

Application of Autoregressive Integrated Moving Average Intervention Model for Corruption Index in Nigeria

Sadiq Nafisatu¹, Nweze N. O.², Ibrahim Ahmed³, Mohammed Rilwan⁴

¹Student Department of Statistics, Nasarawa State University Keffi, Nigeria
nafokikiri[at]gmail.com

²Lecturer Department of Statistics, Nasarawa State University Keffi, Nigeria
obininweze[at]yahoo.com

⁴Lecturer Department of Statistics, Nasarawa State University Keffi, Nigeria
ibrahimloko75[at]gmail.com

¹Student Department of Statistics, Nasarawa State University Keffi, Nigeria
i.am.ridwan.mahmud[at]gmail.com

Abstract: *This study attempts an evaluation of the impact of Independent Corrupt Practice Commission (ICPC) on reduction of corrupt practices and related offences in the country. The study used Autoregressive Integrated Moving Average (ARIMA). However, the study used the basic pre-estimation tests to take care of the stationarity and cointegration of the series. It was noted that from the preintervention series, there is slow up and down trend in the series as a result of some components of time series. The series became stationary after the second difference with statistics values of -3.9754 and probability value of 0.02411 using the Augmented Dickey-Fuller test type. Our findings reveals that the pre-intervention period could best be modelled with an ARIMA (1,2,0). As a result, the study recommends that the agency has to increase her manpower to meet up with exponential growth of the population and engage them in intelligence training that will help them curtail the practicing of corruption and also collaborate with stakeholders, international communities and some security related NGOs that can aid the realizations of the goals of the agency.*

Keywords: Stationarity, Lag Order, Pre-intervention, Coitegration, Moving average, Time series, ICPC Nigeria, Modelling

1. Introduction

Nigeria is Africa's most populated black nation in the world with the largest economy and oil producer in the continent. With these records, it is fair to say that Nigeria has been blessed with many human and natural resources to make it a tourist nation in the world, but the reverse is the case in Nigeria, where it suffers from endemic corruption. The lack of good governance in Nigeria today cannot be given a second thought for one to liken it to corruption. Many policies that were established to facilitate the development of the democratic process failed due to the existing high level of corruption that has engulfed our political terrain and the bureaucratic sector.

With the peak of corruption in Nigeria, one will be tempted to say that it is invented by Nigerians, but that is not true, because many analysts have blamed our colonial master for this endemic corruption in Nigeria. The colonizer of Nigeria left it with an abundance of political, economic, and social issues that are yet to be resolved.

A common view by Nigerians back then is that the colonist's property is not our property, in other words, looting is not seen as a crime to society, which causes disregard public property and lack of public trust that we currently witness in the nation today (History of Nigeria, Peakng.com).

2. Background

Iyanda et al (2016), stated in their work that Nigeria is one of the most populous nations in Africa with a total number of 140 million people. More so, the country is rich and blessed with human and natural resources, billions of dollars are generated from crude oil yearly, and yet nothing to show for this huge revenue in terms of infrastructural development and the living standard of its peoples. This perpetual state of affairs is indeed attributed to corruption. Furthermore, they attribute the causes of corruption in Nigeria to be Social-cultural, Politics, and Economic situations in Nigeria. In their work, they maintained that corruption has been responsible for the instability of successive Nigerian administrations since independence to date, which creates a very negative image and causes losses of developmental purposes. Much so, corruption devalues the quality of human life, robs Nigeria's sectors of revenues, and slows down administrative processes.

Corruption is an alien, and that African pre-colonial nations were founded on strong ethical values ensuring social justice and compliance. Their work on the contrary argues that the colonial masters imported corruption to Nigeria and Africa at large, also they conclude that corruption is innate and deep-seated in Nigeria particularly in the public sector, in addition, they were able to identify that non-conformity to religious tenets, values, culture, ethnicity, favoritisms, nepotism, and weak legal systems as the causes of corruption (Philips et al, 2014).

Volume 10 Issue 8, August 2021

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

According to Nwaodu et al (2009), stated that corruption is still subsisted as one of the greatest challenges facing Nigeria's socio economic life with a high poverty level despite been a six-position supplier of oil to the whole world. An attempt by the Federal Government of Nigeria to eradicate this societal ill led to the establishment of the Economic and Financial Crimes Commission (EFCC), the Independent Corrupt Practices Commission (ICPC), and related Offences among other bodies. They explored the anti-corruption war using EFCC, and there by discovered some of this agency has made a successful impact but still hindered by political, administrative, and judicial bureaucracy from efficient performance.

Okwuagbala (2020), defines corruption to be the offering of a bribe to an official so that the truth will be hidden that is, the embezzlement of public funds for personal use, and any act that is considered to be criminal according to the law of a particular society. Corruption is the biggest problem for every Nigerian, and no citizen can doubt that assertion. More so critical examination of both small and large sectors reveals that corrupt practice is everywhere and at every level.

The intense definition demonstrates that; corruption refers to a broad range of behavior. Usually as the abuse of public power for personal gain, and most time corruption equate with bribery, where an illegal payment is made to a government official in return for some type of official, state-sanctioned, authoritative act that has a selective and tangible impact and that in the absence of the secret payment would not otherwise have been made, however, he said beyond bribery corruption also involves kickbacks which operates much like a bribe, where the illegal money is paid after the service is rendered and also is extortion where the public officials threaten to used state power to induce payment of a bribe.

A survey was made that, bribe payers in Nigeria pay an average of some six bribes within a year, or roughly one bribe every two months. Combining the total number of people who paid a bribe to public officials with the frequency of those payments, it is estimated that a total of 82.3 million bribes were paid in Nigeria in the 12 months before the survey. This results in an average of 0.93 bribes paid per adult, or almost one bribe paid by every adult Nigerian per year. Some people believe that corruption is a culture most especially in Nigeria since it is said that culture is the way of life, therefore they liken it to be a culture since it's been practice everywhere and is entrenched in all segments of the society with many people deeply involved.

According to the research, corruption is a global devil that has devoured human intelligibility in its social context and as anti-social behavior and a plague that has eaten so deep into the entire fabric of the Nigerian society, it confers undue benefits on few people contrary to legal and moral norms of the society. Before its contagious and incurable infection, it undermines authorities' effort to provide welfare for all citizens as the resources to do this are in the hands or at the reach of few people. The work refers to corruption as a die-hard phenomenon that has caused terrible retrogression in Nigerian society (Iyanda, 2012). Liu (2016), choose a set

of definitions, summarize the quantitative and wealth indicators of corruption. To him, the factors of corruption could be classified into three levels such as macro, meso, and micro. Before now most scholars pay attention to the macro factors of the corruption between development, politics and culture compare to others. Meanwhile, the meso level which is internal system construction is the most important factor of which many practices of corruption are experienced. Michael (2015), assesses current literature on corruption at the oversee development institute (ODI) and Nils Taxell at U4, with the UK Department for International Development (DFID). Where they provide key sources of synthesized knowledge to inform effective anti-corruption programs and policy development. Alamu (2016), states that corruption has spread into all spheres of life in Nigeria and made the unpleasant situation downturn the economy.

Many stakeholders have perpetrated this evil of corruption by diverting public funds for self-interest. These defective situations have induced the citizens to cast away moral values to engage fully in corrupt practices. In a bid to curb the menace of corruption, the Nigerian government established anti-corruption agencies to fight corruption, yet because of the aggravated level of corruption in the country frustrate the effort of some of these agencies.

ARIMA is the acronym for the autoregressive integrated moving average. In statistics and econometrics, and in particular in time series analysis, an autoregressive integrated moving average (ARIMA) model is a generalization of an autoregressive moving average (ARMA) model. These models are fitted to time series data either to better understand the data or to predict future points in the series (forecasting). While Intervention analysis or event study is also a form of dynamic regression used to assess the impact of a special event on the time series of interest.

The main focus is to estimate the dynamic effect on the mean level of the series, but other effects can also be considered. Given a known intervention, is there evidence that change in the series of the kind expected occurred, and, if so, what can be said of the nature and magnitude of the change?" (Box and Tiao, 1975). Several interventions have been put in place in preventing corruption in Nigeria. Some were point or discrete while others were continuous or permanent interventions.

Some specific interventions put in place in Nigeria in recent times to fight corruption include the Economic Financial Crime Commission (EFCC); The agency is to prosecute high profile offenders and others. Also, the agency has a program on national television called Eagle Watch which shows its activities to the public and is legally back up with the Economic and Financial Crimes Commission Establishment ACT of 2004 giving it the power to investigate and prosecute economic and financial crimes. Public Complaints Commission with the sole mandate of addressing administrative injustice in the three tiers of government, but this commission is not known by many Nigerians. Independent Corrupt Practice Commission (ICPC) prohibits and prescribes punishment for corrupt practices and related offenses which is the main intervention

that is going to be evaluated in this study. The Commission is backed up with ICPC Act 2000 where the lines of duties are stated in Section 6 of the Act as follows:

- To receive and investigate complaints from members of the public on allegations of corrupt practices and inappropriate cases.
- To examine the practices, systems, and procedures of public bodies and where such systems aid corruption, to direct and supervise the review.
- To instruct, advise and assist any officer, agency, or parastatal on ways by which fraud or corruption may be eliminated or minimized by them.
- To advise heads of public bodies of any changes in practice, systems, or procedures compatible with the effective discharge of the duties of public bodies to reduce the likelihood or incidence of bribery, corruption, and related offenses.
- To educate the public on and against bribery, corruption, and related offenses.
- To enlist and foster public support in combating corruption.

Objectives

The main objective of the study is to identify the influence of the ARIMA intervention model in combating the corruption rate in Nigeria.

Significance

The research work would serve as a manual to our politicians and stakeholders in making intelligent policy and decisions about corruption rates, especially in Nigeria. Also, the information that would be discovered from this work when put into action will better the management of corruption, more especially, would help the current administration in realizing her core mandate of fighting corruption and also, give a good administrative and economic benefit of regaining our lost image from the international society. Finally, anti-corruption would benefit greatly from accurate forecasts of corruption within a geographical area. Then it would be possible to target needed areas with a forecast of corruption increases.

3. Methods

ARIMA Model

A stochastic time-series ARIMA model is employed to analyze the dynamics of changes, variations, and interruptions of corruption in Nigeria through time-series data. The ARIMA model would help to perceive whether the policy interventions have an impact on the corruption rate in Nigeria or not. The study used descriptive statistical data derived from ICPC corruption index records of Nigeria, from the year 2001 to 2020 and R software packages were used for the analysis. The autoregressive integrated moving average which is used for a short-term memory system is characterized by using the last i values for predicting univariate time series analysis. In most statistical analyses the last i are given to predict the actual value at time $i + t$. The general expression for the ARIMA process $\{y\}$ is given by the equation below

$$(1 - \phi_p B) \nabla^d y_t = (I - \theta_q B) \varepsilon_t \quad (1)$$

Were,

$(1 - \phi_p B) \nabla^d y_t = \varepsilon_t$ is the autoregressive component
 $y_t = (I - \theta_q B) \nabla^d \varepsilon_t$ is the moving average component

Intervention Model Analysis

As discussed by Box and Tiao (1975), an intervention model is of the general form:

$$Y_t = V(B) I_t + N_t \quad (2)$$

Where

It is an intervention or dummy variable that is defined as:

$$I_t = \{1, t = T_0, \neq T\} \quad (3)$$

In this instance the intervention input will begin at any point one chooses to introduce it, for instance, 2009 ($t=T$) where it is coded as 1, and remains for just a period in the case of the pulse function, but remains as 1 for the entire presence of the intervention exercise in the case of the step function and is therefore about the ICPC intervention events are formulated as;

$$Y_t = c + w_t I_{1t} + \frac{\theta(L)}{\phi(L)} \varepsilon_t \quad (4)$$

Where

$$I_{1t} = S_t^2 = \{1, t \geq 2009.0, otherwise\}$$

c is a constant and

Y_t is the level of change concerning gains or losses made in the value of reduction. The intervention variable I_{1t} is a step function that will correspond to the ICPC program.

Procedures of Model Development

In general, the model estimation of ARIMA consists of the following three stages:

Unit root test and identification of the order of difference, that is d . This preliminary step is essential to stabilize the time-series data and reduce the residual. The Augmented Dickey-Fuller (ADF) test is often employed for the analysis of the unit root, where the null hypothesis is that the input series has a unit root.

Estimation and diagnosis of the parameters of the transfer function that is p and q . The autocorrelation function (ACF), partial autocorrelation function (PACF), and cross autocorrelation function (CACF) is important to tentatively estimate the parameters of the transfer function, while statistical measures naturally provide statistical evidence to support the determination of an appropriate transfer function.

Residual/noise diagnostic check. The correlogram of Q-statistics based on the ACF and PACF of the residual is generally used for residual analysis.

Types of Intervention Models

An intervention model may be formulated as;

$$Y_t = \frac{w_0}{(1-\delta L)} I_{t-b} + N_t \quad (5)$$

Where

I_{t-b} is the intervention indicator variable normally known as the change agent, scored 0 or 1 for the absence or presence of the intervention event and the subscript b is a possible time delay for the impact to take off.

w_0 is the impact parameter which indicates the magnitude of the impact, and δ represents the decay parameter.

N_t is the noise model. Depending on the situation that prevails, the response series Y_t may not quickly observe the impact of the intervention event. The b index in bI_{t-b} gives the number of periods delayed between the onset of a known intervention and the actual time it is impacting on the response series Y_t . If b is assigned a value of 2, there would be exactly two time periods of delay between the intervention event I_t and the time it takes for its impact to be fully realized on the response series Y_t .

Two major forms that characterize intervention or impact assessments

1) Abrupt Permanent and Gradual Permanent effects:

The abrupt onset and permanent duration effects are popularly called a simple step function. Step functions are mainly used to model permanent changes in the response series Y_t . A step function with a first-order decay rate may be written as;

$$Y_t = \frac{w_0}{(1-\delta L)} I_{t-b} + N_t \quad (6)$$

If after fitting the model above and the denominator reduces to unity, the model will then be called a simple step function with a zero-order decay.

Where:

$$f(I_t) = s_t^{(T)} = w_0 I_{t-b} \quad (7)$$

Also, if there are no time delays ($b = 0$), then $f(I_t) = s_t^{(T)} = w_0 I_{t-b}$ and the full model will now be of the form

$$Y_t = w_0 I_t + N_t \quad (8)$$

However, the gradual permanent effects are characterized by slow changes in the level of the series that usually result in a new permanent level. It is usually model with step function and first-order decay as shown above, if the index $b = 0$, the permanent gradual effect model then becomes

$$Y_t = \frac{w_0}{(1-\delta L)} I_{t-b} + N_t \quad (9)$$

Where $-1 < \delta < 1$

2) Abrupt and Gradual Temporary effects

Temporary effects are often model with pulse functions. The abrupt onset and temporary duration effect are called the pulse effect, simply model as

$$Y_t = w_0 I_{t-b_t} + N_t \quad (10)$$

Where:

I_{t-b_t} is the intervention indicator coded 0 before the event and 1 at the onset and b may indicate a possible time delay between Y_t and I_t . The gradual temporary effects are often modeled with pulse functions having first-order decay rates. It is also formulated as

$$Y_t = \frac{w_0}{(1-\delta L)} I_t (1 - L) + N_t \quad (11)$$

Nature and Sources of the Data

The data for this research work is a time series count data, of corruption convicts' cases, from the ICPC headquarter office Abuja, Nigeria.

Method of Data Analysis

The Data will be analyzed using the ARIMA intervention time series analysis model for the convict's corruption cases.

Estimation Techniques

After identifying the order of the tentative model, the parameters of the model are estimated using the maximum

likelihood estimation to determine the AR and MA parameters, as well as all other parameters reported in the study. Three other penalty function statistics namely the Akaike information criteria (AIC), the Schwarz Bayesian information criteria as well as the corrected Akaike information criteria (AIC) are explained in penalizing fitted models based on the principle of parsimony. These statistics were one of the various checks used to verify the adequacy of the chosen models. Comparatively, models with the smallest AIC and BIC are deemed to have residuals that resemble a white noise process. Twice the number of estimated parameters minus two times the log-likelihood gives the AIC value of a model. The BIC is computed as, $-2\ln(L) + \ln(n)k$, where L is the likelihood, n denotes the number of residuals and k is the number of free parameters. Each parameter estimates report a standard error for that particular parameter. Using the parameter estimate and its standard error, a test for statistical significance (t-value) is then conducted. For statistically significant parameters, the absolute values of the t ratios are expected to be greater than 1.96 or 2 for the parameters to be maintained in the model whereas parameters that are not significant are trimmed or removed from the model.

Justification of the Data Analysis

The ARIMA model was used to analyze the data under the following:

- 1) When the univariate data are not stationary
- 2) When the univariate data are differenced to stationarity.

4. Result and Discussion

The graph in Figure 1 shows clearly that as of 2001 the corruption rate was at low levels but experience a sharp increase in 2002 and a decrease in the corruption level in 2003, as of 2004 the corruption level rises and experience a little drop by the year 2005 and have a drastic drop by 2006, 2007, 2008 but have a sharp rise in 2009 in the country. Though the sharp decrease and increase in the graph indicate probably that, there should be some components of seasonal and irregular components available in the series that made the series non-stationary.

The graph in Figure 2 displays the autocorrelation function and partial autocorrelation function of the pre-intervention series of cases from 2001 to 2009 from where the new policy on embezzlement of public funds slowly rise and fall. The ACF shows a sharp spike at lag zero and one that is showing that there is a relationship within itself and with other variables and spikes further alternating in sign resulting in a wavelike form which indicates a non-stationary time series. While the PACF of the series shows a significant positive spike at lag one and a non-significant negative at lag two and continues to alternate negatively, hence there is no significant relationship between the corruption cases.

The table 1 showed the test statistics with the probability values of the augmented dickey fuller test at different lags. At lag zero, the probability value with the test statistic of -3.5871 shows that the pre-intervention series is not stationary, also at lag one the probability value of 0.01 with the test statistics of -6.3405 indicate that the series is

stationary, and at lag order two, with the probability value of 0.9464 and the test statistics of -0.8247 reject the null hypothesis, which is greater than the critical value of 0.05. Hence, it's obvious that the pre-intervention of the corruption cases is not stationary, also the ACF and PACF graph display above also indicate that there is no stationarity in the pre-intervention cases, and therefore the need to differentiate the pre-intervention series is necessary before it can be used.

The unit root and stationarity test for the differenced series in table 2 tests for stationarity of null hypothesis and alternative of unit root with the augmented dickey fuller test. The test statistics of -0.46528 for the first differenced with P-value 0.9765 at lag order 2 which is greater than the critical value of 0.05 as in the table above showed that we do reject the null hypothesis and accept the alternative hypothesis, and conclude that at the first difference the pre-intervention of corruption cases is not stationary at the first difference, while in the test statistics value -3.9754 for the second difference with P-value of 0.02411 at lag order 1 which is less than the 0.05 confidence interval, indicate that we accept the null hypothesis and reject the alternative hypothesis and concluded that the pre-intervention series is stationary at the second difference, which means our aim is achieved by the second difference. Therefore, the pattern is typical to an autoregressive (AR) process of order one. The identified order of the model is, therefore, ARIMA (1,2,0) representing AR (1), I(2), and MA(0).

From Table 3, the BIC minimum value is reached when $m = 2$, hence just one breakpoint is determined to correspond to the years 2005 and 2012. Plotting the original time series against its structural break and its confidence interval reveals the actual intervention point.

The fitting of intervention or impact assessment model is graphed as displayed in Figure 4 of the corruption series and the dash black line representing the effect of the independent and corrupt practices commission (ICPC) event. The independent and corrupt practices commission started charging more cases of corruption from 2012 and above.

From Table 4, we compare the Akaike Information Criterion (AIC) of all the possible models and find out a model to fit the data better than the others, which is the one with the lowest AIC value. The final model is ARIMA (0, 1, 1).

From the graph in Figure 6, it can be seen that the residuals of the model are normally distributed.

5. Discussion of Findings

The autoregressive integrated moving average (ARIMA) intervention model on recorded corruption index in Nigeria by the ICPC agency was used for this study, the pre-intervention series of the corruption index showed that the index is not stationary till after the second difference of the series. Furthermore, the series exhibits upward and downward movement. The identified model for the series is ARIMA (0, 1, 1) for the pre-intervention of the series. However, after the intervention the series went up indicating that there is an increase in the corruption index when the agency intensifies effort as of the year 2012, meaning that the intervention has a negative effect on the series.

6. Conclusion

Based on our finding, from the pre-intervention series, it shows that the series is not stationary and becomes stationary at the second difference. Furthermore, the stationarity was seen from the ACF and PACF, also, the augmented dickey fuller test statistic values of -3.9754 with the probability values of 0.02411 at lag one established it. More so, we can say confidently that corruption varies at different time points at different degrees, from the pre-intervention graph plot. One can further say that the major the agency introduced as of 2010 is not healthy for the system which is confirmed to the number of cases recorded after the intervention period.

The study recommends that the ICPC should sit up in their operation and must be acquainted with their objectives and work within their constitutional mandate, which entails avoiding biases in the discharge of their function, and also should avoid any external influence that would render the agency a rubber stamp and therefore losing public trust. The study also called on the management of the agency to collaborate with stakeholders, international communities, and also some security-related NGOs that can aid the realization of the goals of the agency. In addition, the agency has to increase its manpower to meet up with the exponential growth of the population and engage them in intelligence training that will help them curtail the practice of corruption.

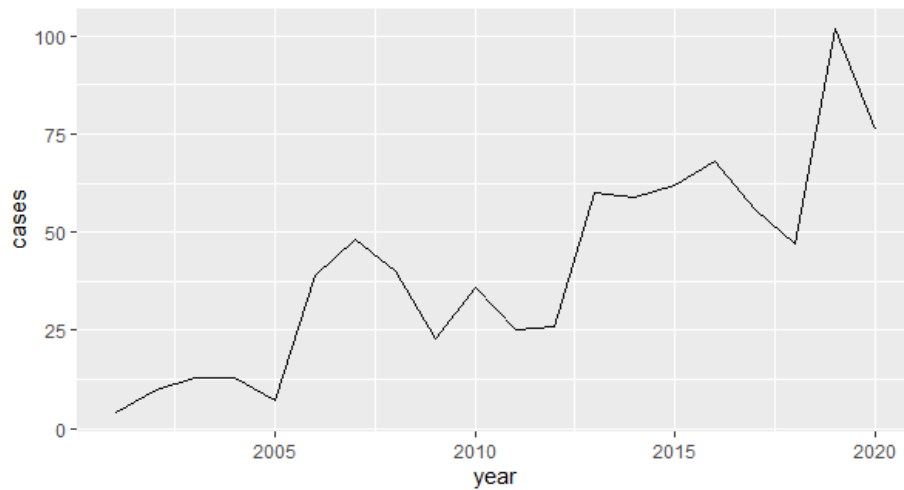


Figure 1: Time Series Graph of the Pre-intervention series

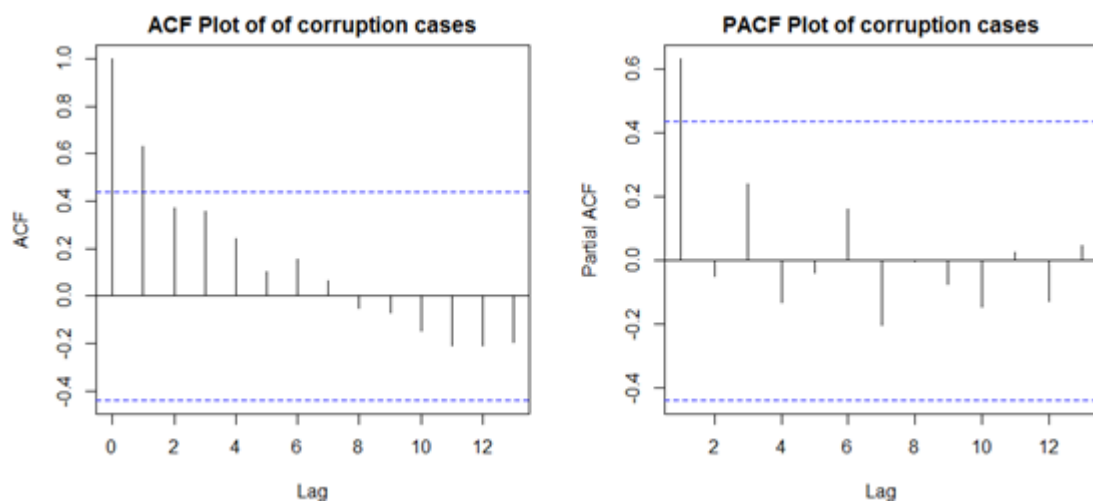


Figure 2: Correlogram Plots of the pre-intervention series.

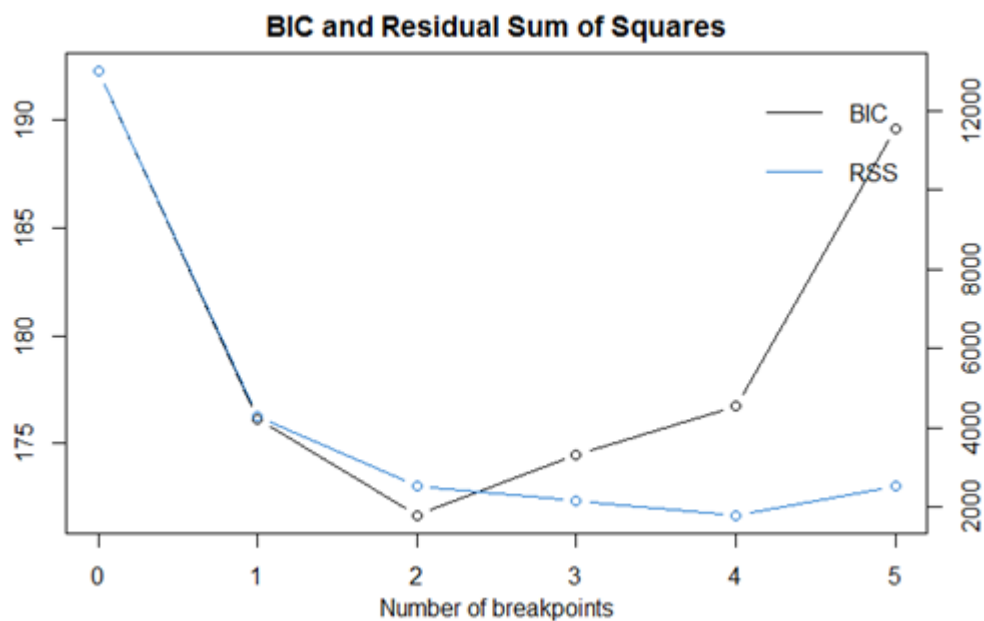


Figure 3: BIC and Residual Sum of Squares

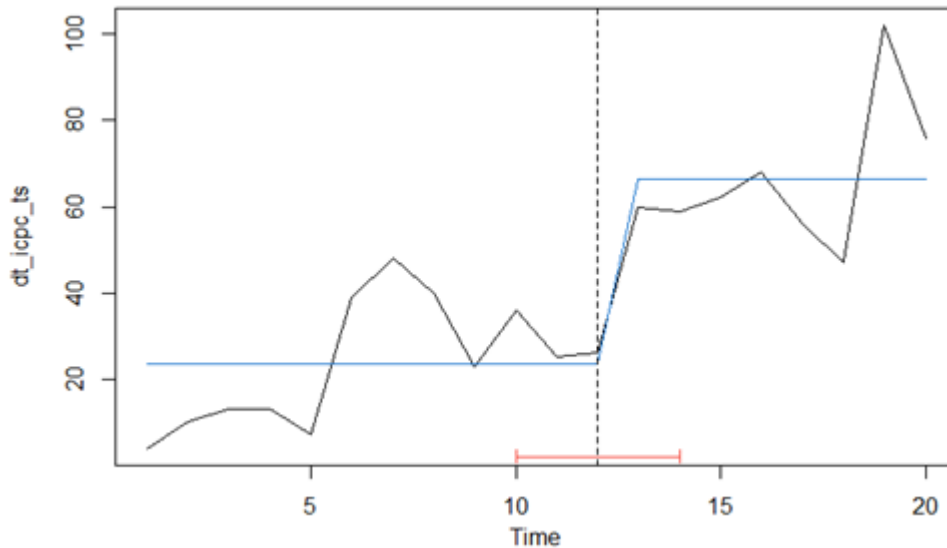


Figure 4: Intervention Assessment Model

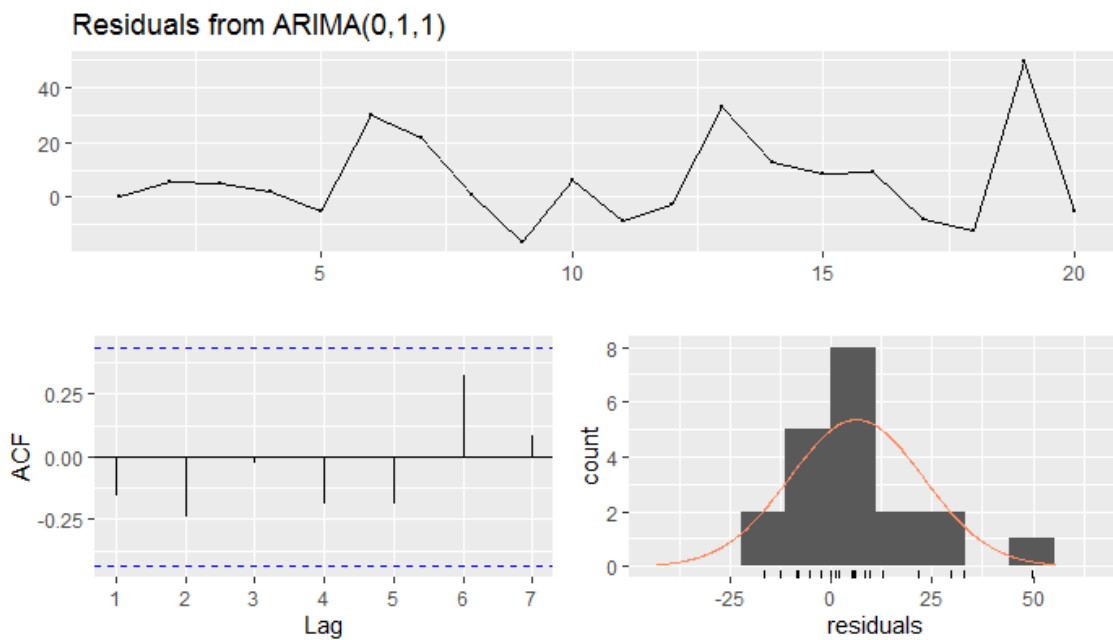


Figure 5: Residuals from ARIMA (0, 1, 1)

Table 1: Unit Root and Stationarity Tests for the pre-intervention series

Test type	Test Statistics	Lag Order	P-Values
Augmented Dickey-Fuller Test	-3.5871	0	0.05179
Augmented Dickey-Fuller Test	-6.3405	1	0.01
Augmented Dickey-Fuller Test	-0.8247	2	0.9464

Source: Researcher's Computation

Table 2: Unit Root and Stationarity Tests for the Differenced Series

Test type	Test Statistics	Lag Order	P-Values
Augmented Dickey-Fuller Test	-0.46528	1(0)	0.9765
Augmented Dickey-Fuller Test	-3.9754	1(1)	0.02411

Table 3: Summary of the Breakpoints at observation number

M	0	1	2	3	4	5
Observation Numbers		2012	2005, 2012	2005, 2008, 2012	2005, 2008, 2012, 2017	2005, 2008, 2011, 2014, 2017
RSS	12998.2	4294.2	2549.6	2172.4	1804.9	2542.5
BIC	192.3	176.1	171.7	174.5	176.8	189.6

Table 4: Comparison of Different Models

Model	Sigma ² estimated	AIC
ARIMA (1, 0, 0)	48.26	894.93
ARIMA (2,0,0)	45.23	888.6
ARIMA (2,1,0)	245.4	1108.67
ARIMA (1,0,1)	46.79	882.62
ARIMA (0,1,1)	46	167.35
ARIMA (1,1,1)	49.74	881.41
ARIMA (1,1,3)	45.68	884.52

Source: Researcher's Computation

7. Acknowledgement

In the name of Allah, the beneficent the merciful praises be to Allah, the Lord of the worlds, for giving me the energy to do this research work.

My heartfelt appreciation goes to my noble supervisor Dr. N.O Nweze (HOD, Statistics Department, Nasarawa State University, Keffi.) For his enlightening discussion, contribution and corrections, and motivation towards a successful completion of this research work.

Special gratitude goes to my internal examiner, Dr. Salihu H. Muhammed for taking his time to go through my work and making corrections where necessary.

My heartfelt gratitude goes to my second supervisor Dr. Adenemo and my lecturers Dr. Bilkisu and Dr. Adeh for their guidance throughout this project work.

My profound gratitude goes to my parents (late Hon. Mbi Okikiri and my mum, Hajiya Okino Hajarat). May the soul of my late father rest in aljanatul firdaus may Allah forgive his shortcomings and reward him with Aljana. Amin thuma Ameen. To my mum may Allah grant you good health and long life, i really appreciate you mama for standing by me since my childhood and supporting my education.

I want to express my gratitude to all my family members especially my dear husband (Barr. Mohammed Asema Sadiq) and my children, for their support and understanding during this period.

Thanks goes to all my coursemates for their encouragement and valuable suggestions and also appreciate Mr.Boakye Agyemang. May Allah grant their heart's desires.

References

- [1] Abdalla El-Habil (2006), Measuring the Impact of a New Policy on Industry in Gaza. An - Najah Univ. J. Res. (H. Sc.) Vol. 21(2).
- [2] Abdel-Aal RE, Mangoud AM. Modeling and forecasting monthly patient volume at a primary health care clinic using univariate time-series analysis. *Computer Methods Programs Biomed* 1998 Jun;56(3):235-47.
- [3] Adejuwon, K. D., & Tijani, A. A. (2012). Poverty reduction and the attainment of the millenium development goals in Nigeria: Problems and prospects. *International Journal of Research in Social Sciences*, 2(2), 53-74.
- [4] Agbese, D. (1992) "Corruption, the Palm Oil that stains the fingers of the Giver and the Receiver" *Newswatch* March 9, vol. 15, No. 109 – 115.pp. 9 – 15.
- [5] Agyemang, B. (2012). *Autoregressive Integrated Moving Average (ARIMA) Intervention Analysis Model for the Major Crimes in Ghana.(The case of the Eastern Region)* (Doctoral dissertation).
- [6] Alamu O. I. (2016) *Corruption, Anti-Corruption Agencies, and the Nigerian Government*. *Global journal of interdisciplinary sciences* vol. 5 (1-5).
- [7] Alesina, A. & Roubini, N. (1990). Political Cycles in OECD Economies. *Review of Economic Studies* 59(4): 663-688. Retrieved from <http://nrs.harvard.edu/urn3:HUL.InstRepos:4553025>, accessed April 26, 2013.
- [8] Alesina, A. & Sachs, J. (1986). Political Parties and the Business cycles in the United States. NBER Working Paper No.1940. Block, S.A (1999). Political Business Cycles, Democratization, and Economic Reform: The Case of Africa. Retrieved from [http://dx.doi.org/10.1016/S0304-3878\(01\)00184-5](http://dx.doi.org/10.1016/S0304-3878(01)00184-5).
- [9] Amoakohene, M. I. (2004). Violence against women in Ghana: A look at women's perceptions and review of policy and social responses. *Social Science & Medicine*, Volume 59, Issue 11, Pages 2373-2385.
- [10] Anthony M., Emily H., Antonio Tjeerd V. S., Ben. G., Laim S. & Krushman B. (2016), Impact of statin-related media coverage on use of statins: interrupted time series analysis with UK primary care data. <https://doi.org/10.1136/bmj.i3283>.
- [11] Anti-Corruption Resource Center (2014). Nigeria: Evidence of corruption and the influence of social norms. www.U4nowwww.transparency.org/cpi. corruption perceptions index 2019.
- [12] Appiahene-Gyamfi, J. (1998). Violent crime in Ghana: The case of robbery. *Journal of Criminal Justice* Volume 26, Issue 5, Pages 409-424.
- [13] Biglan A, Ary D, Wagenaar AC (2000), The value of interrupted time-series experiments for community intervention research. *Prevention Science: the Official Journal of the Society for Prevention Research*, 1:31-49.
- [14] Birylo M., Rzepecka Z., Kuczynska-Siehien J., & J. Nastula (2017), Analysis of water budget prediction accuracy using ARIMA models. <https://www.researchgate.net/publication/318706984>. July 2017 DOI: 10.2166/ws.2017.156.
- [15] Bianchi, L., Jeffrey J. and Hanumara, R.C., (1998). Improving forecasting for telemarketing centers by ARIMA modeling with intervention. *International Journal of Forecasting*, Volume 14, Issue 4, Pages 497-504. <http://www.sciencedirect.com/science>.
- [16] Min, C.H Jennifer (2008b). "Forecasting Japanese tourism demand in Taiwan using an intervention analysis", *International Journal of Culture, Tourism and Hospitality Research*, Vol. 2 Iss: 3, pp.197 – 216.
- [17] Box GEP, Reinsel GC, Jenkins GM (1994), *Time series analysis: forecasting and control*. 3rd edition. Englewood Cliffs, NJ, Prentice-Hall.
- [18] Brockwell PJ, Davis RA (2002), *Introduction to Time Series and Fore-casting*. 2nd edition. New York, Springer.

- [19] Brownsberger, W.N. (1983), "Development and Governmental Corruption-materialism and political fragmentation in Nigeria", *Journal of Modern Africa Studies*, 21:215 -233.
- [20] Bruce G., Kimberley K., Chris R., Karen B., Shaun T., Dennis P. & Lewis R. (2016), Data feedback and behavioural change intervention to improve primary care prescribing safety (EFIPPS): multicenter, three arm, cluster randomized controlled trial. <https://doi.org/10.1136/bmj.i4079>.
- [21] Carprara, G., Schwartz, Capanna, S., Vecchione, C. & M.Barbarenelli (2006). *Personality and Politics: Values, Traits, and Political Choice*. *Political Psychology*, Vol. 27, No. 1, pp. 1-28 Central Bank of Nigeria (2011). *Statistical Bulletin*. Retrieved from <http://www.cenbank.org/documents/Statbulletin.asp>.
- [22] Chang G.L, Chen C.H, and Carter E.C., (1993). Intervention analysis for the impacts of the 65 mph speed limit on rural interstate highway fatalities. *J Safety Res* 1993; 241:33-53.
- [23] Chung, C.P Roy., Ip, W.H. and Chan, S.L., (2009). An ARIMA-Intervention Analysis Model for the Financial Crisis in China's Manufacturing Industry. *International Journal of Engineering Business Management*, Vol. 1, No. 1, pp. 15-18.
- [24] COSMOS A. K. T. (2013), Time Series Analysis of Water Consumption in the Hohoe Municipality of the Volta region of Ghana, Kwame Nkrumah University of Science and Technology.
- [25] Dadajo, K.I (2008). "The Constitutional fight against corruption in Nigeria: Is it enough?" *International Journal of Government, Finance and Management*, 8:61-70.
- [26] Darkwah, K. F., Okyere, G. A., & Boakye, A. (2012). Intervention analysis of serious crimes in the eastern region of Ghana. *International Journal of Business and Social Research*, 2(7), 132-138.
- [27] Eberechi H. A. & Ette H. E. (2017), Arima Intervention Analysis of Nigerian Monthly Crude Oil Prices, *Nigerian Journal of Oil and Gas Technology* Vol 3 No. 1.
- [28] Faal, E. (2007). *Political Budget Cycles in Papua New Guinea IMF Working Paper P/07/219* Retrieved from <https://www.imf.org/external/.../wp07219.pdf>.
- [29] Fafa, H. B. (2010). High crime rate in Ghana. Thursday, 11 November 2010, Jayee University College, Ghana.
- [30] Ferrand, Y., Kelton, C.M., Guo J.J., Levy M.S., and Yu, Y., (2011). Using time-series intervention analysis to understand U.S. Medicaid expenditures on antidepressant agents. *Res Social Adm Pharm*.7(1):64-80. <http://www.ncbi.nlm.nih.gov/pubmed>.
- [31] French, W.M. (2001). Estimating Changes in trend growth of Total Factor Productivity: Kalman and H-P Filters versus a Markovswitching framework. Retrieved from www.federalreserve.gov/pubs/.../200144pap.pdf.
- [32] Green, S. (2011). Time series analysis of stock prices using the box-Jenkins approach.
- [33] Hibbs, D.A (1977). *Political Parties and Macroeconomic Policy*. *The American Political Science Review*. Vol. 71 (4):1467-1487. Retrieved from <http://links.jstor.org/sici?sici=0003-0554%28197712%2971%3A4%3C1467%3APPAMP%3E2.0.O.C.O%3B2-8>.
- [34] Hibbs, D.A. (1992). *Partisan Theory after fifteen years*. *European Journal of Political Economy*. 8: 361-373. Retrieved from www.douglashibbs.com/HibbsArticles/EJPE%201992.pdf.
- [35] Hicksen, A., Satyanath, S. & E. Sergenti (2005). *Political Institutions and Economic Performance: The Effects of Accountability and Obstacles to Policy Change*. *American Journal of Political Science*. Vol. 49, No. 4, Pp. 897-907 Lucas, R.E. (1988). *On the Mechanics of Economic Development*. *Journal of Monetary Economics*, Vol. 22: 3- 42. Retrieved from www.parisschoolofeconomics.eu/.../lucasmecanicseconomicgrowth.pdf. [http://papers.ssrn.com/sol3/papers.cfm?](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1333333) <http://www.globalcorruptionreport.org>.
- [36] <https://peakng.com/nigerian-history/>
- [37] <https://www.pwc.com/ng/en/assets/pdf/impact-of-corruption-on-nigerias-economy.pdf>.
- [38] Inge A. (2017), *Political Corruption: An Introduction to the Issues*. Chr. Michelsen Institute Development Studies and Human Rights, Web/URL:<http://www.cmi.no> ISSN 0804-3639.
- [39] IYANDA D. O. (2012), *Corruption: Definitions, Theories and Concepts*. *Arabian Journal of Business and Management Review (OMAN Chapter)* Vol. 2(4).
- [40] Iyanda K. A, OROGBEMI E. O & Jeje E A. (2016), *History of Corruption and National Development*, *www.iiste.org* Vol.35, ISSN 2224-3178 (Paper) ISSN 2225-0964 (Online).
- [41] James L. B., Steven C. & Antonio G. (2017), Interrupted time series regression for the evaluation of public health interventions: a tutorial. *International Journal of Epidemiology*, P 348-355. doi: 10.1093/ije/dyw098.
- [42] James T. R., Michael A. M. & Hobaart W. H. (2018), *Secondary peritonitis: principles of diagnosis and intervention*. <https://doi.org/10.1136/bmj.k1407>.
- [43] Jeffrey E. J., & Eric K. (2011). ARIMA Modeling with Intervention to Forecast and Analyze Chinese Stock Prices. *International Journal of Engineering Business Management*, 3(3), 53-58.
- [44] Jennifer. C. H., Hsien-Hung, M. K. and Liu, H. H. (2010). Interventions affecting air transport passenger demand in Taiwan. *African Journal of Business Management* Vol. 4(10), pp. 2121-2131, ISSN: 1993-8233.
- [45] Jimo, H., et al (2001). *West and West Central Africa in Global Corruption Report*. Berlin: Transparency International, pp: 81-94 Retrieved from:
- [46] Konie, G. (2003) "National Reconciliation." *The Post, a Zambian Newspaper* July 23.No.2471, pp: 11.
- [47] Lawson, M. (2008). *Youth Crime in Ghana*, Feature Article Sat, 04 Oct 2008. <http://www.infoplease.com/ipa/A0107584.html>. Accessed, 12th September 2011.
- [48] Linus A. (2014). *The Transparency International and Nigeria's Corruption Perception Index: Implications for Sustainable Transformation*. Department of Sociology, Faculty of Social Sciences, Kogi State University, P.M.B 1008, Anyigba, Nigeria.

- [49] Liu, X.Z. (2016), A Literature Review on the Definition of Corruption and Factors Affecting the Risk of Corruption. *Open Journal of Social Sciences*, vol. 4 (171-177). <http://dx.doi.org/10.4236/jss.2016.46019>.
- [50] Lullu K, Kathryn L. & Nina K. (2016), The impact of corruption: Tackling corruption could reap significant benefits for the South African economy.
- [51] McLeod A. I. & Vingilis E. R. (2014), Power Computations for Intervention Analysis, *Technometrics*, 1; 47(2): 174–181. doi:10.1198/004017005000000094.
- [52] Michael G. (2015), Why corruption matters: understanding causes, effects and how to address them. Department of international Development. UKaid.
- [53] Min, C.H Jennifer, Hsien-Hung K., and Hsiang, L. Hsi (2010). Interventions affecting air transport passenger demand in Taiwan. *African Journal of Business Management* Vol. 4(10), pp. 2121-2131, ISSN: 1993-8233.
- [54] Mohammed H. A., Mohammad K. Y., & Jeong K. (2019), Time Series ARIMA Model for Prediction of Daily and Monthly Average Global Solar Radiation, *Symmetry*, 240; doi:10.3390/sym11020240.
- [55] Mrinmoy R., Ramasu B, Amrender K. & Anil R. (2014), Application of Time Series Intervention Modelling for Modelling and Forecasting Cotton Yield. *Statistics and Applications* Vol 12 (1-2) pp. 61-70.
- [56] Muhammad, H. Lee, Suhartono and Bahrom Sanugi (2010). Multi Input Intervention Model for Evaluating the Impact of the Asian Crisis and Terrorist Attacks on Tourist Arrivals. *MATEMATIKA*, Volume 26, Number 1, 83–106.
- [57] Natufe, O.I. (2006). Governance and Politics in Nigeria. A lecture delivered at Staff and Graduate Seminar, Department of Politics and Public Administration, University of Benin Nordhaus, W. (1989). *Alternative Approaches to the Political Business Cycle*. Cowles Foundation Paper No.748. Retrieved from <http://core.kmi.open.ac.uk/download/pdf/6252192.pdf>.
- [58] Nwaobi, G.C. (2004). Corruption and Bribery in the Nigerian Economy: An empirical investigation public Economics 0404006, EconWPA. Retrieved from:
- [59] NWAODU, N. ADAM D. & OKEREKE O. (2012). A Review of Anti-Corruption Wars In Nigeria. School of Post Graduate Studies & Research Igbinedion University, Okada Edo StateEmail:nwaodunnamdi@yahoo.com.
- [60] Okwuagbala, U. M. (2020), Corruption in Nigeria: Review, causes, Effects, and Solutions, <https://soapboxie.com/world-politics/Corruption-in-Nigeria>.
- [61] Otchere, J. N. K. (2007). Increased Crime Rate In Ghana. Feature Article of Wednesday, 12 September 2007 San Diego State University.
- [62] Philips O. O, & Akpokighe O. R. (2014), Corruption in Nigeria: The Possible Way, *Global Journal of human-social science*. Vol. 14. (USA) Online ISSN: 2249-460x & Print ISSN: 0975-587X.
- [63] Rock-Antoine M. and Hannarong Shamsub (2002). Who is benefiting the most from NAFTA? An Intervention time series analysis. *Journal of economic development* 69 volume 27, number 2.
- [64] Rotimi E. M., Obasaju B., Lawal A. & Ise O. J. (2013), Analysis of Corruption and Economic growth in Nigeria. *afro Asian journal of social sciences*. Vol. 4(4.2).
- [65] Salisu, M. (2000). Corruption in Nigeria. Lancaster University Management School Working paper 2000/006.The LUMS Working Papers series. Retrieved from: <http://www.lums.co.uk/publications>.
- [66] Selin Ü. (2017), Comparison of Forecasting Methods for Stock Prices of Consumer Electronics Market, Modul Vienna University.
- [67] Shakira, G. (2011) Time Series Analysis of Stock Prices Using the Box-Jenkins Approach. <https://digitalcommons.georgiasouthern.edu/etd/668>.
- [68] Sathianandan, T.V, Somy Kuriakose , Mini, K. G and Joji, T.V., (2006). Impact of introduction of crafts with outboard engines on marine fish production in Kerala and Karnataka – a study through Intervention analysis. *Indian Journal of Fisheries*, 53 (3): pp. 271-282.
- [69] Shittu O.Ismail (2009). Modeling Exchange Rate in Nigeria in the Presence of Financial and Political Instability: An Intervention Analysis Approach. *Middle Eastern Finance and Economics*, ISSN: 1450 – 2889, Issue 5.
- [70] Stephen D. M. (2011), Forms of Corruption, <https://www.researchgate.net/publication/22738>
- [71] UNODC (2017) Corruption in Nigeria Bribery: public experience and response.
- [72] Utomi, P., Duncan, A. & G. Williams (2007). Nigeria: The Political Economy of Reform, Strengthening the incentives for economic growth. *The Policy Practice*. Retrieved from <http://thepolicypractice.com/publications/Nigeria-the-political-economy-of-reform-strengthening-incentives-foreconomic-growth-updated/> Worldwide Governance Indicators (2013). Retrieved from www.govindicators.org.
- [73] Yaacob, W.F, Husin, W.Z, Abd. Aziz, N., and Nordin, N. I., (2011). An Intervention Model of Road Accidents: The Case of OPS Sikap Intervention. *Journal of Applied Sciences*, 11: 1105-1112. <http://scialert.net/fulltext/>.
- [74] Zambon F., Fedeli U., Cristiana V., Marchesan M., Avossa F., Brocco S., and Spolaore P., (2007). Evidence-based policy on road safety: the effect of the demerit points system on seat belt use and health outcomes. *Journal of Epidemiology and Community Health*, Pp 877-881. <http://jech.bmj.com/content/6>.

Author Profile

Sadiq Nafisatu is a postgraduate student Department of Statistics Nasarawa State University Keffi, Nasarawa State Nigeria. She holds HND in statistics, B.Sc in statistics, PGD in computer science and M.Sc. in computer science. She is happily married and blessed with children.

Dr. N.O Nweze is presently a lecturer and Head of Statistics Department with Nasarawa State University Keffi. He holds B.Sc., M.Sc. and Ph.D. degrees in Statistics. He has a good number of publications in Statistical journals and has presented some of such at conferences. He is happily married and blessed with children.

Ibrahim Ahmed is presently a lecturer with Nasarawa State University Keffi, he has been teaching Statistics for quit number of years till date. He holds B.Sc., M.Sc. and Ph.D. degrees in Statistics and has a good number of publications in both National and International Journals and has presented some of such at conferences. He is happily married and blessed with children.

Mohammed Rilwan is a postgraduate student Department of Statistics Nasarawa State University Keffi, Nasarawa State Nigeria. He is the Chief Executive officer at Alhaji Mamuda Global Resources Keffi, Nasarawa State Nigeria since 2010 and the author of 'Meta-Analysis on the effect of Tamiflu in patients infected with Flu in some areas around U.S and Asia' published in 2021. He is single.

Appendix A: Dataset of Corruption cases from 2001 to 2020.

Year	Number of Cases
2001	4
2002	10
2003	13
2004	13
2005	7
2006	39
2007	48
2008	40
2009	23
2010	36
2011	25
2012	26
2013	60
2014	59
2015	62
2016	68
2017	56
2018	47
2019	102
2020	76

Source: ICPC Report, 2001 – 2020.