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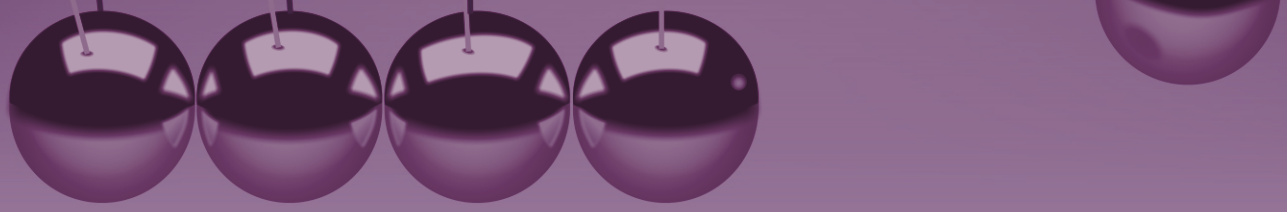

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Effects of Ethnic Diversity and Poverty on Crime Rate in Nigeria

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Abstract
Ethnic diversity in Nigeria and its effects on the poor is endemic. Among the various ethnic diversity, there is high rate of criminal activities and poverty. This study examine the effects of ethnic diversity and poverty on crime in Nigeria. Further, this study tested annual time series based on Nigeria data from 1970 to 2017. While noting endogeneity in the nature of the variable based on literature. The Autoregressive Distributed Lag Model Instrumental Variables used to estimate the model. Estimated result showed that the variables co-integrated at the 1% level of significance. In addition, ethnic heterogeneity, poverty, and under five mortality significant to cause crime. Income growth and security expenditure have significant reduction effect on crime. Thus, this paper suggested to the policy makers to embark on income generation and good health care programmes for the poor. Also, adequate and up-to-date skills and apparatus be given to the security personnel to control crime.

Keywords: Ethnic diversity, poverty, income growth, security expenditure, crime,

Introduction

Shaw and McKay (1942) contended that the society disorganized especially when there was breakdown of bonds, norms, and order. That disorderliness took place because the new poor migrants in urban areas are in majority in any ethnic population confronted with residential immobility and ethnic heterogeneity. As they are challenged with severe poverty over the minority population that is well to do. Further, the problem of economic deprivation made ethnic heterogeneity problem to surface on the pretext to satisfy their economic needs. By this, they jettison the norms and orders in the urban area/society- a situation that often leads to violence and criminal activities. In testing the assertion, many researchers have examined the relationship between ethnic heterogeneity and crime; while some studies found positive linear empirical supports (Ebbe, 1989; Osgood & Chambers, 2000; Altheimer, 2008; Sandoval, 2018), Trawick & Howsen, (2006) found negative linear empirical support as De

Soysa and Noel (2018) found an inverted U-shape when testing the linear and non-linear relationship; their mixed findings pave room for further study to be conducted. Therefore, this study aim to examine the effects of ethnic diversity and poverty on crime rate in Nigeria.

In filling the existing gap in the literature, this study analysed how ethnic diversity and poverty determines crime rate using a time series from 1970 to 2017 especially with the aim to answer a pertinent research question how does ethnic diversity and poverty affect crime rate in Nigeria? The answering to the question demanded attention because Brennan-Galvin (2002) discovered that violence usually erupted among the poor in the different ethnicity residing in cities like Kano, Lagos and other major cities in Nigeria. Ever since, researchers in Nigeria has not considered the effects of ethnic diversity and poverty on crime rate. Moreover, Ebbe (1989) concluded that high crime and delinquency rates was due to heterogeneity. The heterogeneity is made of segregation in residence in terms of low, medium and high-income residents' areas but it limited to Lagos metropolis. Similarly, Badiora *et al.* (2014) showed that the poor among the inhabitants of Ile-Ife which have mix of different ethnic groups involved in violent crime (Badiora *et al.*, 2014).

The contributions of this study are numerous; firstly, it revealed the roles play by ethnic heterogeneity and poverty in Nigeria; secondly, it pointed the devastating effects of crime in the country which increase the cost of operation and national budget spending on security, discourage investment in the country; thirdly, it provided guide to the policy makers, investors and organisation to take the issues of deterrence and adequate investment in health as serious matter in the country; fourthly, it provided a viable document to the literature on crime studies in Nigeria; and lastly, this research served as insight to the policymakers on the need to reduce crime and poverty in the country. The remaining part of this paper is divided into five sections: Section two considered literature review, Section three discussed the empirical strategy, Section four presented the results, Section five focused on discussion and Section six is the conclusion of the study.

Literature Review

Conceptual Issues

Crime rate in Nigeria

What constituted immoral/illegal and criminal acts depends on the norms/values or standard set by any society (Meera & Jayakumar, 1995).It is an illegal act motivated by incentives for

self-enrichment in case of property crime and by hate or passion in the case of person's crime (Ehrlich, 1973). It means any exhibited acts which is against the rules and regulation in a define territory either it may be injurious or not is referred to as crime. It is often measured as $Crime\ rate = \frac{Number\ of\ Crime}{Total\ Popluation} \times 100{,}000.$

Various illegal act existed in Nigeria, among them are murder, assault and burglary as presented in Table 1. For instance, the average murder rate from 2.16 per 100,000population in the period of 1980-1989 increased to 3.89 per 100,000 population in the period of 2000-2009, but reduced to 1.64 per 1000,000 population in the period of 2010-2017. The growth rate of armed robbery reduced by 47.59% and 42.38% in the period of 1980-1989 and 2000-2009 but increased by 53.08% in the period of 2010-2017.Considering the share of total crime cases among regions crime in Nigeria from 2016 to 2017 as presented in Figure 1; the South East has the highest 10.09% change in share of total crime while the least change in share of -6.21% occurred in North Central. But, the South West has the highest recorded of 45.88% in 2016 and 45.31% in 2017 while the North West has 7.87% share in total crime cases in 2016.

There are effects of crime rate in the country; for instance, business and foreign investment suffers losses worth billions of dollars (Brennan-Galvin, 2002). In 2008, 191.62 million metric tons valued at ₦14.594billion lost because of Niger Delta militants' rebellious act (Nigeria Bureau of Statistics (NBS), 2011).Between 2006 and 2011, an average death per person of 1,655 recorded and the killings by armed robbers was 50% of 8,516 deaths (Nigeria Watch, 2011; Nwankwo & James, 2016). Besides, several numbers of police officers murdered by militants and armed bandits (Ojedokun, 2014). Thus, crime amount to wastage of resources and human potentials. Also, the criminality activity affected growth and public service provision, distorts the environment for engaging in business and functions as a tax on private investments in Nigeria (Okonjo-Iweala & Osafo-Kwaako, 2007).

Table2.1: Crime Types in Nigeria

Types of Crime	Average Rate of Crime					Growth Rate of Crime				
	1970-1979	1980-1989	1990-1999	2000-2009	2010-2017	1970-1979	1980-1989	1990-1999	2000-2009	2010-2017
Murder	1.99	2.16	1.50	3.89	1.64	38.69	-28.63	-8.79	1549.86	26.49
Felonious Wounding	10.39	16.81	15.13	11.48	5.28	193.16	-27.70	-18.34	-35.81	20.61
Assault	78.45	61.82	44.89	20.18	10.92	35.87	4.73	-43.13	-68.13	58.13
Armed Robbery	2.637	1.79	1.78	2.02	1.76	-13.60	-47.59	13.74	-42.38	53.08
Burglary	25.61	32.40	18.83	8.16	3.37	51.00	94.90	-52.63	-24.20	-67.54
Other Crimes against Persons	6.035	17.92	20.17	9.91	15.62	-55.89	729.66	-48.51	-74.75	333.28
Other Crimes against Property	15.64	115.56	27.88	27.72	19.70	74.27	3281.77	-36.15	316.33	817.16
Other Minor offences/crimes	16.69	62.52	7.05	1.43	3.48	446.61	-36.83	-34.46	-97.49	4526.94
Total Crime Rate	306.44	370.37	238.41	107.58	67.38	26.053	20.29	-49.30	-56.04	4.49

Note: above elaboration should not be cited without making reference to the author.
Source: Author computation based on crime report from the Nigeria Bureau of Statistic.

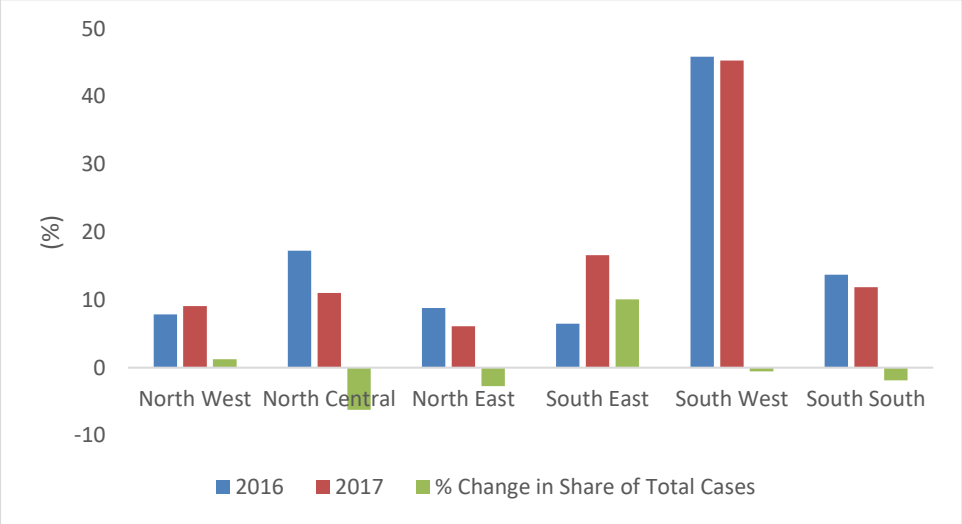

Figure 1: Share of total crime cases among regions crime in Nigeria
Author: Author computation based on NBS crime statistics

Ethnic diversity in Nigeria

Diversity is significant to determine the stability and prosperity of a country. As ethnic diversity is a concept that show diverse attributes in a nation. These attributes include minority, race, class and group in a country. The group can include immigrants or settlers and other nationalities (Saqib, 2018). Ethnicity emphasis culture sharing, languages and religion. It can cause distrust in country thereby making each group hate one another (De Soysa & Noel, 2018). Such hatred make it difficult for the policy makers to manage the ethnic tension (Saqib, 2018). It is thus associated with violence. Ethnic diversity measured by ethnic

fractionalization index. The index reflects the likelihood that two people chosen at random within a given country will be from different ethnic groups.

Heterogeneity effects increases in Nigeria because most urban centres were not planned. Urban dwellers face acute shortage of housing, a situation that led to more slums created. A large number of people facing socioeconomic deprivation resides in slum areas. As slum areas accommodate the poor from the different ethnic population. Heterogeneity became worse as residential classified into high, medium, and low-income in Nigeria (Ebbe, 1989; Opoko & Oluwatayo, 2014). And the poor in urban areas faced high level of job immobility. This reduces social bond due to new contacts made (Shopeju, 2007). Thus, poor social integration increased among migrants from rural to urban areas. This creates difficult situation for the security personnel. This is because available public facilities and resources overstretched and become inadequate. It becomes difficult to apprehend criminals given the opportunity to commit crime.

Poverty in Nigeria

The report of Nigeria Bureau of Statistics of various years indicated that high poverty rate exist in the country (see Table 2.3). Between 1980 and 2010, poverty rates increased from 27.2% in 1980 to 46.3% in 1985 and by 1996, it increases to 65.6%; this later rose to 69% in 2010. Further, the magnitudes of poverty in Nigeria showed that poverty in the urban areas intensified but not like the poverty in the rural areas. Also, a cursory look at Table 2.3 revealed that the urban poverty rose from 43.2% in 2004 to 73.2% in 2010 while the rural poverty increased from 63.3% in 1980 to 73.2% in 2010. However, various measures to reduce poverty have been adopted in the country as highlighted in Obadan (2002) but these measures seems not adequate (Umukoro, 2013). This is because the available social protection in Nigeria were weak to move the large number of population out of poverty; that is, halving number of people living below US$ 1 a day and reduction of poverty to 21.40% proved difficulty (MDG Report, 2013). Thus, the prevalence of poverty in Nigeria may continue to encourage high poor economic development in the country.

TABLE 2.3: Spread and Trend in Poverty Levels (%) in Nigeria

Years	**1980**	**1985**	**1992**	**1996**	**2004**	**2010**
Levels						
NATIONAL	27.2	46.3	42.7	65.6	54.4	69
Urban	17.2	37.8	37.5	58.2	43.2	61.8
Rural	28.3	51.4	46	69.3	63.3	73.2
ZONE						
South South	13.2	45.7	40.8	58.2	35.1	63.8
South East	12.9	30.4	41	53.5	26.7	67
South West	13.4	38.6	43.1	60.9	43	49.8
North Central	32.2	50.8	46	64.7	67	67.5
North East	35.6	54.9	54	70.1	72.2	76.3
North West	37.7	52.1	36.5	77.2	71.2	77.7

Source: National Bureau of Statistics 2010.

Empirical Review

Hansmann and Quigley (1982) observed in a cross-country study of 58 and 40 that population heterogeneity in the cultural group due to interaction among different ethnicity has a significant positive effect on crime of homicide while that of religion and language has an individual impact in reducing crime of homicide using ordinary least square method. Income inequality as not too distant from poverty detected to increase the crime of homicide as income per capita has a reducing effect on homicide. Besides, when the population of young people is higher with a low level of per capita income would further exacerbate the rate of homicide. Sandoval (2018) concluded that demographic disparity especially among the young population and disagreement between armed gangs increases rate of homicide in Colombia.

Cherry (1999) conducted a panel study in the United State by asserting that it is improper to leave unobserved heterogeneity in a crime model. The unobserved heterogeneity as minority population measures it estimated along with other socioeconomic factors and deterrence measures with the random/fixed-effect method. The result indicated that unobserved heterogeneity is significant to increase crime while unemployment increase all types of crime, income only has a reducing effect on murder. The deterrence measures vary in the

outcome, while the probability of arrest has a reducing impact on all types of crime, the length of sentence is not significant but the presence of Police in the crime environment is only significant and negative on murder and positive on larceny. The study results revealed that when unobserved heterogeneity is not considered, the deterrence measures are overstated in the model, therefore, studying the minority population along with the municipal population provided opportunity to see the individual effect of the deterrence measures on various types of crime. Zhang (2016) included the use of police and incarceration showed reducing the effect on crime when taking note of unobserved heterogeneity. Similarly, Cerro & Meloni (2000) found that Police arrest and conviction of criminals led to crime reduction in Argentina in the prevalence of high and inequality causing crime but, found that high income area attract criminal activities as income increases crime.

Trawick and Howsen (2006) examined community heterogeneity on the crime rate in the United State using a Tobit analysis. Community heterogeneity measured with race, ethnicity and religion. The result showed that race/ethnic and religion are significant and negative on the crime rate. This means a homogeneous race community is not prone to criminal activities because when community share the same norms, cultures, beliefs and teaching such community would experience low criminal activities; this supports the sociological theory and thus, the community would require small resources to control crime. However, the selling of alcohol spirit in the community would promote criminal activities, which include larceny, burglary, autotheft,and robbery. The reducing effect of religion on crime by Trawick and Howsen (2006) provided support for Hansmann and Quigley (1982).

Altheimer (2008) examined ethnic heterogeneity and interacted it with social supports on the crime of homicide in a cross-country study of 51. Using the estimation of weighted least square method; the study revealed that ethnic heterogeneity and economic inequality causes homicide in any form of social support introduced. However, when ethnic heterogeneity interacts with health care and human development index at a different time, the homicide rate reduces. Likewise, the general support and income per capita significant reduce the homicide rate. Similar results found in Ouimet (2012), Ouimet (2012) studied ethnic heterogeneity and socioeconomic factors on the crime of homicide in a cross-country study of 165, which include low, medium, and high income in multiple regression. The result showed that ethnic heterogeneity increases homicide, which further supported with the evidence of positive significant impact on homicide in medium income countries. Further, poverty measured with

an excess of under-five mortality rate causes homicide and likewise in high-income countries; but income inequality causes homicide in medium countries and the overall countries.
However, De Soysa and Noel (2018) examined the linked between ethnic diversity and violent crime in study of 140 countries from 1995 to 2013; the data analysed using a robust panel Ordinary Least Squares. Their result indicated that ethnic heterogeneity has an inverted U-shape relationship with violent crime. While they contended that existence of polarisation increased the risk of armed violence, they concluded that ethnic heterogeneity was not responsible for social dislocation happened in the society. Further, they found that GDP per capita reduces violent crime and income inequality did nor drive violent crime.

The empirical finding in Hansmann and Quigley (1982), Trawick and Howsen (2006), Cherry (1999), Altheimer (2008) and Sandoval (2018) supported that ethnic heterogeneity causes crime which support the social disorganization theory. Also, studies with measures of poverty provide support to the social disorganization and rational choice theory (Hansmann & Quigley, 1982; Altheimer, 2008 and Ouimet, 2012). But, De Soysa and Noel (2018) demonstrated a contrary result, and thus concluded that ethnic heterogeneity was not responsible for violent crime. From the previous studies, it is noted that most of the studies are cross country studies and based on developed nations and not in developing country like Nigeria. Also, this study used time series and thus, differed from previous studies that used cross country data, cross-section and time series.

Empirical Strategy

Theoretical Framework

This study used the crime supply function as proposed by Becker (1968), this model presented in equation 1 and it helps to determine the reasons for criminal activities. In the model, determinants are into two forms; while the first form caused crime, the other form sees crime reduction, which referred to, as deterrence. In equation 1, CR_t is the total number of crime which depends on PR_t, PA_t andU_t. The U_t represents socioeconomic factors that motivates crime or increases the opportunity cost of crime in a society, which include poverty. As mentioned earlier, the second form are various deterrence policy such as prosecution and arrest (PR_t) and punishment through the imprisonment (PA_t). Similar studies that have employed this model includes Cherry (1999), Trawick and Howsen (2006).

$CR_t = f(PR_t, PA_t, U_t)(1)$ (1)

The model in equation 1extended to study racial and ethnic homogeneity along with other socioeconomic factors by Trawick and Howsen (2006) presented in equation 2, which did not include any of the deterrence policy. In equation 2, CR_t is crime rate per person in a community, $REG$is the religious factor;$GINI_t$represents the income inequality, indicates the ethnic homogeneity for community, and $Z_t$includes other socio variables in the model.

$CR_t = f(REG_t, GINI_t, HET_t, Z_t)$ (2)

Following Trawick and Howsen (2006), we modified Equation 2which led to equation 3 by testing heterogeneity (HET_t), poverty ($POVC_t$), and under five mortality (MRU_t), the growth rate of income per capita ($GRPC_t$) and public expenditure on internal security (PES_t) on the crime rate (CR_t). This equation 3 includes public expenditure on internal security (PES_t) as a deterrence policy suggested in equation 1 by Becker (1968).

$CR_t = f(HET_t, POVC_t, MRU_t, GRPC_t, PES_t)$ (3)

Where the total crime rate in the country isCR_t, HET_t is the ethnic heterogeneity. $POVC_t$ispoverty rate and $MRU_t$is poverty of under-five mortality, $GRPC_t$ is growth in income and $PES_t$is the public expenditure on internal security. In this model, ethnic heterogeneity (HET_t), poverty rate ($POVC_t$) and the under five mortality (MRU_t) expected to increase crime rate with positive sign since this increases the chances to commit crime. Growth rate of income ($GRPC_t$) and the public security expenditure (PES_t) expected to be negative as an anti-dote to crime because it expects to reduce the chances to commit crime.

Model Specification

In line with the crime model expressed in equation 3, equation 4 thus specified. In this model, $lnCR_t$ represents log of the crime rate variable; HET_t represents the ethnic diversity index, $POVC_t$(%) and MRU_t represents the poverty rate and under five infants mortality respectively.$GRPC_t$ denotes growth rate of income (%) and $lnPES_t$ stands for log of security expenditure. a $\beta_0\ is\ constant,\ \beta_1,\ \beta_2, \beta_3, \beta_4 and\ \beta_5$ are parameters andμ_t is the white noise.

$$lnCR_t = \beta_0 + \beta_1 HET_t + \beta_2 POVC_t + \beta_3 MRU_t + \beta_4 GRPC_t + \beta_5 lnPES_t + \mu_t (4)$$

Cointegration Test

To test the model in equation 4, the preliminary is to conducted unit root tests due to the annual time series employed in the study, and sequel cointegration test. This study conducted unit root test usingAugmented Dickey-Fuller (ADF) and Phillip Perron tests. Based on these tests all the variables are integrated at the level I(0) and first difference I(1) (see Table 3 in section 5.0). Pesaran, Shin, and Smith (2001) proposed that a bound test approach be used to examine the exist of long run relationship specifically when the result of the unit root tests showed that variables are integrated at I(0) and I(1). Besides, the existence of high correlation among the variables in a model suggests high probability of endogeneity. The bound test minimised such problem of endogeneity in the model. This is because the bound test approach has the ability to generate sufficient lags for variables in the model and sufficiently provide for means to ascertain residual correlation. Once there is no serial correlation then endogeneity issue is treated. The dynamism based on the transformation of the variable at the period of one lag in the model using the optimal lag length. These variables in the model transformed based on the Akaike information criterion (AIC) due to the small sample size used in this study (see Adekoya & Abdul Razak, 2017). Liew (2004) found that AIC is most suitable to decide the optimal lag length for the variable in smaller sample size. Further, the Autoregressive Distributed Lag Model (ARDL) Instrumental Variable (this discussed in the next section) used because it is capable of providing the short-run and long run at the same time.

Using the ARDL framework in equation 5, the F-statistic tested the joint significance of the coefficients at one period of lag and the result presented in Table 3. The null hypothesis of no co-integration shows that $H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ (implies non-existence of cointegration) and the alternative is $H_A : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq\neq \beta_5 \neq \beta_6 \neq 0$ where at least one of the $\beta_1 \; to \; \beta_6 \neq 0$ (implies the existence of cointegration). $\gamma_1 \; to \; \gamma_6$ signifythe short-run dynamics of the ARDL model in equation 6.

$$\Delta lnCR_t = \beta_{0A} + \beta_1 lnCR_{t-1} + \beta_2 HET_{t-1} + \beta_3 POVC_{t-1} + \beta_4 MRU_{t-1} + \beta_5 GRPC_{t-1} + \beta_6 lnPES_{t-1} + \sum_{i=1}^{p} \gamma_1 \Delta lnCR_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta HET_{t-1} + \sum_{i=0}^{p} \gamma_3 \Delta POVC_{t-1} + \sum_{i=0}^{p} \gamma_4 \Delta MRU_{t-1} + \sum_{i=0}^{p} \gamma_5 \Delta GRPC_{t-1} + \sum_{i=0}^{p} \gamma_6 \Delta lnPES_{t-1} + \mu_t \quad (5)$$

$$\Delta lnCR_t = \beta_{0B} + \sum_{i=1}^{p} \gamma_1 \Delta lnCR_{t-1} + \sum_{i=0}^{p} \gamma_2 \Delta HET_{t-1} + \sum_{i=0}^{p} \gamma_3 \Delta POVC_{t-1} + \sum_{i=0}^{p} \gamma_4 \Delta MRU_{t-1} + \sum_{i=0}^{p} \gamma_5 \Delta GRPC_{t-1} + \sum_{i=0}^{p} \gamma_6 \Delta lnPES_{t-1} + \mu_{tB}$$

Endogeneity and Bewley Model

Sequel to the bound test used to establish the cointegration among these variables, it is relevant to reaffirm that endogeneity problem is at stake among these variables. This is due to the significant high correlation value among some variables presented in Table 2, which include crime, poverty measurements, and security expenditure. Likewise, Mehlum, Miguel, and Torvik (2006) did not rule out that the causal effects of poverty on property crime are potentially subject to bias due to endogeneity and omitted variables. Also, Levitt (1997), Bourguignon (1999), Adekoya and Abdul Razak (2018)contended that expenditure on internal security have the issue of endogeneity with crime since high criminal activities may suggest that more security with increase insecurity expenditure. Therefore, model 5 (ARDL OLS) becomes sufficient provided there is no serial correlation but we are more concerned about the problem of simultaneity to avoid spurious regression. Therefore, to address potential bias caused by endogeneity and omitted variable bias, the ARDL Instrumental Variable (ARDL IV) was employed (although the estimated standard error in ARDL OLS is identical to ARDL IV, results are available on request). However, the test of homogeneity not conducted since there is the existence of significant high correlation among some of the variables. Notwithstanding, Stučka (2004) affirmed that once ARDL IV used for estimation, there is no need to test for endogeneity.

Therefore, we dealt with the potential bias caused by endogeneity and omitted variable using ARDL instrument variable (IV) by rewritten the Bewley equation. The ARDL IV allows the

estimated short and long run of ARDL using the lag of the dependent variable as the independent variable (Stučka, 2004). Therefore, this study overcomes the problem of whether the instrument should correlate with any of the variables. In addition, Inder (1993) concluded that when ECM (dynamic equation) reparametrized in Bewley equation endogeneity bias problems are insignificant and reasonably inconsequential. Equation 5 and 6 are reparametrized to generate equation 7 and 8 (see Pesaran & Shin, 1997). Thus, the estimated long run and short run model is expressed in equation 7 and 8 respectively based on ARDL selected model1, 1, 0, 0, 1, 0with the instruments as 1, $lnCR_{t-1}$,HET_{t-1} , $POVC_t$, MRU_t , $GRPC_{t-1}$, $lnPES_t$, ΔHET_{t-1} , $\Delta GRPC_t$.

$$lnCR_t = \frac{a_{c0}}{\emptyset(1)} + \vartheta_1 HET_t + \vartheta_2 POVC_t + \vartheta_3 MRU_t + \vartheta_4 GRPC_t + \vartheta_5 lnPES_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \vartheta_6 \Delta HET_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \vartheta_7 \Delta GRPC_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_2-1} \vartheta_8 \Delta lnCR_t + \frac{\eta_t}{\emptyset(1)} \quad (7)$$

$$\Delta lnCR_t = \frac{a_{d0}}{\emptyset(1)} + \vartheta_9 POVC_t + \vartheta_{10} MRU_t + \vartheta_{11} lnPES_t + \vartheta_{12} HET_{t-1} + \vartheta_{13} GRPC_{t-1} + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \vartheta_{14} \Delta HET_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_1-1} \vartheta_{15} \Delta GRPC_t + \frac{1}{\emptyset(1)} \sum_{i=0}^{m_2-1} \vartheta_{16} \Delta lnCR_{t-1} + \frac{\eta_t}{\emptyset(1)} \quad (8)$$

Data

This study used annual time series from 1970 to 2017 to examine the effects of ethnic diversity and poverty on crime. Data on the total crime rate (CR_t) sourced from the Nigeria Bureau Statistics and the Nigeria Police Annual Reports of various publications. Crime rate define as total crime committed/total population multiply by 100,000. It is the interest of the researcher to disaggregate crime but these data are not available up to date. The poverty rate ($POVC_t$) is the inverse of logarithm of per capita household consumption multiply by 100 and is based on data obtained from Economics and Research Department, United Nations. The index used because poverty time series is not available and thus, considered the disadvantage

index approach used in Mata and Bollman (2007). Other variables in the study are the under-five mortality (MRU_t) andincome growth ($GRPC_t$) which is the growth (%) in GDP per capita sourced from the World Development Indicator. Ethnic diversity (HET_t) proxy by ethnic violence index sourced from Marshall (2016), it is the magnitude score of episode(s) of ethnic violence involving the country in each year which is on the scale of 1 (lowest) to 10 (highest) as non-occurrence of violence denoted with zero (0). This data used because ethnic violence is associated with ethnic diversity. As ethnic tensions based on hatred or discrimination often cause of civil unrest (Ouimet, 2012). In Nigeria, this lawlessness caused bloodletting ethnic squabble and secrecy in the entire political landscape (Dike, 2014). Public expenditure on internal security (PES_t) obtained from the Central Bank of Nigeria various annual reports as a percentage to total expenditure. Thus, crime and security expenditure data are in logarithm form.

Results

The descriptive statistics of variables employed in this study are presented in Table 1. It revealed that means of each variables lies between the minimum and maximum values; this means data are fit for further estimation. Moreover, the results in Table 2 shows high correlation exist among crime rate, poverty rate, under five mortality, and security expenditure rate. For instance, significant correlations of 89.85% exist between poverty rate and crime rate, 86.88% for poverty rate and security expenditure rate, and 94.97% in the case of security expenditure and crime rate. These high correlations suggested that these variables are endogenous and therefore the analysis required estimation technique, which can detect and minimize the problem of endogeneity such as the Autoregressive Distributed Lagged Model (ARDL) Two Stage Least Square.

Table1
Descriptive Statistics

Variables	Observations	Median	Mean	Std. Dev.	Minimum	Maximum
$lnCR_t$	48	5.5138	5.2235	0.6718	4.0904	6.1619
HET_t	48	1.0000	1.3333	1.1361	0.0000	4.0000
$POVC_t$	48	8.3656	8.3289	0.1781	8.0117	8.5936
MRU_t	48	208.0500	190.8250	47.1498	100.2000	283.7000
$GRPC_t$	48	1.6729	1.5310	7.6418	-15.4547	30.3565
$lnPES_t$	48	22.2583	22.8628	2.7133	18.9513	27.2820

Table 2
Results of the Correlational Test

Variables	$lnCR_t$	HET_t	$POVC_t$	MRU_t	$GRPC_t$	$lnPES_t$
$lnCR_t$	1.000000					
HET_t	-0.156709	1.000000				
	(0.2875)	-----				
$POVC_t$	0.898596	-0.171890	1.000000			
	(0.0000)	(0.2427)	-----			
MRU_t	0.873804	-0.296938	0.772282	1.000000		
	(0.0000)	(0.0404)	(0.0000)	-----		
$GRPC_t$	-0.221820	0.086739	-0.227598	0.031927	1.000000	
	(0.1297)	(0.5577)	(0.1198)	(0.8294)	-----	
$lnPES_t$	-0.949730	0.232953	-0.868803	-0.903601	0.178475	1.000000
	(0.0000)	(0.1111)	(0.0000)	(0.0000)	(0.2249)	-----

Note: the probability values are in parenthesis, whichindicates the significance level of the correlation value

To ensure that the data employed is not having serial correlation, the Augmented Dickey-Fuller (ADF) and Phillip Perron unit root tests are conducted. The result of the stationarity test as presented in Table3 showed that all the variables are integrated at the levelI (0) and first difference I(1). For instance,$lnCR_t$, $HET_t, POVC_t$ and $lnPES_t$ are stationary at I(1) as MRU_t and $GRPC_t$ are stationary at I(0) in the two tests conducted with exception of MRU_t that only stationary at I(0) under ADF test. Notwithstanding, this suggests the Bound Test approach in the study. It is possible to determine whether variables with different integration order would jointly move together using the Bound Test approach.

Table 3
Results of the Unit Root Test

Variables	Model	Lag length	*Augmented Dickey-Fuller* Statistics	Prob. value	*Phillip Perron* Statistics	Prob. Value	Decision
$lnCR_t$	Intercept and trend	1	-7.057***	0.000	-7.071***	0.000	I(1)
HET_t	Intercept and trend	1	-6.608***	0.000	-6.951***	0.000	I(1)
$POVC_t$	Intercept and trend	1	-9.879***	0.000	-11.658***	0.000	I(1)
MRU_t	Intercept and trend	0	-13.765***	0.000	-2.283	0.4343	I(0)
$GRPC_t$	Intercept and trend	0	-6.004***	0.000	-6.005***	0.000	I(0)
$lnPES_t$	Intercept and trend	1	-7.309***	0.000	-7.446***	0.000	I(1)

Note: the figures reported are t-ratio and showed the p-values of MacKinnon (1996) one-sided at various levels of significance. The asterisks (***) is at 1%.

With the bound test approach to cointegration, the result showed that the null hypothesis of no cointegration is reject atthe1% level of significance. This is because the F-statistic of 4.689 lies above the upper critical bound of 4.15 (see Table 4). That is, variables in the model are cointegrated. Moreover, the results of the long-run and short-run based on Bewley

equation using the ARDL instrument variable (IV) (see Pesaran & Shin, 1997) are presented in Table 4 along with the results of the diagnostic tests.

The long run estimation revealed that ethnic heterogeneity causes crime at the 10% level of significance. This revealed that an increase in ethnic heterogeneity would increase the occurrence of crime in Nigeria. A similar result obtained in Altheimer (2008) and Ouimet (2012). In addition, poverty and under five mortality are both significant at the 5% level of significance. While an increase of 1% in the poverty rate leads to 0.92% in the crime rate, the under-five mortality increases the crime rate by 0.004% point. Similar results obtained in the studies of Poveda (2012), Ouimet (2012), Rogers and Pridemore (2013).

Moreover, economic growth is negative and significant in determining the crime rate at the 10% level of significance. A rise of 1% in the growth rate of income as a measure of economic growth, the crime rate would reduce by 0.014%. Further, the result in Fajnzylber, Lederman and Loayza (2002), Deller and Deller (2012) are evidence that support the result. Nevertheless, Cerro and Meloni (2000) found non-significant impact of income growth on crime. The deterrence policy proxy by security expenditure is negative related to the crime rate at the 1% level of significance. That is, when security expenditure increases by 1%, the crime rate would reduce by 0.120%. This result is in line with Adekoyaand Abdul Razak (2018), Wu and Wu(2012).

Related to the long-run results, the result of the short-run revealed that poverty and under five mortality are significant to determine crime at the 5% level of significance. This means an increase of 1% in poverty increases criminal activities by 0.468%. In addition, an increase in under five mortality increases criminal activities by 0.002% point. Besides, the deterrence policy proxy with security expenditure is significant to reduce crime in the short-run at the 1% level of significance. A rise by 1% in security expenditure would assist to increase the rate of crime detection with a high possibility to apprehend criminals thereby leading to a reduction of crimeby0.060%.

Table 4
Estimates of the ARDL Crime Model using Bewley's regression form

Dependent variable: Crime			
Critical bounds (F-test)	1% significance level	Test of ARDL specification significance	
Lower	3.06	Adj-R-square=0.970	HQ=-1.146
Upper	4.15	SB=-0.925	AIC*=-1.279
ARDL specification	1, 1, 0, 0, 1, 0		
F-statistic	4.689		
Conclusion (sign level)	Cointegrated (1%)		
K	5		
Long-run Estimates			
C	-0.738	-0.181	
HET_t	0.061	1.793*	
$POVC_t$	0.926	2.227**	
MRU_t	0.004	2.284**	
$GRPC_t$	-0.014	-1.860*	
$lnPES_t$	-0.120	-2.885***	
ΔHET_t	-0.122	-2.446**	
$\Delta GRPC_t$	0.009	1.808*	
$\Delta lnCR_t$	-0.978	-2.580**	
Short-run Estimates			
C	-0.373	-0.180	
$lnCR_{t-1}$	-0.505	-5.216***	
HET_t	-0.030	-1.244	
$POVC_t$	0.468	2.034**	
MRU_t	0.002	2.021*	
$GRPC_t$	-0.002	-0.824	
$lnPES_t$	-0.060	-2.725***	
HET_{t-1}	0.061	2.454**	
$GRPC_{t-1}$	-0.004	-1.725*	
Diagnostics Tests			
$\boldsymbol{Normality\ test}\ (\chi^2_N)$	$JB = 8.658\ (0.013)$	$\boldsymbol{Kurtosis\ test} = 4.492$	
$\boldsymbol{Serial\ Correlation\ test}\ (\chi^2_{SC})$	$\chi^2 =\ 0.038\ (0.845)$		
$\boldsymbol{Heterokedasticity\ test}\ (\chi^2_H)$	$\chi^2 = 9.048\ (0.338)$		

Note:the asterisk (*) showed that the estimated coefficients are significant at 1% (***); 5% (**) and 10% (*). Also, the null of the diagnostic tests χ^2_H, $\chi^2_N$and χ^2_{SC} arereject at the 5% level of significance. Variables are defined as crime is$lnCR_t$ as a dependent variable while ethnic heterogeneity (HET_t), poverty ($POVC_t$), under five mortality (MRU_t), growth rate of income ($GRPC_t$) and security expenditure ($lnPES_t$) are independent variables. In the ARDL specification, the F-stat in the bounds test based on critical upper bounds.

The diagnostic test indicated that long-run coefficients estimated are robust for policy implementation. These tests are normality; functionality; serial correlation; heteroscedasticity and the structural stability test. The normality test (χ^2_N) of Jarque-Bera showed that the model failed to pass the test at the 5% level of significance; but, the Kurtosis the model is 4.492 which is in excess. Thus, the results of the Kurtosis were in excess which indicate that there is normal distribution following Saridakis (2011). In addition, this study found no traces of autocorrelation using the Chi-squared tool in LM test (χ^2_{SC}) of Breusch-Godfrey Serial

Correlation at lag 1 at 5% level of significance. Also, the Chi-squared tool of Breusch-Pagan-Godfrey Heteroskedasticity Test (χ_H^2) showed that the models passed this test at the 5% level of significance.

Discussion

The paper examined the effects of ethnic diversity and poverty on crime rate in the country. It is found that ethnic diversity and poverty causes crime; further, it confirmed that the poor among various ethnic diversities are frustrated because of the economic hardship, the stress induced on them encourage them to engage in crime. Similarly, Ebbe (1989) affirmed that children from the poor or slum area in Nigeria engage in crime. This is because economic deprivation is associated with a lack of opportunities, a situation that has caused much violence especially in major cities in the country (Brennan-Galvin, 2002). In most of the major cities, poor areas are characterised with high population density in heterogeneous form of ethnic diversity. This different group of population provide support for themselves even in the midst of one of them engaging in crime related matter. It therefore became it becomes uneasy for security agents to detect criminal among the high number of the poor population in the country. The possibility of this hinged on the fact the Nigeria Police are confronted with challenges that affect their efficiency; these are one, low intelligence capacity to gather facts relating to actual crime committed (Ojedokun, 2014) and two, there is a lack of modern equipment to combat crime in Nigeria (Otu, 2012). The state of the economy in the country is fair to discourage crime but a high economy featured with high rate of poverty and under five mortality required efforts to invigorate it. This is because when an economy improve three thing are emerged; one, it creates a better opportunity to enhance income; two, there is high possibility to reduce poverty and under five mortality in the country due to improved welfare and lastly, the poor are demotivated to engage in criminal activities. Further, sanction and detection prevents the criminal to commit crime because of the fear of imprisonment as criminal weight the cost of apprehension over the gain in committing a crime. Therefore, increasing the Police presence and other security agencies serves to demotivate criminal from engaging in crime in the country.

Conclusion

Ethnic diversity which are heterogeneous in nature causes crime. Similarly, poverty and

under five mortality increases crime in the country. But, income growth and security expenditure as a deterrence measure causes reduction in crime. Thus, the results obtained in this study informed that there is need to reduce crime and at same reduce poverty in the country. To do so, this study suggested the following policies.

Adequate measures to stimulate economic growth must be pursed. Growth policy on key sectors that could generate viable income-employment must be the focused for the policy makers. This shall provide job and enhanced the income for the poor, which is capable to move them out of poverty.

Promoting economic growth vide investment in health sector affords reduction in crime especially among the poor. This is necessary for two reasons; one, it subsidies the money spent by the poor on health bills, thereby complementing the income earn by the poor, and secondly, to aid the poor to access to good health care facilities thereby reducing under five mortality.

Investment in security must be pursed. This is to provide adequate and improve security personnel with modern skills and equipment. This is important to detect and combat crime; to come up with up to date crime statistics; to enhance the image of the country; and also, to boost economic growth indirectly as less criminal activities in the country would stimulate more investment.

This study has not been without challenges in the area of data. Data on crime are not up to date in the country and available ones are not easy to obtain from the Nigeria Police. This is also common in other countries (Wu & Wu, 2012). Similarly, time series data on poverty is not available but this is overcome by using a proxy for it as earlier discussed. Notwithstanding, the estimates in this study are robust for policy implementation. Future studies are required to test this link using panel data in the country.

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