

**AN INVESTIGATION ON CRIME RATE IN SOUTHEASTERN NIGERIA****Osuji G.A., Obubu M., Obiora-Ilouno H.O**

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**ABSTRACT:** *The modern world is everything but a safe place. This sad but indisputable fact has been proven to be true by several research. Crime rate is souring in this part of the continent and there exists many determinant to this anti-societal behavior amongst the people. In this paper, those variables that are crime prone in Southeastern Nigeria over a 10 year study period were determined using Principal Component Analysis (PCA); a Multivariate Statistical Technique that is use to reduce the dimensionality of a large number of interrelated crime variables while retaining as much of the information as possible. Data were collected on seven crime variables, from the data bank of National Bureau of Statistics (NBS). Moderate correlations exists between sizeable number of crimes, two principal components was extracted using the scree plot, explaining 86.4% of the total variation in the dataset. The highest and most committed crime in the study region are Armed Robbery, Murder and Grievous Harm and Wounding.*

**KEYWORDS:** crime rate, southeastern nigeria, principal component analysis, eigenvalues, scree plot

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**INTRODUCTION**

Ordinarily, the term crime denotes an unlawful act punishable by a state. In modern criminal law, the term crime does not have any simple and universally accepted definition though statutory definitions have been provided for certain purposes. The most popular view is that crime is a category created by law; in other words, something is a crime if declared as such by the relevant and applicable law. The notion that acts such as Murder, Rape, and Theft are to be prohibited exists worldwide. What precisely is a criminal offence is defined by criminal law of each country. While many have a catalogue of crimes called criminal code, in some common laws, countries with no such comprehensive statute exists. The causes of crime are multiple and could be traced to bio-genetic factors such as genetic mutation and heredity (Horton, 1939), psychological factors such as personality disorders (Abramson, 1994) and sociological factors such as learning environment (Sutherlands, 1939). Nigeria has one of the highest crime rates in Africa (List25 LLC, 2014). Murder often accompanies minor burglaries. Rich Nigerians lives in highly secured compounds and even the police in some states are empowered to 'Shoot on Sight' violent crimes (Financial times, 2009). These crimes are being carried out with more perfection and sophistication. This has led to the formation of various vigilante groups, to combat crimes in some parts of the country (Fejemirokun et al., 2006). One of the fundamental techniques to combat criminal activities is the better understanding of the dynamics of crime. Crime is often thought of as a moral threat and injurious to the society. However, it has been observed that the entire world is experiencing high criminal rate.

## Classification of Crimes

Crimes are classified based on the extent of punishment that can be given for committing it. The punishment is usually based on the seriousness of the crime. Countries may differ as to the classification of any particular crime. A crime committed in one country may be classified differently than if it was committed in another country. Crimes are classified as Felony Crimes such as Murder, Rape, Burglary, Kidnapping, Arson, Robbery, e.t.c., Misdemeanor Crimes such as Public Intoxication, Trespassing, Speeding, Prostitution, Vandalism, Use of fake ID, e.t.c.

However, In Nigeria, the police classification of crimes depends greatly on what law prescribed . In the Nigerian Police Abstract of Statistics (NPACS), offenses are categorized into four major categories:

- i. Offences against persons include: man slaughter, murder and attempted murder, assault, rape, child stealing, grievous harm and wounding, e.t.c.
- ii. Offences against property include: armed robbery, house and store breakings, forgery e.t.c
- iii. Offences against lawful authority include: forgery of currency notes, gambling, breach of peace, bribery and corruption e.t.c.

Offence against local act include: traffic offences, liquor offences, e.t.c.

In this Paper, Principal Component Analysis was used in determining the number of variables to be used in explaining the crime data, with objectives of;

- i. Examining the degree of the relationship existing between the different crimes considered in the last ten years.
- ii. Examining the crime that accounted for the highest percentage of the total crimes in Southeastern Nigeria.
- iii. Determining the principal variables in the data via principal component techniques.
- iv. Recommend lasting solutions aimed at reducing crime southeastern Nigeria and the world at large.

## METHODOLOGY

### Principal Component Analysis

Principal component analysis is a multivariate technique for transforming a set of related (correlated) variables into a set of unrelated (uncorrelated) variables that account for decreasing proportions of the variation of the original observations (Rencher, 2002). The rationale behind the method is an attempt to reduce the complexity of the data by decreasing the number of variables that need to be considered. If the first few of the derived variables (the principal components) among them account for a large proportion of the total variance of the observed variables, they can be used to provide a convenient summary of the data and to simplify subsequent analysis. Algebraically, principal component are particular linear

combinations of the  $p$  random variables  $X_1, X_2, \dots, X_p$ . Geometrically, these linear combination represents the selection of new coordinate system obtained by rotating the original system with  $X_1, X_2, \dots, X_p$  as the coordinate axes. The new axes represents the directions with maximum variability and provide a simpler and more parsimonious description of the covariance structure. Principal components depend solely on the covariance matrix  $\Sigma$  ( or the correlation matrix  $\rho$  ) of  $X_1, X_2, \dots, X_p$ . Their development does not require a multivariate normal assumption.

let the random vector  $\mathbf{X}^l = [X_1, X_2, \dots, X_p]$  have the covariance matrix  $\Sigma$  with eigenvalues  $\lambda_1 \geq \lambda_2 \geq \dots \geq \lambda_p \geq 0$ .

Consider the linear combination

$$Y_1 = \mathbf{a}'_1 \mathbf{X} = a_{11}X_1 + a_{12}X_2 + \dots + a_{1p}X_p$$

$$Y_2 = \mathbf{a}'_2 \mathbf{X} = a_{21}X_1 + a_{22}X_2 + \dots + a_{2p}X_p$$

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$$Y_p = \mathbf{a}'_p \mathbf{X} = a_{p1}X_1 + a_{p2}X_2 + \dots + a_{pp}X_p$$

Then,

$$\text{Var}(Y_i) = \mathbf{a}'_i \Sigma \mathbf{a}_i \quad i = 1, 2, \dots, p$$

$$\text{Cov}(Y_i, Y_k) = \mathbf{a}'_i \Sigma \mathbf{a}_k \quad i, k = 1, 2, \dots, p$$

Note;

First principle component = linear combination  $\mathbf{a}'_1 \mathbf{X}$  that maximizes  $\text{Var}(\mathbf{a}'_1 \mathbf{X})$  subject to  $\mathbf{a}'_1 \mathbf{a}_1 = 1$

Second principle component = linear combination  $\mathbf{a}'_2 \mathbf{X}$  that maximizes  $\text{Var}(\mathbf{a}'_2 \mathbf{X})$  subject to  $\mathbf{a}'_2 \mathbf{a}_2 = 1$  and  $\text{Cov}(\mathbf{a}'_1 \mathbf{X}, \mathbf{a}'_2 \mathbf{X}) = 0$

At the  $i$ th step,

$i$ th principle component = linear combination  $\mathbf{a}'_i \mathbf{X}$  that maximizes  $\text{Var}(\mathbf{a}'_i \mathbf{X})$  subject to  $\mathbf{a}'_i \mathbf{a}_i = 1$  and  $\text{Cov}(\mathbf{a}'_i \mathbf{X}, \mathbf{a}'_k \mathbf{X}) = 0$  for  $k < i$ .

Consider the covariance matrix of a Bivariate data

$$\Sigma = \begin{pmatrix} \delta_{11} & \delta_{12} \\ \delta_{11} & \delta_{12} \end{pmatrix}$$

and the derived correlation matrix

$$\rho = \begin{pmatrix} 1 & \rho_{12} \\ \rho_{21} & 1 \end{pmatrix}$$

The proportion of the total variance explained by the first principal component is

$$\Psi_{X_1} = \frac{\lambda_1}{\lambda_1 + \lambda_2}$$

which is larger than that explained by the second principal component when the X's are not standardized.

In determining the number of Principal Components to retain, the amount of total variance explained, the relative sizes of the eigenvalues, { Jolliffe (2002) } suggests using a cutoff on the eigenvalue of 0.7 when correlation matrices are analyzed., and a visual inspection of the scree plots are of prior importance.

## DATA ANALYSIS AND RESULT

**Table 1: Descriptive Statistics**

	Mean	Std. Deviation	N
Murder	33.972	21.061	10
Grievous Harm and Wounding6	21.80	14.031	10
Rape	10.100	2.737	10
Armed Robbery	35.402	22.359	10
Kidnapping	13.190	3.028	10
Store Breaking	17.801	7.448	10
House Breaking	13.409	3.591	10

From the descriptive statistics on table 1, we see that in southeastern part of Nigeria, crimes such as; Armed Robbery, Murder, and Grievous Harm and Wounding has the highest recorded rates thus, these crimes contributes highly to the overall total population. Due to the high dispersion amongst the crimes in southeastern Nigeria, we can also say that the crimes are evenly distributed.

**Table 2: KMO And Bartlett's Test**

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.946
Bartlett's Test	Approx. Chi-Square	52.994
Sphericity	df	21
	Sig.	.001

The null hypothesis that the correlation matrix is an identity matrix was rejected at 5% level of significance (Bartlett's test of Sphericity;  $\chi^2 = 52.994$ , p-value = .001), this implies that the correlation in the dataset are appropriate for factor analysis. Also, "Kaiser-Meyer-Olkin statistic = .946" revealed that adequate sampling is being used for this analysis.

**Table 3: Communalities**

	Initial	Extraction
Murder	1.000	.917
Grievous Harm and Wounding	1.000	.908
Rape	1.000	.611
Armed Robbery	1.000	.955
Kidnapping	1.000	.833
Store Breaking	1.000	.955
House Breaking	1.000	.875

From table 3, we see that Armed Robbery, Murder, and Grievous Harm and Wounding (.955, .917, .908) respectively, were best represented in the common factor space this was because a high proportion of their variances was explained by the principal components.

**Table 4: Correlation Matrix**

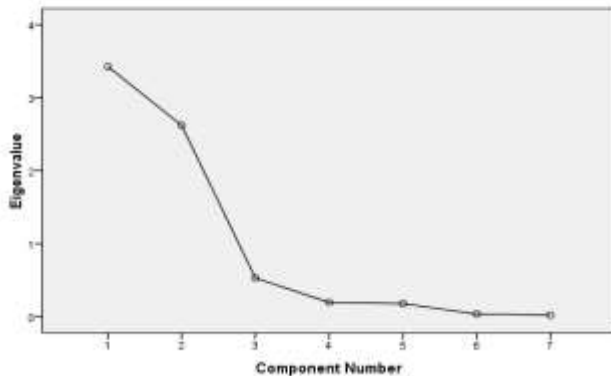
	M.D	GHW	RP	A.R	KNP	S.B	H.B
M.D	1.000	.587	.374	.865	.290	-.299	-.435
GHW	.587	1.000	-.681	.535	.755	.339	.415
RP	.374	-.681	1.000	.394	-.476	-.672	-.550
A.R	.865	.535	.394	1.000	.897	.507	.439
KNP	.290	.755	-.476	.897	1.000	.674	.632
S.B	-.299	.339	-.672	.507	.674	1.000	.658
H.B	-.435	.415	-.550	.439	.632	.658	1.000

Table 4 reveals that all the crime variables considered in this study are relatively important. Significant correlations exist between crimes against person ( Murder(M.D), Grievous Harm and Wounding (GHW), Rape(RP), and Kidnapping(KNP) ) and crimes against property (Armed Robbery(A.R), Store Breaking(S.B), and House Breaking(H.B)). The table shows Armed Robbery and Murder having the highest correlation coefficient (.865) implying that they are the most common crimes in Southeastern Nigeria. The more the population in this region, the more these crime rate (Armed Robbery and Murder).

**Table 5: Total Variance Explained**

Components	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.427	48.956	48.956	3.427	48.956	48.956
2	2.620	37.422	86.378	2.620	37.422	86.378
3	.528	7.542	93.921			
4	.194	2.767	96.687			
5	.177	2.532	99.220			
6	.034	.490	99.710			
7	.020	.290	100.000			

Variables	Component	
	1	2
1	.453	.385
2	.446	.340
3	.104	.054
4	.598	.392
5	.176	.013
6	.131	.008
7	.128	.032

**Fig 1: Scree Plot of Eigenvalues**

From the scree plot of eigenvalues on Fig 1, and extraction sums of squares loading on table 5, we see that two components were extracted. The two components explained 86.4% of the total variance in the data set, with component 1 accounting for 48.956% of the total variance explained with its significant position loading, and component 2 accounting for 37.422% of the total variance.

**Table 6: Coefficient of Principal Components**

	M.D	GHW	RP	A.R	KNP	S.B	H.B
M.D	1.000	.587	.374	.865	.290	-.299	-.435
GHW	.587	1.000	-.681	.535	.755	.339	.415
RP	.374	-.681	1.000	.394	-.476	-.672	-.550
A.R	.865	.535	.394	1.000	.897	.507	.439
KNP	.290	.755	-.476	.897	1.000	.674	.632
S.B	-.299	.339	-.672	.507	.674	1.000	.658
H.B	-.435	.415	-.550	.439	.632	.658	1.000

The equations of the principal components are;

$$Y_1 = 0.453\text{Murder} + 0.446\text{GHW} + 0.104\text{Rape} + 0.598\text{ArmedRobbery} + 0.176\text{Kidnapping} + 0.131\text{Store Breaking} + 0.128 \text{ House Breaking}$$

$$Y_2 = 0.385\text{Murder} + 0.340\text{GHW} + 0.054\text{Rape} + 0.392\text{ArmedRobbery} + 0.013\text{Kidnapping} + 0.008\text{Store Breaking} + 0.032 \text{ House Breaking}$$

From the 1st and 2nd principal component above, we see that Armed Robbery, Murder and, Grievous Harm and Wounding constituted more to the crime rate than Store Breaking, House Breaking, Kidnapping and Rape in Southeastern Nigerian. This implies a great difference between crimes such as; Armed Robbery, Murder and, Grievous Harm and Wounding compared with Store Breaking, House Breaking, Kidnapping and Rape.

## CONCLUSION

Principal Component Analysis was applied in this study from which two components were extracted explaining about 86.4% of the total variability in the data set. The highest and most committed crime in Southeastern Nigeria are Armed Robbery , Murder and Grievous Harm and Wounding. Moderate correlations exists between sizeable number of crimes.

## RECOMMENDATIONS

The role of the police as enshrined in the Constitution of the Federal Republic of Nigeria, as it concerns crime prevention and control cannot be over-emphasized. the development of a society largely depends on the rate of crime. If the crime rate is high, it could scare away or discourage investors. Also, the safety of lives and property is an issue of priority in any given society. Consequently, the government needs to increase its funding for the police so that modern and adequate equipment to combat crime could be acquired. However, such funds are to be properly monitored to avoid diversion into private pockets and also rid the Nigerian police of its corrupt elements. Government intervention in the provision of infrastructure and other basic amenities that would make life more meaningful should be encouraged. The government must also take proactive measures towards poverty alleviation . Poverty readily offers a breeding and fertile ground for crime. As such, any effort made towards poverty alleviation automatically translates to efforts made toward crime prevention and control in the society. The family institution must also play its role by monitoring all the people in the family particularly the youth, as the police cannot fight crime alone. Intelligence gathering is a veritable tool for crime prevention and control. This is why the members of the public must wake up to assist the police in its functions. The public should be ready at all times to give necessary information to the police. This is because, crime is a challenge that all and sundry must confront headlong for a stable and safe society.



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