PREDICTING THE CHANGE IN THE NUMBER OF PERSONS IN POVERTY BY A REGRESSION MODEL 1/

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Introduction

The number of persons in poverty measured by the CPS series is arrived at by comparing incomes of families and unrelated individuals from the annual March supplement on the Current Population Survey to Orshansky Poverty Thresholds. Those families and unrelated individuals falling below the thresholds are considered poor, those falling above the thresholds are nonpoor. 2/ Any references to poverty that follow refer to this official measure.

Due to the large increase in poverty in 1975 the idea occurred to us to investigate the relation between the CPS poverty series and exogenously determined macroeconomic variables. Year-to-year percent changes in real GNP (Gross National Product) and the unemployment rate were thought to be the best theoretical predictors of changes in the number of poor. 3/ A regression model yielded an R^2 of .88 with highly sifnificant coefficients bearing out the implicit hypothesis that year-to-year changes in the poverty series reflect year-to-year changes in aggregate economic performance.

The Model

The general form of the equation is:

(1) Number of persons in poverty = f(real GNP, Unemployment rate)

Real GNP is an indicator of economic performance while the unemployment rate is a measure of the economy's utilization of experienced workers. It is well known that the GNP growth rate is an indicator of changes in the minimum standard of living. 4/ When the economy expands real GNP rises. As this process occurs employed workers and the marginally employable make a larger contribution to output. As the intensity of the contribution of these workers increases their incomes increase. It is thought that many of these workers come from low income families that fall in and out of poverty due to the contribution these workers make to their incomes. When a families' standard of living rises, they come out of poverty; when the standard falls they go into poverty. Approximately 60% of the poor had at least one family member that worked in each survey year. A higher percent of families with at least one worker is found among families that are below 125% of the poverty level. 5/

As the economy expands the unemployment rate also decreases. The affect of changes in the unemployment rate on poverty is of smaller consequence when compared to the affect of changes in real GNP on poverty. The affect is smaller because only about 9% of heads of poverty families are officially unemployed.

So we have isolated a poverty effect due to a change in aggregate economic performance. When GNP and employment go up poverty goes down. A very intuitive Keynesian result. The factor linking the two is the increased contribution of workers at the marigin who would fall in units below the poverty threshold without the rise in economic production. The effect also occurs in reverse when GNP and employment go down.

Maybe the poverty status of persons not able to work, the aged, disabled, and female heads with very young children, have possibly been constant or slowly lessened over time and therefore do not attribute much variation to year-to-year changes. Their income is dependent upon transfer payments which have a more complicated relation to economic performance. The effects on non-working poor of changes in economic performance should be the subject of another paper.

The specific form of the model is:

(2) $\#POOR = C + B\ GNP + B\ UNEMP$

where

C = constant

#POOR = percent change in the number of poor
GNP = percent change in Gross National Product in 1972 constant dollars (real GNP growth rate)
UNEMP = Annual official unemployment rate

Each year from 1959-1975 accounts for one observation. So the model for all 16 years produces a final form of the ordinary least squares regression equation:

(3) $\#POOR = -5.8443 - 1.4651\ GNP + 1.6724\ UNEMP$
$\qquad\qquad\quad (2.9) \qquad (.23) \qquad\quad (.47)$

Below the coefficients in parenthesis appear the standard errors. All coefficients are significantly different from zero at the 95 percent confidence level (within two standard errors). Table 1 is a table of standard errors, t-values, and analysis of variance. Coefficients are tested against the null hypothesis that the coefficient equals 0. Table 2 is a table of the actual values of the independent variable, estimated values, and residuals.

TABLE 1

Variable	Coefficient	Std. Error	t -value	Significance at 99% level
c(constant)	-5.8443	2.9079	-2.0098	*NS
GNP	-1.4651	.2284	-6.4136	S
UNEMP	1.6724	.4694	3.5631	S

		Analysis of Variance	DF	Sum of Squares	Mean Square	F-test	Significance at 99% level
Multiple R	.9385						
R^2	.8807						
Adjusted R^2	.8624	Regression	2	404.24	202.12	47.997	S
Std. Error	2.052	Residual	13	54.743	4.2110		

NS = not significant
S = significant
* significant at the 90% level

TABLE 2

Percent Change in the Number of Persons in Poverty

Period	Actual Percentage Change	Estimated Percentage Change	Residual
1959-60	1.0	- .02	1.02
1960-61	- .6	1.70	-2.30
1961-62	-2.5	-5.14	2.64
1962-63	-5.7	-2.17	-3.53
1963-64	-1.1	-4.91	3.81
1964-65	-8.0	-6.96	-1.04
1965-66	-9.1	-8.28	- .82
1966-67	-2.6	-3.44	.84
1967-68	-8.6	-6.27	-2.33
1968-69	-4.3	-3.80	- .50
1969-70	5.1	2.79	2.31
1970-71	.3	- .37	.67
1971-72	-4.5	-4.83	.33
1972-73	-6.1	-5.71	- .39
1973-74	5.6	6.01	- .41
1974-75	10.7	11.01	- .31

Limitations of the Model

Two known sources contribute to the model's limitations. Both sources are due to the nature of the CPS survey data. In the first case, the C. V.[6] dropped steadily from 1.85% in 1959 to 1.32% between 1966-75. The marked change in the C.V. was due to an expansion of the sample in 1967 (1966 data) from 33,000 in 1966 to 48,000 households in 1967. The sample became 45,000 households in 1971. Thus, the standard error varies from one year to the next.

The second source is a function of the sample selected for the survey. Year-to-year overlap in the sample affects the variation in the number of poor persons estimated by the model. In the Current Population Survey (CPS), there are eight rotation groups. The groups are in the sample for four months out of the sample for eight months and back in the sample for four months in rotating order. A 50% overlap in the sample of households results. There are not necessarily a sample of the same household occupants, but 50% of the same addresses are sampled from one year to the next for each given month. A year-to-year correlation coefficient for poverty estimates results as shown below:

Years	Persons	Families
1974-1975	0.40	0.35
1971-1972	0.15	0.14
1970-1971	0.31	0.28

The positive year-to-year correlations reduce the variance of the number of poor persons estimated by the model.

Current Estimates

By using the model as a point predictor, an estimate for 1976 can be computed as an illustration. [7]

The values for the variable for 1976 are:

GNP = 6.1%
UNEMP = 7.7%
Substituting these into the equation yields:

#POOR = -1.904(%)

By multiplying and then adding that result to the number of poor in 1975 a 1976 estimate of the change in the number of poor and an estimate of the number of poor can be derived.

Chg. in the no. poor = #POOR X Actual no. of poor in 1975

= -1.904 X 25,877,000

= -492,000

Est. no. of poor 1976 = Chg. in the no. poor + Actual no. of poor

= -492,000 + 25,877,000

= 25,385,000

By using the standard error (.0205) a 95% confidence interval can be constructed around the estimates yielding:

29,000 CHG. in the no. poor -1,012,000

24,345,000 EST. no. of poor 1976 26,426,000[8]

Conclusion

The CPS poverty series follows along well in year-to-year changes with variables that measure the macroeconomic performance of the economy. This relationship bears out the well known statement that GNP growth has provided absolute increases in the U. S. minimum standard of living as evidenced through the poverty thresholds. The findings of this paper also give support to the meaningfulness of CPS income data and the Orchansky poverty measure in light of recent criticism of both. [9]

FOOTNOTES

1/ Thanks goes to Renee H. Miller who assisted in the statistical methodology and interpretation of results, but alas, all responsibility for the final draft goes to the author.

2/ See Current Population Reports, Series P-60, No. 102, Appendix A.

3/ After the research was completed, it was learned that the percent point change was used in Okun's work on the relationship between GNP and unemployment. Only further research can determine if the point change in the unemployment rate is a better predictor of poverty than the unemployment rate. For more information refer to Arthur Okun's, The Political Economy of Prosperity, W. W. Norton and Co.,New York, 1970.

4/ P. A. Samuelson, Economics, (McGraw-Hill, New York, 1973, 9th ed.), p. 80.

5/ Current Population Survey, U. S. Bureau of the Census.

6/C. V. is the coefficient of variation on the estimated number of persons in poverty. It is defined to be the standard error of the estimate divided by the estimate.

7/ A more current estimate is not available since the Bureau of the Census has not yet released 1976 actual data.

8/ All numbers are rounded to the nearest thousand to conform with Bureau of the Census convention.

9/ See The Measure of Poverty, U. S. Department of Health, Education and Welfare, April 1976;

and Poverty Status of Families Under Alternative Definitions of Income, Background Paper No. 17, Congress of the United States, Congressional Budget Office, Washington, D. C., January 13, 1977.

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