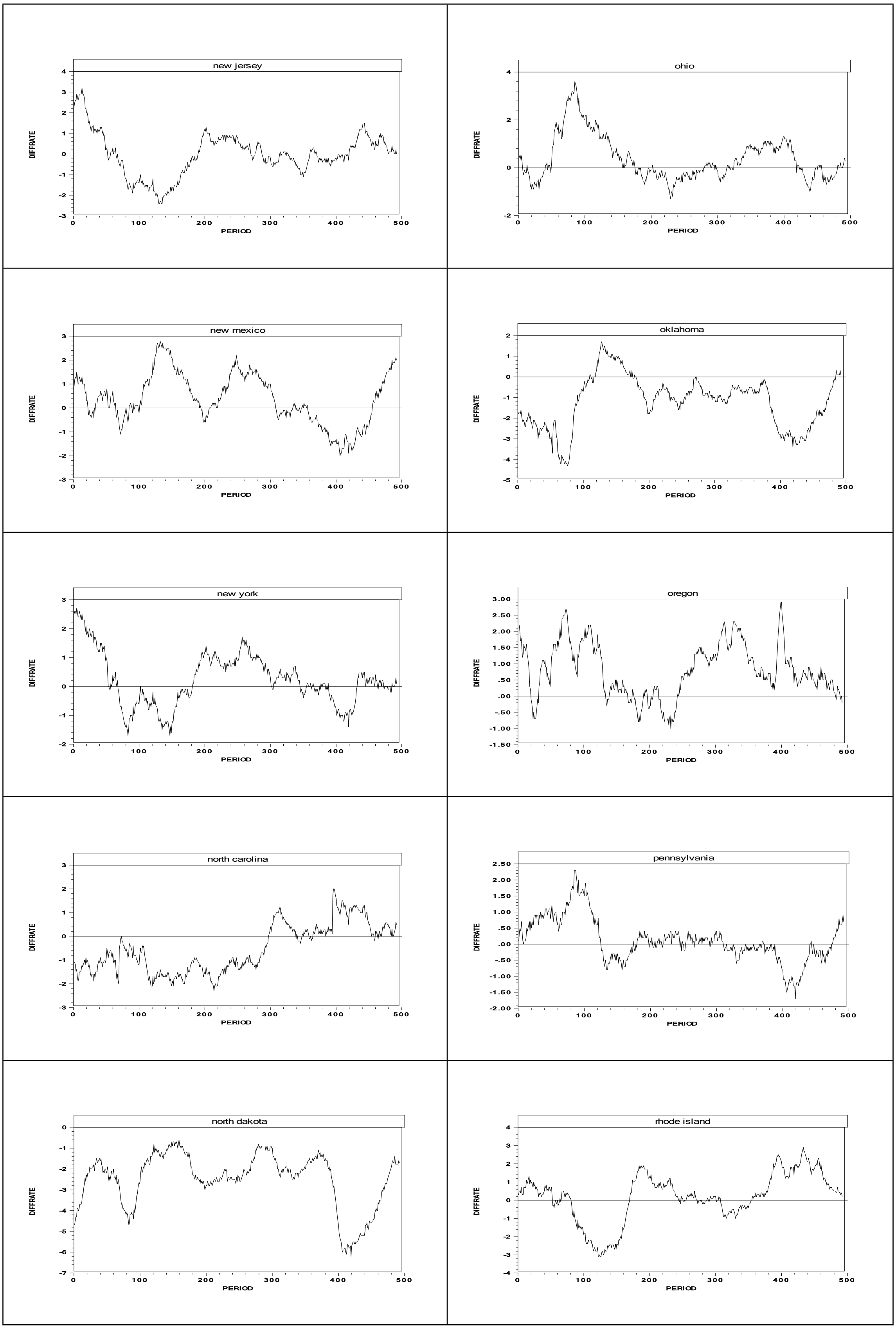
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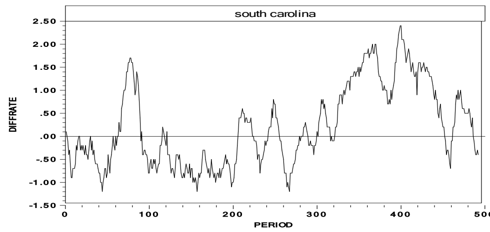
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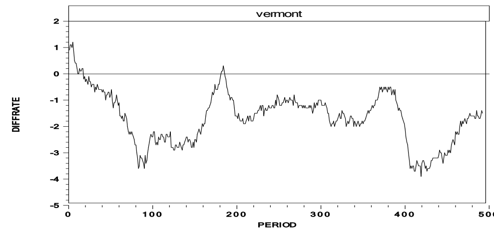
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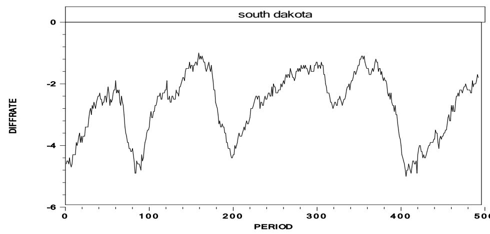
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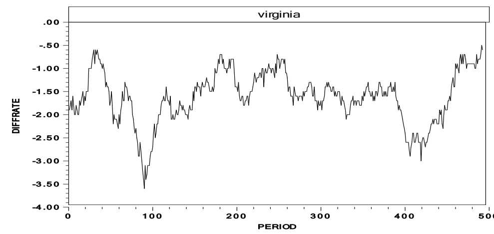
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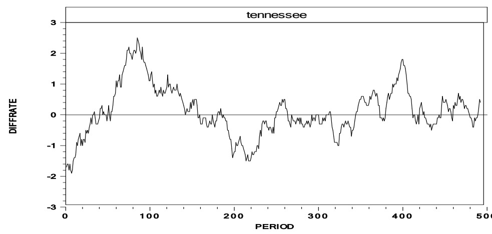
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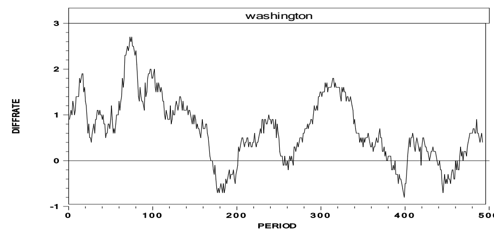
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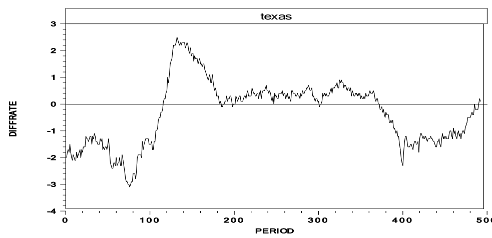
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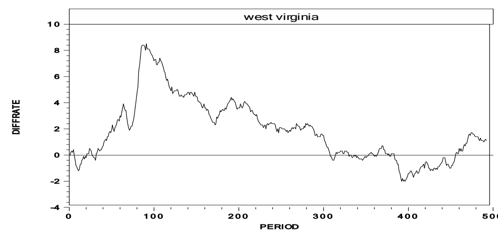
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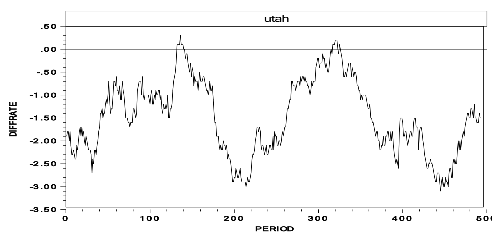
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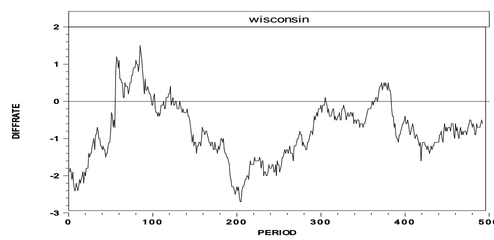
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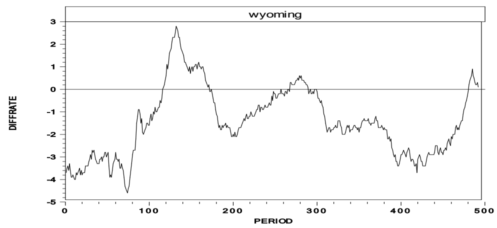

Figure 1. Graphs of Differences between State and U.S. Unemployment Rates

The analysis so far suggests that there exists a distinct regional pattern in state-level unemployment rates over the 1976 to 2016 period. Generally, states in the South and West Census regions have higher unemployment rates than states in the Northeast and Midwest Census regions, with states in the South having the highest rates and states in the Midwest having the lowest rates. The analysis further suggests that states in the East South Central section of the South and in the Pacific section of the West tend to have the highest mean unemployment rates, and that states in the West North Central section of the Midwest tend to have the lowest mean unemployment rates.

In the following section, we examine this issue in more detail by estimating a series of econometric models, where geographic location (Census region, Census division, or state) are explanatory variables. Based on the above analysis, it's our expectation that geographic location will be a strong determinant of state-level monthly unemployment rates. We expect to find that states located outside the Midwest Census region and outside the West North Central Census division to have relatively high monthly unemployment rates, ceteris paribus.

4. Econometric Models

Two different sets of regression equations are estimated in this paper. In the first set of models, all 50 states and the District of Columbia are included as observations in a single regression equation. To ascertain whether there are differences in monthly unemployment rates across geographic space, dummy variables related to the location of a state are included as explanatory variables in the models. The general form of these regressions is:

(1) $\mathbf{Rate_{i,t} = a + b\ US_t + D_i}$

where $\mathbf{Rate_{i,t}}$ is the seasonally adjusted unemployment rate for state i in month t.

$\mathbf{US_t}$ is the U.S. seasonally adjusted unemployment rate in month t.

$\mathbf{D_i}$ is geographic dummy variable to denote the location of state i.

Three versions of the geographic dummy variable are used in the models. In one model, Census region dummy variables are utilized (the Midwest region is the omitted region); in a second model Census division dummy variables are utilized (the West North Central division is the omitted division); and in a third model state dummy variables are utilized (Nebraska is the omitted state). In all three cases, the omitted region/division/state has a mean monthly unemployment rate that's lower than that of the other regions/divisions/states.

In the second set of models, a separate regression is run for each state and the District of Columbia, which yields 51 separate regression equations. The general form of these regressions is:

(2) $\mathbf{Rate_t = a + b\ US_t}$

where $\mathbf{Rate_t}$ is the seasonally adjusted unemployment rate for the state in month t.

$\mathbf{US_t}$ is the U.S. seasonally adjusted unemployment rate in month t.

5. Discussion of Regression Results

The results of equation (1) are reported in Table 5. The results indicate that the U.S. unemployment rate and the location of a state both have a statistically significant effect on a state's unemployment rate. The coefficient on the U.S. Rate is .8908, indicating that, on average, a change in the national unemployment rate of one percentage point induces a slightly smaller .8908 percentage point change in the unemployment rate of a given state. Further, the geographic dummy variables all suggest the existence of a geographic pattern in state unemployment rates. In the model that utilizes Census region dummy variables (where the Midwest region is the omitted region), the results indicate that a state in the South has an unemployment rate that's 1.0253 percentage points higher than a state in the Midwest, ceteris paribus. The results also suggest that a state in the West has an unemployment rate that's .8420 percentage points higher than a state in the Midwest, and that a state in the Northeast has an unemployment rate that's .3711 percentage points higher, ceteris paribus.

In the model that utilizes Census division dummy variables, where the West North Central (WNC) division is the omitted division, the results indicate that in four of the remaining eight regions, a state's unemployment rate will generally be at least two percentage points higher than a state in the WNC division. At the high end, a state in the East South Central division is found to have an unemployment rate that's 2.5646 percentage points higher than a state in WNC division, ceteris paribus. States located in the Pacific, East North Central (ENC), and Middle Atlantic divisions are also found to have an unemployment rate that's at least two percentage points above a state in the WNC division. The results also indicate that the only division dummy with a value less than 1.0 is New England, which has a value of .9576, indicating that a state in the New England division has an unemployment rate that's approximately .96 percentage points higher, on average, than a state in the WNC division.

The dummy variable coefficients for the model that utilizes state dummy variables, where Nebraska is the omitted state, are not reported in Table 5 in order to conserve space. The coefficients on all 50 state dummy variables are statistically significant at the .01 level, however, and all have a positive value. Five of the states have a coefficient that has a value greater than 4.0, indicating that the state's unemployment rate for a given month is typically at least 4.0 percentage points higher than Nebraska's rate. The five states are Alaska, District of Columbia, Michigan, Mississippi, and West Virginia. Three of these states are in the South Census region and one is in the West Census region. At the other extreme, there are three states that have a dummy variable coefficient with a value less than 1.0. The three states are New Hampshire, North Dakota, and South Dakota. Two of the states are in the Midwest census region.

Table 5. OLS Regression Equations: Region, Division, and State Dummy Variable Models

Variable	No Geographic Dummies	Census Region Dummies	Census Division Dummies	State Dummies
Intercept	.3532	-.2687	-1.2064	-2.1493
	(8.06)	(6.26)	(28.74)	(39.81)
US Rate	.8908	.8908	.8908	.8908
	(121.33)	(124.55)	(141.56)	(173.81)
Census Region Dummy Variables (3)				
South		1.0252		
		(37.13)		
West		.8420		
		(29.47)		
Northeast		.3711		
		(12.60)		
Census Division Dummy Variables (8)				
New England			.9576	
			(30.36)	
Middle Atlantic.			2.0113	
			(65.10)	
ENC			2.2505	
			(63.96)	
South Atlantic			1.7664	
			(57.20)	
ESC			2.5646	
			(75.72)	
WSC			1.8036	
			(45.60)	
Mountain			1.3761	
			(48.69)	
Pacific			2.4255	
			(66.42)	

State Dummy Variables (50)				
State Variables				Not Reported Individually
N	25,092	25,092	25,092	25,092
R-Squared	.443	.482	.582	.730

Note. The absolute values of the t-statistics are in parenthesis.

In the State Dummies model all state-dummy coefficients are positive and are statistically significant at the .01 level. Nebraska, the state with the lowest mean unemployment rate, is the omitted state.

The results of equation (2) are reported in Table 6. There are substantial differences among the state-level regressions. The magnitude of the coefficient for the U.S. unemployment rate varies substantially across the 51 state-level equations, from a low of .324 (North Dakota) to a high of 1.675 (Michigan), indicating that the effect of the U.S. unemployment rate is roughly five times stronger on Michigan's unemployment rate than on North Dakota's unemployment rate. Six states have a coefficient that's at least 1.20, and nine have a coefficient that's less than .60. The four states with the lowest coefficient are North Dakota, South Dakota, Nebraska, and Kansas, which are all in the Midwest Census region and are in the West North Central Census division. The R-squared values also vary substantially among the state-level regressions, from a high of .893 (Virginia) to a low of .249 (Wyoming), indicating the explanatory power of the regression equations varies substantially among states. Recall that in the regressions that included all states as observations, the value of the slope coefficient was .8908, suggesting that a one percentage point in the U.S. unemployment rate induces a .8908 percentage point change in the unemployment rate of a given state. In the state-level regression, approximately half the states have a coefficient value less than this amount and half have a coefficient value greater than this amount.

Table 6. State OLS Regression Results

State	Census Region	Census Division	Intercept	US Rate	R-Sqrd
AL	South	ESC	-1.729	1.406	.796
			(7.55)	(35.54)	
AK	West	Pacific	5.005	.462	.272
			(27.93)	(15.40)	
AZ	West	Mountain	-.437	1.063	.816
			(3.57)	(48.70)	
AR	South	WSC	1.301	.825	.705

			(9.51)	(38.31)	
CA	West	Pacific	.275	1.109	.797
			(1.74)	(41.86)	
CO	West	Mountain	.172	.826	.706
			(1.25)	(39.28)	
CT	Northeast	New Eng.	.139	.844	.569
			(0.64)	(23.15)	
DE	South	South Atl.	-.557	.941	.653
			(4.14)	(43.82)	
DC	South	South Atl.	2.708	.780	.632
			(15.14)	(31.83)	
FL	South	South Atl.	-.696	1.088	.819
			(4.23)	(38.70)	
GA	South	South Atl.	-.019	.954	.770
			(0.11)	(31.04)	
HI	West	Pacific	1.453	.551	.284
			(6.39)	(17.04)	
ID	West	Mountain	.181	.917	.754
			(1.30)	(44.68)	
IL	Midwest	ENC	-.560	1.180	.878
			(4.86)	(60.63)	
IN	Midwest	ENC	-2.297	1.339	.836
			(16.40)	(56.47)	
IA	Midwest	WNC	-.110	.746	.643
			(0.74)	(28.22)	
KS	Midwest	WNC	1.821	.450	.562
			(16.98)	(26.19)	
KY	South	ESC	-.007	1.067	.724
			(0.06)	(48.69)	
LA	South	WSC	2.927	.692	.267
			(10.42)	(15.45)	
ME	Northeast	New Eng.	.319	.874	.727
			(2.78)	(49.24)	
MD	South	South Atl.	.620	.737	.789
			(6.93)	(51.06)	
MA	Northeast	New Eng.	.299	.826	.542

			(1.83)	(29.70)	
MI	Midwest	ENC	-2.659	1.675	.806
			(10.99)	(43.14)	
MN	Midwest	WNC	-.099	.783	.849
			(0.97)	(50.82)	
MS	South	ESC	1.429	.970	.641
			(9.63)	(40.45)	
MO	Midwest	WNC	.016	.941	.871
			(0.15)	(58.13)	
MT	West	Mountain	1.801	.631	.576
			(12.18)	(28.85)	
NE	Midwest	WNC	.968	.404	.519
			(10.60)	(26.82)	
NV	West	Mountain	-2.359	1.402	.776
			(9.36)	(35.52)	
NH	Northeast	New Eng.	.252	.643	.530
			(2.31)	(34.78)	
NJ	Northeast	Mid. Atl.	.044	.990	.683
			(0.28)	(37.12)	
NM	West	Mountain	2.486	.671	.558
			(14.57)	(26.47)	
NY	Northeast	Mid. Atl.	1.402	.815	.688
			(10.79)	(38.87)	
NC	South	South Atl.	-1.226	1.106	.750
			(6.73)	(38.18)	
ND	Midwest	WNC	1.828	.324	.300
			(13.64)	(14.01)	
OH	Midwest	ENC	-1.301	1.262	.847
			(7.29)	(41.49)	
OK	South	WSC	1.655	.553	.404
			(10.71)	(21.87)	
OR	West	Pacific	.118	1.109	.820
			(0.95)	(58.22)	
PA	Northeast	Mid. Atl.	-.114	1.036	.852
			(0.65)	(33.68)	
RI	Northeast	New Eng.	-.642	1.129	.643

			(3.28)	(33.82)	
SC	South	South Atl.	-.640	1.134	.852
			(3.80)	(44.17)	
SD	Midwest	WNC	1.038	.417	.655
			(16.19)	(40.32)	
TN	South	ESC	-.964	1.167	.853
			(6.71)	(46.67)	
TX	South	WSC	2.658	.533	.430
			(21.36)	(28.52)	
UT	West	Mountain	-.509	.848	.743
			(4.03)	(43.87)	
VT	Northeast	New Eng.	.498	.661	.611
			(4.53)	(34.06)	
VA	South	South Atl.	-.072	.759	.893
			(0.90)	(62.50)	
WA	West	Pacific	.321	1.055	.846
			(2.51)	(48.84)	
WV	South	South Atl.	.480	1.212	.397
			(0.95)	(13.70)	
WI	Midwest	ENC	-1.104	1.049	.810
			(6.95)	(39.84)	
WY	West	Mountain	1.894	.477	.249
			(9.69)	(15.56)	

Note. The absolute values of the t-statistics are in parenthesis.

The coefficient on the US Rate is statistically significant at the .01 level in all 51 equations.

6. Predicted Unemployment Rates

In Table 7, predicted unemployment rates for each state are reported for six different U.S. unemployment rates, using the regression results from Table 6. The U.S. unemployment rates that are utilized are 4.0%, 5.0%, 6.0%, 7.0%, 8.0% and 9.0%. For a historical context, the U.S. unemployment rate was 9.0 percent or higher 49 times during the 492-month period considered in this study, and it was 4.0 percent or lower 11 times. As such, these two rates are relatively rare.

The predictions indicate a wide range of state unemployment rates for a given U.S. unemployment rate. The predictions also indicate that the range between the unemployment rate of the state with the highest rate and that with the lowest rate is likely to increase as the U.S. unemployment rate increases. When the U.S. unemployment rate is an unusually low 4.0 percent, the range in predicted state unemployment rates is 4.27 percentage points, but when the U.S. unemployment rate is an unusually high 9.0 percent, the predicted range is a much larger 7.81 percentage points.

The predictions also indicate that some states are likely to always have an unemployment rate that's lower than the U.S. rate (Colorado, Connecticut, Delaware, Nebraska, North Dakota, South Dakota, and Utah, for example), while others are likely to always have an unemployment rate that's above the U.S. rate (Alaska, California, District of Columbia, Illinois, Mississippi, and West Virginia, for example).

Table 7. Predicted State Unemployment Rates for Given U.S. Unemployment Rates

State	4.0	5.0	6.0	7.0	8.0	9.0
AL	3.90	5.30	6.71	8.11	9.52	10.93
AK	6.85	7.31	7.78	8.24	8.70	9.16
AZ	3.81	4.88	5.94	7.00	8.06	9.13
AR	4.60	5.43	6.25	7.08	7.91	8.73
CA	4.71	5.82	6.93	8.04	9.15	10.26
CO	3.48	4.30	5.13	5.95	6.78	7.60
CT	3.51	4.36	5.20	6.05	6.89	7.73
DE	3.21	4.15	5.09	6.03	6.97	7.91
DC	5.83	6.61	7.39	8.16	8.94	9.72
FL	3.66	4.75	5.83	6.92	8.01	9.10
GA	3.80	4.75	5.71	6.66	7.62	8.57
HI	3.66	4.21	4.76	5.31	5.86	6.41
ID	3.85	4.77	5.68	6.60	7.52	8.43
IL	4.16	5.34	6.52	7.70	8.88	10.06
IN	3.06	4.40	5.74	7.08	8.42	9.75
IA	2.87	3.62	4.36	5.11	5.85	6.60
KS	3.62	4.07	4.52	4.97	5.42	5.87
KY	4.26	5.33	6.40	7.46	8.53	9.60
LA	5.70	6.39	7.08	7.77	8.46	9.15
ME	3.81	4.69	5.56	6.44	7.31	8.18
MD	3.57	4.30	5.04	5.78	6.51	7.25
MA	3.60	4.43	5.25	6.08	6.91	7.73
MI	4.04	5.71	7.39	9.06	10.74	12.41
MN	3.03	3.82	4.60	5.38	6.17	6.95
MS	5.31	6.28	7.25	8.22	9.19	10.16
MO	3.78	4.72	5.66	6.60	7.54	8.48

MT	4.32	4.95	5.59	6.22	6.85	7.48
NE	2.59	2.99	3.39	3.80	4.20	4.61
NV	3.25	4.65	6.05	7.46	8.86	10.26
NH	2.82	3.47	4.11	4.75	5.40	6.04
NJ	4.00	4.99	5.98	6.97	7.96	8.95
NM	5.17	5.84	6.51	7.19	7.86	8.53
NY	4.66	5.48	6.29	7.11	7.92	8.74
NC	3.20	4.31	5.41	6.52	7.62	8.73
ND	3.12	3.45	3.77	4.09	4.42	4.74
OH	3.75	5.01	6.27	7.53	8.80	10.06
OK	3.87	4.42	4.97	5.52	6.08	6.63
OR	4.55	5.66	6.77	7.88	8.99	10.10
PA	4.03	5.07	6.10	7.14	8.18	9.21
RI	3.87	5.00	6.13	7.26	8.39	9.52
SC	3.89	5.03	6.16	7.30	8.43	9.56
SD	2.71	3.12	3.54	3.96	4.37	4.79
TN	3.70	4.87	6.04	7.20	8.37	9.53
TX	4.79	5.32	5.85	6.39	6.92	7.45
UT	2.88	3.73	4.58	5.42	6.27	7.12
VT	3.14	3.80	4.47	5.13	5.79	6.45
VA	2.96	3.72	4.48	5.24	6.00	6.76
WA	4.54	5.60	6.65	7.71	8.77	9.82
WV	5.33	6.54	7.75	8.96	10.18	11.39
WI	3.09	4.14	5.19	6.24	7.29	8.34
WY	3.80	4.28	4.76	5.23	5.71	6.19
High	6.85	7.31	7.78	9.06	10.74	12.41
Low	2.59	2.99	3.39	3.80	4.20	4.61
Range	4.27	4.32	4.38	5.27	6.54	7.81
Average	3.92	4.81	5.70	6.59	7.48	8.37

7. Summary and Concluding Remarks

This paper has examined the long-term trends in the seasonally adjusted monthly unemployment rates across the 50 states and the District of Columbia. The study has focused on two issues: 1) The extent to which geographic location, using Census regions and Census divisions, affects state unemployment rates; and 2) How the unemployment rate in a given state is affected by the U.S. unemployment rate. The primary focus of the paper is to ascertain the role that a state's location plays in the determination of its unemployment rate.

We find that there are large discrepancies in state-level monthly unemployment rates across the United States, using both Census regions and Census divisions as indicators of a state's location. The regression results strongly support this notion. Generally, the results indicate that states located outside the Midwest Census region have higher unemployment rates than states located in the Midwest, and also indicate that states located outside the West North Central Census division generally have higher unemployment rates than states located in the West North Central Census division. The effect of geographic location is a statistically significant determinant of state-level unemployment rates in all the regressions that include location-related dummy variables.

The regressions in which a separate model is estimated for each state also indicate that there are substantial differences across states. Although the monthly unemployment rate in every state is positively affected by the U.S. unemployment rate, the effect varies greatly. A one-percentage point change in the U.S. unemployment rate causes less than a one-percentage point change in some states (Nebraska, North Dakota, and South Dakota, for example), but causes a larger than a one-percentage point change in the unemployment rate in other states (Alabama, Indiana, and Nevada, for example). Using the estimated regression equation for each state to predict its unemployment rate, given a range of U.S. unemployment rates, further indicates that unemployment rates in different states respond differently to changes in the U.S. unemployment rate.

While this study has determined the extent to which state unemployment rates respond to the U.S. unemployment rate and how a state's location affects its unemployment rate, it does not attempt to determine which factors influence the response. Certainly, there could be several factors that affect the response. The variation of state unemployment rates could be a function of agglomeration economies or growth poles. Factors such as a state's industry-employment mix, whether a state's population is primarily urban or rural, the educational attainment of a state's working-age population, and so on could all potentially affect how its unemployment rate responds to changes in the U.S. unemployment rate. Many of these issues would be difficult to examine using monthly unemployment rates, however, since data pertaining to them are generally not available on a monthly basis and, for the most part, they generally change little, if at all, from one month to the next. Nonetheless, they're issues that could be examined in future studies pertaining to state-level unemployment.

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