

## EMPIRICAL ANALYSIS OF THE CORRELATION BETWEEN EXCHANGE RATE DEREGULATION AND AGRICULTURAL SHARE OF GROSS DOMESTIC PRODUCT (GDP) IN NIGERIA (1990 – 2011)

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### Abstract

*Over the years, the role of exchange rate on the Nigerian Gross Domestic Product (GDP), specifically agricultural produce has been an issue. This paper investigates the correlation between exchange rate deregulation and the agricultural share of GDP in Nigeria. The research work employs econometric tools, using time series data covering a period of twenty one (21) years (1990 – 2011). The Augmented Dickey Fuller test, the unrestricted vector Auto regression, the Pairwise Granger casualty and Vector Error Correction model were utilized to analyse data obtained from Exchange Rate (EXR) and Gross Domestic Product (GDP). The following results were obtained from the study; (i) there was a unidirectional casualty from exchange rate to agricultural share of GDP and (ii) there was a negative influence on agricultural share of GDP in Nigeria. The implication of the above result is that, a floating exchange rate policy over the years has been having economically not-friendly trend in agricultural share of the GDP in Nigeria. The study, therefore, recommends that financial authorities, specifically, the Central Bank of Nigeria (CBN) should cautiously monitor the trend of the Foreign Exchange Market, especially the market-driven exchange rate policy.*

Keyword: Agriculture, Exchange Rate, Deregulation GDP

### Introduction

The role of Agriculture in transforming both the social and economic framework of the Nigeria economy cannot be overlooked. It is a source of food to mankind and raw materials for the industrial sector. It is also essential for expansion of employment opportunity, speeding up industrialization and easing the pressure on the Balance of Payments (BoP) (Anyanwu, 2007). In spite of the contributions of agriculture in accelerating national income, food production capable of sustaining the citizenry and feed the industrial sector has been an issue in Nigeria (Omawale, 1997). In his assertion, Anyanwu, 2007, noted that, the nation's current production of 1.36 per cent, if not increased to meet the growing population rate, the country will face a drastic national hunger that will increase importation of agricultural produce instead of export. As a control measure and to improve local production, several policy reforms were initiated by different

governments, and one of such was the Structural Adjustment Programme (SAP) that was launched in 1986 by the Ibrahim Babaginda's administration (Yesufu, 1991 p.91).

The Structural Adjustment Programme (SAP) was an economic package designed to rapidly and effectively transform the Nigerian economy to a more sustainable path and eradicate excessive dependent by the nation on imports, especially consumer goods. To achieve the above objective, the Structural Adjustment Programme (SAP) embraced exchange rate deregulation by allowing the market forces of demand and supply to determine the price of goods and services, as well allocate resources in the economy (Olaniyan, 1996).

Consequently, imports of various competing food items and other industrial raw materials increased as a result of over-valuation of the exchange rate before deregulation. Massive importation drastically affected our local production of

similar goods hitherto imported (Enoma, 2011). The resultant effect of the above was the abolition of the fixed exchange rate regime and the introduction of floating exchange rate regime via the adoption of the structural adjustment programme. One major effect of the floating exchange rate policy was the removal of the over-valuation problem to the point of making the naira to be under-valued. According to Killick, 1995, introduction of flexible exchange policy aimed at accelerating exports by making Nigerian goods relatively cheaper.

However, over the years, there has been varying opinions among academic scholars regarding the impact of exchange rate variation on economic variables, especially in Nigeria. The traditional economists, however, are of the opinion that fluctuations in exchange rates affect relative local and foreign prices, making expenditure between local goods and international goods to be on the high side (Obstfeld, 2002). Several research works have been conducted on the Nigerian non-oil trade trend (agriculture) yet, there has not been a consensus on the appropriateness of trade and exchange rate deregulation in the Nigerian economy. The Central bank of Nigeria (CBN) in its annual bulletin, 2010, noted that, since the inception of exchange rate deregulation in Nigeria, there have been fluctuations in the value of the naira; however, exchange rate of the naira to the US dollar was relatively stable in 2010. For instance, at the Dutch auction system, the naira was ₦150.30 per the US dollar in 2010, showing a depreciation of 0.9 percent against the rate in 2009.

Consequently, a floating exchange rate policy is expected to be a veritable tool in the determination of exportation of agricultural produce through its influence on prices and the importation of inputs for

agricultural production; however, there exist a shortfall of empirical information on the correlation between agricultural share of GDP and exchange rate deregulation in Nigeria. The above assertion is in accordance with the view of Petreski, 2009, who opined that there is an unclear correlation between exchange rate and economic growth in Nigeria, and requires a detailed empirical research work. Therefore, this research work was conducted with the specific objective of bridging the gap in research by providing empirical information on the correlation between exchange rate deregulation and agricultural share of Gross Domestic Product GDP in Nigeria.

### **Literature Review**

Empirically reviewed studies like; Chen, 2012, Talvas, 2003 and Garofalo, 2005, showed the existence of two schools of thought with regards to the influence of exchange rate on Gross Domestic Product as a result of variations in data and time as well as models used. One of the schools of thought argued that floating exchange rate policy is significant in influencing economic growth (GDP), while the other school maintained that fixed exchange rate policy is significant in influencing economic growth. Consequently, there are different views on exchange rate among academic scholars in Nigeria. For example, Anyanwu (2007), in a study on economic deregulation and supply response to cassava farmers in Nigeria, observed that exchange rate had a negative effect on output. But, expectedly, increased exchange shows appreciation of the Naira which indicates price disincentive for local production of cassava.

In a like manner, Omojimate (2012), in a study on institutions, Macroeconomic policy and growth of Agricultural sector in Nigeria noted that exchange rate was

negative and significant in influencing agricultural production in the country. Also reviewed was Alao (2010), in a study on interest rate determination in Nigeria, maintained that exchange rate adjustment was positive and significant in influencing interest rate, i.e., interest rate affects agricultural production in Nigeria.

Chukwuigwe, and Abili, (2008), did a study on econometric analysis of the impact of monetary and fiscal policies on non-oil exports in Nigeria. In their study, they argued that considering the importance of exchange rate as a major price that affects all sectors of the economy, it was imperative to monitor the movement in the real exchange rate, and the Central Bank of Nigeria should continue to intervene in the foreign exchange market to sustain its stability.

Similarly, Amassoma et al., (2011), in a study on the nexus of interest rate deregulation; lending rate and agricultural productivity in Nigeria, observed that a decline in exchange rate indicates reduction in the cost of importation of agricultural inputs. Wafure and Nurudeen (2010), examined the determinants of foreign direct investment in Nigeria. Their study showed that exchange rate was significant in Foreign Direct Investment (FDI). It further revealed that one (1) percent depreciation in exchange rate causes FDI to rise by 0.02, approximately.

## Methodology

### Description of Data and Sources

The data utilized in this study were time series data on exchange rate (i.e., Naira per US Dollar) and agricultural share of real GDP (in Naira), spanning the period of 1990 to 2011. Data for the study were obtained from the Central Bank of Nigeria (CBN)

annual statistical bulletin (CBN, 2007; 2010), and the National Bureau of Statistics (NBS, 2011).

### Data Analysis Procedure

The Augmented Dickey Fuller (ADF) test, the unrestricted Vector Autoregression (VAR), the Pairwise Granger casualty test and vector error correction model were used in this study. Also, the Eviews econometrics package was used to analyse the data. The model of the ADF is thus expressed as;

$$\Delta Y_t = \alpha_1 + \alpha_2 t + \beta Y_{t-1} + \sum_{i=1}^n \gamma_i \Delta Y_{t-i} + \varepsilon_t$$

Where:

$\Delta Y_t$  = first difference of  $Y_t$

$Y_{t-1}$  = Lagged values of  $Y_t$

$\Delta Y_{t-1}$  = first difference of  $Y_{t-1}$

$\beta$  = test coefficient

$\varepsilon_t$  = white noise

$\alpha_1$  = Constant

$\alpha_2$  = Coefficient of time variable

The null hypothesis ( $H_0: \beta = 0$ ) of the ADF test shows that the series is not stationary and the alternative hypothesis ( $H_1: \beta < 0$ ) is stationary. If the absolute value of the calculated ADF statistic ( $T$ ) is higher than the absolute value of the critical values, we reject the hypothesis which indicates that the series is stationary. But, if the value is lower than the critical values, the time series is not stationary (Gujarati, 2003). Consequently, the Granger casualty prediction of the respective variables X and Y, is contained in the time series data on these variables.

The following pairs of regression are estimated.

$$X_t = \beta_0 + \sum_{i=1}^p \beta_i X_{t-i} + \sum_{i=1}^p \alpha_j Y_{t-i} + \mu_{1t}$$

$$Y_t = \gamma_0 + \sum_{i=1}^p \gamma_i Y_{t-i} + \sum_{i=1}^p \delta_j X_{t-i} + \mu_{2t}$$

Where

$X_t, Y_t$  = regressands of model 2 and 3 respectively

$B_0, Y_0$  = constant terms of model 2 and 3 respectively

$B_i, \alpha_j$  = Coefficients of the regressors of model 2

$Y_i, \delta_j$  = coefficients of the regressors of model 3

$\mu_{it}, \mu_{2t}$  = error terms of model 2 and 3 respectively.

From the above, it is assumed that the disturbances  $\mu_{it}$  and  $\mu_{2t}$  are uncorrelated. Thus, there is unconditional casualty from X to Y if  $\alpha_j = 0$  and  $\delta_j \neq 0$ . Also, there is unidirectional casualty from Y to X if  $\delta_j = 0$  and  $\alpha_j \neq 0$ . The casualty is considered as mutual if  $\delta_j \neq 0$  and  $\alpha_j = 0$ . Lastly, there is no link between X and Y if  $\delta_j = 0$  and  $\alpha_j = 0$ .

### Model Specification

To investigate the correlation between exchange rate deregulation and agricultural share of gross domestic product in Nigeria, the Pairwise Granger Casualty test is modeled as vicariate vector Autoregressive (VAR) model as follows:

$$\begin{aligned} \text{EXR}_t &= \alpha_0 + \sum_{i=1}^P \alpha_i \text{EXR}_{t-i} + \sum_{i=1}^P \omega_j \text{AGDP}_{t-i} + \epsilon_{1t} \\ \text{AGDP}_t &= \beta_0 + \sum_{i=1}^P \beta_i \text{AGDP}_{t-i} + \sum_{i=1}^P \varphi_j \text{EXR}_{t-i} + \epsilon_{2t} \end{aligned}$$

To estimate the short run relationship between the variables, the corresponding error correction equation was estimated as;

$$\Delta \ln \text{AGDP}_t = C_0 + \sum_{i=1}^P c_i \Delta \ln \text{EXR}_{t-1} + \psi \text{ECM}_{t-1} + \epsilon_{3t}$$

Where:

$\text{EXR}_t$  = Exchange rate in year t (i.e., Naira per US Dollar)

$\text{AGDP}_t$  = Agricultural share of real domestic product in year t.

$\alpha_0, \beta_0, C_0$  = constant terms in Models 4, 5, respectively  $\alpha_j, C_j$  = estimated coefficient of

exchange rate in models 4, 5 and 6 respectively

$\omega_j, \beta_1$  = Estimated coefficient of agricultural share of real gross domestic product in models 4 and 5 respectively.

$\epsilon_{1t}, \epsilon_{2t}, \epsilon_{3t}$  = Gaussian white noise error terms in models 4, 5, and 6 respectively.

P = Optimal lag length

$\Delta$  = Difference operator

ECM = error correction term

$L_n$  = National Logarithm

## Results and Discussion

### Descriptive Statistics of Variables

Here, the statistical variables of exchange rate and agricultural share of gross domestic product are carefully examined. Table 1, below, shows the basic characteristics of Exchange Rate (EXR) and Agricultural share of Gross Domestic Product (AGDP) used in this study. The Exchange rate is positively skewed, platykurtic and probability value (0.17) of its JarguaBera Statistic (3.50), shows that its errors are normally distributed based. The Agricultural share of Gross Domestic Product (AGDP) is positively skewed; Platy kurtic and its errors are normally distributed based on the JarqueBera Statistic (3.46). The trend in exchange rate and agricultural share of GDP is presented in figures 1 and 2, respectively.

### Augmented Dickey Fuller Unit Root Test

The ADF test with the assumption of trend and intercept in Table 2, shows that  $L_n \text{EXR}$  and  $L_n \text{GDP}$  were both non-stationery at level form (random walk exhibited) therefore, it needed to be differenced in order to avoid spurious result when the variables are used in their non-stationery form.

**Table 1: Descriptive Statistics of EXR and AGDP in Nigeria (1990 to 2011)**

Statistics	EXR (Naira/US Dollars)	AGDP (Naira in Million)
Mean	70.8186	157700.8000
Median	57.3723	111692.4000
Maximum	158.2300	335400.0000
Minimum	2.0200	69608.0600
Std. Dev.	59.4457	87890.6400
Skewness	0.1096	0.7476
Kurtosis	1.2165	2.0208
Jarque-Bera	3.4980	3.4608
Probability	0.1739	0.1772
Sum	1841.2840	4100221.0000
Observation	26	26

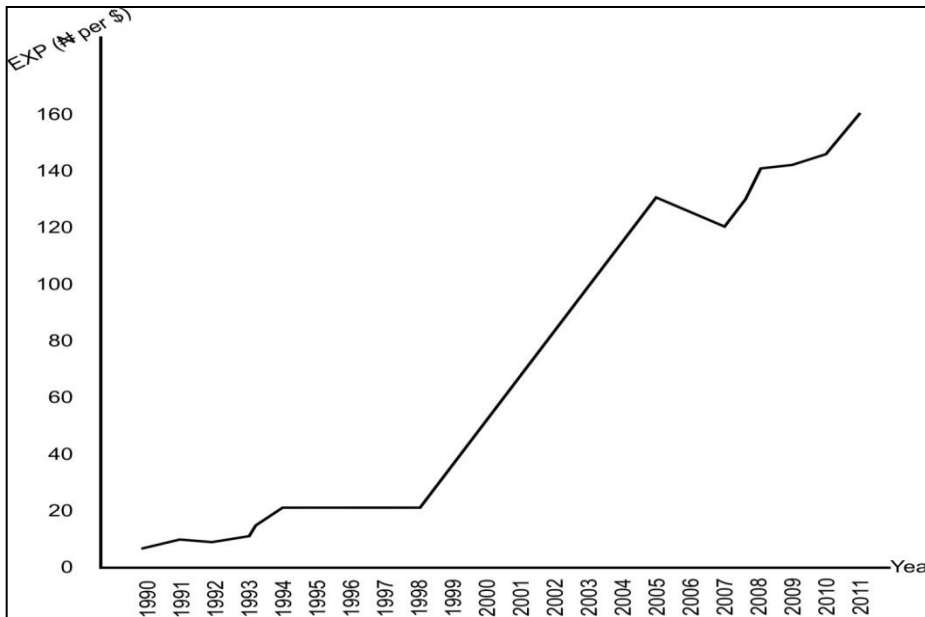
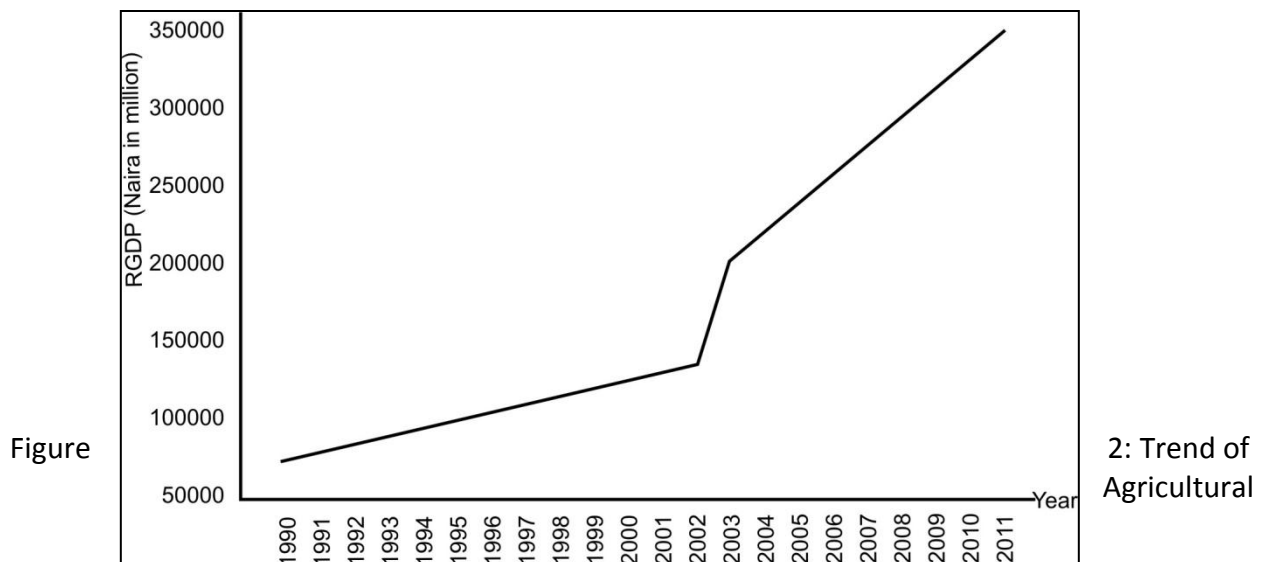


Figure 1: Trend of Exchange Rate in Nigeria (1990 – 2011)



Figure

2: Trend of Agricultural

## Share of GDP in Nigeria (1990 – 2011)

**Table 2: Result of Augmented Dickey Fuller (ADF) Test**

Variable	ADF Statistics	Lag	Test critical Value (5%)	Decision
Level				
L <sub>n</sub> EXR	-2.016752	0	-3.603202	Non-Stationary
L <sub>n</sub> GDP	-1.873371	0	-3.603202	Non-Stationary
First Difference				
ΔL <sub>n</sub> EXR	-5.247509	0	-3.690814	Stationary
ΔL <sub>n</sub> GDP	-4.866667	0	-3.612199	Stationary

**Note:** The Lag length was selected based on Schwarz information criterion (SIC)

**Table 3: VAR Lag order Selection Result**

Lag	LR	FPE	AIC
0	NA	0.064459	2.933882
1	84.62852	0.000860	-1.386750
2	2.8881067	0.001067	-1.185864
3	4.347656	0.001185	-1.115459
4	14.64704 *	0.000546*	1.955094*
5	3.039158	0.000660	-1.878057

Note that \* means lag order selected by the criterion

LR: Likelihood Ratio

FPE: Final Prediction Error

AIC: Akaike Information Criterion

### Vector Autoregression (VAR) Lag Order Selection Criterion

According to Foresti, 2006; Afzal, 2012; Onyimbo et al., 2012, Granger Casualty test is known to be sensitive to lag length, therefore, VAR model was fitted to the time series data in order an appropriate lag structure for the Granger casualty test. The result is presented in Table 3, and it indicates that the optimal lag length is four based on likelihood ratio, final prediction error, Akaike information criterion.

### Granger Casualty Test

Table 4 below shows the result of the Granger Casualty, using an optimal lag length of four. The result shows that there is unidirectional casualty from exchange rate and the agricultural share of GDP in Nigeria. The Hypothesis that exchange rate does not

granger cause agricultural share of GDP is rejected, while the hypothesis that the agricultural share of GDP granger cause exchange rate is accepted. This implies that deregulation of exchange rate is significant in influencing the volume of agricultural share of the GDP in Nigeria within the time of this research work.

The above could be attributed to the influence of market determined exchange rate (i.e., floating exchange rate) on importation of raw materials for agricultural production and export, which is a major contributor of non-oil-export in Nigeria. This is in line with his assertion, Enoma (2011) that exchange rate depreciation helps to restructure the price mechanism of both import and export such that Naira depreciation subtly tends to moderate prices

in Nigeria, especially imported price inflation. To this, it is important to note that the monetary authorities to monitor the

trend in exchange rate depreciation in order to avoid excessive devaluation of the naira that could cause price distortions.

**Table 4: Result of Pairwise Granger Casualty test**

Null Hypothesis ( $H_0$ )	Obs.	F.Statistics	Prob.	Decision
GDP does not granger cause EXR	22	0.02316	0.9988	Accept $H_0$
EXR does not granger cause GDP	22	17.8745*	3.E-05	Reject $H_0$

**Note:** \* indicates significant at 1% probability level.

#### Vector Error Correction Estimate

Table 5, below, shows the result of the vector error estimate, and it contains the short and long run estimates and diagnostic statistics. The long run estimates indicate that the estimated coefficient of exchange rate was -1.932 and was significant at 1% probability level, which means that EXR deregulation has negative influence on the agricultural share of GDP over the period

under study. The result, therefore, suggests that a unit increase in exchange rate will decrease the agricultural share of gross domestic product by 1.932, all things being equal. Similarly, the short run estimate has a similar result in line with the long run estimates as the estimated coefficient of the first lagged value of exchange rate was -0.086291 and significant at 10% probability level.

**Table 5: Vector Error Correction Estimates**

Variable	Coefficient	Std Error	T-Statistics
<b>Long Run Estimates</b>			
Constant	19.09639		
$L_n$ GDP(-1)	1.000000		
$L_n$ EXR (-1)	-1.931569*	0.42364	-4.55946
<b>Short Run Estimates</b>			
Constant	0.104648	0.03044	3.43775
$\Delta L_n$ GDP(-1)	0.085077	0.20132	-0.42260
$\Delta L_n$ GDP(-2)	-0.160531	0.19829	-0.80967
$\Delta L_n$ EXR(-1)	-0.086291***	0.05191	-1.66232
$\Delta L_n$ EXR(-2)	-0.060837	0.05130	-1.18579
ECM(-1)	-0.084327 *	0.03075	-2.74218
<b>Diagnostic Statistics</b>			
R-Squared	0.331543	Loglikelihood	29.64405
Adj. R-Squared	0.134938	Akaike AIC	-2.056005
Sum Sq. Resids	0.102271	Schwarz SC	-1.759789
S.E. Equation	0.077563	Mean Depend	0.064118
F-Statistic	1.686341	S.D. Depend	0.083393

**NB:** \* indicates  $P < 0.1$ , \*\*\* indicates  $P < 0.01$

From the above result, it is clear that the agricultural share of GDP will decrease by 0.086291 as exchange rate increases by one unit. The trend of the correlation between EXR deregulation and AGDP could be attributed to excessive devaluation of the naira that could be detrimental to the contribution of agriculture to the GDP through its inflationary effect on trade and investment in agricultural sector of the economy. Given the above, any attempt to spur the economy through expansionary monetary policy will result in higher rate of inflation, but no increase in the real economic growth (Goldstein, 2002). Also, the error correction coefficient of -0.084327 had the expected negative sign and was significant at one(1)%, which confirms the existence of long run correlation between exchange rate and GDP. The error correction coefficient shows a result of about 8% of the preceding year's disequilibrium from the long run value of EXR.

### Conclusion and Recommendation

Time series data on agricultural share of Gross Domestic Product (GDP) over a selected period (1990-2011) of economic deregulation in Nigeria and exchange rate were carefully analyzed using the Augmented Dickey Fuller (ADF) unit root test, the Unrestricted Vector Autoregression (VAR) and the Pairwise Granger Casualty tests, in order to achieve the objective of the study. A major finding of this study is the presence of unidirectional casualty from exchange rate to GDP from 1990 to 2011. Also, there is a negative influence of exchange rate on Gross Domestic Product (GDP). This implies that exchange rate deregulation has not been favourable to agricultural production in Nigeria.

To this effect, this study recommends that the Central Bank of Nigeria (CBN) should prudently monitor the activities and trend of the floating (market determined) exchange rate, in order to ensure that deregulation of exchange rate does not become detrimental to the economy, through changes in price of agricultural production, agricultural input importation, agricultural produce exportation (i.e., trade) and investment in the sector.

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