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ANALYSIS OF CURRENCY FLUCTUATIONS AND SELECTED AGRICULTURAL EXPORT COMMODITIES IN NIGERIA

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ABSTRACT
The theory of comparative advantage of David Richardo has made it clear that no economy can exist in isolation hence the need to optimize gain from international trade wherein economies of the world could build international trade competitiveness based on area of advantage. The impact of currency fluctuations on selected agricultural export commodities is an effort to unravel the currency fluctuation dynamics of international trade on export commodities. Data for five major agricultural export commodities was sourced from the Food and Agricultural Organisation (FAO) and World Bank Development Indicator database. The result indicates that a unit appreciation of the currency produced a 0.002 unit decline in cocoa-bean export in Nigeria in the short run. Currency fluctuation however had no significant effect on rubber export either in the long or short term. The outcome of the study also shows that a unit rise in the value of the local currency resulted in a 0.03 unit rise in the volume of palm-oil export, while it also increased groundnut export by 0.002 in the short term. Finally, a unit fall in the value of the local currency triggered a 0.049 unit fall in cotton seed export in Nigeria. Generally, the study found that currency fluctuations have a small quantitative impact on the selected agricultural export commodities in Nigeria. The study recommends that Nigerian government should adopt a more rigorous export promotion strategy with direct bearing on improving the competitiveness of exportable especially as the economy tries to break away from oil export dominance.

Key Words: Depreciation, Appreciation, Exchange rate, Fluctuation, Agricultural Output, currency fluctuation.

1. INTRODUCTION
In most developing nations, fluctuations of the domestic currency in respect to foreign currencies has become an issue of great concern. Regardless of the exchange rate policy adopted, it can exert an expansionary or contractionary effect on the country's economic growth. For instance, Mueller and Mueller (2016) noted that the direct effect of exchange rate devaluation is to lower the prices of domestic goods and services and promote exports. Lawal et al. (2016) similarly noted that currency

devaluation is often deployed by several countries, particularly the developing ones to moderate trade deficits. The economic intuition for this stem from the need to improve a country's trade balance.

However, the challenge with the Nigerian exchange rate regime can be traced back to the 1960's when agriculture was the mainstay of the Nigerian economy. The frequent distortion in the exchange rate policy since the SAP, has often been implicated in the dismal performance of agriculture to oil, as it has been often argued that the Nigerian currency is overvalued; consequently, discouraging the export and production of agricultural products and encouraging the import of food items (Yaqub, 2013). To stem this development and ensure an exchange rate that favoured export commodities, especially agricultural exports, the monetary authority put in place a number of exchange rate policies like the introduction of the Structural Adjustment Programme (SAP) in 1986 whose intent was to improve the non-oil exports (especially in agriculture) and discourage growth in nominal value of import for the country (Anyanwu et al., 1997).

Today, there is a growing alignment in the literature that prolonged and substantial exchange rate distortions can generate serious macroeconomic disequilibrium. However, the correction of such disequilibria may depend on both exchange rate devaluation and foreign exchange rate demand management policies. Upon this basis, the face of the Nigerian currency position in international trade in recent times, has been directed to be receptive and correctional to address growing inflationary pressure. It was on this basis that another attempt at liberalising the foreign exchange market in Nigeria was done in 2016, when the floating foreign exchange regime was introduced. To have a functional framework for the new foreign exchange regime, the CBN introduced a three-in-one set of rules. However, just like the previous efforts at liberalising the foreign exchange market, the consistent illiquidity and fluctuation in the value of the naira to the USA dollar; exacerbated by the fall in global commodity prices (especially oil prices), alongside the declining foreign exchange earnings and shrinking foreign reserves, has made the various exchange rate devaluation attempts yield little achievement in promoting growth of exportable commodities in Nigeria (Duru & Oguntuase, 2016).

From the mid-1970, oil revenue toppled agricultural income as the major source of government revenue. Due to the aforementioned, Nigerian currency (Naira) underwent different policy changes in term of its value relative to major international currencies over time. The intuition had always been to provide a favourable currency value particularly for the non-oil exports, which is required to guaranty stability in foreign exchange earnings for the country. Despite the deregulation of the foreign exchange market and the subsequent devaluation of the Nigerian currency under the SAP, the agricultural sector performance did not improve substantially. The contribution of agriculture to the gross domestic product (GDP) continued to dwindle. Although several studies have been conducted on the effect of the exchange rate on agricultural output, most of these studies focussed on aggregate output and ignored the possibility of differences in the response of the components of agricultural output, which may necessitate differential policy response. This notwithstanding the identified short run significant positive impact of government intervention on agricultural output as identified by Oshota, (2023) even though at an aggregate scale. Those that examined the effect on sectoral output (for example Yaqub (2010)) did not examine the effects on the components of each sector. Moreover, many of these studies such as Yakub (2010), Adekunle & Ndukwe (2018), Ikpesu & Okpe (2019) and Obiageli (2020), did not consider the possibility of both exchange rate and agricultural output having a bi-directional relationship. These represent the gaps this study intends to fill by investigating the impact of the currency fluctuations on some selected agricultural export produce namely cocoa beans, rubber, palm-oil, groundnut, and cotton seed. The study is organised in the following sequence namely Introduction, literature, methodology, result and discussion, finally the conclusion and recommendation.

2 LITERATURE

A number of theoretical pontifications tried to offer explanation to dynamics of the subject of discuss. This includes the Standard theory of international trade which holds ceteris paribus, a fluctuation in exchange rate will affect both the value and volume of trade. There is also the elasticities hypothesis alternatively called **the** Bickerdike-Robinson condition (Gandolfo, 2016). The elasticity approach has been adopted by policymakers in different countries, especially when faced with the challenge of reversing the trade deficit position of an economy. The theory holds that in a situation whereby the foreign and domestic demands for imports and exports are elastic, a marginal change in the spot exchange rate might leave significant impact on the trade balance (Daniels & VanHoose, 2005). The Marshall-Lerner condition is a further extension of the elasticities approach. The Marshall-Lerner condition thus states that the sum of the absolute values of the two elasticities should surpass unity (Brown & Hogendorn, 2000). On the other hand, suppose the sum fall below one, trade balance depreciates when a currency devaluation in adopted. A major cutting-edge of the Marshall-Lerner condition as well as the Bickerdike-Robinson's approach, is centred mainly on two assumptions. The first is that trade was initially balanced when exchange rate devaluation was implemented, so that the foreign currency value of exports equate the foreign currency value of imports. The second and at the same time most significant is that prices are fixed in seller's currencies; therefore, the supply elasticities are infinite.

One major flaw of the elasticity approach is the fact that it is based on partial equilibrium analysis which only considers the macroeconomic effects emanating from changes in price and fluctuations in production due to a currency devaluation (Kim, 2009). On the contrary, the absorption and monetary approaches, posits that currency devaluation is associated with macroeconomic variables that normally reduce the favourable effect of the exchange rate devaluation on the trade balance. The absorption approach synchronises the elasticities approach with the Keynesian macroeconomics and is based on the fundamental assumption that a country's spending can be categorised into four headings of consumption (c), investment (i), government expenditures (g), and imports (m). All variables measurement is in real terms since the approach takes prices to be fixed.

In summary, the absorption approach sees trade balance as a function of real income and absorption (domestic consumption) $TB = (Y, a)$.

Base on the flaws of the earlier theories linking exchange rate devaluation to trade balance, this study will be anchored on the monetary approach due to its more realistic approach to the relationship between exchange rate devaluation and export activities, particularly for a developing economy like Nigeria. Hence, the study's empirical model will be developed to test the conformity of the exchange rate behaviour in Nigeria to the monetary approach hypothesis. The choice of this theoretical anchor is built on the dynamics of the Nigerian economy that is import-driven with little or no value chain on available exportable (unlike other theory) as rightly pointed by Amoke *et.al* (2024). Hence making the economy vulnerable to global shocks and pass through exchange rate effect of global inflation which trickles down to what happens to the nation GDP, purchasing power and by extrapolation, the standard of living measured by human development index.

Empirical Review

There are several empirical studies that have been conducted to examine the relationship between exchange rate devaluation and agricultural or non-oil exports in both developed and developing countries. In this subsection, the review outcome of a significant amount of such studies can be found. Lamb (2000) estimates supply functions for total agricultural output, food crops, and export crops in fourteen African countries in the period of 1975-1999. The concept that a country's exports depend on

its exchange rate is examined in the work. The study found that the exchange rate has "a persistent, robust and negative" relationship between the exchange rate and aggregate agricultural output in markets where food crops and export crops are substitutes in production in the short run. The decision between producing food crops or export crops is based on the value of the currency, that is, an overvalued currency makes exports more expensive to other countries and imports less expensive while an undervalued currency makes exports cheaper to other countries and imports more expensive. When a currency is undervalued, export crops are likely to be produced at a time when imports are expensive, leading to the risk of reduced stocks of domestic food.

Cho et al. (2002) studied the effect of medium to long-run exchange rate uncertainty, which had not been evaluated, on agricultural trade and compared the impact on agricultural trade relative to other sectors. The data used were bilateral trade flows for ten developed countries between 1974 and 1995. The aggregate trade flow data was separated into trade in agricultural products, machinery, chemicals, and other manufacturing. A gravity model was applied to the data, allowing for cross-country determinants of trade including income, distance, membership of customs unions, common borders, and exchange rate uncertainty, among others. Additionally, they used panel data which allowed them to capture changes in variables over time such as income and changes in exchange rate uncertainty. The authors found a clear conclusion: compared to other sectors, agricultural trade has been more adversely affected by medium to long-run uncertainty in real exchange rates. The authors made note that short-run volatility could be hedged, and, therefore, it was long-run variability in exchange rates that mattered. This notion implied that if long-run variability was a function of the deviation of nominal exchange rates from underlying fundamentals, then macroeconomic policy may have a key role in influencing trade flows. The evidence they reported suggested that agricultural trade was more susceptible to exchange rate uncertainty than aggregate data would have suggested and that the negative effects on the growth of trade had a stronger effect on trade in agricultural goods than when compared

The study by Jimoh (2004) evaluated the significance of the monetary approach to the floating exchange rate policy adopted in Nigeria from 1987. Both monthly and annual data for the period 1987 to 2001 were used to determine the effect of a floating exchange rate policy on the Nigerian economy. The two models adopted by the study are the ordinary least square (OLS) and the Autoregressive order one Generalised Least Square {AR (1) GLS}; depending on which fits best on the two types of data set adopted. Findings from the study showed that the monetary approach had been effective for economic growth. However, the study noted that pursing substantial economic growth and low interest rate, have the tendency to cause exchange rate appreciation as against devaluation.

Taking on a new challenge, Shane et al (2006) estimated the effect of trade partner income and real trade-weighted exchange rates on USA agricultural exports. The authors used a Ramsey style general equilibrium framework to derive the specification of the empirical model. The authors concluded that the real trade-weighted exchange rate and trade partner income were key determinants of USA. agricultural exports. The trade data suggested that bulk commodities tended to be exported to lower income countries than did the higher valued commodities such as fresh fruit and red meat. For the 1972-2003 period, a one percent annual increase in trade partners' income was found to increase total agricultural exports by about 1.6 percent, while a one percent appreciation of the dollar relative to trade partners' real trade-weighted exchange rate decreased total agricultural exports by about 0.8 percent. The authors also found from a decomposition analysis that the negative effect of exchange rate appreciation on exports often dominated the positive effect from income growth. Most historical increases in agricultural exports were associated with income growth, whereas most of the declines in exports were associated with an appreciation of the U.S. trade-weighted exchange rate. The same analysis also showed that the income effect had tended to dampen over time. This dampening effect allowed the appreciation of the exchange rate to dominate the income effect, particularly for bulk commodities.

Obayelu and Salau (2010) noted that for any reform in the agricultural sector in Nigeria to succeed, the response of agriculture to changes in the relative prices and exchange rate movement is a key factor. The study estimated the response of aggregate agricultural output to exchange rate and price movements of food and export crops in Nigeria using available time series data that spanned 1970 to 2007 which was adapted to a VECM framework. Result from the study showed that short-run adjustment of the variables toward their long-run relationship had a linear deterministic trend. Also, food and export prices as well as the real exchange rate jointly explained variation in the Nigeria aggregate agricultural output in the short-run and long-run. Specifically, total agricultural output was found to respond positively to increases in exchange rate and adversely to increases in food prices both in the short and long run. The study concluded that the significance of food crop prices and exchange rate both in the short and long run suggest that changes in these variables are passed immediately to agricultural output.

Similarly, the study by Essien et al. (2011) assessed the effect of price and exchange rate volatility on cocoa export in Nigeria. The study adopted the OLS regression technique and found that agricultural credit and exchange rate volatility have a positive impact on export of cocoa in Nigeria. It was further revealed that the relative prices in the economy do not have a significant effect on cocoa export. Based on the findings of the study, the following were measures suggested: that the agricultural credit schemes should be restructured in a way that should meet the need of the farmers; such credit facilities should also be made available and accessible to cocoa farmers to boost their production capacity. While the exchange rate market was further recommended to be liberalised due to its positive effect on cocoa output in Nigeria.

Loto (2011) examined the impact of currency devaluation on the trade balance of Nigeria, by using the Marshall-Lerner condition. The study period spanned 1986 to 2008 and the OLS estimation approach was adopted. Findings from the study showed that currency devaluation does not enhance Nigeria's trade balance. However, it was noted that for currency devaluation to benefit the economy, then, the economy must have been significantly export based before the devaluation policy sets in, as against the import dependent nature of the Nigerian economy.

Yaqub (2013) studied the impact of exchange rate fluctuations on disaggregated agricultural output (crop output, fishery output, livestock output and forestry output) in Nigeria. The study adopted the two-stage-least-square estimation technique applied on time series data spanning 1970 to 2008. Findings from the study result showed that the various agricultural outputs reacted to changes in the real exchange rate differently. Specifically, a change in the real exchange rate had adverse effect on crop and fishery output, while forestry and livestock output responded positively. The study concluded that by confirming the variation in agricultural outputs' response to changes in the real exchange rate, suggest the need for caution in exchange rate policy formulation to mitigate the inverse effects such policy, particularly a currency devaluation policy may have on different agricultural outputs.

Ogundipe and Ogundipe (2013) examined the empirical relationship between currency devaluation and Nigeria's trade balance using the VECM analyses from 1970-2010 The empirical results indicated that there exists a long-run stationary relationship between trade balance and its determinant-domestic income, domestic and foreign money supply, domestic interest rate and nominal exchange rate; as employed in the study. Also, there exists an inelastic and significant relation between trade balance and its determinants. The study specifically found that exchange rate induced an inelastic and significant relation on trade balance in the long-run, there exist no short-run causality from exchange rate to trade balance and money supply volatility contributes more to variance in trade balance than exchange rate volatility. The paper concluded that devaluation of the exchange rate worsens the trade balance of Nigeria in the long run.

In another study by Akinlo & Adejumo (2014), the effect of exchange rate volatility on nonoil exports in Nigeria between 1986 and 2008 was examined using the error correction model (ECM) technique.

Findings from the study confirmed the presence of the nexus between real exports and exchange rate volatility in Nigeria. Thus, the study was able to submit that exchange rate volatility and foreign income have positive and significant effects on non-oil exports in the long run. However, the short-run, nexus was found to be insignificant; suggesting that exchange rate volatility and non-oil export are only linked in the long-run.

The study by Oyinbo et al. (2014) evaluated the link between exchange rate deregulation and agricultural output share in the GDP of Nigeria from 1986 to 2011. Methodologically, the study adopted the Vector Autoregression (VAR) and Granger causality estimation techniques. Based on the result findings of the study, it was revealed that there is the presence of a unidirectional Causal effect flowing from exchange rate to the agricultural share of gross domestic Production. Furthermore, exchange rate devaluation was shown to have adversely affected the agricultural share of gross domestic production in Nigeria. Thus, implying that the market driven exchange rate policy has been having undesirable influence on the trend in agricultural share of gross domestic production in Nigeria. It was recommended by the study that the Central Bank of Nigeria (CBN) should meticulously monitor the path of the market determined exchange rate, to ensure that exchange rate deregulation does not become counterproductive through price distortions on agricultural production, trade (agricultural input importation and agricultural produce exportation) and investment in the agricultural sector in line with the Agricultural Transformation Agenda.

Imoughele and Ismaila (2015) examined the effect of exchange rate on non-oil export for the period between 1986 to 2013. The study adopted the OLS statistical technique and reported that effective exchange rate has substantial effect on the growth of non-oil export in the Nigerian economy. specifically, exchange rate appreciation was observed to adversely affect non-oil exports. It was therefore recommended that the monetary authority in Nigeria should ensure a stable exchange rate regime to control for the effect of inflation which could retard the growth of the non-oil sector in Nigeria.

Oriavwote and Eshenake (2015) evaluated the effect of the REER on aggregate non-oil exports in Nigeria. The study adopted the autoregressive conditional Heteroskedasticity/generalised autoregressive conditional Heteroskedasticity (ARCH/GARCH) and the error correction mechanism (ECM) applied on time series data spanning 1980 to 2014. Findings from the study revealed that devaluation of the REER marginally enhanced the level of non-oil exports in Nigeria. The ARCH/ GARCH result suggested that volatility of the REER has impacted non-oil sector performance in Nigeria. The study further submits that devaluation of the exchange rate will increase the domestic production of finished goods, help diversify the productive base and improve the level of non-oil exports in Nigeria; a submission in agreement with Anyanwu et al (2024) which holds that while exports are found to significantly drive economic growth, the imports, the balance of payments, and exchange rate fluctuations present challenges to an economy's stability

Akinniran (2016) evaluated the effect of exchange rate on agricultural output growth in Nigeria from 2002 and 2013. The study employed the OLS estimation approach in deriving the study findings. Major submission of the study was that, although the exchange rate constitutes a significant economic indicator for evaluating the general health of the economy, in Nigeria, the instability of the variable has substantially impacted the growth of the agricultural sector adversely. Hence, the study recommended the need to ensure the regime of an effective exchange rate for enhancing the growth of the agricultural sector.

David and Oluseyi (2017) assessed the impact of currency devaluation on macroeconomic variables such as non-oil export, inflation, trade openness and balance of payment. The study employed vector error correctional model (VECM) on time series data spanning 1986 to 2016. Output from the study showed that while exchange rate devaluation positively impacted on balance of payment, its effect on

non-oil export was found to be adverse. It was noted that despite the diverse benefits of currency devaluation, its benefits can only be accessed when there is improvement in the production of goods and services for both domestic consumption and export purposes.

Similarly, Oye et al. (2018) examined the effect of exchange rate devaluation on agricultural output in Nigeria. The study adopted time series data from 1986 to 2016, which was adapted for a VECM regression analysis and a Toda-Yamamoto causality test. Similar to prior studies, the REER was used to proxy for currency devaluation. To measure agricultural output, the study adopted real agricultural export as proxy. The output of the Vector Error Correction Model (VECM) suggested that further currency devaluation will result in decrease in gross agricultural output. Thus, implying that total agricultural output reacts adversely to exchange rate devaluation. The Toda-Yamamoto causality test supported a unidirectional causal effect from currency devaluation to exports.

Adekunle and Ndukwe (2018) in their study assessed whether exchange rate dynamic behaviour has any impact on the performance of agricultural sector output in Nigeria from 1981 to 2016. The study adopted the non-linear autoregressive distributive lag (NARDL) model in deriving its findings. The study submitted that the significant determiners of agricultural output in Nigeria are the REER (log-levels), real currency appreciation and devaluation (after some lags), industrial capacity utilization rate, and government agricultural spending (after some lags). It was further revealed by the study that although the impact of real appreciation was larger than that of real devaluation, the study could not find any evidence in support of the asymmetric behaviour of the real exchange rate dynamics on agricultural output performance in the Nigerian economy. It was therefore recommended that both fiscal and monetary authorities in Nigeria should synergise their efforts at ensuring that the maximisation of the full potentials of the agricultural sector for the purpose of deriving economic growth and development.

Ikpesu and Okpe (2019) applied the autoregressive distributed lag (ARDL) technique in investigating the effect of capital inflows and exchange rate on agricultural output in Nigeria between the periods 1981 and 2016. Variables used in the study are agricultural output, private capital inflow, public capital inflow, investment, labour, and real effective exchange rate. Findings from the empirical research revealed that the variables are cointegrated. The research outcome also indicates that in the short run and long run, private capital inflow and public capital inflow positively affect the country agricultural output. The study also revealed that exchange rate devaluation would cause agricultural output to decline in the short and long run. Based on the research findings, it was recommended that the government should create an enabling and conducive environment to attract more inflows of foreign capital into the country to boost the agricultural output. Also, monetary authority should ensure the stability of the country's exchange rate (Naira) since exchange rate depreciation affects agricultural output negatively. The study further recommended that there is the need for the harmonization of foreign capital inflow policy and monetary policy by the government, taking into consideration the optimal level of capital inflow that will not have a detrimental effect on exchange rate so as to ensure sustainable growth in agricultural output.

Obiageli (2020) studied the effect of nominal exchange rate on agricultural output in Nigeria from 1987-2019, using the OLS approach. Findings from the study revealed that the nominal exchange rate significantly affect agricultural sector output. Thus, the study's submission that exchange rate inversely affects the growth of the agricultural sector in Nigeria. The study recommended amongst others that; there is need for the government to ensure the implementation of policies that will encourage growth in domestic agricultural output to reduce import. Achieving this will require the implementation of a favourable pricing policy, perfect market, and credit facilities to the agricultural sector, to complement revenue derivable from crude oil production.

Oketooyin et al. (2020) assessed the effect of a currency devaluation on the aggregate non-oil export of Nigeria. The study applied the Granger causality approach on time series data from 1986 to 2018.

Findings from the study revealed that currency devaluation has an adverse effect on non-oil export in Nigeria. Thus, the study recommended improvement in the competitiveness of Nigeria's exportable by either embarking on currency revaluation or import reduction.

From the above review, it can be observed that literature abound on the relationship between agricultural output and exchange rate behaviour; especially as it pertains to Nigeria. The present study differs from these previous studies in the sense that it investigates the effects of exchange rate fluctuations on selected agricultural export commodities, by adopting a symmetric exchange rate analysis; having controlled for some other significant factors already documented in the literature. The only similar study in the literature for Nigeria is credited to Adekunle and Ndukwe (2018). However, their findings were based on the effects of an asymmetric Real Effective Exchange Rate on aggregate agricultural output, while neglecting the specific effect on selected agricultural export commodities as proposed in this study. This depicts a disaggregated impact gap on selected staple agricultural product that represent our major exportable namely *cocoa-beans, rubber, palm-oil, groundnut and cotton seed.* This is in addition to the technique gap-Non Linear Autoregressive distributed lag Model also identified from the literature review.

3 METHODOLOGY

In examining the link between currency fluctuations and selected agricultural exportable commodities in Nigeria, this study will employ an *ex post facto* (after the fact) design. Subsequent analyses will be econometric techniques such as unit root test, bond test of cointegration, ARDL and descriptive analysis and the non-linear auto-regressive distributed lag model of the indicator variables adopted for the study.

Model Specification

This study adopts the Auto-Regressive Distributed Lag (ARDL) framework as proposed by Pesaran and Shin (1999). However, this approach is deficient in measuring the magnitude of the asymmetric impact from volatile variables to a response variable (Aladejare, 2020). For instance, the impact of a volatile exchange rate may vary from when there is a devaluation to when there is an appreciation. The linear or symmetric ARDL model will not give such asymmetric information, as it is only empowered to give an aggregate effect of a regressor on a response variable (Aladejare, 2020).

To ameliorate this deficiency, Shin et al. (2014) recommended the use of a nonlinear or asymmetric ARDL model (NARDL). Its essence is to offer an asymmetric channel to the conventional linear ARDL model as suggested in Pesaran and Shin (1999), and Pesaran et al. (2001). Therefore, this study will adopt the NARDL model for the following reasons: First, the NARDL model permits for both the static and dynamic effect(s) of the independent variable(s) on the dependent variable unlike a static model that accounts for static or fixed effect(s) only Shin et al. (2014). Also, the NARDL framework offers a technique for checking the existence of a long-run relationship between variables, and that is referred to as the *Bounds test*. The Bounds test is flexible as it accommodates both stationary and first difference integrated series unlike other tests of cointegration, such as, Engle-Granger and Johansen tests, which considers only non-stationary series that are integrated of the same order. Finally, the NARDL allows one to capture the dynamic effect of both positive and negative changes in an explanatory variable on a particular dependent variable. To this end, this study adopts a NARDL model to account for the asymmetric effect of real exchange rate devaluation on selected agricultural export commodities. The model below is based on the monetary theory and the Solow-swan production model.

The functional form of the study's model is expressed as follows:

$$AGOUT = f(EXCH, CPI, CAG, AS) \qquad (3.1)$$

where AGOUT denotes the agricultural export commodities; EXCH is the exchange rate; CPI is the consumer price index used to proxy for the effect of inflation; CAG is the capital agricultural expenditure by the government; and AS is the agricultural credit scheme guaranty fund used to proxy for loans to farmers cultivating the exportable agricultural products.

The study's NARDL model is presented as follows:

$$\Delta lCB_t = \propto_0 + \propto_1^+ EXCH_{t-1}^+ + \propto_2^- EXCH_{t-1}^- + \propto_3 lCPI_{t-1} + \propto_4 lCAG_{t-1} + \propto_5 lASCB_{t-1} + \sum_{j=0}^{p} \rho_i \Delta lCB_{t-j} + \sum_{j=0}^{p} (\sigma_i^+ \Delta EXCH_{t-j}^+ + \sigma_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \tau_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \delta_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \pi_i \Delta lASCB_{t-j} + \mu_{t1} \quad (Equ. 3.2)$$

$$\Delta lRB_t = b_0 + b_1^+ EXCH_{t-1}^+ + b_2^- EXCH_{t-1}^- + b_3 lCPI_{t-1} + b_4 lCAG_{t-1} + b_5 lASRB_{t-1} + \sum_{j=0}^{p} \aleph_i \Delta lRB_{t-j} + \sum_{j=0}^{p} (\omega_i^+ \Delta EXCH_{t-j}^+ + \omega_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \beth_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \gamma_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \varphi_i \Delta lASRB_{t-j} + \mu_{t2} \quad (Equ. 3.3)$$

$$\Delta lPM_t = \Omega_0 + \Omega_1^+ EXCH_{t-1}^+ + \Omega_2^- EXCH_{t-1}^- + \Omega_3 lCPI_{t-1} + \Omega_4 lCAG_{t-1} + \Omega_5 lASPM_{t-1} + \sum_{j=0}^{p} \wedge_i \Delta lPM_{t-j} + \sum_{j=0}^{p} (\otimes_i^+ \Delta EXCH_{t-j}^+ + \otimes_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \bowtie_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \lambda_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \mathbb{\Gamma}_i \Delta lASPM_{t-j} + \mu_{t3} \quad (Equ. 3.4)$$

$$\Delta lGN_t = \mathbb{\Pi}_0 + \mathbb{\Pi}_1^+ EXCH_{t-1}^+ + \mathbb{\Pi}_2^- EXCH_{t-1}^- + \mathbb{\Pi}_3 lCPI_{t-1} + \mathbb{\Pi}_4 lCAG_{t-1} + \mathbb{\Pi}_5 lASGN_{t-1} + \sum_{j=0}^{p} \beth_i \Delta lGN_{t-j} + \sum_{j=0}^{p} (\daleth_i^+ \Delta EXCH_{t-j}^+ + \daleth_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \Im_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \gimel_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \lambda_i \Delta lASGN_{t-j} + \mu_{t4} \quad (Equ. 3.5)$$

$$\Delta lCS_t = D_0 + D_1^+ EXCH_{t-1}^+ + D_2^- EXCH_{t-1}^- + D_3 lCPI_{t-1} + D_4 lCAG_{t-1} + D_5 lASCS_{t-1} + \sum_{j=0}^{p} \mathcal{M}_i \Delta lCS_{t-j} + \sum_{j=0}^{p} (\mathfrak{Z}_i^+ \Delta EXCH_{t-j}^+ + \mathfrak{Z}_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \mathfrak{I}_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \mho_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \mathbb{R}_i \Delta lASCS_{t-j} + \mu_{t5} \quad (Equ. 3.6)$$

where CB denotes cocoa-beans output, RB is rubber output, PM is palm oil output, GN is ground-nut output and CS cotton seed. Furthermore, EXCH, CPI and CAG are as prior defined, while ASCB, ASRB, ASPM, ASGN and ASCS represents agricultural credit guaranty schemes for cocoa-beans, rubber, palm-oil, groundnut, and cottonseed respectively. Variables with positive (+) superscript signifies currency appreciation effects, and variables with negative (-) superscript signifies currency devaluation effects. For deriving the error correction version of Equations 3.2 to 3.6, we formulate the following equations.

$$\Delta lCB_t = \emptyset_{i1} ECM_{t-1} + \sum_{j=0}^{p} \rho_i \Delta lCB_{t-j} + \sum_{j=0}^{p} (\sigma_i^+ \Delta EXCH_{t-j}^+ + \sigma_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \tau_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \delta_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \pi_i \Delta lASCB_{t-j} + \mu_{t1} \quad (Equ. 3.7)$$

$$\Delta lRB_t = \emptyset_{i2} ECM_{t-1} + \sum_{j=0}^{p} \aleph_i \Delta lRB_{t-j} + \sum_{j=0}^{p} (\omega_i^+ \Delta EXCH_{t-j}^+ + \omega_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \beth_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \gamma_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \varphi_i \Delta lASRB_{t-j} + \mu_{t2} \quad (Equ. 3.8)$$

$$\Delta lPM_t = \emptyset_{i3} ECM_{t-1} + \sum_{j=0}^{p} \wedge_i \Delta lPM_{t-j} + \sum_{j=0}^{p} (\otimes_i^+ \Delta EXCH_{t-j}^+ + \otimes_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \bowtie_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \lambda_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \mathbb{\Gamma}_i \Delta lASPM_{t-j} + \mu_{t3} \quad (Equ. 3.9)$$

$$\Delta lGN_t = \emptyset_{i4} ECM_{t-1} + \sum_{j=0}^{p} \beta_i \Delta lGN_{t-j} + \sum_{j=0}^{p} (\gimel_i^+ \Delta EXCH_{t-j}^+ + \gimel_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \Im_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \daleth_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \lambda_i \Delta lASGN_{t-j} + \mu_{t4} \quad (Equ. 3.10)$$

$$\Delta lCS_t = \emptyset_{i5} ECM_{t-1} + \sum_{j=0}^{p} \mathcal{M}_i \Delta lCS_{t-j} + \sum_{j=0}^{p} (\beth_i^+ \Delta EXCH_{t-j}^+ + \beth_i^- \Delta EXCH_{t-j}^-) + \sum_{j=0}^{p} \Im_i \Delta lCPI_{t-j} + \sum_{j=0}^{p} \mho_i \Delta lCAG_{t-j} + \sum_{j=0}^{p} \mathbb{R}_i \Delta lASCS_{t-j} + \mu_{t5} \quad (Equ. 3.11)$$

Where the term "ECM" in Equation 7 represents the nonlinear error correction, which shows the long-run equilibrium in the asymmetric model. The parameter $\emptyset_i$ signifies the speed of adjustment term of the error-correcting process.

2

$$\Delta Yt=\delta Yt_{-1}+ut \quad \text{(Equ. 3.12)}$$

When series is with constant we have:

$$\Delta Yt=\alpha+\delta Yt_{-1}+ut \quad \text{(Equ.3.13)}$$

When series is with constant and trend, we then have the following:

$$\Delta Yt = \alpha + \beta T + \delta Yt_{-1}+ut \quad \text{(Equ.3.14)}$$

The Bounds cointegration test

The Bounds test for cointegration tests the null hypothesis that there is no cointegration between agricultural exportable commodities and the real exchange rate, after controlling for other factors, such as, the government capital spending on agriculture, the agricultural guarantee credit scheme fund loan, and inflation rate in the Nigerian context. To determine the presence or absence of cointegration, there is need to compare the computed F-statistic with the critical bound values, that is, I(0) bound (the lower bound) and I(1) bound (the upper bound) at any chosen level of significance. If the F-statistic is less than the I(0) critical value at any chosen level of significance, then there is no cointegration. However, if the F-statistic is greater than the I(1) critical value at any chosen level of significance, then there is cointegration. However, if the F-statistic lies between the I(0) and I(1) critical values at all levels of significance, then the test result is inconclusive.

NARDL short-run and long-run estimate

The existence of long-run relationship between the variables through the bounds approach, will give rise to short-run and long-run NARDL estimation between the dependent and independent variables. The method is appropriate if the order of the integration variable is mixed, that is I(0) and I(1) and if the sample size is small. Specifically, the NARDL will show the effects of both a devalued and appreciating EXCH on the selected agricultural commodities (cocoa-beans, rubber, palm-oil, groundnut and cottonseed). This effect comprises of both short-run and long-run effects. In addition, the NARDL like the conventional ARDL also reveals the speed of adjustment from short-run disequilibrium to long-run equilibrium.

4. RESULTS AND DISCUSSIONS

Presentation of Unit Root Test Results

Prior to the estimation of Equations 3.2 to 3.6, the characteristics of the data must be examined. Testing the stationarity of economic time series is crucial. For example, the ordinary least squares (OLS) estimation of regressions in the presence of non-stationary variables gives rise to spurious regressions if the variables are not co integrated (Gujarati, 1995).

Table 4.2: ADF unit root test

ADF						
	LEVEL			FIRST DIFFERENCE		
	With constant	With constant & trend	Without constant & trend	With constant	With constant & trend	Without constant & trend
Log(CB)	-2.047	-2.686	0.917	-8.916***	-5.893***	-8.873***
Log(RB)	-1.704	-1.754	1.032	-4.916***	-5.028***	-4.783***
Log(PM)	-2.027	-2.456	1.422	-4.732***	-4.725***	-4.486***
Log(GN)	-1.522	-2.011	1.951	-9.654***	-10.07***	-8.069***
Log(CS)	-2.140	-0.859	0.270	-6.115***	-6.385***	-6.186***

$EXCH^+$	-0.892	-1.712	2.391	-5.272***	-5.527***	-4.651***
$EXCH^-$	-0.577	-1.993	0.120	-3.775***	-3.770***	-3.599***
Log(CPI)	-2.207	-2.760	-0.707	-4.637***	-4.660***	-4.682***
Log(CAG)	-1.036	-4.460***	0.564	-10.03***	-9.886***	-10.02**
Log(ASCB)	-1.408	-3.865**	1.226	-8.378***	-8.291***	-7.911***
Log(ASRB)	-2.333	-3.650**	-0.533	-7.010***	-6.939***	-7.077***
Log(ASPM)	-1.719	-3.669**	0.280	-9.601***	-9.465***	-9.507***
Log(ASGN)	-0.623	-3.508*	2.597	-5.937***	-5.424***	-6.755***
Log(ASCS)	-3.372**	-3.406*	-0.153	-7.710***	-7.630***	-7.805***

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively.
Source: Author's Computation, 2022.

The result in Table 4.2 reveals that all the variables attain stationarity mainly at first difference. However, CAG, ASCB, ASRB, ASPM, ASGN and ASCS exhibited level stationarity only with constant and trend.

Table 4.4: Bounds tests

CB = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASCB)							
H_o: no level relationship				F = 4.331			
10%		5%		2.5%		1%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.08	3.0	2.39	3.38	2.7	3.73	3.06	4.15
RB = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASRB)							
H_o: no level relationship				F = 3.528			
10%		5%		2.5%		1%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.08	3.0	2.39	3.38	2.7	3.73	3.06	4.15
PM = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASPM)							
H_o: no level relationship				F = 6.091			
10%		5%		2.5%		1%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.08	3.0	2.39	3.38	2.7	3.73	3.06	4.15
GN = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASGN)							
H_o: no level relationship				F = 6.130			
10%		5%		2.5%		1%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.08	3.0	2.39	3.38	2.7	3.73	3.06	4.15
CS = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASCS)							
H_o: no level relationship				F = 4.855			
10%		5%		2.5%		1%	
I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
2.08	3.0	2.39	3.38	2.7	3.73	3.06	4.15

Source: Author's Computation, 2022.

Estimated NARDL Results

NARDL result for Equation 3.2

Table 4.5: NARDL result for Equation 3.2

CB = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASCB)			
Long-run result	Coefficient	Std. Err.	p-value
$EXCH^+$	0.0000168	0.001	0.870
$EXCH^-$	0.030	0.016	0.075*
Log(CPI)	-0.204	0.098	0.046**
Log(CAG)	0.042	0.065	0.525
Log(ASCB)	0.112	0.054	0.051*

Short-run result			
ECM	-0.560	0.092	0.000***
D($EXCH^+$)	-0.002	0.001	0.078*
Dlog(CPI)	0.052	0.069	0.459
Dlog(ASCB)	0.008	0.018	0.668
Constant	12.718	0.682	0.000***
R-sqd	0.568		
Adj. R-sqd	0.528		

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively, and D is the short-term difference indicator.
Source: Author's Computation, 2022.

Table 4.5 reveals that currency appreciation ($EXCH^+$) has no significant effect on cocoa-beans output in the long-term. However, in the short-term, the result shows that a unit appreciation of the currency will produce a significant decline in cocoa-bean output for export by 0.002 unit. This result is consistent with a priori expectations since as the value of the local currency appreciates against the dollar, exporters of cocoa beans will receive less value for the export in naira terms. On the other hand, a unit fall in the value of the local currency ($EXCH^-$) will cause a significant 0.03 unit rise in the volume of cocoa-beans in the long-run.

The inflation measure (CPI) is found to have a significant effect on cocoa-beans. A unit rise in the level of inflation will translate to a 0.2-unit decline in cocoa-beans output in the long-term. Inflation erodes the value of money, hence, the cost of producing cocoa-beans is expected to rise with inflation. The implication of high production cost is a reduction in the quantity of cocoa-beans produced. Capital expenditure is found not to have a substantial impact on cocoa-beans either in the long-term or short-term. The agricultural credit granted to cocoa-beans farmers shows positive effect on the output of the product in the long-term. A unit rise in the value of the credit will result in an increase in cocoa-bean output by 0.1 unit in the long-term. This result shows that credit opportunities to cocoa-beans farmers has been impactful in improving the quantity of the product.

The error correcting mechanism (ECM) is rightly signed and significant. The coefficient of the ECM factor shows that the speed of adjustment from short-run disequilibrium to long-run equilibrium is 0.56 (56% per annum). The output suggests that in the event of short-run distortion, long-run equilibrium can be restored within 20 months after the disequilibrium.

Table 4.6: NARDL result for Equation 3.3

RB = f($EXCH^+$, $EXCH^-$, CPI, CAG, ASRB)			
Long-run result	Coefficient	Std. Err.	p-value
$EXCH^+$	0.0004	0.001	0.633
$EXCH^-$	-0.014	0.013	0.266
Log(CPI)	-0.319	0.080	0.0005***
Log(CAG)	0.077	0.069	0.271
Log(ASRB)	-0.035	0.031	0.262
Short-run result			
ECM	-0.445	0.081	0.000***
Dlog(RB(-1))	0.491	0.126	0.001***
Dlog(CPI)	0.065	0.051	0.213

Dlog(CAG)	-0.009	0.018	0.612
Constant	13.020	0.414	0.000***
R-sqd	0.511		
Adj. R-sqd	0.467		

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively, and D is the short-term difference indicator.
Source: Author's Computation, 2022 with the aid of E-view 9.

NARDL result for Equation 3.3

Table 4.6 submits that currency devaluation and appreciation do not have significant effect on rubber output either in the short-run or long-run. Therefore, suggesting the ineffectiveness of exchange rate policy on rubber output in Nigeria. In contrast, inflation is found to have a significant adverse effect on rubber output. A unit rise in the level of inflation would translate to 0.32 unit decline in rubber output in the long run. The implication of this result is that if inflation rises in the economy, cost of rubber production will also rise, which will reduce the quantity of the product being produced in the long run. Capital expenditure and credit granted to rubber farmers are found not to have substantial impact on rubber output in the long and short term.

The error correcting mechanism (ECM) is rightly signed and significant. The coefficient of the ECM factor shows that the speed of adjustment from short-run disequilibrium to long-run equilibrium is 0.45 (45% per annum). The output suggests that in the event of short-run distortion, long-run equilibrium can be restored within 26 months after the disequilibrium.

Table 4.7: NARDL result for Equation 3.4

PM = f(EXCH$^+$, EXCH$^-$, CPI, CAG, ASPM)			
Long-run result	Coefficient	Std. Err.	p-value
EXCH$^+$	0.003	0.001	0.023**
EXCH$^-$	0.027	0.016	0.099*
Log(CPI)	-0.113	0.073	0.131
Log(CAG)	-0.021	0.056	0.715
Log(ASPM)	-0.022	0.044	0.620
Short-run result			
ECM	-0.239	0.033	0.000***
D(EXCH$^-$)	-0.016	0.006	0.018**
D(EXCH$^-$(-1))	-0.018	0.006	0.121
Dlog(ASPM)	-0.009	0.006	0.121
Dlog(ASPM(-1))	0.015	0.006	0.015**
Constant	14.262	0.509	0.000***
R-sqd	0.645		
Adj. R-sqd	0.599		

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively, and D is the short-term difference indicator.
Source: Author's Computation, 2022 with the aid of E-view 9.

NARDL result for Equation 3.4

Table 4.7 reveals that currency devaluation has significant effect on palm-oil output export in the long-term, however, the effect is minute. The result reveals that currency devaluation by a unit will produce a significant rise in palm-oil export by 0.027 unit. This outcome is equally in line with a priori expectation given that devaluation of the local currency makes exportation more rewarding. On the other hand, a unit rise in currency appreciation will result in 0.03 unit rise in the volume of palm-oil in the long-run. As the currency appreciates in value, so also does the profit accruable from palm-oil production for those who produce for local consumption, currency appreciation however discourages export. In the short-run, currency devaluation has no significant relationship with palm oil export in Nigeria. But currency appreciation has a significant negative relationship with palm oil export in Nigeria. This result with is consistent with economic postulation indicates that a unit rise in currency appreciation will cause a fall in palm-oil export by 0.016 unit.

Inflation, capital expenditure on agriculture and credit granted to palm-oil famers show no substantial impact on palm oil output in the long-run. Agricultural credit to palm oil farmers shows a significant effect in the short-term. A unit rise in the credit translates to a 0.02 unit increase in palm-oil output in the short-term. Thus, suggesting that credit facilities to oil-palm farmers can aid output growth in the short-term through the purchase of production facilities.

The error correcting mechanism (ECM) is rightly signed and significant. The coefficient of the ECM factor shows that the speed of adjustment from short-run disequilibrium to long-run equilibrium is 0.24 (24% per annum). The output suggests that in the event of short-run distortion, long-run equilibrium can be restored within 50 months after the disequilibrium.

Table 4.8: NARDL result for Equation 3.5

GN = f(EXCH$^+$, EXCH$^-$, CPI, CAG, ASGN)			
Long-run result	Coefficient	Std. Err.	p-value
EXCH$^+$	0.001	0.001	0.678
EXCH$^-$	0.058	0.017	0.003***
Log(CPI)	0.410	0.200	0.052*
Log(CAG)	0.118	0.111	0.298
Log(ASGN)	0.445	3.513	0.002***
Short-run result			
ECM	-0.352	0.047	0.000***
D(EXCH$^+$)	0.002	0.001	0.011**
D(EXCH$^+$(-1))	0.002	0.001	0.009***
Dlog(CAG)	0.001	0.017	0.942
Dlog(ASGN)	0.058	0.016	0.002***
Constant	9.009	1.558	0.000***
R-sqd	0.715		
Adj. R-sqd	0.655		

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively, and D is the short-term difference indicator.

Source: Author's Computation, 2022 with the aid of E-view 9.

NARDL result for Equation 3.5

Table 4.8 shows that currency appreciation has no significant effect on the export of groundnut in the long-term. Thus, indicating the ineffectiveness of currency devaluation policy on groundnut produce

in the long term in Nigeria. However, the short-run effect is statistically significant but minute in magnitude. The short-run result indicates that currency appreciation by a unit will produce a minute rise in groundnut export by 0.002 unit. On the other hand, the long-term effect of currency appreciation is significant. A unit rise in currency appreciation will result in 0.1 unit rise in the volume of groundnut in the long run. Improvement in the value of the currency means improve profit for ground-nut farmers. Hence, output is expected to rise with currency appreciation.

Similarly, a unit rise in inflation will create an increase in ground-nut output by 0.4 unit. One explanation from this outcome stem from the role of middlemen in the ground-nut production chain. A common practice of amongst these middlemen is to store up groundnuts, only to sell when the market price for the product is rising. Capital expenditure on agriculture and credit granted to ground-nut famer's show no substantial impact on ground-nut output in the long-run. Agricultural credit to ground-nut farmers shows a significant effect in the short-term. A unit rise in the credit will translate to 0.1 unit increase in ground-nut output in the short-term. This result is plausible since increase in credit to ground-nut farmers will aid the procurement of farm tools needed to boost output.

The error correcting mechanism (ECM) is rightly signed and significant. The coefficient of the ECM factor shows that the speed of adjustment from short-run disequilibrium to long-run equilibrium is 0.35 (35% per annum). The output suggests that in the event of short-run distortion, long-run equilibrium can be restored within 33 months after the disequilibrium.

Table 4.9: NARDL result for Equation 3.6

CS = f(EXCH$^+$, EXCH$^-$, CPI, CAG, ASCS)			
Long-run result	Coefficient	Std. Err.	p-value
EXCH$^+$	-0.003	0.003	0.194
EXCH$^-$	0.036	0.031	0.255
Log(CPI)	-0.901	0.252	0.001***
Log(CAG)	-0.537	0.272	0.059*
Log(ASCS)	0.171	0.131	0.202
Short-run result			
ECM	-0.367	0.057	0.000***
D(EXCH$^-$)	-0.049	0.027	0.074*
Dlog(CAG)	0.014	0.036	0.699
Dlog(CAG(-1))	-0.115	0.037	0.004***
Constant	13.701	1.555	0.000***
R-sqd.	0.574		
Adj. R-sqd.	0.535		

Note: *, **, and *** indicate significance at 10%, 5% and 1% respectively, and D is the short-term difference indicator.

Source: Author's Computation,2022 with the aid of E-view 9.

Lastly, the effect of currency fluctuation on cotton-seed export in Nigeria during the study period was not significant. However, in the short-run, the effect of currency depreciation on cotton-seed's export was statistically significant. This is to say that cotton seed export in Nigeria was abandoned in the later years. Inflation revealed an adverse long-term effect on cotton-seed output. A unit rise in inflation will create a fall in cotton-seed output by 0.9 unit. As previously posited, inflation erodes the value of money, which drive upward the cost of production, and by implication reduces the quantity of cottonseed that can be produced.

Similarly, capital expenditure on agriculture has a substantial negative effect on cotton-seed output in the long-run. Evidence from Table 4.9 shows that a unit rise in capital expenditure on agriculture will lead to a 0.5 unit decline in cotton-seed output in the long-term. A similar effect is also revealed in the short-run, as a unit rise in capital expenditure on agriculture will yield a 0.1 unit decline in cotton-seed output in the short-run. This could imply that government capital spending on agricultural machinery and other capital equipment do not promote cotton-seed output. It is not unlikely that such capital investments are being channelled into other agricultural sub-sectors. Consequently, cotton-seed production in the long-run and short-run declines due to the ineffectiveness of capital expenditure in the agricultural sector. Agricultural credit to cotton-seed farmers is revealed not have significant effect on cotton-seed output in the long-run. Inadequacy of credit facilities to cotton-seed farmers could be responsible for this result.

4.4.6 Residual Test

Table 4.10: Residual Diagnostic Test

Test	Equation 3.2	Equation 3.3	Equation 3.4	Equation 4.5	Equation 4.6
Normality: Jarque-Bera values	6.55	0.773	0.846	0.326	0.176
Serial Correlation: Obs. R-squared	3.261	11.631	4.548	1.879	7.20
Heteroscedasticity: Obs. R-squared	1.532	1.167	0.245	0.116	0.691

Source: Author's Estimated Result, 2022.

Table 4.10 shows the result of the residual tests conducted, namely, the Jarque-Bera normality test, Breusch-Godfrey higher-order serial correlation test, and the heteroscedasticity test using the autoregressive conditional heteroscedasticity (ARCH) process. The normality test results on the residuals of Equation 3.2 to 3.6 are revealed to be insignificant either at the 1%, 5% or 10% significance level. Hence, indicating the validation of the null hypothesis that the residuals are normally distributed. Similarly, the higher-order serial correlation test on the residuals of the Equations supports the validation of the null hypothesis of no serial correlation. This conclusion is based on the insignificant value of the observed R-squared value for the Breusch-Godfrey serial correlation test either at the 1%, 5% or 10% significance level. Furthermore, the heteroscedasticity test on the residuals of the study's equations supports the null hypothesis of residual homoscedasticity. This conclusion is also based on the insignificant value of the observed R-squared for the heteroscedasticity test, either at the 1%, 5% or 10% significance level.

Furthermore, a stability test on the residuals of Equation 3.2 to 3.6 was conducted using the cumulative sum (CUMSUM) and cumulative sum square (CUMSUMSQ). The result presented in Figure 1 (see appendix 6) shows the output for each equation. From each Equation's CUMSUM and CUMSUMSQ graph, we can conclude that the residuals are stable within the study period, as they do not deviate out of the 5% significance line.

5 DISCUSSIONS OF FINDINGS

The degree of impact of the independent variables and their significance to the economy was tested with the NARDL estimation procedure. As illustrated earlier, one of the merits of the NARDL analytical technique is that it furnishes robust estimates of both the short and long run results.

One of the major findings uncovered by this study is that currency appreciation ($EXCH^{+}$) insignificantly impacted on cocoa-beans export in the long-run. However, in the short-term, the result shows that appreciation of the currency produced a significant decline in cocoa-bean export. This result

is consistent with a priori expectations since as the value of the local currency appreciates against the dollar, exporters of cocoa beans will receive less value for the export in naira terms. The result corroborates the findings of Essien et al. (2011), Obayelu and Salau (2010) who in their different studies also found that exchange rate volatility significantly affects the export of cocoa in Nigeria.

The result has also shown a significant relationship between inflation and cocoa export in Nigeria. In which case rising inflation which erodes the value of money, or increases the cost of producing cocoa-beans becomes a major setback to cocoa exportation. In fact one of the major challenges farmers of cocoa beans face in Nigeria is lack of finance or capital which has caused its exportation to remain low. It becomes imperative for these farmers to be able to access credit for increased output, since the result has also shows that credit opportunities to cocoa-beans farmers had a significant impact on the quantity of cocoa bean produced.

Another important finding uncovered by this work is that while currency devaluation impacted significantly on palm-oil export in the long-term, neither currency devaluation nor appreciation had no significant effect on rubber output in Nigeria. This suggests the ineffectiveness of exchange rate policy on rubber export in Nigeria. This results stands in contrast to the findings of Nse- Nelson et al (2020) that found that devaluation of naira favoured rubber exports despite the increase in domestic utilization of this cash crop. Nevertheless, Nse- Nelson et al (2020) acquiesced to the fact that domestic utilization of the product is an important determinant of the level of rubber export. Likewise, David and Oluseyi, (2017) also found contrasting outcome, but equally noted that despite the diverse benefits of currency devaluation, its benefits can only be accessed when there is improvement in the production of goods and services for both domestic consumption and export purposes.

Inflation on the other hand was found to have a significant adverse effect on rubber output. Meaning that as inflation rises, the cost of rubber production will also rise, which will reduce the quantity of the product being produced in the long run. Capital expenditure and credit granted to rubber farmers are found not to have substantial impact on rubber output in the long and short term because of the limited credit available to farmers in Nigeria

The effect of currency devaluation on groundnut export was significant and positive in the long run. This finding aligns with the study by Essien et al. (2011); Oyinbo et al. (2014); Oye et al. (2018); Obiageli (2020); DAVID et.al (2023) and Oketooyin et al. (2020), who all noted that currency devaluation encourages export of agricultural products. On the other hand, the effect of currency fluctuations on cotton-seed export in Nigeria was insignificant in the long-term. However, in the short-run, the effect of currency depreciation on cotton-seed export was statistically significant but negative. This result negates a priori expectation because as the naira depreciates relative to the dollar, farmers of cotton seed who produce for export would be encouraged to produce more so they could make huge foreign exchange. Inflation and capital expenditure on agriculture is revealed to have an adverse effect on cotton-seed output. But while the negative effect of rising inflation is consistent with economic principles that of expenditure on agriculture is an aberration. The reason for its negative effects stems from the fact that capital spending on agricultural machinery and cotton-seed production has been abysmal over the years.

6 RECOMMENDATIONS

Based on the findings of this study, the following policy options could be found useful.

Considering the relationship between currency fluctuations and output of agricultural commodities, it is recommended that the Nigerian government adopt a more rigorous export promotion strategy as suggested by Okeowo (2023) with direct bearing on improving the competitiveness of such goods, especially as the economy tries to break away from oil export dominance. In other words, enhancing the competitiveness of the agricultural sector could boost the current dwindling revenue base of the government which is predominantly oil determined.

Improved access to loans should strongly be advocated so as to enhance improved value chain of some of these high valued exportable. This would entrench improved competitiveness of our exportable while at same time minimized global exchange rate shocks.

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