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ASPECTS OF ECONOMIC ACTIVITY AND UNEMPLOYMENT*

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INTRODUCTION

In a seminal paper, Okun (1962) investigated the relationship between potential GNP and levels of unemployment in order to identify the loss of national output due to unemployment. From this investigation, a significant macroeconomic relationship was established which received the name Okun's Law. According to Okun's Law, each percentage point of unemployment above 4 percent of the labor force implies a 3 percent gap of foregone potential output. The original study used quarterly data from 1947 to 1960 and employed ordinary least-squares analysis as its primary statistical method. Since Okun's (1962) original work, several studies appeared investigating the same issue and extending the original scope. Here we do not intend to survey the literature on Okun's Law; a good summary of the various studies may be found in Tatom (1978). Instead, what we propose to do is first, to replicate Okun's model for the period 1948-1979 and second, and more importantly, to use a superior econometric technique, namely Cochran-Orcutt regression analysis. This technique removes autocorrelation and allows for a better appraisal of the output-unemployment relationship in Okun's original structural equations.

METHODOLOGY

We consider the period 1948 II - 1979 IV and three shorter periods: 1948 II - 1960 IV; 1960 IV - 1972 IV; and 1973 II - 1979 IV. Note that the period 1948 II - 1960 IV is essentially the same period as in Okun's study. The period since 1960 to 1979 has been subdivided into two subperiods in order to allow us to identify possible changes in the relationship between unemployment and economic activity. More on this will be said in what follows.

For the above four periods, the first model has been estimated using both ordinary least squares regression and the Cochran-Orcutt regression analysis. We begin with the first model.

Let U_t and Y_t denote the rate of unemployment in percentage points and real GNP in time period t, respectively. The time series data is based on quarterly observations. Following Okun, we postulate a linear model of the form
i.e., quarterly changes in the percentage rate of unemployment is a linear function of quarterly percentage changes in real GNP. The estimates of equation (1) are presented in Table 1. Note that the method of ordinary least

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$$U_t - U_{t-1} = a + b \left[\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right] 100 \qquad (1)$$

squares yields a value for the coefficient b of -.34 for the 1948 II - 1960 IV period. This value is similar to Okun's original study. Observe, however that the values of the coefficient b are lower for the other three periods of our study indicating, as expected, that the output-unemployment relationship is affected by the selection of the period. What is more interesting is that the coefficient b is much lower using the Cochran-Orcutt method.

The need for an alternative estimation approach such as the Cochran-Orcutt method is based upon the low Durbin Watson (D.W.) statistics and therefore the presence of positive serial correlation of the error terms. This affects the efficiency of the ordinary least squares regression analysis. Since we are interested in the implications of updating Okun's structural equations, this research did not attempt to determine whether relevant variables have been omitted and/or whether the functional form is correct. Okun discussed these two possibilities and other researchers have pursued these avenues. One use of the Cochran-Orcutt method is based upon the desire to have efficient estimates of Okun's structural equations and to see if these estimates are consistent over alternative and more recent periods than those studied by Okun. In comparison to the Ordinary Least Squares estimates, the Cochran-Orcutt transformations reduced serial correlation (see D.W. statistics) which improved the efficiency of the estimated structural equations.

The main conclusion of our analysis of the first model is this: extending the period of Okun's study from 1948 II - 1960 IV to 1948 II - 1979 IV or studying various other subperiods, i.e., 1960 IV - 1972 IV and 1973 II - 1979 IV, or using the Cochran-Orcutt technique, all lead to lower estimates of the coefficient b. The economic significance of this fact is quite evident: a lower estimate of b means a smaller loss of potential GNP due to unemployment or, to put it differently, a reduction in unemployment does not contribute to as much of an increase in real GNP as postulated by Okun's Law. Our analysis does not supply the reasons of such a change in the output-unemployment relationship; but does suggest that the cost of unemployment to the economy at large is less than originally stated by Okun. Here, a rough estimate of the cost of unemployment for the economy at large is the value of foregone real potential GNP. Our finding is consistent with the various government reports indicating decreases in labor productivity because a decrease in the coefficient of b is partially attributed to a decrease in labor productivity. Other factors are suggested by Okun (1974).

The second model we estimated has the linear form:

$$4 - U = a + b \left(\frac{Y_p - Y}{Y_p}\right) 100 \qquad (2)$$

In equation (2) the variables U and Y are as before Y_p denotes potential GNP. Estimates of potential GNP are obtained by using real GNP in mid-1955 and postulating three alternative rates of growth: 3.5%, 4.0%, and 4.5%. In equation (2) the number 4 in the left-hand side of the equality sign denotes a

TABLE 1

ESTIMATES OF MODEL IN EQUATION 1

	ORDINARY LEAST SQUARES[α]				COCHRAN-ORCUTT ESTIMATES[β]				
PERIOD	a	b	R^2	D.W.	a	b	$\hat{\rho}$	R^2	D.W.
1948 II - 1979 IV	.29	-.31 (-12.49)*	.56	1.41	.22	-.23 (-9.26)*	.44	.62	1.90*
1948 II - 1960 IV	.34	-.34 (-8.41)*	.59	1.64*	.28	-.28 (-6.44)*	.31	.62	1.94*
1960 IV - 1972 IV	.26	-.26 (-6.70)*	.49	1.40**	.13	-.15 (-4.13)*	.46	.54	2.13*
1973 II - 1979 IV	.22	-.30 (-5.85)*	.57	.98	.18	-.23 (-5.08)*	.59	.69	1.55*

α t-Statistics are in parentheses.

β $\hat{\rho}$ Is the estimated autocorrelation coefficient.

* Significant at 5 percent level of significance.

** Significant at 1 percent level of significance.

defined full employment rate. Thus equation (2) relates deviations from the full employment unemployment rate to weighted deviations of real GNP from potential GNP. Table 2 summarizes the ordinary least squares and the Cochran-Orcutt estimates for equation (2) assuming a 3.5% growth in potential GNP. It is rather impressive that for the four periods chosen the relationship postulated in equation (2) is rather stable with value of the coefficient b being:- .39, -.31, -.38 and -.37 for the ordinary least squares case. The values of the coefficient b are lower for each period respectively using the Cochran-Orcutt method. Note that the two periods 1960 I - 1972 IV and 1973 I - 1979 IV are comparable to two of the four periods of Table 1, while the remaining two periods in Table 2 are shorter than the equivalent ones in Table 1. The adjustments in these periods are made to justify our use of a 3.5% trend line growth through middle of 1955. We have also run, but are not reporting, estimates of b using both stated methods for potential GNP growing at 4% and 4.5%. In most cases the estimated values of the coefficient b were higher when potential GNP was assumed to grow at 4% or 4.5% than 3.5%, as expected. Higher rates of growth of potential GNP imply higher quantities of foregone output per rate of unemployment and therefore higher foregone real GNP.

The same model of equation (2) with the full employment unemployment rate being defined as 5% instead of 4% has been estimated to eliminate the question of whether the full employment unemployment rate has increased over time. The computations were based on alternative rates of growth of potential GNP of 3.5%, 4.0% and 4.5% and using mid-1965 real GNP as the benchmark figure for our calculations. The results, summarized in Table 3, assume a 3.5% growth in potential GNP. The resultants when potential GNP is growing at 4% and 4.5% were the same as previously discussed and have been omitted. Note that appropriate adjustments were also made in selecting the periods under study. For the various periods under study, the computations clearly indicate that changing the defined unemployment rate to 5% does not affect the values of the coefficient b. If it were true that the defined full employment unemployment rate did not increase from 4% to 5%, then the model of equation (2) with 5% instead of 4% would have yielded lower values for the coefficient b. We therefore conclude that over time there is evidence that the full employment rate of unemployment has increased.

SUMMARY

We have used two linear models, several periods and two statistical techniques, i.e., the ordinary least squares method and the Cochran-Orcutt method to study the relationship of unemployment to total economic activity. We used real GNP and potential GNP as a proxy of total economic activity.

Our results indicate some variability in the nature of the relationship between unemployment and economic activity caused by the selection of various periods. This is consistent with the findings of other researchers such as Gilbert (1973). However, the variability is not of a high magnitude to refute the practical importance of Okun's Law. What is of practical importance is our results obtained by Cochran-Orcutt method which indicate overall lower values of the coefficient b. This evidence is new and it verifies various arguments proposed by Feldstein (1978) and others to the effect that the aggregate cost of unemployment is not as high as was once believed to be. Actually, our study further hints that statistical evidence indicates that the full employment unemployment rate has increased from 4% in the sixties to about 5% in the seventies.

TABLE 2

ESTIMATES OF MODEL IN EQUATION 2 ASSUMING FULL EMPLOYMENT UNEMPLOYMENT RATE OF 4%
(3.5% TREND LINE GROWTH IN Y_p USING Y IN MID-1955 AS BENCHMARK)

	ORDINARY LEAST SQUARES[α]				COCHRAN-ORCUTT ESTIMATES[β]				
PERIOD	a	b	R^2	D.W.	a	b	$\hat{\rho}$	R^2	D.W.
1953 I - 1979 IV	-.55	-.39 (-17.62)*	.75	.20	-.71	-.32 (11.44)*	.90	.95	1.32
1953 I - 1960 IV	.089	-.37 (-11.26)*	.81	.51	.13	-.39 (-6.98)*	.75	.90	1.51*
1960 I - 1972 IV	-.61	-.31 (-15.00)*	.82	.23	-1.01	-.26 (-6.02)*	.93	.96	1.37***
1973 I - 1979 IV	-1.12	-.38 (-8.90)*	.75	.28	-.79	-.33 (5.32)*	.91	.94	.92

α t-Statistics are in parentheses.

β $\hat{\rho}$ Is the estimated autocorrelation coefficient.

* Significant at 5 percent level of significance.

** Significant at 1 percent level of significance.

*** Indeterminate range at 1 percent level of significance.

TABLE 3

ESTIMATES OF MODEL IN EQUATION 2 ASSUMING FULL EMPLOYMENT RATE OF 5%
(3.5% TREND LINE GROWTH IN Y_P USING Y in MID-1965 AS BENCHMARK)

	ORDINARY LEAST SQUARES[α]				COCHRAN-ORCUTT ESTIMATES[β]				
PERIOD	a	b	R^2	D.W.	a	b	$\hat{\rho}$	R^2	D.W.
1952 I - 1979 IV	.44	-.39 (-18.34)*	.75	.20	.25	-.32 (-11.67)*	.91	.96	1.33**
1952 I - 1968 IV	.69	-.34 (-17.33)*	.82	.36	.63	-.34 (-10.17)*	.81	.94	1.45***
1969 I - 1972 IV	.16	-.44 (-5.45)*	.68	.24	-1.15	-.22 (-3.53)*	.92	.96	1.29**
1972 IV - 1979 IV	-.25	-.37 (-9.05)*	.75	.26	.07	-.32 (-5.66)*	.91	.94	.93
1969 IV - 1979 IV	.02	-.42 (-12.87)*	.80	.26	-.39	-.28 (-6.68)*	.91	.96	.96

α t-Statistics are in parentheses.

β $\hat{\rho}$ Is the estimated autocorrelation coefficient.

* Significant at 5 percent level of significance.

** Significant at 1 percent level of significance.

*** Indeterminate range at 1 percent level of significance.

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A nationally distributed publication is edited and produced at the University of Wyoming.

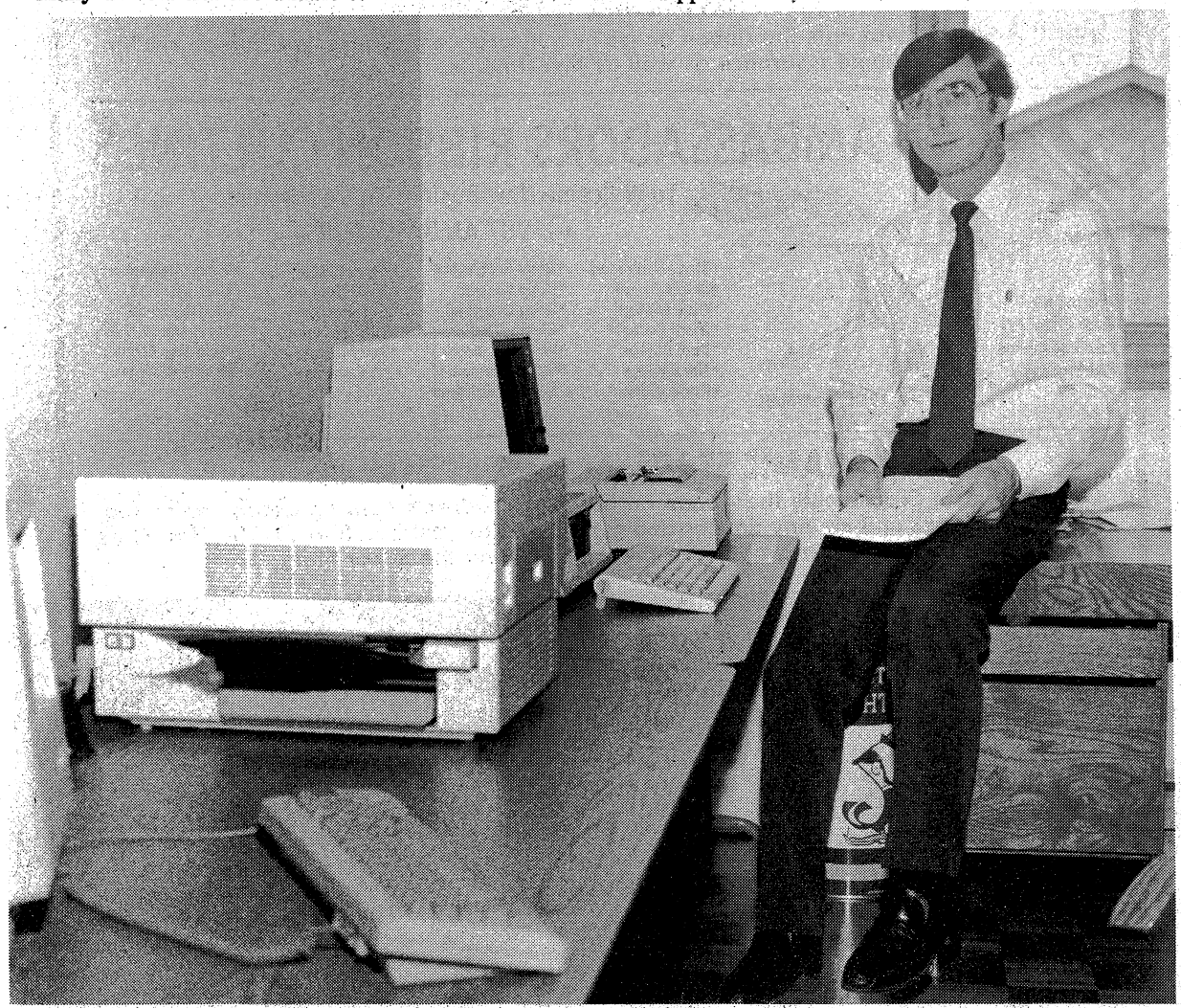
The "Journal of Applied Business Research" is edited by Ronald C. Clute, associate professor of accounting who founded the publication in 1985 while teaching at Loyola University in Chicago. He says the journal is unique because it is entirely self-supported through submission and publication fees, subscriptions and grants.

"Many universities are unable to support such journals because of fiscal constraints," Clute says. "A major purpose for establishing the publication was to develop a new funding technique to produce a journal without relying on public funds."

University faculty members in all areas of business plus several other disciplines including English, history, engineering and mathematics can publish in the journal, which is produced three times annually. The articles deal with ways that academic research can be applied in various fields.

The journal is patterned after the popular publication "Scientific American," and is "much more interesting to read than are most academic journals," Clute says, adding that the number of subscribers is increasing monthly.

Clute recently was awarded a $10,000 grant from the Apple Computer Company to promote and develop the journal. The funding is used for a computer, laser printer and related software.



NEW EQUIPMENT — Ronald C. Clute, University of Wyoming accounting professor, displays the new computer, laser printer and other equipment he uses as editor of the "Journal of Applied Business Research," a self-supported publication with subscribers throughout the United States and two foreign countries.

(UW Photo)

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