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Canonical Correlation Analysis of Some Crimes Rate and Unemployment in Nigeria (1999-2019)

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ABSTRACT

In the 21st century, the internet has become a quicker platform through which crimes are reported to the public. Crime is an important topic and is of interest to us because of the consequences and penalties it attracts. This work the study is to show the pattern and crime rate in Nigeria. Then, show the relationships that exist between crime figures and employment status/gender by using canonical correlation analysis (CCA). Secondary method of Data collection was employed. The findings reveal Burglary as the most common crime type reported over the period, followed by Murder. The trend employed trend analysis in time series, correlation and Canonical Correlation Analysis with a statistical software called Minitab 18. However, the aim of analysis reveals no trend for Murder, upward trend for Armed Robbery and downward trend for both bribery/corruption and Burglary. For correlation studies, it reveals that there is a relationship among the pairs considered at 0.05 level of significance and the CCA suggest variable (Burglary) on both ESG variables are significant (that is sex and employment status of the crime figures are significant than other SCR variables "Murder, Armed Robbery, Bribery and corruption").

Keywords: Canonical Correlation Analysis, Crime Rates, Unemployment, Nigeria.

Introduction

Wrongdoing is one of the human security issues facing humanity across the world. Nations have snared to contain the increasing recurrence of wrongdoing, outfitted theft, and catch, drug managing, sex managing, unlawful weapon running and host of others. Joined Nations Office on Drugs and Crime in 2011 uncovered that murders overall were surveyed at 468,000 and more than a third (36%) was evaluated to have occurred in Africa, 31% in the Americas, 27% in Asia, 5% in Europe and 1% in the tropical Pacific area. According to the report, monetary emergency; food frailty; expansion; and powerless or restricted law and order are factors that drive wrongdoing. Africa has been on the bleeding edge on worldwide measurements on wrongdoing. South Africa and Nigeria have recorded high occurrences of vicious and peaceful violations lately. As indicated by Africa Check, that episodes of homicide expanded from 15 609 killings in 2011/12 to 16 259 killings in 2012/13 in South Africa, with increment of 650 homicide cases or a 4,2% expansion when contrasting the all-out quantities of murders and the past five years.

Nigeria is at present trapped in the snare of wrongdoing difficulty, showing in the convulsive upsurge of both rough and peaceful violations. The upsurge of wrongdoing has been ceaseless as Nigeria has been on the overall wrongdoing map since the 1980s. These agonies of wrongdoing for a significant long time are distinguishable to desperation, poor parental adolescence, and voracity among the young adult; bring in pain free income outlook, lacking wrongdoing control model of public security among others. It is fundamental to choose the association between wrongdoing figures and explain the associations between

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the work status/sex and a portion of the wrongdoing exercises which will help in wrongdoing decrease (assurance of networks), dynamic and the information will likewise be valuable in zones like criminal science, social science, brain research and insights.

Authoritative relationship investigation is known as a strategy for clarifying the relationship between two arrangements of variable by ascertaining direct mixes that are maximally corresponded (Thompson, 1984). Authoritative relationship examination can oversee two variable sets at the same time and convey both mechanical and latitudinal significance (Bilgin et al., 2003). According to Osawe (2015), Crime depicts the mistake of the public authority to give a wellbeing and safe environment for lives, properties, and the course of monetary activities considering the upsetting development in wrongdoings in Nigeria like outfitted robbery, illicit terrorizing, and other related infringement.

Olanrewaju (1994) affirms that wrongdoing relates to tranquilize use which has the social result on understudies appearing in changed constructions which consolidates commandeering, passing, prepared robbery, nonattendance of premium in tutoring, and other criminal offenses. His is truly stuffed in the South, particularly in fundamentally populated areas like Lagos and Port Harcourt. Regardless, the Middle Belt isn't safe from outfitted theft and banditry, particularly in Plateau State, which records higher bad behavior rates. Bad behavior can be followed to the course of action of get-togethers by people who have related interests with the purpose of having a strong association. For example, Babalola (1998) clarifies that "cultism, prescription and mental fighting have a steady nexus, one to the following. At the point when an individual gets trapped to a particular brand of medicine, he pines for it; he discovers straightforward association in anyone that shares vague confidence in that line of psychosomatic attitude.

Methods and Materials

Data Collection

The dataset used in this article incorporates the uncovered examples of manslaughter, arm robbery, pay off/corruption and burglary in Nigeria between the years 1999 and 2019. The dataset was accumulated as a discretionary data and it might be reviewed as reinforcing data. The possibility of the data is with the ultimate objective that it will in general be analyzed using association assessment, definitive relationship examination, and example assessment in time plan assessment, and so on. An expert constantly has two vector components, X1i and X2i for an illustration of subjects, each vector variable tending to assessments from a particular space of properties. It is conceivable that X1i would be a lot of standard (Some Crimes Rate) measures and X2i would be a lot of marker (Employment status/Gender) measures.

Objectives of the Study

The examination is prevalently revolved around gaining the reasonable assessment of Employment Status/Gender (ESG) and Some Crimes Rate (SCR), choosing the association between bad behavior figures and explains the associations that exist between the business status/sex and a bit of the bad behavior practices considered, Estimate the data using the quantifiable system called Canonical Correlation examination among ESG and Some Crimes Rate and a while later, test for the real significance of the legitimate relationship among ESG and SCR using Wilk's premise.

Methods

The examination utilized pattern investigation in time arrangement, connection and Canonical Correlation Analysis with a factual programming called Minitab 18.

The nature of interrelationship of the domains of X_{1i} and X_{2i} (correlation matrix R of order P) would be partitioned into:

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$$R = \left[\begin{array}{c|c} R_{11} & R_{12} \\ \hline R_{21} & R_{22} \end{array}\right] \qquad (1)$$

where R_{11} Is contains the inter-correlations among the elements of X_{1i}, R_{22} is the elements of X_{2i} and $R_{12} = R_{21}$ the cross correlation between elements of X_{1i} and X_{2i}

To know the degree, the vector variable X1i maps subjects' equivalent to does X_{2i}. We utilized the authoritative relationship investigation that includes the arrangement of a convoluted Eigen structure issue, which can be communicated as far as the parcel of the connection network for X_{1i} and X_{2i} together as:

$$\left(R_{22}^{-1}R_{21}R_{11}^{-1}R_{12} - \lambda_j I\right)d_j = 0 \qquad (2a)$$

Or $$\left|R_{22}^{-1}R_{21}R_{11}^{-1}R_{12} - \lambda_j I\right| = 0 \quad (2b)$$

With the limitation condition; $d_j R_{22} d_j = 1$

The trademark roots, is the square of λ_j standard relationship coefficients R_{coeff}.

In allotting X_{1i} and X_{2i} , here we have "m" request of X1i and "m" request of X2i relationship lattice underneath (m=4);

$$R = = \left[\begin{array}{c:c} R_{11} & R_{12} \\ \hdashline R_{21} & R_{22} \end{array}\right] \qquad (3)$$

To figure the j[th] authoritative relationship coefficients $R_{coeff.j.}$

The grid item in the authoritative condition is

$$R_{22}^{-1}R_{21}R_{11}^{-1}R_{12} \quad (4)$$

Then we solve for the roots $\lambda_j = (\lambda_1, \lambda_2, ..., \lambda_m)$ such that substituting into the following determinant yield zero (eigenvalues).

The possible canonical correlations ($R_{coeff.\ j}$) are:

$$R_{coeff.1} = \sqrt{\lambda_1},\ R_{coeff.2} = \sqrt{\lambda_2}, ..., R_{coeff.m} = \sqrt{\lambda_m} \qquad (5)$$

We test for the measurable meaning of authoritative relationship utilizing Wilk's standard: where might be communicated as far as

λ_j

$$\Lambda_k = \prod_{j=1}^{\gamma}\left(1 - \lambda_j\right) \qquad (6)$$

And

$$\nu_k = -\left[n - 1 - \frac{1}{2}(p + q + 1)\right]\ln \Lambda_k \qquad (7)$$

where γ is the number of non-zero values of λ_j . k= 1, 2, …, γ

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Under $H_0 : \rho_{coeff.k} = \rho_{coeff.k+1} = ... = \rho_{coeff.\gamma} = 0$, Λ_k has an approximate chi-squared distribution with (p-k+1)(q-k+1) degree of freedom.

Analysis

Table1: Descriptive Statistics: Male, Female, Unemployed, Employed

Variable	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
Male	30358	15003	22382	93491	4.07	17.70
Female	1575	1492	224	7092	2.64	9.37
Unemployed	30856	15459	21957	95545	4.00	17.24
Employed	1077	1360	180	5038	2.14	3.99

Table2: Descriptive Statistics: Murder, Armed Robbery, Bribery and Corruption, Burglary

CrimeTypes	Mean	StDev	Minimum	Maximum	Skewness	Kurtosis
Murder	1666.6	348.9	1393	2780	2.46	5.86
Armed Robbery	1898	511	997	2714	0.19	-1.07
Bribery and Corruption	256.5	204.6	50	598	0.65	-1.37
Burglary	28112	16565	18143	97125	3.93	16.89

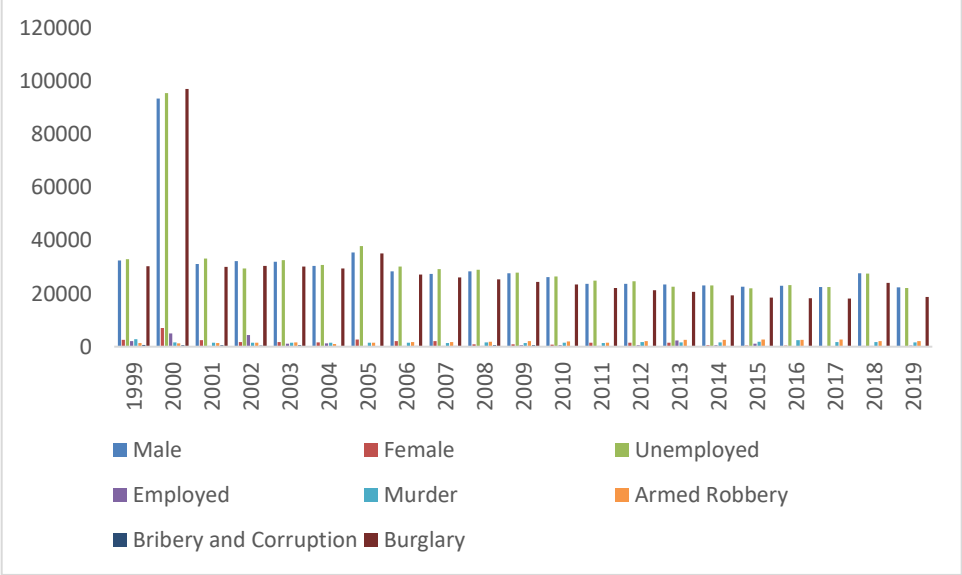

Fig. 1: Graphical portrayal of the quantity of wrongdoing exercises and Employment status/Gender.

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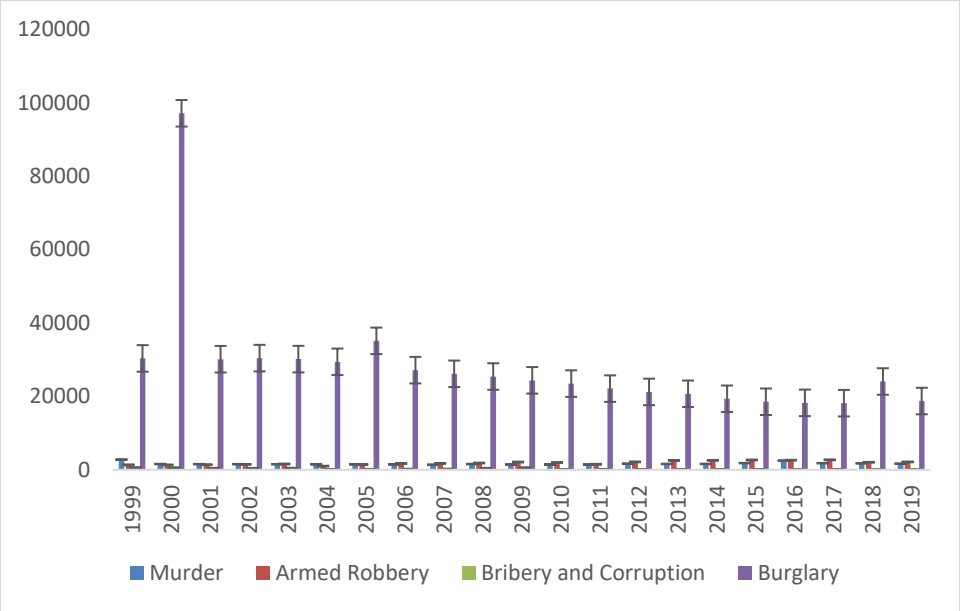

Fig.2: Graphical portrayal of the mean number of the different crime types

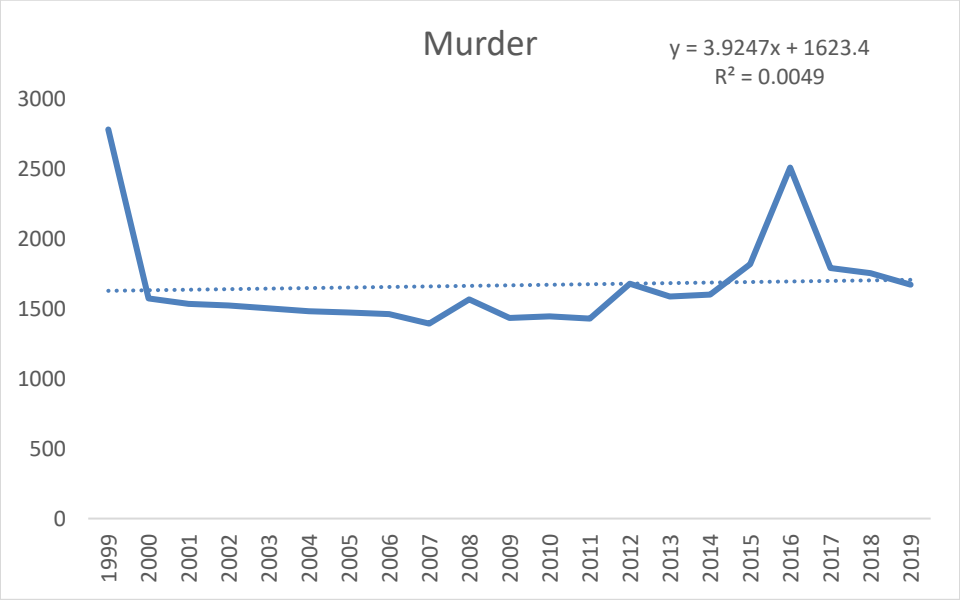

Fig.3: The pattern of murder cases from 1999 to 2019 years.

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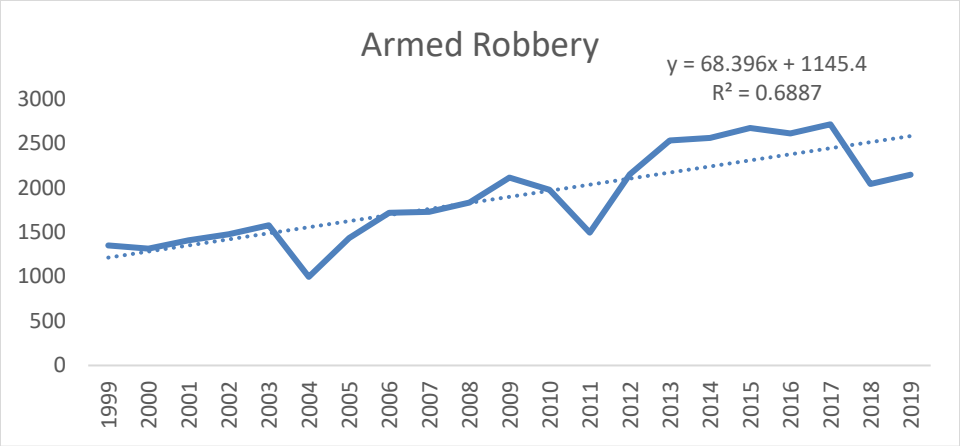

Fig.4: The pattern of armed robbery cases from 1999 to 2019 years.

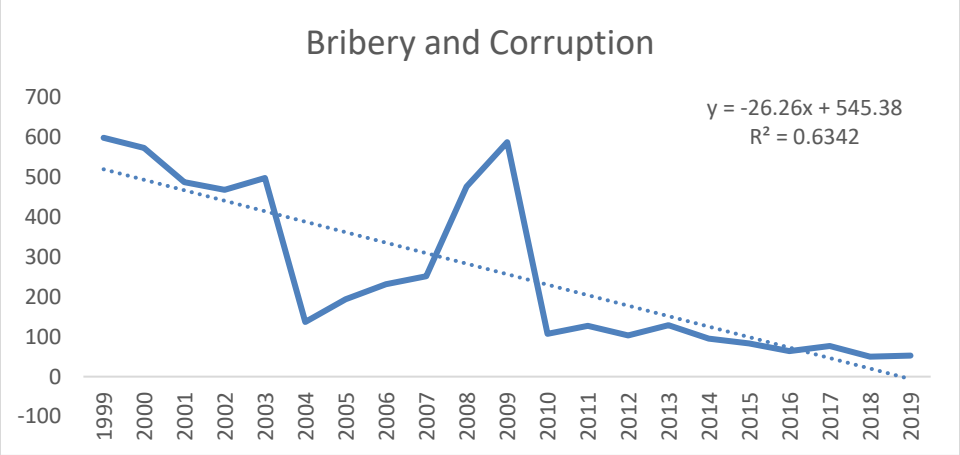

Fig.5: The order of bribery and corruption cases from 1999 to 2019 years.

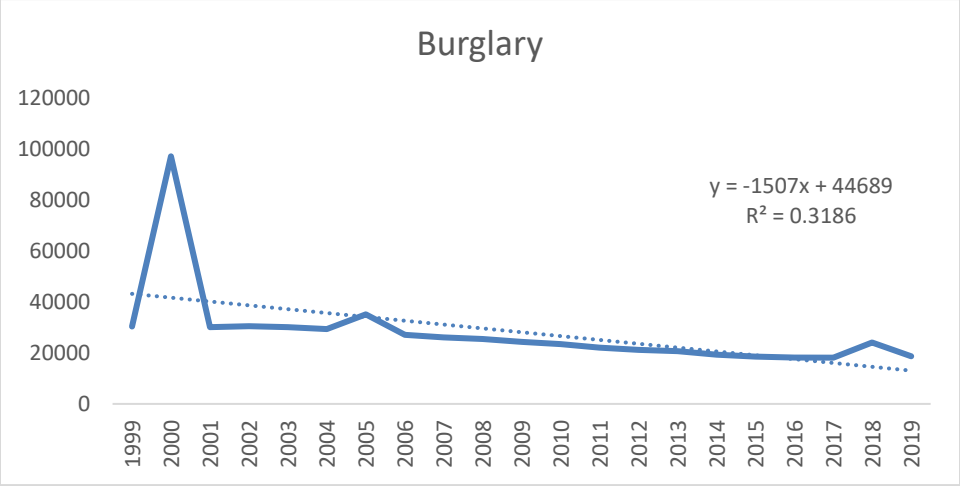

Fig. 6: The order of burglary cases from 1999 to 2019 years.

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Table 3: Results of the correlation analysis between SCR and ESG (p-value in parenthesis).

	Male	***Female***	***Unemployed***	***Employed***
Male	1	0.9214	0.9974	0.7048
Female	0.9214	1	0.9326	0.6610
Unemployed	0.9974	0.9326	1	0.6599
Employed	0.7049	0.6610	0.6599	1

Table 4: Results of the correlation analysis between the crime types (p-value in parenthesis).

	Murder	***Armed Robbery***	***Bribery and Corruption***	***Burglary***
Murder	1	0.2067	0.0320	-0.1083
Armed Robbery	0.2067	1	-0.5432	-0.4985
Bribery and Corruption	0.0320	-0.5432	1	0.5111
Burglary	-0.1083	-0.4985	0.511138	1

Table 5: Results of the correlation analysis between ESG and SCR (p-value in parenthesis).

	Male	Female	Unemployed	Employed	Murder	Armed Robbery	Bribery and	Burglary
Male	1							
Female	**0.921**	1						
	(0.000)**							
Unemployed	**0.997**	**0.933**	1					
	(0.000)**	**(0.000**)**						
Employed	**0.705**	**0.661**	**0.660**	1				
	(0.000)**	**(0.001**)**	**(0.001**)**					
Murder	-0.080	-0.089	-0.090	0.041	1			
	(0.730)	(0.701)	(0.699)	(0.861)				
Armed Robbery	-0.459	-0.603	-0.475	-0.327	0.207	1		
	(0.036)**	**(0.004**)**	**(0.030**)**	(0.148)	(0.369)			
Bribery and	0.505	0.550	0.502	0.478	0.032	-0.543	1	
Corruption	**0.019****	**0.010****	**0.021****	**0.028****	0.890	**0.011****		
Burglary	0.998	0.938	0.998	0.701	-0.108	-0.498	0.511	1
	0.000**	**0.000****	**0.000****	**0.000****	0.640	**0.021****	**0.018****	

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Canonical Correlation Coefficients between Employment Status/Gender and Some Crime Rate

The condition in territory three (Equation 2.1) will be an eight by eight system, since we have four ESG and four SCR. Consequently, the eighth endorsed association coefficients Rcoeff.j.

1	0.921	0.997	0.705	-0.080	-0.459	0.505	0.998
0.921	1	0.933	0.661	-0.089	-0.603	0.550	0.938
0.997	0.933	1	0.660	-0.090	-0.475	0.502	0.998
0.705	0.661	0.660	1	0.041	-0.327	0.478	0.701
-0.080	-0.089	-0.090	0.041	1	0.207	0.032	-0.108
-0.459	-0.603	-0.475	-0.327	0.207	1	-0.543	-0.498
0.505	0.550	0.502	0.478	0.032	-0.543	1	0.511
0.998	0.938	0.998	0.701	-0.108	-0.498	0.511	1

The matrix product in the canonical equation is

$$R_{22}^{-1}R_{21}R_{11}^{-1}R_{12} \qquad (8)$$

We have,

$R_{22}^{-1}=$

1.083	-0.317	-0.252	0.088
-0.317	1.658	0.685	0.442
-0.252	0.685	1.651	-0.530
0.088	0.442	-0.530	1.501

And

$R_{11}^{-1}=$

1341.954	138.206	-1385.842	-122.776
138.206	22.177	-149.718	-13.281
-1385.842	-149.718	1439.091	126.182
-122.776	-13.281	126.182	13.056

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Hence, $R_{22}^{-1}R_{21}R_{11}^{-1}R_{12}$

$$\begin{bmatrix} 0.011 & -0.033 & 0.038 & 0.021 \\ 0.031 & 0.252 & -0.085 & 0.025 \\ 0.032 & -0.012 & 0.052 & 0.012 \\ -0.083 & -0.351 & 0.449 & 1.008 \end{bmatrix}$$

Then we solve for the roots $\lambda_j = (\lambda_1, \lambda_2, ..., \lambda_m)$ such that substituting into the following determinant yield zero (eigenvalues). Minitab 18 statistical was employed to compute the eigenvalues as follows:

$R_{coeff.1} = \sqrt{\lambda_1}$; $R_{coeff.2} = \sqrt{\lambda_2}$; $R_{coeff.3} = \sqrt{\lambda_3}$, $R_{coeff.4} = \sqrt{\lambda_4}$

Test for significance of canonical correlation.

Hence, the possible canonical correlations ($R_{coeff.\ j}$) are

$R_{coeff.1} = \sqrt{\lambda_1} = \sqrt{0.8851} = 0.9408$, $R_{coeff.2} = \sqrt{\lambda_2} = \sqrt{0.7404} = 0.8605$

$R_{coeff.3} = \sqrt{\lambda_3} = \sqrt{0.6053} = 0.7780$, $R_{coeff.4} = \sqrt{\lambda_4} = \sqrt{0.4056} = 0.6368$

Under $H_0 : \rho_{coeff.k} = \rho_{coeff.k+1} = ... = \rho_{coeff.\gamma} = 0$, Λ_k has an approximate chi-squared distribution with (p-k+1)(q-k+1) degree of freedom. We want to test when k= 1, 2, 3, 4.

For k= 1; $\nu_1 = 76.913$,

For k= 2; $\nu_2 = 43.3733$

For k= 3; $\nu_3 = 22.46979$

For k= 4; $\nu_4 = 8.06054$

Then $\chi_9^2(0.05) = 16.919$

Result and Discussions

Table 1

Stationarity (KPSS unit root test)

KPSS test for **Inflation** (without trend)

T = 40

Lag truncation parameter = 8

Test statistic = 0.280364

10% 5% 1%

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Critical values: 0.352 0.473 0.719 stationary

KPSS test for **Unemployment** (without trend)

T = 40

Lag truncation parameter = 8

Test statistic = 0.513714

10% 5% 1%

Critical values: 0.352 0.473 0.719 not stationay

Interpolated p-value 0.043

KPSS test for **Poverty** (without trend)

T = 40

Lag truncation parameter = 8

Test statistic = 0.541845

10% 5% 1%

Critical values: 0.352 0.473 0.719 not stationary

Interpolated p-value 0.039

KPSS test for **d_Inflation**(without trend)

T = 39

Lag truncation parameter = 8

Test statistic = 0.179803

10% 5% 1%

Critical values: 0.353 0.473 0.718 stationary

Table 2

KPSS test for **d_Unemployment** (without trend)

T = 39

Lag truncation parameter = 8

Test statistic = 0.309409

10% 5% 1%

Critical values: 0.353 0.473 0.718 stationary

KPSS test for **d_Poverty** (without trend)

T = 39

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Lag truncation parameter = 3

Test statistic = 0.0501502

	10%	5%	1%	
Critical values:	0.353	0.473	0.718	stationary

Note: Unemployment and poverty become stationary after first difference

Model Building

VAR Lags selection

VAR system, maximum lag order 8
The asterisks below indicate the best (that is, minimized) values
of the respective information criteria, AIC = Akaike criterion,
BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

Lags	loglik	p(LR)	AIC	BIC	HQC
1	-136.73980		8.858737	9.087758	8.934651
2	-130.83473	0.00059	8.552171*	8.826996*	8.643268*
3	-130.55603	0.45531	8.597252	8.917882	8.703532
4	-128.90670	0.06934	8.556669	8.923103	8.678131
5	-128.88158	0.82263	8.617599	9.029837	8.754244
6	-128.88111	0.97550	8.680069	9.138112	8.831897
7	-128.72559	0.57705	8.732850	9.236696	8.899860
8	-128.67977	0.76208	8.792485	9.342136	8.974679

Note: VAR selection criteria suggested VAR (2) model;

However, we computer VAR(1) and VAR(2)

VAR system, lag order 1

OLS estimates, observations 1982-2019 (T = 38)

Log-likelihood = -163.94982

Determinant of covariance matrix = 327.36006

AIC = 8.8395

BIC = 9.0118

HQC = 8.9008

Portmanteau test: LB(9) = 2.04974, df = 8 [0.9794]

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Equation 1: Inflation

	coefficient	std. error	t-ratio	p-value	
const	11.0852	4.50312	2.462	0.0191	**
Inflation_1	0.435076	0.151396	2.874	0.0069	***
d_Unemploym_1	-1.98533	0.870657	-2.280	0.0290	**
d_Poverty_1	-0.0407966	0.802979	-0.05081	0.9598	

Mean dependent var 18.10658 S.D. dependent var 22.34461

Sum squared resid 12439.68 S.E. of regression 19.12781

R-squared 0.326617 Adjusted R-squared 0.267201

F(3, 34) 5.497118 P-value(F) 0.003448

rho 0.013423 Durbin-Watson 1.908909

F-tests of zero restrictions:

All lags of Inflation F(1, 34) = 8.2585 [0.0069]

VAR system, lag order 2

OLS estimates, observations 1983-2019 (T = 37)

Log-likelihood = -158.77592

Determinant of covariance matrix = 312.50014

AIC = 8.9068

BIC = 9.1680

HQC = 8.9989

Portmanteau test: LB(9) = 5.64043, df = 8 [0.6874]

Equation 1: Inflation

	coefficient	std. error	t-ratio	p-value	
const	12.3827	5.22080	2.372	0.0241	**
Inflation_1	0.374538	0.172000	2.178	0.0372	**
d_Unemploym_1	-2.07088	0.881951	-2.348	0.0254	**

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d_Unemploym_2	-0.936738	0.978937	-0.9569	0.3460
d_Poverty_1	0.0436425	0.815235	0.05353	0.9577
d_Poverty_2	0.807976	0.811515	0.9956	0.3271

Mean dependent var 18.38784 S.D. dependent var 22.58453

Sum squared resid 11562.51 S.E. of regression 19.31279

R-squared 0.370309 Adjusted R-squared 0.268746

F(5, 31) 3.646105 P-value(F) 0.010392

rho 0.017648 Durbin-Watson 1.947306

F-tests of zero restrictions:

All lags of Inflation F(1, 31) = 4.7417 [0.0372]

Result and Conclusion

Results

Table 1 and 2 are the summarized estimations of the educational record on bad behavior practices in Nigeria from 1999 to 2019. From Table 2, Burglary has the most raised number of cases (with an ordinary all out of 28,112 uncovered cases) all through the drawn out considered, followed by Murder.

Fig. 1 and 2 are a graphical depictions of the rough data and the mean number of bad behaviors nitty gritty. Also, Figs. 3 to 6 location the example examination for all of the bad behavior types. The case of the examples of the bad behaviors practices some place in the scope of 1999 and 2019 shows that murder had no example; prepared burglary had an upward example while pay off/degradation and theft had a slipping example. The result for the relationship examination is made open in Table 3 to 5. From Table 3 the results written in solid show a significant relationship among the sets considered at 0.05 level of significance. Table 5 shows that there is a significant positive straight association between the four ESG and burglary. In addition, there is a significant slight straight association among robbery and pay off/debasement, by then robbery and outfitted thievery. Moreover, there is a significant slight straight association between the four ESG and pay-off/debasement.

Again, there is a negative straight association between furnished theft and pay off/contamination and thereafter, Armed Robbery and three ESG (Male, Female, and Unemployed) is significantly not exactly equivalent to nothing. At last, from the definitive association assessment and the Wilk's test, it was shown that; the main authoritative relationship coefficient is fundamentally not quite the same as nothing (>), The second sanctioned connection coefficient is essentially not the same as nothing (>). Additionally, the third standard relationship coefficient is essentially not the same as nothing (>), while the fourth accepted connection coefficient isn't altogether not the same as nothing (>).

Conclusion

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Theft remains the best essential kind of bad behavior that is represented reliant on its mean worth followed by Murder, there is a significant of association among the sets considered at 0.05 level of significance and the variable (Burglary) on both ward factors are immense (that is sex and factors "Murder, Armed Robbery, Bribery, and corruption").

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