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DYNAMIC ANALYSIS OF VIOLENT CRIME AND INCOME INEQUALITY IN AFRICA

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Abstract

Study provides empirical evidence on the crime-inequality nexus in Africa using a panel data of 38 countries from 2007-2012. Using the pooled ordinary least squares and difference-GMM, results reveal that inequality aggravates violent crime, rule of law has a reducing effect on violent crime, death penalty is not a deterrent factor, increase in urban population contributes to rising crime, primary education has a reducing impact, unemployment aggravates violent crime, and homicide rate is higher in Southern Africa while lower in North Africa relative to West Africa. However, homicide rate does not seem to be counter-cyclical, and criminal inertia is not significant.

Keywords: Violent crime; Gini index; difference-GMM; Africa

INTRODUCTION

The rate of criminal activities in Africa has over the past decades increased considerably which has become a foremost social problem inhibiting developmental progress in the region. It is predictable that attendant changes in criminal activities will occur as economies transition from traditional to modern ways of life in order to experience socio-economic and cultural changes. The general dearth of investigation into criminality and social responses to crime in

Sub-Saharan Africa (SSA) has emphasised the importance for a scientific study with the aim of detecting issues related to social policy within the framework of regional development. But what is the most likely proxy for violent crime? Homicide is often used as the "best" realistic proxy because it is readily measurable and a good indicator of capturing the level of security in any country. The relevance of studying homicide is embedded in the fact that it is the ultimate crime when a human being kills another whose ripple effects transcends fear to all and sundry. Furthermore, according to UNODC (2013) Report, violent criminals use homicide as a tool to perpetuate their activities and achieve their material goals. Hence, because homicide affects people from all walks of life the need to look at this problem from different angles is justified. Statistics from the Report show that in 2012, the death of more than half a million people across the globe is caused by intentional homicide. 36% of those deaths occurred in Latin America, Africa recorded 31%, Asia 28%, Europe 5% and Oceania 0.3% respectively.

On the drivers of violent rates, several factors have been identified with the key driver being income inequality. The literature on the relationship between income inequality and violent crime is still very sparse compared to other types of criminal acts like property crime, theft, burglary, robbery, fraud, embezzlement, forgery, larceny and so on. However, the link between inequality and crime in general has been stressed by the three main theories of crime: Becker (1968) economic theory of crime; the social disorganisation theory of Shaw and McKay (1942) and Merton (1938). Central to these theories is the undenying fact that income inequality is *criminogenic*[1]. In the economic theories of crime, individuals relate the apportionment of time spent between market (economic) and criminal activities. They compare the expected returns from each activity, and taking account of the likelihood of being caught and severity of punishment. Hence, if the expected returns from the latter is higher than the former and the chances of being caught and punished are low, the incentive to engage in more criminal activities rises. Also, in these models, income inequality leads to crime when low-income individuals who have low returns from market activities are placed within the proximity of high-income individuals who have assets worth taking or killing for. Empirical findings support the hypothesis that inequality is a strong predictor of crime rate (Ouimet, 2012; Han, Bandyopadhyay, & Bhattacharya, 2013; Enamorado, López-Calva, Rodríguez-Castelán, & Winkler, 2014). Thus, a simple analogy can be drawn that factors that determine inequality invariably determine crime rates.

This study situates on Africa because increase in violent crime have been observed in the continent since the 2000s. For instance, the Southern African region historically holds the highest rate of violent crimes on record (with Central America) having rates four times higher

[1]This is a situation or system likely to cause criminal behaviour.

than the global average of 6.2 per 100,000 population with South Africa, Namibia and Lesotho driving this trend. Next is North Africa and East Africa with rising crime rates attributable to political violence such that Kenya and Uganda both showing increases since 2004 (UNODC, 2013). Likewise on income inequality, the continent boasts as having one of the highest inequality amidst global comparison. Using the Gini index as the measure of income inequality, the second most unequal region in the world after Latin America is Africa (Milanovic, 2014; Klasen, 2016). This finding is not new probably because it is also the result of the congenital inequality Africa obtained from colonialism upon attaining independence (Leibbrandt, Finn, & Woolard, 2012; Piraino, 2015). Facts further reveal that by 2010, six of the ten most-unequal countries in the world were in Africa (AfDB, 2012) with the sub-region of Southern Africa showing a striking concentration of countries which suffer from remarkably high income inequality levels. These countries are Namibia, Comoros, South Africa, Angola, Botswana, Lesotho and Swaziland, a crime-inequality pattern can thus be gleaned from this analysis. If income inequality drives violent crime, then it is envisaged that a positive relationship occurs such that countries with high inequality indices will have high rate of violent crime while lower levels of violent crime are generally related to higher levels of development, as well as to lower levels of income inequality. In other words, factors that drive crime rates equally drive income inequality. Figure 1 shows the graphical representation of crime-inequality relationship in Africa on sub-regional basis. The figure shows a pattern that sub-regions with high Gini index also have high rates of violent crimes with countries located in Southern Africa at the upper right end of the plot. West and East African countries are clustered towards the mid-lower left and North African countries are at the extreme-lower left.

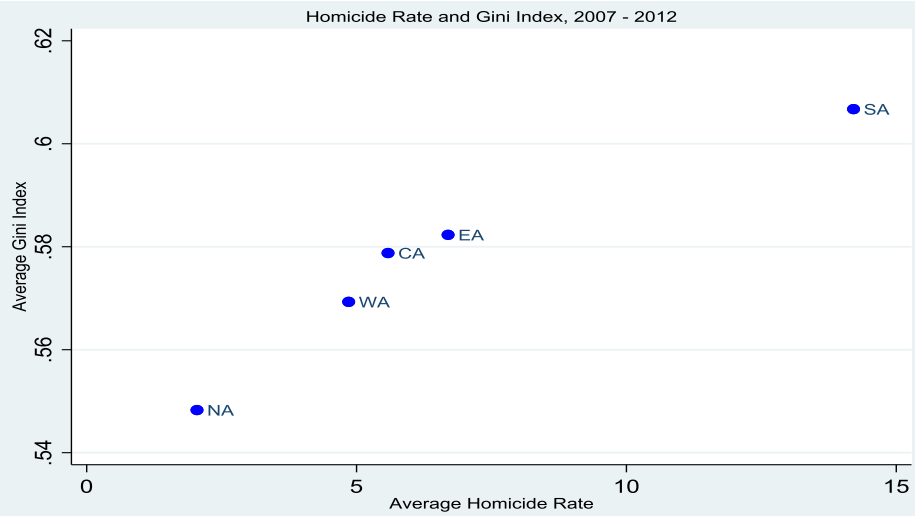

Figure 1: Scatter plot on homicide rate and Gini index (2007 – 2012)

Note: CA: Central Africa; EA: East Africa; NA: North Africa; SA: Southern Africa; WA: West Africa

Source: Authors' compilation

This study presents findings from Africa on the factors driving violent crime and contributes to the crime-inequality literature by engaging a balanced panel data of 38 African countries from 2007 to 2012 for the scientific investigation as no such attempt has been done exclusively for the region[2]. The balanced panel enables the use of dynamic modeling using the two-step difference generalised method of moments (GMM) and for constructive analysis, the continent is divided into five (5) regions: Central Africa (CA), Eastern Africa (EA), Northern Africa (NA), Southern Africa (SA) and Western Africa (WA)[3]. Even though poor countries are associated with high levels of income inequality and crime rates, it is not the intention of this paper to address the issue of rising crime rate, but merely investigate factors that contributes to its increase. The focus of this research is on violent crime, thus, the wording "crime rate" and "violent crime" is used interchangeably throughout the paper, unless something else is specifically stated.

LITERATURE REVIEW

Without any claim to be exhaustive, some of the determinants of crime rate and the contributory factors of crime-inequality nexus in Africa are discussed. Population and urbanisation are known to positively correlate with increase in crime rate (Eide & Showalter, 1999; Brush, 2007; UNODC, 2013). Africa is known for its budding population, the continent has the fastest population growth projected between now and 2050 and the highest youth population in the world. The stark contrast between rich and poor countries is illustrated in the 2013 World Population Data Sheet (WPDS). The analogy compares Niger Republic and the Netherlands. Although both countries have almost the same population size, Niger is projected to nearly quadruple its population from about 17 million today to 66 million in 2050 while that of The Netherlands' will likely grow very slowly from 17 million to 18 million over that same time. Africa champions a demographically young population with 43% below age 15 and all of the 10 countries worldwide with the highest fertility rate are located in Africa. Furthermore, WPDS (2013) predicts that Africa's population is expected to more than double by 2050, rising from 1.1 billion today to at least 2.4 billion.

One of the key demographic factors in terms of crime and income inequality is the population growth rate, as it is generally argued that poor people tend to have more children. Also, it is plausible to find that a bigger rural population and more people employed in

[2]The scope is within this period because the 2017 homicide data from United Nations Office on Drugs and Crime (UNODC) covers 1996 to 2015 with majority of African countries having no statistics for periods prior to 2007 and none after 2012. For instance, data for trend analysis in Africa are only available for a handful of countries and for a relatively short period of time (since 2004). The limited data available for Northern Africa point to a recent sharp increase in violent crime in the sub-region, which is a new and alarming trend largely associated with increased social and political instability.

[3]Comprehensive list of countries and regions is shown in Appendix A1

agriculture is associated with lower income inequality as the distribution of income is even among that social class. Odedokun and Round (2001); Sahn and Stifel (2003) have differing opinions regarding the effect of urbanisation. From a sample of African countries, they conclude that inequality in living standards tends to worsen in rural areas than in urban areas. Reason given is that in a situation where the population rises faster than economic growth, employment opportunity will pose a serious challenge resulting in inequitable income distribution and rising recourse to engage in criminal activities (Glaeser & Sacerdote, 2000; Fajnzylber, Ledeman, & Loayza, 2002). Rapid population growth makes it difficult for economies to create enough jobs to lift large numbers of people out of poverty and increases the tendency for the engagement in criminal activities (Messner, 1983; Krahn, Hartnagel, & Gartrell, 1986).

Another important driver of violent crime is the rate of unemployment. The International Labour Organisation (ILO) harmonised unemployment rate refers "*to those people who are currently not working but are willing and able to work for pay or people who are currently available to work, and have actively searched for work"*. Empirical findings on the impact of unemployment rate on crime rate are mixed. Brush (2007) finds that unemployment rate is a positive predictor of crime. The opportunity cost to engage in criminal activities is driven by youth unemployment (Shaw & McKay, 1942; Sahn & Stifel, 2003; Hove, Ngwerume, & Muchemwa, 2013). Youth employment challenges in Africa are often associated with rapid population growth rates although the correlation however is not always direct, nor that simple. The nexus between the rate of youth employment and population growth rate is somewhat complex. As the population grows, the lack of equitable growth and the exclusion of the youth from market activities increases. Hence, African countries must safeguard against such crises by initiating economic reforms and increasing spending on social services.

In Africa, low levels of literacy and education in general, can impede the economic development of a country in the current rapidly changing, technology-driven world. Levels of education in Africa are comparatively low creating a considerable skills gap among youth at working age. Based on a panel data that covers both developing and OECD countries from 1960-1990, De Gregorio and Lee (2002); Perugini and Martino (2008) find that average years of schooling, and other educational factors, contribute positively to a more equal distribution of income. They show the empirical evidence linking education to income distribution. In his famous paper, Barro (2000) concludes that primary and secondary education have significant negative impact on income inequality while tertiary education exacerbates inequality. Some other studies find that primary and secondary education are equalising variables while higher education further widens the inequality gap (Lochner & Moretti, 2004; Lo Prete, 2013).

Lastly, the existence of effective institutions may curb the perpetuation of criminal activities. For instance, a rape crime *victimises* the person. The family and community of the victim can be considered as secondary victims in the event that when justice is not served, impunity can lead to further victimisation in the form of the denial of the basic human right to justice (UNODC, 2013). Hence, if institutions are weak evidenced with flagrant disregard for the rule of law increase in violent crime may be the likely results. In addition, weak institutions lead to high levels of corruption prevalent in most African countries.

RESEARCH METHODOLOGY

Data

Study uses a panel data on 38 African countries from 2007 to 2012. Since having substantial data points is essential for panel data analysis, countries without data (see Appendix Table A2) on the Gini index and homicide rates, proxy for violent crime, are dropped not only to minimise 'holes' in the data but also to balance the 'trade-off' between sample size, richness and power of the explanatory variables (Barro, 2000; Brush, 2007). The variables are briefly discussed below.

Outcome Variable

The outcome variable is *violent crime*. Globally, crime is classified into two groups: violent and property crimes. Murder, rape, assault and armed robbery are classified as violent crimes while burglary, theft, larceny, fraud and embezzlement are categorized as property crimes. Of these groups; property crimes suffer mostly from under-reporting in countries where the people have lost confidence in the police and judicial systems, where the level of education is abysmally low, and perhaps where inequality is high. Of the violent crime category, psychological trauma and social stigma often prevent rape victims from reporting assault while armed robbery may go unreported if the stolen assets is of a lower value and/or if the incident results in no loss of life, thus only data on murder is adequately captured as the loss of a human life will have to be reported.

Explanatory Variables

Most empirical papers employ the *Gini index* as the measure of income inequality (Krohn, 1976; Witt, Clarke, & Fielding, 1999; Nilsson, 2004; Brush, 2007) due to the fact that it is easily to compute and the data is readily available compared to other income measures like the Palma ratio, the Atkinson index, Theil index, purchasing power parity, income shares, variance of log-income, the Robin Hood index and the coefficient of variation. Following previous empirical studies (Witte & Witt, 2001; Brush, 2007), another economic factor that affects violent crime is *unemployment rate* as there exist the general belief that unemployment is positively correlated with violent crime. Since

unemployment may reduce legal returns from work, the tendency to engage in criminal acts further widens. This variable measures the impact of the ratio of able-bodied individuals who are willing to work but find none. To adequately capture the influence of unemployment on crime rate, a novel approach is introduced with five categories of unemployment including youth unemployment and male unemployment. This is because studies show that at the global level about 95% of violent crime perpetrators are male (UNODC, 2013) and that young men are more prone to engage in criminal activities than the rest of the population, this means that the lure to participate in crime is higher at the initial stage of adulthood (Bound & Freeman, 1991; Grogger, 2000). *Education variables* (primary, secondary and tertiary**)** test the impact of education on the decision to engage in criminal activities through several channels. These are school enrolment ratios, although empirical literatures have mixed views as to their impact on crime rate. As noted by Witt *et al.* (1999) schooling generates benefits beyond the private return received by individuals and education increases the cost associated with incarceration, since more educated individuals will experience greater losses in earnings while in jail. However, on a rational note, a higher educational attainment is expected to reduce crime rate. The *age dependency ratio* indicator is included. This captures the percentage of those within the working-age. It is the percentage of those employed to total population. The ratio is high if a greater proportion of people are employed and low ratio can be seen as a positive sign, especially for young people, if it is caused by an increase in the time devoted to their education. The *share of population living in urban areas* is included in the model. Empirical findings on the effect of increase in urban dwellers on crime rate are mixed. To some, increase in urbanisation imply increase in economic growth and therefore a fall in inequality as people move to the city from rural areas (Galor & Zeira, 1993; Eide & Showalter, 1999). While some studies show that higher homicide rates occur in urban areas even though the metropolis tend to accommodate both the risk of homicide occurring and the protection of the citizenry. The deterrence variable, death penalty is included to test if countries that uphold the death penalty at a particular time have lower homicide rates. It takes the value 1 if countries have the death penalty in a particular year and 0 otherwise. However, it is evident that countries allowing the death penalty have higher homicide rates (Grogger, 1990; Hunt, 2004; Zimmerman, 2006). The *rule of law index* is included to test for the impact of quality institutions and good governance. The index ranges from -2.5 (weak governance) to 2.5 (strong governance) and it is expected that as a country's index improves, crime rate is curbed. Lastly, *five (5) regional dummies*, *CA, EA, NA, SA* and *WA* are added to control for region heterogeneities. Each takes the value 1 if countries belong to that region and 0 otherwise. The empirical approach is to perform a stepwise regression such that the explanatory variables will be included sequentially into the model to observe whether the predictive significance of income inequality on crime rate still holds.

Empirical Model

Following research in related fields, the use of both static and dynamic models are employed: pooled ordinary least squares (OLS) and two-step difference GMM. The pooled OLS estimator captures not only the variation of what emerges through time or space, but the variation of these two dimensions simultaneously. Similarly, the model is estimated using robust and homoscedasticity-consistent standard errors, as proposed by White (1980) to correct for the possible existence of heteroscedasticity and to remove the effect of outliers. The pooled OLS linear model is given as:

$$\boldsymbol{VCr_{it}} = \boldsymbol{\alpha} + (\boldsymbol{\beta X'_{it}} + \boldsymbol{\gamma Z_i}) + (\boldsymbol{\eta_i} + \varepsilon_{it}) \quad \textbf{[1]}$$

where, α, the constant term; *i,,* countries, 1, 2……..*N; t,* time, 1, 2…..*T*, $\beta X'_{it}$, vector of observed time-variant factors and their regression coefficients; γZ_i, vector of observed time-invariant factors and their regression coefficients, η_i denotes unobserved country-specific effects and ε_{it} denotes the unobserved random error term.

Estimating equation [1] may lead to several econometric problems because some explanatory variables are assumed to be endogenous due to correlation with the error term. Similarly, the time-invariant country characteristics (fixed effects) may be correlated with the explanatory variables. In addition, a static model will not adequately capture the persistent nature of violent crime and the short and long-run impacts of the regressors on the outcome variable, hence a dynamic model is employed which addresses the problems of omitted variables, measurement error, endogeneity, and country-specific heterogeneity. The estimator that best addresses these issues is the generalised method of moments (GMM) popularised by Arellano and Bond (1991) and Arellano and Bover (1995). The GMM estimator is a specialised variant of the instrumental variables approach such that the consistency of the parameters obtained depends critically on the validity of the moment conditions (i.e. instruments) of which the authors outlined two specification tests. The Hansen test of over-identifying restrictions is first. Failure to reject the null hypothesis of instruments validity gives support to the choice of the instruments. The test for serial correlation of the error term is the second. Failure to reject the null hypothesis of no second-order serial correlation implies that the original error term is serially uncorrelated and the moment conditions are correctly specified (Roodman, 2014). The two-step difference-GMM model specification is given as:

$$\boldsymbol{\Delta VCr_{it}} = \boldsymbol{\phi \Delta VCr_{it-1}} + (\boldsymbol{\beta \Delta X'_{it}} + \boldsymbol{\gamma \Delta Z_i}) + \boldsymbol{\partial_t} + \boldsymbol{\Delta}\varepsilon_{it}. \quad \textbf{[2]}$$

where, VCr_{it-1} denotes the lag of the dependent variable, ∂_tcontrols for time dimension and ε_{it} is the composite error term which includes country-fixed effects.

A Priori Expectations

In line with the theory of economics of crime (Becker, 1968) and justifications for including the regressors, positive coefficients are expected for the *Gini index*, *death penalty*, and *unemployment rates* while negative coefficients for *age-dependency ratio*, *rule of law index* and *education*.

RESULTS

Data Summary and Correlation Analysis

The summary statistics is conducted on regional basis in comparison with the full sample. From Table 1, the average rate of violent crime and Gini index for the 38 selected countries are 8.08 and 58.04 respectively. Among the regions, Southern Africa has the highest averages for both indicators at 14.21 and 60.67. Generally, all the sub-regions in SSA exhibit high inequality index. Other statistics are as shown.

Table 1 Summary Statistics

Variables	Full Sample		Central Africa		East Africa		North Africa		Southern Africa		West Africa	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Violent Crime	8.04	9.16	5.58	3.39	6.7	2.61	2.04	2.09	14.21	12.78	4.85	3.44
Gini Index	58.08	4.28	57.88	2.27	58.23	2.18	54.83	3.23	60.67	6.03	56.93	2.21
Age Dependency	80.12	18.28	90.72	9.44	80.28	19.81	56.95	12.32	77.91	19.27	88.9	8.74
Urban Pop. Rate	40.49	15.63	43.36	15.08	33.61	21.35	57.96	8.82	36.56	13.44	39.83	8.92
Rule of Law	-0.56	0.55	-1.14	0.36	-0.51	0.32	-0.4	0.38	-0.2	0.62	-0.8	0.43
Death Penalty	0.23	0.42	0.25	0.44	0.29	0.46	0.2	0.41	0.18	0.39	0.26	0.44
Primary Enrol. Rate	103.95	19.27	99.39	16.55	106.53	24.02	106.35	7.38	113.81	13.95	92.16	19.73
Secondary Enrol. Rate	47.07	23.73	34.77	15.1	42.3	19.13	67.15	26.49	52.09	26.37	37.65	14.09
Tertiary Enrol. Rate	10.74	9.79	5.43	3.82	4.45	1.77	22.12	11.62	12.57	11.48	7.89	3.25
Total Unem. Rate	9.85	7.31	7.63	4.2	5.27	3.41	11.46	2.58	16.3	9.26	5.99	2.93
Youth Unem. Rate	17.76	14.02	12.56	7.57	9.25	6.97	24.79	6.69	29.71	17.05	9.15	4.29
Male Unem. Rate	8.7	6.65	6.53	3.46	4.38	2.84	9.7	2.67	14.62	8.66	5.47	2.22
Female Unem. Rate	11.84	8.65	9.2	5.59	6.34	4.33	17.39	5.39	18.33	9.99	6.77	4.27
Youth Male Unem. Rate	16.05	13.21	10.54	5.9	8.37	6.85	21.67	6.58	27.65	16.32	8.08	3.22
Youth Female Unem. Rate	20.8	16.58	16.15	11.86	10.22	7.34	34.2	13.55	32.35	18.41	10.64	6.45

Note: SD = Standard Deviation

Source: Authors' Computations

Further, the correlation analysis in Table A3 (see Appendix) shows the potential relationships between violent crime and the regressors. As expected, the *Gini index*, *death penalty*, *unemployment rates* with the exception of *female unemployment rate* have positive correlation while the *rule of law index*, and *education* have negative relationships. However, there is need to subject these relationships for empirical testing to understand the exact nature of influence of these regressors on violent crime. No correlation statistic is above 0.80, hence no evidence of multicollinearity in the data.

Panel Data Modeling Issues

This study pays attention to issues that often arise in panel data modeling some of which are justifications for the usage of key indicator(s), the problems of slope homogeneity and cross-sectional dependence. The key indicators for this study are the Gini index which is the measure of income inequality and the homicide rate which is the proxy for violent crime. From the summary statistics in Table 1, the Gini index shows considerable variability across the four sub-regions and for the full sample. The standard deviation ranges from 2.18 (East Africa) to 6.03 (Southern Africa) and 4.28 for the full sample. Similarly for violent crime, the standard deviation ranges between 2.09 (Northern Africa) and 12.78 (Southern Africa) with 9.16 for the full sample. These statistics show that there are sufficient variability in these indicators to justify their use in testing the study's research hypotheses.

Likewise, for slope homogeneity and cross-sectional dependence, the goal is to test if there exists unusual patterns in the data for both violent crime and income inequality variables over time and space which in essence is testing the homogeneity of the regression slope coefficients across the 38 countries in the panel. For one, the test for homogeneity is needful to check whether both variables have consistent pattern that is representative of the selected countries. According to Pesaran and Yamagata (2008), Baltagi (2005) and Baltagi, Feng, and Kao (2012) tests for slope homogeneity are only applicable to macro panels having long time series (over 20 - 30 years), however not applicable in this study given the short time dimension of 6 years (2007 to 2012). However, to show the relative homogeneity, the trend of both variables with their mean values are plotted on sub-regional basis.

Figure 2 reveals that across the sub-regions, unobserved variables do not change overtime and that the violent crime indicator clusters around its mean value except for Southern Africa which shows larger values and a wider disparity from others. By and large, the inclusion of Southern Africa is not expected to cause estimation bias.

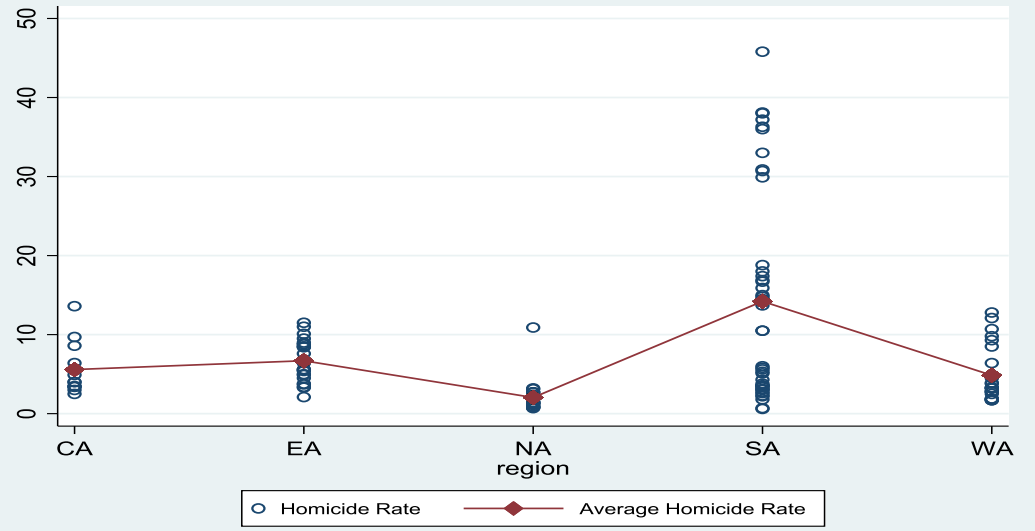

Figure 2: Plot of homicide rate and its averages across 5 sub-regions (2007 – 2012)

Note: CA: Central Africa; EA: East Africa; NA: North Africa; SA: Southern Africa; WA: West Africa

Source: Authors' compilation

Likewise, Figure 3 indicates that the unobserved variables do not change overtime and the Gini index for the sub-regions clusters around its mean value which is relatively same across board. However, Southern Africa shows a larger disparity from the rest. Again, this is not expected to cause any estimation bias. Overall, the assumption of slope homogeneity holds given the relative similarity of both indicators across the sub-regions which justifies the use of the pooled OLS and difference GMM estimation techniques.

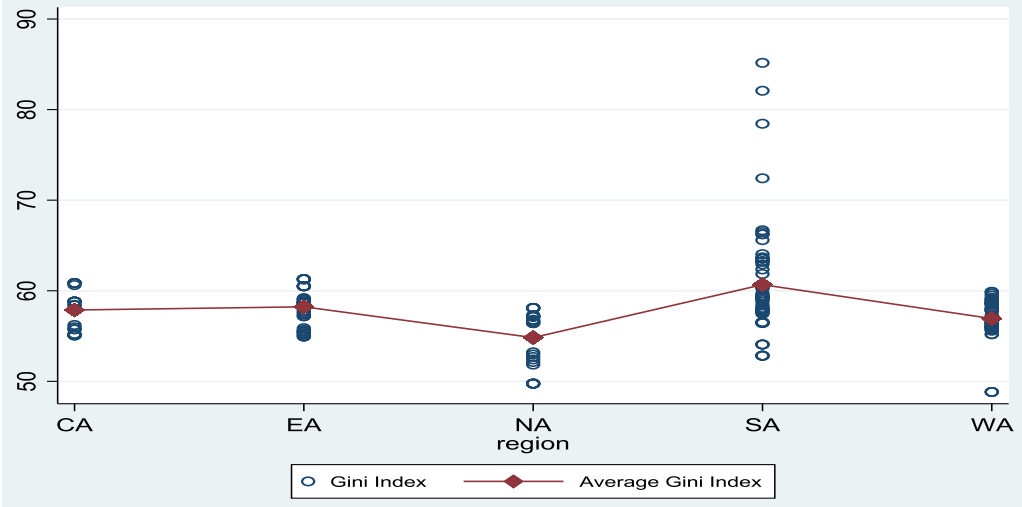

Figure 3: Plot of Gini Index and its averages across 5 sub-regions (2007 – 2012)

Note: CA: Central Africa; EA: East Africa; NA: North Africa; SA: Southern Africa; WA: West Africa

Source: Authors' compliation

On the other hand, cross-sectional dependence (CSD) which is similar to testing for serial correlation in time series analysis checks if the residuals across units in the panel are not correlated. According to Phillips and Sul (2003) and Baltagi *et al.* (2012), testing for cross-sectional dependence relates to panel data models with small *T* and large *N* as in this case. Ignoring sufficient CSD can decrease estimation efficiency and undermine the gains from the pooled least squares estimator. Importantly, having pooled a population with the assumption of homogeneous slope coefficients, ignoring CSD can diminish the efficiency of the pooled least squares estimator, invalidates conventional *t*-tests and *F*-tests which use standard variance-covariance estimators. Testing for CSD is not applicable to this study due to few common observations across the panel this outcome is observed across all the various model specifications.

Pooled OLS Results

Columns [1] to [5] of Table 2 shows the results for the baseline model in column [1], column [2] with the addition of the *Gini index*, columns [3] to [5] has the inclusion of *urban population*, *death penalty* and *rule of law index*. Findings reveal that across the five model specifications, *age dependency ratio* has a reducing impact on violent crime in with three of those being statistically significant at the 5% level. Likewise the *Gini index* provides significant evidence as a strong predictor of crime across the model specifications.

These findings are consistent with the related literature that points to Gini index as a strong predictor of homicide rates (Kelly, 2000; Choe, 2008; Ouimet, 2012; Han *et al.*, 2013). As predicted the coefficients of *death penalty* and *rule of law index* have the expected signs and significant at the 1% level respectively. The result for *death penalty* indicates that countries that uphold policy on death penalty will have an increase in homicide rate compared to those who have abolished the policy. A position confirmed by several *criminometricians*[4] that the death penalty is not a deterrent factor (Grogger, 1990; Daly, Wilson, & Vasdev, 2001; Neumayer, 2003; Hunt, 2004; Soares, 2004; Zimmerman, 2006). The impact of the *rule of law index* supports earlier empirical work on the importance of good governance in reducing crime rates (Fajnzylber *et al.*, 2002; Neumayer, 2003; Adeleye, Osabuohien, & Bowale, 2017). On regional classifications, statistically significant evidence shows that crime is higher in Southern Africa but lower in North Africa relative to West Africa (base region). This could be explained by historical factors, as in the case of South Africa (Odedokun & Round, 2001).

[4]Researchers who study criminal behaviour within socio-economic and demographic frameworks.

Table 2 Pooled OLS Results (Dep. Variable: Violent Crime)

Variables	**[1]**	**[2]**	**[3]**	**[4]**	**[5]**
Constant	13.7289**	-28.3180**	-22.0058	-31.8137***	-26.8989**
	(2.58)	(-2.50)	(-1.33)	(-3.21)	(-2.46)
Age Dependency	-0.1217**	-0.0746	-0.1112	-0.0951**	-0.1198**
	(-2.10)	(-1.63)	(-1.37)	(-2.14)	(-2.33)
Gini Index		0.6846***	0.7118***	0.7444***	0.6954***
		(4.03)	(4.42)	(4.92)	(4.29)
Urban Pop. Rate			-0.0585		
			(-0.71)		
Death Penalty				7.0963***	
				(3.38)	
Rule of Law					-2.9445**
					(-2.03)
Central Africa	1.1950	0.5015	0.3089	1.8457	0.0847
	(0.99)	(0.42)	(0.18)	(1.42)	(0.07)
East Africa	1.4598	-0.2508	-1.5070	-0.5834	0.2418
	(1.16)	(-0.21)	(-0.88)	(-0.49)	(0.18)
North Africa	-6.8152***	-3.8038*	-4.1955*	-4.0398**	-4.0653**
	(-3.01)	(-1.86)	(-1.86)	(-2.01)	(-2.06)
Southern Africa	8.3813***	5.4276**	4.4957**	5.4680***	6.7699***
	(4.53)	(2.50)	(2.42)	(2.79)	(2.74)
Year Dummies	Yes	Yes	Yes	Yes	Yes
No. of Obs.	132	132	121	132	132
R-Squared	0.317	0.415	0.410	0.514	0.427
F Statistic	5.771	11.686	9.943	9.933	12.072

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively;
t-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors
Source: Authors' Computations

The plot of the fitted values of the Gini index against violent crime shown in Figure 4 reveals the positive relationship between the two indicators across the countries in the panel.

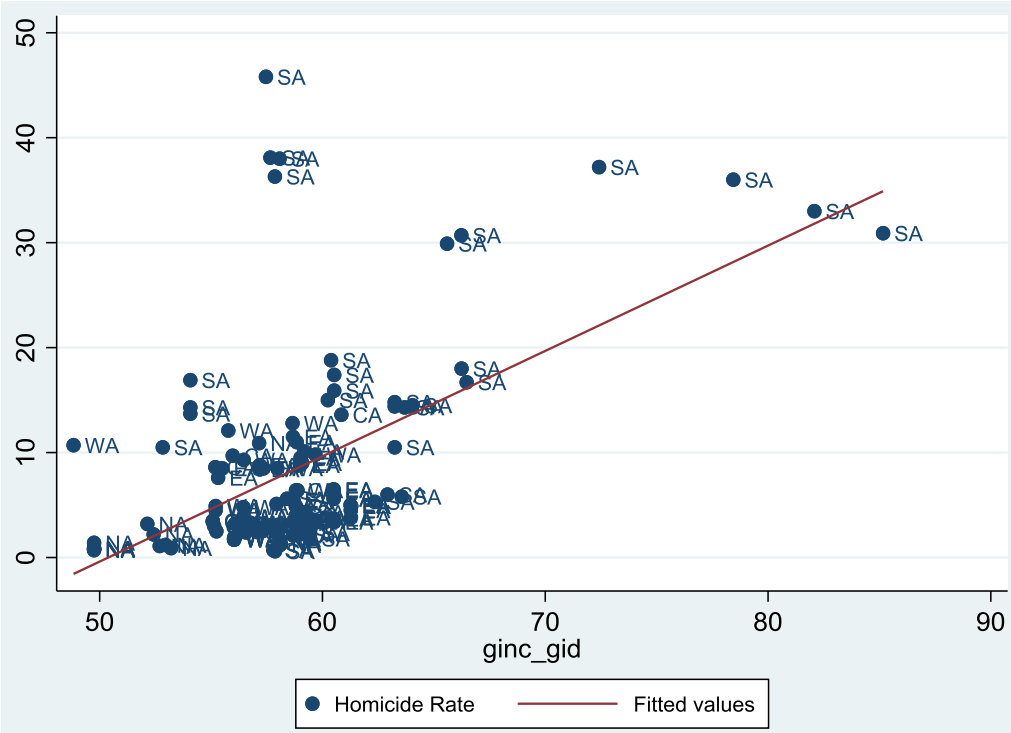

Figure 4: Plot of Homicide Rate and Fitted Values of the Gini Index

Source: Authors' compilation

Results in Table 3 columns [6] to [8] show that with the systematic inclusion of the education variables, the *Gini index* is still a strong and positive predictor of violent crime at the 1% level. Of the three education variables, only *primary enrolment rate* shows a 1% statistically significant reducing effect which may not be surprising considering that many African countries pursue a free primary education agenda which allows children from rich and poor households have access to basic education.

Table 3 Pooled OLS Results (Dep. Variable: Violent Crime)

Variables	**[6]**	**[7]**	**[8]**
Constant	-4.7095	-45.9034**	-42.3347***
	(-0.33)	(-2.41)	(-2.79)
Age Dependency	-0.0591	0.0644	0.0182
	(-1.14)	(0.67)	(0.43)
Gini Index	0.6105***	0.7280***	0.8335***
	(3.47)	(4.11)	(3.28)
Primary Enrol. Rate	-0.1827***		
	(-5.10)		
Secondary Enrol. Rate		0.1048	
		(1.50)	
Tertiary Enrol. Rate			0.1090
			(1.42)
Central Africa	1.6123	-1.2259	-1.2978
	(1.19)	(-0.74)	(-0.86)
East Africa	2.0856	-1.1757	-0.1214
	(1.24)	(-0.68)	(-0.09)
North Africa	-2.6198	-3.3747	-3.1469
	(-1.18)	(-1.28)	(-1.52)
Southern Africa	7.5802***	5.2545*	-1.1509
	(2.90)	(1.74)	(-0.85)
Year Dummies	Yes	Yes	Yes
No. of Obs.	114	94	80
R-Squared	0.476	0.431	0.454
F Statistic	13.147	10.030	4.396

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively; *t*-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors

Source: Authors' Computations

The theoretical link and empirical findings between unemployment and crime is quite strong (Stack, 1984; Britt, 1997; Doyle, Ahmed, & Horn, 1999). Results in columns [9] to [14] of Table 4 reveal that unemployment exacerbates crime with positive and statistically significant coefficients at the 1% level. These finding support earlier studies such as Witt *et al.* (1999) and UNODC (2013) where outcomes reveal that high crime rate is associated with increase in male unemployment. This study provides a new evidence that *female unemployment* and *female*

youth unemployment have positive predictive powers on violent crime at the 1% significance level. This is an important contribution to the crime-inequality literature.

Table 4 Pooled OLS Results (Dep. Variable: Violent Crime)

Variables	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**	**[14]**
Constant	-23.1624**	-23.2853*	-18.8423*	-28.9545***	-19.6708	-30.6081***
	(-2.25)	(-1.95)	(-1.91)	(-2.87)	(-1.58)	(-2.66)
Age Dependency	-0.0530	-0.0422	-0.0701	-0.0344	-0.0744	-0.0186
	(-1.13)	(-0.76)	(-1.58)	(-0.68)	(-1.29)	(-0.36)
Gini Index	0.5227***	0.5306***	0.4755***	0.6219***	0.5234***	0.6238***
	(3.28)	(3.29)	(2.88)	(4.11)	(3.17)	(4.01)
Total Unem. Rate	0.5806***					
	(4.47)					
Youth Unem. Rate		0.2469***				
		(5.08)				
Male Unem. Rate			0.6514***			
			(4.71)			
Female Unem. Rate				0.4729***		
				(4.53)		
Youth Male Unem. Rate					0.2062***	
					(3.95)	
Youth Female Unem. Rate						0.2308***
						(6.27)
Central Africa	-1.5740	-1.1431	-0.8435	-2.2614	-0.2991	-2.2663
	(-1.15)	(-0.91)	(-0.65)	(-1.56)	(-0.25)	(-1.61)
East Africa	0.8312	0.4403	1.4623	0.1577	0.7032	0.1123
	(0.61)	(0.33)	(1.07)	(0.12)	(0.51)	(0.09)
North Africa	-6.714***	-7.093***	-6.583***	-8.278***	-6.949***	-8.0535***
	(-3.41)	(-3.32)	(-3.34)	(-3.82)	(-3.09)	(-3.72)
Southern Africa	-0.8823	0.5101	-0.4737	-0.8316	1.6061	0.1489
	(-0.66)	(0.27)	(-0.37)	(-0.56)	(0.75)	(0.08)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	128	128	128	128	128	128
R-Squared	0.559	0.505	0.566	0.547	0.477	0.529
F Statistic	12.181	13.468	11.773	12.513	12.426	13.928

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively; *t*-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors

Source: Authors' Computations

2-Step Difference-GMM Results

Having controlled for endogeneity and omitted variables, results shown in columns [1] to [4] of Table 5 provide evidence that income inequality is a strong and positive predictor of violent crime in the short-run at the 1% significance level while the covariates are statistically not significant.

Table 5 Difference-GMM Results (Dep. Variable: Violent Crime)

Variables	**[1]**	**[2]**	**[3]**	**[4]**
Violent Crime _1	-0.3546	-0.6236	-0.3231	-0.3546
	(-0.99)	(-1.05)	(-0.88)	(-0.99)
Age Dependency	0.7536*	1.0684	0.6023	0.7536*
	(1.90)	(1.44)	(1.28)	(1.89)
Gini Index	0.1764***	0.1779***	0.1757***	0.1764***
	(3.15)	(2.96)	(3.13)	(3.13)
Urban Pop. Rate		-1.4482		
		(-1.00)		
Rule of Law			3.0652	
			(0.64)	
Death Penalty				0.0000
				(.)
Year Dummies	Yes	Yes	Yes	Yes
No. of Obs.	68	68	68	68
F Statistic	60.246	9.190	56.222	51.851
Groups/Instruments	24/12	24/13	24/13	24/12
AR(2)	0.647	0.927	0.632	0.647
Hansen Statistic	0.461	0.444	0.365	0.326

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively;
t-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors;
p-values reported for AR(2) and Hansen statistic
Source: Authors' Computations

Controlling for the *education* variables, similar results are obtained in Tables 6 columns [5] to [7] which provide significant evidence on the positive predictive power of inequality on violent crime. However, all the education regressors are also not statistically significant.

Table 6 Difference-GMM Results (Dep. Variable: Violent Crime)

Variables	**[5]**	**[6]**	**[7]**
Violent Crime_1	-0.3539	0.4343**	0.1123
	(-0.97)	(2.33)	(0.43)
Age Dependency	0.5246	0.2943	0.5132
	(1.39)	(0.46)	(1.53)
Gini Index	0.1833***	-0.0024	-2.4163*
	(3.06)	(-0.06)	(-1.86)
Primary Enrol. Rate	-0.0871		
	(-0.74)		
Secondary Enrol. Rate		-0.0029	
		(-0.03)	
Tertiary Enrol. Rate			0.0998
			(0.73)
Year Dummies	Yes	Yes	Yes
No. of Obs.	54	45	34
F Statistic	15.333	30.281	8.917
Groups/Instruments	23/13	19/13	15/13
AR(2)	0.555	0.469	0.265
Hansen Statistic	0.383	0.452	0.515

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively; *t*-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors; p-values reported for AR(2) and Hansen statistic

Source: Authors' Computations

With the inclusion of *unemployment* variables, results shown in Table 7 columns [8] to [14] are not significantly different from those already established as the findings reveal that inequality aggravates violent crime. The *unemployment* variables, though have the *a priori* signs, are not statistically significant.

Table 7 Difference-GMM Results (Dep. Variable: Violent Crime)

Variables	**[8]**	**[9]**	**[10]**	**[11]**	**[12]**	**[13]**
Violent Crime _1	-0.2435	-0.3156	-0.3241	-0.1292	-0.3504	-0.2570
	(-0.63)	(-0.97)	(-0.96)	(-0.29)	(-1.09)	(-0.78)
Age Dependency	0.7654*	0.7688*	0.7639*	0.7332	0.7749*	0.7727**
	(1.95)	(1.96)	(2.01)	(1.63)	(1.91)	(2.18)
Gini Index	0.1544**	0.1710***	0.1707***	0.1335**	0.1744***	0.1640***
	(2.78)	(3.57)	(3.49)	(2.13)	(3.71)	(3.49)
Total Unem. Rate	0.1216					
	(0.71)					
Youth Unem. Rate		0.0531				
		(0.59)				
Male Unem. Rate			0.0741			
			(0.46)			
Female Unem. Rate				0.1684		
				(0.99)		
Youth Male Unem. Rate					0.0499	
					(0.51)	
Youth Female Unem. Rate						0.0704
						(0.98)
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
No. of Obs.	66	66	66	66	66	66
F Statistic	74.883	64.706	80.396	74.742	78.418	56.994
Groups/Instruments	23/13	23/13	23/13	23/13	23/13	23/13
AR(2)	0.721	0.672	0.663	0.83	0.666	0.677
Hansen Statistic	0.335	0.386	0.426	0.29	0.433	0.326

Notes: ***, **, *are statistical significance at the 1%, 5% and 10% levels respectively; *t*-statistics (in parentheses) are based on White heteroscedasticity-consistent std. errors; p-values reported for AR(2) and Hansen statistic

Source: Authors' Computations

CONCLUSION AND POLICY RECOMMENDATIONS

The major findings of this paper are that the income inequality is a significant positive predictor of violent crime. Other significant fallouts are surmised as follows: primary education has a crime-reducing impact, the death penalty is not a deterrent factor, the rule of law has a crime-reducing effect, unemployment aggravates violent crime and violent crime is higher in Southern Africa while lower in North Africa relative to West Africa. However, violent crime does not seem

to be counter-cyclical, and criminal inertia is not significant. Hence, for a drastic reduction in violent crime, policy complementarities are required. Policies must be geared towards those indicators that have significant impact on crime rates with the aim of enhancing those with negative effects and correcting those with positive effects. For instance, priority must be accorded to institutional quality, that is, the enforcement of the rule of law and concerted efforts towards strengthening the judicial system. Educational reforms are pivot to reducing inequality by ensuring that education inequality is minimised via the provision of basic education. Governments' actions to increase supply and quality of public education from primary to secondary level will aid in bridging the income gaps between the rich and the poor. Since countries that uphold the death penalty have higher rates of violent crimes which shows that it is not a deterrent factor, it is suggested that other alternatives to capital punishment be explored. In the same vein, concerted efforts must be geared toward reducing the unemployment rate by creating the enabling environment through the provision of basic infrastructures. These will provide the incentives to engage in grass-root farming, small-scale trading and also encourage entrants of large investors. Hence, failure to address these key issues will result in the failure of any policy channelled towards reducing crime rate. Although comprehensive, further research questions relating to both income inequality and criminality remain to be answered. Lack of data can severely hinder the ability to test a range of postulates. It is important to test the impact of other control variables, such as narcotics (production and trade), natural endowments, religion, culture, democracy and political institutions on violent crime. Moreover, it is of interest to explore crime rates for categories other than violent crime.

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APPENDICES

Table A1 List of countries:

S/No.	Country	Code	Region	Income Group	Gini Category
1	Algeria	DZA	NA	UMInc	MI
2	Angola	AGO	SA	UMInc	HI
3	Benin	BEN	WA	LInc	MI
4	Botswana	BWA	SA	UMInc	VHI
5	Cameroon	CMR	CA	LMInc	MI
6	Central African Republic	CAF	CA	LInc	VHI
7	Chad	TCD	CA	LInc	MI
8	Cote d'Ivoire	CIV	WA	LMInc	HI
9	Djibouti	DJI	EA	LMInc	MI
10	Egypt, Arab Rep.	EGY	NA	LMInc	MI
11	Ethiopia	ETH	EA	LInc	MI
12	Ghana	GHA	WA	LMInc	HI
13	Guinea	GIN	WA	LInc	MI
14	Kenya	KEN	EA	LInc	HI
15	Lesotho	LSO	SA	LMInc	VHI
16	Liberia	LBR	WA	LMInc	HI
17	Madagascar	MDG	SA	LInc	HI
18	Malawi	MWI	SA	LInc	MI
19	Mali	MLI	WA	LInc	MI
20	Mauritania	MRT	NA	LMInc	MI
21	Mauritius	MUS	SA	UMInc	LI
22	Morocco	MAR	NA	LMInc	HI
23	Mozambique	MOZ	SA	LInc	HI
24	Namibia	NAM	SA	UMInc	VHI
25	Niger	NER	WA	LInc	MI
26	Nigeria	NGA	WA	LMInc	HI
27	Rwanda	RWA	EA	LInc	HI
28	Sao Tome and Principe	STP	CA	LInc	HI
29	Senegal	SEN	WA	LMInc	MI
30	Seychelles	SYC	EA	UMInc	VHI
31	Sierra Leone	SLE	WA	LInc	MI
32	South Africa	ZAF	SA	UMInc	VHI
33	Swaziland	SWZ	SA	LMInc	HI
34	Tanzania	TZA	EA	LInc	MI
35	Togo	TGO	WA	LInc	MI
36	Tunisia	TUN	NA	UMInc	MI
37	Uganda	UGA	EA	LInc	HI
38	Zambia	ZMB	SA	LMInc	VHI

Notes: Central Africa; East Africa; North Africa; Southern Africa; West Africa; UMInc = upper middle income; LMInc = lower middle income; LInc = lower income; VHI = very high inequality; HI = high inequality; MI = medium inequality

Source: Authors' Compilation

Table A2 Data Description and Sources

S/No.	Variables	Short Description	Data Source(s)
1	Intentional homicides (per 100,000 people)	Death purposely inflicted by another person per 100,000 people	United Nations Office on Drugs and Crime (UNODC) 2017
2	Gini Index	Index of 0 represents perfect equality, while an index of 1 implies perfect inequality.	Lahoti *et al* (2016)
3	Age Dependency Ratio	This is the percentage of working-age to the population	World Bank (2017)
4	Rule of Law Index	Rule of Law (proxy for good governance). Estimate on good governance ranges from -2.5 (very weak) to 2.5 (very strong).	World Bank (2017)
5	Death Penalty	Dummy variable that takes the value 1 if the country has a death penalty in that year and 0 otherwise. Constructed by author	www.deathpenaltyinfo.org
6	School enrolment, primary (% gross)	Gross enrolment ratio is the ratio of total enrolment that officially completes primary education.	World Bank (2017)
7	School enrolment, secondary (% gross)	Gross enrolment ratio is the ratio of total enrolment that officially completes secondary education.	World Bank (2017)
8	School enrolment, tertiary, male (% gross)	Gross enrolment ratio is the ratio of total enrolment that officially completes tertiary education.	World Bank (2017)
9	Unemployment, youth total	Percentage of total labour force ages 15-24 (modeled ILO estimate)	World Bank (2017)
10	Unemployment, youth female	Percentage of female labour force ages 15-24 (modeled ILO estimate)	World Bank (2017)
11	Unemployment, youth male	Percentage of male labour force ages 15-24 (modeled ILO estimate)	World Bank (2017)
12	Unemployment, total	Percentage of total labour force (modeled ILO estimate)	World Bank (2017)
13	Unemployment, male	Percentage of male labour force (modeled ILO estimate)	World Bank (2017)
14	Unemployment, female	Percentage of female labour force (modeled ILO estimate)	World Bank (2017)
15	Urban population	Percentage of total population living in urban areas as defined by national statistical offices.	World Bank (2017)
16	Central Africa, East Africa, North Africa, Southern Africa and West Africa	Dummy variables that take the values of 1 if a country is located in that region and 0 if otherwise.	Constructed by author.

Source: Authors' Compilations

Table A3 Correlation Matrix

Variables	***VC***	***Gini***	***Age***	***Urban***	***RoL***	***DtPen***	***Pry***	***Sec***	***Ter***	***UnemT***	***UnemY***	***UnemM***	***UnemF***	***UnemYM***
Violent Crime	1.00													
Gini Index	0.44	1.00												
Age Dependency	0.28	0.26	1.00											
Urban Pop. Rate	-0.19	-0.34	-0.76	1.00										
Rule of Law	-0.05	0.18	-0.54	0.14	1.00									
Death Penalty	0.33	-0.14	0.20	-0.31	-0.07	1.00								
Pry Enrol. Rate	-0.27	0.30	0.00	-0.17	0.04	-0.13	1.00							
Sec. Enrol. Rate	-0.15	-0.35	-0.90	0.76	0.50	-0.08	-0.11	1.00						
Ter. Enrol. Rate	-0.26	-0.44	-0.87	0.65	0.49	-0.01	-0.15	0.90	1.00					
Total Unem. Rate	0.13	0.07	-0.26	0.39	0.15	-0.13	-0.15	0.30	0.21	1.00				
Youth Unem. Rate	0.09	-0.03	-0.47	0.49	0.30	-0.07	-0.18	0.51	0.45	0.96	1.00			
Male Unem. Rate	0.17	0.14	-0.20	0.37	0.10	-0.17	-0.13	0.22	0.11	0.98	0.91	1.00		
Female Unem. Rate	-0.01	-0.22	-0.46	0.50	0.19	-0.01	-0.15	0.51	0.49	0.91	0.95	0.83	1.00	
Youth Male Unem. Rate	0.08	0.07	-0.40	0.44	0.27	-0.16	-0.16	0.42	0.36	0.97	0.98	0.95	0.89	1.00
Youth Female Unem. Rate	0.00	-0.30	-0.54	0.53	0.24	0.08	-0.16	0.61	0.58	0.80	0.91	0.71	0.97	0.81

Notes: *VC.*= violent crime; *Age* = age dependency ratio; *Urban* = urban population; *RoL* = rule of law; *DtPen.* = death penalty; *Pry* = primary enrolment rate; *Sec* = secondar rate; *Ter* = tertiary enrolment rate; *UnemT* = total unemployment rate; *UnemY* = total youth unemployment rate; *UnemM* = male unemployment rate; *UnemF* = female unemp rate; *UnemYM* = male youth unemployment rate; *UnemYF* = female youth unemployment rate

Source: Authors' Computations