



Analysis of the Impact of Exchange Rate Variation on Non-Oil Export in Nigeria Using ARDL Approach

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Abstract

No doubt that a proper understanding of the relationship between exchange rate and non-oil export is paramount hence it has drawn the attention of various researchers, since exchange rate has been discovered as a means for proper valuation of non-oil export products. There are also arguments over what accounts for the low performance of exchange rate variation as it affects the non-oil exports in Nigeria. To fill the gap, the study employ time series data for the period of 42 years (i.e., from 1980 – 2021). Key variables adopted for the study include non-oil export, exchange rate, bank credits to agriculture and consumer price index. Econometric tool such as Auto Regressive Distribution Lag was used to test the hypothesis. The findings revealed that exchange rate lagged by three-year period exhibits negative influence on the non-oil export, though it is statistically significant at the 5 per cent level in determining the non-oil export in Nigeria both in the long-run and the short-run. The results also revealed the existence of co-integration between the non-oil export and its determinants by the speed of adjustment to equilibrium of 78 per cent approximately. Therefore, the study hereby conclude that exchange rate devaluation enhances the non-oil export in Nigerian economy, hence the study recommends that the government should monitor the exchange rate to know the better prevailing exchange rate that can stimulate the economy.

1. Introduction

Over the years, various scholars have observed that increase in export promotion is the major key to economic growth and development. Ogege (2019) opined that Nigeria is characterized with numerous resources that any economy is required for growth. However,

Nigeria as a country has not actually performed well by way of taking advantage of the available resources. One major reason advocated for this is that, Nigeria has for a long period over relied on crude oil export for foreign exchange earnings thereby abandoned the non-oil sector(s)

that is capable of generating higher foreign exchange earnings

The desire to promote the non-oil export as Chigu (2020) noted was established not only the need for foreign exchange earnings, but also to generate employment in order to tackle the issue of poverty in the economy. The menace arising from foreign exchange rate fluctuation was identified, hence the structural adjustment Program (SAP) was introduced in 1986. This period was characterized with severe fluctuations in oil prices and the revenue was adversely affected thereby creating both external and internal imbalances. However, the primary objective for the introduction of SAP was geared towards economic reconstruction in order to achieve growth through export especially the non-oil exports. The means to achieve this is deregulation of the external trade and payment arrangements, adoption of market determined exchange rate. The market determined exchange rate was considered the major potentials to stimulate non-oil exports and to accelerate economic growth and this attracts foreign capital

The study considers the impact of exchange rate changes variation on non-oil export in order to examine export behavior of non-oil products in Nigerian economy for the period 1980 to 2021. Nigeria experienced exchange rate devaluation of her local currency (Naira). The null hypothesis to justify the objective is such that there is no significant relationship between the exchange rate variation and the non-oil export in Nigeria. To fill the gap in the literature, the study employs time series data for period of 42 years (i.e., from 1980 – 2021) using econometric tool such as Auto Regressive Distribution Lag to test the hypothesis. This study is structured as follows: section two the literature review. Section three is the methodology, while section four represents results and discussed of findings. Section five, deals with conclusion and recommendations

Null Hypothesis

H_0 : There is no significant relationship between the exchange rate variation and the non-oil export in Nigeria.

2. Literature review

Variation in the relative prices of export and imports have existed over time through changes in the devaluation or appreciation of exchange rate. Exchange rate devaluation implies a reduction in the purchasing power parity of the domestic economy in terms of foreign currency (US dollar). Dwivedi (2020) took a look at these expressions in terms of the purchasing power parity theory as a means of correcting imbalance in the balance of payments (BOP). In this regard, import prices are expected to rise relative to export prices and as a result, the volume of export will increase while that of import will fall. Tarad (2021) stated that, the rationale for exchange rate stability has for a long time remained the key objective of monetary policy use in most countries. For this reason, the fixed exchange rate as embedded in the Bretton Wood Agreement in 1944 was regarded as a prevailing feature in the developing countries. (Abdullhi, 2020), at this time the International Monetary Fund (IMF) was unable to sustain enough reserve needed to tackle the short-term imbalance in the Balance of payments, hence the fixed exchange rate type. Being that as it may, the currency of the developing countries was devalued in order to restructure the economy better. By this action, there exists some elements of doubt the viability of the fixed exchange rate system and also the Bretton Wood system.

Various economists have argued that currency devaluation may not yield the desire outcome particularly in country like Nigeria because, in line with Anyanwu (2000) argued that crude oil accounts for more than 95 per cent of Nigeria means of foreign exchange earnings having the value of its output determined by Organization of Petroleum Exporting Countries (OPEC). Therefore, devaluation of the Nigerian

currency would not have any impact on the crude oil export, hence the value of non-oil export can be obtained from the measure of the substantial impact of the currency devaluation.

A number of studies have examined exchange rate devaluation on non-oil exports and these includes: Aliyu, (2021), who examined the effects of exchange rate volatility on the Nigerian non-oil export using the Vector Autoregression technique. The findings revealed the existence of a long-run relationship between the non-oil exports and the fundamental factors. The naira exchange rate volatility decreased the non-oil export by 3.6 per cent while the dollar volatility warrants an increase of 5.3 per cent in the year 2018. The study therefore recommended policy measure to promote openness in the economy as well as exchange rate stability

Zhao (2020), investigated the impact of exchange rate volatility on trade flows of the small scale open economy of New Zealand, using vector error mechanism and co-integration to ascertain the existence of equilibrium long-run relationship in the model. The results proved that real exchange rate volatility is inversely related with the dependent variable. Therefore, the study concluded that the utilization of forward exchange markets to fully hedge exchange rate risk may have made exchange rate volatility less of a factor in explaining real export changes in the short-run, but found to be important factor in the long run equilibrium.

Egert (2021), the relationship between export function in nominal real terms for the transition countries of central and Eastern Europe for the period spanning 1990 to 2017 using Auto-regressive distributed lag approach. The study used domestic and foreign income, real exchange rates as exogenous variables and concluded that, appreciation of exchange rate and volatility are harmful to export earnings.

Bermardina (2020) assessed the impacts of real exchange rates, non-oil gross domestic product and income on the non-oil export in

Russian. The results found out a robust impact on the Russian economy, meaning the existence of equilibrium long-run relationship between the real exchange rate and Russian non-oil export. In order to fill the gap in the literature, the study extends the scope and integrate consumer price index (CPI) into the estimated model 2 by using the ARDL technique to test the hypothesis.

3.1 Methodology

3.1.1 Data Sources

This study relies on historical quantitative data which are available in secondary form and were obtained from the Central Bank of Nigeria Statistical Bulletin 2017 and 2021. The study employs annual time series data covering the period 1980 to 2021. The variables used include non-oil export, consumer price index, Exchange rate and bank credit to Agriculture.

3.1.2 Theoretical Framework

Traditionally, considering the impact of exchange rate variation on non-oil exports encourages exports and discourages imports with no change in the internal purchasing power of the domestic economy. A review of the various theories of exchange rate determination under market determined exchange rate system also affirms that the impact of currency appreciation on exports is negative. Therefore, the model for this study is estimated using the annual time series data spanning from 1980 to 2021. The study used the Autoregressive Distributed Lag (ARDL) technique and bound test developed by Pesaran and Pesaran (2001) to investigate the relationship between exchange rate and the non-oil export in Nigeria. To avoid spurious results which could emanate from the non-stationarity of the time series data, and to estimate a robust relationship of the exchange rate and the non-oil export, Augmented-Dickey Fuller unit root test was conducted to know whether or not the time series data is unit root free. The study also used co-integration test to ascertain the existence of long-run relationship

between the endogenous and the exogenous variables. These procedures are characterized by some econometric advantages over the traditional approach such as Engle and Granger (1987) and Johansen (1988). The ARDL technique can be applied irrespective of whether the variables are integrated at different order i.e I(0) and I(1) and in addition, ARDL technique avoids problems resulting from time series data (Laurenceson and Chai, 2003). In order to achieve the objective, the study uses time series data of export of non-oil products, consumer price index, exchange rate, bank credits to agriculture. In addition, the choice of non-oil export as endogenous variable is attributed to peculiar nature characterized by the Nigerian economy whose export mainly on crude oil and the price is determined in foreign currency. The study conducted Waldd (F-test) to ascertain the existence of long-run relationship between the non-oil export and the selected macroeconomic variables. In addition, the short-run coefficients were estimated using the error correction mechanism of the ARDL with the view to determining the speed of adjustment.

3.1.3 Model Specification

The functional form of the relationship between the dependent and independent variables is adapted from the study by Bermardina (2020) who assessed the impacts of real exchange rates, non-oil gross domestic product and income on the non-oil export in Russian. In the study, it was established that:

$$NEX = f(EXR, BCR) \quad (1)$$

The study found inclusion of consumer price index (CPI) relevant as this affects the level of non-oil export in Nigeria. Being that as it may, CPI is however integrated into the model and this addressed the gap, hence the model is re-specified as:

$$NEX = f(EXR, BCR, CPI) \quad (2)$$

where: NEX represents non-oil export, EXR denotes exchange rate, BCR stands for bank credits to agriculture and CPI equals consumer price index. Equation (2) can be re-written as:

$$NEX_t = \varphi_0 + EXR_t + BCR_t + CPU_t + \mu_t \quad (3)$$

Therefore, the ARDL model from the above equation can take the form:

$$\Delta NEX_t = \varphi_0 + \sum_{i=1}^n \varphi_1 \Delta NEX_{t-1} + \sum_{i=0}^n \varphi_2 \Delta EXR_{t-1} + \sum_{i=0}^n \varphi_3 \Delta BCR_{t-1} + \sum_{i=0}^n \varphi_4 \Delta CPI_{t-1} + \mu_t \quad (4)$$

The error correction model (ECM) therefore follows the order of ARDL model specification as follow:

$$\Delta NEX_t = \varphi_0 + \sum_{i=1}^n \varphi_1 \Delta NEX_{t-1} + \sum_{i=0}^n \varphi_2 \Delta EXR_{t-1} + \sum_{i=0}^n \varphi_3 \Delta BCR_{t-1} + \sum_{i=0}^n \varphi_4 \Delta CPI_{t-1} + \vartheta_1 NEX_{t-1} + \vartheta_2 EXR_{t-1} + \vartheta_3 BCR_{t-1} + \vartheta_4 CPI_{t-1} + ECM_{t-1} + \mu_t \quad (5)$$

Where the parameters $i = 1, 2, 3, 4$ are the short-run dynamics elasticities in the model converging to equilibrium. All the variables are earlier defined. The a priori expectations for the coefficients are $\varphi_1 > 0$, $\varphi_2 < 0$, $\varphi_3 > 0$, $\varphi_4 > 0$. To ascertain the long-run relationship, the study examined the joined null hypothesis which state that:

$$H_0 : \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = 0$$

Against the alternative that:

$$H_1 : \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq 0$$

Therefore, the existence of the long-run relationship is established when H_0 is rejected. For us to accomplish this, two critical values are provided (Pesaran and Pesaran, 2001). In the first case, it is assumed that all variables are I(0), while the second assumption is I(1). Therefore, the null hypothesis will be rejected if confirmed that the calculated F-value is however exceeds

the upper bound, but is accepted if otherwise. However, if the F-value is within, it is inconclusive. The study then proceeds to estimate the ARDL long-run model and also the short-run dynamics of equation (5).

4. Results and discussion

4.1. Unit Root Test

The results of the stationarity test of the time series data is obtained by using Augmented – Dickey Fuller (ADF) test statistic. The results indicate that the CPI is only the variable found stationary at level i.e. $I(0)$ while others are not,

which by implication would not guarantee long-run relationship except the time series data are subjected to further differenced. Box and Jenkins (1978) had it that the non-stationary time series can be made stationary by taking the first difference of the variables. Given the results of the unit root test as reported in table 1, the ADF test statistic of each of the variable shows that the variables became stationary at first difference thereby possessing unit root free

Table 1: Unit Root Test Results

Variables	ADF Test @ Level	ADF Test @ 1 st Diff.	Order of Integration	Remark
NEX	-0.9672	-4.9052	I(1)	Stationary
EXR	-1.1430	-4.3422	I(1)	Stationary
BCR	-0.9721	-4.5811	I(1)	Stationary
CPI	-3.6554	Nil	I(0)	Stationary

5 % critical value = 2.9663

4.2 Lag Length Selection

Find above in table 2, the results of the lag length selection criteria. The study used annual time series data of the variables used in the specified

model to determine the lag length. However, the maximum lag is 3 as indicated by the Final prediction error (FPE) which demotes the minimum value.

Table 2: Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2680.352	NA	2.35e+22	112.7521	122.4242	122.3003
1	-2164.254	441.8211	3.45e+25	105.1352	113.4055	105.2021
2	-2421.421	127.3501	6.72e+27	102.2321	112.4212	108.2130
3	-2311.791	95.1050*	2.13e+26*	112.5410*	114.4521*	106.4810*

*Indicates lag order selected by the criterion

Source: Author's Computation from the estimated output

The Table 3 above represents the computed F-statistic from the bound test result which is given as 3.64. The value appears greater than the upper bound critical value of 3.44 and 3.05 at the 5 and 10 per cent level.

This means that the null hypothesis of no long-run relationship between the non-oil export and its determinants is however rejected

Table 3: Bounds Test for Co-integration

F-statistic	Critical F-statistic	K= 4	K= 4
	Lower bound	Upper bound	Level of Significance
3.64	2.23	3.44	5%
	1.87	3.05	10%

K= Number of repressor i.e. 4

The long-run results presented in table 4 above indicate that the coefficients of the parameter estimate of all the variables except that of the exchange rate are rightly signed. The direct relationship of the bank credits to agriculture (BCR) and consumer price index (CPI) indicate that an increase in the two variables will result to an increase in the non-oil export in the Nigerian

economy. However, the coefficient of the exchange rate did agree with the a priori prediction. The result shown a direct relationship between the exchange rate and the non-oil export which implies a rise in exchange rates can as well lead to increase in the non-oil export in the Nigerian economy.

Table 4: Long Run Results with Dependent Variable NEX

Variable	Coefficient	Std. Error	t statistics	Probability
C	-3.3449	0.8136	-3.9650.	0.0367
EXR	0.0632	0.0160	3,9500	0.0131
BCR	0.0541	0.3762	0.1438	0.0974
CPI	0.0362	0.2086	0.1735	0.0158

Source: Computed by the Authors

The results of the dynamic model shown in table 5 above had it that all the variables indicators are statistically significant at the 5 per cent level and that the value of the coefficient of determination is 0.91. The parameter estimates are also correctly signed except the bank credit to agriculture (BCR) which is inversely related to the non-oil export thereby contradicting the theoretical expectation. This is not unexpected because most of these bank credit for agricultural productivity do not translate to increase its output return needed to boost export in Nigeria. The reason for its failure to translate to agricultural productivity can be attributed to mis-management of the funds and its diversion to the pockets of the few individual on top. The result is contrary to the claim of Bermardina (2020) who assessed the impacts of real exchange rates, non-oil gross domestic product

and income on the non-oil export in Russian that bank credits to agricultural activities enhances output return in Russian thereby leading to corresponding increase in export value.

The direct relationship of the consumer price index (CPI) further demonstrates that a rise in the consumer price index increases the level of aggregate non-oil export in Nigeria. In addition to this claim is that, the result is also statistically significant at the 0.05 level.

The coefficient of the exchange rate lagged by three-year period returned its sign as expected and it is also statistically significant at the 5 per cent level. By implication, it then follows that a reduction in exchange rate increases the volume of net export in any economy. The result is in line with Aliyu, (2021), who examined the effects of exchange rate volatility on the Nigerian non-oil export using the Vector Auto-

regression technique. The findings revealed that there exist long-run equilibrium relationship

between the non-oil exports and the fundamental factors.

Table 5: The Parsimonious Error Correction Estimates of ARDL Model

Variables	Coefficient	Std. Error	t. Statistics	Probability
C	0.1248	0.1586	0.7868	0.2780
D[EXR(-3)]	-0.3017	0.1074	2.8091	0.0152
D[BCR(-1)]	-0.0626	0.0811	-0.7719	0.0542
D(CPI)	0.1005	0.0756	1.3294	0.0517
ECM (-1)	-0.7750	0.2150	-3.6047	0.0215
R-Squared	0.9143			
Adj. R-Square	0.9033			
F-statistic	373.2132			
Prob(F-sta.)	0.0000			
DW Stat.	1.9393			

Source: Computed by the Authors

The coefficient of the estimated lagged error correction model (ECM_{t-1}) is negative and also statistically significant at the 5 per cent level. This is an additional evidence to support the co-integration relationship among the variables.

The coefficient for the feedback of the error correction model is -0.7750, this indicates that when the non-oil export goes beyond the long-run equilibrium, relationship with the exchange rate, it can be adjusted backward at the speed of about 78 per cent.

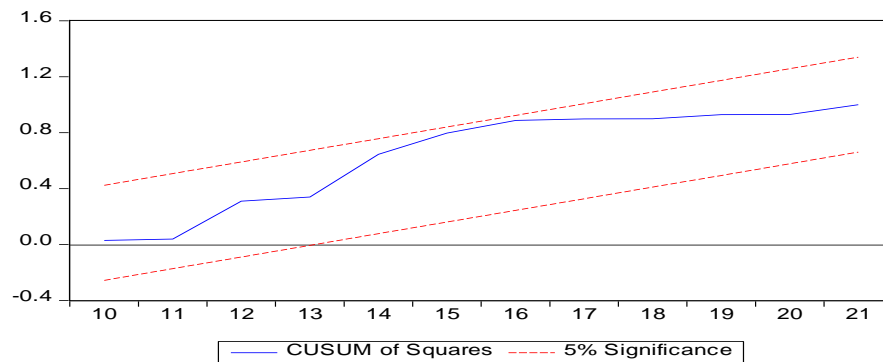
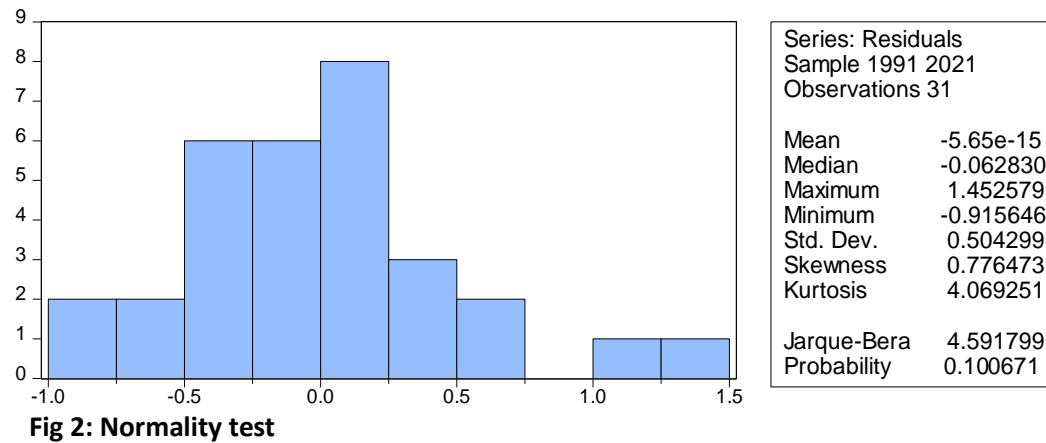


Fig1: Stability Test



In order to test for the existence of stability in the long-run coefficient as well as the short-run dynamics, the cumulative sum of squares was employed. The null hypothesis is that the coefficient must be same at all period while the alternative is the reverse. (Bahmani-Okoe, 2013). The cumulative sum of squares statistic is plotted against the critical bound at the 0.05 level of significance. (Bahmani-Okoe, 2014) stated that if the plot of this statistic lies within the critical bound at the 0.05 level of significance, the null hypothesis will be accepted thereby rejecting the alternative. To ascertain the claim, the cumulative sum of squares of the recursive residual is presented in figure 1.

5 Conclusion and recommendations

The study attempts to explore the link between the exchange rate variation and the non-oil export in Nigeria for the period 1980 to 2021, using Auto-regressive Distributed Lag (ARDL) technique. The results obtained indicate that exchange rate has a direct relationship with the non-oil export in the Nigerian economy. This demonstrates existence of a long-run equilibrium relationship between the non-oil export and its determinants as corrected in the short-run error correction dynamics

On the basis of this, the study concludes that exchange rate devaluation can enhance the non-oil export in Nigeria. Therefore, the study

recommends that the government should at all-time monitor the exchange rate as to know the better prevailing exchange rate for the economy. Secondly, the government should have a thorough market survey so as to identify the non-oil products that can stimulate demand and concentrate on increasing the productivity of the identified products for the reason of increasing the level of exports. Thirdly, the government should monitor the non-oil outputs to ensure that there no leakage in the export goods as this will enhance the level of foreign exchange earnings in the Nigerian economy. More also, a credible department in the bank industry should be establish to ensure judicious utilization of bank credits to agriculture.

References

- Abdullhi, S.M (2020). "Exchange Rate Adjustment in Nigeria, the Problem, the Solution and the Cost", *International Journal Attah, M Kwnnashie and O. Ojowu (eds). The Nigerian Economy under SFEM, Zaria Ahmadu Bello University.*
- Aliyu, F. (2021) "Price, Exchange Rtae Volatility and Nigeria Agriculyural Trade Flows: ADynamic Analysis", AERC Research Paper 8 March.
- Anyanwu, J.C. (2000). "Export Credit and Performance in Nigeria External Trade and Economic. Development in Nigeria,

- Selected Papers for 2000 Annual Conference of the Nigeria Economic Society.
- Bermardina, A. (2020). "Price and Income Elasticities of Russian Exports". *The European Journal of Comparative Economics*, 1(2), 175-193.
- Bahmani-Oke, R. (2013). "Appraisal of Recent Exchange Rate Policy Measures in Nigeria". *Economic and Financial Review* 29(2).
- Bahmani, T. (2014). "Determinants of Agricultural Exports" *Kamla-Rai J Hum Eco*, 9(3).
- Central Bank of Nigeria (2017) Statistical Bulletin
- Central Bank of Nigeria (2021) Statistical Bulletin.
- Dwivdi, D.N. (2020). "Managerial Economics. New Delhi: Vikas Publishing, New York Routledge Chapman & Hall, Inc.
- Egett, B. (2021). "Exchange Rate Regimes, Foreign Exchange Volatility and Export Performance in the Central and Eastern Europe. (Reference here).
- Engle, R.F. & Granger, C.W.J. (1987). "Co-integration and Error Correction Representative Estimation and Testing 5(2).
- Johansen, S. (1988). "Estimation and Hypothesis Testing of Co-integration Vectors in Gaussian Vector Autoregressive Model". 9(2).
- Laurenceson, R. & Chai, H. (2003). "The Effects of Fiscal Decentralization on Public Spending The Korean Case". *Public Budgeting and Finance* 23(4).
- Ogege, S. (2019). "Nigrian Foreign Trade Policy: Its Impact on Non-Oil Exports". *Journal of Economics and International Finance* 4(3).
- Chigu, M. (2020). "Bank Liquidity and Deregulated Foreign Exchange Rate in Nigeria". *The Nigerian Journal of Economics and Management Studies*, 3(1).
- Pesaran, J & Pesaran, M.H. (2001). "Bound Testing Approach to the Analysis of level relationship" *Journal of Applied Economics* 16(3).
- Tarad, K. (2021). "Non-Oil Export Financing and Nigeria Economic Growth". *Inter-discipline Journal of Contemporary Research in Business*, 4(1)
- Zhao, Y. (2020). "Revenue Fluctuations and the current and development Expenditure in the Developing countries" *Pollicy Review* 9; 29-36.