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THE ROLE OF EXCHANGE RATE ON ECONOMIC RECESSION IN NIGERIA

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ABSTRACT

This study adopted intervention model to model the monthly United Stated Dollar/Nigerian Naira(NGN) exchange rate in recession. The data was sourced from the website of the central bank of Nigeria (cbn.org) and from the period of January 2012 to May 2017. The point of intervention is spotted at T=17 and was characterized by step function. The pre-intervention

INTRODUCTION

Being an under-developed country, Nigeria is faced with numerous challenges including the creating policies that gear towards economic development and solving problems arising from the implementation of both microeconomic and macroeconomic policies such fiscal policy, monetary policy to exchange rate policy. The impact of exchange rate cannot be over emphasis as it plays a key role in both international and national economies thereby standing as good indicator for sound economic management. Exchange rate means that the price of a country's currency in terms of another country's currency.

According Yadav (2014), Exchange rate is simply the rate at which one currency is converted into another. A declining exchange rate obviously decreases the purchasing power of income and capital gains derived from any returns exchange rate is the expression of national currency's quotation in respect to other countries (Alotaibi, 2016). The exchange rate is very important as it affects the prices of exports as well as imports. While a country's exports depend on the purchasing power of the rest of the world and the price competition of the goods and services it exports, its imports are dependent on the income and spending power of its residents and the

plot indicates that there was an initial negative trend and later an upshot to positive trend which did not favour the Naira. The plot also revealed that the pre-intervention rates are non- stationary but after the first difference occurred it became stationary. The ACF and the PACF of the differenced exchange rate data indicated a white noise pattern. The difference between the forecast and the post-intervention series was modeled after the intervention transfer function and was seen to be statistically significant which indicated the model adequacysss. The comparison of the intervention forecasts and the post intervention data showed a close agreement between the curves is a testimony to the correctness on the intervention model thereby making the model fit to be used to help strengthen the Nigerian Naira. Therefore, recommended that the government should come up with a stable monetary policy that can be able to with stand the wave in the foreign market in order to avoid further recession period in Nigeria.

Keywords: *Intervention modelling, exchange rate, economic recession*

competitiveness with imported products in relation to domestically produced goods and services.

If our own country currency rate increases due to foreign exchange rate decline, then the domestic country can import the goods at cheap prices. In contrast if the home country currency decreases due to an increase in exchange rate then the imports of the home country will decrease due to increasing in other country prices as well. If the domestic currency appreciates due to declining in exchange rate the domestic country exports will bring the high foreign exchange for the country and vice versa.

For instance, for the past few years of United State Dollar has continue to increase while Nigeria Naira has continued to decrease as its lower prices reduce corporate profits, which triggers more job cuts which has led to economic slowdown. The Nigeria currency has gradually losing its face thereby increasing the cost of living and multiply the number of poor people in the country. Certain factors like inflation, rate of interest, cost of manufacture, debt of the country, gross domestic, political stability, and employment data, relative strength of other currencies while other factors like macroeconomic and geopolitical outcomes are the influences currency exchange rate which have gradually bring the Nation to the state of recession.

Recession is as the general slowdown in economic activity. In macroeconomics, recessions are officially recognized after two consecutive quarters of negative GDP growth rates (National Bureau of Economic Research (NBER)). Recessions are considered a part of the natural economic cycle of expansion and contraction. Every business start with weakest point and gradually increasing until it arrived at its highest point.

Statement of the Problem

Recession is not new experience in Nigeria as it reflects its ugly face over and over again like the previous ones that took place in the 1970s, 1980s and 1990s, 2004, 2008 and 2009 (Onwe & Eze, 2019) but the collapse in global oil prices that become critical towards the end of 2015 led to a slowdown in economic growth and depressed foreign direct investment into the country. And the renewed agitation in the Niger Delta in early 2016, resulting to the vandalism of major oil and gas infrastructure contributed in expanding the existing problem which causes reduction in crude oil production and foreign exchange earnings for the government (Adeniran, 2017) thereby reducing the price of Nigeria Naira in respect to United State Dollar. Combination of these factors generated a substantial shock to the economy as GDP growth rate in the first and second quarters of 2016 were -0.36% and -2.06% respectively (Otuonye, Nwaimo, & Udunwa, 2017) as witness in Nigeria. It is on this note that the researcher sought to investigate the role of exchange rate on economic recession in Nigeria.

Review Literature

Researchers like Gilmour, Degenhardt, Hall and Day (2006) adopted intervention time series analysis to examine the impact of unplanned events on time series when the timing of the event is not accurately known. Australian Heroin Shortage of 2001 was used to illustrate the method which provide an opportunity to investigate the health and social consequence of the unexpected change in heroin availability in an environment of widespread harm reduction measures.

Mosugu and Anieting, (2006) examined the impact of Nigeria's Foreign exchange rate using classical multiple regression model under the assumptions of ordinary

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least squares method (OLS) and intervention model using lag operator L. Monthly time series data spanning 1980 to 2014 were used and a number of statistical tools are employed to verify this hypothesis. The study concluded that useful approach is to test the significant change between the long-run mean effect before and after each intervention.

Etuk, Dimkpa, Sibeate, and Godwin (2017) investigated daily exchange rates of the Japanese Yen and the Nigerian Naira between May 1, 2016 and October 28, 2016 The result revealed that the change is significant as the pre-intervention series has a mean of 1.845 with a standard deviation of 0.0335 and the post-intervention mean of 2.9941 and standard deviation of 0.1965. The study also displayed that the situation demand for intervention on the part of the Nigerian Government. The pre-intervention data is modelled as an ARIMA(13,1,0) model. The study concluded that the intervention was carried out on the basis of the fitted model.

In order to model the daily Norwegian Kroner (NOK) /Nigerian Naira(NGN) exchange rate, Amekauma and Daniel (2019) developed an appropriate intervention model using data from 24th, 2017 to April 21st 2018 which was gotten from Nigerian Bureau of Statistics (NBS). The point of intervention denoted by step function and was noticed at T=81. The pre-intervention plot indicates that there was an initial negative trend and later an upshot to positive trend which did not favour the Naira. The plot further shows that the pre-intervention rates are non- stationary but became stationary after first difference was taken. The ACF and the PACF of the differenced exchange rate data showed a white noise pattern. Forecast was made. The difference between the forecast and the post-intervention series was modeled after the intervention transfer function and was seen to be statistically significant (P 0.0002 <0.05,0.01), this is an indication of model adequacy. There was a close agreement between the intervention model and the post intervention data. The model so fitted may be used to help strengthen the Nigerian Naira.

Aboko, (2020) examined the daily exchange rate of the South African (ZAR) and the Nigerian Naira (NGN) which starts from 11th March,2017 and 9thSeptember,2017 reveals an abrupt change on 4th August,2017 in further favour of the Rand. This change is significant as the pre-intervention series was stationary. The pre-invention series was modeled as ARMA(3,12) model using Augmented Dickey Fuller unit root test which was adjusted to fit the model to be stationary. An intervention model was obtained and the post-intervention data closely agreed with the forecast data.

GARCH (1,1) and the ECM were employed by Ajao (2015) to compute the volatility of the real exchange rate in Nigeria and to analyse the numerous determinants of exchange rate volatility in Nigeria, respectively, between 1981 and 2008. The results suggest that REXRVOL and its various drivers are in a long-term equilibrium, which is in line with prior studies. REXRVOL's performance was also influenced by the openness of the economy, government expenditure, fluctuations in interest rates and the lagged exchange rate throughout this time period, according to the research.

Naira real exchange rate (RER) deviances from its long-term equilibrium path were analysed from 2000Q1 to 2016Q1 by Essein, Uyaebo, and Omotosho (2017). It was found that the RER model's cointegrating vector had an endogenously determined breakpoint, which was taken into account when using the BEER model method. A structural rupture in 2011Q1 was discovered by empirical approaches to be associated with RER and its underlying causes. Among other things, the results of the model demonstrated that actual changes in exchange rates are affected by the policy of the exchange rate, productivity, and interest rate differences. Overvalued by 1.22 percent during the IFEM regime of 2000–2002; undervalued by 0.35 percent during the RDAS regime of 2002–2006; and undervalued by 0.25 percent in the time immediately after the WDAS regime until March 2016 were the model findings. RER misalignment levels were shown to be linked across exchange rate methods, according to the model's results. It was discovered that Nigeria's currency was overvalued by 0.15 percent, which meant that the government earned 0.15 cents for every dollar spent in Nigeria.

Examining the relationship between Nigeria's exchange rate regimes and inflation was the focus of a study conducted by Oke, Bokana, and Soluade (2017). They employed the Autoregressive Distributed Lag (ARDL) method to test the stability of our inflation model as part of their research. Recent data shows that the current inflation rate is positively correlated with the exchange rate.

A study by Ezenwakwelu et al., (2019) looked at the impact of currency rate regulation on Nigerian manufacturing companies between 2015 and 2017. Data on productivity and performance metrics were obtained by analyzing cross-sectional data from company annual reports. For Bureau de change and currency movements, the Central Bank of Nigeria supplied the data. According to the multiple regression analysis, industrial businesses' productivity was negatively impacted by variations in the exchange rate. Manufacturing businesses' performance did not significantly benefit from either a floating or fixed exchange rate, according to this study. Nigerian industry is strongly reliant on foreign currency fluctuations since capital goods are imported and paid for in foreign currency. While a variable exchange rate system makes fiscal policy less effective, a fixed exchange rate system does the opposite.

Methodology

As an extension of the Auto Regressive Integrated Moving Average (ARIMA) model, Intervention analysis measure the effect of change of an external or exogenous interference on a time series. It can be seen as an extreme change in the mean level of a time series at a known point in time t = T. The essence of analyzing is to know how and why the change has taken place thereby focusing on the nature, pattern and the magnitude of its existence (Amekauma & Daniel, 2019). Pre-intervention data should be simulated first, and then predictions for the post-intervention data should be made using an ARIMA model (Box and Tao, 1975). By applying finite differencing to the data points in an ARIMA time series, it is possible to make a non-stationary time series, such as those that occur on a regular basis in reality, stationary.

Assuming that the ARIMA model for the observation series (x_t) is without intervention model as shown below

$$x_t - \mu = \frac{\Theta(D)}{\Phi(D)} w_t \quad (1)$$

Considering the existing assumption of the error series w_t. Where

$\Theta(D)$ is the MA polynomial

$\Phi(D)$ is the AR polynomial

Suppose that z is the amount of change detected at time of the intervention and T is the time of intervention. If $z_t = 0$ before time, T then the value of z_t may not be zero (0) after time T. Hence, the general model including the effect of the intervention can be written as

$$X_t - \mu = \frac{\Theta(D)}{\Phi(D)} w_t \quad (2)$$

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$$X_t = Z_t + \frac{\Theta(D)}{\Phi(D)} W_t \qquad 3$$

Results

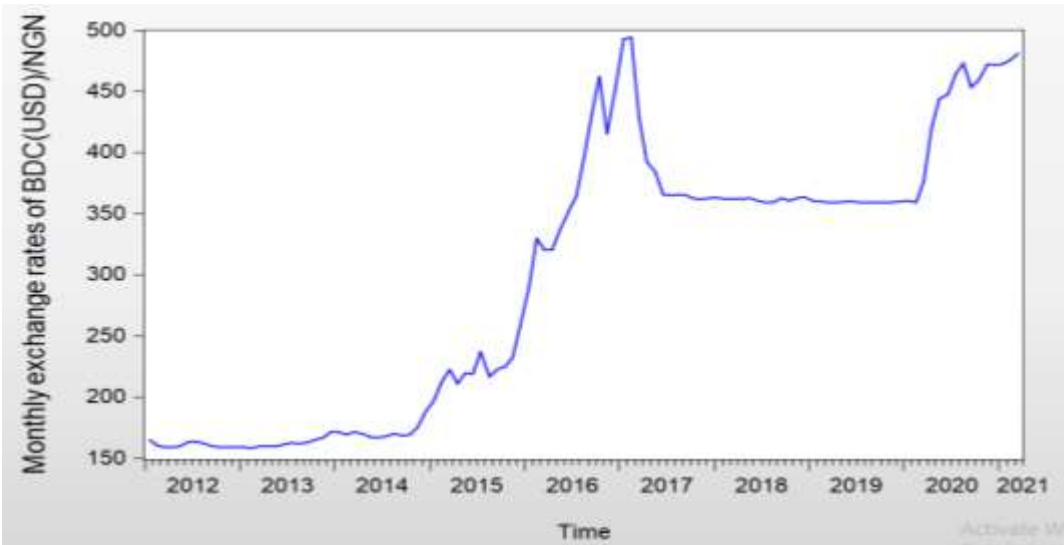

Figure 1: Time Plot of the BDC(USD)/NGN exchange rates

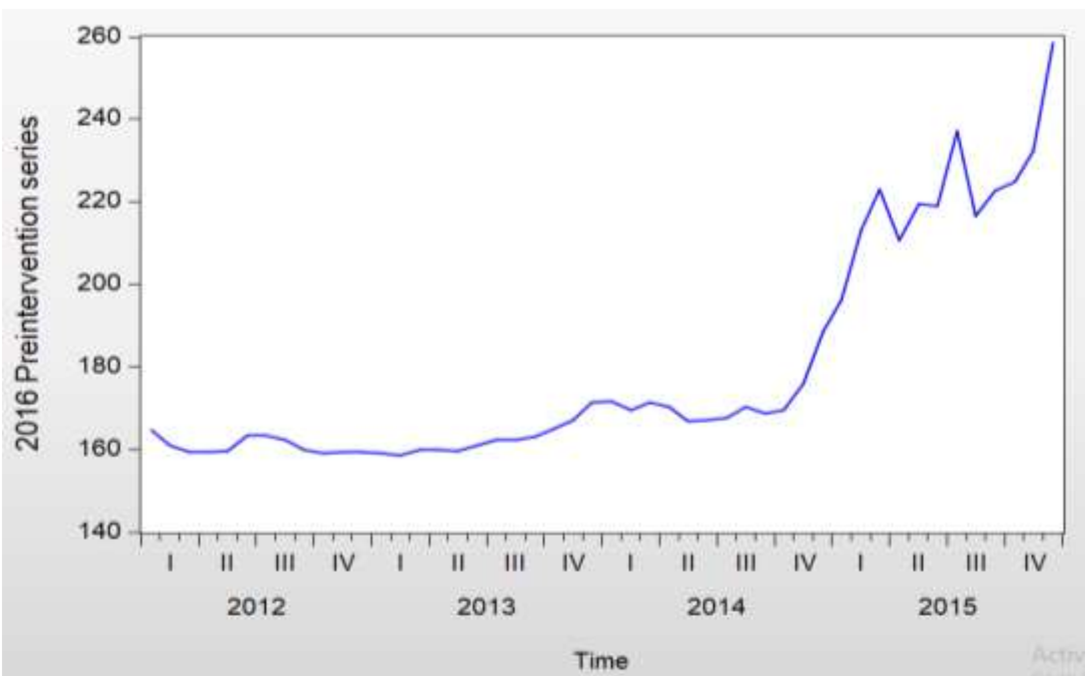

Figure 2: Time Plot of the 2016 Pre-intervention Series

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Table 1: Unit root test for the 2016 pre intervention series

Null Hypothesis: BDCS has a unit root
Exogenous: Constant
Lag Length: 8 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		3.234873	1.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(BDCS)
Method: Least Squares
Date: 05/12/21 Time: 11:27
Sample (adjusted): 2012M10 2015M12
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BDCS(-1)	0.243041	0.075132	3.234873	0.0030
D(BDCS(-1))	-0.257936	0.186669	-1.381781	0.1776
D(BDCS(-2))	-0.053902	0.192667	-0.279768	0.7816
D(BDCS(-3))	-0.513476	0.175832	-2.920269	0.0067
D(BDCS(-4))	0.042681	0.182270	0.234162	0.8165
D(BDCS(-5))	-0.018883	0.250750	-0.075305	0.9405
D(BDCS(-6))	-0.837422	0.242425	-3.454358	0.0017
D(BDCS(-7))	0.249476	0.271734	0.918089	0.3661
D(BDCS(-8))	-1.014553	0.269954	-3.758237	0.0008
C	-38.05500	12.51868	-3.039857	0.0050

R-squared	0.556457	Mean dependent var	2.530769
Adjusted R-squared	0.418806	S.D. dependent var	7.641185
S.E. of regression	5.825341	Akaike info criterion	6.578867
Sum squared resid	984.1035	Schwarz criterion	7.005421
Log likelihood	-118.2879	Hannan-Quinn criter.	6.731911
F-statistic	4.042513	Durbin-Watson stat	2.153796
Prob(F-statistic)	0.001931		

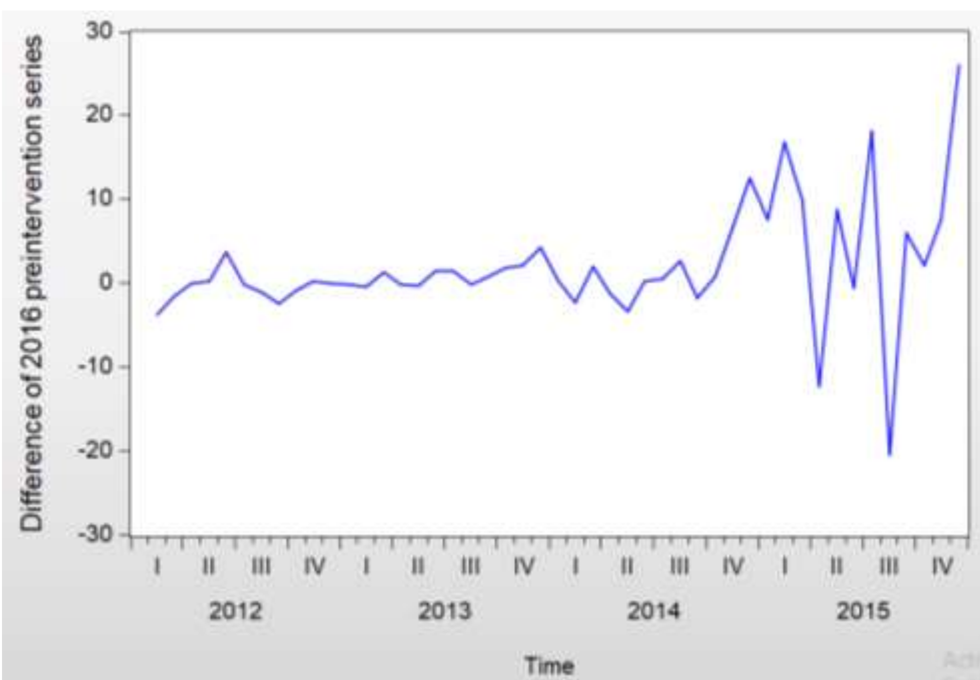

Figure 3: Difference of the 2016 preintervention series

Table 2: Unit root test for the difference of the pre-intervention series

Null Hypothesis: DBDCS has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.319855	0.0000
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

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

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(DBDCS)
Method: Least Squares
Date: 05/12/21 Time: 11:34
Sample (adjusted): 2012M03 2015M12
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DBDCS(-1)	-1.092868	0.172926	-6.319855	0.0000
C	2.259665	1.089201	2.074608	0.0439

R-squared	0.475820	Mean dependent var	0.649348
Adjusted R-squared	0.463906	S.D. dependent var	9.809470
S.E. of regression	7.182338	Akaike info criterion	6.823632
Sum squared resid	2269.783	Schwarz criterion	6.903138
Log likelihood	-154.9435	Hannan-Quinn criter.	6.853415
F-statistic	39.94057	Durbin-Watson stat	1.716022
Prob(F-statistic)	0.000000		

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob
		1	-0.070	-0.070	0.2481	0.618
		2	0.181	0.177	1.9199	0.383
		3	-0.097	-0.077	2.4092	0.492
		4	-0.023	-0.066	2.4370	0.656
		5	0.167	0.203	3.9696	0.554
		6	-0.090	-0.072	4.4199	0.620
		7	0.091	0.009	4.8966	0.673
		8	-0.213	-0.155	7.5688	0.477
		9	0.073	0.045	7.8901	0.545
		10	0.128	0.192	8.9062	0.541
		11	0.152	0.151	10.378	0.497
		12	0.113	0.047	11.218	0.510
		13	0.049	0.117	11.382	0.579
		14	0.012	-0.020	11.392	0.655
		15	0.006	-0.032	11.394	0.724
		16	0.021	-0.031	11.427	0.782
		17	-0.036	-0.047	11.524	0.828
		18	-0.000	0.032	11.524	0.871
		19	-0.037	0.029	11.636	0.901
		20	-0.052	-0.095	11.870	0.920

Figure 4: Correlogram of the difference of the pre-intervention series

Table 3: Computation of the intervention transfer function

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Dependent Variable: Z
Method: Least Squares (Gauss-Newton / Marquardt steps)
Date: 05/12/21 Time: 11:47
Sample: 2016M01 2017M05
Included observations: 17
Convergence achieved after 23 iterations
Coefficient covariance computed using outer product of gradients
Z=C(1)*(1-C(2)^(T-48))/(1-C(2))

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	27.28309	6.172956	4.419777	0.0005
C(2)	0.868885	0.051211	16.96684	0.0000

R-squared	0.677241	Mean dependent var	133.8065
Adjusted R-squared	0.655724	S.D. dependent var	62.80798
S.E. of regression	36.85262	Akaike info criterion	10.16186
Sum squared resid	20371.74	Schwarz criterion	10.25989
Log likelihood	-84.37582	Hannan-Quinn criter.	10.17161
Durbin-Watson stat	0.723614		

The intervention model for 2016 is $Y_t = \varepsilon_t + 27.28309*(1-0.868885^{(t-48)})/(1-0.868885)$, t = 49, 50, 51, … , 65

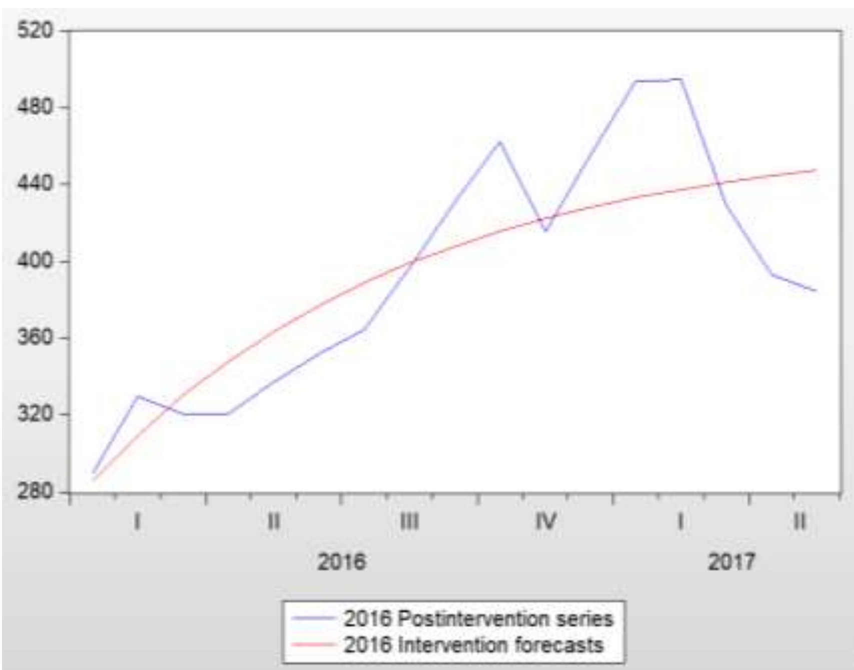

Figure 5: Comparison of the intervention forecasts and the post intervention data

Discussion

Figure 1 shows the time plot of BDC(USD)/NGN exchange rates which indicates that there were intervention points at the month of February 2016 and April 2020. This reflects a typically intervention problem. After the first intervention point, the exchange rate between the United State Dollar (USD) and Nigeria Naira (NGN) was more than two hundred naira (200.00) per Dollar. In the same manner, as it can be observed that immediately after the second intervention point the exchange rate between the United State Dollar (USD) and Nigeria Naira (NGN) was more than three hundred naira (300.00) per Dollar.

Figure 2 displays 2016 Pre-Intervention Series of the exchange rate of United State Dollar (USD) and Nigeria Naira (NGN). The pre-intervention period is from January, 2012 to February 2016 with the intervention exchange rate of #329.00. The time plot show a negative trend initially and later display a positive trend. The figure showed a pattern the intervention analysis of the time series. The trend following a gradual increase in the mean level which later rapidly increased and leveled up at a new mean that higher the mean level. This implies that the Nigeria Naira is at lost.

The above Table 1 indicates that the hull hypothesis that exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) has a unit root. Hence, the Unit root test are statistical tests used to test for the stationarity in time series. A situation where there a shift in time does not bring about a change in the shape of the distribution, the time series is said to stationary. Unit roots are the major causes of non-stationarity in time series data.

From the above Table 1 the Augmented Dickey-Fuller Test statistics before the adjustment was 3.234873 which is greater the t-value of -3.610453 for 1% (0.01) critical value level. Furthermore, the value 3.234873 is greater than -2.938987 for 5% (0.05) critical value level. In the same point of view, the value 3.234873 is greater than -2.607932 at 10% (0.1) critical level. The P-value which is 1.00 is also greater than the 0.05 critical level of significance. Hence, the Augmented Dickey-fuller test Statistics before the adjustment of the pre-intervention exchange rate is not significant.

The Augmented Dickey-fuller test Statistics after the adjustment of the pre-intervention exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) reveals a P-value of 0.0030 which is greater than 0.05 critical value. This implies that the pre-intervention rates are non-stationary.

Figure 3 display a time plot of the difference of the pre intervention exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) above indicates that there is no trend in the differenced series of the 2016 pre-intervention series.

The above Table 2, it is seen that the null hypothesis that both United State Dollar (USD) and Nigeria Naira (NGN) exchange rate has a unit root. The Augmented Dickey-Fuller Test Statistics before the adjustment difference of the pre-intervention exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) was -6.319855 which is less than the t-value of -3.581152 for 1% critical level. Again the value -6.319855 is less than the t-value of -2.2926622 for 5% critical value and the value -6.319855 is less than the t-value of -2.601424 for 10% critical level. The p-value 0 is less than 0.05 critical level. Therefore, the null hypothesis that there is unit root must be rejected. That is The Augmented Dickey-Fuller Test Statistics for the exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) is significant.

The Augmented Dickey-Fuller Test Statistics after adjustment difference of the pre-intervention of exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) show P-value 0 is less than 0.05 critical level and the c-curve of 0.0439. Therefore, the differenced series of the pre-intervention exchange rate between United State Dollar (USD) and Nigeria Naira (NGN) is stationary.

Figure 4 shows that the differenced series follows a white noise process (i.e., there is no spikes of any of the lags under consideration). This implies that the Correlogram of 2016 difference of the pre-intervention series of exchange rate is the autocorrelation structure of white noise (United State Dollar (USD) and Nigeria Naira (NGN) are independent and identically distributed within the zero mean but the same variance where each value has a zero correlation with all other values in the Differenced data).

Table 3 highlight on the white noise model. Based on the white noise model of the difference of pre-intervention data, the forecasts for the post intervention period is 258.30

Figure 5 displayed the comparison of the intervention forecasts and the post intervention data. The close agreement between the curves is a testimony to the correctness on the intervention model.

Conclusion

The comparison of the intervention forecasts and the post intervention data showed a close agreement between the curves is a testimony to the correctness on the intervention model thereby making the model fit to be used to help strengthen the Nigerian Naira. Therefore, there is need for both government and other potential stakeholders to re-plan and re-strategize to ensure a stable monetary policy that can be able to with stand the wave in the foreign market in order to avoid further recession period in Nigeria.

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