Income Inequality and Crime: Evidence from a Dynamic Panel Data Approach

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ABSTRACT

Motivated by the inconclusive evidence from previous empirical studies on the nexus between crime and income inequality, this study investigates the effect of income inequality on crime using the dynamic panel system generalized method of moments (GMM) for the period of 1989-2012. The study also provides new evidence that sheds light on the role that institutional quality plays in moderating the relationship between income inequality and crime. The empirical results indicate that income inequality is positively associated with crime. However, better institutional quality has a negative moderating effect on the relationship between income inequality and crime. The findings of the marginal effect reveal that the effect of income inequality on crime is significant at the mean level of the institutional quality variable.

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Keywords: Income Inequality; Crime Rate; Institutional Quality

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INTRODUCTION

Violent crime degrades the quality of life and can force skilled workers to leave, while the direct impacts of victimisation, as well as the fear of crime, may impede the development of those that remain. Violent crime moreover weakens the ability of a country to promote development by destroying the trust relationship between the people and undermining democracy and confidence in the criminal justice system (UN, 2012). A high crime rate suggests an unsafe community, which brings a significant impact on society's quality of life and may discourage visitors, tourists and even investors to visit or invest in a country.

The United Nations Office on Drugs and Crime (UNODC) in 2008/2009 reported that countries such as Costa Rica, Thailand and Jamaica which had experienced a drop in GDP and increased income inequality had experienced a peak in their respective crime rates. Hence, suggesting that economic stress might be associated with the crime rate. Berker's (1968) analytical framework, suggested that engagement in crime will only take place should an individual think the returns from committing the crime were significantly better than working legally. In the context of income inequality, a feeling of unfairness may lead certain groups of individuals to seek compensation and redemption by any means, including by committing crimes. Income inequality which is caused by a higher concentration of economic wealth in the hands of a few will serve as a clear target for potential crime.

The trends in crime and criminal justice have been mixed over the last five years. The United Nations Office on Drugs and Crime (UNODC) reported in 2004, that there were approximately 7.6 cases recorded per 100,000 inhabitants for the intentional killing of a person by another (Assault/homicide). In Latin America, the crime rate increased by 12 per cent between 2000 and 2010 (UNODC, 2011), and a similar trend was expected in countries such as Syria, Egypt, Ukraine, and Thailand due to their political instability. The rise of the crime rate has removed the basic human rights of enjoying freedom and safe living space, it also portrays significant economic loss. Recent research by Delisi et al. (2010) focused on the monetary cost of the crime rate (assault/homicide), the study concluded that the average cost per murder exceeded USD17.25 million. This total monetary cost was the result of the summation of the victim's costs (tangible and intangible costs), the criminal justice costs (investigation cost, legal defence), offender productivity and the willingness to pay (amount of money that citizens would be willing to pay to prevent crimes). Thus, suggesting that violent crime is extraordinarily costly.

The United Nations Office on Drugs and Crime (UNODC) (2011) commented that the reasons that might lead to higher levels of interpersonal violence could be very complex, vary greatly within or between regions and levels of poverty. The criminal motivation theory by Agnew (1992) suggested that during a time of economic hardship, it would be more likely for an individual to commit a crime to overcome their immediate shortages due to a loss of employment, inflation, the high cost of living or a significant gap in income distribution.

Using the panel system generalized method of moments (GMM), the objective of this study was to investigate the significance of income inequality on crime rates. We also intended to examine the role of institutional quality in the income inequality – crime rate nexus. The results of this study contribute to the unresolved question regarding the significance of income distribution disparities on the crime rate, as well as providing new information on the impact of institutional quality on the crime rate. In addition, this study offers a new dynamic for policymakers in the following ways. Firstly, the constituents of the research work on the determinants of the crime rate will enable policymakers to identify the contributing factors of higher crime rates. Secondly, the inclusion of the interactive indicators of income inequality with the institutional quality variable will encourage policymakers to investigate the indirect impacts of other economic indicators on crime rates

The remainder of this paper is structured as follows: Section 2.0 reviews the existing literature concerning income inequality and crime rates. Section 3.0 presents the empirical model and explains the estimation techniques. Section 4.0 discusses the empirical results and robustness checks. Section 5.0 provides the summary and conclusions.

A REVIEW OF LITERATURE

Crime and violence are development issues for nations. High rates of crime and violence have both direct effects on human welfare in the short-run and longer-run effects on economic growth and social development (UNODC, 2007). Research in the fields of criminology and economics suggests that income distribution disparities can incite criminal activity (Brush, 2007).

Enamorado et al. (2016) utilised an instrumental variable for the Gini coefficient to examine the effect of income inequality on crime rates in Mexico's drug war. They concluded that a one-point increment in the Gini coefficient between 2007 and 2010 translated into an increase of more than 36% in the number of drug-related homicides per 100,000 inhabitants. Fajnzylber and Lederman (2002) investigated the correlation of income inequality and violent crime on 5 yearly average panel data for 39 countries over the period of 1965 to 1995. The findings of their study suggested that the crime rate and income inequality were positively associated. Hence, an increase in income inequality was likely to increase the crime rate of their investigated countries. In addition, Stucky et al. (2016) employed geocoded Uniform Crime Report data from the Indianapolis police department together with economic and demographic characteristics of the population from the American Community Survey from 2005 to 2009 to examine whether, within and between neighbourhoods, income inequality was associated with any variation in violent and property crime. They concluded that lower levels of income were associated with higher levels of violent and property crime. Within-tract income inequality was also associated with higher Uniform Crime Reports of violent and property crime.

Increased income inequality was found to unambiguously increase the burglary crime rate as suggested by Chiu and Madden (1998). Using the Lorenz curve and relative differential comparisons of income distribution, the authors also pointed out that worsening income inequality increased the number of burglaries. However, richer neighbourhoods may have lower crime rates than poorer neighbourhoods because they may have a lower relative differential of income inequality. In addition, richer neighbourhoods are also equipped with effective defence technologies against burglary. In addition, Imrohoroglu et al. (2000) applied the general equilibrium model and the Ordinary Least Squares (OLS) method on data of crimes in the USA. They concluded their analysis with three main findings. Firstly, increasing the variance of income inequality led to an increase in crime. Secondly, increasing the mean of the variance of the wage distribution or the efficiency of the apprehension technology led to greater expenditure on the police. Finally, economies with greater redistribution of income may have lower, higher or even the same crime rates depending on the characteristics of their wage distribution and police technology.

Income inequality measured by the Gini coefficient was found to have a strong and robust impact on burglary in the USA (Choe, 2008). However, income inequality was found to be strongly correlated with robbery but not significantly correlated with other crime categories including violent and property crime. Wang and Arnold (2008) used three different data sources to investigate the relationship between income inequality and crime in the USA over the period of 1965-1995. They highlighted that the income inequality index and homicide rates were found to be highly statistically significant. In addition, the relationship between the concentrated disadvantages scores in urban areas and homicide was pronounced in the high-income inequality areas after controlling for other socioeconomic variables and job accessibility.

Using a simple theoretical model and panel data from seven Columbian cities over the period of 1986 to 1998, Bourguignon et al. (2003) suggested that the majority of the crimes in Columbian cities were committed by individuals whose income per capita was below 80 per cent of the mean of the population. In addition, tertiary education was found to be significantly correlated with the crime rate. By way of contrast, urbanisation had no significant impact on the crime rates of Columbian cities. This view was supported by Demombynes and Ozler (2005) who examined the effects of inequality on property and violent crime in South Africa. They concluded that income inequality was found to be significantly correlated with property and violent crime in South Africa.

In South America, Menezes et al. (2013) analysed the correlation between homicide rates (crime) and income inequality over the period of 2008 to 2010. Using a spatial model and OLS regression in their estimations, the authors suggested that the homicide rate increased in areas with greater income inequality. In contrast, their empirical findings also suggested that there was no significant correlation between homicide, college degrees and income per capita. On the other hand, Hojman (2002) examined the role of income inequality and unemployment on the crime rate in Buenos Aires over the period of 1985 to 1997. Utilising

multi-regression analysis techniques, the author concluded that income inequality helped to explain changes in the crime rate but that unemployment was not a significant determinant of the crime rate. In Sao Paolo, Brazil, income inequality had a positive effect on pecuniary crime (Scorzafave and Soares, 2009). As highlighted in their empirical results, a percentage point increase in income inequality was likely to increase the pecuniary crime rate of Sao Paolo state by 1.46 per cent, hence suggesting that a more effective legal system was needed.

EMPIRICAL MODEL

From observation, most of the existing literature has considered institutional quality as an independent variable (additive model) to explain its correlation with the crime rate. This study, on the other hand, incorporates institutional quality as an interactive term in the multiplicative model, thus investigating the marginal effect of income inequality on the crime rate with the presence of institutional quality.

The Modernization theory (Durkheim, 1895) and the General Strain Theory (1992) suggested that the process of development and modernisation could significantly influence the trends of violent crime rates. Urbanization and sudden income growth might raise violent crime as it disrupts the traditional models of social organisation and control. The General Strain Theory on the other hand further enhanced the argument that income inequality may lead to criminal behaviour as an attempt to prevent the loss of the positively valued stimuli (Agnew, 1992). Based on the suggestions of the Modernisation Theory and the General Strain Theory, as promoted by Nuemayer (2005), the basic model of our study is as follows:

$$CMR_{it} = \alpha_0 + \beta_1 IE_{it} + \beta_2 RGDPC_{it} + \beta_3 Uem_{it} + \beta_4 Ub_{it} + \beta_5 INF_{it} + \beta_6 Edu_{it} + \varepsilon_{it} \tag{1}$$

Where CMR represents the Crime Rate, RGDPC represents the real gross domestic product per capita, IE represents income inequality (Gini coefficient), Uem represents the unemployment rate, Ub represents urbanisation and lastly, Edu represents tertiary education attainment. The subscripts i and t refer to the country and year respectively. $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \, and \, \beta_6$ are the slope parameters to be estimated and ε is the model's error term.

Due to the dynamic nature of the crime rate (Fajnzylber et al. (2002) and McCrary (2010) Equation (1) will be transformed into Equation (2) with the inclusion of a lagged dependent variable

$$CMR_{it} = \alpha_0 + \beta_1 CMR_{it-1} + \beta_2 IE_{it} + \beta_3 RGDPC_{it} + \beta_4 Uem_{it} + \beta_5 Ub_{it} + \beta_6 INF_{it} + \beta_7 Edu_{it} + \mu_i + \varepsilon_{it} \tag{2}$$

In a similar manner, North (1991) conceptualised institutions as the human-devised constraints that structure political, economic and social interaction, therefore an additional control variable was included to examine the interaction of institutions with the crime rate in the following Equation (3).

$$CMR_{it} = \alpha_0 + \beta_1 CMR_{it-1} + \beta_2 IE_{it} + \beta_3 INST_{it} + \beta_4 RGDPC_{it} + \beta_5 Uem_{it} + \beta_6 Ub_{it} + \beta_7 INF_{it} + \beta_8 Edu_{it} + \mu_i + \varepsilon_{it} \tag{3}$$

As suggested by Nuemayer (2005), the sign of β_2 was expected to be positive which indicates that income inequality is associated with a higher level of violent crime. The sign of β_3 was expected to be negative where better institutional quality tends to lower the crime rate (Nuemayer, 2003). The sign of β_4 was expected to be negative, an increase in average income tends to diminish the crime rate (Nuemayer, 2003). β_5, β_6 and β_7 were expected to carry a positive sign as higher unemployment, urbanisation and the inflation rate are associated with a higher crime rate. Lastly, the sign of β_8 was expected to be negative where a higher level of tertiary education attainment is associated with a lower crime rate (Brilli and Tonello, 2014).

With the adoption of Chong and Gradstein's (2007) observation that there was a significant correlation between income inequality and the weakness of institutions, an additional control variable was included to examine the interaction of institutions with income inequality on the crime rate, Equation (3) is thus transformed into Equation (4) (interactive equation) with the inclusion of the control variable of institutions as a constitutive term and interactive term with income inequality (Brambor et al., 2006).

Interactive equation

$$CMR_{it} = \alpha_0 + \beta_1 CMR_{it-1} + \beta_2 IE_{it} + \beta_3 INST_{it} + \beta_4(IE_{it} \times INST_{it}) + \beta_5 RGDPC_{it} + \beta_6 Uem_{it} \\ + \beta_7 Ub_{it} + \beta_8 INF_{it} + \beta_9 Edu_{it} + \mu_i + \varepsilon_{it} \tag{4}$$

Coefficient β_2 on the constitutive term (income inequality) only captures the effect of income inequality on the crime rate when institution is absent. Similarly, β_3 only captures the effect of institution on the crime rate when income inequality does not exist. It is, therefore, incorrect to say that a positive/negative and significant coefficient of β_2 and β_3, indicates that an increase in income inequality (institution) is expected to lead to an increase in the crime rate for Equation 4 (Brambor et al., 2006). Thus, β_2 and β_3 were not interpreted. On the other hand, institution as the moderator is expected to buffer the effect of income inequality on the crime rate, thus β_4 was expected to be negative or marginally positive. β_5 was expected to be negative which suggests that higher average income is associated with a lower crime rate. β_6, β_7 and β_8 were expected to carry a positive sign as higher unemployment, urbanisation and inflation rate are associated with a higher crime rate. Lastly, the sign of β_9 was expected to be negative where higher tertiary education attainment is associated with a lower crime rate (Brilli and Tonello, 2014).

Interactive Modelling

In this study, institution was introduced as an interactive term, the conditional hypothesis follows Brambor et al. (2006) who suggested that all analysis should use interactive models whenever the hypothesis intended to test is conditional in nature and the inclusion of all constitutive terms in the interaction model is required. This is because all of the parameters of interest will be estimated with bias if the coefficient on any omitted term is not equal to zero. However, constitutive terms should not be interpreted as unconditional marginal effects as they do not capture the effect of the constitutive term on Y, but the effect of X on Y when Z is zero.

Based on this interpretation, the conditional hypothesis is as follows:

H_A: *An increase in **X** is associated with an increase in **Y** when condition **Z** is met, but not when condition **Z** is absent.*

The model presented in the following equation captures the intuition of the aforesaid hypothesis.

$$Y_t = \beta_0 + \beta_1 X_t + \beta_2 Z_t + \beta_3 X_t * Z_t + \varepsilon_t \tag{5}$$

To explain the above hypothesis, if G_t is absent then:

$$Y_t = \beta_0 + \beta_1 X_t + \varepsilon_t \tag{6}$$

Thus Equation (6) explained clearly that Y_t is explained by X_r should Z_t be absent.

Friedrich (1982) indicated that the introduction of a constitutive term (additional variable X and Z in the model) in an interaction model does not increase multicollinearity with the interactive term. This is because the coefficient in the interaction model does not indicate the average effect of a variable as it would in an additive model but it indicates the effects of Z when X is absent. Thus omitting the constitutive terms will result in biased (and inconsistent) estimates of β_0, β_1 and β_3 (Green, 2003).

From Equation 5, when $Z = 0$

$$\frac{\partial y}{\partial x} = \beta_1 \tag{7}$$

Thus, β_1 captures the effects of a one unit change in X on Y when Z is absent.

With the presence of Z, where $Z = 1$ the Equation (5) can be simplified as follows,

$$Y_t = (\beta_0 + \beta_2) + (\beta_1 + \beta_3)X_t + \varepsilon_t \tag{8}$$

with the presence of Z

$$\frac{\partial y}{\partial x} = \beta_1 + \beta_3 \tag{9}$$

Thus, the unit change in X on Y when Z= 1 is represented by $\beta_1 + \beta_3$.

Brambor et al. (2005) also indicated that interpreting the constitutive terms of an interactive model as average effects is incorrect as conditional hypothesis does not explain the effect of X on Y, but the effects of X on Y when Z(Z=0) is absent or the effect of coefficient Z on Y when X is zero. Thus, it is incorrect to conclude that a positive and significant coefficient of X (or Z) indicates that an increase in X (or Z) is expected to lead to an increase in Y.

From Equation (5) – the marginal effect of X in the multiplicative interaction model will be as follows, which also further points out that the interaction model indicates the effect of a change in X on Y depends on the value of the conditioning variable Z.

$$\frac{\partial y}{\partial x} = \beta_1 + \beta_3 Z \tag{10}$$

Friedrich (1982) and Brambor et al. (2005) indicated that analysts who are interested in the marginal effect of X on Y through employing a multiplicative interaction model should calculate the standard error of $\frac{\partial y}{\partial x} = \beta_1 + \beta_3 Z$ instead of the standard errors of $\beta_0, \beta_1, \beta_3 \ and \ \beta_3$, and the standard error of interest should be as follows:

$$\hat{\sigma}_{\frac{\partial y}{\partial x}} = \sqrt{var(\widehat{\beta_1}) + Z^2 var(\widehat{\beta_3}) + 2Z cov(\widehat{\beta_1}\widehat{\beta_3})} \tag{11}$$

Estimation Method

The empirical approach utilised in this research was based on the panel data structure.
Due to the panel nature of the data and the presence of a lagged dependent variable, this study utilised the Arellano-Bond (1991) and Arellano and Bover (1995) generalized method of moments (GMM) estimator to analyse the role of income inequality on the crime rate.

The Arellano and Bond (1991) estimator uses the following moment conditions to propose a two-step GMM estimator:

$$E[y_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \ for \ s \geq 2; t = 3, \dots T \tag{12}$$
$$E[X_{i,t-s}(\varepsilon_{i,t} - \varepsilon_{i,t-1})] = 0 \ for \ s \geq 2; t = 3, \dots T \tag{13}$$

The system GMM estimator combines the moment conditions for the first difference model (Equations (12) and (13) with the levels model, and has been shown to perform in a less biased and more accurate manner especially when the series are persistent. Arellano and Bover (1995) and Blundell and Bond (1998) proposed using an additional moment condition (Equations (14) and (15)) in which the lagged differences of the dependent variables are perpendicular to levels of the disturbance.

The instruments for the regression in levels were the lagged differences of the corresponding variables under the system GMM estimator, however, the instruments for the differences were the same. The additional moment conditions for the second part of the system were as follows:

$$E[y_{i,t-s} - y_{i,t-s-1})(\lambda_i - \varepsilon_{i,t})] = 0 \ for \ s = 1 \tag{14}$$
$$E[X_{i,t-s} - X_{i,t-s-1})(\lambda_i - \varepsilon_{i,t})] = 0 \ for \ s = 1 \tag{15}$$

The moment conditions in Equations (12), (13), (14) and (15) were employed to generate consistent and efficient parameter estimates based on the GMM procedure.

Diagnostic test for the system GMM equation

The Sargan test was employed to test for over-identifying restrictions, with the null hypothesis that the instruments were valid and not correlated with the error terms. To test the Arellano-Bond test for zero

autocorrelation in the first-differenced errors, the second autocorrelation [AR (2)] test was used in the analysis. [1]

The Data

The data were grouped into five yearly averages over the period 1989-2012 and was composed of a dataset containing 55 countries.

Assault is defined by the United Nations Office on Drugs and Crime (UNODC) as a physical attack against the body of another person resulting in serious bodily injury; excluding indecent/sexual assault; threats and slapping/punching. This study utilised data of the mortality rate due to assault to represent the crime rate in this study. The data were obtained from the WHO Mortality Database (2014). To portray the trend in income distribution disparity, the Gini Coefficient which is a measure based on the Lorenz curve was utilised (Gini, 1912). Data were taken from the Standardized World Income Inequality Database (SWIID, 2015).

Furthermore, as highlighted by the Modernisation Theory (1895), the high level of urbanisation, inflation and the unemployment rate due to the process of modernisation produces psychological stress to the poor in society. The urbanisation, unemployment and inflation data were taken from the World Development Indicators 2015. Lochner and Moretti (2003) suggested that raising high school graduation rates through increases in compulsory schooling led to a significant decline in incarceration rates. As a result, tertiary education could be an important determinant of the crime rate across countries. Tertiary education attainment of the adult population age 25 is used to represent the level of educational attainment in this study, and data were drawn from Baroo and Lee (2012). Lastly, better institutional quality is associated with a better legislative system in a country. Characteristics of good institutional quality include the strength of the legal system and popular observance of the law. This implies that an increase in institutional quality will enhance the legislative system in a country and hence is likely to lead to a diminishing crime rate. Therefore, institutional quality is an important element in determining the level of the crime rate across countries. Institutional quality is measured based on the political risk rating pioneered by Knack and Keefer (1995).

Table 1 Summary statistics (N = 55)

Variable	Source	Unit of Measurement		
Crime Rate	WHO Mortality Database (2014)	Rate per 100,000		
Income inequality	SWIID	Percentile 0 -100		
Real Gross Domestic Product	World Development Indicator (WDI)	US Dollars	)	)
Institutional Quality	International Country Risk Guide (ICRG)	Index 0-12		
Education	Barro and Lee (2013)	Percentage 0-100		
Urbanisation	WDI	Percentage		
Unemployment	WDI	Percentage		
Inflation	WDI	Percentage		

Note: Argentina, Armenia, Australia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, Chile, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Ecuador, El Salvador, Finland, France, Germany, Greece, Guatemala, Hong Kong, Hungary, Ireland, Israel, Italy, Japan, Kazakhstan, South Korea, Latvia, Mexico, Netherland, New Zealand, Norway, Panama, Paraguay, Philippines, Poland, Portugal, Romania, Russia, Singapore, Slovakia, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Trinidad and Tobago, Ukraine, United Kingdom, United States, Uruguay, Venezuela.
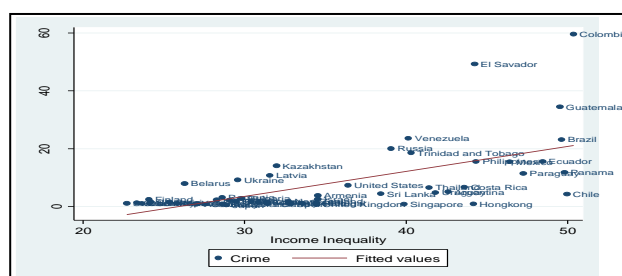

Figure 1 Income Inequality and Crime Rates (1989-2012)

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[1] The Stata command for autocorrelation test is estat abond.

EMPIRICAL RESULTS

The following section reports the results of the estimation using the dynamic GMM estimator. The investigation of the correlation between income inequality and the crime rate is presented in the following sequence. Firstly, the empirical results of the estimation followed by the robustness checks that ensure the sensitivity of the results to alternative measures of the institutional quality variable will also be included in this study.

Table 2 and Table 3 highlight the results of the estimations on Equation (3) and interactive model-Equation (4) from applying the system GMM estimator. As can be seen from Table 2, the Sargan test for overidentification fails to reject the null (p-value >0.05), thus indicating that the instrument variables are valid and highly informative. On the other hand, the coefficients obtained for the test of second-order autocorrelation [AR (2)] suggested that there was no evidence for significant second-order autocorrelation. Lastly, the coefficients of the lagged dependent variables obtained were significant at the 1 per cent significance level thus indicating that the model was dynamic in nature.

As can be seen from Table 2, the positive coefficients obtained for the income inequality variable suggests that a percentage point increase in income inequality was likely to increase the crime rate by 0.576 percentage points. This is in parallel with the General Strain Theory's argument that the feelings of disadvantage and unfairness, which may lead the poor to seek compensation and satisfaction by any means, including by committing crimes. Moreover, as predicted by the Modernisation theory, the unemployment variable was found to be significantly associated with the crime rate. The coefficient displayed suggested that a percentage point increase in unemployment tended to increase the crime rate by 0.136 percentage points. By way of contrast, the urbanisation, inflation and real GDP per capita variables were not significant determinants of the crime rate as their respective coefficients obtained failed to reject the null at the conventional significance level. Lastly, the tertiary education attainment rate and the institutional quality variable were associated with a lower crime rate. The coefficients obtained indicated that a percentage point increase in the tertiary education attainment rate and institutional quality variables were associated with 0.017 and 0.089 percentage point increases in the crime rate.

In conclusion, from the empirical results presented in Table 2, a higher level of income inequality was associated with an increase in the crime rate. This is in parallel with the General Strain Theory's argument. Secondly, the tertiary education enrolment rate was a significant determinant of the crime rate. Thirdly, as predicted by the Modernisation theory the unemployment and the inflation variables were positively associated with the crime rate but the urbanisation variable suggested otherwise. Lastly, the institutional quality variable was a significant determinant of the crime rate.

Table 2 System GMM – Income Inequality and Crime Rates

Variables	Coefficients	P-value
Crime rate	0.605***	0.000
	(0.235)	
Income Inequality	0.576*	0.097
	(0.347)	
Urbanisation	-0.135	0.526
	(0.212)	
Unemployment	0.136**	0.025
	(0.061)	
Inflation	0.045	0.299
	(0.043)	
Institutional Quality	-0.089**	0.024
	(0.039)	
Real GDP per Capita	0.099	0.231
	(0.082)	
Education	-0.017*	0.095
	(0.01)	
Intercept	-2.914**	0.038
	(1.408)	
Sargan Test	10.145	0.255
AR(1)	-1.955*	0.051
AR(2)	1.124	0.261
Observations	220	-
Number of Code	55	-

Notes: Standard errors in parentheses ( ). *, **, *** Refers to the levels of significance at 10%, 5% and 1% respectively.

Table 3 presents the results of the estimations on Equation (4) utilising the system GMM estimator. As highlighted in Equation (4), an interactive term was included in the model, which represented the conditional hypothesis in this study. The institutional quality and income inequality variables were the constitutive terms in the model and were not interpreted as unconditional marginal effects as they do not capture the effects of the constitutive term on the independent variables, but the effect of the interactive term on the dependent variable when both of the constitutive terms are present and not otherwise (Brambor et al., 2006). As a result, the marginal effect of the income inequality variable on the crime rate variable was investigated and the result of the estimations are highlighted in Table 4. From Table 3, the Sargan test for overidentification failed to reject the null (p-value >0.05), thus indicating that the instrument variables were valid and highly informative. As for the second order autocorrelation [AR (2)], the coefficients obtained failed to reject the null hypothesis at the conventional level, hence suggesting that there was no evidence of second-order autocorrelation.

As indicated in Table 3, the impact of the unemployment variable on the crime rate was found to be significant at the 10 per cent significance level. The coefficient obtained suggested that unemployment was likely to promote the crime rate, this was in parallel with the Modernisation theory's prediction. In contrast, the inflation, urbanisation and real GDP per capita variables were not significant determinants of the crime rate as their respective coefficients obtained failed to reject the null at conventional significance level. On the other hand, the tertiary education attainment rate variable was a significant determinant of the crime rate as its coefficient obtained was significant at the conventional level. The results obtained thus acknowledged Moretti's (2005) argument that increasing educational attainment might lower the probability of committing a crime. Lastly, as highlighted in Table 4, the marginal effect of income inequality on the crime rate was found to be negatively and significantly associated with the crime rate at the mean level of the institutional quality variable. Thus suggesting that income inequality had a significant marginal effect on the crime rate when the institutional quality variable was present at the mean level.

Table 3 System GMM- Interactive model – Income Inequality and Crime Rates

Variables	Coefficients	P-value
Crime rate	0.655***	0.000
	(0.229)	
Income Inequality	0.436	0.266
	(0.391)	
Urbanisation	-0.046	0.831
	(0.216)	
Unemployment	0.110*	0.061
	(0.058)	
Inflation	0.042	0.328
	(0.043)	
Institutional Quality	1.524*	0.095
	(0.914)	
Real GDP per Capita	-0.087	0.284
	(0.081)	
Education	-0.013	0.662
	(0.031)	
Income Inequality x Institutional Quality	-0.426*	0.078
	(0.242)	
Intercept	-2.606**	0.077
	(1.474)	
Sargan Test	9.412	0.309
AR(1)	1.968**	0.049
AR(2)	1.076	0.282
Observations	220	-
Number of Code	55	

Notes: Standard errors in parentheses ( ). *, **, *** Refers to the levels of significance at 10%, 5% and 1% respectively.

Table 4 Marginal Effect of Income Inequality on Crime Rates

	Principle Component of Institutional Quality	
	Coefficients	Standard Errors
Min	-2.504	2.308
Mean	-0.671*	0.408
Max	-0.423	0.396

Note: *, **, *** Refers to the levels of significance at 10%, 5% and 1% respectively. The standard errors were calculated based on Equation (10). The marginal effects were based on the results of the System GMM estimator indicated in Table 2.

Robustness Check

Table 5 presents the empirical results with an alternative source of income inequality data (source: Estimated Household Income inequality Date (EHII), University of Texas). The Sargan test for over-identification failed to reject the null (p-value > 0.05). This demonstrated that the instrumental variables were valid and highly informative. In addition, the test of second-order autocorrelation [AR (2)] suggested that there was no second-order autocorrelation. Lastly, the coefficients of the lagged dependent variables were significant at the 1 per cent level.

The findings indicated that the income inequality indicator led to an increase in the crime rate. Hence implying that income inequality leads to an increase in crime rates. In terms of other control variables, inflation, urbanisation and unemployment variable were not significant determinants of the crime rate whereas both the real GDP per capita and education were statistically significant. Lastly, the coefficient of the institutional quality variable was negative and statistically significant at the conventional level. Hence, suggesting that better institutional quality tended to lower the crime rate.

Table 5 System GMM – Robustness Check to Alternative Income Inequality Data

Variables	Coefficients	P-value
Crime rate	0.735***	0.000
	(0.057)	
Income Inequality	0.323**	0.043
	(0.162)	
Urbanisation	-0.282	0.331
	(0.216)	
Unemployment	0.067	0.562
	(0.068)	
Inflation	0.053	0.438
	(0.040)	
Institutional Quality	-0.064*	0.092
	(0.038)	
Real GDP per Capita	-0.014	0.256
	(0.068)	
Education	-0.058**	0.022
	(0.027)	
Intercept	-1.607	0.677
	(1.091)	
Sargan Test	7.752	0.458
AR(1)	-1.938*	0.053
AR(2)	1.631	0.103
Observations	220	-
Number of Code	55	

Notes: Standard errors in parentheses ( ). *, **, *** Refers to the levels of significance at 10%, 5% and 1% respectively.

CONCLUSION

The objective of this study was to investigate the impact of income inequality on the crime rate. The results contribute to the unresolved question regarding the significance of income distribution disparities on the crime rate as well as providing new information on the impact of institutional quality on crime rates. Based on the empirical evidence obtained from the system GMM estimator on panel data studies, the objective of this study has shed new light on this subject as follows:-

Firstly, the empirical evidence obtained has revealed that income inequality was positively associated with crime rates. The positive correlation obtained suggested that increased income inequality was associated with a higher crime rate. This suggested that income inequality was a significant factor that affected the crime rate. In addition, the unemployment variable was found to be positively and significantly associated with the crime rate, this suggested that an increase in the unemployment rate was likely to increase the crime rate.

Secondly, institutional quality was negatively associated with the crime rate, suggesting that an increase in institutional quality tended to decrease the crime rate. This finding suggested that better institutional quality, such as the strengthening of the rule of law, was likely to discourage criminal activities thus diminishing the crime rate. On the other hand, when the institutional quality variable was introduced as an interactive term in the model, the marginal effect of income inequality on the crime rate was found to be

significant at the mean level of the institutional quality variable. Thus, indicating that the institutional quality variable was an effective tool to combat the crime rate.

Lastly, the tertiary education attainment rate variable was significantly associated with lower crime rates. This finding suggested that higher levels of tertiary education attainment were likely to discourage criminal activities thus diminishing the crime rate.

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