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Income Inequality: Impact of Inequality Measures on Crimes An Analysis of the State of New Jersey

Bertram Chukwudum Ifeanyi OKPOKWASILI[1]

ABSTRACT

This research used time-series data for the 50 year period of 1964 to 2014 to investigate the relationship between income inequalities and crimes in the state of New Jersey, United States of America. It found that income inequality had a significant relationship to all four types of crime measured – murder, forcible rape, aggravated assault and property crimes. Statistical significance would seem to depend on the model and inequality measure used. A log-log relationship existed between inequalities and all the crimes. Different inequality measures enabled different measures of significance. It also found that it was possible to come to different conclusions with respect to the relationships by using different inequality measures- the Gini and the 20/20 measures in our case.

Keywords: 20/20 measure, aggravated assault, forcible rape, inequality measures, Gini coefficients.
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1.0 INTRODUCTION AND PRIOR LITERATURE

1.1 INTRODUCTION

The publication of the Spirit Level in 2009 by two British epidemiologists[2] ignited a considerable attention to the consequences of inequality in the developed economies. Wilkinson and Picket attributed many of society's ills, such as " life expectancy, infant mortality, mental illness, obesity, homicides, teenage birth

[1] Georgian Court University. USA. Email: okpokwasilib@georgian.edu

[2] Richard Wilkinson and Kate Picket- "The Spirit Level: Why more equal societies almost always do better"

rates, imprisonment, educational failures"[3] to income inequality. This publication was very well received in Britain and all over the world. The book was however, widely criticized for statistical errors, data selection issues and misspecifications.[4] Nevertheless the implications of inequality on various aspects of health and quality of life, including mortality and crimes were unmistakable. And much research has since followed in an attempt to prove or disprove the effect of income inequality on crimes, on poverty and on other sociological issues.

Even with increased search, and more sophisticated methodologies for the relationship between income inequalities and crimes, the results still seemed inconclusive. Crime reporting, especially across the United States, is better and more uniform in the recent years because the Federal Bureau of Investigation (FBI) in the US has sought to standardize the crime reporting system across the country. This has come under a unified structure and code nationally. So the study of the relationship between inequality and crimes should not suffer from inconsistent and inaccurate crime data, especially in cross-section inter- and intra- country studies. Yet, if anything, the findings are as divergent as ever, many finding inequalities relating positively to crimes, and others showing either negative relationships or no relationships at all.

This study showed, using consistent data from one state, that the question should not be whether inequality significantly impacted one type of crime or the other. There was consistent significant relationship between inequality and all types of crimes. It depended on what inequality measure was used and the model specification. Policies should be directed toward reducing inequalities as well as implementing many other crime reducing initiatives.

Using the 20/20 (ratio of the lowest 20% to the highest 20% of income earners) and the Gini coefficient as measures of inequality, this paper found that the crime of murder had a significant negative relationship with the Gini and a positive significant relationship with the 20/20 measure. It found, in using the Gini coefficient, there was a significant and positive relationship between inequality and the crime of forcible rape. The use of 20/20 measure did not find any such significance with forcible rape.

In a log-linear model however, the 20/20 measure showed positive significance with the crime of aggravated assault, and the Gini did not show any significance. Neither of the two inequality measures had any significant relationship with property crimes. In a log-log model analyses, however, the Gini coefficient was found to significantly relate to property crimes.

1.2 SOME PRIOR LITERATURE

Studies have been on both sides of the relationship quest between inequality and crimes. Others found no relationships at all. One would ask why there was such disparity in the conclusions of the studies. We would think that possible answers to the question rest on the model used and what inequality measures were applied. In this study we use 3 different variations of the model and two inequality measures.

Rufrancos, Power, Pickett and Wilkinson (2013) compiled the methodologies and results of 17 studies of the relationship between inequality and crimes.[5] The 17 studies segmented the types of crimes used in individual research. There were altogether 37 different studies done on various types of crimes, ranging from murder and homicide to automobile thefts and pick pockets.

Of the 37 reports, 24 showed positive statistical relationships between inequality and crimes. 10 showed negative significant relationships and 3 showed no significant relationship at all. The inequality measure used, in most of the studies, was the Gini coefficient. There were one or two other measures, but the

[3] Child Poverty Insights, August 2010, Social and Economic Policy UNICEF Policy and Practice, Bill Kerry, Kate E. Picket and Richard Wilkinson. This was a set of questions questions asked of Kate Pickett and Richard Wilkinson, authors of the Spirit Level, by Bill Kerry.

[4] Milos Simic, 2012

[5] Hector Gutierrez Rufrancos, Madeleine Power, Kate Pickett and Richard Wilkinson- Income Inequality and Crime: A Review and Explanation of the Time-Series Evidence, Sociology and Criminology-Open Access, 2013.

Gini dominated. Positive relationships would mean that increases in inequality increased crime. Negative relationships meant that increases in inequality decreased crime.

6 murder/homicide crimes were studied, 4 showed significant positive relationship with inequalities, 2 showed significant negative relationships. This would seem to agree with the findings in this study, of significant negative relationships with the crime of murder.
For the 3 crime measures classified as violent, the research findings were all statistically negative relationships. Of the 3 crimes classified as property crimes, 2 had positive relationships and 1 had a negative relationship. We found, using the log-log model that only the Gini showed significant relationship with property crimes.

Adam Whitworth found significant relationship between local inequality and crimes. In a study of the English cities of London and South Yorkshire, he argued that local inequality had relevance, and that was "particularly true in acquisitive crimes such as burglary --- where local inequality best captured the economic trade-off of costs and benefits to potential burglar within any particular location, given that journeys-to-crime tend to be relatively short". Withworth went on to quote other researchers who argued that "temptation for potential offenders may be expected to be greater when deprived individuals are in daily contact with affluence."[6]

Bruce Kennedy et.al. (1998) found in the 1991-1994 time frame, using data in all 50 states of the United States, that income inequality was strongly correlated with firearm violent crime (firearm violent crime as well as other measures of social capital and lack of social trust.)[7] The Robinhood Index was used in their study.

Pablo Fajnzylber, Daniel Lederman and Norman Loaza studied inequality and violent crime for the World Bank[8]. They used the Gini coefficient and cross-country data for 39 countries every 5 years from 1965 – 1995, and 37 countries from 1970-1994. They found significant positive correlation between crime rates and inequality within and between countries.

It would seem that they found a causality relationship from inequality to crimes[9]. In essence arguing that inequality causes violent crimes. They failed to find any mechanisms through which increased inequality led to increased crimes. If they had, it would have seemed a little contradictory, given the US experience of reduced crimes and increased inequality in recent times.

George Saridakis[10] studied various types of crimes in the US from 1960 to 2000, using Time-Series analysis, and segregating the crimes into Overall Violent Crimes, Murder, Rape and Assault. He used economic variables of economic growth, income/capita, Gini coefficient of inequality, and social variables of alcohol consumption, male youth population, growth in imprisonment, to measure short term and long term relationships between inequalities and crimes on the one hand, and crimes and the other variables on the other. Saridakis found no long term relationship between the inequalities and the crimes studied. He found significant short term relationships. He concluded that even in the short term, economic variables had marginal roles in violent crime rates with the exception of murder rates. This would seem to agree with our findings that inequalities had significant but negative relationships with Murder and not with Forcible Rape and Aggravated Assaults.

The rest of the paper is structured as follows. Section 2 covers the research data and methodology, section 4 discusses the research results, and section 5 concludes the paper.

2.0 RESEARCH DATA AND METHODOLOGY

[6] Adam Whitworth (March 2013) Local Inequality and Crime, Urban Studies at 50
[7] Brice Kennedy, et.al. Social Capital, Income Inequality, and Firearm Vioent Crime, Social Science Media, Vol. 47, 1998
[8] Pablo Fajnzylber, Daniel Lederman and Norman Loayza- Inequality and Violent Crime, Journal of Law and Economics, 2002
[9] Fajnzylber, Lederman and Loayza, "Inequality and Violent Crime, Journal of Law and Economics (April 2002)
[10] Vioent Crime in the United States of America: A Time-Series Analysis Between 1960-2000, March 2004

2.1 CRIMES IN NEW JERSEY

There are two major categories of crimes reported by the New Jersey State Police. These are Violent and Property Crimes[11]. The state reporting follows the national reporting guidelines, which makes comparison between states possible and easier. This comparison facilitation is one difficulty that cross-section data from different countries pose. Violent Crimes are crimes that involve harm or injury to the person. These include murder, forcible rape and aggravated assault. Non-violent crimes are crimes without bodily injury. Property crimes are crimes against property. We evaluate the relationship between income inequality measures and these four crime elements.

- Murder is defined by the police as the unlawful killing of a human being with malice aforethought.
- Forcible Rape is defined as the carnal knowledge of a female forcibly and against her will. The police include assaults and attempts to rape in the rape data, but do not include statutory rape and other sex offenses.
- Aggravated Assault is an attempt or offer, with unlawful force to do serious injury to another
- Property Crimes include various types of robbery, car-jacking and burglary and larceny - depriving a person of their property.

The crime data came from the Uniform Crime Reporting historical data of the New Jersey State Police.

2.2 INCOME INEQUALITY DATA. THE 20/20 MEASURE AND THE GINI COEFFICIENTS

The 20/20 measure

This study uses data from 1964 through 2014 of household incomes in New Jersey, derived from the March CPS (Current Population Survey) Data of the US Bureau of the Census, stored by IPUMS (Integrated Public Use Microdata Series).

The data retrieved had to be sorted by years and in ascending family income order. For each year, we would break down the data in 5 income categories (called quintiles for 1/5 of the population), designating the income segments that would constitute the basis of our study. We would then, use Descriptive Statistics to analyze each quintile to get its mean, median, and various other statistical measures given by the Descriptive Statistics function. The 20/20 measure is derived by the ratio of the lowest mean income quintile and the highest income quantile mean. Income inequality increases as this ratio decreases, and vise-versa.

The Gini Coefficient

Gini Coefficients for New Jersey were derived from Mark Frank ("A New State –Level Panel of Income Inequality Measures over the Period 1916- 2005", 2008).This had been updated to 2012 by a later publication[12]. So it was possible to get the inequalities, other than the 20/20 measures, from this panel. The Gini is the most widely used measure of income distribution, and varies from 0 to 1. A measure of 0 indicates perfectly equitable distribution of income. A measure of 1 is the most inequitable distribution of income. The Gini coefficient is said to be most appropriate for inequalities in the middle spectrum. It may have difficulties at the top or at the bottom[13].Unfortunately income distribution in the US has hovered between .4 and .6 in the study period, and this is one of the worst in OECD countries. This has gotten worse in the last 30 years.

2.3 OTHER CONTROLLED FOR VARIABLES USED

[11] State Summary and Offense Analysis for 2013, retrieved 03-07-2016, www.njsp.org/info/ucr2013/pdf/2013_sect2.pdf
[12] Mark Frank and Sommeiller- Price Series, Annual Top Income Measures for each state 1917-2012
[13] Fernando G De Maio, 'Income inequality measures', www.jech.com, J. Epidemical Community Health 2007

We controlled for other variables such as **economic growth, state poverty rate,** and **educational attainment.** These have been shown by other researchers to have significant effect on criminal activities in inter- and intra- country studies (see Saridakis 2004, Fajnzylber et al, 2000[14]).
State GDP is calculated as the sum of GDP by state estimates prepared for 81 NAICS (North American Industry Classification System) industries[15]. For each industry, GDP by state is presented in four components:

- Compensation of employees (COMP),
- Taxes on production and imports (TOPI),
- Subsidies (SUB), and
- Gross operating surplus (GOS).

Nominal GDP is reduced to real GDP for 2009 dollar values. We calculated GDP growth as change in real GDP per capita for the years in question. Nominal New Jersey GDP figures were derived from the Bureau of Economic Analysis (2014)

Educational attainment represents the percentage of New Jersey residents with high school level of education or higher. Mark Frank calculated this percentage for the US and all the States from 1940 to 2014[16]...

Poverty Rate in New Jersey was controlled for because of the feeling, probably not justified, that poverty induced criminal activities on account of deprivation and anger against the community at large. Except in one case, the poverty rate did not seem to be statistically significant in determining criminal activities.

Other social variables such as the percentage of Black and Hispanic young men in the population, or the rate of urbanization were not controlled for. These have been shown, in other studies to have some effect on crime rates. These would be included in the error term, which was quite small in the results, as one reached 97% -98% coefficient and adjusted coefficient of determination, using lagged dependent variables. We recognize the importance of these social variables. The main objective of this paper is to assess the role of inequality on crimes.

3.0 MODELS AND ESTIMATION METHODS:

3.1 CRIMES AND INEQUALITY MODEL

We use a simple version of the Solow Model:

$$\hat{Y}i = \beta_o + \sum \beta i\, Xij + \xi ij \text{ ----------3-1}$$

Where:

$\hat{Y}i$ = New Jersey Crime Rates
βi = Coefficients
Xij = Independent variables – representing economic growth, poverty rate, the Gini coefficient, 20/20 measure and educational attainment in New Jersey
ξij = The error term

3.2 ESTIMATION METHODS

This study used the Ordinary Least Squares (OLS) regression method to evaluate the relationship between crime rates and the inequality measures over the time period 1964 to 2014. Since this was a time series estimation, one would suspect the existence of non-stationarity and unit roots issues of the

[14] In a study of "what causes violent crimes" this group found economic (growth rate, educational attainment, inequality), sociological and demographic elements as chief causes of criminal activities.
[15] Bureau of Labor statistics (2014) GDP by State Estimation Methodology
[16] Mark Frank (2015)

dependent variables. In order to check for this we use the Augmented Dickey- Fuller (ADF) approach to estimate whether or not our crime data were stationary.

The primary tool used in the study was MS Excel, and it did not have some of the requisite analytical software. So two additional Excel Add-ins were employed. One was a free add-in named Stat-tool, which helped in the calculation of various statistical tests, such the Durbin-Watson statistic for serial correlation in the variable, the Breusch-Pagan heteroskedasticity test , and the Jarque-Bera non-normality test.

The second add-in tool was not free, called NumXL, which would do the ADF test and give a report for whether the dependent data exhibited trend association which would render the OLS method inconsistent.

Since the correction for trend influence and stationarity could be accomplished by using lagged variables, such were incorporated as independent variables in the analyses. Doing this shortened the data by one year's entry. Eventually the paper ended up using data from 1964 to 2012. The ADF test results are shown in Appendix 1.

4.0 RESEARCH RESULTS

4.1 THE CRIME OF MURDER AND THE INCOME INEQUALITY MEASURES

The murder rate in New Jersey was shown (using the ADF test) to exhibit non-stationarity over the study period, and as such could render the OLS estimation unreliable. A lagged model was employed to mitigate this, and achieve at least some weak stationarity. Models 1 and 2, employed the Gini inequality measure, whereas models 3 and 4 employed the 20/20 measure.

Table 1 models 1 thru 4 demonstrate the results of the regression analyses with respect to the murder rate. Model 1 had the murder rate as the dependent variable, and the controlled for variables were economic growth, poverty rate, the Gini coefficient and the educational attainment. This model did not contain the lagged murder rate variable. Model 2 was the same as model 1, except that model 2 had the lagged murder rate variable as an additional controlled for independent variable.

Murder Rate vs. the Gini Coefficient Income Inequality Measure.

Model 1 (Table 1 below) showed statistically significant Gini coefficient. It also showed that the controlled for variables; economic growth and educational attainment, were statistically significant in determining the murder rate. The poverty rate was not significant. The Gini and the economic growth coefficients showed negative signs.

The negative relationship between the Gini and the crime of murder was surprising. So we explored the possibility of serious multicollinearity with the independent variables. The Variance Inflation Factor in the residual analysis showed close relationship between the educational variable and the Gini coefficient. The educational component was temporarily removed from the regression analysis. The Gini remained negative. Since model 1 did not use the lagged variable, it was thought to be non-stationary, and as such was discarded.

The negative coefficient which the Gini exhibited in model 1 continued in model 2, when the lagged murder variable was used.

This paper therefore showed the inequality measure of the Gini coefficient to be negatively related to murder rates. What this meant was that increases in inequality were advantageous in mitigating the crime of murder in the state. Economic growth also showed a negative relationship with the murder

crime rate. In essence increases in growth would lead to a reduction in the rate of murder, but increases in inequality would also lead to reduction in murder rate.

Table 1: OLS results for murder and forcible rape
Dependent Variables – Murder and Forcible Rape in New Jersey

	Murder				Forcible Rape			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Constant Term - β_0	12.92 (10.25)**	3.819 (2.94)**	-0.869 (-0.5185)	-2.24 (-2.287)**	59.17 (6.77)**	-10.74 (-2.92)**	-38.04 (-2.846)**	-1.391 (-0.4276)
Lagged Murder Rte-Yt-1		0.762 (8.716)**		0.798 (9.514)**				
Lagged Forcible Rape – Vt-1						1.027 (24.477)**		0.972 (29.13)**
Economic Growth - X_1	-0.131 (-2.83)**	-0.064 (-2.159)**	-0.0649 (-1.338)	-0.034 (-1.2115)	0.494 (1.54)	0.0529 (0.609)	1.0027 (2.59)**	0.044 (0.4718)
Poverty Rate - X_2	0.0068 (0.7395)	0.0071 (1.246)	0.0045 (0.4621)	0.00647 (1.1384)	-0.039 (-0.612)	-0.0276 (-1.6259)	0.074 (0.9488)	-0.02469 (1.396)
Gini Coeff - X_3	-23.99 (-5708)**	-10.02 (-3.305)**			-193.11 (-6.627)**	24.67 (2.096)**		
20/20 Ratio - X_4			0.386 (4.787)**	0.164 (3.149)**			2.3948 (3.7225)**	-0.11235 (-0.668)
Educational Attainment - X_5	9.325 (4.0247)**	5.075 (3.382)**	4.095 (2.315)**	3.06 (2.973)**	116.04 (7.223)**	-5.215 (-0.7991)	61.7667 (4.378)**	5.769 (1.5568)
R^2	47.72%	80.83%	40.29%	80.47%	57.79%	97.11%	36.35%	96.86%
Adjusted R^2	43.07%	78.65%	34.98%	78.25%	54.04%	96.78%	30.57%	96.50%
F-Statistics	10.27	37.09	7.59	36.25	15.04	295.92	6.393	271.077
Significance for F, p-value	.00054%	0000%	0.00920%	0000%	.0001	0.0000%	0.0367%	00000%
Degrees of Freedom	(4, 45)	(5, 44)	(4,45)	(5, 44)	(4, 45)	(5, 44)	(4, 45)	(5, 44)

** Significant at 95% confidence level. Critical t is 1.66, and t's are in parentheses
*** Significant at 90% level

This is not necessarily a contradiction, even though we would intuitively think that increases in inequality would be detrimental to both growth and the incidence of murder. This is in fact in accord with the findings of other researchers using state data (see George Saridakis 2004).

Many had argued that inequality in developed economies was indeed helpful to economic growth, Barro (2007) and Gerald Auten (2014)[17]. If that was the case, it would not be contradictory to recognize that increases in inequality would lead to reduction in the crime of murder.

Murder Rate vs. the 20/20 Income Inequality Measure

[17] In the Manhattan Institute Paper – E21; Economic policies for the 21st Century.

Models 3 and 4 in Table 1 reported the relationship between another inequality measure- the 20/20 quintile ratio approach- to the crime of murder in New Jersey.

This measure was applied similar to the Gini in models 1 and 2. Model 3 did not contain the lagged murder rate variable, but model 4 did. The same controlled variables were used as in models 1 and 2.

We found a statistically significant relationship between the 20/20 measure and the crime of murder. The coefficient of the 20/20 was positive. Once again, a surprising phenomenon as with the Gini. The 20/20 measure used was the ratio of the bottom quintile income mean to the top quintile. Increases in this ratio would mean lessening of inequality, and decreases would mean worsening inequality. If there was a positive relationship between the 20/20 measure and the crime rate, that would mean that better inequality measures resulted in worsening murder rates (increasing murder rates). Again if one accepted the fact that increases in inequality in the developed world would in some cases be beneficial to growth, then it would be plausible that worsening inequality would be helpful in reducing murder rates.

4.2 FORCIBLE RAPE AND INCOME INEQUALITY

Forcible Rape showed non-stationarity in all its facets, which indicated that there were trend effects in forcible rates data. So the report here is for the analysis done with the stationary model with lagged rates. The relationships between the Gini coefficient and the 20/20 measure are shown in models 6 and 8 of Table 1.

Forcible Rape (FR) and the Gini Coefficient

There was a direct and statistically significant relationship between income inequality measured by the Gini coefficient and forcible rape. A direct (positive) relationship indicates that increases in inequality in the state made for increases in forcible rape. Decreasing inequality would have the effect of reducing forcible rape.

All other things being equal, the relationship of forcible rate to the Gini coefficient is

(FR(Yt) = -10.74 + 1.027Yt-1 + 24.67Gini).

If the lagged FR is held constant, one would get

Yt + 10.74 = 25Gini. A percentage change in Gini would change FR by .04%.

Forcible Rape and the 20/20 measure of inequality.

Model 8 (in Table 1) showed no statistical significant effect of this measure of inequality on forcible rape. There was a negative relationship.

4.3 AGGRAVATED ASSAULT (AA) AND THE INEQUALITY MEASURES

Aggravated Assault and the Gini Coefficient of Inequality

Aggravated assault data exhibited non-stationarity for trend, so the lagged variable had to be incorporated in order to make the OLS results meaningful. The study, however explored the model (model 9 of Table 2) without lag and that with lag (model 10 of Table 2).

Model 9 showed a negative, but statistically significant, relationship with the Gini coefficient.

Table 2: OLS results for aggravated assault and property crimes

	Dependent Variables – Aggravated Assault and Property Crimes							
	---------- Aggravated Assault ----------				---------- Property Crimes ----------			
	Model 9	Model 10	Model 11	Model 12	Model 13	Model 14	Model 15	Model 16
Constant Term - β_0	271.4 (3.7)**	-59.525 (-2.78)**	-288.6 (-2.9)*	-17.34 (-0.712)	10867.9 (8.309)**	-641.257 (-1.12)	-4954.8 (2.61)**	-1200 (-2.73)**
Lagged Ag.A. Rte-Yt-1		0.974 (27.16)**		0.946 (28,89)**				
Lagged Pro.Crimes – Vt-1						0.9804 (24.72)**		0.964 (29.55)**
Economic Growth - X_1	2.602 (0.966)	0.232 (0.3559)	5.449 (1.896)***	0.0949 (0.1404)	1.96 (0.0407)	34.64 (2.733)**	80.686 (1.469)	36.68 (2.99)**
Poverty Rate - X_2	-.637 (-1.185)	-0.0046 (-0.0349)	-0.8037 (-1.3805)	0.0038 (0.0285)	-3.76 (-0.3919)	1.063 (0.4214)	-7.7 (-0.69)	1.29 (0.52)
Gini Coeff - X_3	-1067.3 (-4.365)**	117.459 (1.6069)			-2922 (-6.7)**	-274.998 (0.1680)		
20/20 Ration - X_4			14.416 (3.02)**	-0.5505 (-0.4591)			420.164 (4.60)**	28.58 (1.182)
Educational Attainment - X_5	913.793 (6.78)**	1.676 (0.036)	633.9 (6.049)**	59.537 (1.924)***	15245.8 (6.3384)**	1409.8 (1.672)	8015.98 (4.002)**	1754.34 (3.57)**
R^2	57.87%	97.63%	50.14%	97.50	52.91%	96.84%	36.04%	96.93%
Adjusted R^2	54.15%	97.36%	45.71%	97.22	48.72%	96.48%	30.35%	96.58%
F-Statistics	15.467	362.6	11.32	343.66	12.638	269.3	6.339	277.94
Significance for F, p-value	0000	0000	0.00019%	0.0000%	0.0000%	0.0000%	0.039%	0.0000%
Degrees of Freedom	(4, 45)	(5, 44)	(4, 45)	(5, 44)	(4, 45)	(5, 44)	(4, 45)	(5, 44)

** Significant at 95% confidence level. Critical t is 1.66, and t's are in parentheses
*** Significanct at 90% level

Model 10, however showed a positive, but statistically insignificant relationship between aggravated assault and the Gini coefficient. Since model 9 was considered unstable, model 10 would be the valid configuration. This showed no significant relationship between inequality and aggravated assault.

Aggravated Assault and the 20/20 measure of Inequality

Models 11 and 12 studied the impact of inequality, as measured by the 20/20 ratio, and aggravated assault. Just as with the Gini coefficient, the unstable model 11, showed significance while the stable model 12 showed a negative, but statistically insignificant relationship. The sign seemed correct, in that a negative relationship would mean that aggravated assault would go down as inequality decreased (increase in the 20/20 ratio).

4.4 PROPERTY CRIME AND THE INEQUALITY MEASURES OF THE GINI COEFFICIENT AND THE 20/20

The Gini coefficient and Property Crimes.

The stationarity tests showed that the data on property crimes were stationary with respect to trend. Models 13, without the lagged variable would therefore be considered stable. The lagged variable was used in model 14 of Table 2.

Model 13 showed a statistically significant, but negative relationship with property crimes. This model however exhibited serious autocorrelation problems, in that the Durbin-Watson test was almost zero (0.29 as opposed to 2 for no autocorrelation in the residuals). There was a problem of multicollinearity between the Gini and the educational attainment parameters. When the education variable was not controlled for, the R^2 and Adjusted R^2 went to single digits. Model13 was abandoned because of these statistical problems.

Model 14 showed no statistical significance for the Gini coefficient, and it showed a negative relationship.

The 20/20 inequality measure and Property Crimes

Just as with the Gini, the 20/20 did not show any statistically significant relationship with property crimes. Model 15 was disqualified because of the statistical problems of autocorrelation and multicollinearity, just as in the Gini case above. This was the only model that showed statistical significance. Model 16 with the lagged property crime variable did not show any significance for this inequality measure.

4.5 EXPLORING THE RELATIONSHIPS WITH LOG-LINEAR AND LOG-LOG MODELS

There seemed to be a slight difference in significant relationships when the dependent variables were transformed into natural logarithmic functions in a log-linear exploration, and when both the dependent and independent inequality measures were transformed for log-log analyses. The most significant observations were in the relationships with aggravated assault and property crimes. In the earlier models, Tables 2, there were no significant relationships between these two crime types and the inequality measures of Gini and 20/20. The log-log transformation changed that.

Table 3 reported the log-linear relationships between the different crimes and the two inequalities measures. **Log of the crime of murder**, reported in models 17 and 18, continued to show statistical significance with both the Gini and the 20/20 inequality measures. The Gini continued a negative but significant (at the 95% level) relationship with the murder rate.

Similarly the 20/20 measure showed significant and positive relationship with the murder rate. **Log of forcible rape,** reported in models 19 and 20**,** failed to show any significance with either the Gini or the 20/20 .The 20/20 showed significance with **the log of aggravated assault**, in model 22, which was not the case earlier in model 12 of Table 2. The Gini, though still negative, did not show significance in model 21. Neither the Gini nor the 20/20 measure showed any significance with the **log of property crimes,** models 23 and 24.

Table 4 used a log-log transformation to evaluate the relationships. The log-log relationships were significant for both murder and forcible rape with respect to the gini and the 20/20 measures, models 25,26,27 and 28.

The log of the gini was negative with respect to the log of murder, but positive with respect to the log of forcible rape.

Ln **murder** (Yt) = 4.501 – 1.098 ln Gini (X3) ---

This reflects the elasticity of murder with respect to the inequality measured by the Gini coefficient. A percent increase in the gini will reduce the murder rate by approximately 1%,

The log of the 20/20 was positive and significant with the log of murder.

in Ln murder (Yt) = -0.3829 + 0.325 Ln 20/20 (X4).

Table 3: OLS Results For Ln of Various Crimes in New Jersey
Dependent Variables – The Natural Log of Various Crimes in New Jersey
Ln Murder Rate(MR) Ln Forcible Rape (FR) Ln Aggrvt Assault (AS) Ln Propty Crime(PC)

	Model 17	Model 18	Model 19	Model 20	Model 21	Model 22	Model 23	Model 24
Constant Term - β_0	1.26 (4.94)**	0.2425 (1.507)	1.331 (6.008)**	1.51 (11.27)**	4.04 (31.78)**	3.610 (36.84)**	6.59 (35.5)**	6.77 (64.56)**
Lagged (MR)-Yt-1	0.1574 (9.167)**	0.171 (10.43)**						
Lagged (FR) – (Y_2t-1)			0.052 (20.39)**	0.0478 (26.46)**				
Lagged (AS)- (Y_3t-1)					0.0046 (21.433)**	0.00466 (26.61)**		
Lagged (PC)- (Y_4t-1)							0.0003 (23.70)**	0.00029 (28.16)**
Econ. Growth - X_1	-0.011 (-1.893)	-0.0036 (-0.6229)	-0.0022 (-0.423)	-0.0003 (-0.061)	-0003 (-0.078)	0.0022 (0.0038)	0.0129 (3.173)**	0.012 (2.957)**
Poverty Rate - X_2	0.00155 (1.397)	-0.0111 (-2.45)**	-0.0033 (-3.19)**	(-0.0082) (-2.003)**	-0.0007 (-0.8855)	-0.00776 (-2.687)**	-0.00067 (-0.828)	-0.002 (-0.623)
Gini Coeff - X_3	-2.0474 (-3.437)**		1.098 (1.546)		-0.796 (-1.834)		0.673 (1.281)	
20/20 Ratio - X_4		2.218 (2.727)**		0.928 (1.2889)		1.2704 (2.504)**		0.281 (0.469)
Educ.Attaimt - X_5	1.165 (3.95)**	0.674 (3.28)**	-0.0095 (-0.024)	0.7802 (3.886)**	1.296 (4.683)**	1.42 (7.064)**	0.1388 (0.513)	0.524 (3.365)**
R^2	81.58%	80.01%	96.06%	96.00%	97.34%	97.49%	96.33%	96.22%
Adjusted R^2	79.49%	77.74%	95.61%	95.54%	97.04%	97.21%	95.92%	95.79%
F-Statistics	38.98	35.23	214.6	211.12	321.9	342.165	231.3	223.83
Significance for F, p-value	0.0000%	0000%	0.000%	0000%	.0000%	0.0000%	0.0000%	00000%
Degrees of Freedom	(5, 44)	(5, 44)	(5,44)	(5, 44)	(5, 44)	(5, 44)	(5, 44)	(5, 44)

** Significant at 95% confidence level. Critical t is 1.66, and t's are in parentheses
*** Significant at 90% level

The constant term was not significant, so could be assumed to be 0. One percentage decrease in the 20/20 measure would reduce murder rate by 0.325%. A decrease in 20/20 would mean an increase in inequality. So this confirms what the Gini showed, that a unit increase in inequality would reduce the murder rate fractionally.

The **forcible rape** relationship, shown in models 27 and 28 would be intuitively correct. Model 27 showed that the Gini is positively and significantly related to forcible rape. If the Gini increased, forcible rape would increase, and vice-versa.

Ln. FR = -.0.3634 + 0.5746 ln Gini (X3).

The constant term is not significant. A percentage increase in the Gini would increase forcible rape by 0.57%. An increase in Gini means worsening inequality.

For the 20/20 measure (model 28), a percentage decrease in the 20/20 measure would increase forcible rape by 0.213%. A decrease in 20/20 means worsening inequality.

In the case of **aggravated assault,** model 30, only the 20/20 measure showed significance, the Gini was not significant. With respect to **property crimes**, model 31, only the Gini showed significance, the 20/20, model 32, was not significant.

Table 4: OLS Results For Log-Log Relationships (Ln Crime Rates and Ln Inequality)
Dependent Variable – The Ln Crime Rates
_Ln Murder Rate(MR) ___ Ln Forcible Rape(FR)___ Ln Aggrvd Assault(AA) __Ln Propty Crimes(PC)

	Model 25	Model 26	Model 27	Model 28	Model 29	Model 30	Model 31	Model 32
Constant Term - β_0	4.501 (3.725)**	-0.3829 (-1.2296)	-0.3634 (-0.8218)	2.394 (18.42)**	5.368 (6.588)**	3.229 (13.785)**	5.5378 (9.441)**	7.064 (44.89)
Lagged MR	0.1594 (9.342)**	0.1647 (9.836)**						
Lagged FR			0.0514 (31.79)**	0.0517 (28.41)**				
Lagged AA					0.00457 (22.116)**	0.0045 (23.267)**		
Lagged PC							0.000304 (42.69)**	0.00029 (41.21)**
Economic Growth	-.01059 (-1.83)***	-0.00574 (-1.0235)	-0.00212 (-0.4121)	-0.0057 (-1.03)	-0.0003 (-.0869)	0.0018 (0.4769)	0.0055 (2.367)**	0.00111 (1.73)***
Poverty Rate -	0.00143 (1.284)	0.00169 (1.477)	-0.0032 (-3.21)**	-0.00314 (-2.78)**	-0.0007 (-0.93)	-0.00051 (-0.68)	-0.00119 (-2.557)**	-0.00111 (-2.201)**
Ln Gini Coeff -	-1.098 (-3.331)**		0.5746 (5.22)**		-0.4454 (-1.8976)		0.4268 (2.606)**	
Ln 20/20 Ratio		0.325 (3.104)**		-0.2129 (-3.698)**		0.1857 (2.595)**		-1.41E-05 (-0.0003)
Educational Attainment -	1.199 (3.847)**	0.7575 (3.603)**			1.320 (4.708)**	1.2446 (6.548)**		0.0416 (0.3882)
R^2	81.34%	80.83%	96.10%	95.20%	97.35%	97.52%	98.77%	98.58%
Adjusted R^2	79.22%	78.66%	95.75%	94.77%	97.05%	97.23%	98.63%	98.42%
F-Statistics	38.4	37.11	277.05	222.9	323.52	345.4		611.85
Significance for F, p-value	0.0000%	0.000%	0.0000%	0.0000%	0.00%	0.000%	0.000%	0000%
Degrees of Freedom	(5, 44)	(5, 44)	(4, 45)	(4, 45)	(5, 44)	(5, 44)	(5, 44)	(5, 44)

** Significant at 95% confidence level. Critical t is 1.66, and t's are in parentheses
*** Significant at 90% level

5.0 CONCLUSION

This paper found significant relationships between the two income inequality measures used and all the four crime types measured. The finding of significance depended on the model constructs and the inequality measures used. As surmarised in table 1 below, both the Gini and the 20/20 measures had statistically significant relationships with the crime of murder. The signs of the inequalities were counter intuitive, but explainable.

This analysis showed that the crime of murder was inversely related to the Gini coefficient and positively related to the 20/20 measure. Essentially saying in both cases that inequality was helpful to the reduction of murder cases. In which case, murder rates would go down if inequality increased. This is not totally unreasonable , recognizing also that economic growth showed the same negative statistical significance to the crime of murder. One could also surmise that the murder of crime is a little more complex to interprete than the simple measure of inequality.

One could infer that economic growth reduced murder rates because it would generate the increased resources that would enable a successful fight against murder. It would enable such technological breakthroughs as DNA forensic investigation, the hiring of more police and the whole crime fighting apparatus in the society.

In finding a negative relationship with inequalities, the study is giving support to the conventional wisdom, expressed by many writers, that rich communities were safer from crimes because they had the resource where-with-al to protect themselves, and criminals would be reluctant to commit crimes where the likelihood of being caught was relatively high.

Table 6: Summary of the study findings with resgard to the relationship between income inequality and crimes in the state of New Jersey from 1964 to 2013

Crime Type	Inequality Measure	Findings	Conclusion
Murder	Gini	Significant –ve	Relationship Exists, ordinarily, in
	20/20	Significant +ve	ln-linear and ln-ln model analyses
Forcible Rape	Gini	Significant +ve	Relationship Exists, ordinarily with the Gini, then with both the
	20/20	Significance in a ln-ln model	Gini and 20/20 in ln-ln model analyses
Aggravated Assault	Gini	No significance with Gini	Ln-Linear and ln-ln Relationship
	20/20	Significance with ln-linear and ln-ln model with 20/20	Exists only with the 20/20
Property Crimes	Gini	Significance in a ln-ln model.	Relationship exists with the Gini
	20/20	No significance with 20/20	in only a ln-ln model. None with the 20/20

It also found significant relationships between the Gini coefficient measure and forcible rape on the one hand, and the 20/20 measure with the natural logarithm of aggravated assault on the other. Using a log-log model construct, the study also found significant relationship between the Gini and property crime. The 20/20 measure did not find such significance.

One would argue that using different measures of inequality could yield different results with regard to the existence or lack thereof of the relationships studied. Secondly we have demonstrated that inequality impacts all crimes. It is a question of using different inequality measures and different models.

The policy implications would be that since inequality affects all crimes in one form or the other, attempts to reduce inequality seem quite desirable. Given that the changes in crimes caused by inequality changes are rather small, resources should be better directed to other crime abatement initiatives.

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APPENDIX 1

Table 1: The Augmented Dickey-Fuller Stationarity Results

Stationarity Test For Murder rates in NJ.

Test	Stat	P-Value	C.V.	Stationary?	5.0%
ADF					
No Const	-0.2	61.4%	-2.0	FALSE	
Const-Only	-3.0	6.3%	-3.1	FALSE	
Const + Trend	-4.3	0.0%	-1.6	TRUE	
Const+Trend+Trend^2	-3.8	0.0%	-1.6	TRUE	

Stationarity Test For Forcible Rape

Test	Stat	P-Value	C.V.	Stationary?	5.0%
ADF					
No Const	-0.8	37.2%	-2.0	FALSE	
Const-Only	-1.6	51.9%	-3.1	FALSE	
Const + Trend	-1.1	13.9%	-1.6	FALSE	
Const+Trend+Trend^2	-1.0	15.2%	-1.6	FALSE	

Stationarity Test For aggravated assault

Test	Stat	P-Value	C.V.	Stationary?	5.0%
ADF					
No Const	-0.5	49.9%	-2.0	FALSE	
Const-Only	-2.0	31.9%	-3.1	FALSE	
Const + Trend	-1.4	8.4%	-1.6	FALSE	
Const+Trend+Trend^2	-3.0	0.1%	-1.6	TRUE	

Stationarity Test For Property Crimes

Test	Stat	P-Value	C.V.	Stationary?	5.0%
ADF					
No Const	-0.4	52.7%	-2.0	FALSE	
Const-Only	-1.4	60.2%	-3.1	FALSE	
Const + Trend	-2.8	0.3%	-1.6	TRUE	
Const+Trend+Trend^2	-0.9	17.8%	-1.6	FALSE	