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Empirical Analysis of Poverty and Income Inequality in West Virginia

By

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Abstract

Poverty and income inequality have attracted a lot of attention in recent literature and policy discussions. Using Ordinary Least Squares and Two stage least squares and cross sectional data for all counties in West Virginia, this study examines the determinants of poverty and income inequality and possibility of simultaneous relationship between them. Findings indicate there is a weak simultaneous relationship and income inequality is declining among aged 65 and above. Education, seen as social equalizer does not provide any evidence in reducing income inequality in West Virginia but as more and more women take up headship in families, poverty and income inequality increase.

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INTRODUCTION

Poverty, whether absolute, relative or quasi-relative had been an issue in both developed and developing world regions. Whilst the magnitude and the measure might be different for the two world region, the concept is the same (Iceland 2003). World poverty line (PL) as defined by The World Bank and adopted by United Nations (UN) is \$2 a day. Any person who lives with less than \$2 a day is considered to be living in poverty. Many countries especially post industrial developed countries have thresholds much higher than The World Bank definition of poverty. United States, according to Bluestone and Harrison (2000) has high percentage of poor among the Post Industrial developed countries. In the mid 1960s United States officially adopted Orshansky's (1965, 1966) absolute poverty thresholds as part of the nationwide war on poverty declared by President Johnson. The measure which was based on Low cost food plan is three times the average household expenditure on food. The table below shows the revised thresholds as of 2006.

Persons in Family Unit	48 Contiguous States and D.C.	Alaska	Hawaii
1	\$9,800	\$12,250	\$11,270
2	\$13,200	\$16,500	\$15,180
3	\$16,600	\$20,000	\$19,090
4	\$20,000	\$25,000	\$23,000
5	\$23,400	\$29,250	\$26,910
For each additional person, add	\$3,400	\$4,250	\$3,910

Source: *Federal Register*, Vol. 71, No. 15, January 24, 2006, pp. 3848-3849.

Theoretically, there is inverse relationship between economic performance and poverty levels (Gunderson and Ziliak 2004). The period 1949-1960 saw rapid decline in both

urban and suburban poverty rates as a result of economic growth. However, the decades between 1970 and 1990 saw nationwide economic recessions and reversal of gains.

Poverty and income inequality have been identified to be inextricably linked and that the existence of one often implies the existence of the other (Burtless, and Smeeding, 2002).

West Virginia is trailed by only Mississippi in terms of poverty and economic stagnation.

West Virginia is buried in the Appalachian region and trails other states in almost all the indicators of socio economic growth and quality of life. The state has high unemployment rate, high income inequality, low quality human capital, high percentage of population on welfare and high out migration (Census 2000; Dilger and Witt, 1994). Though unemployment rate had decline from 5.3 in August 2006 to 4.0 in January 2006 according to Bureau of Labor Statistics, the economic growth slowed.

Just like the rest of the country, the availability of unskilled labor especially in the West Virginia attracted a lot of manufacturing jobs even to the rural areas and ensured economic growth between 1949 and 1969. However, the global competition coupled with structural changes in the US economy shot up the demand for skilled labor in the technology based economy. Lack of high- tech labor in West Virginia during the late 1970s and 1980s meant that not many high tech companies could locate in the state and many already there relocated. This according to Deavers and Hope (1992) resulted in higher rates of poverty unprecedented in the economic history of US and West Virginia.

The general theory had been that economic growth will lead to decline in poverty rates and may occasion decline in income inequality (Feldstein, 1999). Feldstein (1999) again posit that if economic growth leads to a rise in income inequality, Pareto principle is still upheld if nobody is made worse off though others might have benefited from the growth. Whereas there had been many studies on poverty and income inequalities in US few however had examined the possibility of simultaneous causal relationship between poverty and income inequality.

The traditional economic theories of “life cycle analysis” and “permanent-income hypothesis” are important theories that explain income and consumption patterns. However, they offer little help in explaining income inequalities. More recent theories focus on household economic behavior and decision making that influence household income and inequality. Gary Becker (1991) argued that human capital is the main determinant of adult income, which is significantly influenced by parental economic endowment and public expenditure on children. Hence, the income of parents is a determinant factor of later life income distribution and inequality. In contrast, Frank (1997) concluded that in addition to absolute incomes, relative household position in income distribution significantly affects household decision-making and inequality.

At the macro level however, skewed income distribution among population has significant impact on regional development and poverty. Alesni and Rodrik (1994) analyzed the relationship between average growth rates and a measure of inequality and

demonstrated that greater inequality in the distribution of income slows down economic growth.

This study examines the determinants of poverty measured with the proportion of households below official poverty levels and inequality measured by Gini Index in West Virginia as well as the relationship between income inequality and poverty levels. It is hypothesized that there is no relationship between poverty and income inequality.

Theoretical Models

Gini Coefficient as a Measure of Income Inequality

There are a number of approaches to measure income inequality. However, Lorenz concentration curve is widely used. The Lorenz curve measures the cumulative share of income as a function of cumulative population proportions. Gini coefficient is one measure in the family of inequality or dispersion measures that is widely used to measure income inequality in population cohorts based on the Lorenz curve. Mathematically, the Lorenz curve can be estimated as follows. Let $P(x)$ be defined as the population density function of a given income x . Then, the cumulative share of population for income less than or equal to x is given by:

$$P(x) = \int_0^x p(y)dy$$

The share of total income received by this population group can be estimated as:

$$\psi(x) = (1/\mu) \int_0^x yp(y)dy$$

where the mean $\mu = \int_0^{\infty} yp(y)dy$

The Lorenz curve function runs from 0 to 1. For perfect equality of distribution, the Lorenz curve becomes the diagonal horizontal line and the associated inequality measure becomes 0. To derive the Gini coefficient from the Lorenz curve, the following computation can be used:

$$G = 1 - 2 \int_0^1 \psi(z) dz, \text{ where } \dots z = (P(x))$$

The 2000 data on population share of income categorized into age cohorts as well as population in each of the West Virginia 55 counties is used for the computation of the Gini coefficient.

Methodology

Ordinary least squares regression models are used to determine the levels of poverty and income inequality whilst two stage regression is used to determine the simultaneity between income inequality and poverty.

Model 1

Determinants of poverty

$$pov_t = \beta_0 + \beta_1 pci_t + \beta_2 \log(gini)_t + \beta_3 pop65_t + \beta_4 pop18_t + \beta_5 fhh_t + u \quad 1$$

Model 2

Determinants of income inequality

$$gini_t = \beta_0 + \beta_1 leduc_t + \beta_2 fhh_t + \beta_3 lpov_t + \beta_4 hhw65_t + u \quad 2$$

Model 3

Reverse Causality test

$$pov_t = \alpha_1 \log(gini)_t + \beta_0 + \beta_1 pci_t + \beta_2 hhw18_t + \beta_3 hhw65_t + \beta_4 fhh_t + \varepsilon_1 \quad 3$$

$$\log(gini)_t = \alpha_2 pov_t + \gamma_0 + \gamma_1 educ_t + \gamma_2 hhw65_t + \gamma_3 fhh_t + \gamma_4 lconstru + \varepsilon_2 \quad 4$$

Where: pov_t = population below poverty level at 2000 (% of total)

pci_t = per capita income at 2000

$gini_t$ = gini coefficient at 2000

$hhw65_t$ = households with population aged 65 and over at 2000 (% of total)

$hhw18_t$ = households with population aged 18 and below at 2000 (% of total)

fhh_t = female headed households at 2000 (% of total)

$educ_t$ = population aged 25 and above with at least 12years of education at 2000 (% of total)

$lconstru$ = log of construction employees at 2000 (% of total)

Table 1 Summary of Variables and the expected signs for models 1 and 2 OLS

		Expected Sign	
		POV	GINI
Dependent variables:			
POV_t	Poverty level		+
$GINI_t$	Gini coefficient	+	
Explanatory Variables			
PCI	Per capita income	+/-	
HHW65	Elderly aged 65+	+	+
HHW18	Minor population	+	
FHH	Female Headed Households	+	+
GINI	Gini coefficient	+	
LEDUC	% 25yr + with at least 12year educ		+
GINI	Gini coefficient	-	
LPOV	Percentage pop. Below poverty levels		-
LCONSTRU	log of construction employees		-

Table 2 Summary of Variables and expected signs for Model 3 TSLS

		Expected Sign	
		POV	LGINI
Dependent Variable			
POV	Poverty		+
GINI	Gini coefficient	+	
Explan. Var.			
PCI	Per capita income	+/-	
Lpov	poverty level		+
Lgini	income inequality	+	
HHW65	%H' Holds with elderly	+	+
HHW18	% H' Holds with minors	+	
Lconstru	Log of construction employee		+
Educ	adults 25+ with 12+ educ.		-
FHH	Female headed households (% of total)	+	+

A Cross sectional data with for all 55 counties in West Virginia for 2000 is used for this study. The data are sourced from U.S Census Bureau decennial census database and Bureau of Labor Statistics.

Results and Discussion

Determinants of poverty and income inequality

The initial OLS results for poverty model indicated the presence of heteroskedasticity it was therefore corrected using White's Heteroskedasticity Consistent Computational routine. Based on the adjusted R^2 , the OLS model explains 87% and 77% of the variations in dependent variables Poverty and Income inequality. The F-statistic is highly significant at less than 1 percent level. Ramsey's RESET test also indicates the model is correctly specified. The model results show significant relationship between the endogenous variables per capita income, Gini coefficient and poverty levels. As expected the model indicates one percent increase in per capita income will induce a corresponding 0.002 percent fall in the poverty level. This is significant at less than 1% significant level.

Table 3 Ordinary Least Squares Regression Estimates for model 1 and 2

Dependent Variables	OLS	
	POV	GINI
Explanatory Variables	Coefficient Estimates	
Constant	-13.663 (-0.979)	8.643 (0.529)
FHH	0.360 (0.828)	0.403*** (3.184)
HHW18	0.0868 (0.418)	
HHW65	-0.022 (-0.151)	-0.229*** (-3.451)
GINI	1.438*** (8.587)	
PCI	-0.0018 *** (-6.173)	
LEDUC		3.067 (0.917)
LPOV		6.852*** (7.978)
R ²	0.88	0.79
Adjusted R ²	0.87	0.77
F-statistic 72.22***		47.42***
Durbin-Watson	1.88	2.17
Ramsey's RESET F-statistic	13.24***	1.17

Note: Asterisks(***) =<99% confidence level Numbers in parenthesis are t-statistics.

Not only this, a one percent increase in income inequality will increase poverty levels by 1.44 percent. The coefficient of female headed households is not statistically significant in the poverty equation but very significant in the inequality equation. The relationship between female headed household and the income inequality is that one percent increase in number of female headed households will occasion a 0.40% increase in income inequality. This is consistent with the findings of Burtless and Smeeding, (2002) who

found that as percentage of female headed households increase poverty levels and income inequality also increase.

The coefficient for percentage of population aged 65 and above is not significant in the poverty equation but highly significant (1% significant level) in the income inequality equation. Its sign in both equations however, is not as expected and again contradicts most finding in the literature. Rather surprisingly a one percent change in households with population aged 65 and over will actually reduce inequality levels by 0.23 percent. The economic explanation here is that most “seniors” receive similar retirement income above poverty levels. Others have investments and receive additional assistance from children and well wishers. Additional increase in this population will rather serve as equalizer for income inequality.

For the proportion of households with children 18 and under, the coefficient is not significant at any level though it bears the same expected sign in the poverty equation. What this means is that the coefficient estimate is not robust enough to offer any explanation in the dependent variable. Explanatory variable (log of education) was not significant in the inequality equation though the coefficient has the same hypothesized sign. The model confirms earlier research that poverty level is correlated with income inequality (Feldstein, 1999). Poverty levels are used in the inequality equation and the result suggests a positive relationship between poverty and income inequality to the extent that one percent increase in the percentage of population below official poverty levels will increase income inequality by 6.85 percent *ceteris paribus*.

Table 4 Regression Estimates of Reverse Causality Test Between Poverty and Income Inequality

Dependent Var.	OLS		TSLS	
	POV	LGINI	POV	LGINI
Expl. Var.	Coefficients		Coefficient	
Constant	-159.89*** (-5.10)	2.9780*** (19.90)	160.95*** (-5.27)	3.125*** (18.16)
FHH	0.8907 (1.614)	0.0070** (2.167)	0.4204 (0.938)	0.0094*** (3.08)
EDUC		-0.0003 (-0.231)		0.0013 (1.037)
PCI	-0.0016*** (-6.197)		-0.0018*** (6.179)	
LGINI	54.4299*** (7.447)		55.8752*** (8.2113)	
HHW65	-0.1406 (0.170)	-0.0043*** (-2.59)	-0.5452 (-0.359)	-0.0054***
HHW18	-0.1148 (-0.568)		0.0825 (0.561)	
LPOV		0.2069*** (8.32)		0.1745*** (7.240)
Lconstru		0.0550* (1.922)		0.0678** (2.07)
R2	0.88	0.80	0.87	0.79
Adj. R2	0.87	0.78	0.86	0.77
F- Statistic	62.17***	41.37***	69.50***	46.12***
Durbin Watson	1.81	2.15	1.927	2.19
RESET F-	15.88***	0.006	8.35***	0.076

Note: Asterisks(***)=<1% significant level (**)=<5% significant (*)=<10% significant

Reverse Causality

To determine the simultaneous relationship between poverty and income inequality model three is used to estimate both the OLS and TSLS and the coefficients compared. The results of OLS and TSLS for model 3 are summarized in Table 3. The numbers in the parenthesis are T-Statistics and the asterisks beside the coefficient indicate significant level of which the null hypothesis is tested. The results of OLS/TSLS regression are shown in table 3 above. Ramsey's test again shows the models are correctly specified for the dependent variables. However, there are noted differences between the coefficient estimates of the OLS and TSLS for model 3. The coefficient for female headed households still remained insignificant in the poverty equation when OLS and TSLS are used but is significant at 90% and 5% confidence interval in the income inequality equation for both OLS and TSLS estimate respectively. One percent increase in proportion of household headed by females will induce 0.0070 and 0.0094 percent increase income inequality ceteris paribus. The sign is expected. However, the magnitude of the coefficient is lower than expected considering pay differentials among men and women in West Virginia and U.S in general. On the contrarily, after exclusive restrictions are imposed the coefficients of explanatory variables perform better in the TSLS than in the OLS. However, in terms of explaining the overall variations in the dependent variables the OLS estimate is better. For poverty and income inequality, the models explain 88 and 80 percent against 87 and 79 percent for OLS and TSLS respectively. The TSLS result also shows that a 1 percent increase in income inequality (GINI) will induce a corresponding 0.1745 percent increase in poverty levels. Education which is seen as social equalizer did not appear to be significant in both the OLS and TSLS model

estimations. The reason for this may be that there are comparable levels of education in all the 55 counties of West Virginia or variations in income inequality might be due to unobserved factors other than education. Income inequality is declining among those aged 65 and is significant in both OLS/TSLs.

Summary and conclusion

This study used cross-sectional data from US Census Bureau 2000 Decennial reports to estimate the relationship between poverty and income inequality. The results of the tests and coefficient estimates indicate a simultaneous relationship between poverty and income inequality though the strength of this relationship is not as expected. Econometric results reveal that an increase in the proportion of female-headed households will lead to an increase in the Gini coefficient (estimate of income inequality) *ceteris paribus*. An increase in per capita income will, as expected, lower the poverty levels. The results also indicate that as the proportion of the elderly increases, income inequality and poverty decrease, a reverse of what exists in most literatures. The study also explores the possibility of simultaneity between income inequality and poverty and found a relationship between them in the form: an increase in poverty increases income inequality and vice versa.

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