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Intervention Analysis of Daily Australian Dollar (AUD)/Nigerian Naira (NGN) Exchange Rate

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ABSTRACT

Intervention Analysis seek to measure the effect of a particular situation, such as the global pandemic pronounced in March 2020 which affected exchange rate of several countries. In this study which was geared towards developing an intervention model to forecast daily Australian dollar (AUD) /Nigerian naira (NGN) exchange. It was discovered that two hundred and seventy four daily amount of naira (NGN) per dollar from 12th August 2020 on up till 26th December 2020 a sudden jump from 289 to 300. The level increased and decreased leading to a perturbation. The point of post intervention are made on the basis of forecast. Pre-intervention exchange rate are certified as non-stationary and first order differencing renders them stationary. The autocorrelation structure indicated as SARIMA (1,0,1) (1,0,1)2 model is a better model AIC ground and is therefore adopted. Post –intervention forecast are obtained on the basis of the model. The difference between the forecast and their corresponding actual observation is modelled to obtain the intervention model.

Keyword: T**ime series, trend, seasonality**, **Intervention analysis, Forecasting.**

1. Introduction

Australia uses Dollar as its legal tender and its acronym AUD (for Australian Dollar) on the other hand, Naira is Nigerian Currency and is donated by NGN. Exchange rates between the two currencies are the basis for international trade between the two nations and may be used as proxy for relative performance of their economies. The purpose of this work is to propose an intervention model for their exchange rates. This is sequel to an observation that on 11th December, 2020, there was a sharp and abrupt decrease in the comparative value of the Naira and it has not recovered since then. The data analyzed started from 11th August 2020 to 7th February 2021. It is believed that this intervention situation result from the current economic recession in Nigeria. The approach is that of Box and Tiao (1975) which is based on ARIMA methodology and it has been extensively applied on many time series successfully. For instance, Masukawa *et al* (2014) studied the impact of rotavirus vaccine on the rates of hospitalization of children less than 5 years old for acute diarrhea. Valadkhani and Layton (2004) examined the effect of goods and services tax inflation in Australia. They observed a transitory effect. Ismail (2009) has noticed a significant impact of fiscal and political instability on the Naira/US Dollar exchange rates. *Etuk et al.* (2017) has fitted an intervention model to the Euro/British Pound exchange rates occasioned by Brexit. An intervention study has been conducted by Etuk and Eleki (2017) on the exchange rates of the Central African Franc and the Nigerian naira still due to the current economic recession in Nigeria. The Impact of subprime mortgage crisis in the United States of America on the exports manufacturing industry of China has been investigated by *Chung et al.(*2009), to mention but a few.

Time series is a series of points (listed or graphed) in time order. **It** can also be seen as a sequence that takes a successive equally spaced point in time sequence of discrete-time data, examples are heights of oceans, tides and counts of sunspots and values of exchange rate

currency over a long period of time between different currency.

An ARIMA model is a generalization of an autoregressive moving average applied in statistics and econometrics fitted in time series for forecasting. According to Adhikari and Agarwal (2009) Arima is referred to as autoregressive integrated moving average model which is a combination of autoregressive (AR) and moving average (MA) models as well as the integration process at which a non-stationary time series variable is differenced to make it stationary.

There are two types of time domain models:

Models that relate the present value of a series to past prediction errors called Arima models. Ordinary regression models that use time indices. These can be helpful for an initial description of the data and form the basics of several forecasting methods. Examples of time series include heights of ocean tides, counts of sunspots and daily closing values of the dew jones industrial average. Time series are plotted via line chart. It's application ranges from signal processing pattern recognition, econometric, earthquake prediction, astronomy, communication engineering and largely in any domain of applied science and engineering.

Time series analysis comprises of several methods for analyzing time series data in order to extract meaningful statistics and other characteristics of the data.

Time series data include the following:

Time series data: A set of observations on the values that a variable takes at different times.

Cross sectional data: Data of one or more variable, collected at the same point in time.

Pooled data: A combination of time series data and cross sectional data.

Time series forecasting is the use of a model to predict future values based on previously observed values. Regression analysis is often employed so as to test theories that the current values of one or more independents time series affect the current values of another time series,

Generally Arima is represented with ARIMA (p, d, q), where p is order (number of time lags) of the models, d is the degree of differencing (number pas values subtracted) and is the order of

the moving average model.

Seasonality in a time series is a regular pattern of changes that repeats over S times periods where S defines the number of time periods until the pattern repeats again. In a seasonal model AR and MA terms predict Xt using data values and errors at times with lags that are multiples of S (the span of the seasonality).

Seasonal ARIMA is represented with (P,D,Q)m Arima where m is the member of observation per year example m=4 quarterly and m=12 for yearly. Box-Jenkins method was introduced by two statistician George box and Gwilym Jenkins, they applied the autoregressive moving average (ARIMA) and autoregressive integrated moving average (ARIMA) mode to forecast the best fit of a time series model using past values. The modeling approach make use of iterative three-stage modeling

Box-Jenkins method refers to the iterative application of the following three steps

1.Identification

2.Estimation

3. Diagnostic Testing

Identification: Using plots of the data: Autocorrelation, partial autocorrelation and a class of simple ARIMA model is selected. This estimates appropriate values of P.

Estimation: The phis and thetas of the selected model are estimated using maximum likelihood techniques, back casting etc. as outlined in Box-Jenkins (1976).

Diagnostic Checking: The filled model is checked for inadequacies by considering the autocorrelations of the residual series. (The series of residual or error value).

Exchange rate is controlled by the stock exchange market consisting 166 equities, 154 bonds 9 exchange traded funds (EIFS) and 53 memoranda listings with a total market capitalization of over N28trillion as at January 9, 2019.

Exchange Rate Policies: Exchange rate policies involves choosing an exchange rate system and determining the particular rate at which foreign exchange transaction will take place .A country's economic structure and its institutional characteristics are important consideration in determining exchange rate policy. The exchange rate of a country affect aggregate demand which affects imports and export . It differs from natural rate so it can be manipulated. The exchange rate policy is guided by the need to reduce excess volatility ,prevent the emergence of establishing speculative activities , help maintain an adequate level of reserves , and develop an orderly foreign exchange market.

1.1 Statement Of The Problem

In the year 2020 April, a global pandemic called corona virus (covid19) invaded the world which affected the economy of many nations and the exchange rate of many countries was affected, there was a sharp rising and falling leading to a trend. Hence the need to carry out a Forecasting of exchange rate using an intervention analysis to find a suitable model to explain the relationship between both country exchange rate.

1.1 Objective of the Study

The main objective of this study is to fit an intervention model that can predict the expected exchange rate values that exist between both countries using previous values over the years. A review of relevant literature reveals that exchange rate rise and fall depend on economic situation facing a country eg like the global pandemic and government policies. Hence an intervention

model to assist policy makers, government and investors for effective decision making.

1.2 Significance of the Study

The study is aimed at analyzing Nigeria naira and Australian dollar from August 2020 to February 2021 .Exchange rate plays a major role in the economy of any nation. The rising and falling trend will tell the government, companies and all private investors the right time to invest. In most cases, it also affect decision to making and policies to adopt in a given economy.

1.3 Research Questions

(i) Does intervention analysis affect exchange rate

(ii) Does intervention model has any effect in government polies and decision making.

(iii) Does increase in exchange rate affect the economy of any nation

(iv) Are Time series stationary in terms of unit root?

(v) Are time series stationary in terms of trend?

1.4 Statement Of Hypothesis

The hypothesis are as follows:

(1) H_0: Intervention analysis does not affect exchange rate versus

H_A: Intervention analysis affect exchange rate

(2) H_0:Intervention model does not affect government policies and decision making versus

H_A: Intervention model affect government policies and decision making

(3) H_0:Increase in exchange rate does not affect the economy of any nation versus

H_A: Increase in exchange rate affect the economy of any nation

(4) H_0: Time series is stationary in terms of unit root versus

H_A Time series is not stationary in terms of unit root

(5) H_0: Time series is stationary in terms of trend versus

H_A: Time series is not stationary in terms of trend

2. Literature Review

Arima models as been studied by many people over the years. Some of them include.

Commandeur & Kropman (2007) argues that the box-Jenkins approach is fundamentally problematic. The problem arises because in "thus the economic and social fields real series are never stationary between much differencing are done" thus the investigator has to face the question. How close to stationary is close enough.

Box and Jenkins (1970), in early 1970's pioneered m evolving methodologies for statistical modeling within univariate time series.

Ette E.H and Siberate (2017) examined statistical analysis of Nigeria monthly house hold herosen distribution.

Ette E.H and Eleki (2017) examined intervention analysis of monthly XAD-NGN exchange rate occasioned by Nigeria economic recession, noble intervention.

Mandel et al (2014) studied the usefulness of time series modeling in forecasting stock prices were a research was conducted on fifty six Indian stocks from different sectors and the effect on the accuracy of prediction using previous data taken from. Akaike information criterion (AIC). The outcome of the experiment showed that automobile steel and banking sectors has a high deviation which means that values spread over a wide range. In some stocks Arima model don't produce good result.

Box and Hunter (1978) stated that two sample procedures are not robust against alternative involving correlative. The further stated that change agent is an events represented by step functions. If the step agent is an event, the step function should be modified to accommodate the known property of the change agent.

Box and Tiao 1975 stated two common types of intervention variable, one representing an intervention occurring at time that remains in effect thereafter called step function. The other one represents an intervention taking place at only one time period called pulse function.

Batimi (2004), Nigerians' currency was devalued to attract foreign investment among other reasons. These policy implementation have impacts of varying magnitude on the exchange rate of Naira against the currencies of the trading partners of the world so also on future salaries.

Etuk and Udoudo (2018) analyze the daily exchange rate of Indian rupee and Nigerian naira and propose an intervention model for their data. Their approach of intervention was applied to model the intervention by legislation in reported cases of crimes reporting.

Muth (1961) generalized the statistical formulation of adaptive expectation. The concept of expectation has to do with a general form for the statistic linear representation of the series.

Box and Jenkin's (1970) proposed a simple means of modeling seasonality within the time domain of airline mode. The so called "airline model" proposes a rational impulse respond function of the type.

$$\varphi(l) = \frac{(1+\varphi l)(1+\varphi las)}{\Delta\Delta s}$$

$yt = \varphi(l)\varepsilon t \ni \varepsilon t \sim www$

The success of the airline model led to the general multiplication of seasonal sarima process of order (p, d, q) *(P,D,Q)s : $\emptyset\ (Ls)\varphi(l)\Delta d\Delta Dyt$

Wiener (1994) and Kolmogorov (1941) were pioneers in the linear prediction but their approaches differs; wiener worked in the frequency domain popular amongst engineers while Kolmogorov on time domain and their solution to basic geometric problem were equivalent. The research of wiener is relevant to modem time series.

Makridakis and hidom (1979) proposed a simple ad hoe methods to forecast a more complicated methods but Newbold (1983) responded by contending that applying different method should not be emphasized rather we should consider relevant issues related to time series in forecasting any series for the choice of method

Components are modeled together as a single ARIMA process. It is rather that the components are explicitly defined as a statistical model of seasonal variation, as opposed to purely and hoc signal extractions methods like he X-11. More ever in the vein of pagan (1975) Engle employs the state-space framework and Kalman filter to estimate the latent components themselves once the parameters of the structural form are provided.

Ette Harison (1998) used a technique approach to forecast Nigeria naira-US dollar using seasonal Arima model for the period of 2004 to 2011. He reveals that the series (exchange rate) has a negative trend between 2004 and 2007 and was stable in 2008. His good work expantiate that seasonal difference once produced a series sender with slightly positive trend but still within disermible stationarity.

The exchange rate is the measure of a domestic currency in terms of another another in terms of relative price (Nwankwo ,2014). The exchange rate is seen as a relative value of deomestic currency in terms of foreign exchange (Mussa,1984;Ahmed,2001).

The exchange rate of the currency of a country depend upon its balance of payment (Oleka *et al*,2004). Favorable bal5ance of payment will improve exchange rate while unfavorable balance of payment reduces exchange rate (Jhingan,2004) .

(Meyler,1998) used Arima Model for forecasting increase in the price in Irish ,
(Mondal , 2014) used
Arima model to predict stock price, Arima is a good solution for forecasting some
(Nwankwo,2014) .

Babatope Obasa (2004). In 1999 observed in his study a shift in naira-dollar exchange rate resulting from the military system of leadership ranging form the deregulation of financial market.

Batini (2004). In the year 2000 Nigerians currency was also devalued to attract foreign investment, all these policy has impact as regards to exchange rate of naira against the

currency of trading patners

Box and Tiao (1965) analyzed data on naira-dollar exchange rate using classical multiple regression with the view to compare the result with that of the intervention analysis.

Frenkel et al [34] established that the intervention operation in the foreign exchange market by the bank of Japan in 2011.

Reitz and Taylor (2012) Employed autoregressive distributed lag method in evaluation the intensity of foreign expenditure intervention on monetary aggregates . He concluded that no strong relationship exist between intervention and exchange.

Hamisu A, and James T.H [21] employed used error correction method to evaluate the impact of currency evaluation to find out that the intervention has no impact on exchange rate .

Lorna K, & Frank W, Agbola [47] evaluated the impact of foreign exchange intervention on the fluctuation of the Uganda Shillings/Us dollar (UGX/USD), the outcome of the research shows that the intervention has mixed impact on the fluctuation of foreign exchange rate caused by inflation.

Ali U.A., Surayai., Siba D., Ahmad A. A., Ibrahim S.F., Aminu H.J &Umara A.M. [49] investigated the long run relationship between CBN intervention exchange rate from 1980-2018 with the aid of non linear unit root, co-integration and causality testing approach the outcome of their research reveal that there is a long run relationship between the intervention and Naira/USD exchange rate.

3. Methodology

3.1 Source of data and variable

The study uses monthly data collected from a secondary source published by central bank of Nigeria CBN on line statistical database **WWW.EXCHANGERATES.ORG.US/DOLLAR-NGN-**

EXCHANGE-RATE-HISTORY.HTML. The data used is daily data of from August 2020 to February 2021.

3.2 **Autoregressive Model**

An Autoregressive (AR) Model is a representation of random process used to describe time varying processes in . The autoregressive model shows that the output variable depends linearly on previous data. The model is in the form of a stochastic difference equation (or recurrence relation which should not be confined with differential equation).

The AR (p) model is of the form

$$Y_t = C + \beta_1 Y_{t-1} + \beta_2 Y_{t-2} + \cdots + \beta_P Y_{t-p} + \varepsilon_t \quad \text{.....3.1}$$

In the equation above *Yt* represents the future value that is to be predicted by its past lag value as represented by *Yt-1, Yt-2,……..., Yt-p*; ***c*** is the constant term and ε_t is the white noise error term and *β1, β2, ……, βp* are parameters of the AR(p) model.

Where $\{yt\}$ is a white noise sequence with zero mean and some variance order 2

3.3 Moving Average Model

The moving average (MA) model can also be called moving average process used for modelling univariate time series. It specifies that the output variable depends linearly on the current and past values of a stochastic term. The moving average (MA) in a time series model is a past error (multiplied by a coefficient).

Below is a mathematical illustration of a MA(q) model.

$$Y_t = \mu + \theta_1 \varepsilon_{t-1} + \theta_2 \varepsilon_{t-2} + \cdots + \theta_q \varepsilon_{t-p} + \varepsilon_t \quad \text{... ... ... .3.2}$$

μ represents the mean value of the series, where $\theta_1 \theta_2 \theta_3$ as are the parameters of the model and q is the model order, Adhikari and Agrawal (2009).

3.4 Intervention Model

Suppose that a time series *Xt* encounters an intervention at time t=T. This intervention has altered the trend of the series Box and Tiao have advocated that the pre-intervention series be modeled as an ARIMA model .

Suppose this is an ARIMA (p,d,q)
that is

(L)
$\nabla^d X_t =$
$B(L)\varepsilon_t$ ……..3.3

Where A (L) is the autoregressive (AR) operator
defined by

A (L) = $1-\alpha_1 L - \alpha_2 L^2 - \cdots - \alpha_P L^P$ ……..3.4 and

B (L) is the moving average operator
defined by

B (L) = $1+\beta_1 L - \beta_2 L^2 - \cdots - \beta_q L^q$ ...3.5

Moreover $\nabla = 1 - L \; and \; X_t L^K = X_{t-k}$ the sequence (ε_t) is a white noise process forecast are obtained for the post-intervention period on the basis of model (1) .Suppose these forecast are Ft the difference $Z_t = X_t - F_t$ can be modeled by

$$Z_t = \frac{c(1) * c(2)^{(t-T+1)}}{1-C(2))} \text{ ……..3.6}$$

The final intervention model is
given by

$$Y_t = \frac{B(L)\varepsilon_t}{A(L)\nabla^d} + \frac{I_t C(1)(1-C(2)^{t-T+1}}{(1-C(2)} \text{…….3.7}$$

Where it = 0 t<T AND It=1,
t ≥ T

In practice the model 1 is modeled by firstly estimating the differencing order d

initially d=0 if X_t is adjusted Dickey Fuller test then d=0 otherwise d=1 as first difference is obtained from the series otherwise d=2 ,the process continues until stationary is attained . To determine p and q, the autocorrelation function (PACF) of the series $\{X_t\}$ are computed. The cut-off lags, if any, the $\alpha's$ and the $\beta's$ are estimated by the least squares criterion by the views 7 software.

3.5 Model Estimation

The model is estimated with the following steps:

3.5.1 Time plot and differencing

Time plot and differencing of variable was in a time plot format to ascertain the trend and direction of the variables. Since trends exist, it is needful to difference the variable to enhance stationary.

3.5.2 Unit Root Test

Augmented Dickey Fuller (ADF) test was used in conducting the unit root test to ensure that unit root is not found.

3.5.3 Correlogram

The correlogram was done to check for serial correlation, if it exist, there is need for differencing to make it stationary. The Autocorrelation function (ACF) and partial Autocorrelation function (PACF) will be considered in model selection.

3.6 Model Selection

The Akaike information criterion (AIC) is the basis of model selection. The least AIC will be considered the best model.

3.7 Model Diagnostic Test

The model diagnostic test was done to verify whether the model under selection will be good for forecasting. The diagnostic are as follows, normality test, residual test and correlogram.

4. Results and Interpretation

The section focuses mainly on the presentation of results and interpretation of the data output used to achieve the desirable objective of the study.

4.1 Time plot and Differencing

The data used in this work are of secondary sources. The data analyzed in this work are daily Dollar/NGN exchange rates from August 2020 to February 2021 to from the website www.exchangerates.org.us/Dollar-NGN-exchange-rate-history.html. They are read as the amounts of NGN per dollar. The used data is listed in the appendix.

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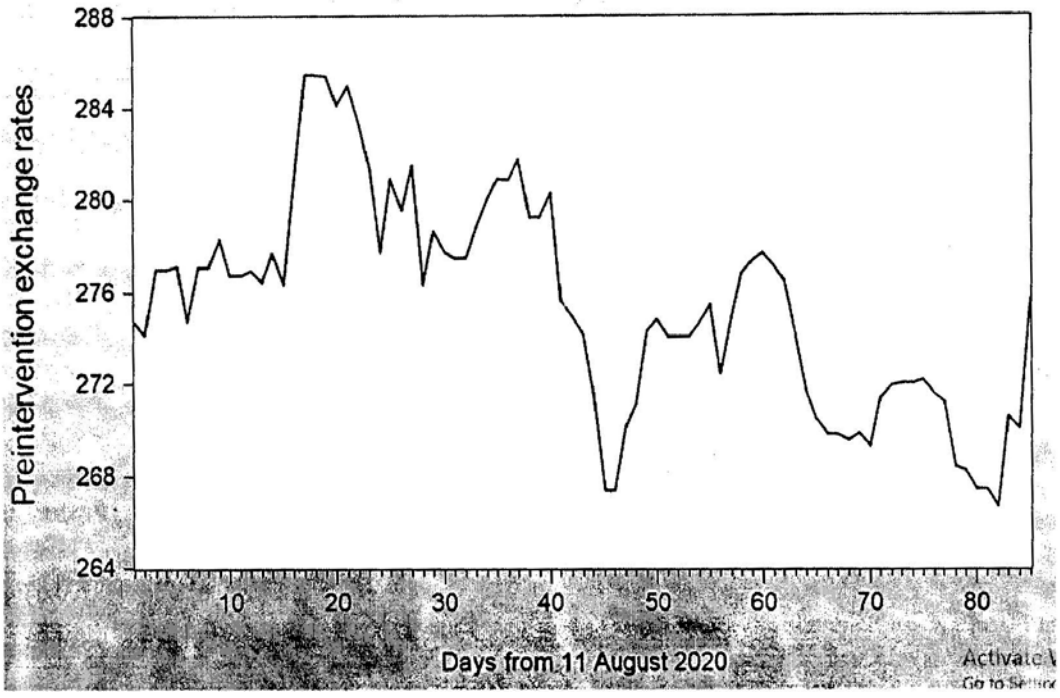


Figure 4.1: Time plot of Daily AUD / NGN exchange rate

Figure 4.2: Time plot of the pre-intervention exchange rates.

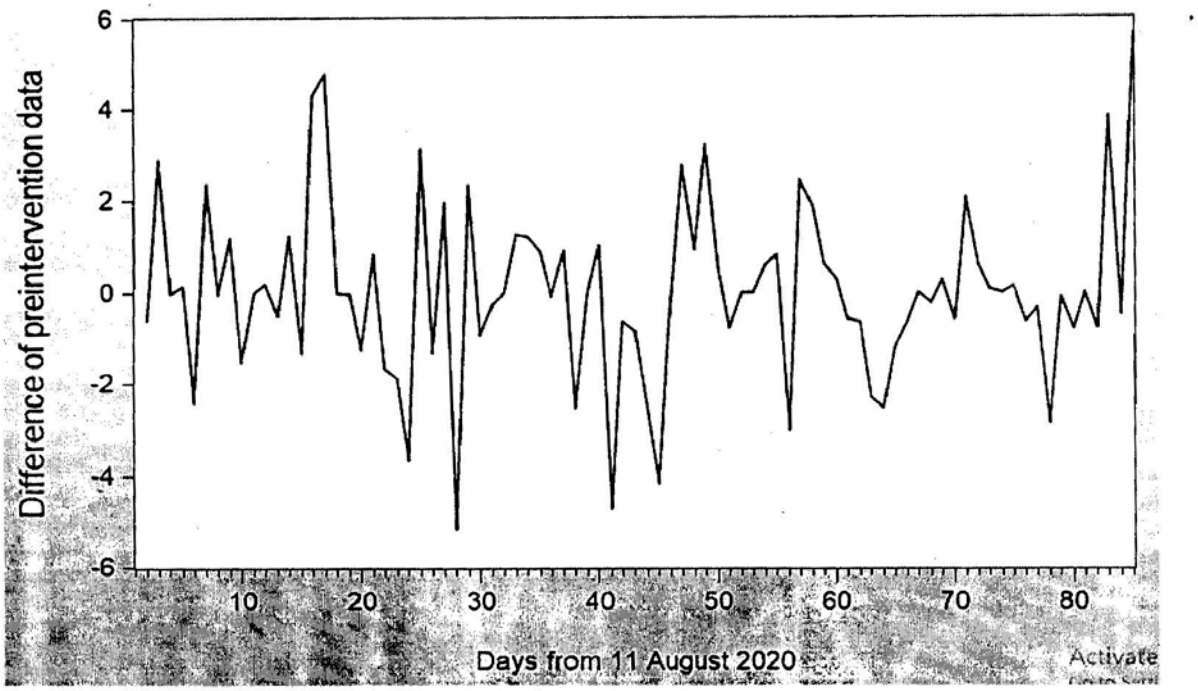


Figure 4. 3: Time plot of the difference of the pre-intervention series

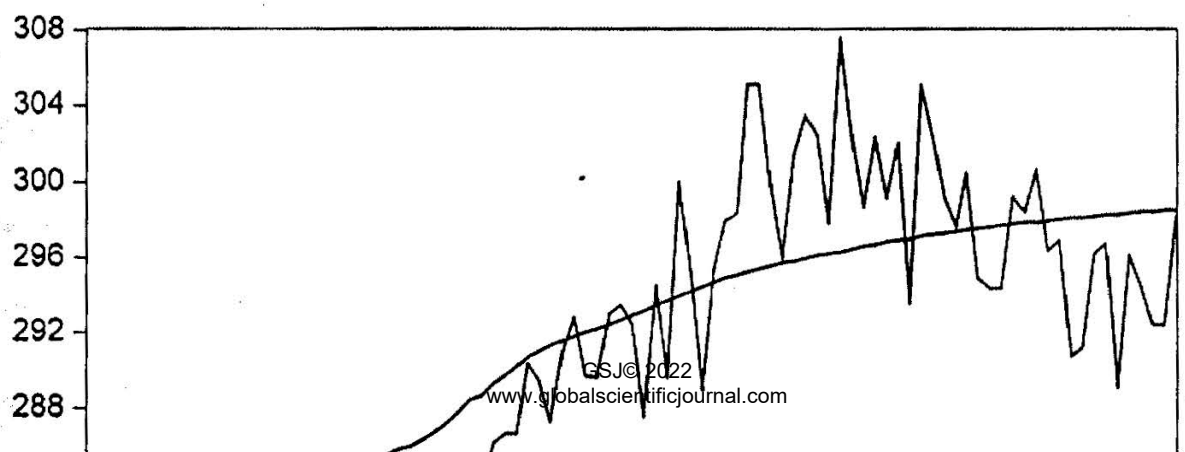
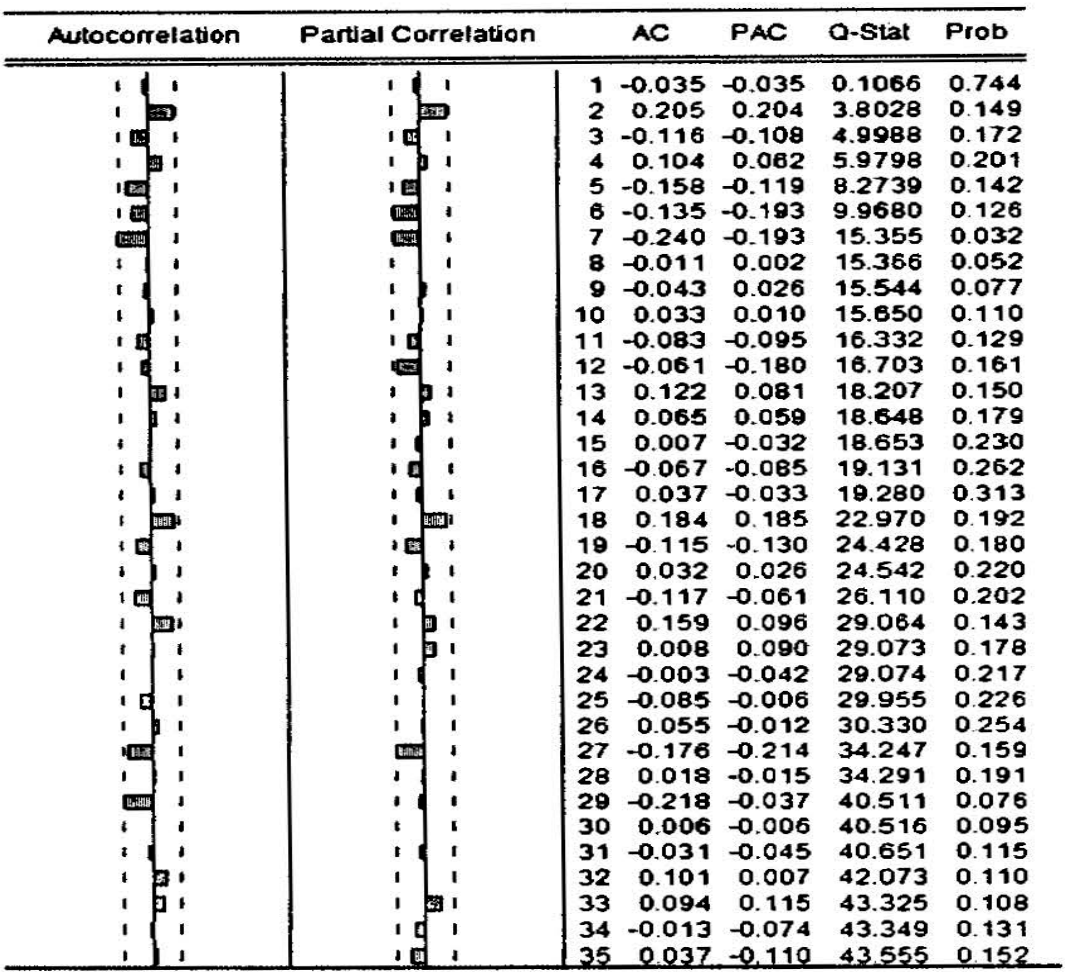


Figure 4.4: Superimposition of the intervention forecasts and the post-intervention data

4.2 Seasonality



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.035	-0.035	0.1066	0.744
		2	0.205	0.204	3.8028	0.149
		3	-0.116	-0.108	4.9988	0.172
		4	0.104	0.062	5.9798	0.201
		5	-0.158	-0.119	8.2739	0.142
		6	-0.135	-0.193	9.9680	0.126
		7	-0.240	-0.193	15.355	0.032
		8	-0.011	0.002	15.366	0.052
		9	-0.043	0.026	15.544	0.077
		10	0.033	0.010	15.650	0.110
		11	-0.083	-0.095	16.332	0.129
		12	-0.061	-0.180	16.703	0.161
		13	0.122	0.081	18.207	0.150
		14	0.065	0.059	18.648	0.179
		15	0.007	-0.032	18.653	0.230
		16	-0.067	-0.085	19.131	0.262
		17	0.037	-0.033	19.280	0.313
		18	0.184	0.185	22.970	0.192
		19	-0.115	-0.130	24.428	0.180
		20	0.032	0.026	24.542	0.220
		21	-0.117	-0.061	26.110	0.202
		22	0.159	0.096	29.064	0.143
		23	0.008	0.090	29.073	0.178
		24	-0.003	-0.042	29.074	0.217
		25	-0.085	-0.006	29.955	0.226
		26	0.055	-0.012	30.330	0.254
		27	-0.176	-0.214	34.247	0.159
		28	0.018	-0.015	34.291	0.191
		29	-0.218	-0.037	40.511	0.076
		30	0.006	-0.006	40.516	0.095
		31	-0.031	-0.045	40.651	0.115
		32	0.101	0.007	42.073	0.110
		33	0.094	0.115	43.325	0.108
		34	-0.013	-0.074	43.349	0.131
		35	0.037	-0.110	43.555	0.152

Figure 4.5 : Correlogram of the differenced pre-intervention series

List of Table

4.3 Unit Root test

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.927195	0.3185
Test critical values:	1% level	-3.510259	
	5% level	-2.896346	
	10% level	-2.585396	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(AUNN)
Method: Least Squares
Date: 02/08/21 Time: 01:10
Sample (adjusted): 2 85
Included observations: 84 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AUNN(-1)	-0.086517	0.044893	-1.927195	0.0574
C	23.84451	12.36843	1.927853	0.0573

R-squared	0.043331	Mean dependent var	0.011548
Adjusted R-squared	0.031664	S.D. dependent var	1.946912
S.E. of regression	1.915840	Akaike info criterion	4.161711
Sum squared resid	300.9764	Schwarz criterion	4.219588
Log likelihood	-172.7919	Hannan-Quinn criter.	4.184977
F-statistic	3.714079	Durbin-Watson stat	1.895067
Prob(F-statistic)	0.057418		

Table 4.1: Unit root test of the pre-intervention series

Null Hypothesis: DAUNN has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.869746	0.0000
Test critical values:	1% level	-3.511262	
	5% level	-2.896779	
	10% level	-2.585626	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DAUNN)
Method: Least Squares
Date: 02/08/21 Time: 01:17
Sample (adjusted): 3 85
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DAUNN(-1)	-1.038839	0.117122	-8.869746	0.0000
C	0.016605	0.216152	0.076822	0.9390

R-squared	0.492711	Mean dependent var	0.075181
Adjusted R-squared	0.486448	S.D. dependent var	2.746650
S.E. of regression	1.968318	Akaike info criterion	4.216037
Sum squared resid	313.8164	Schwarz criterion	4.274323

Table 4.2 Showing the differenced series stationary with p-value less than 0.05.

Dependent Variable: DAUNN
Method: ARMA Maximum Likelihood (OPG - BHHH)
Date: 02/08/21 Time: 01:23
Sample: 2 85
Included observations: 84
Convergence achieved after 29 iterations
Coefficient covariance computed using outer product of gradients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	0.808236	0.242629	3.331159	0.0013
AR(2)	0.662552	0.284909	2.325482	0.0227
AR(3)	-0.722627	0.257847	-2.802546	0.0064
MA(1)	-0.857346	0.290947	-2.946747	0.0042
MA(2)	-0.444368	0.341237	-1.302226	0.1967
MA(3)	0.457653	0.335545	1.363909	0.1766
SIGMASQ	3.249370	0.436053	7.451776	0.0000

R-squared	0.132424	Mean dependent var	0.011548
Adjusted R-squared	0.064820	S.D. dependent var	1.946912
S.E. of regression	1.882755	Akaike info criterion	4.191024
Sum squared resid	272.9470	Schwarz criterion	4.393593
Log likelihood	-169.0230	Hannan-Quinn criter.	4.272455
Durbin-Watson stat	1.937969		

Inverted AR Roots	.84+.33i	.84-.33i	-.88
Inverted MA Roots	.78-.21i	.78+.21i	-.70

Table 4.3 Showing Estimation of the SARIMA (1, 0, 1) x (l, 0, 1)2 model.

Dependent Variable: Z
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 02/08/21 Time: 13:07
Sample: 86 180
Included observations: 95
Convergence achieved after 10 iterations
Coefficient covariance computed using outer product of gradients
Z=C(1)*(1-C(2)^(T-85))/(1-C(2))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.586423	0.089336	17.75802	0.0000
C(2)	0.961901	0.002924	328.9540	0.0000

R-squared	0.848994	Mean dependent var	31.02347
Adjusted R-squared	0.847370	S.D. dependent var	10.83383
S.E. of regression	4.232549	Akaike info criterion	5.744314

Table 4.4 Estimation of the Intervention Transfer Function

5. DISCUSSIONS

5.1 Trend Analysis and Seasonality

Trend analysis is the widespread practice of collecting information and attempting to spot a pattern in some field of study. Trend analysis is often used to predict future events , it could be used to estimate uncertain events in the past. Trend is the upward and downward movement in a time series.

Figure 4.1, As from time point 85, there is an abrupt rise in the trend of the series. This indicates an intervention in the series. This is caused by the current economic recession which Nigeria is going through and the coronavirus pandemic

bedeviling the world.

It may be noted that there is generally a negative trend in the series.

Seasonality is a characteristics of a time series in which the data experiences regular and predictable changes that recur every calendar year.

Table 4.1 Shows that the series is non-stationary with the t-statistical value -1.927195 > each critical value given and the p-value more than 0.05. Table 4.2 This shows that the differenced series is stationary with the p-value less than 0.05. Figure 4.4 shows There is indication of seasonality of lag 2.

5.2 Forecasting

Forecasting is a technique that uses historical data to make informed estimates that are predictive in determining the direction of the future trends and also bases of selection for the best model with the least Akaike Criterion (AIC) .

From table 4.3 we observed With the MA(2) and the MA(3) coefficients not significant, the model becomes a SARIMA (1, 1,1)x(l, 0, 0)2 model. Post-intervention forecasts are made on the basis of this model. Let the forecasts be Fore. The quantities Z = X1 — Fore are obtained for the post-intervention period.

From figure 4.4 Their agreement is testimony to their closeness.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The research work is about intervention analysis of daily Australian dollar to Nigerian naira, the aim was to study time series analysis of daily Naira-Australian errors using box-Jenkins Arima model. The techniques applied, to arrive at the least

AIC include time plot, unit root test and correlogram. we observed With the MA(2) and the MA(3) coefficients not significant, the model becomes a SARIMA (1, 1,1)x(l, 0, 0)2 model.

6.2 Recommendation

i. Arima model is a useful model because of its significance in the exchange rate market

ii. Two countries can trade easily, if there is understanding in their economy which is a function of a stabilized exchange rate.

iii. Fraud stars should be avoided in exchange rate

Contribution to knowledge

i. The relationship between Arima model and intervention analysis was well explained

ii. A model that simulates intervention analysis of exchange rate was established

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APPENDIX DATA

Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21
274.72	285.01	274.04	266.68	281.14	305.19	
274.13	283.32	274.03	270.52	282.35	305.19	
277.00	281.42	274.03	275.04	283.22	299.90	
277.01	277.77	274.63	275.69	282.52	296.02	296.80
277.17	280.89	275.45	278.49	282.51	301.47	289.20
277.12	279.56	269.84	277.25	282.77	303.53	296.20
274.76	281.51	269.27	277.26	283.71	302.54	294.58
277.09	276.35	271.32	278.92	283.14	297.84	292.49
278.29	278.68	272.45	278.73	283.40	307.56	292.49
276.75	277.75	274.89	276.76	286.26	302.43	298.28
276.75	277.50	276.78	278.98	286.68	298.71	
276.95	277.50	277.41	276.78	286.68	302.44	
276.45	278.79	277.70	276.65	290.37	299.23	
	280.02	277.13	276.64	289.49	302.08	
	280.93	276.48	278.76	287.39	299.23	
	280.86	274.18	278.52	290.98	305.18	
277.70	281.78	271.65	278.41	292.86	302.46	
276.36	279.26	270.45	280.04	289.75	299.22	
280.66	279.26	269.79	278.75	289.69	297.66	
285.45	280.29	269.79	278.24	293.02	300.59	
285.45	275.59	269.56	278.23	293.50	294.97	
285.43	274.97	271.91	280.68	292.50	294.39	
284.17	274.13	271.99	279.65	287.59	294.39	
	271.54	271.99	280.85	294.54	299.27	
	267.37	272.15	280.57	289.69	298.48	
	267.37	271.53	280.45	300.13	300.74	
	270.12	271.21	281.08	295.25	296.41	
	271.08	268.36	281.02	289.01	297.00	
	274.29	268.25	281.29	295.36	290.82	
	274.82	267.45	282.08	298.00	291.31	
		267.45		298.39	296.28	