MEASURING CYCLICAL SENSITIVITY IN STATE PERFORMANCE: 1969-1984

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The cyclical performance of state economies is a topic of concern to state planners which is likely to be of increasing importance. The continuing effort of the federal government to shift the budget responsibility for a growing number of programs to the state level has created a new urgency to the importance of understanding state cycles. If some state economies are more cyclically sensitive than other state economies, it is likely the ability to absorb the increased funding requirements of transferred federal programs will not be uniform among the states. The purpose of this paper is to identify the responsiveness of state economies to the cyclical performance of the overall U.S. economy. The identification of this responsiveness should help state planners concerned with understanding the cyclical performance of state economies.

In an earlier study we found it was possible to calculate quarterly Gross State Product (GSP) for each state during the 1981-82 recession using a modified Kendrick and Jaycox technique [2]. GSP is the market value of all final goods and services produced by a state's economy in a designated time period. The technique used produced annualized values of real GSP in a given state in a designated quarter.

These values of GSP we judge, provide a better measure of cyclical state performance than either the State Personal Income series or the Total Employment series. As a measure of cyclical performance, the State Personal Income series can be misleading because it includes transfer payments received by households and excludes income received by the business, government and foreign sectors. The Total Employment series is flawed as a measure of cyclical state performance because of its failure to reflect changing labor productivity and the productivity of the other factors of productions. For the reasons cited above, both the State Personal Income series and the Total Employment series do not adequately measure the cyclical nature of state economies. Quarterly estimates of GSP provide a better short term measure of a state's output than either the income or employment series. For these reasons we have used the methodology developed earlier [1] to calculate quarterly estimates of annualized real GSP for each state and Washington, D.C.

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The results of our earlier study and subsequent research have shown a wide variation in the performance of state economies when measured by annualized rates of change in real GSP. For example, during the 1981-82 recession twenty-one states had declines in real GSP, in percentage terms that were more than double the percentage decline in real GNP for the U.S. during the same period. At the other extreme, eight states had an increase in real GSP during the national recession [1, pp. 6-7].

The wide variation in state GSP found in these earlier studies has led us in this study to expand the time period under study and specifically address the question of how responsive state economies are to the national business cycle. To do this we calculated the annualized level of real GSP on a quarterly basis for each state and Washington, D.C. between 1969-I and 1984-III (the last period for which complete data was available). We then estimated the following model for the 63 quarters in the study:

$$\log GSP^i_Q = b^i_0 + b^i_1(\log GNP_Q) + e_1 \qquad \text{(Equation 1)}$$

where: GSP^i_Q = the annualized level of real GSP in state i during quarter Q,

GNP_Q = the annualized level of real GNP for the U.S. in quarter Q,

b^i_1 = the average elasticity during the 63 quarters under study, reflecting the percentage change in real GSP in state i associated with a one-percent change in real GNP in quarter Q

e_i = the randomly distributed error term.

The advantage of this specification in log form is to provide a relative measure (elasticity) of state performance in relation to national cyclical performance. This model was estimated for each of the fifty states and Washington, D.C.

Results

The elasticity estimates (b^i_1) for each state and Washington, D.C. are presented in Table I. The table is organized in ascending order of b^i_1 and the states are ranked accordingly. The magnitude of the difference in elasticities between states was surprising and produced a range from a high elasticity of 2.27 for Alaska to a low of .33 for New York. These numbers indicate that over the almost sixteen years covered by the study for each 1% change in real GNP, Alaska's real GSP changed by an average 2.27% in the same direction. This extremely high sensitivity to the U.S. performance in Alaska is contrasted with a very low sensitivity in New York where a 1% change in real GNP was associated with an average change of only a .33% in real GSP.

Overall, nineteen states and Washington, D.C. have elasticities of less than 1.00. It is noteworthy that not one "sun-belt" state is in this group of nineteen states which includes almost all of the industrialized eastern and midwestern states. Of the twelve states with the highest elasticities only New Hampshire is not a "sun-belt" and/or energy producing state. The wide variation in the

estimated elasticities clearly indicates that over a long period of time, including three major U.S. business cycles, there are important differences in the performance of state and regional economies versus the U.S. economy as a whole.

Table I also provides the adjusted coefficients of determination (adjusted R^2) for each state based on the forecast values of real GSP^i_Q generated using Equation 1 and the actual values of real GSP^i_Q.[1] The adjusted R^2 values range from a high of .99 for seven states (Kansas, Maine, Minnesota, South Carolina, Tennessee, Virginia and Utah) to a low of .56 in Michigan and 62 in New York. Overall, thirty-seven states and Washington, D.C. have values of adjusted R^2 of .90 or above. These results suggest that for these states, there is a close association between the timing and average relationship of the changes in the national cycle and that states economic changes.

States with high adjusted R^2 and high elasticity coefficients (b^i_1), like Wyoming with an elasticity coefficient of 2.07 and an adjusted R^2 of .92 have shown cyclical patterns that match in general the timing of the national cycle (as indicated by the adjusted R^2) and have shown on average a wider swing in activity over the cycle (as measured by the high elasticity). Washington, D.C. has a high adjusted R^2 (.91) and a low elasticity (.38) suggesting its economic activity in general moves with the national cycle but the magnitude of its cycle in relative terms is less than the magnitude of the national cycle. States like New York, Michigan, Ohio, Indiana, Iowa and West Virginia have low elasticity coefficients and relatively low adjusted R^2 values. This combination of results suggests these states' economies have not followed the pattern of the national cycles with the same consistency or magnitude as states with higher adjusted R^2 values and higher elasticity coefficients. An examination of the residual values (GSP^i_Q – fitted GSP^i_Q) for Michigan, Ohio, Indiana, Iowa and West Virginia all show large negative values from 1981 or 1982 forward. This indicates the severity of the recession that has affected these states and the failure of these state economies to match their long-term recovery relationship with the national business cycle. (New York's residuals present a different pattern showing large negative residuals between 1969 and 1973 and large positive residuals between 1977-1980.)

As one additional measure of state performance over the period under study, we calculated the compound long-term real growth rate ($LTRGR^i$) for each state, Washington, D.C. and the overall U.S. LTRGR. These results are presented in Table 2 and are arranged and ranked in ascending order. The range of LTRGR is striking. Alaska had an average LTRGR of 6.69 percent versus a .98 percent LTRGR for the District of Columbia. The rankings in Table 2 are roughly consistent with the elasticity rankings in Table 1. This consistency was expected because of a similarity in the mathematical definition of b^i_1 and $LTRGR^i$.[2]

The overall LTRGR for the U.S. during the period (1969-I through 1984-III) was 2.76 percent. Thirty-three states had higher growth rates than the U.S. rate, while seventeen states and Washington, D.C. had lower growth rates. Since the U.S. rate is essentially a weighted average of the state rates,

TABLE I
State Results for 1969-I to 1984-III

Rank	State	Estimated State Elasticity (b_1^i)	Adjusted R^{2*}
1.	New York	0.33	.62
2.	Washington, D.C.	0.38	.91
3.	Ohio	0.51	.79
4.	Pennsylvania	0.52	.91
5.	Michigan	0.55	.56
6.	Illinois	0.56	.84
7.	Rhode Island	0.58	.92
8.	Indiana	0.62	.74
9.	West Virginia	0.67	.75
10.	Iowa	0.73	.70
11.	Missouri	0.73	.97
12.	Massachusetts	0.74	.89
13.	Maryland	0.79	.98
14.	Montana	0.80	.86
15.	New Jersey	0.81	.96
16.	South Dakota	0.83	.85
17.	Vermont	0.92	.95
18.	Delaware	0.93	.93
19.	Nebraska	0.93	.93
20.	Wisconsin	0.98	.98
21.	Hawaii	1.00	.95
22.	Connecticut	1.01	.94
23.	Maine	1.01	.99
24.	Kentucky	1.07	.97
25.	Minnesota	1.09	.99
26.	Mississippi	1.16	.96
27.	Alabama	1.18	.97
28.	North Carolina	1.18	.98
29.	North Dakota	1.18	.72
30.	Tennessee	1.21	.99
31.	Kansas	1.25	.99
32.	Virginia	1.28	.99
33.	Oregon	1.29	.89
34.	California	1.32	.98
35.	Georgia	1.36	.97
36.	Arkansas	1.37	.97
37.	South Carolina	1.37	.99
38.	Idaho	1.43	.96
39.	Washington	1.43	.94
40.	New Mexico	1.45	.98
41.	Louisiana	1.51	.95
42.	Oklahoma	1.62	.95
43.	Utah	1.62	.99
44.	New Hampshire	1.64	.97
45.	Florida	1.70	.96
46.	Arizona	1.83	.98
47.	Colorado	1.89	.97
48.	Nevada	1.93	.96
49.	Texas	1.96	.96
50.	Wyoming	2.07	.92
51.	Alaska	2.27	.68

*See footnote 1 for an explanation of how the adjusted R^2 was calculated.

TABLE 2
Annual Growth Rates: 1969-I to 1984-III

Rank	State	Compound Annual Real Growth Rate
1.	Washington, D.C.	.98%
2.	Ohio	1.28%
3.	New York	1.30%
4.	Michigan	1.31%
5.	Pennsylvania	1.47%
6.	Indiana	1.50%
7.	Illinois	1.51%
8.	Iowa	1.64%
9.	Rhode Island	1.81%
10.	West Virginia	1.82%
11.	Montana	1.91%
12.	Missouri	2.01%
13.	South Dakota	2.35%
14.	Maryland	2.40%
15.	Massachusetts	2.44%
16.	Wisconsin	2.47%
17.	Nebraska	2.50%
18.	New Jersey	2.73%
19.	Vermont	2.77%
20.	Delaware	2.78%
21.	Hawaii	2.83%
22.	Maine	2.89%
23.	Connecticut	2.92%
24.	Washington	2.95%
25.	Oregon	2.96%
26.	Mississippi	2.97%
27.	Kentucky	3.04%
28.	Minnesota	3.06%
29.	Alabama	3.15%
30.	California	3.40%
31.	Tennessee	3.45%
32.	North Carolina	3.50%
33.	Louisiana	3.50%
34.	Kansas	3.53%
35.	Idaho	3.61%
36.	North Dakota	3.69%
36.	Virginia	3.69%
38.	Arkansas	3.71%
39.	New Mexico	3.83%
40.	South Carolina	3.93%
41.	Georgia	4.25%
42.	Oklahoma	4.31%
43.	Utah	4.38%
44.	New Hampshire	4.62%
45.	Wyoming	4.66%
46.	Nevada	4.86%
47.	Texas	5.06%
48.	Florida	5.22%
49.	Colorado	5.33%
50.	Arizona	5.49%
51.	Alaska	6.69%
	United States	2.76%

variability around the U.S. rate is not surprising but the magnitude of the differences and the geographical distribution is striking. Not a single "sun-belt" state grew at or below the overall U.S. LTRGR during the almost sixteen years studied. This pattern of results certainly suggests important long-term differences in the vitality and strength of state and regional economies.

Conclusions

The results of this study clearly suggest that there are significant and systematic differences between states performance when measured against the national business cycle. Some states had high elasticities and high long-term real growth rates and followed the timing of the national cycle closely. Other states with low elasticities and low growth rates followed the national cycle less closely.

The results show differences in the responsiveness of state economies to the cyclical performance of the overall U.S. economy. Because of these differences, the ability of state economies to absorb the increased funding requirements of transferred federal programs is likely to differ significantly between states and different regions of the country. Both national and state planners should be sensitive to the impact of differences in the cyclical performance of states identified in this study.

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