The Relationship between the Tenth District Economy and the National Economy

By Tim R. Smith

Information about the national economy is typically available well before information about the regional economy. For example, national employment data are usually released about a month before data for individual states, and the state data are often revised subsequently, resulting in a lag of two months or more for accurate information. In addition, output data for the states are released several years after output data for the nation. This lag in economic data makes it difficult for regional policymakers and business planners to gauge current regional economic conditions and to make decisions based on the region's outlook. Moreover, specialized state or regional economic data are often more difficult and costly to obtain than the widely publicized national economic data.

If the Tenth District economy closely tracks the national economy, the early national data could give advanced signals about regional economic conditions and perhaps even give clues about the future course of the district economy. This article explores the relationship between the district and national economies and finds that the district economy generally moves with the national economy. The article also finds that information about past changes in the national economy can help predict changes in the district economy.

The first section of the article uses employment data to examine how closely the district economy tracks the national economy during business cycles and over longer time periods. The second section uses more complex employment evidence to determine whether past information about the national economy helps predict the district's future economic performance.

I. DO THE DISTRICT AND NATIONAL ECONOMIES MOVE TOGETHER?

To determine if recent information about the national economy can be used as an early indicator of economic performance in the region, it is necessary to show that measures of district and national economic performance move together over time. If the two economies do show signs of such comovement, then measures of national economic performance can be used as reliable indicators of district economic performance. To simplify the analysis of the relationship between the district and national economies, this article focuses on employment growth, a gauge

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Table 1

INDUSTRIAL STRUCTURE

Tenth District

	1970	1975	1980	1985	1990	1995
Total nonfarm	1.00	1.00	1.00	1.00	1.00	1.00
Mining	2.49	2.31	2.69	2.53	2.31	2.21
Construction	.97	1.10	1.08	1.03	.86	1.08
Manufacturing	.74	.75	.77	.79	.85	.84
Durable goods	NA	.74	.77	.79	.86	.84
Nondurable goods	NA	.77	.77	.80	.84	.84
Transportation and public utilities	1.16	1.14	1.18	1.18	1.17	1.13
Wholesale and retail trade	1.08	1.08	1.06	1.04	1.03	1.03
Wholesale trade	1.12	1.08	1.10	1.03	1.02	.99
Retail trade	1.07	1.07	1.04	1.04	1.03	1.04
Finance, insurance, and real estate	.99	.97	.95	.96	.93	.94
Services	.98	.98	.95	.94	.95	.95
Total government	1.21	1.12	1.09	1.13	1.15	1.11

Note: Industrial structure is determined by dividing Tenth District shares of employment by U.S. shares of employment.
Source: Author's calculations are based on employment data from the Bureau of Labor Statistics.

of economic activity widely followed by analysts, policymakers, and business people.

This section examines three questions about the comovement between the district and national economies. First, do the district and national economies have the same broad industrial structure? If the two economies have the same industrial structure, they are more likely to move together over time. Second, how do the two economies move together as they reach turning points in the business cycle? Third, how closely does the district track the nation over longer time periods that include several business cycles?

Industrial structure evidence

One reason to expect the district economy to behave like the national economy is that the two economies are similar in their industrial structure. Generally speaking, if the industrial makeup of a region is similar to that of the nation, changes in the region's economy will closely match those in the nation's economy. A study by Sherwood-Call, for example, found that stronger linkages between state and national economies are associated with state industrial structures that resemble the nation's.[1]

As the ratios in Table 1 show, the shares of employment in most major industries of the district are similar to their national counterparts. The ratios represent the shares of district nonagricultural employment in major industries relative to their national counterparts. More detailed industry categories than those displayed in Table 1 would provide a clearer picture of how closely the district's industrial structure matches the

Table 2

INDUSTRIAL STRUCTURE INDEXES

Tenth District states

	1970	1975	1980	1985	1990	1995
Tenth District	5.05	5.34	6.24	4.54	2.62	1.98
Colorado	8.39	10.29	9.50	6.71	3.82	4.74
Kansas	4.75	2.14	1.88	2.54	1.63	1.69
Missouri	.85	.97	1.35	.99	.97	.64
Nebraska	6.89	9.12	8.09	6.76	4.20	2.17
New Mexico	52.70	48.73	49.75	32.55	24.60	22.83
Oklahoma	25.64	20.75	29.87	27.39	17.64	10.34
Wyoming	140.55	185.36	256.34	168.07	143.65	132.56

Note: Index values decrease as the district or state industry mix more closely match the nation's industry mix.
Source: Author's calculations are based on employment data from the Bureau of Labor Statistics.

nation's, but such data are not available for all district states.[2] To determine whether the district's industrial structure has become more like the nation's over time, the table examines ratios for 5-year intervals from 1970 to 1995. A ratio of 1.00 means the shares of employment in an industry are identical for the district and the nation. A ratio greater than 1.00 means the share of employment in an industry is greater for the district than the nation, and a ratio less than 1.00 means the share of employment in an industry is smaller for the district.

While Table 1 indicates that the district's industrial structure generally has become more like the nation's, some important differences remain. For example, the district's share of mining employment remains more than double the nation's share even though it has declined since the 1980s. And agriculture, while not reflected in the employment data, accounts for much larger shares of earnings and output in the district than in the nation.[3] The district's share of employment in manufacturing has remained somewhat below the nation's share, but the shares have converged over time.

The index used in Table 2 shows that the industrial structures of individual district states also appear to be becoming more like the industrial structure of the nation. The index summarizes the comparisons of industrial structure between district states and the nation at five-year intervals from 1970 to 1995. This index takes into account differences between the state and national shares of employment across industries. The index values decrease as state shares of employment across industries move closer to the U.S. benchmark.[4] Conversely, the index values increase as state shares of employment diverge from their national counterparts.

According to Table 2, the industrial structures of the district and of all seven district states have become more like the industrial structure of the nation over the past 25 years. Moreover, the

Table 3
INDUSTRIAL STRUCTURE INDEX, 1995

California	.64	Tennessee	5.61
Missouri	*.64*	Arizona	5.61
Minnesota	1.00	Texas	5.86
Illinois	1.20	New York	6.12
Vermont	1.28	Alabama	7.53
Pennsylvania	1.37	Wisconsin	8.93
Kansas	*1.69*	Maryland	9.65
Iowa	1.88	Florida	9.90
Washington	1.94	*Oklahoma*	*10.34*
Oregon	2.16	Michigan	11.76
Nebraska	*2.17*	Arkansas	11.84
Virginia	2.29	Mississippi	12.54
Utah	2.33	Delaware	13.42
South Dakota	2.78	Louisiana	14.62
Maine	2.82	South Carolina	14.98
Idaho	3.14	Indiana	14.98
Massachuestts	3.39	North Dakota	15.18
New Jersey	4.21	North Carolina	16.10
Georgia	4.22	Montana	16.51
New Hampshire	4.55	*New Mexico*	*22.83*
Connecticut	4.62	West Virginia	27.58
Colorado	*4.74*	Hawaii	29.17
Rhode Island	4.87	Nevada	32.56
Kentucky	5.19	Alaska	47.09
Ohio	5.43	*Wyoming*	*132.56*

Note: Index values decrease as the district or state industry mix more closely match the nation's industry mix.
Source: Author's calculations are based on employment data from the Bureau of Labor Statistics.

industrial structures of most district states are broadly similar to the industrial structure of the nation. These states include Missouri and Colorado, the district's two most populous states. Kansas and Nebraska also have industrial structures similar to the nation's, while those of New Mexico, Oklahoma, and Wyoming diverge from the national norm because of relatively larger shares of employment in mining.

Table 3 shows how district states compare with other states in their similarity to the nation's industrial structure. The district states range from among the states that are the most similar to the nation to those that are the least similar. Missouri's industrial structure index places it second after California among the states most like the nation. Kansas, Nebraska, and Colorado also rank among the top half of the states in terms of their similarity. Oklahoma and New Mexico are less similar to the nation than most other states, and Wyoming is the least similar to the nation among all 50 states.

In sum, all seven Tenth District states have become more like the nation in terms of their

Table 4

CORRELATION OF DISTRICT AND U.S. EMPLOYMENT GROWTH
1970:Q1-1995:Q4

District	.78
Colorado	.52
Kansas	.64
Missouri	.82
Nebraska	.59
New Mexico	.57
Oklahoma	.35
Wyoming	.22

Note: Before calculating correlation coefficients, quarter-to-quarter growth rates were regressed on a constant term and three quarterly dummy variables. Residuals from these regressions were used as data in calculating correlation coefficients. Based on t-statistics, all correlation coefficients are significant at the 95 percent confidence level.
Source: Author's calculations are based on employment data from the Bureau of Labor Statistics.

industrial structure. While there remains considerable variation across states in the degree of similarity with the nation, the industrial mixes in the states have become more like that of the nation as a whole. And the largest district states—those given the most weight in measures of regional economic performance—are the states with industrial structures most similar to the nation's.

Business cycle evidence

Broad similarity of industrial structures suggests that movements in the district economy might match movements in the national economy. One way to assess how closely the district economy has been tracking the national economy is to look at turning points in the business cycle. If the peaks in district and national employment coincide, then early information about national employment may foreshadow a recession in the district economy. Likewise, if troughs in district and national employment coincide, early information about national employment may foreshadow a district recovery.

Evidence from regional and national employment data shows that employment in the nation tends to peak in the business cycle before it peaks in the district. The first panel of Chart 1 shows the average employment levels in the district and the nation during the five business-cycle peaks since 1970.[5] The chart records the average level of employment during the four quarters before and after the cyclical peak. On average, employment peaks in the nation four quarters before it peaks in the district. Thus, a downturn in national employment generally provides ample warning of a downturn in district employment.[6] The seven remaining panels in Chart 1 show how employment in individual district states tracks national employment during business-cycle peaks. The national peaks precede state peaks, and thus provide early

Chart 1
AVERAGE EMPLOYMENT DURING BUSINESS-CYCLE PEAKS

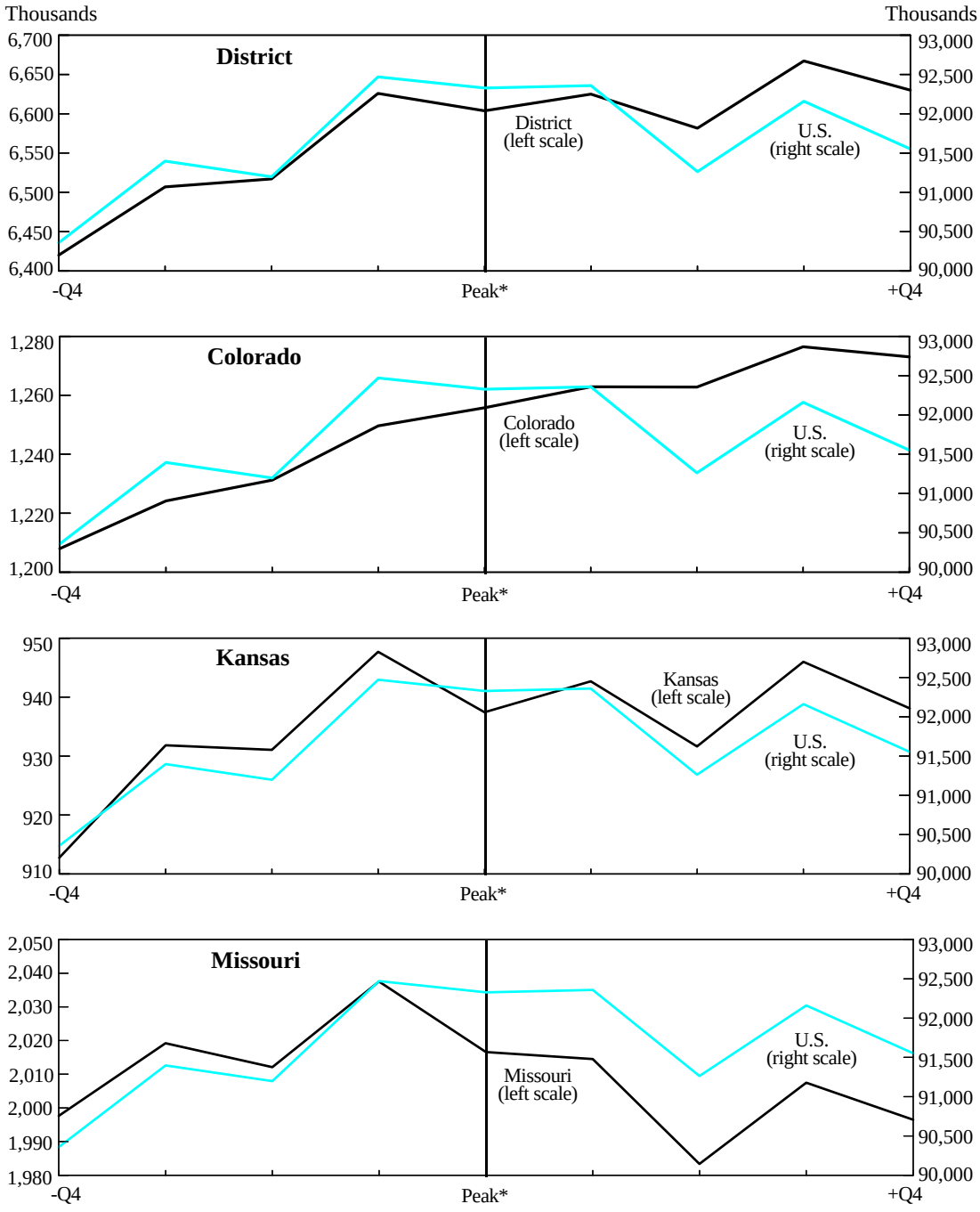
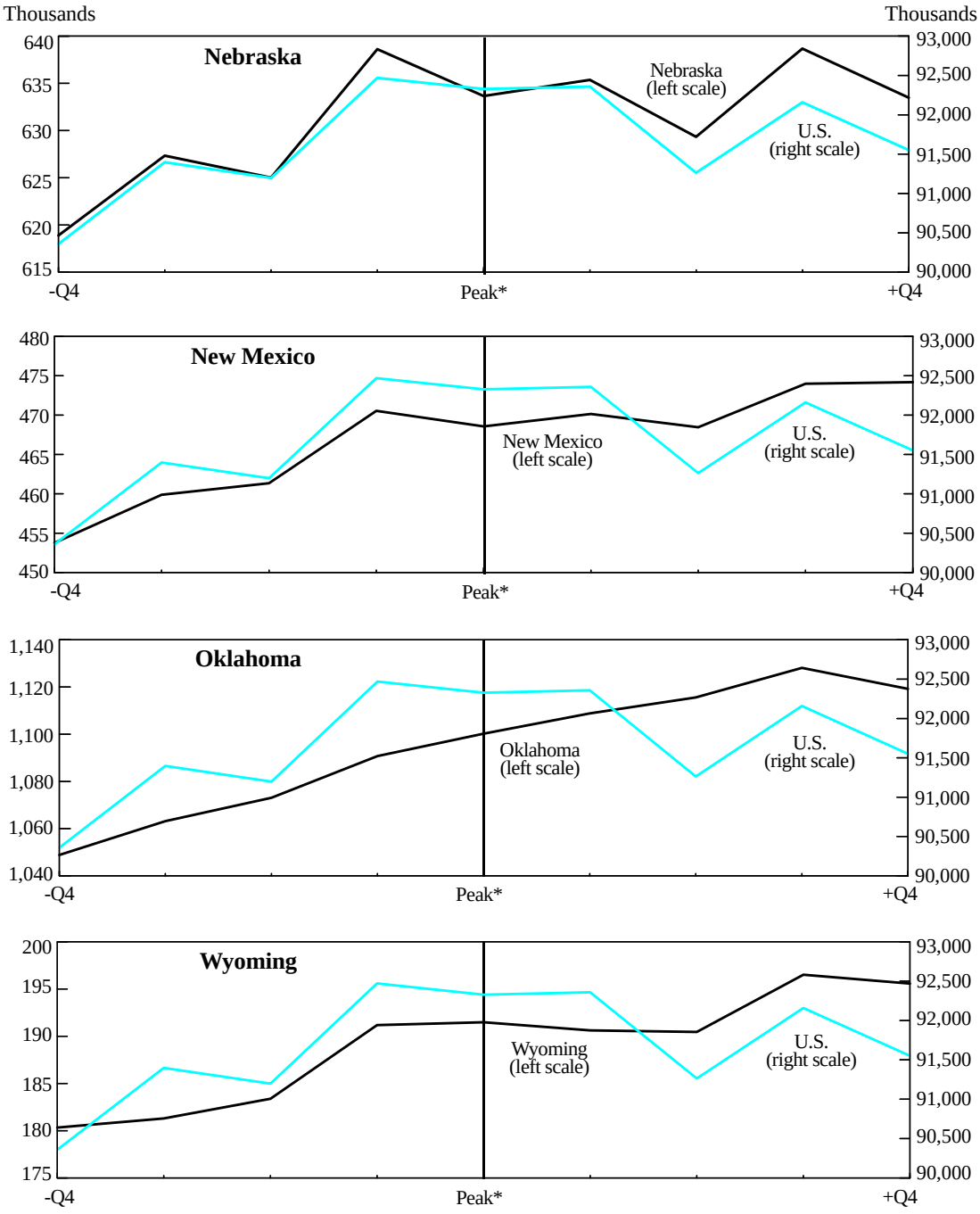


Chart 1 (continued)
AVERAGE EMPLOYMENT DURING BUSINESS-CYCLE PEAKS



*NBER business cycle peaks since 1970.

Chart 2
AVERAGE EMPLOYMENT DURING BUSINESS-CYCLE TROUGHS

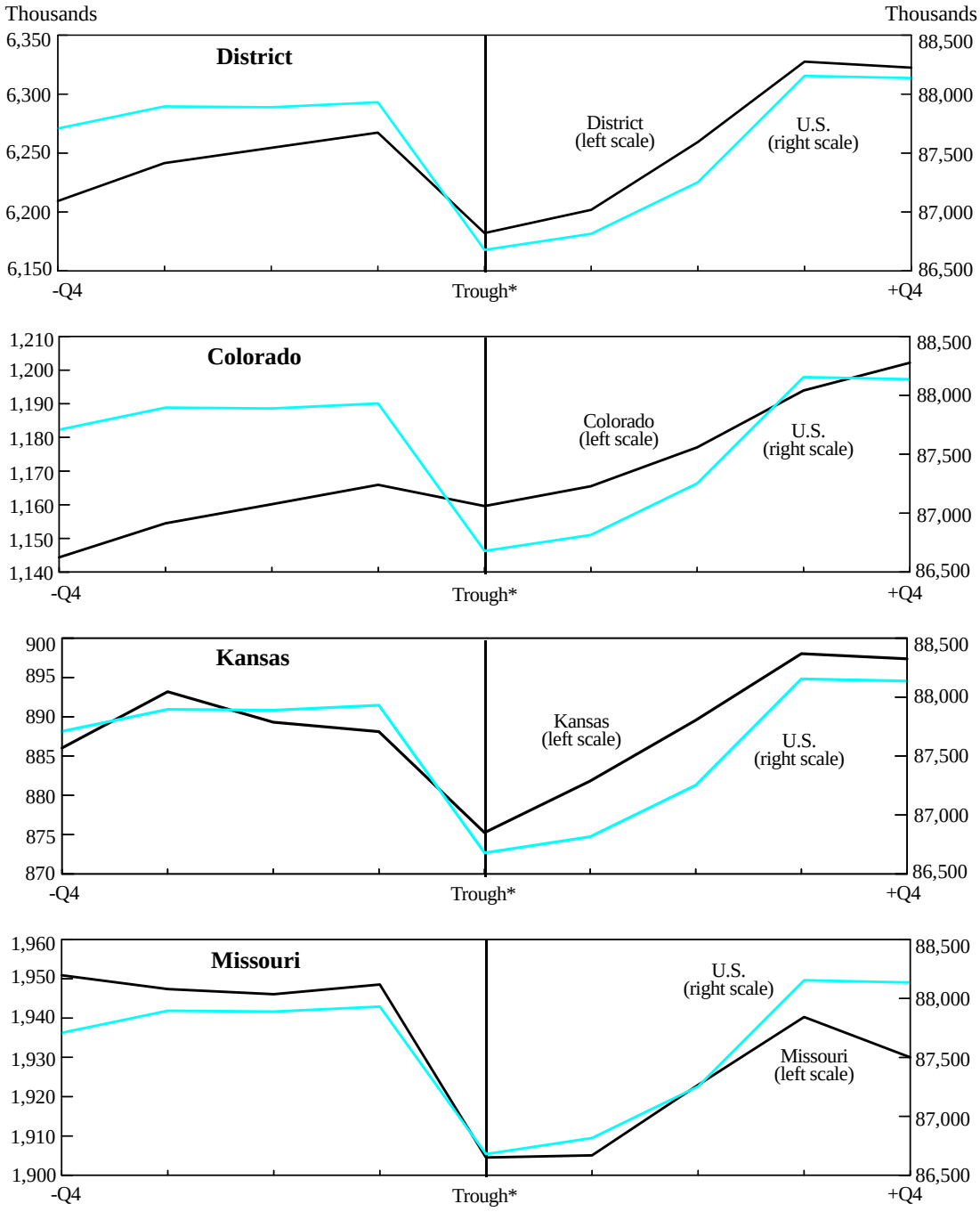
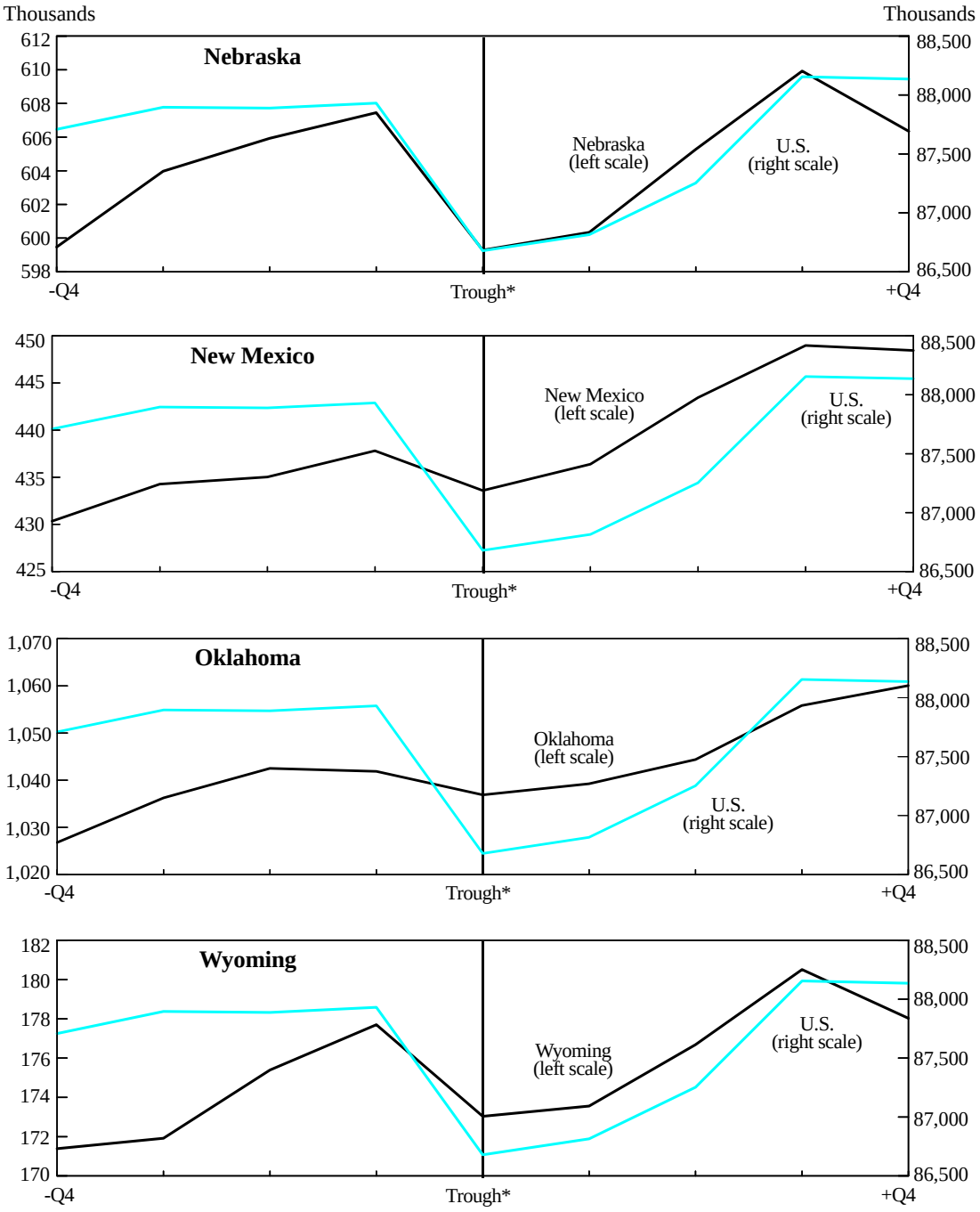


Chart 2 (continued)
AVERAGE EMPLOYMENT DURING BUSINESS-CYCLE TROUGHS



*NBER business cycle troughs since 1970.

warnings of downturns, in Colorado, New Mexico, Oklahoma, and Wyoming. In Kansas, Missouri, and Nebraska, the national and state peaks coincide. The close match between business-cycle peaks in these states and the nation may be explained by their similar industrial structures (Tables 2 and 3).

Similarly, employment tends to reach business-cycle *troughs* at the same time in the nation and the district. The first panel of Chart 2 shows that, on average, employment in the nation and the district has bottomed out in the same quarter during the five business-cycle troughs from 1970 to 1995. Thus, national employment data, which are available before district employment data, can signal an upturn in the current period even though they cannot be used as a leading indicator.[7] The seven remaining panels in Chart 2 show how employment in individual district states tracks national employment during business-cycle troughs. The troughs in national employment coincide with the troughs in employment in all seven district states.

Long-term evidence of comovement

Another way to determine whether the district and national economies move together is to look at quarter-to-quarter fluctuations over an extended period that includes several business cycles. Correlation coefficients measure the degree to which two variables move together over time. This measure of comovement takes a value of 1 if there is a perfect positive relationship and zero if the variables are unrelated.

The long-term evidence provided by correlation coefficients, shown in Table 4, suggests a relatively strong relationship between employment growth in the district and in the nation. The correlation coefficients measure the degree of comovement between quarter-to-quarter changes in employment in the district and the nation. The correlation coefficient of 0.78 indicates a relatively strong positive relationship between national employment growth and growth in the district. Among individual district states, the relationship is strongest in Missouri—the district's most populous state—and weakest in Wyoming.[8]

II. DO CHANGES IN THE NATIONAL ECONOMY HELP PREDICT CHANGES IN THE REGIONAL ECONOMY?

Evidence that the district economy and the national economy move together during business cycles and over longer time periods suggests that early information about the national economy may give clues about yet-to-be-released (or revised) information on the district economy. And the evidence that national employment may lead district employment going into business-cycle peaks suggests that the national economy sometimes leads the district economy. However, government and business decisionmakers may want to know if readily available information about the national economy helps predict the performance of the district economy.

Simple measures of comovement generally cannot provide conclusive evidence of leading or lagging relationships. In other words, simple correlations are unable to detect a relationship where changes in national employment growth precede changes in district employment growth. While district employment growth in a given quarter appears to be correlated with national employment growth in the same quarter, district employment growth may also be correlated with past growth in national employment. If so, information about national employment can help predict the future course of district employment.

Looking at the contemporaneous relationship between the nation and the district also fails to take into account possible inertia in the district

employment data. That is, district employment growth in any given quarter may bear a close relationship to district employment growth in previous quarters. When employment increases, the effects may be felt in subsequent quarters as workers spend their incomes and generate more jobs in the local economy.

Therefore, to demonstrate that changes in the national economy help predict changes in the regional economy it is necessary to examine more complex employment evidence. The analysis in this section explicitly accounts for the possibility of lagged responses of district employment growth to national employment growth and inertia in district employment growth. The analysis also includes two time periods. The first time period is a 25-year sample of quarter-to-quarter employment growth from 1970 to 1995. A second time period, 1988 to 1995, is included to avoid the wide swings in oil and farm prices and related economic activity that were prevalent during the 1970s and early 1980s. The runup in oil prices during the 1970s and the subsequent downturn in the mid-1980s may have created disturbances in both district and national employment growth. If the disturbances affected national employment growth differently than district employment growth, finding a relationship between the nation and the district could be difficult. Thus, the more recent subperiod should provide a more accurate reading on the nature of the relationship between the national economy and the district economy. The later time period might also more accurately reflect the current relationship, because the district's industrial structure after 1988 has been more similar to the nation's than it was in the 1970s.[9]

Table 5 presents the results of statistical tests of a leading relationship between national and district employment growth for the two time periods. "Yes" indicates a statistically significant relationship between district employment growth and past growth in national employment. "Maybe" indicates a weaker statistical significance, while "No" indicates no significance.[10]

The statistical tests give somewhat mixed evidence about the district's relationship to the nation. While national employment growth generally helps predict district employment growth, the strength of the relationship depends on the state and choice of time period (Table 5). For example, past employment growth in the nation helps predict employment growth in Kansas, Missouri, Nebraska, and New Mexico during the entire 25-year period. However, a relationship does not appear to exist for the district as a whole or for Colorado or Wyoming. In Oklahoma, the evidence provides only weak support of a relationship between national and state employment growth.

As expected, the evidence from the 1988-95 subperiod suggests a more robust relationship between past changes in national employment and changes in district employment. In this more recent period, past employment growth in the nation does help predict district employment growth. Moreover, the leading relationship appears in all district states except Wyoming. In New Mexico, the evidence provides weak support of a leading relationship during the recent subperiod.

III. CONCLUSIONS

Due to lags in the availability of state-level economic information, observers of the district economy often turn to national economic information for clues about current or prospective conditions in the district. And many businesses may find information about the national economy easier and less costly to obtain than specialized regional information. To determine if the national information provides reliable clues about the district, it is important to determine

Table 5

DOES U.S. EMPLOYMENT GROWTH HELP PREDICT DISTRICT EMPLOYMENT GROWTH?

	1970:Q1-1995:Q4		1988:Q1-1995:Q4	
District	No	(.1211)	Yes	(.0161)
Colorado	No	(.4177)	Yes	(.0052)
Kansas	Yes	(.0260)	Yes	(.0025)
Missouri	Yes	(.0004)	Yes	(.0144)
Nebraska	Yes	(.0283)	Yes	(.0460)
New Mexico	Yes	(.0154)	Maybe	(.0592)
Oklahoma	Maybe	(.0661)	Yes	(.0004)
Wyoming	No	(.1618)	No	(.7817)

Note: This table reports the results of bivariate Granger causality tests on whether past values of national employment growth help predict district employment growth. All tests are based on regressions containing five lags of the dependent variable (district employment growth), two lags of the independent variable (national employment growth), a constant, and three quarterly dummy variables. All variables are expressed in growth rates.
Numbers in parentheses give the marginal significance level of F-tests on the joint significance of the two lagged national variables. "Yes" indicates a rejection, at the 5 percent level, of the null hypothesis that the two lagged national variables are jointly insignificant. "Maybe" indicates rejection of the null hypothesis at the 10 percent level. "No" indicates a failure to reject the null hypothesis.
Source: Author's calculations are based on employment data from the Bureau of Labor Statistics.

whether the two economies move closely together. Evidence on employment growth suggests that early information about national employment growth can shed light on current regional employment growth.

In addition to providing an early signal about lagging regional economic indicators, information about past performance of the national economy also appears to be useful in providing clues about the future course of the district economy. Evidence on the relationship between regional employment growth and past growth in national employment suggests that, for most district states, national growth helps predict state growth. Thus, business planners may be able to rely on readily available information about the national economy. Moreover, if the district's industrial structure continues to look more like the nation's industrial structure, the reliability of this leading information may improve in the future.

ENDNOTES

[1] The Sherwood-Call study uses the national component from a decomposition of variance in a vector autoregression (VAR) to derive a measure of linkage between state and national economic movements. The resulting measure of linkage is then regressed on several state characteristics including a measure of how each state's industrial structure diverges from the nation's structure.

[2] The extent to which a region's industrial structure is found to match the nation's industrial structure depends on the level of aggregation used in the comparison. The broad industry categories used in this article could lead to a mistaken conclusion that the district is similar to the nation, when it might be quite different than the nation at lower levels of aggregation. However, an examination of two-digit data on earnings in the district's manufacturing sector suggests that the structure of the district and nation's manufacturing sectors have become more similar over time.

[3] The ratios of the earnings share of agriculture in the district to the earnings share for the nation fell from 2.11 in 1970 to 1.92 in 1995. Gross state product data for a shorter time period show the ratios of output shares for agriculture increased from 1.79 in 1977 to 2.14 in 1992.

[4] The index is calculated as

$$I = \sum_{i=1}^{n} \frac{(S_i - S_i^*)^2}{S_i^*} * 100,$$

where S_i is the state or regional share of employment in industry I, S_i* is the U.S. share of earnings in industry I, and n is the number of industries. This index, calculated from earnings data instead of employment data, is used by Gilmer to examine the diversification of cities. Squaring the difference between regional and national shares causes the index to increase rapidly if a region's industry mix differs much from the U.S. norm. In the Gilmer study, the value of the index ranged from 15 for Chicago—a highly diversified city with an industry mix much like the nation's—to 1,274 for Midland-Odessa, Texas—a city highly specialized in oil and gas extraction. Sherwood-Call uses a similar index to measure diversity among states.

[5] The business cycle turning points are those designated by the National Bureau of Economic Research (NBER). The NBER peaks and troughs are not based solely on employment. Other economic information and judgment are used to identify these official turning points in the economy. As a result, the peaks or troughs in the employment data do not always coincide with the NBER peaks or troughs. The averages include five peaks: 1969:Q4, 1973:Q4, 1980:Q1, 1981:Q3, and 1990:Q3. The averages include five troughs: 1970:Q4, 1975Q1, 1980:Q3, 1982:Q4, and 1991:Q1.

[6] Examination of each business cycle peak since 1970 shows that the nation clearly led the district going into the recessions in the early 1980s and the early 1990s. During the 1970s, the district and national peaks coincided.

[7] Employment data are released monthly. To reduce some of the noise from month-to-month fluctuations, this article uses quarterly data. Taking into account the lags in the revisions of monthly data, revised quarterly data for the district tends to lag U.S. data by a quarter.

[8] Although the correlation coefficients are calculated to take into account seasonal patterns in both district and U.S. employment growth, the quarterly data generally contain more unexplained noise than two-quarter or four-quarter growth rates. Correlation coefficients calculated with two-quarter and four-quarter growth rates were considerably higher for the district and most district states. The R^2s from ten-year rolling regressions of current district employment growth on current national employment growth and three lags of national employment growth provide another rough measure of comovement and show how it changes over time. Although this measure of comovement between the district and national economies fluctuated somewhat for some samples beginning in the 1970s, it remained close to .75. Thus, by this measure, the quarter-to-quarter variation in national employment growth has consistently explained about three-fourths of the variation in district employment growth over the past 25 years.

[9] One potential problem with the analysis is its focus on two endogenous variables. These variables are undoubtedly influenced by many other variables. In focusing on the interaction of only two variables, the evidence in Table 5 may oversimplify the relationship between regional employment growth and national employment growth. Looking at a more complete set of regional characteristics and policy variables may result in a more accurate description of the relationship between district and national employment growth. For example, the effects of changes in energy prices on the national and regional economies are not modeled. Simply including the price of oil as an independent variable does not appear to

capture the complex effects of changes in energy prices on district and national employment. The price of oil was not included in the regression used to perform the Granger causality tests, because its coefficient was insignificant in other regressions of current district employment on lagged district and U.S. employment. During the 1970s, oil prices moved infrequently and in discrete jumps due to the structure of the oil market. As a result, there may not have been enough variation in oil prices to capture a relationship with economic activity during the early part of the 25-year time period.

[10] Similar criteria were used by Kahn to determine if lagged values of money growth help explain bank loan growth. The lag lengths in the regression of past district and national employment growth on current employment growth were chosen by using the optimization criteria suggested by Akaike and Schwarz. Tests of reverse causality show no statistically significant causality running from district employment growth to national employment growth.

Similarly, regressions where data for the nation were replaced with data for the nation, excluding the seven district states, produced almost identical results to those presented in this article for all causality tests.

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