



Exchange Rate and Agricultural Output Growth in Nigeria

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Abstract

This study contextualizes the growth in the Nigeria agriculture sector between 1986 and 2023 in relation to the value of the exchange rate, using multiple regression analysis. The result of the multiple regression depicts that exchange rate, food imports, and agricultural employment affects Nigeria's agricultural output growth negatively. Agricultural employment has been proved to be statistically significant, while exchange rate and food import are statically insignificant. Moreover, fertilizer consumption and government capital expenditure on agriculture were positive and significant at 5 percent. It is, thus, recommended that government introduce policies aimed at stabilizing the exchange rate through building foreign exchange reserves, diversifying the economy to reduce dependence on oil exports. This will be affected through the promotion of value-added agricultural exports, and also attracting investment into other sectors to better cushion the economy from external shocks and subsequently lessen exchange rate volatility.

Keywords: *Exchange rate, Agricultural output, Food imports, Nigeria*

Introduction

Agricultural growth is central to the advanced and developing economies, though the importance is varied. In advanced economies, growth in agriculture generally results in technological change, productivity enhancement, and better sustainability. It is also important in attaining food security, reduction of import dependence, and rural development. Such economies, therefore, have highly mechanized farming, innovations in agro-processing, and international trade contributions (World Bank 2020). The relationship between exchange rates and agricultural growth is multifaceted. Actually, the exchange rate-agricultural growth nexus in Nigeria presents some beneficial effects as well as challenges. These include increased export earnings on account of a more competitive naira. This would raise the incomes of farmers in export crops and enable them to have more capital for them to reinvest in their farms. The depreciation of the exchange rate can further stimulate domestic agricultural production by increasing the price of food imports and creating a wider market for domestically produced food. Agriculture is one of the important sectors in the Nigerian economy and has historically been the backbone of the livelihood of the nation before the discovery of oil. In 2022, agriculture alone contributes about 24% to the GDP and provides work for about 70 percent of the working population of Nigeria, especially in the rural areas (National Bureau of Statistics, 2023). The diversified nature of agriculture that exists in Nigeria makes it possible for the country to produce virtually all types of crops, ranging from maize, cassava, yams, and rice to cash crops such as cocoa, rubber, and cotton.

Notwithstanding, the sector has been hampered by inefficiency in actualizing its growth potential due to a variety of economic factors, one of which is fluctuations in the exchange rate. The immediate challenge to surmount is the cost of imported inputs, which really presses on productivity and consequently dampens the use of modern agricultural technologies. According to the Central Bank of Nigeria (2021), on the contrary, exchange rate volatility increases uncertainty and therefore makes planning into the future by farmers very challenging. Moreover, these are further compounded by the lack of access to affordable credit, as the increased price levels from currency depreciation make the financing of such purchases quite difficult for farmers.

This dynamic disproportionately affects the majority of Nigeria's agricultural workforce, comprised of smallholder farmers. The Nigerian government has identified these challenges and has put in place a number of policies to address the impact of exchange rates on agricultural growth. Among the key policies, the Central Bank of Nigeria has an Anchor Borrowers' Programme, meant to provide finance to smallholder farmers. It aims at cushioning the impact of the higher input costs brought about by depreciation through facilitating access to credit. On import substitution, the government has taken various initiatives on that with regard to the import substitution policy under Agricultural Transformation Agenda (ATA). The main attempt of this policy is to encourage the local production of such agricultural commodities as a means of reducing the import bill and insulating this sector against the vagaries of the exchange rates (NBS, 2020). In fact, similar policies have been implemented in the form of foreign exchange controls and the restriction of imports as a means of safeguarding the sector. These are implemented but full achievement

of their successes is dampened by bureaucratic inefficiency and a great reliance on oil revenues which has a direct impact on stability in the exchange rates. The dominance of oil exports in the economy of Nigeria implies that the exchange rate movements are often transmitted by the changes in world oil prices. Of course, there is normally currency depreciation when oil prices fall, which has several implications on agricultural production (NBS, 2020).

It is expected to raise the price competitiveness of agricultural exports such as cocoa and rubber. Nevertheless, on one hand, depreciation increases the price competitiveness of agricultural exports, thus allowing farmers to have better earnings in local currency terms. On the other hand, an increased cost of imported inputs such as fertilizers, equipment, and seeds might nullify these gains. In this manner, the usual effects are often mixed in their impact, where some sub-sectors benefit even as others at the same time suffer due to increased production costs (CBN, 2021). Hence, the relationship between exchange rates and agricultural growth needs to be fully comprehended if various strategies must be devised which would stabilize and increase the said vital sector to food security, employment, and poverty alleviation.

Literature Review

Theoretical Framework: The Conservation Theory of Agricultural Development

The conservation theory of agricultural development, which is very much associated with Theodore W. Schultz, emerged in the middle of the 20th century—that is, with his work in the 1960s. At its strongest, the conservation theory is sometimes referred to as the "high-payoff input" theory. It views traditional agriculture as not necessarily being backward, and farmers in developing countries as acting generally rationally given their resources and information. Schultz's line of reasoning was such that the key to transforming traditional agriculture was to introduce new technologies and high-yielding varieties of crops that promise higher returns on investment. In the conservation model, organic manure generation and utilization, succession of increasingly complex agricultural systems requiring much land and manpower, development of manpower-intensive capital formation in physical structures to make better use of land and water resources were emphasized. Schultz underlined that this category of farmers would happily adopt new practices provided they were properly convinced of tangible benefits and the infrastructure and policies supported such transitions (Schultz, 1964). Indeed, most criticisms of Schultz's theory have been based on over-reliance on a technological explanation of the constraints assumedly facing traditional agricultural systems more than any other factor for their lack of access to modern inputs. Critics go further to argue that such a view actually ignores important structural problems concerning land tenure, access to markets, education, and credit facilities that also impact on the level of agricultural productivity given (Hayami & Ruttan, 1985).

Schultz's theory guides agricultural policies in the context of Nigeria by introducing new and improved seed varieties and technologies that enhance productivity. The theory forms a theoretical framework because it puts emphasis on the introduction of new technologies and improved seedlings into the agricultural system, which will help to boost agricultural produce. The theory further argues that infrastructure aids in the development of the agricultural

sector. It is a fact that investment in infrastructures, new technologies, and introducing improved seedlings would develop the agricultural sector.

Review of Empirical Literature

Eniekezimene et al. (2024) studied the impact of constant fluctuations in the value of the naira against the dollar on agricultural production in Nigeria from 1981 to 2021 through the theoretical framework of Dutch Disease Syndrome and the non-linear autoregressive distributed lag (NARDL) approach. The result showed that the long-run impact of the change in the exchange rate on agricultural output was symmetric: whereas the exchange rate appreciation increased real agricultural GDP by about 8.8%, the depreciation contributed an increase of only 0.11%. The impact in the short run was asymmetric. *Al-Ameen and Hassan (2024) examined the effect of exchange rate volatility (ERV) on food prices (FPI) in Nigeria with quarterly time series data from 1999Q1 to 2023Q4 using Structural Vector Autoregressive (SVAR) approach. The findings of structural impulse response functions of the food prices index increased steadily to itself and to exchange rate volatility, but a downward movement to monetary policy rate (MPR), imported food prices. The result of the Structural Variance Decomposition revealed that exchange rate volatility is the only principal variable that affects the food prices in Nigeria. Other variables do not significantly affect the variation of food prices.*

Odey et al. (2023) analyzed the effects of exchange rate dynamics on Nigeria's agricultural sector performance between 1981 and 2022, applying both ARDL and Generalized Autoregressive Conditional Heteroskedasticity methods. From the ARDL results, the study found a long-run relationship between the exchange rate and agricultural output, as well as GARCH analysis, which showed that the change in the exchange rate negatively influenced the aggregate agricultural output. Olaoye (2022) estimated the ARDL method to ascertain the impact of exchange rate volatility on agricultural output in Nigeria from 2000 to 2020. The result obtained showed that the change in the exchange rate negatively impacted agricultural output in the short term but was not statistically significant at the desired level. However, the change in the long-run exchange rate positively influenced agricultural output and was statistically significant.

Dangok and Ige (2020), using the NARDL model and monthly data from 2000 to 2018, examined both the symmetric and asymmetric impacts of the volatility of the exchange rate on agricultural commodity prices in Nigeria. The study presented that the changes in both positive and negative exchange rates were positively and significantly related to agricultural commodity prices. The asymmetry tests, therefore, revealed the presence of a symmetric impact of exchange rate changes, whether negative or positive and of equal magnitude, on commodity prices. Applying the method of structural vector autoregression, Abiola (2019) conducted an analysis of the effect of exchange rate reforms on agricultural output in Nigeria for the period of 1981-2018. The result, as the study averred, showed that agricultural labour and exchange rate were positively related to the agricultural output, while acreage and lending rates were negatively related to it.

Yaqub (2019) analyzed the impact of exchange rate fluctuation on disaggregated agricultural output in Nigeria between 1970 and 2018 using the two-stage least square method. The findings revealed that whereas fluctuation in the exchange rate had an adverse effect on crop and fishery output, it positively influenced the output in livestock and forestry. Using the nonlinear ARDL approach, Awolaja and Okedina (2019) examined asymmetric effects of exchange rate fluctuations on agricultural output in Nigeria, between 1981 and 2017. The results indicated that in the long run, real exchange rate appreciation positively influenced the aggregate and sectoral agricultural output, while exchange rate depreciation had a negative impact.

Using secondary data spanning the period between 1970 and 2018, Mejeha et al. (2019) analyzed the impact of the exchange rate on agricultural trade in Nigeria through methods of multiple regressions and correlation analyses. From the study, it emerged that the exchange rate, the world price of cocoa, and the average rainfall all combine to influence the volume of export of cocoa. The world price of palm oil and rainfall were significant in determining palm oil exports, and the world price of rice, time trends, exchange rate, and local rice output were important determinants in rice imports. Results of the correlation revealed that the exchange rate was positively and significantly correlated with the export volume of palm oil and import volume of rice. Oye et al. (2018) studied the impact of exchange rate devaluation on agricultural output in Nigeria by applying data between 1986 and 2016. Based on the results obtained, the vector error correction mechanism (VECM) implied a negative relationship between real effective exchange rate and agricultural output. Therefore, it was deduced that devaluation had an adverse effect on agricultural performance.

Gap in the Literature

A major gap in the literature is the limited analysis of broader economic factors such as food inflation, agricultural employment, fertilizer consumption and capital expenditure on agriculture, which are crucial in understanding the full impact of exchange rate volatility. This study addresses this gap by incorporating these additional variables into the model, offering a more comprehensive understanding of the factors affecting agricultural sector growth.

Methodology

Empirical Model Specification

Based on the conservation theory adopted as the theoretical framework, the multiple regression technique was employed because it permits to control explicitly for many other factors that simultaneously influence the dependent variable. As such, the model for this study incorporates agricultural output, exchange rate, food imports, fertilizer consumption, agricultural employment, government capital expenditure on agriculture. The model can be specified functionally as;

$$AGOU = f(EXCR, FOIM, FERC, AGEM, GCEA) \quad (1)$$

Econometrically, equation 1 can be written as;

$$AGOU_t = \alpha_0 + \beta_1 EXCR_t + \beta_2 FOIM_t + \beta_3 FERC_t + \beta_4 AGEM_t + \beta_5 GCEA_t + \mu_t \quad (2)$$

Where,

AGOU = Agricultural output

EXCR = Exchange rate

FOIM = Food imports

FERC = Fertilizer consumption

AGEM = Agricultural employment

GCEA = Government capital expenditure on agriculture

α_0 = constant term

$\beta_1 - \beta_5$ = slopes of the coefficient

To be able to interpret the coefficient values as elasticities, the model needs to be transformed into logarithms and this can be specified as;

$$\ln AGOU_t = \alpha_0 + \beta_1 \ln EXCR_t + \beta_2 \ln FOIM_t + \beta_3 \ln FERC_t + \beta_4 \ln AGEM_t + \beta_5 \ln GCEA_t + \mu_t \quad (3)$$

Thus, the multiple regression model can be expressed as in equation 4.

$$AGOU_t = \alpha_0 + \beta_1 EXCR_t + \beta_2 FOIM_t + \beta_3 FERC_t + \beta_4 AGEM_t + \beta_5 GCEA_t + \mu_t \quad (4)$$

Estimation Techniques and Procedures

The study used time series econometrics to investigate the effect of exchange rates on agricultural output growth. The multiple regression method is utilised specifically because it allows for the building of stronger models for predicting the dependent variable. Multiple regression analysis also has the advantage of being able to incorporate rather general functional form relationships. Because multiple regression models may include a large number of associated explanatory variables, we can attempt to infer causation in situations where simple regression analysis would be misleading. The model's pre-test approaches employ the unit root test using Augmented Dickey-Fuller. This is done to avoid running erroneous regressions. Similarly, the Johansen cointegration test was used to determine a long-term relationship between the variables.

Presentation and Discussion of Results' Findings

Augmented Dickey Fuller Unit Root Test

The ADF unit root test was used to check for stationarity because time series data typically exhibits unit root; the outcome is shown in Table 1.

Table 1: Summary of ADF Test

Variables	ADF Statistics	Critical Value @5%	Order of Integration	Remarks
AGOU	-5.6732	-2.9458	I(1)	Stationary
EXCR	-6.3005	-2.9458	I(1)	Stationary
FOIM	-7.8805	-2.9458	I(1)	Stationary
FERC	-8.1942	-2.9458	I(1)	Stationary
AGEM	-4.7268	-2.9458	I(1)	Stationary
GCEA	-6.7226	-2.9484	I(1)	Stationary

Source: Author's Compilation Using Eviews Output 12

From Table 1, the ADF test results provide evidence that all variables are stationary at first difference. This is evidenced by ADF statistics whose absolute value is greater than the 5 percent critical values. Consequently, this rejects the null hypothesis for the presence of unit roots. Therefore, from here it can be concluded that the series are stationary, thus ensuring estimates are consistent and unbiased.

Johansen Cointegration Test

The results of the test are displayed in Table 2.

Table 2: Summary of Johansen Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Stat	Critical value @5%	Prob	Max-Eigen Stat	Critical value @5%	Prob
None *	0.844194	134.6422	95.75366	0.0000	66.92921	40.07757	0.0000
At most 1	0.499917	67.71295	69.81889	0.0728	24.94732	33.87687	0.3886
At most 2	0.435683	42.76563	47.85613	0.1384	20.59698	27.58434	0.3013
At most 3	0.280161	22.16865	29.79707	0.2892	11.83419	21.13162	0.5641
At most 4	0.168163	10.33445	15.49471	0.2559	6.628289	14.26460	0.5340
At most 5	0.097827	3.706164	3.841465	0.0542	3.706164	3.841465	0.0542

Source: Author's Compilation Using Eviews Output 12

The result in Table 2 indicates that there is one cointegrating equation for each of trace and max-eigen statistics. This shows that the model variables are related in the long term.

Multiple Regression Model

By using the model, the coefficients of the parameters of the regression model have been estimated and the result is as in Table 3.

Table 3: Multiple Regression Result

Dependent Variable: AGOU

Method: Least Squares

Sample: 1986 2023

Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.185503	0.862098	9.494869	0.0000
EXCR	-0.048063	0.058946	-0.815383	0.4209
FOIM	-0.008315	0.103793	-0.080113	0.9366
FERC	0.135535	0.062849	2.156520	0.0387
AGEM	-0.705707	0.454308	-5.955671	0.0000
GCEA	0.146396	0.040111	3.649786	0.0009
R-squared	0.958826	Durbin-Watson stat		1.984184
Adjusted R-squared	0.952392			
F-statistic	149.0373			
Prob(F-statistic)	0.000000			

Source: Author's Compilation Using Eviews Output 12

From the result in Table 3, the constant value is 8.1855 and it suggests that if all the variables are held constant or fixed (zero), agricultural output growth will be valued at 8.1855. Exchange rate (EXCR) has negative value of -0.048, which means that, on average, 1 percent increase in EXCR will decrease EXCR by 0.05 percent. The p value of 0.4209 suggests that the EXCR is statistically insignificant with agricultural output growth in Nigeria. The coefficient of food imports (FOIM) with negative value of -0.0083 implies that on average, 1 percent increase in FOIM will reduce AGOU by 0.008 percent. Judging from the p value which is 0.9366, it can be concluded that food imports is statistically insignificant at 5 percent level. Furthermore, agricultural employment (AGEM) has negative coefficient value of -0.7057. This indicates that on average, if AGEM is increased by 1 percent, it will lead to about 0.71 percent reduction in AGOU. This variable is however statistically significant as the p value is lower than the critical value at 5 percent. The coefficient values of fertilizer consumption (FERC) and government capital expenditure on agriculture (GCEA) are 0.1355 and 0.1464 with p values of 0.0387 and 0.0009 respectively. This means that FERC and GCEA are positive and statistically significant, and it suggests that on average, 1 percent increase in FERC and GCEA will increase AGOU by 0.14 percent and 0.15 percent respectively. Also, R^2 is given as 0.9588, which means that, 96% of the variations in the AGOU are being accounted for by EXCR, FOIM, FERC, AGEM, and GCEA in Nigeria, while 4% is explained by error term. The F-statistic is 149.0373 with a probability of the F stat being practically zero, that is,

0.00000. This infers that all the variables are jointly statistically significant since the F-calculated is greater than F-tabulated. It is observed that the DW statistic is 1.9842, which is approximately 2, and it implies that there is no autocorrelation in the residuals.

Diagnostic Tests

The diagnostic tests were conducted to ascertain the validity and reliability of the model for economic predictions. These results are presented as follows:

Table 4: Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	2.124116	Prob. F(5,32)	0.0879
Obs*R-squared	9.469181	Prob. Chi-Square(5)	0.0918
Scaled explained SS	8.641673	Prob. Chi-Square(5)	0.1242

Source: Author's Compilation Using Eviews Output 12

In accordance to the result, the probability (F-statistic) is 0.0879, which is higher than the significance level of 0.05 percent. The investigation comes to the conclusion that the residuals in the model do not exhibit heteroscedasticity. The data is reliable for forecasting.

Test for Normality

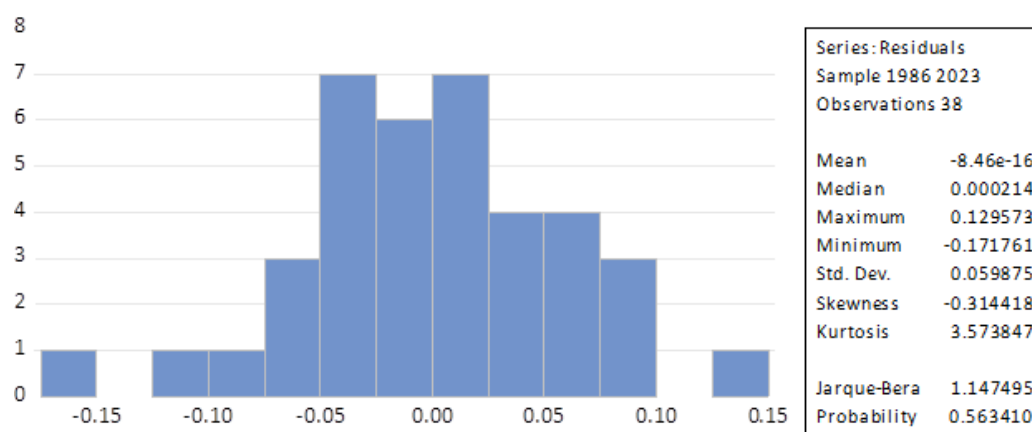


Figure 1: Histogram Normality Test

Source: Eviews 12 Output

As presented in Figure 1, the Jarque-Bera probability value is 0.5634, which is literally greater than 0.05. This suggests that the model is normally distributed. Therefore, the null hypothesis which states that the residual is normally distributed is accepted.

Discussion of Findings

In this study exchange rate and food imports have negative impact on agricultural sector development. This is because imports of agricultural foods and inputs which comes with high exchange rate determines how large agricultural sector can grow. This conforms to the a priori expectation because when agricultural inputs enter a country with high costs due to high exchange rate, it affects the development of agricultural sector. Similarly, employment in agriculture has negative impact on agricultural sector development in Nigeria during the period covered in this study. This is because during those times, agricultural sector was neglected due to oil booms, and this reduced the number of people who are engaged in agricultural sector. The findings failed to conform to the a priori expectation because the number of people who works in the farm is expected to add to the output growth of the sector. On the other hand, fertilizer consumption and government capital expenditure on agriculture positively impacted agricultural sector. The findings conform to the a priori expectation because some farmers use local manures to boost the fertility of the soils used for farming. This in turn helps to increase the output of the sector, hence, the sector develops. Also, investments in some infrastructures in this sector helps the development of the sector as well. This conforms to the a priori expectation because it is expected that one naira spent in building infrastructural facilities needed in this sector will attract investors to invest and this will aid the development of the sector. Basically, the findings between exchange rate and agricultural output from this study, which was positive, support that of Eniekezimene et al. (2024); Olaoye (2022); Abiola (2019). In contrast, the findings failed to support the findings of Awolaja and Okedina (2019), Oye et al. (2018), and Odey et al. (2023).

Conclusion and Recommendation

The study examines the impact of exchange rate on agricultural output growth in Nigeria from 1986 to 2023 using Multiple Regression Model. From the result of the study, it is observed that exchange rate, food imports and agricultural employment exhibit negative impact on agricultural sector development in Nigeria. These suggest that, increase in exchange rate, food imports and employment in agriculture will decrease agricultural sector development in Nigeria. It further shows that fertilizer consumption and government capital expenditure on agriculture have positive impact on agricultural sector development in Nigeria. Fluctuations in the exchange rate significantly affect agricultural sector development in Nigeria. Such fluctuations can alter the price of imported inputs such as fertilizers, machinery, and seeds which can raise the cost of production and make farming less profitable. An exchange rate that is depreciating to this extent may prove to be more competitive for exports, increasing agricultural export revenues. This may also result in inflationary pressures via a higher cost of living and reduced consumer purchasing power. The dual impact of such a possibility is that the heightened export opportunities may stimulate agricultural growth or hinder it, depending upon the balance between this and the increased input costs.

The study therefore recommends, based on the findings of this study, that:

- i. The government of Nigeria should lay down policies that give room for stability in the nominal exchange rate through building foreign exchange reserves and diversification of the economy. This needs to be done through increased value addition on

- agricultural exports and investment in other sectors so as to cushion the economy from external shocks and dampen exchange rate volatility.
- ii. The policies that enhance food production in Nigeria can be implemented to curtail the negative impact that importation of food stuff has brought to Nigeria's agricultural sector. This can include investing in agricultural infrastructure, subsidizing local farmers through some form of financial incentives, and supporting research and development in agriculture to boost productivity and yields.
 - iii. The Nigerian government should provide subsidy and support for local production to enhance accessibility and affordability of fertilizers to the smallholder farmer. Through this, agriculture productivity can increase, contributing to overall agricultural development.

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