

Time Series Analysis of Reported Cases of Crimes (Case Studies of North Eastern State of Nigeria)

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Abstract

The time series is a set of observations taken at specified time at equal Intervals, Usually Weekly monthly quarterly or yearly. This report covers the total monthly reported. Cases of Crimes at North Eastern State Of Nigeria Yobe State, Borno State, And Adamawa State. time Series analysis is Used to analysis the trend of the total number of Crimes.

Key words: *analysis on trend of the total number of Crimes, in Yobe, Borno and Adamawa State of Nigeria.*

1. INTRODUCTION

Crimes Is any Unlawful Conduct that can be punished by The State of Country or it is any action or omission which constitutes an offence and is punishable by law. The law has attached different punishments for Various offence and The Law does not Look at a person's dignity personality, his responsibility or office to The State Country or Community on a he has been forum guilty in the Court of law he must face the Consequences as it Is stated in the laws of the land or. *Ralph et al*(2024), Constitution.

HISTORICAL BACKGROUND OF THE STUDY.

Historical Background of the Study yobe state divisional Police Station Was created in 1976 after the Creation of Borno State from north Eastern State. It is located on latitude 12.89 and longitude 11.93° about 181km to north of amature town. It Shares boundary with Yunusari Local Government area to the north. North East and north Intest Damasak Local Government to the West and Tarmuwa Local Government to the South-east. It is not more Than 50km away from maine Soroa to The north East. *Ralph et al* (2023)

Crime Wave

Crime Was reduced in the month Under review with only Three cases reported out of Which one case of rage was reported one make suspect arrested case transferred to state CID Damaturu for discrete Investigation. one case of Theft was reported two make suspects Was also arrested and the Case Is Under Investigation. *Canberra et al* (2024)

1.2 Statement of Research Problem

This research work is to determine whether the reported Cases of Crimes in Geidam Local Government area of Yobe State is on Increase or decrease in spite of the punishment attached to it and study the trent of reported case of crime in Yobe state.

The study is equally restricted reported Cases of Crimes in Geidam divisional Police Station Area of Yobe State, the data Used for the study has limited for time series Analyses on

reported cases of Crimes. It is limited only period of ten Years SONH.*et al* (2014 -2024)

1.3 Objective of the Study

These are the specific objectives you want to achieve to address the problems you stated in the preceding section (1.2). The objectives are itemized each will start with

1.To determine the trend Analysis Seasonal

2.To suggest possible Solution to reduce criminal acts to be minimum if not completely Eradicated

3.To determine Whether Crime Cases in yobe, borno, and Adamawa state is seasonal

2.0 LITERATRE REVIEW

2.1 Introduction

This section of the research aimed at providing a theoretical overview and empirical evidences on performance evaluation of research domain. For Centuries, the world has experienced different Kinds of crimes that Include armed robbery, Theft Prostitution and drugs abuse among others.

These Vices are generally termed as crime. There haves been many theories as to why People become Criminals. Criminologist do not believe that there Is any single case but many among these are separation and divorce or parents Who neglect their children mental deficiencies or illness, alcohol drinking or drug addiction and facial or religious prejudice. *Dambazau "Crime*(2020)

According to Michael Haralambus and martin Holborn, authors of Sociology: Themes and perspectives, they noted the Issue of Crime in Urban areas. "It has long been recognised that some areas of town or Cities have higher levels of reported Crime. And deviant than others. While some neighborhoods are quite safe in alters Walking the Streets at night could be parlous as official Statistics show The Crime Is Concentrated main, in urban areas. Much more attention has been given in recent Years to ways of Preventing Crime. *Canberra).et al* (2024).

Many people vehemently believe that Crime will be reduced when some of the Social

factors that seem to be closely linked with it are improved. These include a lack of education, parental influence, drugs and alcohol, lack of proper role models in society, unemployment, media. Since many of the youths are influenced by the negative messages being sent by the new wave of artists who increasingly preach about "being gangster" and "get rich or die trying?" further influence is caused by decreased government revenue within the country and reduced quality of life with a drop in the standard of living for the citizens due to high inflation rate and this new global recession.

In a society under siege written by Ramesh Deosaran, the following quote

was taken. "Law and order must rest on the white framework of political accountability, judicial accountability and public morality if the issue of crime should be corrected." *Dambazau "Crime et al (2020)*

Demoiselle R.S and Ralph IN (1980) in their book "Introduction to Sociology" consider all crimes as deviant and act classified them under behavioral deviances. They explain behavioral deviances "as behaviors that is learned which is harmful on the society of particular individuals within the society." Jude H.H (1988) in his paper "A time series analysis of cases of crime in Imo State Nigeria (2023-2025)" commented that crimes have been following a seasonal pattern. Here he said crime case varies from one quarter to the year to another. Rodney Start (1989) in his book "sociology" stated the Durkheim's theory that predicts that deviance rate will vary as integration varies. For instance armed robbery rate will be higher whenever moral and social integration is lower.

An Italian criminologist Cesare Lombroso (1835-1909) asserted that there is a criminal phenotypic type whose trait is passed on by inheritance. In *Criminal man et al (2024)*,

Vierpunis from of has no he stated the trait as including a heavy jaw slapping forehead,

scanty bearded and vary often left handed. Modern criminologists and biologists do not agree with this theory. Another pioneer Italian (Viminalist) Enrico (1856-1929) asserted that crime is due to many causes. The stressed on the effects of environment and later criminologists tend to agree with this.

There are several approaches to treatment of criminal. The oldest is the Italian idea that criminal should be punished for revenge or because he is wicked or sinner. Infliction of the death penalty, solitary confinement and for substances to hard labor reflects this view. Another view is that speedy and drastic punishment of criminal will prevent other from committing crimes because of the fear of receiving similar treatment - evidence however showed that this was little or no effect in preventing crime. An accused criminal in democratic countries is entitled to a tax lawyer and fair trial and if found guilty for his particular crime whether felony or misdemeanour. For the judge or sometimes the jury allows a choice of several penalties. The judge may pressure a minimum period if prisoner's conduct is good.

Crime has been made her object of statistical investigation for many years. Brougham in 1880 said that criminal statistics are important to the legislator as charts and compass are to navigator. However criminal statistics do not give complete picture of crime as antisocial act since the use of it as a basic in most cases. Richardson *Third edition et al (2020)*

2.2 anything relevant to your research

thirty-eight residents murdered in suicide bombing in north-east as fighting rages in Geidan machael olugbode in Maiduguri said The Nigeria military in one of its deadliest encounters in recent weeks, killed over 100 fleeing Boko Haram terrorists who in the early hours of Tuesday made a futile attempt

on taking the 120 task force Battalion located in Goniri Yobe State. the military however lost seven of its Soldiers in the process. Directors of *in January (2025) terrorists killed over 40 farmers and fishermen in Dumba community, kukawa local*

3.0 METHODOLOGY

Time series analysis to be used for Computation and analysis of the data on Yearly monthly weekly or quarterly reported Cases of Crimes abstain in Geidam divisional police station Yobe state from 2019-2024 *Crime prevention and control in Nigeria" (2019)*

1 GRAPHIC (FREE- HAND CURVE FITTING) METHOD

This Is the simplest and the most flexible method of Estimating the secular trent and

Table 1: Semi Average Point

S/N	Y	4 Point M. Total	2 Point M Average	8 Point M. Average
1	Y1 Y2			
2	Y1+Y2+Y3+ Y4	Y2+Y2+Y3+Y4+ Ys.		
3 4	Y3	Y2+Y3+Y4+Y5	Y2+Y3+Y4+Y5+Y6	Y1.....+Y4+Y2....Y 6//8
	Y4	Y3+Y4+Y5+Y6	Y3+Y4+Ys+Y6+Y7	Y2+Y5+Y3 ..Y6/8
5	Y5	Y4+Ys+Y6+Y7	Y4+Y5+Y6+Y7+Y8	Y3 +Y6+Y4 Y7//8
6	Y6	Ys+Y6+Y7+Y8	Y5+Y6+Y7+Y8+Y9	Y4 +Y+YsY8/8
7	Y7	Y6+Y+Y8+Y9	Y6+Y7+Yg+Yg+Y10	Y5 ... +Yg+Y6.....Y9//8

Consists in first obtaining historigram by Plotting the time series Values on a graph paper and then drawing a free hand Smooth Curve Through These Points so That It accurately reflects the long term tenddecy of the data.

Semi average method

In This method, The Whole time series data Is Classified into two equal Part of almost Equal Parts the average of Each Part (x1+x2 and X2 +>2) and Cantered in The appreciated period of the two point obtained are now plotted and the line Joining the point form the required trend.

Below is an illustration of 4 point moving average

8	Y8	Y7+Y8+Yg+Y10		Y6.....+Yg+Y7....Y10 //8
9	Y9			
10	Y10			

iii. MOVING AVERAGE

A method based on moving average is more frequently used for estimating the seasonal variables. Even when it is applied to estimate the trend values, the moving average method

does not establish a trend line by estimating cyclical, seasonal and random variations in the time series data. Centered moving average of value is computed as follows: -

If we have Y1, Y2, Y3. ... Y12, moving average is given between Y6 and Y7

$$=(Y1+Y2+Y3+Y4+Ys+Y6+Y7+ys+Yg+Y10+Y11+Y12)/12 =Y7$$

between Y, and $Yg=(Y2 +Y3+Y4 Y13)/12 = Ys$

Moving average of order four (4)

$$Y2=(Y1+Y2+Y3+Y4)/4$$

$$Y3=(Y2+Y3+Y4+Ys)/4$$

$$Ya=(Y3+Ya+Y5+Ys)/4$$

$$Ys=(Y4+Y5+Y6+Y7)/4$$

MODELS OF TIME SERIES

Two models are appropriate for associating the components of time series.

These are:

i. THE ADDITIVE MODEL

In the additive model, the observation is considered to be addition of the four components of time series, which is written as:

$$Y=T+S+C+I$$

Where Y = observed data

T = Trend value

S = Seasonal variation

C = Cyclical variation

I = Irregular variation

ii. MULTIPLICATIVE MODEL

In multiplicative model, the observation is considered to be multiplication of the four

components of time series which are written as

$$Y = T \times S \times C \times I$$

$$\log Y = \log T + \log S + \log C + \log I \quad \text{iii}$$

least square method

The use of least square method of estimation is justified by Gauss-Maleer theorem which states that the least square estimates have minimum variances among a class of linear

$$e = y - a - bx \quad \text{squaring both sides} \quad e^2 = (y - a - bx)^2 \quad \text{sum both sides} \quad \sum e^2 = \sum (y - a - bx)^2 \quad \dots \dots \dots (1.1) \quad \text{differentiating (1.1)}$$

$$\text{w.r.t. } a = -2 \sum (y - a - bx) \quad \dots \dots \dots 1.2 \quad \text{let (1.2) } = 0 \quad -2 \sum (y - a - bx) = 0$$

$$\text{d.b.s by } -2 \sum (y - a - bx) = 0$$

$$\sum y - na - b \sum x = 0$$

3.2 Deseasonalisation of Data

The elimination of seasonal effects from the given values is termed as deseasonalisation of data. Time series data can be deseasonalised by removing seasonal variation calculated from the original data. Assuming multiplicative model of the time series, the deseasonalised values are obtained on dividing the given values by the corresponding indices of seasonal variation.

$$\text{Deseasonalised data} = y/S = TCSI = TCI$$

In case of absolute seasonal variation (additive model of the time series), the deseasonalised values are obtained on subtracting the seasonal variation from the given values.

$$\text{Thus, Deseasonalised data} = y - S = (T + S + C + 1) - S$$

unbiased estimates. In this method, the trend line is represented by the trend equation of a straight line. $Y = a + bx + c$ where $Y =$ trend value

$C =$ intercept on y

$$Y = a + bx$$

The error term (e) is the difference between the observed actual value (y) and the estimated value (y^{\wedge}) That is, $e = y - y^{\wedge}$ but $y^{\wedge} = a + bx$ if the model is exact $= e = y - (a + bx)$

$$= T + C + 1$$

3.3 Forecasting

After analysing the data, it is important to forecast and predict the future pattern of the variable. This can be done in two ways.

FORECAST FOR ADDITIVE MODEL

$$\text{Forecast} = \text{estimated trend} + \text{seasonal fluctuation}$$

$$= T + S$$

FORECAST FOR MULTIPLICATIVE MODEL

$$\text{Forecast} = \text{estimated trend} \times \text{seasonal fluctuation} + T \times S$$

4.0 DATA ANALYSIS

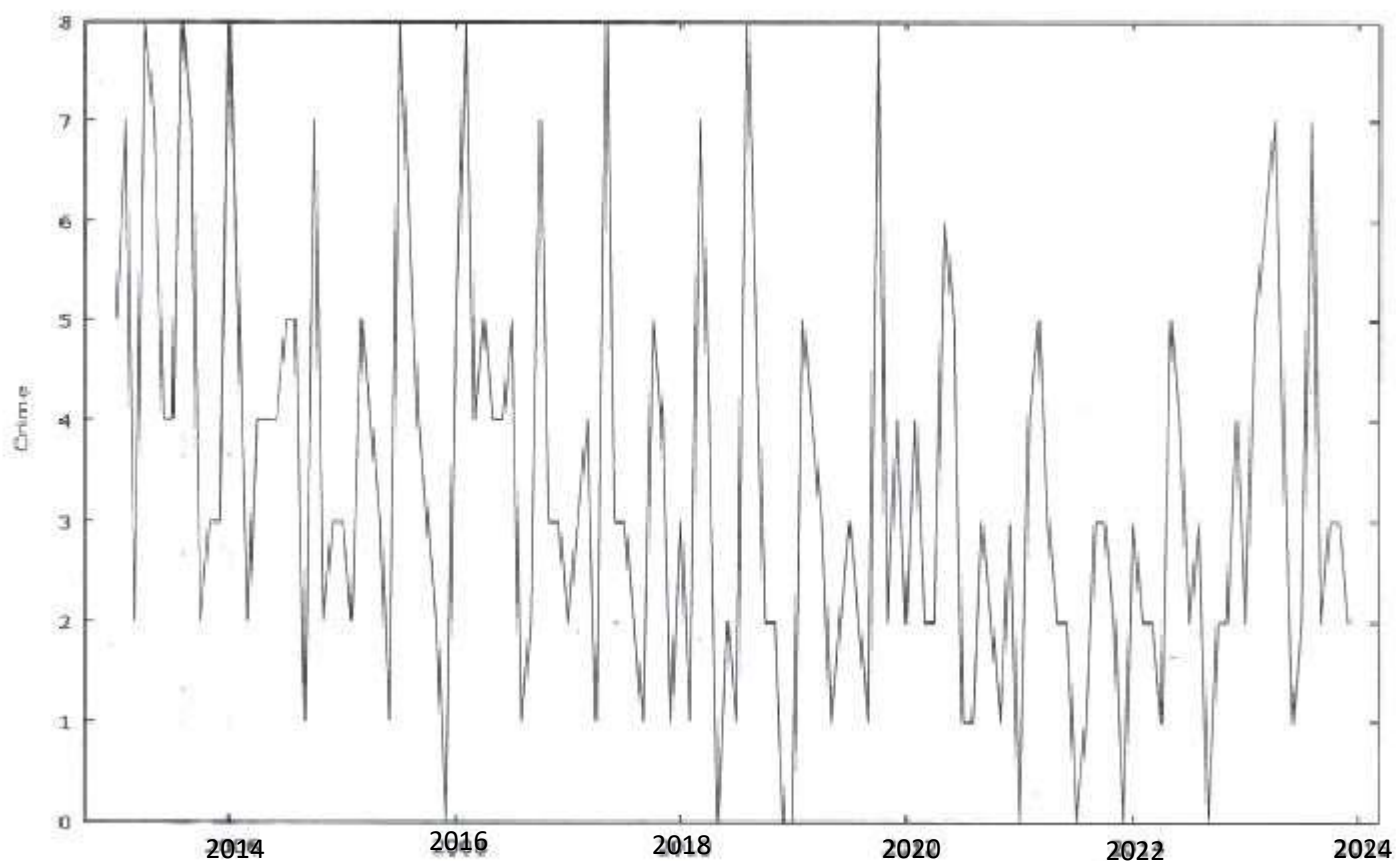


Figure 1: Graph representation on reported cases of crimes in Yobe

MAPE. 60.0183

MAD 1.5620

MSD 3.8166 Y (

Crime

Time.	Rate)	MA	Predict	Error
1	5	*	*	*
2	7	*	*	*
3	2.	*	*	*
4	8.	*	*	*
5	7	*	*	*
6	4.	*	*	*

7	4	5.12500	*	*
8	8	5.16667.	5.12500	2.87500
9	7	5.08333	5.16667	1.83333
10	2	4.91667.	5.08333.	-3.08333
11	3	4.62500	4.91667	-1.91667
12	3	4.50000.	4.62500.	-1.62500
13.	8	4.54167	4.50000.	3.50000
14.	5	4.45833	4.54167.	0.45833
15.	2	4.08333	4.45833	-2.45833
16	4	4.04167.	4.08333.	-0.08333
17.	4	4.20833	4.04167.	-0.04167
18	4	4.16667	4.20833.	-0.20833
19.	5	3.95833	4.16667	0.83333
20.	5	3.62500.	3.95833	1.04167
21.	1	3.62500	3.62500.	-2.62500
22.	7	3.75000	3.62500.	3.37500
23.	2	3.70833.	3.75000	-1.75000
24.	3	3.54167.	3.70833.	-0.70833
25	3	3.54167.	3.54167	-0.54167
26.	2	3.70833	3.54167.	-1.54167
27.	5	3.87500	3.70833.	1.29167
28.	4	3.83333	3.87500	0.12500
29.	3	3.66667	3.83333	-0.83333
30.	1	3.54167.	3.66667.	-2.66667

31.	8 3.50000	3.54167	4.45833
32.	6 3.83333	3.50000	2.50000
33.	4 4.04167	3.83333	0.16667
34.	3 4.04167.	4.04167	-1.04167
35.	2 4.12500	4.04167	-2.04167
36.	0 4.29167.	4.12500.	-4.12500
37.	5 4.29167	4.29167	0.70833
38.	8 3.95833	4.29167	3.70833
39.	4 3.66667.	3.95833	0.04167
40.	5 3.75000.	3.66667	1.33333
41.	4 3.95833	3.75000	0.25000
42.	4 4.12500.	3.95833	0.04167
43.	5 4.12500	4.12500	0.87500
44.	1 3.79167.	4.12500.	-3.12500
45.	2 3.58333.	3.79167	-1.79167
47.	3 3.41667	3.41667.	-0.41667
48.	3 3.54167.	3.41667	-0.41667
49.	2 3.41667	3.54167	-1.54167
50.	3 3.37500.	3.41667	-0.41667 51
52 1	3.25000	3.37500.	-2.37500
53 8	3.20833.	3.25000.	4.75000
54.	3 3.16667.	3.20833.	-0.20833
55	3 3.12500.	3.16667.	-0.16667

56.	2	3.08333.	3.12500	-1.12500		
57.	1	3.12500	3.08333	-2.08333	58.	3. 1.875059
	5	3.37500	3.12500.			
58.	3.	3.458900	3.245001			
59.	4	3.16667.	3.37500	0.62500		
60	1	2.79167.	3.16667.	-2.16667		
61	3	2.66667.	2.79167.	0.20833		
62.	1	2.83333.	2.66667	-1.66667		
63.	7	3.25000.	2.83333.	4.16667		
64.	4	3.29167.	3.25000	0.75000		
65.	0	3.08333	3.29167	-3.29167		
66.	2	2.95833.	3.08333.	-1.08333		
67.	1	2.79167	2.95833	-1.95833		
68	8	2.83333	2.79167.	5.20833		
69.	5	2.87500	2.83333	2.16667		
70.	2	2.70833	2.87500.	-0.87500		
71	2	2.70833	2.70833.	-0.70833		
72.	0	2.75000	2.70833	-2.70833		
73	0	2.83333	2.75000.	-2.75000		
74	5	2.66667	2.83333	2.16667		
75.	4	2.25000	2.66667.	1.33333		
76.	3	2.33333.	2.25000	0.75000		
77	1	2.58333	2.33333.	-1.33333		
78.	2	2.75000.	2.58333.	-0.58333	79	3
	3.	0.00000.	2.75000.	0.25000		
80	2	3.04167.	3.00000.	-1.00000		

81.	1	2.91667	3.04167.	-2.04167	82	8
		2.79167	2.91667.	5.08333		
83.	2	2.95833.	2.79167.	-0.79167		
84.	4	3.29167	2.95833.	1.04167		
85.	2	3.33333	3.29167.	-1.29167		
86.	4	3.20833	3.33333	0.66667		
87	2	3.25000	3.20833.	-1.20833		
88	2	3.08333.	3.25000.	-1.25000		
89.	6	2.79167	3.08333.	2.91667		
90.	5	2.70833	2.79167	2.20833		
91.	1	2.58333.	2.70833.	-1.70833		
92.	1	2.50000.	2.58333.	-1.58333	93.	3
		0.50000				2.62500
						2.50000.
94.	2	2.79167	2.62500	-0.62500		
95.	1	2.66667.	2.79167.	-1.79167	96.	3
		2.66667	0.33333			2.37500
97	0	2.20833.	2.37500.	-2.37500		
98.	4	2.16667	2.20833.	1.79167		

fig 3:

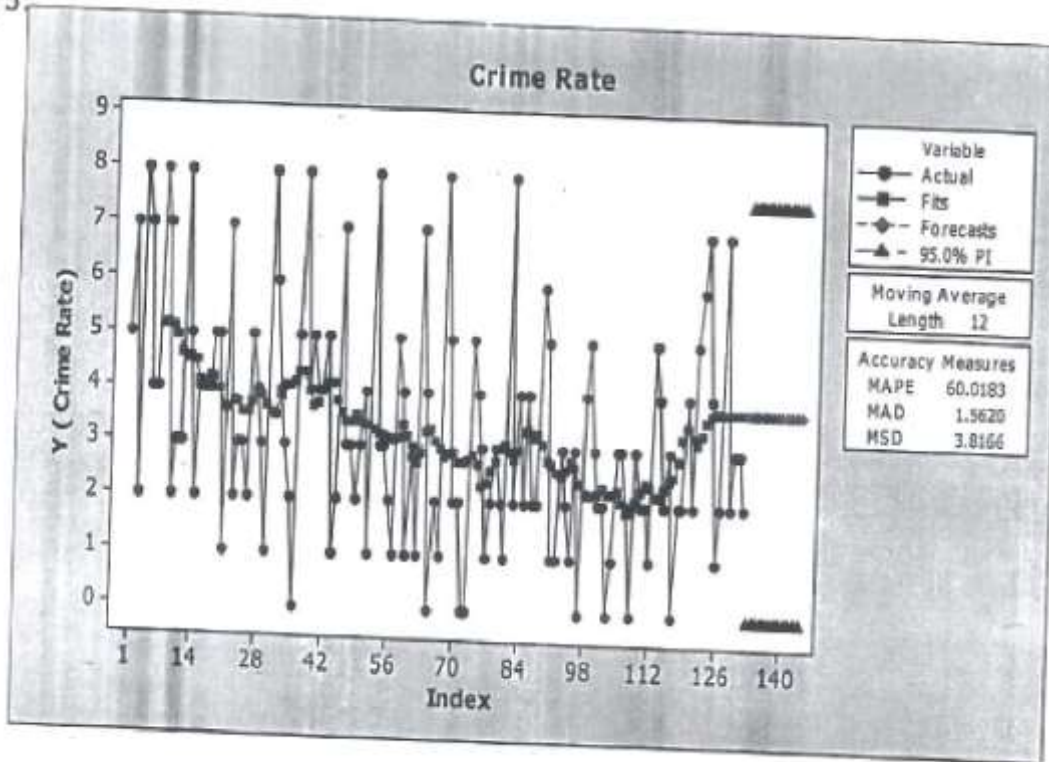


Figure 2: Crime rate

4.3 Regression Analysis: Y (Crime Rate) Versus X (Time)

The regression equation is

$$Y (\text{Crime Rate}) = 4.43 - 0.0164 X (\text{Time})$$

Table II

Predictor Coef SE Coef T P VIF

Constant 4.4260 0.3554 12.46 0.000

X (Time) -0.016431 0.004636 -3.54 0.001 1.000

S = 2.02976 R-Sq = 8.8% R-Sq(adj) = 8.1%

PRESS = 552.437 R-Sq(pred) = 5.94%

4.0 RESULT AND DISCUSSION

4.1 Introduction

This section of research presents the result obtained after experimentation. Based on the result of the data of time series analysis on reported cases of crime in yobe, and borno state it is found that $Y = 4.43 - 0.016x + e_i$ is

Table III

4.4 ANALYSIS OF VARIANCE

Source	DF	SS	MS	F	P
Regression	1	51.740	51.740	12.56	0.001
Residual Error	130	535.593	4.120		
Total	131	587.333			

There are no replicates.

Minitab cannot do the lack of fit test based on pure error.

the simple regression equation for the two variables. This can be interpreted as, if the time increases by 1 then crime rate decreases by 0.0164.

The analysis of variance in the table calculated $F_{cal} = 12.56$ and $F_{0.95}$,

1,58=7.08 which mean that the scope of the equation is different from zero at 95% level of significance.

method of estimation of trend, models of time series depersonalization of data and forecasting and chapter four (4) which is data analysis consists of graph representation on reported cases of crimes in yobe, borno, and Adamawa from 2023-2025, moving average for Y(crime rate), forecast, graphs, regression analysis, analysis of variance, values of predictors for new observations table and interpretation of result.

5.0 CONCLUSIONS

From the result of our analysis in chapter four, predicted values for new observation shown significant at 95% level indicating of weak positive linear relationship between the crime rate and time. The regression equation relating crime rate and time can be used for the purpose of estimating the number of crimes and the total time taken

6. RECOMMENDATIONS

Based on the summary of the research works, the researcher has the following recommendations to make.

Parents should live to expectations: -

Socialization - Simply means the process of leaning. Socialization they say starts from the family. Parent/guardians should live decent live and guide their children from joining the company of bad friends. This will go a long way in reducing crimes especially the problem of armed robbery.

Teaching of good morals: Good moral should be taught in all institution of learning religious bodies should intensify their teaching/preaching against greed. This will help.

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In January (2025) *Terrorists Killed Over 40 Farmers and Fishermen in Dumba community, kukawa local government Area, Borno and abducted scores of people.*