



## AN ASYMMETRIC RELATIONSHIP BETWEEN TRADE OPENNESS, CORRUPTION AND EXCHANGE RATE IN NIGERIA

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### ABSTRACT

*This study investigates the asymmetric relationship between trade openness, corruption and exchange rate in Nigeria. Time series data was used from first quarter of 1996 to fourth quarter of 2021 on different series, nominal exchange rate, trade openness, corruption, inflation, export and foreign direct investment. Data was extracted from World Development Indicator (WDI) of World Bank database and International Transparency database. Trade openness was constructed using Composite Trade Intensity (CTI) measurement. NARDL was employed to examine the asymmetric relationship between trade openness, corruption and exchange rate in Nigeria. Asymmetric relationship was found between trade openness, Corruption and exchange rate in Nigeria. Base on the result, it was revealed that an increase in trade openness resulted to an increases on exchange rate (naira depreciation) and a decreases in trade openness also lead to an increase on exchange rate. It found that an increase in corruption control leads to appreciation of naira and a decrease corruption control leads to depreciation of naira. It was concluded that increases in corruption control is intensity to appreciation of naira to foreign currency in the long run. The study recommended that the government should put more long-term efforts in checking and controlling corruption for exchange rate to be appreciated.*

**Keywords:** Asymmetric, trade openness, exchange rate, Corruption, Composite Trade Intensity

**JEL Classification Code:** C1, E5, F4

### 1.0 Introduction

For the past few decades, Nigerian economy has been experiencing continuous depreciation on naira exchange rate and corruption become rampart. Despite the record that Nigeria is one of the biggest economies in Africa, 6th highest exporter of crude oil in the world, yet the naira is continuing depreciating (WDI, 2018). Nigeria government pursued trade openness improvement through Structural Adjustment Program (SAP) in 1986 to establish a realistic, sustainable and appreciable of Naira. The trade openness improvement failed to bring about a realistic and sustainable exchange rate for the Naira. This failure may be as a result of corruption among the policy maker, political instability, policy missteps, and lack of continuity reform effort as suggested.

However, examination on the impact of trade openness on exchange rates has remained controversial with studies yielding mixed and conflicting results. Therefore, growing number of scholars has found a positive impact of trade openness on exchange rate partners (Nelson, et al., 2016; Muh-Kamran, Jian-Zhou & Muh-Imran, 2019; Muhammad & Ahmed, 2011). On the other hand, studies have found that trade openness negative impact exchange rate (Ajao, 2015; Victor, Isa & Jerome, 2022). Most of these studies assume that the long term relationship is captured as a symmetrically linear combination of nonstationary stochastic regressors. On this note, these studies ignore the examination on a nonlinear relationship between trade openness and exchange rate (Nelson, et. at.,2016; Muh-Kamran, et.at., 2019; Muhammad &

Ahmed, 2011; Ajao, 2015). Moreover, the previous studies pay little or no attention to investigate the relationship between corruption and exchange rate in Nigeria. Corruption is one of challenges facing Nigeria economy nowadays in all sectors in which this study set to examine its relationship with exchange rate and trade openness.

Exchange rate is one of the major macroeconomic factors that may help country achieve its steady growth rate and development through optimal productive capacity, particularly in a country like Nigeria which is heavily reliant on imports (Diai 2022). Exchange rate has been continuously depreciating for some years back. In 1996, naira is exchange to dollar at the rate of 21.9 per dollar and currently now (2024) naira is exchange to dollar at the rate of more than 1200 naira per dollar. This is a doom for an economic growth and development. In the cause of this, Nigerian inflation is increasing persistently, the poverty level is increasing, the level of unemployment is alarming and the economic growth is retarding.

However, there is need to tackle the problem of continuous depreciation of naira in order to solved the aforementioned problems (inflation, poverty, unemployment and the poor economic growth. And as stated earlier that many studies have investigated the symmetric relationship between trade openness and exchange rate in Nigeria without considering the asymmetric relationship between trade openness, corruption and exchange. Failure of the previous studies to consider the asymmetric relationship may lead to policy misstep on their policy recommendations. Thus, this study set to investigate the asymmetric relationship between trade openness, corruption and exchange rate in Nigeria and suggest probable solution to naira depreciation. The rest of this paper is structured as follows: Section 2 reviews the literature, while the methodology presented in section 3. The data analysis and presentation are presented in section 4, and section 5 concludes the study and provides policy recommendations.

## 2.0 Literature Review

### 2.1 Conceptual Review

**Exchange Rate:** The exchange rate is the worth of one currency in terms of another currency, that is, the current market price for which one national currency can be exchanged for another. It is expressed as the number of units of a domestic currency that will purchase one unit of a foreign currency or the number of units of a foreign currency that will purchase one unit of a domestic currency. For example, the naira per United States (US) dollar (N/US\$) or US dollars per naira (US\$/N). If 1 US Dollar can be exchanged for N540, then one naira can be exchanged for US\$0.042.

**Trade openness:** Trade openness refers to the degree to which a domestic country permits trade with other countries. The trade openness otherwise known as trade liberalization. It is the process of reducing or removing restrictions on international trade. The Nigeria trade openness has been experiencing fluctuation and decreasing in degree since 1990. It recorded highest degree in 2011. Initially, as stated above that SAP was introduced to improve trade openness in order to establish a realistic, sustainable and appreciable exchange rate for the Naira. The result of trade openness improvement in 2011 does not reflect in establish a realistic and sustainable exchange rate for the Naira

**Corruption:** Transparency International define corruption as abuse of entrusted power for private gain. Corruption erodes trust, weakens, democracy, hamper economic development and further exacerbates inequality, poverty, social division and the environmental crisis.

## 2.2 Theoretical Review.

### 2.2.1 Purchasing Power Parity Theory (PPPT):

Purchasing power parity theory (PPPT) is an economic theory used in determining the relative value of currencies, estimating the amount of adjustment needed in the exchange rate between countries, for the exchange rate to be equivalent to each currency's purchasing power. This theory recognizes inflation levels and trends as important determinants of the exchange rate of a currency both in emerging and developed economies (Scott, 2008). PPPT avers that a currency will lose value if there is a high level of inflation in the country or if inflation levels are perceived to be going up. This is attributed to the fact that inflation erodes the purchasing power, thus demand for that specific currency. A currency may sometimes strengthen when inflation rises due to expectations that the central bank of the country concerned will raise short-term interest rates to combat rising inflation (Oleka, et al., 2014). The equilibrium exchange rate between two invertible paper currencies is determined by the equality of their purchasing power (that is, their relative prices).

Therefore, in the existence of trade openness, if the price of domestic goods and services is more expensive to foreign products, people will prefer demanding foreign goods and services. High demand for foreign products will lead to the depreciation of the local currency exchange rate (Nasir & Valdrina, 2017). That is, high inflation will discourage openness of local country trade to the other countries of the world. By implication, it will lead to depreciation or appreciation of exchange rate.

Thus, by simplifying,

$$\text{exch} = f(\text{opt}, \text{infl}) \text{-----}(1)$$

Where exch implies exchange rate, f indicates function, of opt is trade openness and inf is inflation which implies the price of goods.

## 2.3 Empirical Review

An Autoregressive Distributed Lag (ARDL) bounds test approach for co integration was applied by Muhammed, et al., (2019) to test the long-run relation between the dependent and the independent variables which include Exchange rate, Gross Domestic Product Growth, Inflation, Interest rate and trade openness. It investigates the effect of macroeconomic variables on the exchange rate USD/CYN using yearly time series data for China's economy from 1980 to 2017. The results of long-run ARDL indicate that gross domestic product growth and trade openness have a positive effect on the exchange rate USD/CNY while interest and inflation rates have a negative effect on the exchange rate.

The impact of trade openness on the real exchange rate in Pakistan was investigated by Muhammad and Ahmed (2011), using quarterly data for the period 1972 to 2010. The study reveals a significant positive effect of trade openness on the real exchange rate. A floating exchange rate system also depreciates the real exchange rate significantly. The results are robust to alternative trade openness measures and different model specifications. The results also highlight the role of other variables in determining the real exchange rate. Government consumption and foreign direct investment significantly positively affect the real exchange rate; while terms of trade, capital inflows, and capital accumulations have significant negative impacts on the real exchange rate.

Similarly, a very relevant study was carried out by Nelson, et al. (2016), which applied Ordinary Least Square (OLS) method and pair wise correlation matrix technique to

investigate the trade openness and exchange rate fluctuations Nexus in Nigeria. Time series data were used, covering from 1984 to 2013. They found out that; trade openness has positive impact on the exchange rate fluctuations in Nigeria. This study failed to examine corruption as one of the factors that may cause the exchange rate fluctuation. An investigation into the relationship between political corruption, income inequality and poverty between 2000 and 2019 has been carried out by Lucas, et al. (2022) using modified OLS. Consequently, they found out that political corruption and income inequality have a significant negative relationship in Nigeria. This shows that corruption and exchange rate have a significant positive relationship. Political corruption could also be attributed to the persistent fall in Naira vis-à-vis dollar in the foreign exchange market.

In examines the impact of exchange rate on trade flow in Nigeria by Victor, et al. (2022) from 1986 to 2021. The study utilizes linear and nonlinear autoregressive distributed lag (ARDL and NARDL) models to test the J-Curve hypothesis and the Marshall-Lerner condition in Nigeria. The study found symmetric effects of exchange rate on trade balance, exports, and imports. The findings also show that real exchange rate depreciation has a strong negative influence on trade balance and exports in the short run but positive in the long run. Abula, et al. (2016) examined the impact of corruption on external debt in Nigeria from 1996 to 2014. The study employed Vector Error Correction Technique (VECM) to analyses time series data from following variables: external debt stock, corruption perception index, total public expenditure and exchange rate. Findings revealed that corruption and public expenditure have a significant positive relationship with external debt while the relationship between exchange rate and corruption is negative with respect to Nigeria in the long-run.

However, many studies were carried out on investigating the relationship of trade openness and exchange rate in Nigeria. The debate on this note is inconclusive because all the related previous studies did not have consistent findings. Some studies have revealed that trade openness has increased the performance of exchange rate stability which leads to economic growth. On the other vein, studies have shown little evidence to prove a strong relationship between trade openness, corruption and exchange rate in some countries around the world including Nigeria. Previous studies have paid a little or no attention to the existence of non-linear cointegration relationship between trade openness, corruption and exchange rate in Nigeria. This study set an investigation to examine asymmetric relationship between trade openness, corruption and exchange rate in Nigeria which previous study paid little or no attention on it. Likewise, this study adopted a new measure of trade openness, (the composite trade intensity (CTI)) as suggested by Squalli and Wilson (2006).

### **3.0 Methodology**

#### **3.1 Data Sources**

Nominal exchange rate, inflation rate proxy by Consumer Price Index (CPI), foreign direct investment and export were sourced from World Development Indicators (WDI) of World Bank Database. Corruption index was sourced from Transparency International and trade openness that is constructed by the author using trade intensity and relative world trade intensity data sourced from World Development Indicators (WDI) of World Bank Database.

#### **3.2 Variable and Measurement**

Base on the sources of the variables, nominal exchange rate, inflation, foreign direct investment, export and corruption were measured from their sources. Only trade openness was measured by the author using Composite Trade Intensity (CTI) as suggested by Squalli and Wilson (2006). The CTI is combination of Trade intensity (TI) and Relative world trade intensity (RWTI). Combining TI and RWTI.

### 3.3 Model Specification (theoretical model)

Purchasing power parity (PPP) theory used as basis for the study. The equilibrium exchange rate between two invertible paper currencies is determined by the equality of their purchasing power (that is, their relative prices). Therefore, in the existence of trade openness, if the price of domestic goods and services is expensive to foreign products, people will prefer demanding foreign goods and services. High demand for foreign products will lead to the depreciation of the local currency exchange rate.

Thus, by simplifying,

$$exch = f(opt, infl) \text{ --- --- --- --- --- (1)}$$

Where *exch* is exchange rate, *f* indicates function of, *opt* is trade openness and *infl* is inflation which implies the price of goods. That is, the exchange rate is the function of trade openness and inflation.

#### 3.3.1 Descriptive Analysis

The study conducted a descriptive statistic test to describe the general characteristic of all variable used.

#### 3.3.2 Stationary Analysis

Methods for detecting the presence of a unit root in parametric time series models have lately attracted a good deal of interest in both statistical theory and application. Fuller (1984) and Dickey, Bell & Miller (1986) review much of the literature. The latter article provides a helpful practical guide to the use of some of the formal tests. Therefore, the methods of detecting the presence of a unit root in parametric time series models was conducted, which are Argumented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root test.

#### 3.4.3 Models Specification

This study adopted and modified the study of Nelson, et. al. (2016) model on this contention. Their model stated as follow:

$$rex = \beta_0 + \beta_1 top + \beta_2 infl + \beta_3 rir + \beta_4 rgdp + \beta_5 fir + \mu_t$$

where: *rex* = real exchange rate, *top* = trade openness, *infr* = inflation rate, *rir* = real interest rate, *rgdp* = real gross domestic product proxied for economic growth, *fir* = foreign interest rate proxied by US interest rate,  $\mu_t$  = stochastic error term.

Thus, this study is econometrically modified it as follow:

$$lnexch = \beta_0 + \beta_1 lnopt + \beta_2 crpi + \beta_3 lninfl + \beta_4 lnfdi + \beta_5 lnexpt + \mu_t \text{ --- --- --- --- --- (2)}$$

#### Non-linear Autoregressive Distributed Lags (NARDL) Model.

To examine the asymmetric relationship between trade openness, corruption and exchange rate were examined. The ARDL technique provides profoundly misleading results in terms of nonlinearity and asymmetries in the trade openness, corruption and exchange rate relationship. To address this issue, the non-linear autoregressive distributed lags (NARDL)

modelling approach developed by Shin, Yu and Greenwood (2014) with the assumption that the cointegrating association could be asymmetric or nonlinear as specified in equation 3.

$$\begin{aligned}
 lnexch_t = & \beta_0 + \beta lnexch_{t-i} + \beta^+ lnopt_{t-1}^+ + \beta^- lnopt_{t-1}^- + \beta_{lnopt} lnopt_{t-i} + \beta^+ crpi_{t-1}^+ \\
 & + \beta^- crpi_{t-1}^- + \beta_{crpi} crpi_{t-i} + \beta_{lninfl} lninfl_{t-i} \\
 & + \beta_{lnfdi} lnfdi_{t-i} + \beta_{lnexpt} lnexpt_{t-i} + \sum_{i=0}^p P_i \Delta lnexch_{t-i} + \sum_{i=0}^p \gamma_{lnopt,i} \Delta opt_{t-i} \\
 & + \sum_{i=0}^p \gamma_{crpi,i} \Delta crpi_{t-i} + \sum_{i=0}^p \gamma_{lninfl,i} \Delta lninfl_{t-i} + \sum_{i=0}^p \gamma_{lnfdi,i} \Delta lnfdi_{t-i} \\
 & + \sum_{i=0}^p \gamma_{lnexpt,i} \Delta lnexpt_{t-i} + \sum_{i=0}^s (\gamma_i^+ \Delta lnopt_{t-1}^+ + \gamma_i^- \Delta lnopt_{t-1}^- + \gamma_i^+ \Delta crpi_{t-1}^+ \\
 & + \gamma_i^- \Delta crpi_{t-1}^-) + \mu_t \text{ --- (3)}
 \end{aligned}$$

In equation 3, where lnexch is the natural log of the nominal exchange rate, lnopt is the natural log of trade openness, crpi is corruption index, lninfl is natural log of inflation (Consumer Price Index), lnfdi is natural log of foreign direct investment, lnexpt is natural log of export, Δ represents the first difference operator, β<sub>0</sub> is the constant in the model, i = 0 represent the number of variables in the model, β<sub>1</sub>..... β<sub>6</sub> are short-run coefficients, β<sub>7</sub>... β<sub>12</sub> are long-run coefficients, p and s denote the lag length for the variables in the distributed lag part; ∑<sub>i=0</sub><sup>S</sup> γ<sub>i</sub><sup>+</sup> and ∑<sub>i=0</sub><sup>S</sup> γ<sub>i</sub><sup>-</sup> capture the short run influence of an increase and decrease in lnopt<sub>t</sub> and lncrpi<sub>t</sub> and μ<sub>t</sub> is error term.

#### 4.0 Data Analysis

##### 4.1 Descriptive Statistic Results.

Descriptive statistics is the summary of data used as presented on table 1.

**Table 1: Descriptive Statistic Result.**

	EXCH	OPT	CRPI	INFL	FDI	EXPT
Mean	41.43276	2.864042	0.561058	28.87135	0.348355	5.275948
Median	34.40109	1.782260	0.621875	20.67798	0.353256	5.188895
Std. Dev.	24.52086	2.903270	0.152257	23.13895	0.187601	1.879289
Skewness	0.798058	2.889842	-1.225754	1.072692	0.341154	0.030388
Kurtosis	3.036666	11.80533	3.890187	3.203352	2.133032	2.181930
Jarque-Bera	11.04538	480.7340	29.47676	20.12411	5.274437	2.916041
Probability	0.003995	0.000000	0.000000	0.000043	0.071560	0.232696
Sum	4309.007	297.8603	58.35000	3002.620	36.22894	548.6986
Sum Sq. Dev.	61931.09	868.1845	2.387763	55147.33	3.624988	363.7678
Observations	104	104	104	104	104	104

Source: Author’s computation, using E-view 10.

From table 1, the mean and median of exchange rate (EXCH), trade openness (OPT), inflation (INFL) and export (EXPT) are above unity and positive values. While the mean and median of corruption (CRPI), foreign direct investment (FDI) are less than 1 but they are positive. The result revealed the skewness value of exchange rate is 0.79, trade openness revealed 2.89, corruption index revealed -1.23, inflation shows 1.07, foreign direct investment is 0.34 and export is 0.03. This implies that exchange rate, trade openness, inflation, foreign direct investment and export has long-right tail distribution because of their positive value. While corruption has long-left tail distribution base on its negative value. More so, the kurtosis value of exchange rate, trade openness, corruption index and inflation are leptokurtic. Their values

are greater than 3 as stated respectively 3.04, 11.81, 3.89 and 3.20. While foreign direct investment revealed value of 2.13 and export revealed value of 2.81 which are less than 3, hence they are platykurtic. The standard deviations estimation revealed higher volatility on exchange rate (61931.09), trade openness (868.18), inflation (55147.33) and export (363.77). While corruption and foreign direct investment revealed low volatility, they have the value of 2.39 and 3.62 respectively. Likewise, the Jarque- Bera probability of exchange rate, trade openness, corruption and inflation are statistically significant at 5 per cent, while foreign direct investment and export are not statistically significant at 5 per cent.

## 4.2 Unit Root Test Result

Before evaluating regression models, the stationary test of variables has conducted exploiting ADF and PP unit root test. The results summary is given in the Table 2;

**Table 2 Argumented Dickey-Fuller (ADF) and Philips-Perron (PP) Unit Root Test Results**

Variables	ADF statistic	P-Values	PP statistic	P-values	Order of Integration
<b>@LEVELS</b>					
Lnexch	-1.0081	0.9377	-0.4642	0.9838	
Lnopt	-3.0894	0.1144	-2.7159	0.2326	
Crpi	-3.4555	0.0499	-4.1849	0.0067	1(0)
Lninfl	-2.4522	0.3510	-2.1178	0.5296	
Lnfdi	-2.8142	0.1957	-1.9552	0.6183	
Lnexpt	-3.6930	0.0272	-2.8252	0.1918	1(0)
<b>@FIRST DIFFERENCE</b>					
D{lnexch}	-5.1426	0.0003	-4.6213	0.0016	I(1)
d(lnopt)	-8.1261	0.0000	-9.6261	0.0000	I(1)
d(crpi)	-6.3522	0.0000	-6.8389	0.0000	I(1)
d(lninfl)	-4.3395	0.0041	-4.4054	0.0033	I(1)
d(lnfdi)	-7.9503	0.0000	-5.9371	0.0000	I(1)
d(lnexpt)	-4.6544	0.0015	-4.5281	0.0022	I(1)

From table 2 ADF and PP unit root result, the result is based on 5 percent level of significant in both at level  $i(0)$  and first different  $i(1)$ . It was revealed that all the variables are stationary at given 5 percent level of significant. Since the unit root results have confirmed mixed order of integration (at level and first different) and the absence of second different  $i(2)$  variables, NARDL methodology was used for estimation.

## 4.3 Non-Linear Autoregressive Distributive Lag (NARDL) Results

Sequel to the result of unit root with the absence of order of integration second different ( $i(2)$ ) with the combination of stationarity at level and at first difference, it facilitate the estimation of NARDL.

### 4.3.1 Bound Test of Non-Linear ARDL Results

Bounds test for co-integration was performed to check the presence of long-run relationship among the variables. The null hypothesis is that there is no long-run relationship.

**Table 3. Bound Test of NARDL Results**

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	15.51895	5%	2.17	3.21

Source: author's computation exploiting E-view 10.

The result of bound test of co-integration was summarized in table 3, the result shows that the value of F-statistics is 15.51895 and is higher than lower and upper bound of critical values at 5 percent level of significance with the value of 2.17 and 3.21 respectively. Therefore, the study failed to accept the null hypothesis and conclude that the variables have long-run relationship. The long-run NARDL bound test result indicate that there is long run equilibrium relationship between trade openness and exchange rate in Nigeria. This is on agreement with the finding of Adznan and Masih (2018), Longe, et al., (2019).

Table 4. The Long-Run Non-Linear ARDL Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$\ln opt_{t+}$	11.59457	4.904873	2.363889	0.0211
$\ln opt_{t-}$	11.57780	7.173561	1.613954	0.1114
$crpi_{t+}$	-149.4873	62.00255	-2.410986	0.0187
$crpi_{t-}$	55.94416	74.52353	0.750691	0.4555

Source: author's computation exploiting E-view 10.

From Table 4, it shows that a positive change in trade openness lead to positive and significant change on exchange rate on Nigerian economy in the long-run. This implies that when the degree of trade openness is increase by 1 percent, exchange rate increases (depreciation) by approximately 11.59 percent. On the other hand, a negative change in trade openness lead to positive but significant change on exchange rate in the long-run. This implies that when the degree of trade openness is decrease by 1 percent, exchange rate increases (depreciation) by approximately 11.58 percent in the long-run. This result concurred with the study of Adznan and Masih (2018); Longe, et. al., (2019); Apenisile and Aloba (2020).

More so, from the table 4, the result revealed that a positive change in corruption control leads to negative and significant change in exchange rate in the long-run. This implies that when corruption control is increase by 1 percent, exchange rate decreases (appreciation) by approximately 149.49 percent in Nigeria. On the other hand, a negative change in corruption control leads to positive but insignificant change in exchange rate in the long-run. This implies that when corruption control is decrease by 1 percent, exchange rate increases (depreciation) by approximately 55.94 percent in Nigeria. This result is similar to the findings of Lucas, et. al. (2022) and Aye (2017). generally, an increases on exchange rate is depreciation of naira, while a decreases on exchange is appreciation of naira. Therefore, fighting corruption has the potential for naira appreciation in the long-run on Nigerian economy.

### 4.3.3 Short-run Results of Non-Linear ARDL

In the presence of co-integrating equations revealed by the NARDL Long-run and Bound form result, the error correction model was estimated to examine the short-run dynamic.

Table 5: NARDL Short-run Results.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
$d(\ln opt_{t+})$	3.298544	0.533229	6.185983	0.0000
$d(\ln opt_{t-})$	-1.172973	0.631213	-1.858283	0.0677
$d(crpi_{t-})$	42.68029	10.91038	3.911898	0.0002
$CointEq(-1)^*$	-0.075462	0.006025	-12.52441	0.0000

Source: author's computation exploiting E-view 10.



Table 5 shows the low speed of adjustment (CointEq(-1)\*) with the coefficient of -0.075462 at 5% level of significant when there is disequilibrium from short run to the long run. From the Table 5, it was found that a positive change in trade openness lead to a positive and significant increase on exchange rate in the short-run. That is when the degree of trade openness is increase by 1 percent, exchange rate increases by approximately 3.29 percent in the short-run. It was revealed that a negative change in trade openness lead to a negative but insignificant decrease on exchange rate in the short-run. That is when the degree of trade openness is decrease by 1 percent, exchange rate decreases by approximately 1.17 percent in the short-run. This result is in line with findings of Longe, et. al., (2019); Adznan and Masih (2018) and Victor, et., al. (2023).

Furthermore, from the table 5, the result did not show the positive changes in corruption to exchange rate in the short-run. While revealed that the negative changes in corruption lead to positive and significant change on exchange rate in the short-run in the short-run. This implies that when corruption control effort is decrease by 1 percent, exchange rate increases approximately by 42.68 percent in Nigeria in the short-run. This is similar to the findings of Lucas, et. al. (2022) and Aye (2017). By implication, a decrease in corruption control in Nigeria leads to increase on exchange rate (depreciation of naira).

#### 4.3.4 Wald Test for the Asymmetry.

The asymmetric relationship of the Wald test between trade openness, corruption and exchange rate. It hypothetically stated that  $H_0$ : there is no asymmetric relationship in the model. If the F-statistics value is statistically significant, then reject the null hypothesis and conclude that there is asymmetric relationship in the model.

**Table 6: Wald Test Asymmetry Relationship Between trade openness and Exchange Rate:**

Test Statistic	Value	Df	Probability
F-statistic	9.745481	(8, 65)	0.0000
Chi-square	77.96385	8	0.0000

Source: Author's computation exploiting E-views10.

From the table 6 above, there is evidence of asymmetry between the trade openness and exchange rate. Therefore, the study rejects the null hypothesis. It is concluded that there is evidence of asymmetric relationship between trade openness and exchange rate in Nigeria. This result is in line with the findings of Adznan and Masih (2018), while it against the study of Victor, et., al. (2023) and Longe, et. al., (2019).

**Table 7. Wald Test Asymmetry Relationship Between Corruption and Exchange Rate:**

Test Statistic	Value	Df	Probability
F-statistic	3.509568	(5, 65)	0.0072
Chi-square	17.54784	5	0.0036

Source: Author's computation using E-views10.

However, table 7 present the result of asymmetric relationship between corruption and exchange rate. It was revealed that there is evidence of asymmetry between the trade openness and exchange rate due to significance of its probability. Therefore, the study rejects the null hypothesis and concluded that there is evidence of asymmetric relationship between corruption and exchange rate in Nigeria.

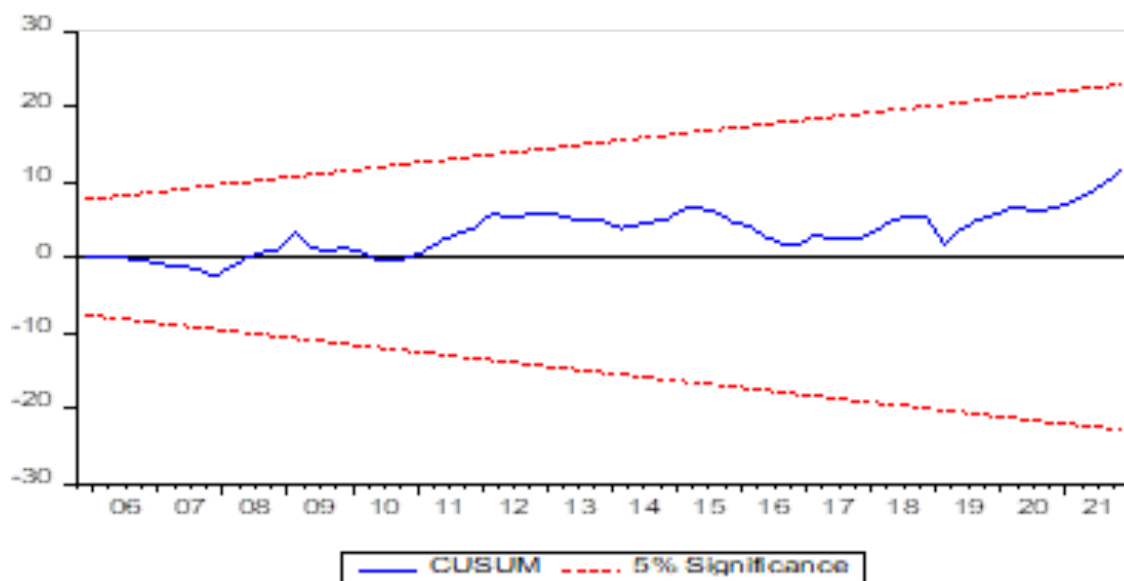
### 4 3.5 Diagnostic Results of Non-Linear ARDL

To validate the estimation, the following diagnostics tests were performed with their respective result as show in table 8 below such as serial correlation (Bruch & Godfray LM Test) where the probability F-statistic is 0.3130 and Prob. Chi-Square is 0.1666; Heteroskedasticity (Arch) where the probability F-statistic is 0.5782 and Prob. Chi-Square is 0.5736; normality test where Jarque-Bera 89.33693 and Probability 0.00000. The Jarque-Bera value and the probability of the normality test result shows that the data are not normally distributed, but this does not warrant the ejection of the whole regression result. Base on central limit theorem, time series data with long length (large observations for the same years), there is no need for stringent normalization techniques with regard to time series. The basic asymptotic theory for time series does not require normality to hold true. (Aishwarya, 2022; Wooldridge, 2012). More so, the stability of the parameters was checked using CUSUM square and CUSUM as present in figure 1.

**Table 8. Diagnostic Results of NARDL**

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	83142	Prob. F(2,63)	0.3130
Obs*R-squared	3.583838	Prob. Chi-Square(2)	0.1666
Heteroskedasticity Test: ARCH			
F-statistic	0.311198	Prob. F(1,96)	0.5782
Obs*R-squared	0.316655	Prob. Chi-Square(1)	0.5736
Normality Test			
Jarque-Bera	9.33693	Probability	0.00000

Source: Author's Computation using E-view10.



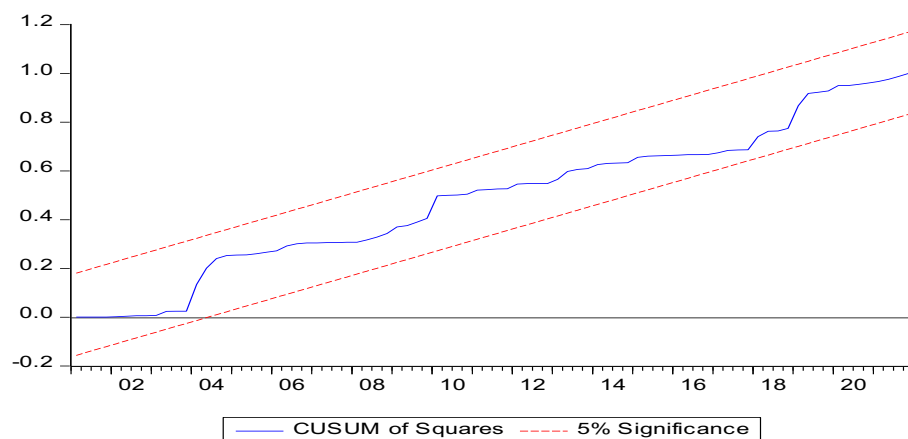


Fig1: Results of CUSUM of Square and CUSUM tests, Author's Computation using E-view10.

## 5.0 Conclusion and Policy Recommendations

### 5.1 Conclusion

The empirical findings underscore an asymmetric relationship between trade openness, corruption and exchange rate. A positive and significant relationship was found between trade openness and exchange rate in the long and short run when there is increase change in trade openness. Likewise, a positive but insignificant relationship was found between trade openness and exchange rate in the long-run when there is decrease change in trade openness. It revealed negative and significant relationship between trade openness and exchange rate in short-run.

On the other hand, a negative and significant relationship was found between corruption and exchange rate in the long run when there is an increase in corruption control. It revealed a positive and significant relationship between corruption and exchange rate in the long run when there is decrease in corruption control. In the short run, a positive change in corruption control does not reveal. While a positive and significant relationship between corruption and exchange rate was revealed when there is negative change in corruption control in the short-run. The examination shows that there is asymmetric relationship between trade openness, corruption and exchange rate. It concluded that corruption control is intensity to naira appreciation, while trade openness has no potential of naira appreciation.

### 5.2 Policy Recommendations

It is recommended that government should engaging in an incorrupt diplomacy, to build international relations and promoting exportation with other countries of the world. This will help in demanding for naira in international market for purchasing of local products that will lead to stability and appreciation of naira. More so, the study recommended that the government should not waste time and resource on focus trade openness generally. Instead government should always encourage exportation and discourage importation. Exportation always brings about demanding for naira in money market which will lead to appreciation of naira.

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