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Nexus between real effective exchange rate misalignment and rubber export in Nigeria

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Abstract

Purpose — This study examines the nexus between the real effective exchange rate misalignment (REERM) and rubber exports in Nigeria. The effects of equilibrium real exchange rate (ERER) and some economic fundamentals on rubber exports are also investigated.

Methods — Johansen cointegration, vector error correction model and Granger causality test are employed as methods of data analysis.

Findings — The results show that a long-run relationship exists between REERM and rubber export. REERM influenced rubber export negatively while ERER had a positive effect on rubber export. The past values of REERM can be used to predict the present volume of rubber export, and the past values of ERER and rubber export can be used to forecast the present values of each other. Trade openness positively influences rubber export while the term of trade has a negative effect on rubber export.

Implication — REERM worsens the performance of rubber export in Nigeria while ERER improves its performance. Thus, rubber export can be enhanced through measures such as trade openness, improved term of trade and monitoring of exchange rate to reduce the REERM and maintain a stabilized equilibrium exchange rate system.

Originality — This study focuses on the effect of deviation of the exchange rate from equilibrium, ERER and economic fundamentals on rubber export which has not been previously investigated.

Keywords — exchange rate misalignments, equilibrium real exchange rate, rubber export, trade openness.

Introduction

The nexus between agricultural export and exchange rate is an important issue, this is because the exchange rate determines the volume and worth of agricultural export in any nation. In developing nations, the management of exchange rate has always been at the centre of policy debate on topics such as macroeconomic stabilisation, promotion of export and economic development (Atingi-Ego & Sebudde, 2004; Essien, Uyaebo, & Omotosho, 2017). It has remained among the most closely watched economic indicators by policymakers, industries and financial market participants involved in international trade (Khomo & Aziakpono, 2020). Foreign exchange policies affect economic activities and determine the course of macroeconomic variables in a country to a large extent. Globally, the importance and role of the exchange rate on international agricultural trade have been recognized by researchers over time (Alegwu, Aye, & Asogwa, 2018; Awe, Akinlana, Yaya, & Aromolaran, 2018). In Nigeria, the exchange rate is one of the main drivers of agricultural

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export levels and economic strength. Its role in the scale of trade cannot be overemphasised because it influences export and import, reduces income purchasing power and influences other income factors (Güzel & Arslan, 2019; Nwachukwu, Adebayo, Shettima, Anigwe, & Udechukwu-Peterclaver, 2016).

The real effective exchange rate (REER) has traditionally performed a major role in economic growth and monetary policy in Nigeria due to its key impact on the country's international trade. For this purpose, the Central Bank of Nigeria had engaged in fixed and flexible exchange rate adjustment policies on several occasions for the attainment of its stability (Ajao & Igbekoyi, 2013). The REER is a measure of competitiveness in international trade and a major macroeconomic relative price. It determined the volume of the export sector globally and performs a vital role in spending and production resource allocation behaviour in the economy. It is as a result of these roles that the International Monetary Fund (IMF) encouraged developing and emerging economies to maintain their REER close to its equilibrium. Maintaining the REER around its equilibrium will also prevent a nation from banking and currencies crisis. Thus, effective exchange rate management requires that policymakers understand a vital reference value known as equilibrium real exchange rate (ERER) (Ali, Ajibola, Omotosho, Adetoba, & Adeleke, 2015).

The ERER is the value of REER consistent with the simultaneous attainment of both external and internal equilibrium (Essien et al., 2017). The deviation of actual REER from its equilibrium values is the real effective exchange rate misalignment. Misalignment in REER could either be overvalued or undervalued, any of these have implications on the trade and economy of a nation as a whole. The failure of REER to perform the role of allocative and provide adequate signals to direct resource allocation resulted in REERM (Edwards, 1988). There are at least two possible ways through which REERM might affect economic growth. Firstly, they could affect both foreign and domestic investment which further affects the accumulation of capital. On the other hand, REERM could influence the tradable sector and its competitiveness in the global market (Razin & Collins, 1997). Thus, the real exchange rate misalignment creates serious distortions and affects several sectors of an economy negatively. For instance, exchange rate misalignments in the form of overvalued domestic currency serve as a tax on prices of traded commodities globally, especially the developing countries which export primary products.

African countries are known for the production and exportation of primary goods which has performed a crucial role in Africa economy (Alegwu et al., 2018). Thus, the most important single activity for African nations is still the agricultural sector (Amoro & Shen, 2013). Agriculture serves as a major engine for the growing economy in middle-income countries (Güzel & Akin, 2021). The role of agricultural commodity trade in developing Africa's economy is prominent as a supplier of raw materials to many western countries (Nwachukwu et al., 2016). In Nigeria, the role of the agricultural sector is very vital as it employs over 70 per cent of the labour force and contributes significantly to the GDP (Obetta, Achike, Mukaila, & Taru, 2020). Prior to the oil discovery in Nigeria in the 1960s, rubber is one of the major cash crops in the country which was exported to others countries and served as means of foreign exchange rate earnings. In the 1960s and early 1970s, it contributed immensely to the Gross Domestic Product of Nigeria in conjunction with other cash crops such as cocoa, oil palm and groundnut. Agricultural sector contributions to GDP in Nigeria have reduced due to a decline in agricultural exports as a result of crude oil export which replaced agricultural exports. Though, recently, the country is striving to diversify its economy back to agriculture and finding ways of improving and transforming the agricultural sector. To achieve effective economic diversification, improve and transform the agricultural sector, effective management of the exchange rate is needed. This is because an effective exchange rate will play a competitive role for agricultural export in the world market. The extent to which maintaining the exchange rate at its equilibrium value and how exchange rate misalignments affect agricultural export has not gained much attention, especially in Nigeria.

Most studies on the nexus between exchange rate and agricultural export concentrated on the exchange rate volatility without examining the effect of maintaining the REER at equilibrium and its departure from equilibrium value on the agricultural export performance (e.g., A. Adaramola, 2016; Alegwu et al., 2018; Gatawa & A., 2017; Huchet-Bourdon & Korinek, 2011).

Also, past studies on ERER and REERM did not investigate its effect on agricultural trade performance (e.g., Barbosa, Jayme, & Missio, 2018; Elbadawi, Kaltani, & Soto, 2012; Essien et al., 2017; Gan, Ward, Ting, & Cohen, 2013; Khomo & Aziakpono, 2020; Libman, 2018; Mahraddika, 2020; Nouira & Sekkat, 2015; Nwachukwu et al., 2016; Palić, Dumičić, & Šprajaček, 2014; Saadaoui, Mazier, & Aflouk, 2013; Udah & Ite, 2016)

Alegwu et al. (2018) investigated the effects of exchange rate fluctuation or volatility on agricultural export in Nigeria using the vector error correction model (VECM). The study revealed that exchange rate volatility affected agricultural exports negatively. Gatawa and Mahmud (2017) also examined the effect of exchange rate volatility on crop export using GARCH and ARDL. They also reported that the exchange rate volatility hurt crop export volume. In the same vein, Adaramola (2016) examined the effect of the volatility of the exchange rate on Nigeria agricultural export. This study used the GARCH, ARCH, error correction model, co-integration and Johansen Multivariate as methods of data analysis. The study revealed that the exchange rate was volatile and had a positive effect on trade. Huchet-Bourdon and Korinek (2011) also examined the effect of exchange rate volatility on trade flows in the United States, China and the Eurozone in the manufacturing and mining sector and agricultural sector. They found that currency volatility affected the trade flows in the sectors investigated in the countries.

Khomo and Aziakpono (2020) examined the level of South African exchange rate misalignment following the behavioural equilibrium exchange rate (BEER) approach. They employed a cointegration technique and a Markov regime-switching method. They discovered that the South Africa exchange rate was misaligned. Essien et al. (2017) and Nwachukwu et al. (2016) also used the BEER to compute the ERER and REERM in Nigeria. The study revealed that Nigeria exchange rate was misaligned with episodes of undervaluation and overvaluation. Saadaoui et al. (2013) identified the drivers of exchange rate misalignment using the fundamental equilibrium exchange rate approach. Their study revealed that regional specialization, trade openness and financial openness are the drivers of misalignment of the exchange. The reviewed literature revealed that the past studies did not examine either the effect of REERM or ERER on agricultural export. There is thus a need to compute the ERER and REERM and examined their effect on agricultural export performance in Nigeria using rubber export as a case study.

Upon this background, this study was poised to compute the ERER and REERM, and investigate their effect on the performance of rubber export in Nigeria. The effect of some economic fundamental variables, such as trade openness, term of trade, capital inflows and government expenditure on rubber export were also investigated. The effects they have on agricultural export can transpose to other tradeable sectors of the economy. Also, the effects they have on Nigeria agricultural export performance can be related to other developing countries and emerging markets that are homogenous and engaged in exporting primary produce.

The organization of this paper is as follows: The next section explained the methodology used which includes a brief description of the study area, data source, econometric procedures, and model specifications. Section 3 presents the results and discussion of the study. The last section draws conclusions and policy implications.

Methods

The study was carried out in Nigeria. Nigeria is Africa's most populous nation with a population of over 202 million and a total area of 923.768km^2 landmass (World Bank, 2019). The majority of the population engaged in agricultural activities. Rubber is one of the cash crops grown and exported in Nigeria.

This study employed annual time-series secondary data covering 1980-2019 (that is thirty-nine years). The data on rubber exports and REER were sourced from the Food and Agriculture Organization and the International Financial Statistics database of IMF, respectively. Data on trade openness index, capital inflows, term of trade and government expenditure were sourced from the World Bank database. All the series were transformed into natural logarithms to stabilize the variance of the series.

Estimation of The Equilibrium Real Exchange Rate and Exchange Rate Misalignment

To model the ERER, the study was based on the BEER approach. This model was enunciated by Edwards (1988), also used by Gan et al. (2013), Montiel (1997), and Khomo and Aziakpono (2020). This model was used because it is most appropriate and widely used in developing nations. It involves the use of some economic fundamental variables, such as trade openness, government expenditure, capital inflows and terms of trade, affecting the ERER to model the equilibrium path of the exchange rate. To estimate a reduced form REER, the economic fundamentals were regressed against the REER. Before estimation of the reduced form REER, the study computed long-run sustainable or normal values for the economic fundamentals by decomposing the fundamental variables into transitory and permanent components.
The reduced form REER is thus specified as:

$$REER = a + \beta_1 TOP + \beta_2 TOT + \beta_3 FLOWS + \beta_4 GE + \varepsilon_t \quad (1)$$

Where TOP is trade openness, TOT is the term of trade, FLOWS is capital inflows, GE is government expenditure, β_1 to β_4 are their corresponding coefficients and ε_t is the error term.

The permanent components of the fundamental variables and the estimated regression coefficients, β_i, were used to construct the equilibrium path for the REER. Thus,

$$ERER = \beta_i xp_{it} \quad (2)$$

Where β_i are the coefficient of the fundamental variables and xp_{it} is the permanent component of the economic fundamentals.

After the estimation of the ERER, the real effective exchange rate misalignment was estimated which is the difference, at any moment in time, between the ERER and the actual REER.

$$REERM = ERER - REER \quad (3)$$

If ERER is greater than REER, it implies currency overvaluation; On the other hand, if ERER is less than REER, the currency is undervalued. In another word, a positive value of REERM implies overvaluation of the exchange rate while a negative REERM implies undervaluation of the exchange rate. A zero value of REERM implies that the exchange rate is at equilibrium.

Description of The Economic Fundamental Variables

Government expenditure measured the national expenditure within a year and serves as a proxy for demand pressure in an economy. It, however, contains a higher non-tradable component than the total domestic spending. Thus, an increase in government spending will exert an increase in non-tradable prices and result in real exchange rate appreciation (Edwards, 1989). When government spending is channelled to tradable imports such as capital equipment, it would result in exchange rate depreciation (Goldfajn & Valdés, 1999).

Term of trade is the price of a country's exports relative to imports. It has effects on real effective exchange rates due to substitution effects and income. An increase in income due to improved terms of trade result in high non-tradable demand which causes REER appreciation. Meanwhile, if the substitution effect is higher than the income effect, there would be a depreciation of REER (Edwards, 1989).

Trade openness reflects trade liberation. This is because it measures the level at which a nation is connected to the world. It is calculated by adding a country's total export plus import and divide by the GDP. The extent of trade openness affects the REER, volume and price of export and imports (Khomo & Aziakpono, 2020). The effect of trade openness on the REER depends on export and import volume. When the substitute effect is greater than the income effect, under the assumption that non-tradable and tradable are substitutes, the REER will have a positive relationship with trade openness (Edwards, 1989). Thus, an increase in trade openness will increase

tradable goods demand which will, in turn, require depreciation of exchange rate to shift the demand from tradeable goods to non-tradable goods.

The capital inflow to a country reflects the nation's external position. A continuous increase in capital inflows will improve the nation's net capital position which will, in turn, appreciate the exchange rate over time.

Econometric Procedures

A stationary series is a key term in analysing a time series (Ahmed, Rostam, & Mohammed, 2020). Before using time-series data, it is necessary to ascertain the level of stationarity of the series to employ an appropriate analysis model and to avoid spurious regression. This would also allow us to understand the order of integration, behaviour, and nature of the series. The Augmented Dickey-Fuller (ADF) and Philips-Perron tests were, therefore, used to test the stationarity of the variables. Philips-Perron was used to confirm and supplement the results of the ADF test because the ADF test may not identify non-stationary when there is a structural break in the series (Perron, 2006).

After ascertaining the unit root property of the series, the study proceeded to test for the long-run relationships among the variables. Based on the unit root property of the series which revealed that the series are integration of order 1, the Johansen cointegration test was employed. This was because the Johansen cointegration test can effectively test for the existence of long-run relationships among variables of the same order. The appropriate lag length was selected based on the Schwarz information criterion (SIC) and the Akaike information criterion (AIC). The criterion for lag length selection was AIC because it has the least value. Due to the nature of series, annual time series, to avoid losing the degree of freedom, the maximum lag length selected was 2. Wooldridge (2013) stated that annual time series have a small lag typically between 1 and 2 not to lose degree of freedom. The final lag length selected was 1 because it has the least AIC value.

Vector Error Correction Model (VECM)

To estimate the causal effect and the time it will take rubber export to converge to its equilibrium value as a result of shocks to the system, the vector error correction equation was employed. VECM was used because the series indicate the existence of a long-run relationship. This was specified for the case of a cointegration relationship among the variables, i.e., rubber export, ERER, REER, government expenditure, trade openness, term of trade and capital inflow:

$$\Delta lRE_t = \alpha_1 + \sum_{i=1}^{p} \beta_i \, \Delta lRE_{t-1} + \sum_{i=1}^{p} y_i \, \Delta lREERM_{t-1} + \sum_{i=1}^{p} \theta_i \, \Delta lTOT_{t-1} + \sum_{i=1}^{p} \delta_i \, \Delta lTOP_{t-1} + \sum_{i=1}^{p} \emptyset_i \, \Delta lFLOW_{t-1} + \sum_{i=1}^{p} \vartheta_i \, \Delta lGE_{t-1} + \sum_{i=1}^{p} y_i \, \Delta lERER_{t-1} + \varphi_1 \mu_{t-i} + \varepsilon_{1t} \quad (4)$$

Where RE is rubber export, Δ is difference operator, *l* is *the* natural logarithm, φ_i is the speed of adjustment, μ_{t-i} is the error correction term, ε_{1t} and ε_{2t} are the error or random term. Other variables as previously defined

Granger Causality Test

Granger (1969) proposed the Granger causality test to examine the causal relationships between variables and to know the direction of causality. This has been widely accepted and used by financial analysts and economists to test plausible economic relationships between variables (Awe et al., 2018). Variable Y is Granger causing X if Y can predict X using all available information. On the other hand, variable X granger cause Y if the past and current values of X facilitate the prediction of Y when used with the past value of Y as compared with when only past values of Y are used (Granger, 1969).

To explore the causality between REERM and rubber export, and ERER and rubber export, the bivariate Granger causality test was used. It further provides the direction of causality between REERM and rubber export, ERER and rubber export. The study employed the bivariate Granger causality test to capture the major variables of interest. The Granger causality between rubber export and REERM was specified as:

$$\Delta \mathrm{l}\,(RE)_t = \alpha_1 + \sum_{i=1}^{n} \beta_i\, \Delta \mathrm{l}(RE)_{t-i} + \sum_{i=1}^{m} \delta_j\, \Delta \mathrm{l}(REERM)_{t-j} + r_1(EC_1)_{t-1} + \varepsilon_t \quad (5)$$

$$\Delta \mathrm{l}(REERM)_t = \alpha_2 + \sum_{i=1}^{n} c_i\, \Delta \mathrm{l}(REERM)_{t-i} + \sum_{i=1}^{m} g_j\, \Delta \mathrm{l}\,(RE)_{t-j} + r_2(EC_2)_{t-1} + \mu_t \quad (6)$$

The Granger causality between rubber export and ERER was specified as:

$$\Delta \mathrm{l}\,(RE)_t = \alpha_1 + \sum_{i=1}^{n} \beta_i\, \Delta \mathrm{l}(RE)_{t-i} + \sum_{i=1}^{m} \delta_j\, \Delta \mathrm{l}(ERER)_{t-j} + r_1(EC_1)_{t-1} + \varepsilon_t \quad (7)$$

$$\Delta \mathrm{l}(ERER)_t = \alpha_2 + \sum_{i=1}^{n} c_i\, \Delta \mathrm{l}\,(ERER)_{t-i} + \sum_{i=1}^{m} g_j\, \Delta \ln\,(RE)_{t-j} + r_2(EC_2)_{t-1} + \mu_t \quad (8)$$

Where α_1 and α_2 are intercept, β_i, δ_i, g_i, and c_i are coefficient, $(EC_1)_{t-1}$ and $(EC_2)_{t-1}$ are error correction terms that represent the lag residuals from the co-integration equations, *n* and *m* are numbers of lag lengths chosen by AIC, and ε_t and μ_t are error term. Other variables as previously defined.

Results and Discussion

Table 1 presents the results of Augmented Dickey-Fuller and Philips-Perron tests used to examine the unit root properties of the series. As shown from the result, all the variables included in the model were not stationary at their level form, but the series became stationary after the first difference. These suggest that the variables (rubber export, ERER, REER, REERM, government expenditure, trade openness, term of trade and capital inflows) are integrated of order one, that is I(1). To investigate the long-run relationship among these variables of the same order, the Johansen cointegration test became appropriate for these variables.

Table 1. Unit roots test results

Variables	Augmented Dickey-Fuller		Philips-Perron	
	Level	First Difference	Level	First Difference
RE	-2.165	-6.753***	-2.257	-6.754***
	(0.222)	(0.000)	(0.190)	(0.000)
FLOW	-1.573	-11.384***	-2.554	-11.702***
	(0.488)	(0.000)	(0.110)	(0.000)
GE	-0.584	-6.071***	-0.883	-6.222***
	(0.862)	(0.000)	(0.790)	(0.000)
REERM	-2.381	-4.729***	-2.381	-4.627***
	(0.153)	(0.001)	(0.153)	(0.005)
REER	-2.344	-5.188***	-1.823	-5.095***
	(0.163)	(0.000)	(0.365)	(0.000)
ERER	-1.429	-3.666***	-1.353	-3.650***
	(0.560)	(0.008)	(0.597)	(0.008)
TOT	-2.063	-7.081***	-2.070	-7.217***
	(0.260)	(0.000)	(0.258)	(0.000)
TOP	-2.197	-8.238***	-2.296	-8.108***
	(0.210)	(0.000)	(0.178)	(0.000)

*** denotes stationarity at the first difference (at 1% significant level). Probability values of test statistics are in parenthesis.
Source: Author's computation

Long-run nexus between real effective exchange rate and rubber exports

After performing the unit root tests, the Johansen cointegration test was performed due to the nature of the variables which were stationary at first different. The cointegration test results for the variables were presented in Table 2 for Maximal eigen and Trace statistics. The cointegration test result for the variables revealed that co-integration (long-run relationship) exists among rubber export, ERER, REERM, trade openness, term of trade, government expenditure and capital inflows. This was indicated by the value of Trace statistics (159.354) which was higher than the critical value (125.615) at a 5% level of significance and the value of Max-Eigen statistics (52.150) which was greater than the critical value (46.231) at 5% level. The null hypothesis of no

cointegration was rejected. These results suggest the estimation of the vector error correction model due to the existence of a long-run relationship among the variables.

Table 2. Johansen cointegration result

		Trace test		Maximal eigenvalue test	
H_0	H_1	Statistic	5% C.V.	Statistic	5% C.V.
r = 0	r ≥ 1	159.354**	125.615	52.150**	46.231
r ≤ 1	r ≥ 2	107.204**	95.754	36.435	40.078
r ≤ 2	r ≥ 3	70.765	69.819	27.748	33.877
r ≤ 3	r ≥ 4	43.017	47.856	24.108	27.584
r ≤ 4	r ≥ 5	18.909	29.797	10.537	21.132
r ≤ 5	r ≥ 6	8.371	15.495	8.164	14.265
r ≤ 6	r ≥ 7	0.207	3.841	0.207	3.841

Source: Author's computation

Effect of real effective exchange rate misalignment on rubber export

The empirical estimates of VECM for the causal effect of exchange rate misalignment, ERER, capital inflows, term of trade, trade openness and government expenditure on rubber export were presented in Table 3. As shown from the VECM results, the error correction coefficient (CointEq(-1)) had a negative sign and was significant at 5% which is a good sign. The VECM results appeared within the expectation and had correct signs. The adjustment term (the adjustment factor of the cointegration equation) was -0.335 and significant which shows that the reversion to long-run equilibrium is at an adjustment speed of 33.5%. This implies that 33.5% of disequilibrium error in the rubber export was corrected within a year and rubber export returns to its equilibrium level in about three years in absence of any other shocks. The R-square of 0.680 implies that 68.02 per cent of the variation in rubber export were explained by ERER, REERM, government expenditure, trade openness, the term of trade and capital inflows. The F-statistic of 5.53 was however statistically significant at 1%, this shows that the model generally has a good fit.

Table 3. Effect of real effective exchange rate misalignment on rubber export

Error correction	Coefficient	Stand. Error	T-Statistic
CointEq(-1)	-0.335**	0.122	-2.749
LNREERM	-0.020**	0.008	-2.552
LNERER	0.202*	0.117	1.725
LnFLOW	0.005	0.004	1.184
LNGE	0.263	0.165	1.599
LnTOT	-0.828**	0.369	-2.242
LnTOP	1.138**	0.482	2.360
C	0.025	0.046	0.556
R-squared	0.680		
F-statistic	5.045		
Diagnostic Tests			
Test		F-stat	Probability
Breusch-Godfrey Serial Correlation LM Test		0.718	0.888
Breusch-Pagan-Godfrey Heteroskedasticity Test		1.63	0.41
Ramsey RESET Test		1.59	0.31

*** p<0.01, ** p<0.05 and * p<0.1

Source: Author's computation

Real effective exchange rate misalignment had a negative and significant *(P<0.05)* effect on rubber export. This suggests that a 1% increase in REERM decrease rubber export in Nigeria by 2.552%. This implies that misalignments in the exchange rate reduce the volume of rubber export and worsen its performance in Nigeria. Thus, REERM hurt agricultural trade and agricultural transformation in the country. This is because an overvalued exchange rate (Naira) will make

rubber export very expensive to other countries. This will thus reduce the international demand for rubber export from the country. On the other hand, although an undervalued exchange rate will increase the demand for rubber from Nigeria in the international market, but a continuous undervalued exchange rate will lower the morale of rubber farmers and exporters as this would reduce their profit and may not even cover their cost of production. These results further imply that for the effective performance of rubber export in Nigeria, a stable exchange rate at its equilibrium value is needed to better the performance of rubber export in the country and other developing countries which were homogenous in nature and export primary produce. This is in line with the findings of Atingi-Ego and Sebudde (2004) who reported that exchange rate misalignments negatively affects non-traditional export in Uganda. A similar result was reported by Jongwanich (2009) that exchange rate misalignments had a negative effect on trade in Asia.

Equilibrium real exchange rate had a positive and significant *(P<0.10)* effect on rubber export. This suggests that ERER increases rubber export volume significantly. This implies that maintaining the exchange rate at its equilibrium value increase the rubber export. This will, therefore, improve the agricultural sector performance in the country. Maintaining the exchange rate around its equilibrium value will make trading of rubber and other exports in Nigeria with other countries effective because the trading partners will pay exactly the monetary value for rubber and the rubber exporters will also get the value for their products.

Term of trade had a negative and significant *(P<0.05)* effect on rubber export. This suggests that a 1% increase in terms of trade will reduce rubber export by 2.2418%. This implies that a high term of trade reduces the performance of rubber export in Nigeria. This is because a high term of trade is usually associated with exchange rate overvaluation which will make rubber export in Nigeria highly expensive to other countries in the international market. A higher price will attract low demand, *ceteris paribus.* This will thus reduce the volume of rubber export in the country and lower the agricultural transformation.

Trade openness had a positive and significant effect *(P<0.05)* on rubber export. This suggests that a 1% increase in trade openness will increase rubber export by 2.360%. This result implies that trade openness with other countries will favour and improve rubber export in Nigeria. An increase in agricultural export will help in diversifying the economy and agricultural transformation agenda in the country. This result is against the findings of Alegwu et al. (2018) who found that trade openness had a negative effect on rubber export in Nigeria.

Regarding the diagnostic test for the model used. The Breusch-Godfrey Serial Correlation LM Test was used to check autocorrelation among the variables. The null hypothesis (Ho) was that there is no serial correlation in the model. The null hypothesis is not rejected as the P=0. 718>0.01 is not significant (either at 1, 5 or 10 per cent level). This implies that there is no serial correlation in the model. Heteroskedasticity in the model was tested using the Breusch-Pagan-Godfrey test. The null hypothesis was that the model has a constant variance (Homoskedasticity). The result further showed that P=0.41>0.01 is not significant. Therefore, the null hypothesis of constant variance is not rejected. This implies that the variance of the error term in the model is constant. In testing the model specification error, the regression specification error test (RESET) enunciated by Ramsey was employed. The null hypothesis (Ho) was that the model has no omitted variables. From the result (P=0.31>0.01) shown in Table 3, the probability is not statistically significant, therefore, the null hypothesis of no omitted variable(s) in the model is not rejected. This result indicates that none of the variables was omitted in the model, the estimated model has corrected functional form and no irrelevant variables were added. This implies that there is no serious error of specification, and the model is well specified.

Table 4 presents the result of the Granger causality test between REERM and rubber exports, and ERER and rubber export in Nigeria. The Granger causality test results revealed a unidirectional causality that runs from the real effective exchange rate misalignment to rubber export. This implies that REERM granger caused rubber export and the past value of REERM can be used to predict or forecast the current value of rubber export. Bidirectional causality exists between equilibrium real exchange rate and rubber export. This implies that the past values of equilibrium real exchange rate can be used to forecast the present value of rubber export and the

past values of rubber export can also be used to forecast the current value of equilibrium real exchange rate.

Table 4. Granger causality test results

Null hypothesis	F-Statistics	P-value	Decision
REERM does not granger cause rubber export	5.375	0.006	Reject
Rubber export does not granger cause REERM	0.741	0.483	Accept
ERER does not granger cause rubber export	3.988	0.041	Reject
Rubber export does not granger cause ERER	2.588	0.084	Reject

Source: Author's computation

Conclusion

This study explored the nexus between the real effective exchange rate misalignment and rubber export in Nigeria. The effect of maintaining the exchange rate at equilibrium including trade openness, term of trade, government expenditure and capital inflows on rubber export were also examined. The results revealed that there exists a long-run relationship between rubber export and real effective exchange rate. Also, real effective exchange rate misalignment had a negative and significant effect on rubber export. Misalignments in exchange rate worsen and reduce the performance of rubber export in Nigeria thus bad for the trade and agricultural sector in the country. An overvalued exchange rate will make rubber export very expensive to other countries which will result in a reduction in rubber export demand in the international market. On the other hand, a continuous undervalued exchange rate will reduce the morale of rubber farmers and exporters as this would reduce their profit, thus worsen the performance of rubber export and agricultural transformation. This study further revealed that maintaining the exchange rate towards its equilibrium value increase the rubber export thereby improving its performance in Nigeria. Maintaining the exchange rate around its equilibrium value will make trading of rubber in Nigeria with other countries effective. Its effect could also transpose to other sectors of the economy in the county in a bid to improve their performance. Term of trade had a negative effect on rubber export which shows that a high term of trade reduces the performance of rubber export in Nigeria. Trade openness had a positive effect on rubber export. This shows that trade openness with other countries will favour and improve rubber export in Nigeria. It can, therefore, be inferred from this study that real effective exchange rate misalignment is a strong determinant of the volume of rubber export in Nigeria, when the real effective exchange rate is highly misaligned there is a greater probability that rubber export will reduce. This is because REERM will lead to the reduction of export activities, especially by risk-averse exporters. On the other hand, when the exchange rate is at equilibrium, there is a high probability that the rubber export volume will increase.

Therefore, for the effective performance of rubber export and other agricultural export in Nigeria and other developing countries, a stable exchange rate at its equilibrium value is needed to better the performance of rubber export in the country. This would go a long way in transforming agriculture in Nigeria and other African countries and increase the contribution of the agricultural sector, through agricultural export, to the nation's economy. In addition, more trade openness with other countries is very important in transforming agriculture, through export, in Nigeria and other African nations. Improved term of trade is also needed to improve the performance of rubber export in a bid to diversify the economy and transform agriculture in Nigeria.

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