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# EXPLAINING DIFFERENTIALS IN STATE UNEMPLOYMENT RATES DURING RECESSIONS

*John E. Connaughton and Ronald A. Madsen\**

Past recessions provide evidence that differences in industrial structure cause some state economies to be more sensitive to aggregate economic performance than other state economies. Because of the severity of the most recent recession, the importance of estimation of the magnitude of these differences and identification of the causes of these differences is accentuated. The purpose of this paper is to investigate how differences in the relative importance of state manufacturing sectors affect state economic performance during a recession. Additionally, the mixture of durable versus nondurable production within the manufacturing sector is studied to determine how differences in this mixture are reflected in state performance during a recession.

There is substantial evidence that manufacturing employment is frequently the most severely reduced during a recession. Rosen notes in his review of the 1974-75 recession that 15 of the 17 states with above-average over-the-year unemployment rate increases also had an above average proportion of jobs in manufacturing. [6, p. 22]. While Rosen does review the percentage of nonagricultural employment in manufacturing by state in 1974, he does not try to estimate the size or the significance of the varying importance of the manufacturing sector on state unemployment performance. A number of other studies have also identified the importance of the relative size of the manufacturing sector in explaining state or regional differences in unemployment rates during a recession. These include studies by Bednarzik [1], Gellner [3], and Hyclak and Lynch [5]. The Hyclak and Lynch study did indicate, through the use of a Chow test, that by state, the responsiveness to overall aggregate performance varied with differences in manufacturing activity. However, the study did not attempt to estimate the magnitude of the responsiveness. Several studies that attempt to explain regional patterns in unemployment rates in the U.S., Canada, and Great Britain provide related evidence on the importance of manufacturing on area unemployment rates [4], [7], and [10]. A logical extension of this research would be to estimate the size and significance of the relative size of the state manufacturing sector on state unemployment rates during a recession.

## **The Model**

The focus of this paper is on explaining differences in the sensitivity of state economic performance relative to the overall performance of the U. S. economy during a recession. In specifying the model, the dependent variable was defined as the change in a state's unemployment rate relative to the

\* Department of Economics, University of North Carolina at Charlotte.

change in the U.S. unemployment rate during a designated recession ( $\Delta\text{STATE}/\Delta\text{US}$ ). Specifying the dependent variable in this way provides two important insights. First, it allows the coefficients of the independent variables to be expressed in relative terms. Thus, the value of the coefficient reflects the impact that an explanatory variable has on the change in a state's unemployment rate as compared to the change in the U.S. unemployment rate. Second, the value of the dependent variable for each state provides a good indicator as to the cyclical sensitivity of that state unemployment rate during a recession.

The change in the U.S. unemployment rate ( $\Delta\text{US}$ ) was measured from the unemployment rate at the start of the recession to the peak unemployment rate during that recession. The change in the state unemployment rate ( $\Delta\text{STATE}$ ) was measured as the difference in the state unemployment rate at the start of the recession (for the U.S. economy) to the state peak unemployment rate during that recession.

Thus, if a state's unemployment rate went up by 4 percentage points during the recession, and the U.S. unemployment rate also went up 4 percentage points, the dependent variable would have a value of 1.00. States with cyclically sensitive economies would have values of  $\Delta\text{STATE}/\Delta\text{US}$  greater than 1.00. States with values of the dependent variable less than 1.00 would be less adversely affected by the recession than the cyclically sensitive states.

The independent variable PCTMFG was defined as the percentage of state income produced by the manufacturing sector. The expectation was that states with larger manufacturing sectors would be more cyclically sensitive than states with smaller manufacturing sectors.

A second independent variable was included to determine how differences in the mixture between durables and nondurables within the manufacturing sector affected the state's relative change in unemployment. This variable, PDURABLE, was calculated as the proportion of manufacturing income accounted for in durable goods production. There is a general expectation that a state with a manufacturing sector dominated by durable goods production is more cyclically sensitive than a state with a similar size manufacturing sector that has less output concentrated in durable goods. The basis for this expectation is that purchases of durable goods by consumers is more easily postponed during a recession. While this is a generally held belief, little supporting research evidence exists at the state level. Thus, the prediction is that the sign of the coefficient on PDURABLE should be positive.

The size of the civilian labor force by state (CLF), in hundreds of thousands of workers, was included in the model to control for differences in the absolute size of the state economies. There was no basis for predicting the sign of the relationship between CLF and the relative change in state unemployment rates ( $\Delta\text{STATE}/\Delta\text{US}$ ).

Thus, the following linear model was specified:

$$(1) \quad \Delta\text{STATE}/\Delta\text{US} = b_0 + b_1\text{PCTMFG}_i + b_2\text{PDURABLE}_i + b_3\text{CLF}_i$$

Where:

$\Delta STATE_i/\Delta US$  = the change in the unemployment rate of state  $i$  relative to the change in the national unemployment rate during a designated recession.

$PCTMFG_i$  = the percentage of income in state  $i$  generated by the manufacturing sector.

$PDURABLE_i$  = the proportion of manufacturing in state  $i$  accounted for by durable goods production.

$CLF_i$  = the size of the civilian labor force in state  $i$ , in hundreds of thousands of workers.

Data was collected for the 1970-71 recession, the 1974-75 recession, and the 1979-80 recession. Monthly state unemployment rate data was provided by the Bureau of Labor Statistics and comes from a series that was unpublished prior to 1975. The values for  $PCTMFG_i$ ,  $PDURABLE_i$ , and  $CLF_i$  were based on 1970, 1974, and 1979 values for the three respective recessions. This data was collected from various volumes of *Local Area Personal Income* published by the U.S. Department of Commerce, Bureau of Economic Analysis. Although data was collected for all 50 states, inconsistencies in state data for Oregon and Delaware led to excluding them from the sample.

The regression equation was estimated using Ordinary Least Squares (OLS) for the remaining 48 states for each of the three designated recessions. Additionally, the model was estimated for each recession restricting the sample to the 25 states with the largest manufacturing sectors.

## Results

The results of the OLS estimates for each of the three recessions for the 48 states are presented in Table 1. The results indicate that the only statistically significant relationship between the relative change in the state unemployment rate ( $\Delta STATE/\Delta US$ ) in the 1970-71 recession and the explanatory variables was with the absolute size of the civilian labor force ( $CLF_i$ ). It is likely that these results reflect the special nature of the 1970-71 recession which was heavily concentrated in states with large levels of defense and/or aerospace employment. The variables  $PCTMFG_i$  and  $PDURABLE_i$  may not adequately capture the industry specific effects within the manufacturing sector. Both  $PCTMFG_i$  and  $PDURABLE_i$  do have positive coefficients as predicted.

The results in Table 2 were estimated for the 25 states with the largest manufacturing sectors. The results for the 1970-71 recession indicate that when the sample is restricted to the 25 largest manufacturing states, the size of the civilian labor force ( $CLF_i$ ) is no longer significant. The coefficient on  $PDURABLE$  is positive as predicted and is significant at the .01 level. The

coefficient on PCTMFG<sub>i</sub> is unexpectedly negative, but is not significantly different from zero. When the sample was restricted to the 25 largest manufacturing states for the 1970-71 recession, the proportion of variation in the relative change in state unemployment explained by the equation increased from 19.2% to 44.2%. Again, the best explanation for these results would appear to be the industry specific nature of the 1970-71 recession, which could help explain the statistical significance of the coefficient on PDURABLE<sub>i</sub> (the proportion of durable goods within the manufacturing sector).

The 1974-75 recession was more general in its impact. The results in Table 1 show that the coefficients for PCTMFG<sub>i</sub> and PDURABLE<sub>i</sub> were positive as expected and were statistically significant at the .05 level. The absolute size of the labor force has a negative coefficient that is not statistically significant. Unlike the 1970-71 recession, when the sample size was restricted to the 25 largest manufacturing states, the proportion of explained variation dropped. Additionally, the coefficient on PDURABLE<sub>i</sub> is estimated to be negative and would have been significant had a two-tailed hypothesis test been specified. An explanation for the change in the sign of the coefficient is not apparent. A possible problem with multi-collinearity was investigated, but only a very weak relationship between the independent variables could be identified (simple correlation coefficients were .35 or less). The coefficient on PCTMFG<sub>i</sub> remained positive and statistically significant in the estimate using the restricted sample size for the 1974-75 recession.

**Table 1: Results For 48 States During Designated Recession**

**1970-71 RECESSION <sup>a</sup>**

$$\Delta STATE_i / \Delta US = .602 + .004 PCTMFG_i + .339 PDURABLE_i + .011 CLF_i^{**}$$

( .008 )                      ( .549 )                      ( .004 )

R<sup>2</sup> = .192                      F-statistic = 3.49\*

**1974-75 RECESSION**

$$\Delta STATE_i / \Delta US = -.383 + .050 PCTMFG_i^{**} + 1.461 PDURABLE_i - .005 / CLF_i$$

( .012 )                      ( .844 )                      ( .005 )

R<sup>2</sup> = .385                      F-statistic = 9.16\*\*

**1979-80 RECESSION**

$$\Delta STATE_i / \Delta US = -.578 + .059 PCTMFG_i^{**} + 1.028 PDURABLE_i - .002 CLF_i$$

( .011 )                      ( .770 )                      ( .005 )

R<sup>2</sup> = .476                      F-statistic = 13.29\*\*

<sup>a</sup> Numbers in parentheses are standard errors of the respective coefficients.

\* Indicates significance of the coefficient(s) at the .05 level.

\*\* Indicates significance of the coefficient(s) at the .01 level.

**Table 2: Results For 25 States With Largest Manufacturing Sectors During Designated Recession**

**1970-71 RECESSION<sup>a</sup>**

$$\Delta \text{STATE}_i / \Delta \text{US} = -.188 - .003 \text{PCTMFG} + 2.009 \text{PDURABLE}^{**} + .009 \text{CLF}_i$$

(.013)
(.693)
(.005)

$R^2 = .442$       F-statistic = 5.59\*\*

**1974-75 RECESSION**

$$\Delta \text{STATE}_i / \Delta \text{US} = .940 + .031 \text{PCTMFG}^{**} - 1.222 \text{PDURABLE}^b + .007 \text{CLF}_i$$

(.010)
(.597)
(.004)

$R^2 = .338$       F-statistic = 3.56\*

**1979-80 RECESSION**

$$\Delta \text{STATE}_i / \Delta \text{US} = -1.628 + .107 \text{PCTMFG}^{**} + .407 \text{PDURABLE} - .0001 \text{CLF}_i$$

(.002)
(1.216)
(.007)

$R^2 = .596$       F-statistic = 10.31\*\*

<sup>a</sup> Numbers in parentheses are standard errors of the respective coefficients.

\* Indicates significance of the coefficient(s) at the .05 level.

\*\* Indicates significance of the coefficient(s) at the .01 level.

<sup>b</sup> If a two-tailed hypothesis test had been employed this negative coefficient would have been significant at the .05 level.

The results for the 1979-80 recession for 48 states shown in Table 1 indicate the  $\text{PCTMFG}_i$  was significantly related to the relative change in state unemployment performance. While the coefficient on  $\text{PDURABLE}_i$  does have the expected sign, it is not statistically significant, nor is the coefficient on  $\text{CLF}_i$  significant. The higher  $R^2$  (47.6%) does indicate that, versus the 1970-71 recession and 1974-75 recession, variation in the values of  $\text{PCTMFG}_i$ ,  $\text{PDURABLE}_i$ , and  $\text{CLF}_i$  explained more of the relative change in state unemployment rates in the 1979-80 recession. The pattern of results in terms of explained variance (measured by  $R^2$ ) over the three recessions may indicate a strengthening of the relationship between state unemployment variability and the relative importance of manufacturing. This strong relationship is also suggested by the increasing size of the coefficients estimated for the  $\text{PCTMFG}_i$  variable.

When the sample was restricted to the 25 largest manufacturing states for the 1979-80 recession, there was an increase in  $R^2$  to 59.6% versus the 47.6% for the 48 state results for this recession. The results on the statistical significance of the coefficients are the same for the restricted sample and the 48 state sample, although the size of the coefficients are markedly different.

A Chow test leads to the conclusion that the equations for each of the three recessions are significantly different. The conclusion that each recession had unique features that were not controlled for in the relatively simple specification of the model should not be surprising.

## Conclusions

Overall, the results show the expected significance of the relative importance of manufacturing by state in explaining the relative state unemployment changes during a designated recession. These results were estimated while controlling for the proportion of durable goods production within the manufacturing sector and the absolute size of the civilian labor force. The size and significance of the coefficient on  $PCTMFG_i$  was different for each of the three recessions studied.

The results do confirm the previous studies which cited the above average relative importance of manufacturing in explaining larger than average state or regional unemployment rates during recessions. The results for the 1979-80 recession for the 48 states would indicate, for example, that a state with 30% of state income generated in the manufacturing sector would have a relative change in unemployment rate .59 larger than a state with 20% of state income generated in the manufacturing sector, other factors ( $PDURABLE_i$  and  $CLF_i$ ) held constant. In a state that would have otherwise had an average change in unemployment versus the U.S. change in unemployment rate (thus  $\Delta STATE/\Delta US$  equal 1.00), the  $\Delta STATE/\Delta US$  value would be 1.59. Thus, the greater relative importance of state manufacturing would lead to a markedly higher cyclical sensitivity for the state economy.

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