AN ECONOMIC ANALYSIS OF THE RELATIONSHIP OF POVERTY AND INCOME INEQUALITY IN RURAL WEST VIRGINIA[1]

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INTRODUCTION

The state of West Virginia comes second, after Mississippi, in the nation in terms of the incidence of poverty, and it lags behind the nation and the Appalachian Region for most economic indicators. High rates of poverty, a decline in per capita income, high unemployment rates, low human capital formation, and population loss (especially young college graduates) are the general features of rural life in West Virginia (Dilger and Witt, 1994). The slow or negative growth in income and employment in the state, the population out-migration, and the disappearance of rural households are both causes and effects of the persistently high rates of poverty with repercussions for the economic and social well-being of the rural population, the health of local business, and the ability of the local governments to provide basic services (Cushing and Rogers, 1996).

In the 1960s and 1970s, the availability of a low-cost, unskilled, and less educated labor force helped attract manufacturing from urban to rural areas. This seemed to have resulted in an apparent decline in rural poverty due to growth and economic vitality brought about by increased employment. However, in the 1980s and 1990s, the global competition and structural changes in the U.S economy plus the rise in high-tech/new-tech industries, demanding highly educated workers, made it difficult for rural areas to attract industries requiring skilled labor force. Moreover, there has been a disproportionate coverage of urban poverty in terms of media and research studies. More federal programs targeted to alleviate poverty have been devoted to urban as compared to rural areas. The failure of the literature on poverty to adequately address rural poverty limits its scope in understanding the vitally different character and changing nature of rural poverty, and hence its value for policy makers in designing development and federal programs to serve the rural poor (Deavers and Hoppe, 1992).

Poverty is a historical fact of life in many rural areas of America, and the Appalachian Region, where the whole of West Virginia is located, is a classic example of deeply rooted poverty. Despite the economic expansion of the late 1980s, rural areas have lagged behind the rest of the nation, and poverty rates remained high (Deavers and Hoppe, 1992). This evidence suggests that many rural areas and rural poor are at a disadvantage in competing for new job and higher income opportunities, even in a growing economy. The Appalachian Regional Commission (ARC) has classified 28 percent (about 111) of the 406 Appalachian counties as distressed due to low per-capita income plus high poverty and unemployment rates (Allen Smith et al., 2000). Furthermore, there is evidence of inequality in the rural areas in general and particularly in rural Appalachia (both in terms of size distribution of household income, and government funds for poverty assistance). The causes of poverty are multifaceted and complex (Duncan, 1992). Nevertheless it has been shown that poverty is inextricably linked to the labor market, income inequalities by race and gender, welfare dependence, single-parent families, presence of pre-school children, low human capital, lack of earning ability, low annual earnings, and economic insecurity.

The structural changes in rural economies are not temporary phenomena, but a situation in which the economic bases of rural communities will be changing constantly as a response to ongoing international forces and national structural economic adjustments (Reeder, 1990). To provide public facilities and services, and to strengthen and diversify the local economy, policy makers and local leaders need to know the incidence of poverty and the nature of income distribution patterns. Understanding the characteristics of the rural poor is crucial to design specific development policies to attenuate the causes of poverty and alleviate income inequality.

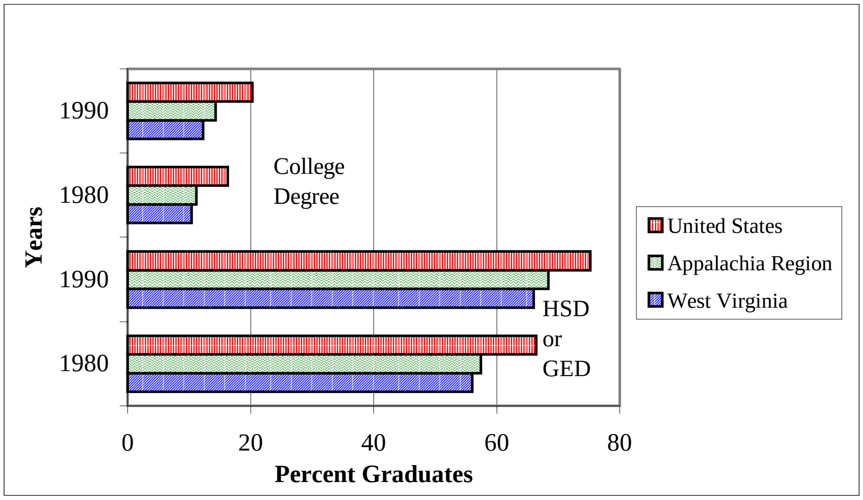
Background Information on West Virginia

West Virginia is part of the Appalachian region, which has relatively high poverty rates, high unemployment rates, and a low ratio of jobs to people (Allen-Smith et al., 2000). In West Virginia 28 counties are classified as "transitional," and 26 counties are classified as "distressed," making a total of 54 counties. Forty-three of these 54 counties are located within rural (non-metropolitan) areas (Appalachian Regional Commission, 1999).[3] The state of West Virginia does not have an "attainment" county, and only Jefferson County is considered a "competitive" county (Appalachian Regional

[3] ***Distressed*** counties are those with 1996-1998 three-year average unemployment rate of 7.4 percent or more, 1997 per capita market income of $14,164 or less, and a 1990 Census poverty rate of 19.7 percent
Attained counties are those with 1996-1998 three-year average unemployment rate of 4.9 percent or less, 1997 per capita market income of $21,141 or more, and a 1990 Census poverty rate of 13.1percent or less. ***Transitional*** are counties that are not in other class, and individual indicators vary. (ARC, 1999).

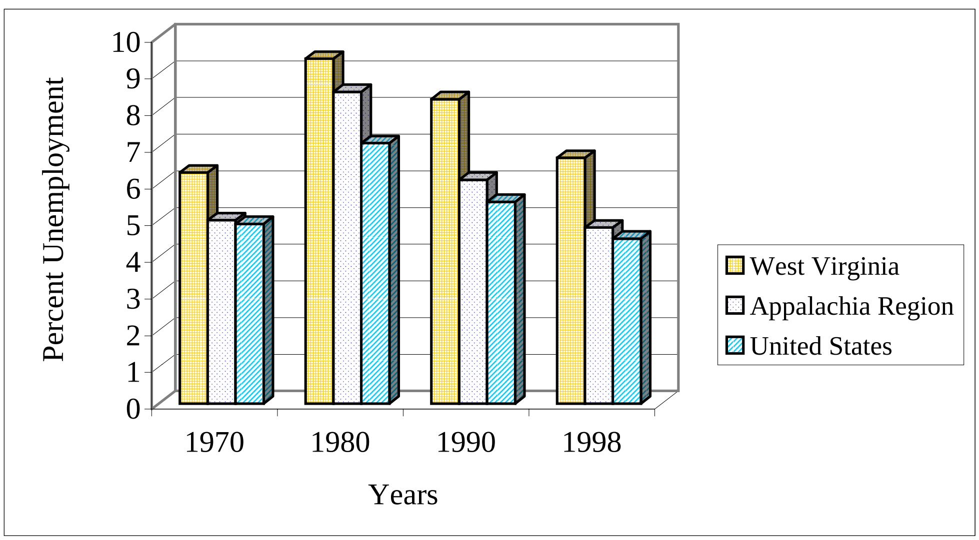
Commission, 1999)[4]. In Figure 1, West Virginia is shown to fall behind the nation and the Appalachian region in terms of educational attainment, i.e., percentage of adults of age 25 or older with high school diploma or college degree.

Figure 1 Percentage of Adults 25 Years and Over with High School Diploma and College Degree



Source: Data from Appalachian Regional Commission, 1999

Figure 2 Unemployment Rates 1970, 1980, 1990, and 1998



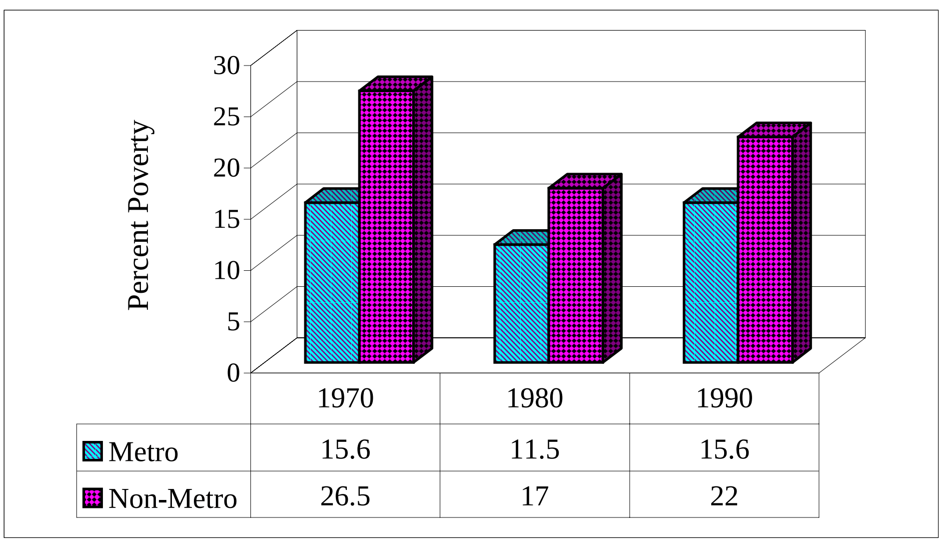
Source: Data from Appalachian Regional Commission, 1999.

[4] Competitive counties are those with 1996-1998 three-year average unemployment rate of 4.9 percent or less, 1997 per capita market income between $16,913 and $21,140, and a 1990 Census poverty rate of 13.1 percent or less (ARC, 1999).

The unemployment scenario at the beginning of the last three decades as shown in Figure 2, indicates that West Virginia not only leads the nation and the Appalachian region, but also that the unemployment rate increased considerably in the decades of 1980s and 1990s, presumably due to a decline in the demand for unskilled rural labor. Recent statistics reveal that, while West Virginia's unemployment rate has declined it is still high compared to the rest of the nation. For instance, in 1998 (Figure 2) the unemployment rate in West Virginia was 6.7 percent compared to 4.8 percent and 4.5 percent for the whole of Appalachia and the United States, respectively (Appalachian Regional Commission, 1999).

The Appalachian Regional Commission (1999) also reports that in 1980, 17 percent of non-metropolitan West Virginia's population lived in poverty, and by 1990 the rate had increased to 22 percent, (Figure 3).

Figure 3 Poverty Rates in West Virginia, Non-Metropolitan versus

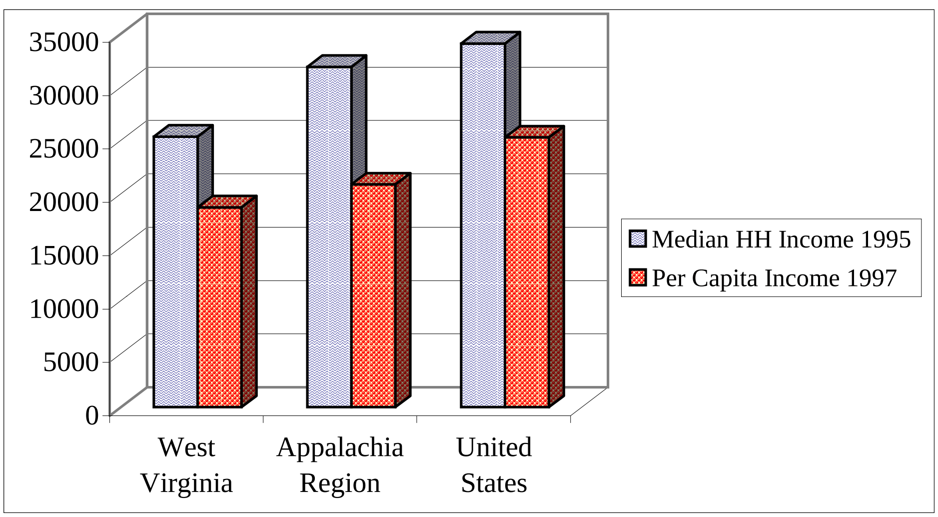


Metropolitan, 1970, 1980, and 1990.

Source: Data from Appalachian Regional Commission, 1999

In 1997, West Virginia's average per capita income was $18,724, lagging behind national and Appalachian regional averages estimated to be $25,288 and $20,872, respectively. This is consistent with household median income in 1995 (Figure 4). A study by Lozier and Smith (1994) reveals various degrees of income inequality (measured by the Gini Index) in West Virginia counties for 1979 and 1989. In 1979, the Gini Index ranged from a low of 0.352 in Putnan County to a high of 0.430 in Summers County. However, in 1989 the Gini Index ranged from a low of 0.375 in Berkeley County to a high of 0.480 in Mingo County. These figures show evidence that income inequality increased between the two periods. Ngarambe, Goetz, and Debertin, (1998) found that there is a positive relationship between economic growth and income inequality, i.e., as the economy grows, income inequality increases. However, the evidence of low per capita income plus high unemployment and poverty rates among the rural counties in West Virginia do not support much the idea that the increase in income inequality is due to local economic growth.

Figure 4 Median Household Income for 1995 and Average Per Capita Income in U.S. Dollars for 1997



Source: Data from Appalachian Regional Commission, 1999.

The main objective of this paper is to analyze the relationship of poverty and income inequality in rural West Virginia, and draw relevant policy implications from the research findings.

LITERATURE REVIEW

Although attention is now given to income inequality in the United States, there are scholars who dispute the growing evidence of its contribution to high poverty incidence. Feldestein (1999) contends that not all income inequality implies the violation of the Pareto principle. He stresses that most income inequality actually satisfies the

Pareto principle. In other words, the widening gap in the income distribution due to increases in the incomes of high-income individuals without decreasing the incomes of others makes some people better off without making anyone else worse off. According to Caputo (1995), the growing evidence of income inequality is disputed in part because of controversy regarding the appropriate way to evaluate changes in distribution of income among families and workers.

Timothy Smeeding (1991) did a cross-national comparison study of inequality and poverty positions on the following countries: U.S., Australia, Canada, Netherlands, Switzerland, U.K., Israel, Germany, Norway, and Sweden. The data from Luxembourg Income Study (LIS) for the period 1979 to 1983 were used. He used three different inequality measures (Atkinson, Theil , and Gini index) of family disposable income and he adjusted disposable income by adult equivalence scale. For poverty and near poverty, different types of families were used (all persons, single person, single parent with children, couples with and without children, elderly couples and elderly singles). His study reveals that the U.S. stands first for all measures of income inequality (for both adjusted and unadjusted incomes), followed by Australia and Canada, with Norway and Sweden having the least inequality. The same findings were observed for poor and near poor, where U.S. stands first for all the family types, followed by Australia and Canada, with Sweden and Norway with the lowest incidences of poverty. Smeeding's study also revealed that single parents with children and single elderly had higher incidences of poverty and near poverty compared to other types of families.

Kwan Kim (1997) also did an interregional comparison study of income distribution and poverty for a period between 1979 and 1994. Kim's study focused on the following regions: Western Europe and North America, Eastern Europe, East Asia, sub-Sahel Africa and Latin America. In his analysis of findings on the distribution of income and poverty among developed or industrialized countries, the U.S. again emerges as the most unequal (see Table 1). Income inequality and poverty increased more during this period in the transitional economies in Central and Eastern Europe, many Latin American countries and African countries, but not in the East Asian countries. Kim summarizes that although the causes behind interregional disparities are country-specific, it could be argued that for developed countries it is due to the linkages between the changes in labor and capital markets within the domestic economy and the global economy in technology, trade and capital movement, and vice-versa.[5] Furthermore, he asserts that for many developing countries, the rise in inequality and poverty between 1979 and 1994 is due also to the downside of globalization in the context of rapidly evolving technologies, which increased the demand of better-educated and trained workers even in developing countries.

Table 1 Quintile Distributions in the OECD Nations during the 1980s

Countries	Income Share of Bottom Quintile %	The Ratio of Income Share of Bottom to the Top Quintile
France	6.3	6.48
Great Britain	5.8	6.81
Italy	6.8	6.03
Germany	6.8	5.69
Japan	8.7	4.31
United States	4.7	8.91
Average	6.5	6.14

Source: Kim, 1997 pp. 1911 (World Bank Data).

In 1996, Alain de Janvry and Elisabeth Sadoulet conducted a causal analysis study on growth, inequality, and poverty in Latin America. In their study they conducted a detailed country specific-spells analysis of growth and recession between 1970 and 1994. The causal relationship between growth rates in inequality represented by the Gini index, the rate of growth in rural poverty and the rate of growth in urban poverty were determined simultaneously. They hypothesized that the Gini is affected by urban and rural poverty growth rates and that urban poverty growth rates are affected by rural poverty growth rates, and reciprocally, through the migration rate. The Gini Coefficient affects both rural and urban poverty growth rates. The results show that when the incidence of poverty is specified (headcount ratios), poverty has a significant impact on inequality. When poverty is specified as number of poor, poverty is affected by inequality, but inequality is not affected by poverty.

Through the set of other explanatory variables, de Janvry and Sadoulet tried to find the main determinants of inequality, urban and rural poverty. They found that

[5] Vice-versa is in the sense that global economy is also linked to the domestic labor market. According to Kim (1997) the adoption of labor-saving technologies and shift in consumer demands toward technology-

economic growth was not a strong determinant of changes (increases) in inequality, but migration was (during the study period). Furthermore, the most important factors that contributed to decreasing inequality were structural characteristics of the countries, such as a higher share of agriculture in GDP, or a higher share of urban in total population, and higher initial income inequality level. For both urban and rural poverty, they found that economic growth (through GDP per capita) reduced poverty rates, but the effect was partially cancelled by the fact that growth increases inequality, which in turn increases poverty. The structural features of the countries also played an important role in determining changes in poverty. For instance, they found that countries with higher GDP per capita and higher initial levels of poverty facilitated reduction in both urban and rural poverty. The authors also tried to determine total effects of growth and found that for all periods a negative relationship between income and poverty (both urban and rural) occurred mainly during recessions.

Other important components (besides the labor market and changing demographics) that have been emerging in recent studies of income inequality and poverty are race, gender and family structure. Darity et al. (1998) used a decomposition model on racial earnings disparity and family structure during the end of Carter administration and into the Reagan and Bush administrations, and found that gender and race discrimination explain substantial portions of the gaps in earnings. They assert that, although family structure matters, racial discrimination (especially the pre-labor and labor-market treatment) was a stronger influential factor in the determination of the widening racial gaps in earnings among family heads during the shift that begun toward the end of the Carter administration and lasted into the Reagan and Bush administrations (1976-1985). The authors purport that if blacks and whites were treated equally in every aspect to the point that the coefficients in the labor force participation, family structure, and earnings equations were identical for both groups, then there would have been a convergence of black and white probabilities of female-headed families by 1985, black labor force participation would have climbed, black earnings would have increased tremendously, and earning disparities would have declined dramatically.

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intensive products away from standardized products have induced a widening wage gap between skilled and unskilled workers.

Caputo (1995) also studied the effect of race and the policies of five different administrations (Nixon, Ford, Carter, Reagan and Bush) on income inequality and family poverty. The study focused on main effects for the decades of 70s and 80s as well as race and interaction effects on several family-income dispersion and poverty measures, including the Gini index and income-poverty ratio. Multivariate and univariate ANOVAs were used in the study. Caputo's findings reveal that both black and white low-income families were worse off in the 1980s than they were in the 1970s due to different policies intended to alleviate poverty. Furthermore, the gap between high and low-income black families, which widened considerably in the 1970s, widened even further in the 1980s compared with their white counterparts (Caputo, 1995). In other words, low-income black families were pushed further into poverty by having less income in 1980s compared with other groups (high and low-income white households and high-income black households).

At the regional level Ngarambe, Goetz, and Debertin (1998) examined joint determinants of U.S. Southern county-level income growth and income inequality using Gini coefficients for decades of the 1970s and 1980s. The study tested for reverse causality between income growth and income inequality (endogenous variables), using two-stage least squares regression. Among the list of explanatory variables for the structural model, were variables such as educational attainment, earnings from the industrial mix per county, wage, minority, and female-headed households. Their results reveal a positive relationship between family income growth and income inequality in the 1980s, while in 1970s it is not statistically significant (below 10 percent level) in explaining income inequality. Furthermore, their results confirm the evidence of an increased income inequality in the 1980s, and a positive relationship between the racial factor and income inequality primarily due to job discrimination and limited economic opportunities, as reported by other studies.

Robert Lerman (1996) used shift-share analysis and Gini decomposition methods to study the impact of the changing U.S. family structure on child poverty and income inequality. Basically Lerman wanted to examine what would have happened if the existing unmarried mothers had married the pool of unmarried men and if both men and women had changed their earnings patterns in response to their new family and income situations. The Gini decomposition served to capture the inequality within groups and between groups, and the stratification terms. Then new poverty rates for each group (black and white) were projected based on the new family structure.

Lerman's study reveals that family structure changes were of foremost importance to changes in poverty and income inequality. Lerman asserts that based on his simulated marriages and marriage-induced earnings effects, the 1971-1989 trend away from marriage among parents accounted for almost half the rise in income inequality and more than the entire increase in child poverty rates. Moreover, he affirms that changes in family structure increased income inequality and poverty among children of both white and black groups; however, black children were affected more by the weakening ties of marriages among parents.

In the state of West Virginia, Motahar (1986) studied the relationship between alternative employment mixes and income distribution patterns in the counties for 1970 and 1980. He found that service-producing industries create more than 60 percent of total employment in the state, and the highest percentage increase in employment in the service-producing industries over the decade was in the finance, insurance and real estate sector. Based on industries that generated highest percentage of total employment, Motahar identified five different types of counties: mining, non-durable goods manufacturing, durable goods manufacturing, retail trade, and professional services. The findings reveal that manufacturing counties had the least income inequality among the five county types, and professional services counties had the highest income inequality. Moreover, it was found that the manufacturing sector as a whole tends to have an equalizing effect on income distribution.

Lozier (1993) studied the relationship between economic growth (measured as change in total personal income) and income inequality (measured by Gini index) in the counties of West Virginia for 1989. The hypothesis was that the income inequality level is a function of economic growth. However, Lozier found no evidence to support the conclusion that economic growth is a determinant of household income inequality.

METHODOLOGY

Data and Model Specification

The study relies solely on secondary sources of data from 1980 and 1990 U.S. Censuses of Population, General Social and Economic Characteristics in West Virginia; Regional Economic Information Service (REIS); Bureau of Labor Statistics, and Bureau of Business and Economic Research of WVU**.**

Cross-sectional data for 38 rural counties of West Virginia for 1980 and 1990 were used. A two-stage least square regression model was used to estimate the simultaneity between annual rates of change in poverty and income inequality, and ordinary least square regressions are used to determine the levels of poverty and income inequality.

Model 1: Reverse Causality Test

Equation (1)

$$\Delta POV_{c,\Delta t} = \alpha_0 + \gamma_1 \ln POV_{ct} + \gamma_2 \Delta GINI_{c,\Delta t} + \phi_1 \ln PCI + \phi_2 \ln AGE \geq 65_{c,t}$$

Equation (2)

$$\Delta GINI_{c,\Delta t} = \alpha_1 + \gamma_3 GINI_{ct} + \gamma_4 \Delta POV_{c,\Delta t} + \delta_1 HCS_{c,t} + \delta_2 WELFARE_{c,t}$$
$$+ \delta_3 \ln CONS + \delta_4 \ln MANUG_{c,t} + \varepsilon_{2c,t}$$

where:

$$\Delta GINI = \ln \left({GINI_{t+10}}/{GINI_t} \right) / 10 \quad \text{and} \quad \Delta POV = \ln \left({POV_{t+10}}/{POV_t} \right) / 10$$

specified as:

$\Delta GINI$ = compounded annual rate of change in the Gini coefficient;

$GINI_t$ = the initial level of inequality in period t = 1980/1990;

ΔPOV = compounded annual rate of change in the level of poverty; and

POV_t is the initial level of poverty (in percentage) in period t = 1980/1990.

Model 2: Determinants of Poverty

$$POV_t = \beta_0 + \beta_1 WELFARE_t + \beta_2 AGE \geq 65_t + \beta_3 MINOR_t + \beta_4 \ln PCI_t + \varepsilon_t$$

Model 3: Determinants of Income Inequality

$$\ln GINI_t = \beta_0 + \beta_1 \ln FHH_t + \beta_2 \ln HCS_t + \beta_3 \ln POV_t + \beta_4 \ln AGE \geq 65_t + \varepsilon_t$$

The variable descriptions and the expected signs are depicted in Table 2 & 3.

Table 2 Summary of Variables and the Expected Signs for Model 1

		Expected Sign	
Variable	Description	*ΔGINI*	*ΔPOV*
Depend. Variables:			
ΔGINI	Compounded annual change in Gini Coefficient		+
ΔPOV	Compounded annual change in Poverty Level	+	
Explanat. Variables:			
$GINI_t$	Gini Coefficient of concentration	-	
$LnPOV_t$	*ln* of Poverty rate (% of pop. below the official poverty level)		-
$LnMANUG_t$	*ln* of Manufacturing employees (% of total)	-	
$LnCONS_t$	*ln* of Construction employees (% of total)	-	
HCS_t	Human capital stock (% adults with 12 years or more of education)	+/-	
$LnPCI_t$	*ln* of Per capita income		-
$LnAGE \geq 65_t$	Population of age 65 or older (% of total)		-
$WELFARE_t$	Population on welfare (% of total)	+	

Table 3 Summary of Variables and the Expected Signs for Models 2 &3

		Expected Sign	
Variable	Description	*lnGINI*	POV_t *or* $lnPOV_t$
Depend. Variables:			
$ln\ GINI_t$	ln of the Gini index of concentration		+
POV_t *or* $ln\ POV_t$	Poverty level (% of pop. below the official poverty level).	+	
Explanat. Variables:			
HCS_t	Human capital stock (% adults with 12 years or more of education)	+/-	
PCI_t	Per capita income	+	
$MINOR_t$	Minority population (% of total)	+	-
$FEMHH_t$	Households headed by single female (% of total)	+	+
$POP \geq 65_t$	Population of age 65 or older (% of total)	+	+
$WELFARE_t$	Population on welfare (% of total)	+	+

RESULTS AND DISCUSSION

Ordinary least square regressions (OLS) were used for models 2 and 3, which estimate the determinants of poverty and income inequality for 1980 and 1990. Model 1 tested whether there is a reverse causal relationship between poverty and income inequality, i.e., if both increases in poverty *(ΔPOV*) and income inequality *(ΔGINI*) could take place simultaneously. To test for this effect, two equations, using Two-Stage Least Squares regressions (TSLS) for 1980 and 1990 were used in model 1. Before proceeding with the TSLS, the OLS regressions and Hausman Specification Test (to test the presence of simultaneity between *ΔPOV* and *ΔGINI*) were performed for both equations.

The results of the OLS/TSLS regressions (model 1) for 1980 and 1990 are shown in the Tables 4a and 4b, respectively. The 1980 OLS estimation for the annual rate of change in poverty levels (equation 1) reveals that the estimated coefficients for the annual rate of changes in the Gini index *(ΔGINI*), the initial poverty levels, and the proportion of the population of age 65 or older are statistically significant at less than 1 percent level. The signs of the first two coefficients conform to the hypothesized expected signs. The sign of the coefficient for the proportion of the population age 65 or older is positive, which is contrary to what was originally hypothesized.[6]

The model explains 49.9 percent of the variation in the annual rate of change in poverty levels, as shown by the R^2. The F-statistic for the model was also significant at less than 1 percent level. Although the F-statistic of the model is low (8.208), the model is correctly specified according to Ramsey's RESET test F-statistic (4.79), which is lower than that of the model. The Hausman test for simultaneity resulted in statistically significant residual at less than 1 percent level, thus confirming the simultaneity between poverty *(ΔPOV*) and income inequality *(ΔGINI*). This means that the endogenous regressor *ΔGINI* is correlated with the error term; therefore, the TSLS regression would yield more efficient estimates. As shown in Table 4a, the signs and the statistical significance of the estimated coefficients remained the same, but the coefficients and the *t*-statistics changed with the TSLS. White's heteroskedasticity test revealed no presence of heteroskedasticity.

[6] The reason for the positive sign will be discussed later in this section.

Table 4a Regression Estimates of Reverse Causality Test between Poverty and Income Inequality Specified by equations 1 and 2 (Model 1), 1980

	OLS - 1980		TSLS - 1980	
Dependent Variables	*ΔPOV*	*ΔGINI*	*ΔPOV*	*ΔGINI*
Explanatory Variables	Coefficient Estimates		Coefficient Estimates	
Constant	-0.0262	0.080***	-0.0091	0.0568**
	(-0.129)	(6.179)	(-0.0429)	(2.396)
ΔPOV		0.115***		0.1624***
		(5.444)		(3.112)
ΔGINI	2.850***		2.99***	
	(4.672)		-4.75	
lnPOV	-0.034***		- 0.038***	
	(-3.157)		(-3.849)	
lnPCI	0.003		0.001	
	(0.132)		(0.0435)	
lnAGE	0.038***		0.0412***	
	(3.112)		(2.852)	
GINI		-0.174***		-0.120**
		(-5.537)		(-2.110)
HCS		-0.006***		-0.0063***
		(-3.730)		(-3.201)
WELFARE		0.004		0.0039***
		(3.497)		(2.939)
lnCONS		0.001***		0.0011
		(1.175)		(0.958)
lnMANUG		-0.003***		-0.0024***
		(-4.535)		(-2.918)
R^2	0.499	0.814	0.496	0.77
Adjusted R^2	0.438	0.779	0.435	0.72
F-statistic	8.208***	22.69***	7.98***	14.82***
Durbin-Watson	2.34	2.25		
n	38	38	38	38
Hausman estimated residual	1.813***	0.181**		
	(3.111)	(2.276)		
Ramsey's RESET F-statistics	4.79**	1.32		
White's heteroskedasticity χ^2	11.29	33.02		

Note: *** =< 1% significance level; ** = < 5% significance level; * =< 10% significance level. Numbers in parenthesis are *t*-statistics.

Table 4b Regression Estimates of Reverse Causality Test between Poverty and Income Inequality Specified by equations 1 and 2 (Model 1), 1990

	OLS - 1990		TSLS - 1990	
Dependent Variables	ΔPOV	$\Delta GINI$	ΔPOV	$\Delta GINI$
Explanatory Variables	Coefficient Estimates		Coefficient Estimates	
Constant	0.438**	0.002	0.4538**	-0.0085
	(2.437)	(0.349)	(2.351)	(-0.955)
ΔPOV		0.012		0.0313**
		(1.453)		(2.197)
ΔGINI	5.73		5.846	
	(1.637)		(1.661)	
lnPOV	-0.049***		-0.0501***	
	(-6.403)		(-5.543)	
lnPCI	-0.0467**		-0.0484**	
	(-2.430)		(-2.348)	
lnAGE	0.0626***		0.0645***	
	(6.307)		(5.462)	
GINI		-0.001		0.0208
		(-0.101)		(1.110)
HCS		-0.0005		-0.0006
		(0.825)		(-1.139)
WELFARE		0.0002		0.0003
		(0.825)		(0.765)
lnCONS		0.0001		0.0002
		(0.697)		(0.660)
lnMANUG		-0.000006		0.0003
		(-0.283)		(0.844)
R^2	0.61	0.153	0.610	-0.0026
Adjusted R^2	0.563	-0.011	0.562	-0.1966
F-statistic	12.95***	0.932	10.20***	1.147
Durbin-Watson	1.98	2.49		
n	38	38	38	38
Hausman estimated residual	-8.111	-0.0022		
	(-0.798)	(0.1095)		
Ramsey's RESET F-statistics	2.13	5.02**		
White's heteroskedasticity χ^2	4.47	12.3		

Note: *** =< 1% significance level; ** = < 5% significance level; * =< 10% significance level. Numbers in parenthesis are *t*-statistics.

The TSLS results reveal that a one-percentage increase in the annual rate of change in the Gini index (income inequality) increased the annual rate of change in poverty levels by 2.99 percent. A one-percentage increase in the initial poverty level decreased the annual rate of change in poverty levels *(ΔPOV)* by 0.038 percent. Moreover, as the proportion of the population age 65 or older increased by 1 percent, the annual rate of change in poverty levels increased by 0.0412 percent. These findings imply that counties that had higher annual increases in income inequality and higher percentages of population age 65 or older, experienced higher rates of change in the annual poverty levels in 1980 compared to those with lower income inequality and less elderly populations. On the other hand, counties that had higher initial poverty levels experienced decreased annual rates of change in poverty levels.

The results for the poverty equation (model 1) for 1990 are shown in Table 4b. The estimation procedures (OLS, Hausman's test, Ramsey's RESET test, White's heteroskedasticity test, and TSLS) were used for 1990 data. The estimated residual in Hausman's test was not statistically significant, thus implying no simultaneity between poverty *(ΔPOV)* and income inequality *(ΔGINI)*. However, the TSLS coefficients were compared with the OLS estimates (Table 4b). The lack of simultaneity between *ΔPOV* and *ΔGINI* for 1990 is believed to be associated with the data used to calculate *ΔGINI* for 1990,[7] and also with the fact that annual rate of change in the Gini index is very small between 1990 and 1997.

For 1990 the initial levels of poverty and the proportion of the population of age 65 or older, exhibited the identical sign and the level of significance (at less than the 1 percent level) as it was for 1980. However, for per capita income, although it has the same sign as initially hypothesized, the coefficient for 1990 is statistically significant at below the 5 percent level, which was not the case for 1980 (see Tables 4a and 4b). The annual rate of change in the Gini index (besides the lack of simultaneity) is not statistically significant. The model explains 61 percent of the variation in the annual

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[7] The formula used to calculate *(ΔGINI)* is on page 12. Due to the lack of most current Census data on the household's income distribution for the 1990s at county level, the 1997 estimates of household's income distribution from the Bureau of Economic Analysis (BEA) was used to calculate the Gini index for 1997. Then the 1997's Gini index was used to compute *(ΔGINI)* for 1990s. These estimates had also 9 classes of

rates of change in poverty levels for 1990 and the F-statistic is significant at less than the 1 percent level. Ramsey's RESET test confirms that the model is correctly specified as shown by lower F-statistic compared to that of the model. White's test reveals no heteroskedasticity.

The results in Table 4b imply that counties that had initial poverty levels higher by 1 percent had reduced annual rates of change in poverty levels by 0.049 percent. The findings indicating that the higher initial poverty levels contributed to reduce the annual rate of change in poverty levels are consistent with the findings of de Janvry and Sadoulet (1996) in Latin America. As the proportion the population of age 65 or older increased in the counties by 1 percent, the annual rate of change in poverty levels increased by 0.0626 percent in these counties. The sign of the coefficient of the proportion of population age 65 or older was hypothesized to be negatively related to the changes in annual rate of poverty. The hypothesis was based on the belief that many elderly population are retired and, hence, would have higher retirement incomes. However, the results for both 1980 and 1990 imply that in the rural areas of West Virginia the elderly population still is not very well-to-do despite the fact that various studies report reduced poverty rates among the elderly groups (Deavers and Hoppe, 1992; Ruggles, 1991). It may also be the case that although there has been a decline in poverty rates for the elderly, their share of the total population has grown, thus impacting the annual rate of change in poverty levels. Moreover, the results are consistent with the studies of Rank and Hirschl (1999), and Smeeding (1991). In studying the likelihood of poverty across Americans' adult life span, Rank and Hirschl (1999) found that by age 65 more than half of all Americans would have experienced a year below poverty line, and by age 85 two thirds would have experienced poverty at least for a year.

Counties where the per capita income increased by 10 dollars had reduced annual rates of change in poverty levels of 0.0467 percent. If per capita income measures the economic growth of a county, this finding is also consistent with the findings of de Janvry and Sadoulet (1996) in Latin America, where increases in the GDP (representing the economic growth) decreased poverty levels.

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income range, but at different intervals than those from the Census Bureau. Therefore, this may have influenced and altered the results.

The results of the OLS for income inequality, 1980 (equation 2, model 1) are also shown in Table 4a. The model explains 77.9 percent of the variation in the annual rate of change in income inequality *(ΔGINI*) and the F-statistic is significant at less than 1 percent level. Ramsey's RESET test also confirms that the model is correctly specified given that the F-statistic of 1.32 is much lower than that of the model (22.69). White's test revealed no presence of heteroskedasticity, and the Hausman test for simultaneity confirmed the simultaneity between *ΔGINI* and *ΔPOV* at less than the 5 percent level based on the estimated residual (Table 4a). All the estimated coefficients of TSLS regression exhibited the hypothesized signs. According to the coefficient, counties that had 1 percent increase in the annual rate of change in poverty levels contributed to increased rates of change in income inequality *(ΔGINI*) by 0.1624 percent. Counties with an initial Gini index higher by 1 percent had decreased annual rates of change in income inequality of 0.12 percent. A one percent increase in the human capital stock of a county contributed to reduce the annual rate of change in income inequality by 0.0063 percent. This implies that education served to equalize economic opportunity and facilitate labor mobility as discussed by Bishop et al. (1992), and Danzigler and Gottschalk (1993). As the proportion of people on welfare in a county increased by 1 percent, the annual rate of change in income inequality increased by 0.0039 percent.

Regarding the shares of private employment by industry (construction and manufacturing), only the coefficient for the manufacturing industry was significant at less than 1 percent level. This result implies that as the employment shares in manufacturing industry increase by 1 percent in a county, the annual rate of change in income inequality decreases by 0.0024 percent. The result is consistent with the findings of Ryscavage and Henle (1990), and Motahar (1986).

The results for the 1990 income inequality (equation 2, model 1) are also shown in Table 4b. Starting with the OLS estimation, none of the estimated coefficients were statistically significant. The model poorly explains the variation in the annual rate of change in income inequality for 1990, and the Ramsey's RESET test confirms that the data does not fit the model (see the R^2 and the F-statistics in Table 4b). The Hausman test also failed to show simultaneity between income inequality *(ΔGINI*) and poverty *(ΔPOV*) for 1990. Despite the failure of simultaneity test the TSLS regression was estimated and the same poor results were observed with the exception that ΔPOV was statistically significant at less than 5 percent level.

Determinants of Poverty

The coefficients for model 2, 1980 and 1990, are shown in Table 5. For 1980, the coefficients for the proportion of the population on welfare is statistically significant at less than the 1 percent level, as expected. The coefficient for the proportion of minority population is statistically significant at less than the 10 percent level, but the sign is not as originally hypothesized and not consistent with other studies at national and regional levels. The results imply that counties where the proportion of people on welfare increased by 1 percent, poverty level also increased by 1.08 percent. On the other hand, counties where the proportion of minority population increased by 1 percent, poverty level decreased by 0.024 percent. This finding implies that the minority population in rural counties of West Virginia may be younger and perhaps with a socio-economic level better than those found in the Black belt or other pockets of poverty around the nation where there are large minority population. Moreover, in a population with a relatively low average education, the presence of a small minority group generally will not influence the poverty level very much.

Model 2 explains 97.2 percent of the variation in poverty levels in 1980, and the F-statistic is highly significant at less than 1 percent level (Table 5). Ramsey's RESET test confirms that the model is correctly specified, and the χ^2 from White's heteroskedasticity test indicates no presence of heteroskedasticity.

For 1990, the same model explains 98.8 percent of the variation in poverty levels, and the F-statistic is highly significant at less than the 1 percent. Ramsey's RESET test indicates that the model is correctly specified, but White's heteroskedasticity test indicates the presence of heteroskedasticity. Before correcting for heteroskedasticity, the coefficient estimates of the proportion of the population age 65 or older was statistically significant at less than the 5 percent level, and the coefficient for the proportion of the population on welfare was statistically significant at less than the 1 percent level. After correcting for heteroskedasticity, the coefficient estimates for the proportion of the population on welfare remained statistically significant at less than 1 percent level, while the statistical significance of the proportion of the population age 65 or older improved

Table 5 OLS Regression Estimates on Determinants of Poverty (Model 2), 1980 and 1990

	OLS - 1980	OLS - 1990	
Dependent Variable	*POV*	*POV*	
	Coefficient Estimates	Coefficient Estimates	
Explanatory Variables		Initial	Corrected for Heteroskedasticity
Constant	0.1592 (0.0891)	1.559 (1.303)	1.559 (1.224)
WELFARE	1.0811*** (16.017)	0.966*** (26.46)	0.966*** (24.79)
AGE	-0.0887 (-1.047)	0.134** (2.430)	0.134*** (2.725)
MINOR	-0.0243* (-1.776)	-0.011 (-1.211)	-0.011 (-0.947)
lnPCI	-0.0176 (-0.0849)	-0.1769 (0.130)	-0.1769 (-1.294)
R^2	0.972	0.988	0.988
Adjusted R^2	0.968	0.987	0.987
F-statistic	288.7***	713.42***	713.42***
Durbin-Watson	2.11	2.18	2.18
n	38	38	38
Ramsey's RESET F-statistcs	0.149	4.87**	
White's heteroskedasticity χ^2	6.41	13.46*	

Note: *** =< 1% significance level; ** = < 5% significance level; * =< 10% significance level.
Numbers in parenthesis are t-statistics.

from the 5 percent to 1 percent level. The results imply that when the proportion of the population on welfare increases by 1 percent, an increase of 0.966 percent in poverty levels occurs. Furthermore, counties that had an increase of 1 percent in the proportion of the population age 65 or older experienced increased poverty levels of 0.124 percent. Thus, this means that the proportion of population age 65 or older not only affects the annual rate of change in poverty levels (as previously discussed), but it also affects the actual levels of poverty.

Determinants of Income Inequality

Model 6 also estimates the determinants of income inequality using human capital stock and poverty levels, the proportion of female-headed households, and the proportion of population age 65 or older as explanatory variables (Table 6). The coefficients for human capital stock exhibited statistically significant effects on income inequality at less than the 1 and the 5 percent levels for 1980 and 1990, respectively. In this model, a one percent increase in human capital stock contributed to a decrease in income inequality by 0.126 and 0.085 percent for 1980 and 1990, respectively.

Poverty level and the proportion of population age 65 or older are statistically significant at less than the 1 and the 10 percent levels, respectively for 1990, but not for 1980 (Table 6). The estimated coefficient for the poverty levels exhibited the hypothesized positive relationship to income inequality. The coefficient on the population age 65 or older exhibited a negative relationship to income inequality, which is not the initially hypothesized sign. A possible explanation to this finding could be that rural West Virginia has a large proportion of elderly population possibly with approximately the same retirement income levels. Thus an additional increase in this population group may not shift the income distribution very much.

The model explains the variation in the dependent variable using 1990 data better than the 1980, data as can be seen by the R^2 in the Table 6. There was no heteroskedasticity in this model, and the F-statistics are statistically significant at less than the 1 percent level. Ramsey's RESET test indicated no error in the model specification.

SUMMARY AND CONCLUSIONS

The present study examined the possibilities of simultaneity between annual rates of change in poverty and income inequality (represented by the Gini index) in 38 rural counties of West Virginia. Furthermore, the study examined the determinants of poverty incidence and income inequality. Cross-sectional data for 38 rural counties of West Virginia for 1980 and 1990 were used in the study. A two-stage least squares regression was applied to estimate the simultaneity between annual rates of change in poverty and income inequality and ordinary least squares regressions were used to address the determinants of both poverty and income inequality.

Table 6 OLS Regression Estimates on Determinants of Income Inequality (Model 6), 1980 and 1990

	OLS - 1980	OLS - 1990
Dependent Variable	*lnGINI*	*lnGINI*
	Coefficient Estimates	Coefficient Estimates
Explanatory Variables		
Constant	-0.939***	-0.872***
	(-77.35)	(-122.68)
lnFHH	0.046	0.034
	(0.704)	(0.835)
lnHCS	-0.126***	-0.085**
	(-3.887)	(-2.641)
lnPOV	0.012	0.121***
	(0.508)	(9.800)
lnAGE	0.069	-0.074*
	(1.249)	(-1.681)
R^2	0.391	0.822
Adjusted R^2	0.317	0.80
F-statistic	5.30***	38.16***
Durbin-Watson	2.2	2.19
n	38	38
Ramsey's RESET F-statistcs	0.027	0.245
White's heteroskedasticity χ^2	15.7	8.53

Note: *** =< 1% significance level; ** = < 5% significance level; * =< 10% significance level. Numbers in parenthesis are *t* -statistics.

The econometric results reveal that the annual rate of change in poverty levels can take place simultaneously with the annual rate of change in income inequality, when income inequality is represented by the Gini index. Thus, a reverse casual relationship exists between poverty and income inequality. The results also revealed that initial higher levels of poverty and income inequality contributed to reduce the compounded annual rate of change in both poverty and income inequality, respectively.

Regarding the determinants of poverty and income inequality, the econometric results reveal that increases in the proportions of population on welfare, and of the population age 65 or older, contributed to increase poverty levels (measured as the proportion of people with total incomes below the official poverty line). On the other hand, increases in the level of per capita income in the counties, contributed to reduce poverty. The main factor that contributed to increase income inequality, according to the results, is poverty level of the counties. However, the proportion of human capital stock (represented by adults of age 25 or older with high school diploma and/or college degree), contributed to reduce income inequality.

Policy Implications

This study contributed a new perspective on the analysis of poverty and income inequality in the rural counties of West Virginia, by virtue of exploring the possibility of simultaneity between the two factors. The fact that the annual rates of change in poverty and income inequality can take place simultaneously helps bring awareness to local governments and policy makers of the need to design policies and strategies that could both reduce poverty and income inequality. Generally most poverty reduction strategies tend to reduce slightly the income inequality, however, the strategies to reduce income inequality do not necessarily reduce poverty. For instance, a strategy to reduce income inequality requires simultaneous interventions to promote job creation (quantity and quality) and entrepreneurship/self-employment as well as to improve equity in the opportunity of participation in these jobs through improved educational levels. There is also a need to improve the access to these new jobs by reducing gender, wage, and class discrimination[8] that exist in local labor market.

The study revealed that higher per capita income is associated with reduced poverty. The educational attainment reduced income inequality (through the equalizing effect of economic opportunity). The creation of new jobs (in quantity and quality) may motivate investment in human capital for males and females, resulting in higher educational attainment, which in turn results in higher productivity and wages and higher per capita income leading to less poverty and income inequality. There is also a need for strategies that would help upgrade workforce skills and facilitate a long-term transition of welfare recipients into the workforce, as the study reveals that this group contributes to increased levels of poverty.

[8] See Cynthia Duncan (1992).

Limitations of the Study

The limitations of this study are with respect to the data used, which are mostly from decennial censuses of 1980 and 1990. These data are extremely overused and hopelessly outdated; nevertheless, we cannot cease doing research due to a lack of adequate data, especially when it comes to a micro-level study such as counties within a state. The lack of annual data prevented the possibility of a combination of time-series and cross-section study, which could have made it possible to conduct a comparative analysis of poverty and income inequality during the recession and recovery periods.

Another limitation lies with the methodology used by the Census Bureau in determining people on poverty and also the income level estimation, which excludes in-kind income and tax obligations. This is a fallacy, which makes income a less attractive measure of income inequality; however, the lack of data on household expenditures at the county level prevented the calculation of inequality in household expenditures.

Another limitation of this study may be the possible presence of spatial dependence among the observations. The counties are close to each other and many share borders, thus the socio-economic conditions in one county may not differ very much from an immediate neighboring county. Although, the possibility of spatial dependence is acknowledged, attempts to correct that is beyond the scope of this study.

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