Understanding Differential State Expansions Following the 1990-1991 and 2001 Recessions

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Abstract. This paper investigates the recoveries following the 1990-91 and 2001 recessions on a state by state and regional basis, and examines why different states and regions performed differently over these two expansions. The general conclusion of the study is that, when measured by a six-year Okun Gap contribution, the 50 states showed great variability following the 1990-91 recession and the 2001 recession. The results also indicate that the relative magnitude and variability were not the same for the two recessions, but states with higher relative levels of manufacturing were more likely to have had positive six-year Okun Gap contributions following both recessions.

1. Introduction

Since World War II there have been ten national recessions. Over time, the severity of these recessions has varied. Different regions and the various states have not been uniformly impacted by each recession. Some states and regions have experienced above average growth patterns over the last sixty years and diminishing cyclical volatility, while at the same time other states and regions have experienced below average growth patterns and increased cyclical volatility. This paper investigates the recoveries following the 1990-91 and 2001 recessions on a state by state and regional basis and examines why different states and regions performed differently over these two expansions.

The National Bureau of Economic Research defined the 1990-91 recession as beginning in July of 1990 and ending in March of 1991, and defined the 2001 recession as beginning in March of 2001 and ending in November of 2001. Table 1 provides a comparison of the two recessions. Both recessions were 8 months in length. The unemployment rate increases during the two recessions were similar with a 2.3 percent increase during the 1990-91 recession and a 2.0 percent increase during the 2001 recession. The total job losses for the 2001 recession were considerably more than during the 1990-91 recession, and the job

loss and the duration of unemployment were longer during the 2001 recession.

Table 1. Comparison of 1990-91 and 2001 recessions.

Item	1990/91	2001
Start Date	July 1990	March 2001
End Date	March 1991	Nov. 2001
Duration	8 months	8 Months
Unemployment Rate:		
Beginning	5.5%	4.3%
Peak	7.8%	6.3%
Increase	2.3%	2.0%
Duration	53 Months	67 Months*
Job Losses	-1,621,000	-2,708,000
Job Loss Trough	11 Months	30 Months

* Minimum unemployment rate of 4.4%

The paper compares the state-by-state actual Gross State Product (GSP) growth versus each state's potential GSP growth for the six year period after each trough and then estimates for each state an "Okun Gap contribution" for output for the six-year recovery

period. Each state's Okun Gap contribution for output is also expressed in relative terms, allowing for comparisons of volatility between states with respect to the each recession. For each expansion, each state has been ranked based on its relative Okun Gap contribution. A rank order correlation analysis is provided to identify similarities or differences in state performance during the two recessions. A regression based on demographic and structural factors is used to explain differences between state-by-state and regional performance over the two recovery periods.

2. Literature review

Connaughton and Madsen (1985) examined the impact of the 1981-82 recession on state and regional economies. The paper used state-specific estimates of real GSP to assess the regional impacts of the 1981-82 recession. The results showed a wide variation in the performances of state economies when measured by annualized rates of change in real GSP. Percent changes in real GSP ranged from a decline of 10.8 percent for Iowa to an increase of 4.6 percent in Alaska (pp. 9-10). Additionally, northern states generally showed larger declines in real GSP than southern states, and there were substantial differences in industry-specific impacts by state.

The concept of the Okun Gap goes back to 1962, when Arthur Okun first introduced the idea of using potential GNP as a benchmark for recession policy (Okun, 1962). His paper also introduced the concept of Okun's Law, which identified the relationship between the departures from the natural rate of unemployment and changes in real output (Okun, 1962). At the national level, subsequent research has focused on Okun's Law and the empirical measure of this relationship. It is also part of the Congressional Budget Office's (CBO) estimates of cyclically-adjusted budget measures (CBO, 2004). The CBO calculates potential GDP based on a framework of the Solow Growth Model (CBO, 2004). This measure is the most widely accepted estimate of annual potential GDP.

At the regional level a number of studies have tested the idea of Okun's Law. Donald Freeman (2000) concluded that "there do not appear to be significant interregional differences in the response of output to changes in unemployment rates …" (p. 568). Freeman's study utilized statistical filtering techniques to estimate regional output data. The study period ran from 1959 to 1997 and was interested in the Okun's law relationship over time without regard to regional differences in output performance during a recessionary period. Similar long-term regional studies on Okun's Law have been conducted on Greek

regions (Apergis and Rezitis, 2003, and Christopoulos, 2004), Canada (Adanu, 2005), and Spain (Villaverde and Maza, 2007). None of these studies specifically addressed differences in regional performance and their individual contributions to the overall national Okun Gap during a recessionary period. This study estimates the contribution that each state made to the overall U.S. Okun Gap during the six year recovery period following the 1990-91 and 2001 recessions. This study also analyzes a number of factors that explain the differences in the state levels of contribution to the Okun Gap.

There are several types of explanatory variable that are consistently identified as having an influence on state economic performance. The selection of explanatory variables for this study was based on earlier studies which focused on changes in state performance measured by per capita personal income over time. For example, Berry and Kaserman (1993) included the percentage of employment in manufacturing as an explanatory variable in explaining state economic growth over the extended time period of 1929-1987. Levernier, Partridge, and Rickman (1996) utilized economic, demographic, human capital, and labor market variables along with regional dummies to capture unmeasured regional fixed effects (pp. 363-364). Vohra (1997) specified differences in demographics, industrial mix, human capital, and technology or physical capital to explain forces influencing productivity and the rate of convergence among states. Connaughton and Madsen (2005) also showed the importance of controlling for fixed effects of the eight census regions of the United States when explaining differences in state performance measured by real per capita income.

3. Methods and data

For the U.S. as a whole, the Congressional Budget Office regularly provides estimates of potential GDP. We define the Okun Gap contribution for output as:

$$Qgap^i = \sum_{t=1}^{6} (\widehat{GSP}_t^i - GSP_t^i) / GSP_{t=0}^i \qquad (1)$$

where:

$Qgap^i$ = output gap contribution in state i,

$\widehat{GSP}_t^i$ = estimated potential Gross State Product in state i in year t, and

GSP_t^i = actual GSP in state i in year t.

At the regional or state level there is no potential GSP measurement available. In order to gauge the

cumulative state effects of a slowdown we have employed a hybrid Okun Gap approach that uses the most recent long-term growth rate preceding each recession. For the 1991 recession, a long-term growth rate for each state and the U.S. was calculated between 1983 and 1991. For the 2001 recession, a long-term growth rate for each state and the U.S. was calculated from 1992 to 2000. The U.S. long-term growth rate was then adjusted to conform to the CBO's estimates of potential GDP for each year during the analysis period (1991-1996 for the 91 recession and 2001-2006 for the 2001 recession). This adjustment was then applied to each state's long-term growth rate. The resulting sum of the state's individual potential GSP estimates equals the CBO's U.S. potential real GDP estimates.

The estimated Gross State Product variable $\widehat{GSP}_t^i$ was calculated using this approach. Through both 1996 and 2006 U.S. real GDP had still not reached the CBO's estimate of potential GDP indicating that the U.S. economy had still not closed the Okun Gap.

The BEA's real GSP (2000 dollars) series up to 1997 is based on SIC definitions. From 1997 on the series is based on NAICS industry definitions. There is only one year of overlap. The variation for each state's two

1997 estimates is wide, so a state-specific correction was applied. For each state the percent difference between the 1997 NAICS and SIC real GSP estimate was calculated and applied to the 1990 through 1996 SIC-based GSP estimates. Prior to 1990 the BEA does not currently provide real GSP estimates. Before the change over to NAICS industry definitions the BEA did provide chain weighted real GSP estimates in 1996 dollars back to 1977. To extend the BEA real estimates in 2000 dollars back to 1997 we calculated each state's implicit price deflators (IPDs) in 1996 dollars on the SIC data between 1977 and 1990. These IPDs were then adjusted to 2000 dollars and applied to the BEA's Current Dollar GSP estimates for 1977 to 1990. The SIC/NAICS adjustment factor was also applied to this series.

4. Results and analysis

4.1. The 1990-91 Recovery

Over the two recovery periods the state-by-state contribution to the respective national Okun Gaps varied widely. Table 2 contains the estimated size of the cumulative six-year loss in output (Okun Gap contribution) for each state for the 1990-91 recession.

Table 2. Cumulative Okun Gap contribution by state 1991-1996 (in millions of base year 2000 dollars).

State	1991-96 Rank	1991-96 Six-Year Cumulative Gap	Six-Year Relative Gap	State	1991-96 Rank	1991-96 Six-Year Cumulative Gap	Six-Year Relative Gap
California	50	$857,743	0.9163	Kansas	25	($3,045)	-0.0484
Connecticut	49	$106,841	0.8504	Missouri	24	($7,183)	-0.0537
Maine	48	$24,662	0.7980	Georgia	23	($10,302)	-0.0578
Maryland	47	$115,798	0.7886	Indiana	22	($13,341)	-0.0975
Vermont	46	$9,950	0.7390	Nevada	21	($7,023)	-0.1698
Hawaii	45	$30,225	0.7379	Wisconsin	20	($21,729)	-0.1746
Rhode Island	44	$18,986	0.6988	Iowa	19	($15,448)	-0.2335
Alaska	43	$20,428	0.6797	Nebraska	18	($10,621)	-0.2564
Massachusetts	42	$123,123	0.6426	Kentucky	17	($23,343)	-0.2757
New York	41	$351,617	0.5824	Arizona	16	($22,905)	-0.2764
New Jersey	40	$154,092	0.5676	Oregon	15	($20,000)	-0.3114
Virginia	39	$79,506	0.4188	Tennessee	14	($38,427)	-0.3214
Delaware	38	$12,585	0.3947	West Virginia	13	($11,715)	-0.3472
South Carolina	37	$32,284	0.3905	Oklahoma	12	($25,944)	-0.3719
Florida	36	$114,280	0.3468	Texas	11	($199,895)	-0.4374
New Hampshire	35	$9,112	0.3387	Wyoming	10	($6,227)	-0.4405
Pennsylvania	34	$51,687	0.1665	Mississippi	9	($21,405)	-0.4508
Washington	33	$22,143	0.1482	Arkansas	8	($23,251)	-0.4993
Ohio	32	$36,240	0.1264	Utah	7	($22,767)	-0.5604
Louisiana	31	$13,216	0.1150	Montana	6	($10,687)	-0.6420
Minnesota	30	$12,415	0.0988	South Dakota	5	($9,903)	-0.6492
Michigan	29	$15,887	0.0620	North Dakota	4	($9,845)	-0.7077
Illinois	28	$16,484	0.0480	Idaho	3	($15,146)	-0.7782
North Carolina	27	$2,785	0.0156	Colorado	2	($73,566)	-0.7816
Alabama	26	($2,721)	-0.0312	New Mexico	1	($47,016)	-1.6886
				United States		**1,511,171**	**0.2152**

Note: 1990-1991 Recession Dates: Peak: July 1990; Trough: March 1991.

(As noted in the methods and data section, all dollar values are presented in constant 2000 dollars to allow for comparisons across time.) If a state made a positive cumulative Okun Gap contribution for this recession, this indicates that over the six-year period following the recession trough the state had performed cumulatively below its pre-recession projected growth path. The table is arranged in the descending order of the size of the six-year loss of output in a state relative to each state's 1990 level of real GSP. Negative values for the cumulative gap contribution and relative gap indicate that the state did not suffer a cumulative loss in real GSP over the 1991-1996 time period. In fact, negative values indicate that the state's output, as measured by real GSP, exceeded its expected growth level for the period.

Table 2 shows that there were 27 states, led by California, that had not returned to their projected real GSP growth path by 1996. The table indicates that California contributed $857,743 billion to the total cumulative Okun Gap for the U.S. of 1.511 trillion dollars. This represents a loss of output in California that accounts for 56.8 percent of the cumulative loss for the U.S. economy as a whole. Table 2 also shows this six-year cumulative loss of output in California was 91.63 percent of California's 1990 output level.

Table 2 further shows there were 23 states, led by New Mexico, that had cumulative increases in real GSP relative to their potential GSP. New Mexico's contribution to the total cumulative Okun Gap for the U.S. was to reduce the size of the U.S. gap by $47 billion. Other states in Table 2 with negative six-year cumulative gap contributions should be interpreted in a similar manner. Overall, Table 2 shows the great disparity in the cumulative impact of the 1990-91 recession on the fifty states. While the relative cumulative six-year Okun Gap for the U.S. is estimated to be a loss of 21.52 percent versus the 1990 U.S. GDP, the relative cumulative losses for several states, like California, were more than triple the U.S. relative loss. Over the same six-year period other states, like New Mexico, showed no cumulative output loss versus their projected real GSP levels, and in fact substantially outperformed their projected growth paths.

4.2. The 2001 Recovery

Table 3 contains the estimated size of the cumulative six-year loss in output for each state for the 2001 recession. Table 3 is arranged in the descending order of the size of the six-year loss of output in a state relative to each state's 2000 level of real GSP. Table 3

Table 3. Cumulative Okun Gap contribution by state 2001-2006 (in millions of base year 2000 dollars).

State	2001-06 Rank	2001-06 Six-Year Cumulative Gap	Six-Year Relative Gap	State	2001-06 Rank	2001-06 Six-Year Cumulative Gap	Six-Year Relative Gap
Colorado	50	$155,069	0.9023	Arkansas	25	$9,765	0.1462
Georgia	49	$199,964	0.6874	New York	24	$112,443	0.1447
Michigan	48	$208,077	0.6170	Tennessee	23	$24,273	0.1388
Arizona	47	$94,752	0.5977	Kansas	22	$11,276	0.1362
Massachusetts	46	$163,934	0.5962	Louisiana	21	$16,202	0.1232
Oregon	45	$66,091	0.5878	West Virginia	20	$4,888	0.1179
New Hampshire	44	$25,549	0.5871	Iowa	19	$10,350	0.1148
Idaho	43	$19,128	0.5467	Pennsylvania	18	$27,656	0.0710
Washington	42	$118,659	0.5346	New Jersey	17	$16,299	0.0473
Utah	41	$34,277	0.5073	Nebraska	16	$2,314	0.0417
New Mexico	40	$24,389	0.4808	Oklahoma	15	$3,507	0.0391
North Carolina	39	$118,874	0.4343	South Dakota	14	$511	0.0221
Indiana	38	$82,962	0.4267	Virginia	13	($2,763)	-0.0106
Illinois	37	$180,980	0.3899	Rhode Island	12	($1,394)	-0.0415
Texas	36	$282,085	0.3879	Alabama	11	($6,426)	-0.0561
Ohio	35	$142,294	0.3825	Maine	10	($2,785)	-0.0784
Connecticut	34	$56,985	0.3552	Vermont	9	($1,653)	-0.0930
Mississippi	33	$21,755	0.3385	Florida	8	($65,337)	-0.1386
Minnesota	32	$62,513	0.3377	Alaska	7	($5,693)	-0.2106
Wisconsin	31	$54,902	0.3124	Delaware	6	($8,783)	-0.2118
California	30	$340,073	0.2642	North Dakota	5	($4,119)	-0.2320
Missouri	29	$44,625	0.2525	Wyoming	4	($4,086)	-0.2357
South Carolina	28	$24,507	0.2178	Montana	3	($5,079)	-0.2377
Nevada	27	$15,361	0.2084	Maryland	2	($53,491)	-0.2966
Kentucky	26	$21,551	0.1926	Hawaii	1	($26,106)	-0.6494
				United States		**2,413,159**	**0.2475**

Note: 2001 Recession Dates: Peak: March 2001; Trough: November 2001.

shows that there were 37 states which had not returned to their projected GSP growth path by 2006. The results in Table 3 suggest the 2001 recession had the largest relative impact on Colorado, Georgia, Michigan, Arizona, Massachusetts, Oregon, and New Hampshire. In relative terms Colorado had the largest six-year cumulative gap with a 90.23 percent loss in output relative its 2000 output level. The average size of the real output loss per year over the six-year period in Colorado was 15.04 percent of the 2000 level of real GSP in Colorado (90.23%/6). Table 3 also shows that, when measured in dollars, the 2001 recession had the largest cumulative impact on California, with an estimated Okun Gap contribution of over $340 billion.

Table 3 further shows there were 13 states, led by Hawaii, that had cumulative increases in real GSP relative to their potential GSP following the 2001 recession. Overall the relative cumulative six-year Okun Gap for the U.S. is estimated to be a loss in output of 24.75 percent versus the 2000 U.S. real GDP level.

Table 3 shows that the state by state contributions to this U.S. six-year cumulative Okun Gap varied greatly.

4.3. Combined 1990-91 and 2001 Recoveries

Table 4 presents each state's per capita six-year cumulative Okun Gap contribution for each recession. This table also shows the average annual per capita gap contribution for each state for both recessions combined. Connecticut had an average annual per capita Okun Gap contribution of $4,051 (($32,230 + $16,381)/12). This number indicates the per capita annual loss in output for the state measured against its projected growth path resulting from the two recessions. For the U.S. as a whole the average annual per capita output gap for the combined recessions was $203 per year. The states in Table 4 are organized by the descending magnitude of their average annual per capita output gap contribution. Based on this measure the average annual per capita output gap ranged from $4,051 in Connecticut to -$1,816 in North Dakota. The variability of the average annual per capita Okun Gap contribution is surprisingly large across the states.

Table 4. Per capita Cumulative Okun Gap contribution by state by recession.

State	Per Capita Gap 91-96	Per Capita Gap 01-06	Average Annual Per Capita Gap	State	Per Capita Gap 91-96	Per Capita Gap 01-06	Average Annual Per Capita Gap
Connecticut	$32,230	$16,381	$4,051	Louisiana	$3,051	$3,640	$558
Massachusetts	$20,226	$25,493	$3,810	Pennsylvania	$4,264	$2,237	$542
California	$27,386	$9,557	$3,079	Missouri	-$1,356	$7,777	$535
New Hampshire	$8,002	$19,811	$2,318	West Virginia	-$4,257	$10,015	$480
Alaska	$34,289	-$8,735	$2,130	Hawaii	$25,700	-$20,834	$406
New York	$19,124	$5,846	$2,081	Florida	$8,107	-$3,797	$359
Virginia	$4,166	$19,196	$1,947	Kansas	-$1,188	$4,126	$245
Michigan	$1,659	$20,670	$1,861	United States	-$11,819	$14,251	$203
New Jersey	$19,305	$1,887	$1,766	Nevada	-$4,785	$6,704	$160
Georgia	-$1,457	$22,551	$1,758	Texas	-$10,885	$12,611	$144
Maine	$19,853	-$2,131	$1,477	Idaho	-$13,469	$13,788	$27
Rhode Island	$18,698	-$1,302	$1,450	Mississippi	-$8,008	$7,543	-$39
Ohio	$3,261	$12,436	$1,308	Kentucky	-$6,101	$5,216	-$74
Illinois	$1,391	$14,273	$1,305	Iowa	-$5,436	$3,506	-$161
Minnesota	$2,711	$12,315	$1,252	Alabama	-$644	-$1,422	-$172
South Carolina	$8,763	$5,866	$1,219	Tennessee	-$7,407	$4,132	-$273
Utah	$17,128	-$2,670	$1,205	Washington	-$6,455	$2,701	-$313
North Carolina	$391	$13,988	$1,198	Nebraska	-$6,501	$1,328	-$431
Wyoming	$5,782	$8,256	$1,170	Arkansas	-$9,390	$3,561	-$486
Colorado	-$20,093	$33,846	$1,146	Oklahoma	-$7,951	$997	-$580
Maryland	$23,184	-$9,700	$1,124	South Dakota	-$13,661	$665	-$1,083
Oregon	-$6,475	$18,455	$998	New Mexico	-$28,373	$12,897	-$1,290
Vermont	$12,157	-$372	$982	Montana	-$12,562	-$5,502	-$1,505
Arizona	-$5,490	$16,627	$928	Wisconsin	-$13,100	-$8,107	-$1,767
Indiana	-$2,315	$13,354	$920	North Dakota	-$15,309	-$6,488	-$1,816
Delaware	$17,673	-$10,663	$584				

In Table 5 the average of the cumulative relative Okun Gap contribution for the 1990-91 and 2001 recessions for each state (from Table 2 and Table 3 respec-

tively) is presented. The table is organized by first grouping the states that had positive cumulative Okun Gap contributions for both recessions, the states with

positive contributions for only one of the two recessions, and finally states that had negative contributions for both recessions. For each of these three groups of states a state is then ordered according to descending magnitude of the state's average cumulative relative contribution gap measure. The table also shows the ranking of each state's relative contribution gap from each of the two recessions provided earlier in Table 2 and Table 3. Table 5 also indicates whether each state had a positive or negative cumulative contribution to the overall U.S. Okun Gap for each recession. For each recession this is indicated by a + for states with a positive cumulative Okun Gap contribution and a - for states with a negative cumulative Okun Gap contribution.

Table 5. Average relative cumulative Okun Gap contribution by state: 1991-96 and 2001-06 combined.

State	91-96 Rank	01-06 Rank	Average Relative Gap	Gap in 1991-96	Gap in 2001-06	State	91-96 Rank	01-06 Rank	Average Relative Gap	Gap in 1991-96	Gap in 2001-06
Massachusetts	42	46	0.6194	+	+	Florida	36	8	0.1041	+	-
Connecticut	49	34	0.6028	+	+	Missouri	24	29	0.0994	-	+
California	50	30	0.5903	+	+	Delaware	38	6	0.0915	+	-
New Hampshire	35	44	0.4629	+	+	Wisconsin	20	31	0.0689	-	+
New York	41	24	0.3635	+	+	Colorado	2	50	0.0604	-	+
Washington	33	42	0.3414	+	+	Hawaii	45	1	0.0442	+	-
Michigan	29	48	0.3395	+	+	Kansas	25	22	0.0439	-	+
New Jersey	40	17	0.3074	+	+	Nevada	21	27	0.0193	-	+
South Carolina	37	28	0.3041	+	+	Texas	11	36	-0.0248	-	+
Ohio	32	35	0.2544	+	+	Utah	7	41	-0.0265	-	+
North Carolina	27	39	0.2250	+	+	Kentucky	17	26	-0.0415	-	+
Illinois	28	37	0.2189	+	+	Mississippi	9	33	-0.0561	-	+
Minnesota	30	32	0.2183	+	+	Iowa	19	19	-0.0594	-	+
Louisiana	31	21	0.1191	+	+	Tennessee	14	23	-0.0913	-	+
Pennsylvania	34	18	0.1187	+	+	Nebraska	18	16	-0.1074	-	+
Maine	48	10	0.3598	+	-	West Virginia	13	20	-0.1147	-	+
Rhode Island	44	12	0.3287	+	-	Idaho	3	43	-0.1157	-	+
Vermont	46	9	0.3230	+	-	Oklahoma	12	15	-0.1664	-	+
Georgia	23	49	0.3148	-	+	Arkansas	8	25	-0.1766	-	+
Maryland	47	2	0.2460	+	-	South Dakota	5	14	-0.3136	-	+
Alaska	43	7	0.2346	+	-	New Mexico	1	40	-0.6039	-	+
Virginia	39	13	0.2041	+	-	Alabama	26	11	-0.0436	-	-
Indiana	22	38	0.1646	-	+	Wyoming	10	4	-0.3381	-	-
Arizona	16	47	0.1607	-	+	Montana	6	3	-0.4399	-	-
Oregon	15	45	0.1382	-	+	North Dakota	4	5	-0.4698	-	-

Table 5 shows there were fifteen states that had positive cumulative Okun Gap contributions for both the 1990-91 recession and the 2001 recession. There were only four states (North Dakota, Montana, Wyoming, and Alabama) that had negative cumulative Okun Gap contributions for both recessions. The other thirty-one states had a positive cumulative Okun Gap contribution for one but not both of the recessions. Figure 1 presents the geographic distribution of the states with respect to whether or not the state made a positive cumulative Okun Gap contribution for each recession. The fifteen states that had positive contributions for both recessions appear to be states with significant manufacturing sectors. Figure 1 also shows that states in the central and western part of the country, excluding California and Washington, did not experience a cumulative output loss from the 1990-91 recession.

4.4. Variability by state in the 1990-91 and 2001 recoveries

The variability in the magnitude of the state-by-state cumulative six-year relative gap contribution between the two recessions is significant. Variability also appears between the two recessions when examining the state-by-state rank for each recession as shown in Table 5. To investigate the variability in the rank order of relative Okun Gap contribution of the states between the two recessions a Spearman rank order correlation test was conducted. This test provided an estimated rank order correlation coefficient of -0.242 with a t-value of -1.728. This result shows a weak negative correlation (at the 0.10 level of significance) and confirms the apparent variability in the state by state results for the two recessions.
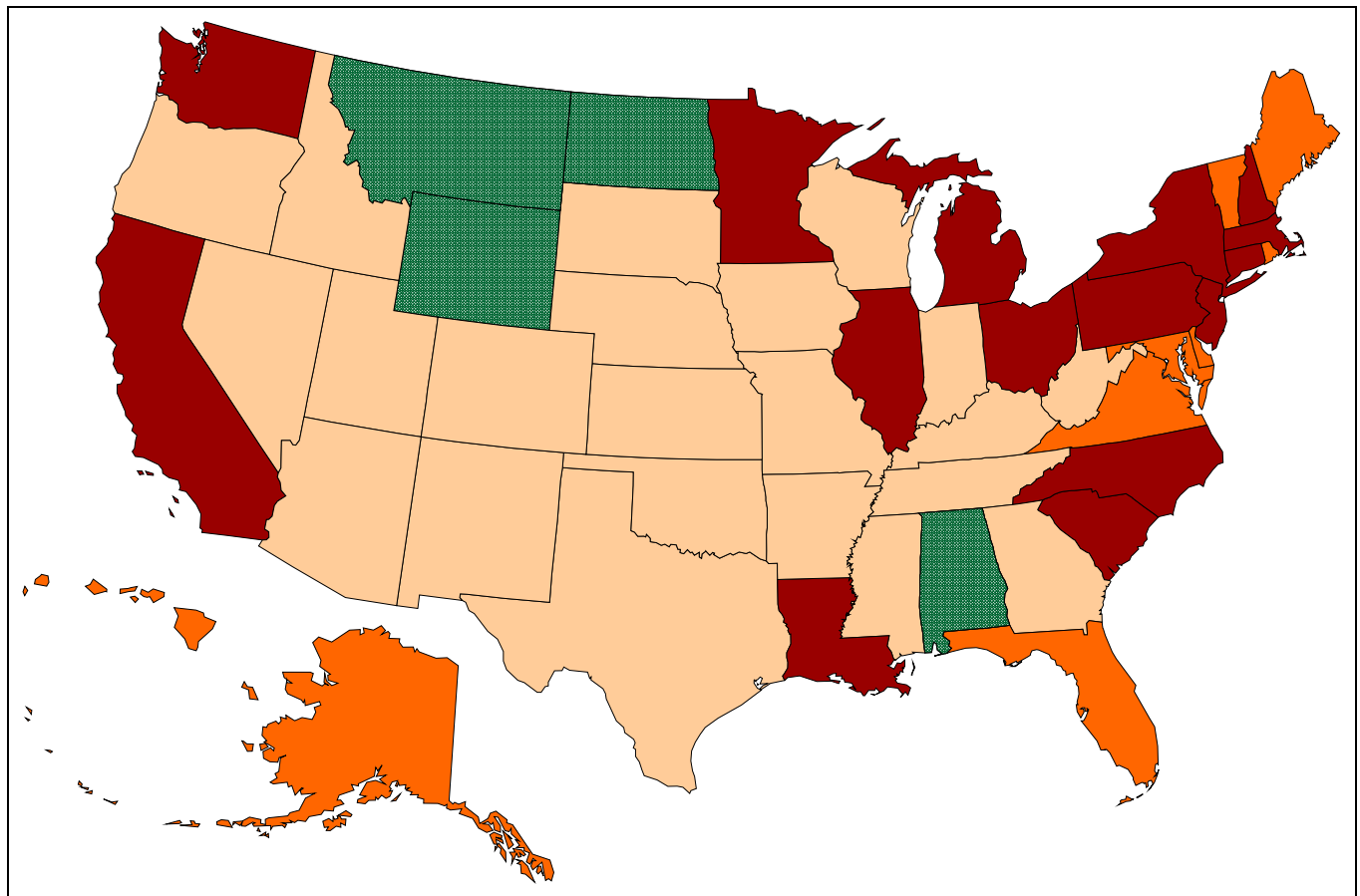
Legend:

🟩 No Okun Gap 1991 or 2001
🟧 Okun Gap 2001 Only
🟧 Okun Gap 1991 Only
🟥 Okun Gap 1991 and 2001

Figure 1. Okun Gap contributions for the 1991 recession and 2001 recession.

In an attempt to explain why some states had positive Okun Gap contributions for both recessions a probit model was estimated. The model specified the dependent variable (RECESS) with a value of 1 for each of the fifteen states that had positive Okun Gap contributions for both recessions and a value of 0 for the other thirty-five states. The dependent variable is hypothesized to be a function of a set of demographic, human capital, and industrial structure variables along with a set of regional dummy variables to capture regional fixed effects. (The Mideast BEA region was the omitted category for the regional variables.) The model was specified as:

$$RECESS = \alpha + \beta_1 PMANQ + \beta_2 PURBAN + \beta_3 PWNOHS + \beta_4 PPOV + \beta_5 NE + \beta_6 SE + \beta_7 GL + \beta_8 PL + \beta_9 SW + \beta_{10} RM + \beta_{11} FW + e \qquad (2)$$

where RECESS = 1 for each state that had a positive Okun Gap contribution for both recessions and a value of 0 otherwise, *PMANQ* is the percent of total output in a given state produced in the manufacturing sector, *PURBAN* is the percent of the population in a given state residing in an urban area, *PWNOHS* is the percent of the adult population (25 years+) in a given state without high school degrees, and *PPOV* is the percent of the population in a given state below the poverty level. NE, SE, GL, PL, SW, RM, and FW are dummy variables for states in the New England, Southeastern, Great Lakes, Plains, Southwestern, Rocky Mountain, and Far Western BEA regions, respectively.

All data are year 2000 values obtained from BEA or the 2000 Census. Table 6 presents the results for the probit model. The model produces a reasonably good fit with an R_p^2 measure of .80. This measure is the

ratio of the number of observations "predicted" correctly to the total number of observations and is analogous to the R^2 for an OLS regression (Studenmund, 2001, p. 438). Further, the coefficient on the manufacturing variable (*PMANQ*) is positive and significant at the 0.05 level. This confirms that states with higher relative levels of manufacturing output were more likely to have had positive Okun Gap contributions for both recessions. A similar conclusion would be made for states with larger percentages of their populations residing in urban areas since the coefficient on *PURBAN* tests significant at the 0.10 level. The negative coefficient on *PWNOHS*, the percent of the adult population (25 years+) in a given state without high school degrees, tests significant at the 0.05 level. This result may indicate that states with larger percentages of unskilled workers lose smaller amounts of output per worker than states with higher skilled workers, and these states with larger percentages of unskilled workers recover more quickly following a recession.

Table 6. Probit results (dependent variable RECESS).

Variable	Coefficient	Std. Error	t-statistic	p-value
C	-5.95	3.72	-1.60	0.12
PMANQ	28.33	11.39	2.49	0.02
PURBAN	6.68	3.38	1.98	0.06
PWNOHS	-47.83	22.04	-2.17	0.04
PPOV	51.54	34.02	1.51	0.14
NE	1.22	1.24	0.98	0.33
SE	-0.94	1.14	-0.82	0.41
GL	-2.02	1.31	-1.55	0.13
PL	-1.49	1.11	-1.35	0.18
SW	-13.50	11952511	0	1
RM	-10.62	9786337	0	1
FW	-2.73	1.39	-1.97	0.06
Observations w/Dependent = 1:		15		
Observations w/Dependent = 0:		35		

All the estimated coefficients on the regional dummies are negative, except for the NE region, and the coefficient for the FW region tests significant at the 0.10 level. The negative signs on these coefficients suggest states in the Mideast BEA region, the omitted regional category, were more likely to have positive Okun Gap contributions for both recessions. In spite of the general lack of significance of the coefficients on the regional dummies, it is useful to have controlled for fixed regional effects when estimating coefficients on the other variables in the model. (Logit results for this model provide the same pattern of signs and significance for all coefficients.)

5. Conclusions

Following the 1990-91 recession the six-year cumulative Okun Gap for the U.S. was estimated to be $1.511 trillion. This represents a cumulative loss in national output that is 21.52 percent of the 1990 U.S. real GDP, or an average annual loss of output of 3.59 percent per year. The total U.S. loss was generated by the 27 states, led by California, that had not returned to their projected real GSP growth paths by 1996, and it was reduced by the 23 states, led by New Mexico, that had cumulative increases in real GSP relative to their potential real GSP. Overall, there was great disparity in the cumulative impact of the 1990-91 recession on the fifty states.

In the six years following the 2001 recession the cumulative Okun Gap for the U.S. was estimated to be $2.413 trillion. This represents a cumulative loss in national output that is 24.75 percent of the 2000 U.S. real GDP, or an average annual loss of output of 4.13 percent per year. The total U.S. loss was generated by the 37 states, led by Colorado, that had not returned to their projected real GSP growth paths by 2006, and it was reduced by the 13 states, led by North Dakota, that had cumulative increases in real GSP relative to their potential real GSP. Similar to the post 1990-91 recession, there was great disparity in the cumulative impact of the 2001 recession on the fifty states.

Looking at the combined impact of the two recessions on state economies on an average annual per capita basis gives a strong indication of the variability by state of these recessions. Based on this measure the average annual per capita Okun Gap ranged from $4,051 in Connecticut to -$1,816 in North Dakota. The negative value reflects an average annual per capita output that exceeded the projected real output level for North Dakota. Overall 33 states had positive average annual per capita Okun Gaps and 17 states had negative average annual per capita Okun Gaps. For the U.S. as a whole the average annual per capita output gap for the combined recessions was $203 per year. The variability of the average annual per capita Okun Gap contribution was surprisingly large across the states, while the loss for the country as a whole was quite small.

There were 15 states that had positive cumulative Okun Gap contributions for both the 1990-91 recession and the 2001 recession. A probit analysis indicates that states with higher relative levels of manufacturing output were more likely to have had positive Okun

Gap contributions for both recessions. A similar conclusion is made for states with larger percentages of their populations residing in urban areas. These conclusions were reached while controlling for fixed regional effects.

The general conclusion of the study is that when measured by a six-year Okun Gap contribution, the 50 states showed great variability following the 1990-91 and 2001 recessions. The results also indicate that the relative magnitude and variability were not the same for the two recessions, but states with higher relative levels of manufacturing were more likely to have had positive six-year Okun Gap contributions following both recessions.

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