



The 2001 Recession and the States of the Eighth Federal Reserve District

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This paper examines and compares the recent business cycle experiences of the seven states that lie partly or wholly within the Eighth Federal Reserve District (Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee). For the period surrounding the 1990-91 recession, six of the seven states had recessions that were much shorter than that for the country as a whole. In addition, for the period surrounding the 2001 recession, four states (Arkansas, Indiana, Kentucky, and Tennessee) entered and exited recession earlier than the country as a whole. Recessions in the other three states began earlier and ended later than the recession for the country as a whole.

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This paper examines and compares the recent business cycle experiences of the seven states that lie partly or wholly within the Eighth Federal Reserve District (Arkansas, Illinois, Indiana, Kentucky, Mississippi, Missouri, and Tennessee). We pay particular attention to the period surrounding the 2001 national recession. Our analysis relies on the supposition that state-level business cycles can be characterized as a series of distinct recession and expansion phases, as is commonly held to be true of the national business cycle. The primary example of such a characterization of the national business cycle is the activity of the National Bureau of Economic Research (NBER) Business Cycle Dating Committee, which provides semiofficial recession and expansion dates.

Because the NBER chronology is available only for U.S. national economic activity, alternative methods must be used to identify business cycle turning points in state-level data. To this end, we follow a recent paper by Owyang, Piger, and Wall (2005), hereafter simply OPW, in estimating state-level turning points with a version of the regime-switching model of Hamilton (1989).

As with the NBER, the Hamilton model is based on the notion that the business cycle can be split into distinct recession and expansion phases. In fact, the Hamilton model can be thought of as a nonjudgmental, statistical alternative to the committee-consensus method of the NBER.

A significant hurdle in determining business cycle turning points at the state level is the inadequacy of data relative to what is available for the national economy. When applied to the national economy, the Hamilton model is typically applied to gross domestic product (GDP), which has a quarterly frequency and has been found to provide distinct turning points in and out of expansion and recession phases.¹ At the state level, however, the analog to GDP—gross state product—is produced only with an annual frequency and with a 2- to 3-year lag, making it of little use in detecting phase shifts. The solution in OPW is to use the state-level coincident index (SCI) produced by the Federal Reserve Bank of Philadelphia and described by Crone and Clayton-Matthews (2005).

¹ Boldin (1994) and Chauvet and Piger (2003), among others, have found that the Hamilton model does quite well in mimicking the turning point dates of the NBER.

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The SCI uses the dynamic factor model of Stock and Watson (1989) to combine four variables—the unemployment rate, payroll employment, average weekly manufacturing hours, and real wage and salary disbursements—into a single indicator of state-level labor-market activity.

The main advantage of the SCI is that, as demonstrated by OPW, it provides timely and frequent observations of series that tend to have distinct state-level business cycle turning points. Further, it provides a much cleaner and better-behaved variable than any of its components, which are much noisier and more erratic than their national-level counterparts. The disadvantage of the SCI is that, because it uses labor-market variables only, it is not as broad a measure of activity as GDP. As such, it is probably best viewed as an indicator of overall state-level labor-market conditions rather than as a coincident indicator of gross state product or some other broad measure of state-level conditions. With this in mind, we also apply the Hamilton model to national non-farm payroll employment to provide more-relevant national recession and expansion dates to compare with our state-level dates.

MODEL AND ESTIMATION

In the Hamilton (1989) Markov-switching model, different business cycle phases are treated as arising from different models, each with its own mean growth rate. Let μ_0 be the mean growth rate when the economy is in expansion, and let μ_1 , which is normalized to be negative, be the difference between the mean growth rates in expansion and recession. Specify a simple model for the growth rate of some measure of economic activity, y_t , as

$$(1) \quad y_t = \mu_0 + \mu_1 S_t + \varepsilon_t, \quad \mu_1 < 0.$$

To introduce recession and expansion phases, the mean growth rate in (1) switches between the two regimes, where the switching is governed by a state variable, $S_t = \{0, 1\}$. Deviations from this mean growth rate are created by the stochastic disturbance, $\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$. When S_t switches from 0 to 1, the growth rate switches from μ_0 to $\mu_0 + \mu_1$.

Because $\mu_1 < 0$, S_t switches from 0 to 1 at times when the economy switches from the high-growth phase to the low-growth phase (expansion to recession) or vice versa.

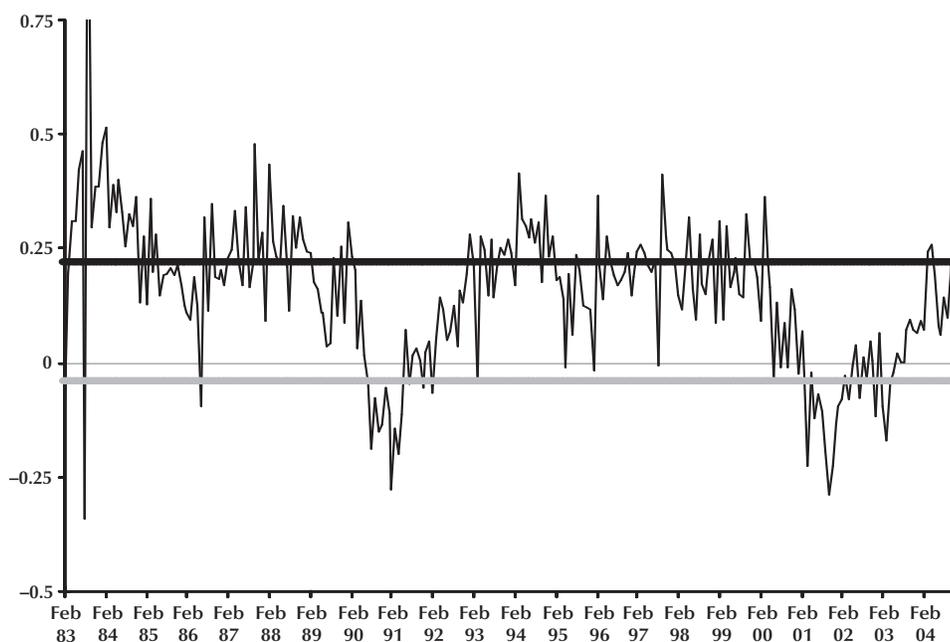
The switching variable, S_t , is unobserved, meaning that we need to place restrictions on the probability process governing it. We assume that the process for S_t is a first-order two-state Markov chain, implying that any persistence in the regime is completely summarized by the value of the state in the previous period. More specifically, the probability process driving S_t is captured by the transition probabilities $\Pr[S_t = j | S_{t-1} = i] = p_{ij}$. We estimate the model using the multi-move Gibbs-sampling procedure for Bayesian estimation of Markov-switching models implemented by Kim and Nelson (1999).²

Our data are monthly observations of the SCIs over the period 1983-2004 for the seven states of the Eighth District. We restrict our estimation to post-1982 data to avoid possible problems with structural breaks. Clarida, Galí, and Gertler (2000) and Boivin and Giannoni (2003), for example, show how monetary policy shocks have much smaller effects on output in the post-Volcker period. Also, McConnell and Perez-Quiros (2000) demonstrate how national output growth has been significantly less volatile since the early 1980s.

Our first step is to use the Hamilton model to obtain a useful description of the national business cycle that we can compare with the state-level business cycles from the SCIs. As we have mentioned, because the SCIs are indicators of labor-market conditions, we use national nonfarm payroll employment to describe the national employment cycle, which grew at an average monthly rate of 0.15 percent during our sample period.³ For reference, monthly growth of payroll

² The Gibbs sampler draws iteratively from the conditional posterior distribution of each parameter, given the data and the draws of the other parameters of the model. These draws form an ergodic Markov chain whose distribution converges to the joint posterior distribution of the parameters, given the data. When we simulate the posterior distribution, we discard the first 2,000 draws to ensure convergence. Descriptive statistics regarding the sample posterior distributions are then based on an additional 10,000 draws.

³ We should note that the employment series from the household survey is of limited use for our purposes because its monthly growth does not exhibit the distinct breaks found in payroll employment.

Figure 1**U.S. Payroll Employment Growth (percent)**

NOTE: The thick black line is the average expansion growth rate; the thick gray line is the average recession growth rate.

employment over the period was 0.18 in Arkansas, 0.10 in Illinois, 0.15 in Indiana, 0.18 in Kentucky, 0.14 in Mississippi, 0.13 in Missouri, and 0.18 in Tennessee.

According to the model, this average growth rate is the average of the recession and expansion growth rates weighted by the frequencies of the two business cycle phases. The Hamilton model provides estimates of the average growth rates in each of the two phases and, for each observation, the probability that the labor market is in the recession phase. Applying the Hamilton model yields average monthly national employment growth rates of 0.22 percent during expansion and -0.04 percent during recession.⁴

In divining the probability of recession, the model compares the actual growth rate to the average growth rates for the two phases. The model also considers how persistently this relative

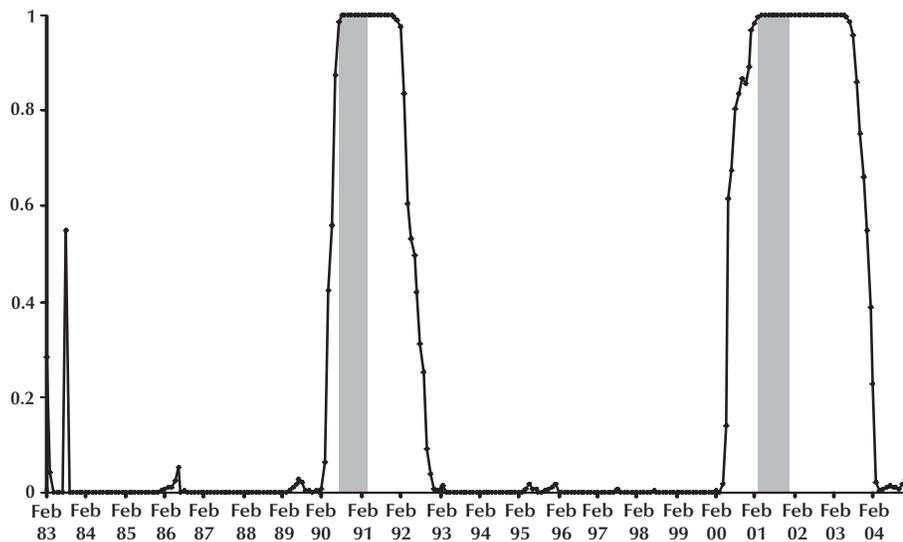
proximity is. Figure 1 shows actual average U.S. employment growth relative to the average growth rates for the two phases. The probability that the national labor market is in recession is provided by Figure 2, where the shaded areas indicate periods of national NBER recessions.⁵ As Figure 2 shows, the model does a good job of separating the data into recession and expansion phases in that the probability of recession rises and falls rapidly as the national labor market switches between phases. The only period for which the model provides mixed signals is for August 1983 (see Figure 1). That month appears to be anomalous in that employment growth spiked down in August, only to spike up in September to more than make up for the previous month's job losses.

The main result apparent in Figure 2 is the different timings and lengths of the NBER and

⁴ The 90 percent coverage intervals for these growth rates are (0.20, 0.23) and $(-0.07, -0.01)$, respectively.

⁵ According to the NBER, the national economy was in recession twice during the sample period: August 1990–March 1991 and April 2001–November 2001.

Figure 2
Probability of U.S. Employment Recession



NOTE: Shaded areas indicate NBER recessions: August 1990–March 1991 and April 2001–November 2001. National labor-market recessions: June 1990–April 1992 and June 2000–November 2003.

national labor-market recessions. Using an admittedly arbitrary recession probability of 0.6 or higher to indicate months of recession, the first national labor-market recession began in June 1990 (2 months before the start of the NBER recession) and ended in April 1992 (more than a year after the end of the NBER recession). This long lag between the ends of the NBER and labor-market recessions was the period of the so-called jobless recovery.

The 2001 NBER recession shared some of the features of the 1990-91 NBER recession. In particular, it did not last nearly as long as the associated labor-market recession did, which began much earlier and ended much later than the 2001 NBER recession: The national labor market entered recession in June 2000—10 months prior to the April 2001 start of the NBER recession. Further, although the NBER recession ended in November 2001, it was not until a full 2 years later that the national labor market saw an end to its recession. Thus, the disjointedness between the labor-market and the broader economy was significantly greater

with the 2001 NBER recession than the 1990-91 NBER recession: In 2001, the national economy went into recession well after the national labor market did,⁶ and the jobless recovery lasted almost twice as long as it did in 1991-92.

ESTIMATION OUTPUT FOR THE STATES

Growth Rates

The estimated state-level average monthly growth rates in expansion and recession are provided in Table 1, along with the actual growth rates for the period 1983-2004. Of the seven states of the Eighth District, Tennessee had the highest average growth rate over the sample period

⁶ We should note that this overstates the difference between the start of the NBER recession and the surrounding national labor-market recession. The NBER determined the start of the recession before data for 2000 were revised downward significantly. Using revised versions of the same data used by the NBER, Chauvet and Piger (2005) determine that the national economy entered recession in November 2000.

Table 1
Actual and Estimated Growth Rates, 1983-2004 (percent)

	Average monthly growth rate 1983-2004	Monthly growth rate in expansion	Monthly growth rate in recession	Difference between expansion and recession growth rates
Arkansas	0.29	0.36 (0.34, 0.41)	0.02 (-0.04, 0.13)	0.34
Illinois	0.27	0.41 (0.39, 0.43)	-0.07 (-0.12, -0.03)	0.49
Indiana	0.30	0.39 (0.37, 0.42)	-0.11 (-0.17, -0.06)	0.51
Kentucky	0.29	0.36 (0.35, 0.38)	-0.03 (-0.07, 0.02)	0.39
Mississippi	0.25	0.34 (0.32, 0.36)	0.02 (-0.03, 0.06)	0.32
Missouri	0.26	0.37 (0.35, 0.40)	-0.08 (-0.12, -0.03)	0.45
Tennessee	0.34	0.46 (0.42, 0.49)	0.04 (-0.02, 0.11)	0.42

NOTE: The 90 percent coverage intervals are in parentheses.

(0.34 percent), which was quite a bit higher than the state with the second highest average growth rate, Indiana (0.30 percent). At the other end, Mississippi had the lowest average growth rate (0.25 percent), which was not far from the performances of Missouri and Illinois (0.26 percent and 0.27 percent, respectively).

Because the Hamilton model allows states to switch between expansion and recession phases, these actual average growth rates can be broken down into their two component growth rates. The second and third columns of Table 1 provide the estimated average growth rates in expansion and recession for the seven District states. Of these states, Tennessee's average growth during expansion (0.46 percent) easily outpaced that of Illinois (0.41 percent) and Indiana (0.39 percent). Of the remaining states, Mississippi has the lowest average expansion growth rate (0.34 percent).

It is during their recession phases that the differences between states are most glaring. Three states—Arkansas, Mississippi, and Tennessee—have average recession growth rates that are positive, although the 90 percent coverage interval around the estimates includes negative numbers. At the other end are three states—Illinois, Indiana, and Missouri—whose average recession growth rates are well below zero. These are also the states that suffer the most during a month of recession in that they have the greatest differentials between their average expansion and recession growth

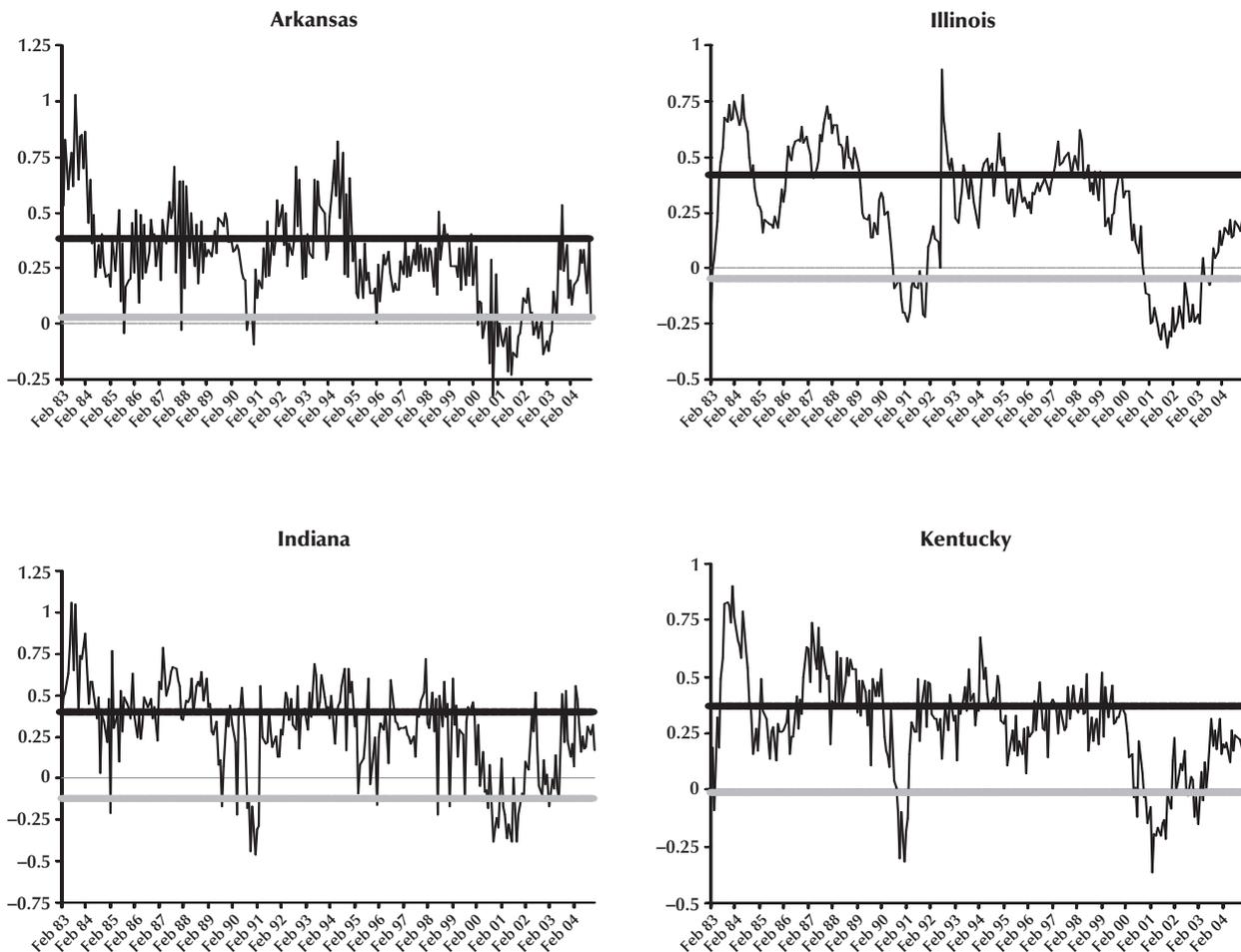
rates. In each of these states, a month of recession tends to mean about one-half of a percentage point lower growth. Tennessee is not far behind these states in terms of the opportunity cost of a month in recession. Although Tennessee tends to experience positive growth during a month of recession, its average growth rate in expansion is so high that its average output lost during recession is also relatively high.

In trying to explain the differences in average growth rates across states, OPW found that the factors that might explain recession growth rates are not the same as those that explain expansion growth rates. Specifically, they found that demographic factors such as education and age distributions were related to expansion growth rates, but not to recession growth rates. On the other hand, they also found that states' shares of employment in manufacturing and construction and mining were related to recession growth rates, but not to expansion growth rates.

Pre-2001 Recession/Expansion Experiences

For reference, Figure 3 provides the actual monthly growth rates for the District states, along with the estimated average growth rates in the two business cycle phases. The Hamilton model also determines the probability that the data for a particular month indicates either a recession or expansion. It is not just data for the month in ques-

Figure 3
Actual and Average Growth Rates for District States (percent)



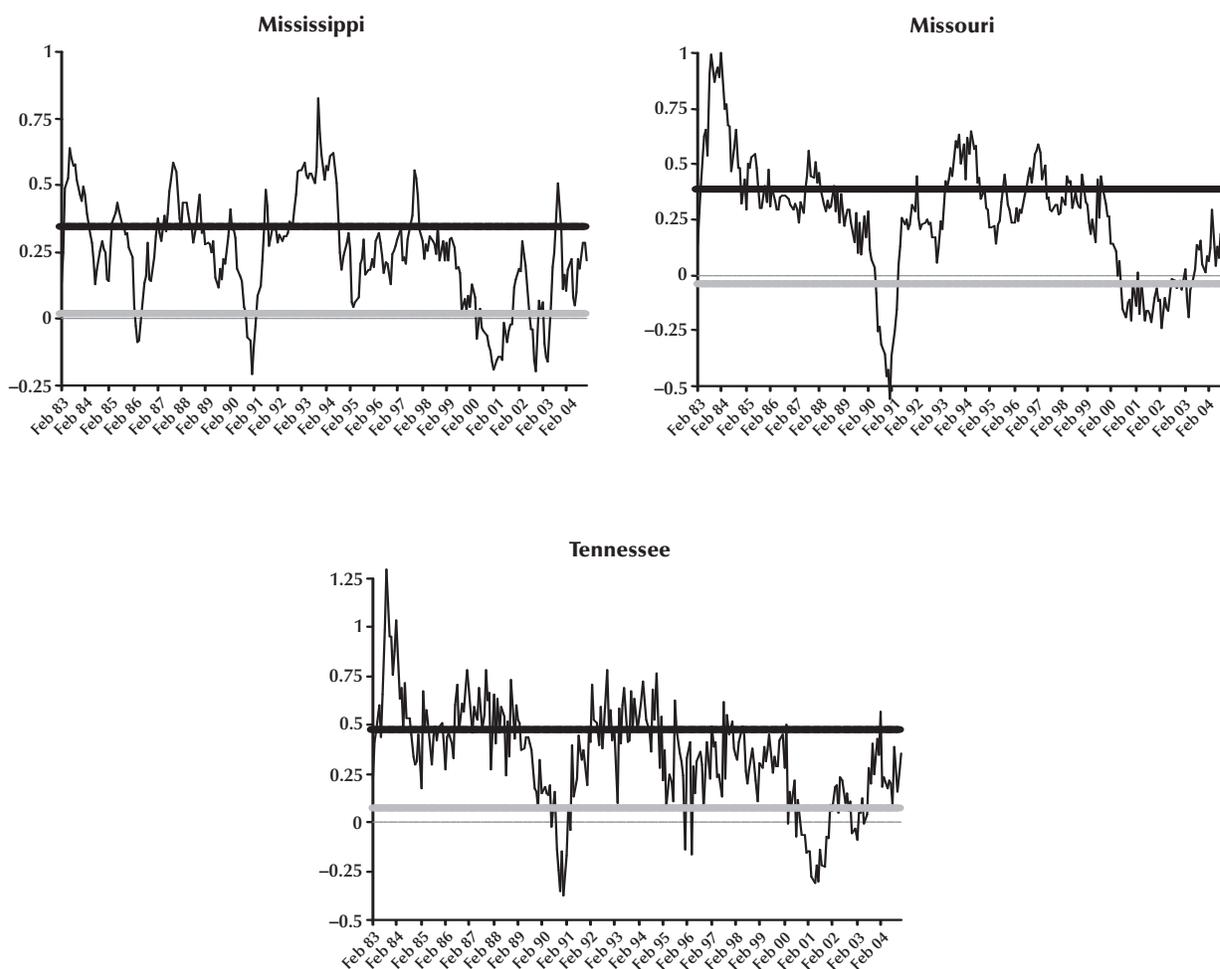
NOTE: Thick black lines are average expansion growth rates; thick gray lines are average recession growth rates.

tion that matters, however. For a given month, the probability of being in recession also depends on the preceding and subsequent months.

The recession and expansion cycles for the seven District states are illustrated by Figure 4, which provides the probability of recession for each month of our sample period. In these charts, the light-shaded areas indicate the national labor-market recessions determined above and the dark-shaded areas indicate NBER recessions. The model does a good job of separating the data into two phases in that the probability of recession is usu-

ally close to either 1 or 0, although Indiana experienced several idiosyncratic spikes. On the whole, however, the model provides a clear picture of recent state-level recession/expansion experiences in the District.

Even though we deal with only a small subset of states, Figure 4 illustrates that some of the business cycle characteristics found by OPW for the 50 states apply to the 7 District states: Although state-level recessions tend to occur alongside national recessions, there have been occasions of state recessions that were independ-

Figure 3, cont'd**Actual and Average Growth Rates for District States**

NOTE: Thick black lines are average expansion growth rates; thick gray lines are average recession growth rates.

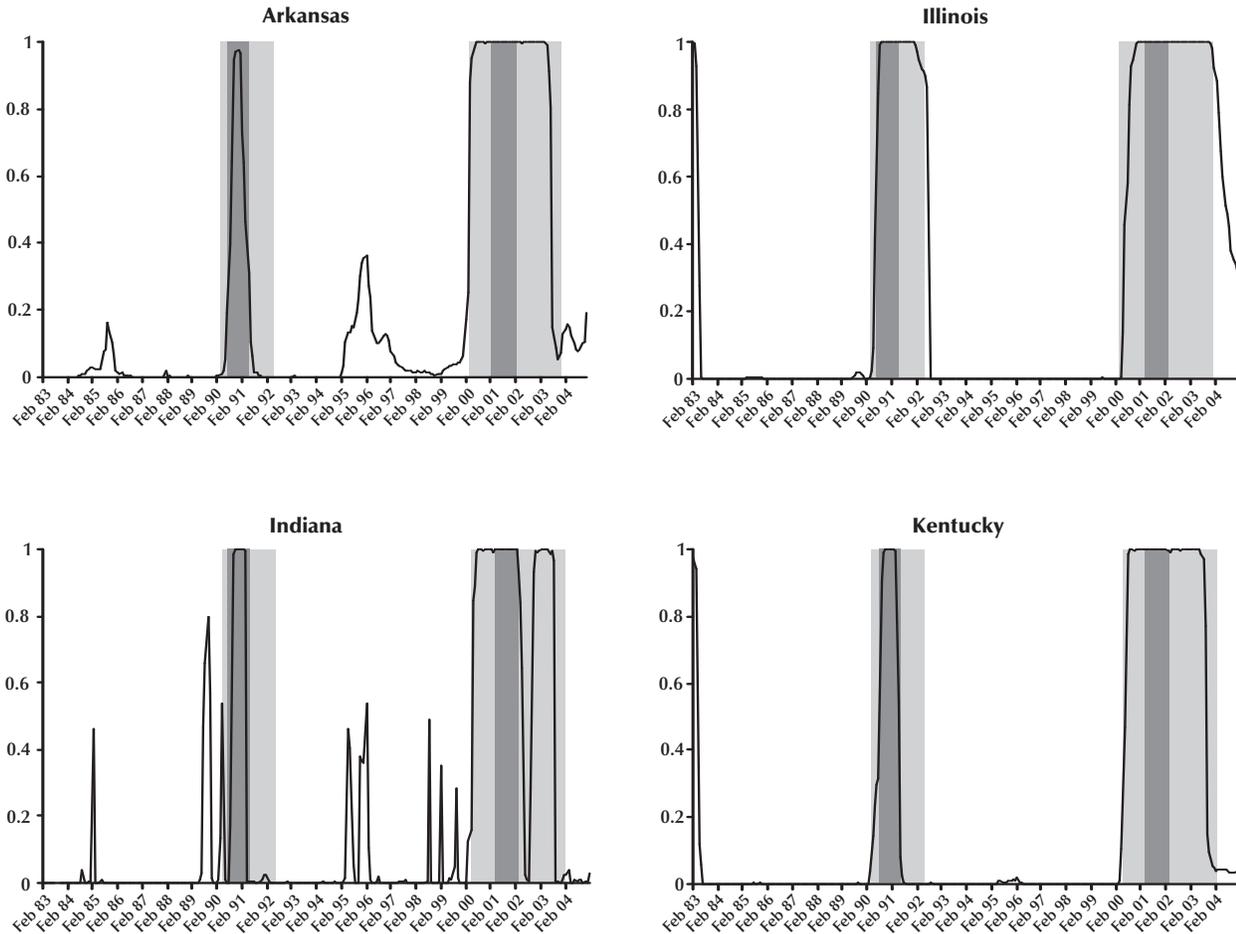
ent of national recession. In addition, there are significant state-level differences in the timing of recession episodes, relative both to each other and to the country as a whole.

For the most part, District states experienced labor-market recessions that were roughly in line with the NBER recession of 1990-91. In this regard, the District differed from other parts of the country, particularly the coasts, where labor-market recessions began much earlier and ended much later than the NBER recession. As described by OPW, there was a strong geographic pattern to the state-

level labor-market recessions of the period: States in the Northeast and Far West switched into labor-market recessions up to 2 years before the start of the NBER recession. Recession spread from the coasts into the interior of the country and receded back to the coasts, ending for some Eastern and Western states more than 2 years after the end of the NBER recession.

There were interesting intra-District differences in the period. Of the District states, Illinois stands out in that its labor-market recession was very similar in timing to the national labor-market

Figure 4
State Recession Probabilities

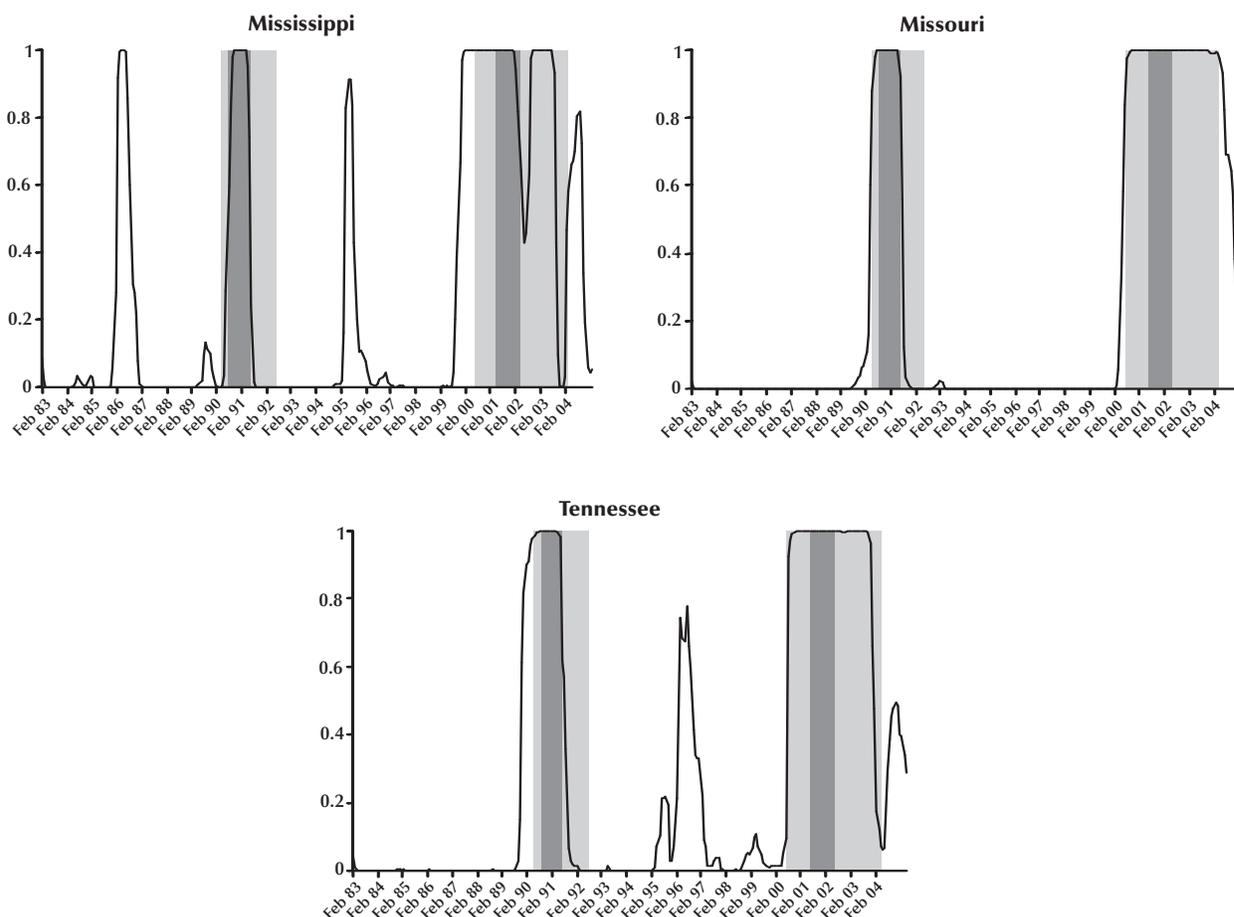


NOTE: Dark-shaded areas indicate NBER recessions; light-shaded areas indicate national employment recessions.

recession. Less glaring than the difference between the experience of Illinois and those of the rest of the states is that labor markets in Tennessee and Missouri went into recession 10 and 4 months, respectively, before the start of the NBER recession. Finally, the labor-market recessions in Arkansas, Indiana, Kentucky, and Mississippi were somewhat shorter than the NBER recession. It should also be noted that Indiana experienced a brief labor-market recession in 1989 that was not experienced in the rest of the District. Although some coastal states were in recession at this time, it is likely that Indiana's recession was idiosyn-

cratic and unrelated to the recessions experienced in other parts of the country.

Although there were only two national recessions during our sample period, OPW found that there were two periods during which significant numbers of states went into recession while the national economy remained in expansion. The first such period was in 1985-86, when, following simultaneous downturns in the petroleum and agricultural sectors, nearly every state geographically between Idaho and Louisiana was in recession for at least one quarter. As Figure 4 shows, Mississippi was the only District state to have

Figure 4, cont'd**State Recession Probabilities**

NOTE: Dark-shaded areas indicate NBER recessions; light-shaded areas indicate national employment recessions.

experienced this non-national recession, although Arkansas and Indiana experienced enough of a slowdown for their probabilities of recession to blip upward.

The second period during which states experienced labor-market recessions while the national economy was in expansion was in 1995. OPW found that several states—although no District states—experienced recessions beginning in 1995 that lasted between one and five quarters. As shown in Figure 4, we find that two District states—Mississippi and Tennessee—switched into recession during 1995 and that Arkansas

and Indiana saw their probabilities of recession rise during the year without becoming high enough to indicate an actual recession. The difference between our results and those of OPW with regard to District states is likely due to our sample period, which, as mentioned above, was chosen to account for possible structural breaks during the 1980s.

THE 2001 RECESSION

As OPW showed, many state-level labor markets were not in sync with the NBER recession of

2001. States in the Mississippi and Ohio valleys, the Southeast, and the Northwest had switched into labor-market recessions in 2000. Also, many states located geographically between Montana and Texas had not switched into labor-market recession until mid-2001. Further, OPW found that most state-level labor-market recessions continued past the end of the NBER recession. Because their sample period ended in mid-2002, however, OPW was unable to provide a complete picture of the labor-market recessions at the state level. In this paper, with revised data through the end of 2004 in hand, we are able to analyze the entire labor-market recession experience of the states of the Eighth District during the period surrounding the 2001 NBER recession. Also, because of the differences in our sample period, we find presently that the labor-market recessions in District states began much earlier than had been documented by OPW.

Although this was not the case with the previous (1990-91) recession, the states of the Eighth District had labor-market recessions in and around 2001 that were much more in line with the national labor-market recession than with the NBER recession. Like the national labor market, the seven state labor markets went into recession well before the start of the NBER recession and into expansion long after the end of the NBER recession. As shown in Figure 5, which provides a close-up view of District states between 1999 and 2004, there were interesting differences within the District and between District states and the country as a whole. In the figure, a solid box (■) indicates that a state's labor market was in recession during that month. The dark-shaded area shows the 8-month-long NBER recession, and the light-shaded area shows the 42-month-long national labor-market recession. The cross-state comparisons are summarized in Table 2, which compares the timing of each state's labor-market recession with that of the national labor-market recession.

Arkansas

Arkansas's labor market switched into recession in April 2000, 2 months before the national labor market made the same switch, and a year

before the start of the NBER recession. As one can see from Figure 3, Arkansas's growth dropped off dramatically during this month and remained low long afterward. Throughout the first half of 2003, growth began to rise until the labor market switched into expansion in August 2003, 4 months before the national labor market switched into its expansion phase. Overall, then, Arkansas's labor-market recession, which lasted 40 months, was 4 months shorter than the national labor-market recession. Among District states, only Indiana spent fewer months in recession.

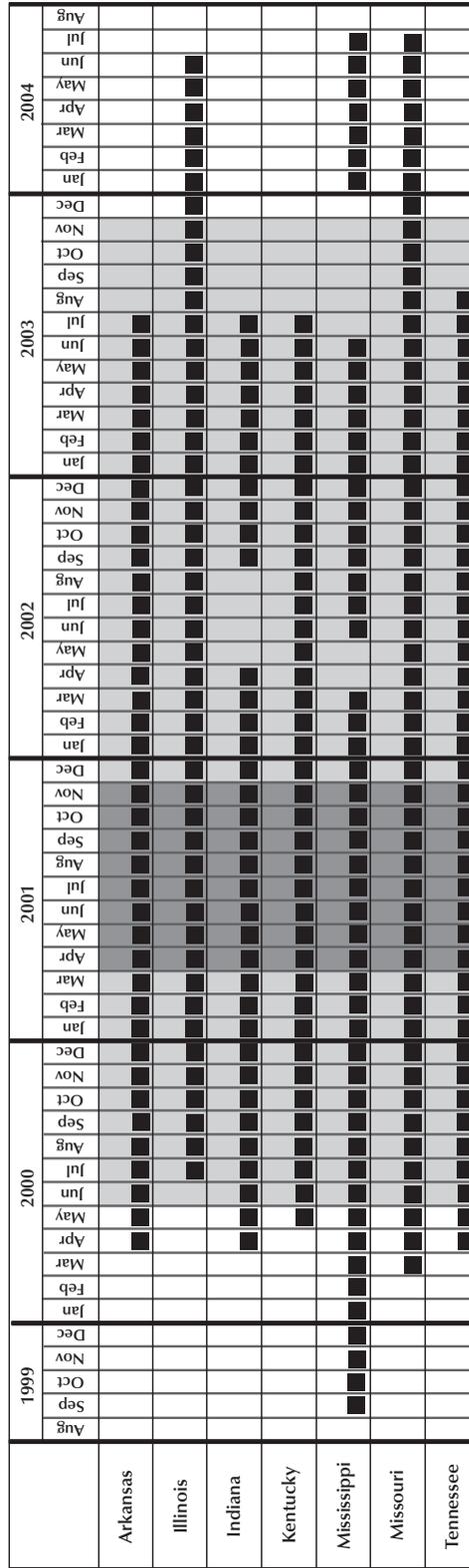
Illinois

Illinois's labor market switched into recession in July 2000, 1 month after the national labor market did and 9 months before the start of the NBER recession. Of the District states, Illinois was the last to switch into recession. Figure 3 shows the clear drop-off in growth that occurred at that time and which continued into 2001 and beyond. It was only in late 2003 that growth became positive, although it was not until July 2004 that it became persistently high enough that the probability of recession went below the 0.6 threshold, thereby signaling the end of the state's labor-market recession. Note that even by the end of 2004, the expansion in Illinois was not as clear as in other states. This lack of clarity can be seen in Figure 3: Although growth had been persistently positive for several months, it was still languishing between the expansion and recession growth rates. Other states had made up more of the growth gap and had, therefore, seen a clearer signal that expansion was ongoing. In total, Illinois spent 49 months in labor-market recession during the period surrounding the 2001 NBER recession.

Indiana

Between the beginning of 2000 and the end of 2004, Indiana experienced two distinct labor-market recessions interrupted by a brief expansion. Indiana's first recession began in April 2000, 2 months before the start of the national labor-market recession. The state switched back into expansion in May 2002, 5 months into the NBER expansion. As illustrated in Figure 3, growth in

Figure 5
The 2001 Recession and the Eighth District States



NOTE: The solid boxes indicate the state's labor market was in recession. The dark-shaded area indicates the NBER recession; the light-shaded area indicates the national employment recession.

Table 2**Summary of Labor-Market Recessions Surrounding the 2001 NBER Recession**

	Start of first recession period (U.S. = 0)	End of last recession period (U.S. = 0)	Number of recession periods (U.S. = 1)	Total months of recession (U.S. = 42)	Percent SCI reduction
Arkansas	-2	-4	1	40	-15.2
Illinois	+1	+7	1	49	-22.9
Indiana	-2	-4	2	36	-17.8
Kentucky	-1	-4	1	39	-16.5
Mississippi	-9	+8	3	51	-16.3
Missouri	-3	+8	1	53	-22.2
Tennessee	-2	-3	1	41	-22.0

Indiana again rose to above the average expansion growth rate and remained high until August 2002. By September 2002, however, the Indiana labor market had returned to recession, where it remained until August 2003, the first month of an expansion that it has so far maintained. Although Indiana experienced a “double-dip” labor-market recession, the state spent fewer months in recession (36) than any other District state.

Kentucky

Kentucky’s labor-market recession began in May 2000, 1 month before the start of the national labor-market recession and 11 months before the NBER recession. Figure 3 illustrates the obvious drop-off in growth that signaled the switch into recession. As with the other states, growth rose during 2003, sustaining a level close to the average expansion growth rate by the middle of the year. The final month of Kentucky’s single recession episode was July 2003, 4 months before the final month of the national labor-market recession and more than a year and a half after the end of the NBER recession. In total, Kentucky spent 39 months in a labor-market recession.

Mississippi

Mississippi was the first of any District state to switch into labor-market recession and was the last to enter a sustained period of expansion. Further, it experienced a “triple dip” in that it

saw two short periods of recovery between three periods of recession. The first recession period began in September 1999, 9 months before the start of the national labor-market recession and 19 months before the start of the NBER recession. The first recovery period was in April and May 2002; but, as shown in Figure 4, the model produces a relatively high probability of recession even during these months. The second recession phase lasted until June 2003, which was about the time that several other District states were switching into expansion. Mississippi’s expansion lasted only 6 months, however, and the third period of labor-market recession began in January 2004, 2 months after the national labor-market recession ended. By July 2004, this final, 7-month-long recession period ended, 8 months after the end of the single national labor-market recession. Between September 1999 and July 2004, Mississippi’s labor market was in recession for 51 months and in expansion for 8 months.

Missouri

Of the seven District states, Missouri spent the most months in recession (53) during the period surrounding the 2001 NBER recession. Whereas Mississippi’s overall recession experience spanned a longer time period, Missouri’s labor market was in recession for a single block of time that began in March 2000, more than a year before the start of the NBER recession and 3 months before the national labor-market recession. As

Figure 3 shows, Missouri's growth dropped off considerably at this time, providing a clear signal that its labor market had switched into recession. Growth remained consistently negative through the rest of 2000 and all of 2001 and 2002. Although it picked up somewhat during 2003, the model yields little doubt that the recession continued through to 2004. It wasn't until August 2004, 8 months into the national labor-market expansion, that growth was high and persistent enough to signal the start of the labor-market expansion.

Tennessee

Tennessee's labor-market recession began in April 2000, 2 months before the start of the national labor-market recession (The drop-off in growth at this time is clear from Figure 3.) Its recession ended shortly after those of Arkansas, Indiana, and Kentucky, and 3 months earlier than the national labor market. In total, Tennessee's labor market was in recession for 41 months. Within this single recession phase, Tennessee's growth was relatively turbulent, falling well below its average recession growth rate for all of 2001. Recovery was strong in 2003, however, and growth had risen above the average expansion growth rate by the beginning of 2004. More troubling for Tennessee was the rocky performance during the second half of 2004, when growth fell and the probability of recession rose, as shown in Figures 3 and 4. At that time, however, growth had not fallen persistently close enough to the average recession growth rate to have signaled a recession.

CONCLUSIONS

Typically, District states experienced labor-market recessions that were roughly in line with the NBER recession of 1990-91. This is in contrast with other parts of the country where labor-market recessions began much earlier and ended much later than the NBER recession. Illinois differed from the rest of the District states in that its labor-market recession was very similar in timing to the national labor-market recession. In addition, the labor-market recessions in Arkansas, Indiana,

Kentucky, and Mississippi were somewhat shorter than the NBER recession was.

During the period surrounding the 2001 NBER recession, the labor markets of four District states—Arkansas, Indiana, Kentucky, and Tennessee—spent somewhat less time in recession than did the national labor market. Each of these states went into labor-market recession a month or two before the country as a whole, while entering expansion 3 to 5 months earlier than the country as a whole. On the other hand, the labor markets of three District states—Illinois, Mississippi, and Missouri—were in recession for more time than the national labor market was. All three switched into recession earlier than the country as a whole: For Mississippi, the switch occurred 10 months earlier. Sustained labor-market expansion didn't begin in these three states until 7 or 8 months after it did for the country as a whole.

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