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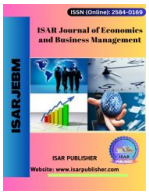

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EXCHANGE RATE INFLUENCERS AND NON-OIL EXPORTS: FRESH INSIGHTS FROM NIGERIA

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Abstract: This research investigates the effectiveness of currency rate influencers and non-oil exports in Nigeria. Time series data were taken from the World Development Index (WDI) and the CBN Statistical Bulletin 2022. The variable's nature necessitates the employment of Autoregressive Distributed Lag (ARDL) across a 43-year period (1981-2022). The results revealed that there is a long-term association between exchange rate and non-oil exports in Nigeria. It also indicated that the exchange rate had a positive but minor influence on non-oil exports, indicating that the naira's depreciation versus the US dollar did not enhance non-oil export growth throughout the study period. Evidence from the results revealed a detrimental association between trade openness and non-oil exports. In terms of inflation, the analysis revealed that inflation had an advantageous but small long-term influence on non-oil exports. According to the study, increasing the money supply has a considerable long-run effect on non-oil exports. Following this, the report advised, among other things, that the government, through its monetary authority, develop a comprehensive exchange rate policy that will not only keep the exchange rate generally constant but also relatively high for investors interested in non-oil sectors. This serves as an incentive for these investors, boosting non-oil GDP and enhancing Nigeria's economic growth and development.

Keywords: Exports; Non-oil GDP; Investor; Nigeria.

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1. Introduction

The exchange rate influences trade by determining the connection between international and domestic pricing; however, changes in the real exchange rate cause the prices of Nigerian commodities in the international market to rise or fall, whereas a decline in the naira lowers these prices. Exchange rate volatility makes imports and exports cheaper or more expensive, and it also adds uncertainty or risk to commerce. Export performance is determined by a favourable international market, a stable exchange rate, and the inherent risks of international trading.

The exchange rate is an important macroeconomic variable in the context of overall economic policymaking, and particularly economic reform plans. The exchange rate is the price of one currency in relation to another (international). It is one of the most important variables in international commerce sectors. The strength and state of the exchange rate system influence the outcome of international trade, which has a significant impact on the balance of payments (Eduno, Edet Bassey).

The exchange rate policy refers to how a country handles its currency in relation to other currencies and the foreign exchange market. Exchange rate policy entails selecting an exchange rate system and establishing the specific rate at which foreign exchange transactions will occur. A country's exchange rate policy influences the relative price structure in domestic currency terms of commodities traded internationally (tradables) versus those produced for the domestic market (non-tradables or home goods). Furthermore, exchange rate policy will influence the overall level of domestic pricing. (Richard Barth).

Non-oil exports constitute a major part of a country's economic output. It is very vital in order to maintain a current account surplus. Any country that pays much attention to its exports usually has a healthy economy. There is a consensus in the literature that an expansion in the export base of any nation as well as an increase in its value of exports, is capable of improving the value of the country's currency causing it to appreciate. There is also a general consensus that the behaviour of the exchange rate of the domestic currency in relation to foreign currencies has important implications for the value of both oil exports and non-oil exports.

Development remains an objective for countries that are desperately poor. Development as an objective entails that government consciously develops sound and implementable policies, and orient its strategies to achieving them. (Ijeoma Emele Kalu. Jan 27, 2022).

For any economy to attain macroeconomic goals is to a large extent determine by the policies the government put in place and the conscious effort to implement them.

Additionally, empirical studies on the impact of exchange rate on non-oil exports in Nigeria and beyond reveals mixed results. While some studies recognized a positive relationship between exchange rate and the non-oil exports in Nigeria, others found a negative relationship between exchange rate and non-oil exports in Nigeria. For instance, scholars like Adejumo and Akinlo (2014) and Oriavivote and Eshenake (2015) have found that there is a positive relationship between exchange rate policies and non-oil exports in Nigeria. On the other hand, scholars like Fagate and Olufayo (2014) and Alalade and Adekunle (2014) have discovered through their studies that there is a negative relationship between exchange rate policies and non-oil exports in Nigeria.

The mixed results from previous scholars make it complicated to make a general conclusion about the impact of exchange rate on non-oil exports in Nigeria. Therefore the basic statement of this study is whether exchange rate policies have helped to promote the growth and development of non-oil exports in the Nigerian economy. It is against these backgrounds that this question arises "What is the impact of exchange rate on non-oil exports in Nigeria?"

The main objective of this study is to ascertain the impact of exchange rate on non-oil exports in Nigeria from 1981-2022.

2. Literatures Review

2.1 The Purchasing Power Parity (PPP)

The purchasing power parity theory was propounded by Professor Gustav Cassel of Sweden. According to this theory, rate of exchange between two countries depends upon the relative purchasing power of their respective currencies. Such will be the rate which equates the two purchasing powers.

Interest Rate Parity (IRP*)*

Interest Rate Parity (IRP) is a theory in which the differential between the interest rates of two countries remains equal to the differential calculated by using the forward exchange rate and the spot exchange rate techniques. Interest rate parity connects interest, spot exchange, and foreign exchange rates. It plays a crucial role in Forex markets.

IRP theory comes handy in analyzing the relationship between the spot rate and a relevant forward (future) rate of currencies. According to this theory, there will be no arbitrage in interest rate differentials between two different currencies and the differential will be reflected in the discount or premium for the forward exchange rate on the foreign exchange.

The theory also stresses on the fact that the size of the forward premium or discount on a foreign currency is equal to the difference between the spot and forward interest rates of the countries in comparison.

Covered Interest Rate Parity (CIRP)

According to Covered Interest Rate theory, the exchange rate forward premiums (discounts) nullify the interest rate differentials between two sovereigns. In other words, covered interest rate theory says that the difference between interest rates in two countries is nullified by the spot/forward currency premiums so that the investors could not earn an arbitrage profit.

Uncovered Interest Rate Parity (UIP)

Uncovered Interest Rate theory says that the expected appreciation (or depreciation) of a particular currency is nullified by lower (or higher) interest.

In the given example of covered interest rate, the other method that Yahoo Inc. can implement is to invest the money in dollars and change it for Euro at the time of payment after one month.

This method is known as uncovered, as the risk of exchange rate fluctuation is imminent in such transactions.

2.2 Review of Empirical Literature

Lawrence Ehikioya Imoughele and Mohammed Ismaila 2015 investigated The Impact of Exchange Rate on Nigeria Non-Oil Exports the results showed that effective exchange rate, money supply, credit to the private sector and economic performance have a significant impact on the growth of non-oil export in the Nigerian economy and appreciation of exchange rate has negative effect on non-oil export which is consistent with the economic theory. Exchange rate plays a key role in international economic transactions because no nation can remain in autarky due to varying factor endowment (Ladipupo and Ogheneov, 2011). Movements in the exchange rate have ripple effects on other economic variables such as interest rate, inflation rate, unemployment, money supply; economic growth, balance of payment etc. These facts underscore the importance of exchange rate to the economic well-being of every country that opens to international trade in goods and services. Therefore, nations in the pursuit of the macroeconomic goals of healthy internal and external stability of her economy, find it imperative to articulate an exchange rate policy. Omojimite and Akpokodje (2010) study the effect of exchange rate reforms on Nigeria's trade performance for the period which spanned between 1986 to 2007 and discovered a minor positive effect of exchange rate reforms on non-oil exports through the depreciation of the value of the country's currency and concluded that exchange rate reforms are not sufficient to diversify the economy and there is need for major incentives in the form of conducive environment for domestic production, especially effective infrastructure that could lead to significant improvement in competitiveness are required.

Easterday Ebi 2022 examined the role of economic policies in the diversification of the Nigerian economy for the period of 1981 - 2020) using Autoregressive Distributed Lag (ARDL) model. Results from Autoregressive Distribution Lag models revealed a long rung relationship between the regressand (Non-oil gross domestic product) and the regressors (money supply, interest rate, taxation, government expenditure and inflation). The study concluded that the role of government in the prudent management of the economy cannot be underestimated. As such, the role of its fiscal and monetary policies in the diversification of the economy is key and fundamental to the economic growth and development of Nigeria. Based on the result, the study recommends amongst others, that the government through its monetary authority should channel more funds to Non-oil sector (particularly to the agricultural sector) and monitor such funds so as to curb any form of corruption practices. This will invariably boost the non-oil gross

domestic product and enhance the diversification of the Nigerian economy.

Bassey Ofonbuk 2022 examined fiscal policy and real sector performance in nigeria: a focus on agricultural sector (1980-2020). The study adopted Ordinary Least Square (OLS) regression technique. The results of the study showed that there is a significant and positive impact of government expenditure on the growth of the agricultural sector in Nigeria, while taxation had a significant negative impact on growth of Agricultural sector in Nigeria. This study concluded that an expansionary fiscal policy (in form of increase in government expenditure or decrease in taxation) is capable of increasing agricultural sector growth and thereby increases its contributions to the growth of the economy.

Furthermore, Hossain (2002) agreed that exchange rate helps to connect the price systems of two different countries by making it possible for international trade and also effects on the volume of imports and exports, as well as country's balance of payments position. AZeeZ, Kolapo and Ajayi, (2012) noted that when there is deviation of this rate over a period of time from the benchmark or equilibrium, exchange rate is called exchange rate volatility. It also indicates that misalignment of exchange rate as occurred where there is multiplicity of markets parallel with the official market.

Shehu (2012) quantitatively assess the impact of exchange rate volatility on non-oil export flows in Nigeria. Employing quarterly data for twenty years, vector co-integration estimate revealed that the naira exchange rate volatility decreased non-oil exports and recommended measures that would promote greater openness of the economy and exchange rate stability in the economy.

Eduno, Ededet Bassey 2019 examined the impact of exchange rate on non-oil exports in Nigeria between 1980 and 2018 using Autoregressive Distributed Lag (ARDL). The results revealed that there exists no long run relationship between exchange rate and non-oil exports in Nigeria.

Alalade, Adekunle and Joseph (2014) investigated the effect exchange rate regimes as had on non-oil export revenue. It specifically ascertained the effects of some macroeconomic variables (inflation, price index, gross domestic product (GDP), exchange rate and degree of openness) as had on non-oil export revenue in Nigeria as well as the performance of the non-oil export sector over the period 1986 to 2010. Using annual data from 1986 to 2010: The study employed a non-oil model proposed by Mehdi S.(2011), Augmented Dickey Fuller unit root test, Eagle-Granger approach to test co- integration in the long run, and error correction model to correct short run deviations. The study broke down data in three period's and discussed each periods result with the three periods combined and also compared these results with other similar works. The study discovered that exchange rate, degree of economic openness, GDP, inflation rate and price index collectively accounts for 97.7 per cent variations in non-oil export variations. The study also discovered a one per cent increase in the naira exchange rate result to 0.4 per cent decrease in non-oil export revenue. It also discovered that GDP (2.34 per cent) accounts for the highest individual variations in non-oil export revenue. The study recommended an appropriate policy mix that encourages a suitable atmosphere for domestic and foreign production.

Ismaila and Imoughele (2015) examine the impact of exchange rate on non-oil export. The study used time series data obtained from CBN for a period of 27 years that is 1986 to 2013. Augmented Dickey- Fuller (ADF) test was used for the unit root test and Johansen's co-integration test was also conducted to establish short and long run relationships between non-oil exports and independent variables. The result shows three co-integrating equations which establish the existence of long run relationship among the variables. Ordinary Least Square statistical technique was used to assess the determinants of non-oil export in Nigeria. The results show that effective exchange rate, money supply, credit to the private sector and economic performance have a significant impact on the growth of non-oil export in the Nigerian economy and appreciation of exchange rate has negative effect on non-oil export which is consistent with the economic theory. Following this, the study recommended among others that monetary authority should ensure exchange rate stability in order to stem inflationary tendencies in Nigeria which have adverse effect on the growth of non-oil export.

Nkiru Patricia Chude and Daniel Izuchukwu Chude investigated, empirically the effect of exchange rate policy on non-oil export in Nigerian economy 1981-2021. Ordinary least square (OLS) method of data analysis was adopted. The data used were sourced from Central Bank of Nigeria Statistical Bulletin. The variables were on non-oil export as the dependent variable, while trade openness, exchange rate and money supply as the independent variables. The study employed unit root test to determine the stationarity of the variables, co-integration approach to determine the long-run equilibrium relationship of the model and error correction model to correct the error of the model. From the model it was discovered trade openness has significant impact on non-oil export in Nigeria. Exchange rate sector has significant impact on non-oil export in Nigeria. Money supply has significant impact on non-oil export in Nigeria .The study recommends that foreign exchange control should be adopted to determine appropriate exchange rate value. Government should adopt selective credit control to channel funds to the productive sectors of the economy. Restrictive policy is also recommended to reduce pressure on foreign currency.

Oriavwote and Eshenake (2015) empirically evaluate the impact of the Real Effective Exchange Rate on non-oil exports in Nigeria. The study covered the period of 1980 to 2014. The cointegration technique was applied to estimate the data. The result of the ADF unit root test indicates that all the variables are I(1). The result of the Johansen cointegration test reveals a long run relationship among the variables. The ECM result shows that the Real Effective Exchange Rate and the degree of openness have positive and significant impact on non-oil exports in Nigeria. The ARCH/GARCH results indicate that the volatility of the REER has influenced the level of non-oil exports in Nigeria. The result recommends further devaluation of the exchange rate backed by increased domestic production through a diversified production base.

Chukuigwe and Abili (2008) empirically examined the impact of monetary and fiscal policies on non-oil exports in the Nigeria economy using Ordinary Least Squares (OLS) estimation, the study revealed that exchange rate, being proxies for monetary policy, negatively affect non-oil exports and concluded that exchange rate as a major price that affects all sectors of the

economy and all economic agents, it is imperative to monitor the movements in the real exchange rate in order to foster competitiveness and improve the supply of exports in the medium to long term. Policies that at worst, keep the exchange rate stable are desirable. In this regard, The Central Bank of Nigeria should continue to intervene in the foreign exchange market to maintain stability.

3. Methods of Study

3.1 Data required and Sources

The study uses annual time series data from 1982-2023. This period is chosen as it corresponds to the period where Nigeria external sector was liberalized and consistent data on the relevant variables are available. More importantly, this period witnessed tremendous reformed to enhance diversification of Nigerian. Data for the study was obtained from Central Bank of Nigeria (CBN) statistical Bulletin and CBN Annual Report and Statement of Accounts various issues.

3.2. Model specification

The objectives of this study are basically to examine the influence of exchange rate on Nigerian economy non-oil export. To achieve the above objectives, we develop economic aggregates in line with the theoretical framework and literature reviews. The quantified model was assessed using the multiple regression analysis. This is due to the specified explanatory variables in the model above are more than one, thus stimulating the adoption of the multiple regression econometric technique for this study. The model was estimated in both the linear and non-linear forms;

In the linear form,

NOE= βo+β 1EXCHR+β 2GDP+β 3OPEN+β 4CPS+βINFL +U1.....2

Was estimated where U1 = stochastic error term and other variables as earlier defined.

β 0 is the constant term;

β 1, β 2, β 3, β 4,and β 5 are the regression coefficients. β >0, β 2>0, β 3>0, β 4><0, β 5<0.

We also estimated the above equation in the non-linear form:

LnNOE = β 0 + β 1lnEXCHR + β 2lnGDP + β 3lnOPEN + β 4CPS+ β 5 InINFL+U2-------3

Where β 0 = constant term;

Adopted Error-Correction Model (ECM) for this study takes the following form:

$\Delta NONt = \alpha 0 + \Sigma \beta i \Delta EXRt\text{-}1 + \Sigma \beta i \Delta LRGDPt\text{-}1 + \Sigma \beta i \Delta$ INFRt-1 +

Σ OPENt-1 + ΣβiΔCPSt-1 + ΣβiΔLGDP t-1 + ΣβiΔLEXRt-1 + ΣβiΔLM2t-1 + Ut (3)

i=1 i=1 i=1

Where:

GDP = Gross Domestic Product;

NON = the Value of Non-Oil Export Ratio;

EXR= Exchange Rate;

OPEN = Openness of the Economy;

CPS = Credit to the private sector;

INF = Inflation Rate;

M2 = broad money supply;

Ut= Error Term.

3.2. Apriori Expectation

Variables	Expectations	Mathematical Representation
Exchange rate	Positive(+)	$\delta_1>0$
Credit	Negative(-)	$\delta_3<0$
Broad money supply	Positive(+)	$\delta_1>0$
Inflation	Negative(-)	$\delta_3<0$
Openness of the economy	Negative(-)	$\delta_3<0$

Source: Author's Compilatiom

3.2.1. Definitions of the Variables

Money Supply (M2)

Money supply (M_2) is money outside bank plus demand and time deposit. In economics, broad money is a measure of the money supply that includes more than just physical money such as currency and coins (also known as narrow money). It generally includes demand deposits at commercial banks, and any monies held in easily accessible accounts. Components of broad money are still very liquid, and non-cash components can usually be converted into cash very easily.

Inflation Rate (INFR):

This is annual rate of inflation. The growth rate of consumer price index is used as a proxy for this variable. It is defined as a positive rate of growth of the general price level in an economy. It covers the period of 2009 to 2020. The reason for the choice of this variable is that inflation is an important determinant of Gross Domestic Product given its effect on purchasing power. This variable is expected to impact negatively on diversification. The data are sourced from World Bank National Data Accounts published in 2020.

Degree of Economic Openness: Economic openness, in political economy, is the degree to which non domestic transactions (imports and exports) take place and affect the size and growth of a national economy. The degree of openness is measured by the actual size of registered imports and exports within the national economy, also known as the Impex rate.

Credit to Private Sector: Domestic credit to private sector refers to financial resources provided to the private sector by financial corporations, such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable, that establish a claim for repayment.

Exchange rate: Exchange rate has been defined as the price of one currency in terms of another asserted that an exchange rate, as a price of one country's money in terms of another's, is among the most important prices in an open economy. It influences the flow of goods, services, and capital in a country, and exerts strong

pressure on the balance of payments, inflation and other macroeconomic variables.

3.3. Estimation Technique

3.3.1 Unit Root Test

In order to avoid spurious regression result, the analytical procedure of this study began with unit root (stationarity) test using Augmented-Dickey Fuller (ADF) test statistic. However, at levels, all the variables proved to be stationary at 1%, 5% and 10% levels of significance. This led to the rejection of null hypothesis of non-stationary at levels which implied that they are I(0) series. Given the unit root properties of the variables, the study proceeded to estimate the multiple regression models using ordinary Least Square (OLS) method.

3.3.2 Ordinary Least Square (OLS) Regress Method

This work will use ordinary Least Square (OLS) method. The reason is that this method (OLS) will produce reliable results that are BLU (best, linear and unbiased.) if its assumptions are satisfied.

The Coefficient of Determination (R^2): The coefficient of determination will be used to measure the overall goodness of fit of the regression model. That is, it shows how well the regression line fits the data. It shows the proportion of variation in the dependent variable "explained" by the changes in the independent or explanatory variables. The R^2 value ranges between 0 and 1, hence the closer its value to one, the better the goodness of fit.

F-Test: this will be used to check the statistical significant of the explanatory variables in the whole model. The null hypothesis is that the explanatory variables in the whole model are not significant. If its probability is less than 0.05 the whole model is statistically significant.

T-Test (Test of Hypotheses): This is the test of significance of the individual parameter estimates and shall be used to test hypothesis. The test shall here be carried out by comparing the observed probability value of the individual parameter estimates with their respective probability values. Decision Rule: If the probability value is less than 0.05 we reject the null hypothesis (H_0) and conclude that the parameter estimate is statistically significant and vice versa.

Durbin-Watson Alternative Test: Durbin Watson alternative test will be used to check if there exist autocorrelation or not. The null hypothesis is that there is no autocorrelation while the alternative is that there is autocorrelation. If the probability value is less than 0.05 we do not reject the null hypothesis.

4. Results and Discussion of Results

4.1 Presentation of Data

The data used for this study was sourced from CBN's statistical bulletin 2021 and runs from 1981 to 2023. For simplicity sake, this data have been moved to the appendix section.

Table 1: Descriptive Statistics

	NOE	INFR	OPEN	MS	CPS	EXR
Mean	491642.2	18.8381	31.5695	9088.029	11.6576	115.7410
Median	64401.02	12.7100	33.3896	1387.643	8.0994	115.2551
Maximum	3207100	72.9800	53.2779	48462.07	22.7548	425.9811
Minimum	203.2	5.3900	9.1358	14.4711	5.8061	0.6100
Std. Dev.	808620.5	15.9496	12.2956	13281.91	5.5915	119.1411
Skewness	2.0617	1.8907	-0.2374	1.4231	0.6143	1.0213
Kurtosis	6.7077	5.7612	2.1588	3.9002	1.6068	3.2212
Jarque-Bera	53.8122	38.3660	1.6327	15.5952	6.0387	7.3878
Probability	0.0000	0.0000	0.4420	0.0004	0.0488	0.0248
Observations	42	42	42	42	42	42

Source: Author's computation (2024)

Before embarking on the estimation of the specified model, the study carried out descriptive analysis of the employed variables. The summary statistics covered nonoil export, exchange rate, inflation, trade openness, money supply, and credit to private sector. Table 1 which conveys the descriptive statistics for each variable reveals that over the 42 years nonoil export averaged N491642.2 million, with a median of N64401.02 million. From 1981 to 2022, exchange rate averaged N115.7410/US$1 and ranged from N0.61/US$1 to N425.9811/US$1. During the period, inflation averaged 18.83 percent, increasing from 5.39 percent to 72.98 percent. For trade openness, the study found that the degree of openness of the Nigerian economy to global trade averaged 31.5695 percent, ranging from 9.1358 percent to 53.2779 percent. During the period, the average money supply was N9088.029 billion and the volume of money supply during the period fluctuated between N14.4711 billion and N48462.07 billion. Every year, about 11.6576 percent of gross domestic product is allocated by deposit money banks to the private sector, and credit to private sector ranged from 5.8061 percent to 22.7548 percent of gross domestic product.

The result of the descriptive statistics reveals non-oil exports, money supply and exchange rate are more dispersed, informed by the computed standard deviations of N808620.5, 13281.91 and 119.1411 respectively. This suggests fluctuations in nonoil export, money supply and exchange rate over the study period. Table 1 reveals mild fluctuation in credit to private sector and trade openness given the standard deviation values of 5.5915 and 12.2956 respectively. The kurtosis statistics revealed that three employed variables have excessive kurtosis as their kurtosis values are greater than 3. Specifically, nonoil export, inflation and money supply are leptokurtic as their calculated kurtosis values significantly exceed 3. The study observed that trade openness, credit to private sector are platykurtic with a calculated kurtosis of 2.1588 and 1.6068, which are less than 3.

The skewness revealed that the distribution of non-oil export, exchange rate, inflation, money supply, and credit to private sector are skewed to the right. It implies that there has been increase in non-oil exports, exchange rate, inflation, money supply, and credit to private sector. Trade openness has declined over the period given that the distribution is skewed to the left. Table 1 reveals that only trade openness is normal//ly distributed as the study failed to reject the null hypothesis that the series are normally distributed.

Unit Root Test

The result of the augmented Dickey-Fuller test of stationarity at level and first difference are presented in Table 2.

Table 2: Unit Roots Result

Variable	Augmented Dickey-Fuller (ADF)			I(d)
	Level	1st Diff	5% Critical Value	
$lnNOE_t$	-0.8642	-7.9824***	-2.9350	I(1)
$INFR_t$	-3.2113**	-	-2.9350	I(0)
$OPEN_t$	-2.4559	-5.6331***	-2.9350	I(1)
$lnMS_t$	-1.0721	-4.1857***	-2.9350	I(1)
CPS_t	-1.0375	-5.9146***	-2.9350	I(1)
$lnEXR_t$	-2.1954	-5.4264***	-2.9350	I(1)

Note: *, **, and *** denote significance at 10%, 5% and 1%, respectively

Source: Authors' compilation (2024)

The table above shows the outcome of the Augmented Dickey-Fuller test conducted to ascertain the order of integration of the variables captured in the model. The result documented in Table 2 revealed that inflation is stationary at level as its ADF test statistic was above the corresponding critical value at 5 per cent level of significance. Other variables such as non-oil export, trade openness, money supply, credit to private sector, and exchange rate became stable only after differencing one. Conclusively, the variables in the adopted model for this investigate are of order one I(1) and zero I(0), as none is of order two I(2), thus fulfilling the condition for the use of the ARDL/Bound method of estimation to examine the short run dynamics of the variables and the long run relationship.

Co-integration Test

The need to confirm if there is cointegrating relationship between exchange rate policy and non-oil export in Nigeria is due to evidence from the unit root test indicating that some of the employed variables are non-stationary but integrated of order one, I(1). Without evidence of cointegration among the series, then the regression result obtained in understanding the effect of capital structure on stock returns is no longer spurious. The cointegration test was based on the bound test. The results of the test are presented in Table 3.

Table 3: Bounds Test Co-Integration Result based on F-statistics

Significant Level	I(0) Bound	I(1) Bound	Value
10%	2.08	3.0	F-Stats = 5.839556***
5%	2.39	3.38	k = 5
2.5%	2.7	3.73	
1%	3.06	4.15	

Note: *K* denotes regressors in the model. (Null Hypothesis: Series are not cointegrated). *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

Source: Author's computation (2024)

Table 3 gives the summary of the bound test of co-integration. As advanced by Pesaran, et al., (2001), the study failed to accept the null hypothesis of no long run association between considered variables in a situation whereby the calculated F-statistics is greater than the upper bound value and vice versa. As provided by Table 3, the calculated F-statistics of 5.839556 is greater than the upper bound value of 3.38 at 5 per cent level of significance, leading to the rejection of the null hypothesis of no long run relationship. Hence, the study resolved that exchange rate, trade openness, money supply, credit to private sector, inflation, and nonoil export move together in the long run and that the short run and long run model can be estimated.

Table 4: ARDL Long and Short Run Results

Dependent Variable:				
Part I: Long Run Results				
Variable	Coefficient	Std. Error	t-Stats	Prob.
INF_t	0.0111	0.0095	1.1603	0.2569
$OPEN_t$	-0.0155	0.0157	-0.9885	0.3324
$lnMS_t$	0.6889**	0.2745	2.5088	0.0190
CPS_t	0.0524	0.0485	1.0795	0.2907
$lnEXR_t$	0.4592	0.3186	1.4411	0.1619
C	4.2158	0.8394	5.0223	0.0000
Part II: Short Run Results				
Variable	Coefficient	Std. Error	t-Stats	Prob.
$D(INFR_t)$	-0.0050	0.0040	-1.2579	0.2200
$D(INFR_{t-1})$	-0.0059	0.0039	-1.5001	0.1461
$D(INFR_{t-2})$	-0.0107**	0.0041	-2.5610	0.0169
$D(OPEN_t)$	0.0163**	0.0064	2.5291	0.0181
$D(OPEN_{t-1})$	0.0115*	0.0066	1.7352	0.0950
$D(OPEN_{t-2})$	0.0205***	0.0067	3.0335	0.0056
$D(lnEXR_t)$	-0.3020*	0.1743	-1.7319	0.0956
ECM_{t-1}	-0.6202***	0.0871	-7.1195	0.0000
$R^2 = 0.6007$			Adjusted $R^2 = 0.5106$	

Note: *, ** and *** denote significance at 10%, 5% and 1% level.

Source: Author's computation (2024)

Part I of Table 4 shows the outcome of the long-run regression. Evidence from the results disclosed a negative relationship between trade openness and non-oil export. The study found that, an increase in trade openness by 1 percent result in a decline in nonoil export by 0.0155 percent. The negative relationship found existing between trade openness and non-oil exports in the long run was found to be insignificant. Regarding inflation, the outcome of the analysis showed that inflation had positive and insignificant effect on nonoil export in the long run. The positive relationship between inflation and nonoil export is inconsistent with economic theory. The study found that an increase in money supply significant stimulate non-oil export in the long run. Table 4 revealed that an increase in money supply by 1 percent is expected to result in 0.6889 percent growth in nonoil export in the long run. Examining the relationship between exchange rate policies (proxy by official exchange rate), Table 4 show a positive relationship between exchange rate and nonoil export that is consistent with economic theory. While currency depreciation by 1 percent enhances nonoil export by 0.4592 percent, the positive impact of exchange rate on nonoil export is insignificant. This can be explained by the uncertainty and volatility in the Nigerian exchange rate market, which increases uncertainty in the Nigerian business space. Table 4 showed that increased credit to private insignificantly enhances nonoil export in the long run.

As deduced from part II of Table 4, 60 percent fluctuation in the explained variable (nonoil export) is accounted for jointly by exchange rate, inflation, trade openness, money supply, credit to private sector, with the residual of 40 percent accounted for by variables not considered in the model but captured by the stochastic term. The results above disclosed that lag 2 of inflation exert a negative and significant impact on current level of nonoil export. Current and lag 2 of trade openness impacted on non-oil export positively, with their impact significant, causing increase in

nonoil export by approximately 0.0163 and 0.0205 percent, respectively. The coefficient of the lagged error correction term (ECT) of -0.6202 suggests that the convergence of the model to long run equilibrium occurs at a speed of 62 percent. This means that 62 percent of the disequilibrium that results from the fluctuation of the predictor variables in the short run will be dissipated before the next time period and the existing disequilibrium will be reduced in less than 2 years to achieve long run equilibrium. This attest to the fast equilibrating speed of the model as short run disequilibrium caused by variations in predictor variables will be dissipated in less than 2 years.

Diagnostic Test

The usage of a model for prediction is predicated on the model passing four basic diagnostic test which includes: normality test, serial correlation test, heteroscedasticity test and the stability test. The outcome of these tests is presented in Table 5.

Table 5: Model Diagnostic Result

Test	Null Hypothesis	Test Type	Test Stat.	Prob
Autocorrelation	Serially Independent	Breusch-Godfrey LM	0.2085	0.9010
Heteroscedasticity	Homoscedastic	Breusch-Pagan-Godfrey	0.0756	0.7832
Normality	Normally Distributed	Jarque-Bera	0.5783	0.7488
Stability	Stable Parameters	CUSUM		
Stability	Stable Parameters	CUSUM of Squares	-	-

Source: Authors' computation (2023)

In addition to the prior test conducted, the study also undertook diagnostic test on the error correction model (ECM) to ensure that the parameter estimates can be utilized for future prediction or forecast. The diagnostic tests conducted include the test of normality for which the Jarque-Bera statistics or test was used, serial correlation test employed to ascertain if correlation exist between the current and lagged estimates of the error term for which the Breusch-Godfrey LM test was favoured, the test for constant variance or homoskedasticity test for which the Breusch-Pagan-Godfrey test. From the table above, the error term is normally distributed as the probability value of the Jarque-Bera statistics exceeds the 5 percent level of significance. The Breusch-Godfrey LM test showed absence of serial correlation between current and lagged values of the error term, as the Breusch-Pagan-Godfrey test revealed the existence of constant variance, suggesting the presence of homoscedasticity.

The stability of the model was tested using the cumulative sum (CUSUM) and cumulative sum (CUSUM) of squares stability test. The plot of CUSUM and CUSM of squares displayed in figure 1 and 2 below shows that the statistics are within the 5 percent critical bounds implying that the estimated ARDL model is stable and devoid of any structural break.

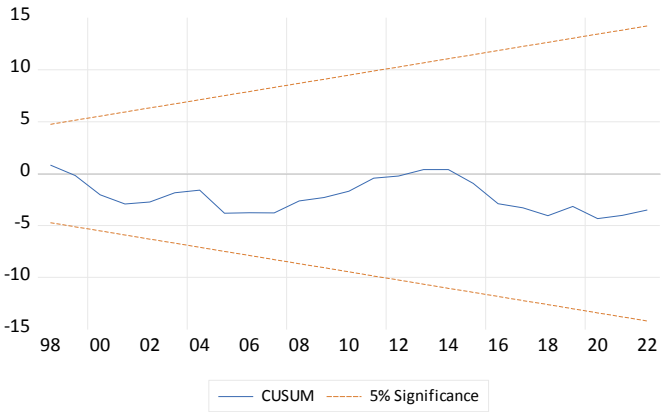

Figure 1: Cumulative Sum (CUSUM) Plot

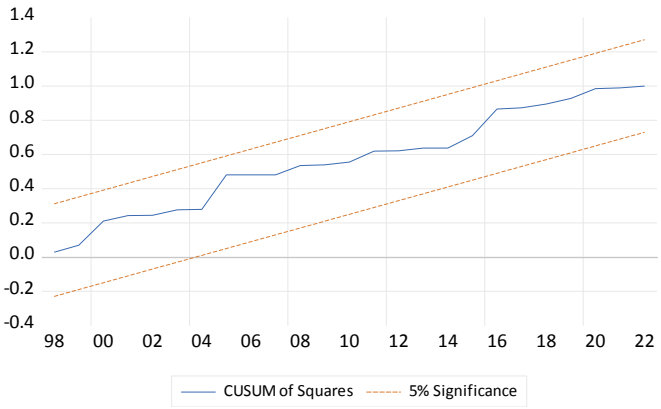

Figure 2: Cumulative Sum (CUSUM) of Squares Plot

5. Conclusion and Recommendations

This paper examined the effect of exchange rate policy on nonoil export in Nigeria between 1981 and 2022, using annual frequency data. This study adopts static and dynamic model specification in the form of the autoregressive distributed lag (ARDL) method. The results clearly show that exchange rate had positive and insignificant effect on nonoil export, indicating that currency depreciation of the naira against the US dollar do not promote non-oil export growth during the period studied.

Recommendations

The recommendations for this study are organized into recommendations for policy and further studies.

Policy Recommendations

i. Government at all levels in Nigeria should expand their investments in the non-oil sectors to promote rapid and sustained economic growth.

ii. The government through its monetary authority should channel more funds to non-oil sector and monitor such

funds so as to curb any form of corrupt practices. This will invariably boost the non-oil gross domestic product and enhance the growth and development of the Nigerian economy.

iii. The government through its monetary authority should come up with a holistic exchange rate policy that will not only make the exchange rate relatively stable but relatively high for investors who have investment interest in the non-oil sector. This will serve as incentive to these investors and invariably boost the non-oil gross domestic product and enhance the growth and development of the Nigerian economy.

iv. The study found that trade openness has a negative relationship with non-oil exports, indicating that Nigeria's openness to international trade has not been beneficial for its non-oil export sector. Therefore the Government through its agencies should implement policies that will restrict the free flow of international trade in the Nigerian economy to avoid the economy becoming a dumping ground.

Recommendations for further Study

A study of this nature is inexhaustible; as such further studies should be conducted in the following areas.

i. Exchange rate policies and the development of the Nigeria economy. An impact assessment.

ii. Economic Policies and the Diversification of the Nigerian Economy. A Relative Analysis.

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APPENDIX

Year	NOE	INFR	OPEN	MS	CPS	EXR
1981	342.8	24	18.17173	14.47117	6.151762	0.610025
1982	203.2	7.53	13.77983	15.78674	7.157501	0.672867
1983	301.3	18	10.04497	17.68793	7.349939	0.724142
1984	247.4	37.71	9.380541	20.10594	7.514391	0.764942
1985	497.1	5.95	10.39198	22.29924	6.958579	0.89375
1986	552.1	7.26	9.135846	23.8064	7.695945	2.020575
1987	2152	11.28	19.49534	27.57358	8.616549	4.017942
1988	2757.4	31.79	16.94061	38.3568	8.65814	4.536733
1989	2954.4	51.26	34.18262	45.90288	7.328533	7.391558
1990	3259.6	7.81	30.92474	47.42329	6.782195	8.037808
1991	4677.3	12.26	37.0216	75.40118	7.008182	9.909492
1992	4227.8	43.7	38.22739	111.1123	6.415129	17.29843
1993	4991.3	58.08	33.71975	165.3387	10.11138	22.05106
1994	5349	56.73	23.05924	230.2926	8.108599	21.8861
1995	23096.1	72.98	39.52838	289.0911	5.806165	21.8861
1996	23327.5	29.3	40.25773	345.854	5.839275	21.8861
1997	29163.3	10.67	51.46101	413.2801	7.156097	21.8861
1998	34070.2	7.86	39.27861	488.1458	7.324552	21.8861
1999	19492.9	6.62	34.45783	628.9522	7.864657	92.69335
2000	24822.9	6.94	48.9956	878.4573	7.509444	102.1052
2001	28008.6	18.87	49.6805	1269.322	9.289721	111.9433
2002	94731.85	12.88	40.03517	1505.964	8.090231	120.9702
2003	94776.44	14.04	49.33496	1952.921	8.088351	129.3565
2004	113309.4	15	31.89587	2131.819	7.84407	133.5004
2005	105955.9	17.86	33.05946	2637.913	7.950867	132.147
2006	133595	8.23	42.56657	3797.909	7.541084	128.6516
2007	199257.9	5.39	39.33693	5127.401	10.57984	125.8331
2008	525859.2	11.58	40.79684	8643.429	19.77047	118.5669
2009	500864.6	12.54	36.05871	9687.507	22.75484	148.8802
2010	710953.7	13.74	43.32076	11101.46	18.96213	150.298
2011	913511.3	10.82	53.27796	12628.32	15.06752	153.8616
2012	879335.2	12.23	44.53237	15503.41	18.31089	157.4994
2013	1130171	8.49	31.04886	18743.07	17.8514	157.3112
2014	955061.8	8.05	30.88519	20415.61	18.58616	158.5526
2015	660678.3	9.01	21.33265	20885.52	19.63529	193.2792
2016	656794	15.7	20.72252	24259	20.49735	253.4923
2017	1074902	16.5	26.3476	28604.47	19.54685	305.7901
2018	1425374	12.09	33.00783	29774.43	17.54347	306.0802
2019	3207100	11.4	34.02388	34257.9	17.63047	306.9206
2020	1555441	13.25	16.35219	36038.01	18.81982	358.8108
2021	2466831	16.95	22.57654	40370.41	18.65431	400.2391
2022	3029976	18.85	27.27388	48462.07	19.2486	425.9811

Null Hypothesis: LNOE has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.864254	0.7895
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNOE)

Method: Least Squares

Date: 05/15/24 Time: 11:55

Sample (adjusted): 1982 2022

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNOE(-1)	-0.021531	0.024912	-0.864254	0.3927
C	0.450257	0.274217	1.641974	0.1086

R-squared	0.018792	Mean dependent var	0.221632
Adjusted R-squared	-0.006367	S.D. dependent var	0.461009
S.E. of regression	0.462474	Akaike info criterion	1.343099
Sum squared resid	8.341415	Schwarz criterion	1.426688
Log likelihood	-25.53353	Hannan-Quinn criter.	1.373537
F-statistic	0.746935	Durbin-Watson stat	2.365021
Prob(F-statistic)	0.392733		

Null Hypothesis: D(LNOE) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.982412	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LNOE,2)

Method: Least Squares

Date: 05/15/24 Time: 11:56

Sample (adjusted): 1983 2022

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNOE(-1))	-1.218492	0.152647	-7.982412	0.0000
C	0.288759	0.078107	3.696961	0.0007

R-squared	0.626421	Mean dependent var	0.018214
Adjusted R-squared	0.616590	S.D. dependent var	0.718770
S.E. of regression	0.445063	Akaike info criterion	1.267504
Sum squared resid	7.527075	Schwarz criterion	1.351948
Log likelihood	-23.35008	Hannan-Quinn criter.	1.298036
F-statistic	63.71889	Durbin-Watson stat	1.955125
Prob(F-statistic)	0.000000		

Null Hypothesis: INFR has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.211333	0.0264
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(INFR)

Method: Least Squares

Date: 05/15/24 Time: 11:56

Sample (adjusted): 1982 2022

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR(-1)	-0.416943	0.129835	-3.211333	0.0026
C	7.728690	3.204731	2.411650	0.0207

R-squared	0.209128	Mean dependent var	-0.125610

Adjusted R-squared	0.188849	S.D. dependent var	14.72263
S.E. of regression	13.25977	Akaike info criterion	8.054897
Sum squared resid	6857.042	Schwarz criterion	8.138486
Log likelihood	-163.1254	Hannan-Quinn criter.	8.085336
F-statistic	10.31266	Durbin-Watson stat	1.747361
Prob(F-statistic)	0.002647		

Null Hypothesis: CPS has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.037533	0.7308
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(CPS)

Method: Least Squares

Date: 05/15/24 Time: 11:56

Sample (adjusted): 1982 2022

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPS(-1)	-0.063411	0.061117	-1.037533	0.3059
C	1.046919	0.776559	1.348151	0.1854

R-squared	0.026861	Mean dependent var	0.319435
Adjusted R-squared	0.001908	S.D. dependent var	2.139281
S.E. of regression	2.137239	Akaike info criterion	4.404457
Sum squared resid	178.1438	Schwarz criterion	4.488046
Log likelihood	-88.29137	Hannan-Quinn criter.	4.434896
F-statistic	1.076475	Durbin-Watson stat	1.559568
Prob(F-statistic)	0.305878		

Null Hypothesis: D(CPS) has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.914659	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(CPS,2)

Method: Least Squares

Date: 05/15/24 Time: 11:57

Sample (adjusted): 1984 2022

Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPS(-1))	-1.141812	0.193048	-5.914659	0.0000
D(CPS(-1),2)	0.412194	0.151767	2.715966	0.0101
C	0.359278	0.327961	1.095489	0.2806

R-squared	0.505535	Mean dependent var	0.010304
Adjusted R-squared	0.478065	S.D. dependent var	2.787256
S.E. of regression	2.013656	Akaike info criterion	4.311584
Sum squared resid	145.9731	Schwarz criterion	4.439550
Log likelihood	-81.07589	Hannan-Quinn criter.	4.357497
F-statistic	18.40297	Durbin-Watson stat	2.094573
Prob(F-statistic)	0.000003		

Null Hypothesis: LEXR has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.195499	0.2109
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LEXR)

Method: Least Squares

Date: 05/15/24 Time: 11:58

Sample (adjusted): 1982 2022

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LEXR(-1)	-0.046567	0.021210	-2.195499	0.0341
C	0.327392	0.087148	3.756762	0.0006

R-squared	0.110000	Mean dependent var	0.159723
Adjusted R-squared	0.087179	S.D. dependent var	0.281351
S.E. of regression	0.268808	Akaike info criterion	0.257910
Sum squared resid	2.818047	Schwarz criterion	0.341499
Log likelihood	-3.287158	Hannan-Quinn criter.	0.288349
F-statistic	4.820217	Durbin-Watson stat	1.872174
Prob(F-statistic)	0.034144		

Null Hypothesis: D(LEXR) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.426452	0.0001
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LEXR,2)

Method: Least Squares

Date: 05/15/24 Time: 11:58

Sample (adjusted): 1983 2022

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LEXR(-1))	-0.874100	0.161081	-5.426452	0.0000

C	0.140849	0.052249	2.695751	0.0104

R-squared	0.436589	Mean dependent var	-0.000893
Adjusted R-squared	0.421763	S.D. dependent var	0.376360
S.E. of regression	0.286191	Akaike info criterion	0.384395
Sum squared resid	3.112411	Schwarz criterion	0.468839
Log likelihood	-5.687905	Hannan-Quinn criter.	0.414928
F-statistic	29.44638	Durbin-Watson stat	1.991669
Prob(F-statistic)	0.000003		

Null Hypothesis: LMS has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.072145	0.7177
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LMS)

Method: Least Squares

Date: 05/15/24 Time: 11:59

Sample (adjusted): 1982 2022

Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LMS(-1)	-0.007624	0.007111	-1.072145	0.2902
C	0.250342	0.052431	4.774673	0.0000

R-squared	0.028630	Mean dependent var	0.197960
Adjusted R-squared	0.003723	S.D. dependent var	0.122064
S.E. of regression	0.121837	Akaike info criterion	-1.324721
Sum squared resid	0.578922	Schwarz criterion	-1.241132
Log likelihood	29.15678	Hannan-Quinn criter.	-1.294282
F-statistic	1.149495	Durbin-Watson stat	1.247196
Prob(F-statistic)	0.290245		

Null Hypothesis: D(LMS) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.185730	0.0021
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(LMS,2)

Method: Least Squares

Date: 05/15/24 Time: 11:59

Sample (adjusted): 1983 2022

Included observations: 40 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LMS(-1))	-0.620567	0.148258	-4.185730	0.0002
C	0.125476	0.034526	3.634225	0.0008

R-squared	0.315566	Mean dependent var	0.002392
Adjusted R-squared	0.297555	S.D. dependent var	0.136534
S.E. of regression	0.114432	Akaike info criterion	-1.448963
Sum squared resid	0.497599	Schwarz criterion	-1.364519
Log likelihood	30.97926	Hannan-Quinn criter.	-1.418431
F-statistic	17.52034	Durbin-Watson stat	2.065326
Prob(F-statistic)	0.000162		

Null Hypothesis: OPEN has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.455931	0.1335
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPEN)
Method: Least Squares
Date: 05/15/24 Time: 11:59
Sample (adjusted): 1982 2022
Included observations: 41 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPEN(-1)	-0.253793	0.103339	-2.455931	0.0186
C	8.260738	3.510460	2.353178	0.0238

R-squared	0.133941	Mean dependent var	0.222004
Adjusted R-squared	0.111735	S.D. dependent var	8.619289
S.E. of regression	8.123492	Akaike info criterion	7.074948
Sum squared resid	2573.654	Schwarz criterion	7.158537
Log likelihood	-143.0364	Hannan-Quinn criter.	7.105386
F-statistic	6.031596	Durbin-Watson stat	2.178286
Prob(F-statistic)	0.018611		

Null Hypothesis: D(OPEN) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.633198	0.0000
Test critical values:	1% level	-3.610453	
	5% level	-2.938987	
	10% level	-2.607932	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPEN,2)
Method: Least Squares
Date: 05/15/24 Time: 12:00
Sample (adjusted): 1984 2022
Included observations: 39 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OPEN(-1))	-1.459655	0.259117	-5.633198	0.0000

D(OPEN(-1),2)	0.179140	0.164714	1.087583	0.2840
C	0.496681	1.381966	0.359402	0.7214

R-squared	0.630651	Mean dependent var	0.216210
Adjusted R-squared	0.610132	S.D. dependent var	13.81731
S.E. of regression	8.627453	Akaike info criterion	7.221579
Sum squared resid	2679.586	Schwarz criterion	7.349545
Log likelihood	-137.8208	Hannan-Quinn criter.	7.267492
F-statistic	30.73440	Durbin-Watson stat	2.043177
Prob(F-statistic)	0.000000		

Dependent Variable: LNOE

Method: ARDL

Date: 05/15/24 Time: 11:53

Sample (adjusted): 1984 2022

Included observations: 39 after adjustments

Maximum dependent lags: 2 (Automatic selection)

Model selection method: Akaike info criterion (AIC)

Dynamic regressors (3 lags, automatic): INFR OPEN LMS CPS LEXR

Fixed regressors: C

Number of models evalulated: 2048

Selected Model: ARDL(1, 3, 3, 0, 0, 1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNOE(-1)	0.379718	0.142966	2.656000	0.0136
INFR	-0.005041	0.005223	-0.965192	0.3437
INFR(-1)	0.006035	0.006135	0.983593	0.3347
INFR(-2)	-0.004795	0.006191	-0.774471	0.4459
INFR(-3)	0.010697	0.005320	2.010861	0.0552
OPEN	0.016391	0.008360	1.960558	0.0612
OPEN(-1)	-0.014471	0.009907	-1.460679	0.1566
OPEN(-2)	0.008941	0.009456	0.945503	0.3535
OPEN(-3)	-0.020503	0.008639	-2.373322	0.0256
LMS	0.427319	0.212098	2.014728	0.0548
CPS	0.032522	0.030476	1.067154	0.2961
LEXR	-0.302022	0.255366	-1.182702	0.2481
LEXR(-1)	0.586897	0.307973	1.905678	0.0683
C	2.614990	0.610129	4.285961	0.0002

R-squared	0.988663	Mean dependent var	11.11349
Adjusted R-squared	0.982767	S.D. dependent var	2.707189
S.E. of regression	0.355383	Akaike info criterion	1.042021

Sum squared resid	3.157425	Schwarz criterion	1.639197
Log likelihood	-6.319409	Hannan-Quinn criter.	1.256283
F-statistic	167.6997	Durbin-Watson stat	1.964088
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test

Dependent Variable: D(LNOE)

Selected Model: ARDL(1, 3, 3, 0, 0, 1)

Case 2: Restricted Constant and No Trend

Date: 05/15/24 Time: 11:53

Sample: 1981 2022

Included observations: 39

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.614990	0.610129	4.285961	0.0002
LNOE(-1)*	-0.620282	0.142966	-4.338673	0.0002
INFR(-1)	0.006896	0.006128	1.125386	0.2711
OPEN(-1)	-0.009643	0.009335	-1.032931	0.3115
LMS**	0.427319	0.212098	2.014728	0.0548
CPS**	0.032522	0.030476	1.067154	0.2961
LEXR(-1)	0.284875	0.195265	1.458913	0.1570
D(INFR)	-0.005041	0.005223	-0.965192	0.3437
D(INFR(-1))	-0.005902	0.005783	-1.020658	0.3172
D(INFR(-2))	-0.010697	0.005320	-2.010861	0.0552
D(OPEN)	0.016391	0.008360	1.960558	0.0612
D(OPEN(-1))	0.011562	0.009023	1.281374	0.2118
D(OPEN(-2))	0.020503	0.008639	2.373322	0.0256
D(LEXR)	-0.302022	0.255366	-1.182702	0.2481

* p-value incompatible with t-Bounds distribution.

** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INFR	0.011118	0.009581	1.160356	0.2569

OPEN	-0.015546	0.015726	-0.988511	0.3324
LMS	0.688911	0.274589	2.508880	0.0190
CPS	0.052431	0.048568	1.079543	0.2907
LEXR	0.459266	0.318677	1.441165	0.1619
C	4.215805	0.839411	5.022335	0.0000

EC = LNOE - (0.0111*INFR -0.0155*OPEN + 0.6889*LMS + 0.0524*CPS +
0.4593*LEXR + 4.2158)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.839556	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=40	
Actual Sample Size	39			
		10%	2.306	3.353
		5%	2.734	3.92
		1%	3.657	5.256
			Finite Sample: n=35	
		10%	2.331	3.417
		5%	2.804	4.013
		1%	3.9	5.419

ARDL Error Correction Regression

Dependent Variable: D(LNOE)

Selected Model: ARDL(1, 3, 3, 0, 0, 1)

Case 2: Restricted Constant and No Trend

Date: 05/15/24 Time: 11:53

Sample: 1981 2022

Included observations: 39

ECM Regression

Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.

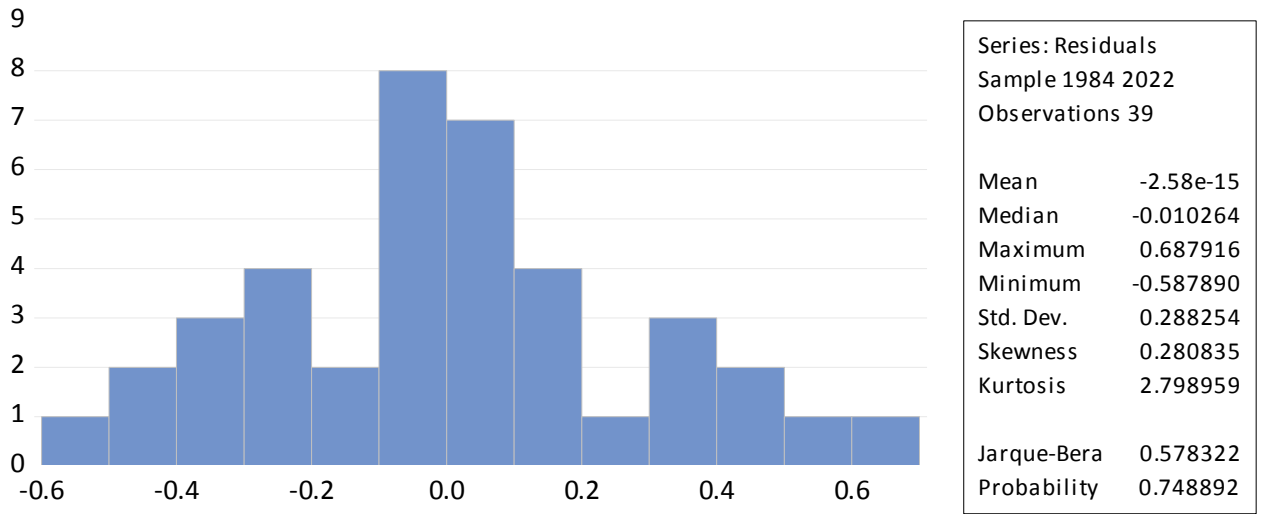
D(INFR)	-0.005041	0.004007	-1.257970	0.2200
D(INFR(-1))	-0.005902	0.003935	-1.500131	0.1461
D(INFR(-2))	-0.010697	0.004177	-2.561044	0.0169
D(OPEN)	0.016391	0.006481	2.529173	0.0181
D(OPEN(-1))	0.011562	0.006663	1.735215	0.0950
D(OPEN(-2))	0.020503	0.006759	3.033555	0.0056
D(LEXR)	-0.302022	0.174384	-1.731941	0.0956
CointEq(-1)*	-0.620282	0.087124	-7.119504	0.0000

R-squared	0.600765	Mean dependent var	0.236307
Adjusted R-squared	0.510615	S.D. dependent var	0.456205
S.E. of regression	0.319143	Akaike info criterion	0.734329
Sum squared resid	3.157425	Schwarz criterion	1.075572
Log likelihood	-6.319409	Hannan-Quinn criter.	0.856764
Durbin-Watson stat	1.964088		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.839556	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15



Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.061835	Prob. F(2,23)	0.9402
Obs*R-squared	0.208581	Prob. Chi-Square(2)	0.9010

Test Equation:

Dependent Variable: RESID

Method: ARDL

Date: 05/15/24 Time: 11:54

Sample: 1984 2022

Included observations: 39

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNOE(-1)	0.066050	0.239533	0.275747	0.7852
INFR	0.000112	0.005511	0.020387	0.9839
INFR(-1)	-0.000131	0.006426	-0.020396	0.9839
INFR(-2)	-0.000297	0.006558	-0.045237	0.9643
INFR(-3)	-0.000332	0.005645	-0.058784	0.9536
OPEN	0.000470	0.008859	0.053083	0.9581
OPEN(-1)	-0.001444	0.011210	-0.128833	0.8986
OPEN(-2)	0.000312	0.009930	0.031397	0.9752
OPEN(-3)	0.000744	0.009230	0.080593	0.9365
LMS	-0.071465	0.300660	-0.237694	0.8142
CPS	0.000152	0.031910	0.004762	0.9962
LEXR	-0.030474	0.288421	-0.105659	0.9168
LEXR(-1)	0.026463	0.339608	0.077922	0.9386
C	-0.170491	0.800689	-0.212930	0.8333
RESID(-1)	-0.110831	0.324742	-0.341288	0.7360
RESID(-2)	-0.052033	0.252207	-0.206308	0.8384

R-squared	0.005348	Mean dependent var	-2.58E-15
Adjusted R-squared	-0.643338	S.D. dependent var	0.288254
S.E. of regression	0.369520	Akaike info criterion	1.139223
Sum squared resid	3.140538	Schwarz criterion	1.821709
Log likelihood	-6.214839	Hannan-Quinn criter.	1.384093
F-statistic	0.008245	Durbin-Watson stat	1.889054
Prob(F-statistic)	1.000000		

Heteroskedasticity Test: ARCH

F-statistic	0.071844	Prob. F(1,36)	0.7902
Obs*R-squared	0.075685	Prob. Chi-Square(1)	0.7832

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

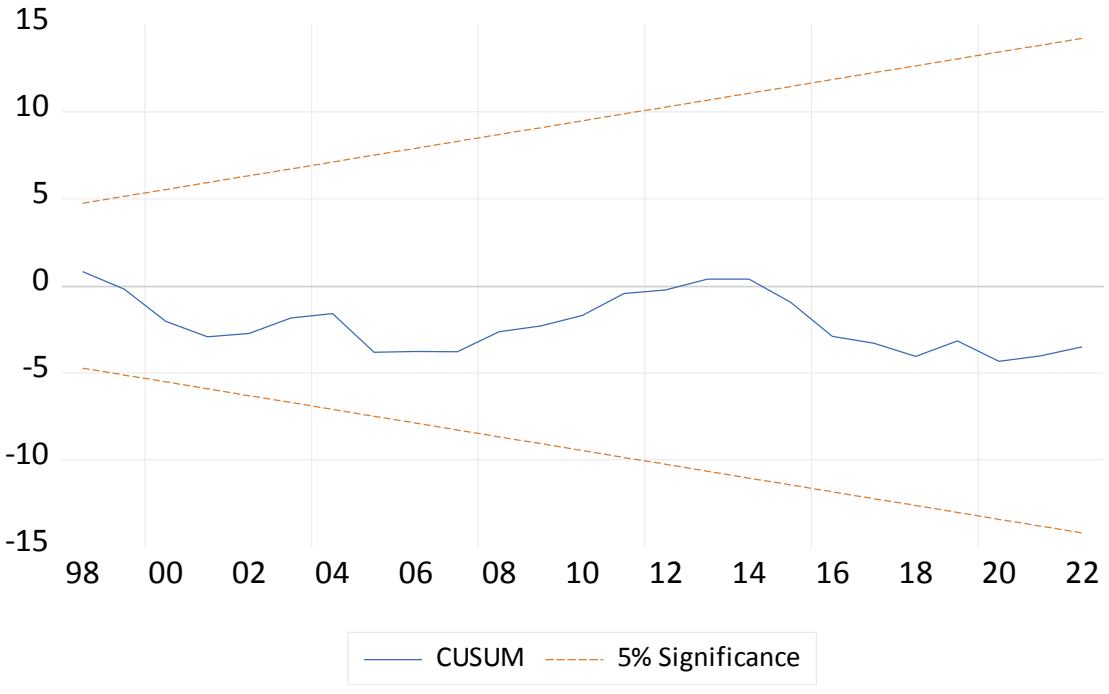
Date: 05/15/24 Time: 11:54

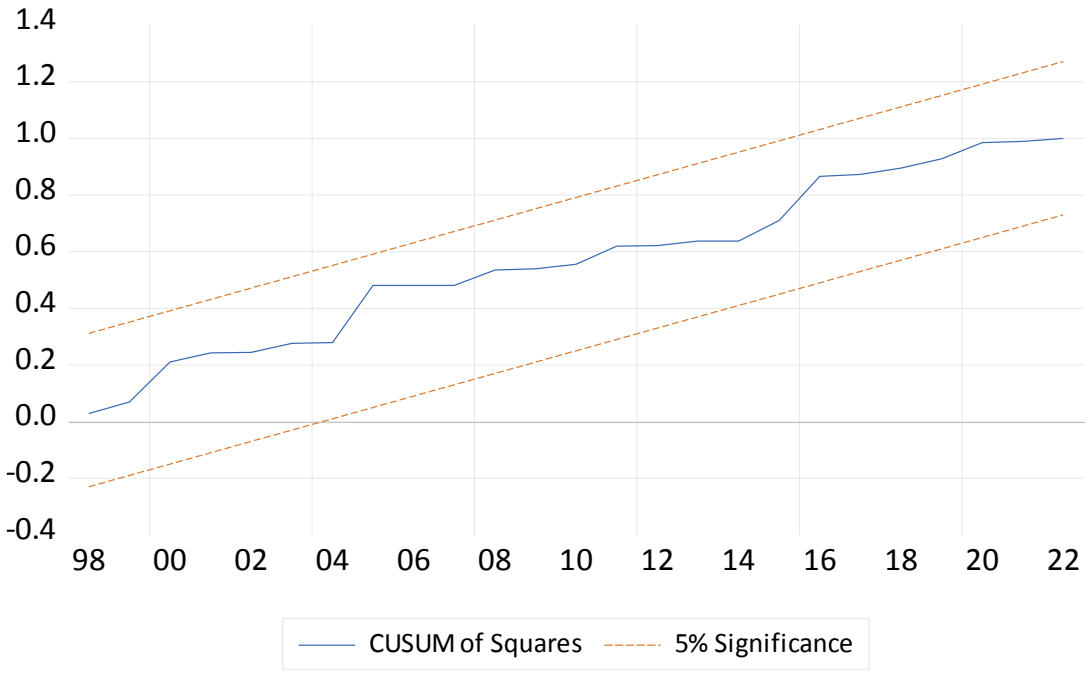
Sample (adjusted): 1985 2022

Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.077384	0.021046	3.676880	0.0008
RESID^2(-1)	-0.041131	0.153452	-0.268038	0.7902

R-squared	0.001992	Mean dependent var	0.073995
Adjusted R-squared	-0.025731	S.D. dependent var	0.102400
S.E. of regression	0.103709	Akaike info criterion	-1.643264
Sum squared resid	0.387198	Schwarz criterion	-1.557075
Log likelihood	33.22202	Hannan-Quinn criter.	-1.612599
F-statistic	0.071844	Durbin-Watson stat	1.901561
Prob(F-statistic)	0.790200		

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