Modeling Export Functions: An Empirical Evidence from Nigeria

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Abstract

This study is devoted to the modeling of export functions in Nigeria to examine the factors that drive export. The study analysis was carried out from 1981 – 2020 with data gathered from the statistical bulletin of the central bank of Nigeria and World bank development indicators. Preliminary analysis of descriptive statistics and unit root test using the Augmented Dickey-Fuller were carried out while the Dynamic Ordinary Least Square (DOLS) was adopted as the econometric technique for estimation of coefficient with post estimation checks. The unit root test results showed that all the variables employed are stationary with a combination of level and first difference series. The DOLS result revealed that government capital expenditure and foreign direct investment inflows are the significant factors that positively drive export in Nigeria while real effective exchange rate and real interest rate are the insignificant positive driver of export. The study further found that about 67percent variation in export is caused by real effective exchange rate, government expenditure, real interest rate, and foreign direct investment while the post estimation diagnostics – normality and stability tests confirm that the study residual series are normally distributed and stable over 1981 – 2020. The study thus among others recommend that the government should increase its spending on capital infrastructure and encourage more foreign direct investment inflows to further boost export performance.

Keywords: Export, FDI, Dynamic Ordinary Least Square.

JEL Codes**:** F1; F3; H50

1. Introduction

Differences in nations' resource endowment have made trade cogent among economies of the world. However, every economy desires their exports outweigh imports to have a favourable balance of payment and gain from the international market. Export trade is an important component of every economy's growth and survival (Bisiriyu et al., 2021). Its sustainability ensures greater utilization of resources which in turn increases employment, foreign exchange earnings, income, and standard of living among others (Chen et al., 2016). Increased exportation offers firm in less developed and developing countries the chance to have enlarged markets and benefit from international trade. A sustainable increase in the net exports of a country generates an increase in aggregate demand and positively affects the real gross domestic product. No economy can consume all it produces, as such the fundamental objective of export for foreign earnings becomes fulfilled (Etukafia & Udoidem,

2019). However, most economies in sub-Saharan Africa (SSA) that are characterized as developing are struggling to produce enough for their domestic consumption and to meet exportation needs.

Theoretically, it was suggested by the Ricardian and Heckscher-Ohlin trade theories that countries should capitalize on the production and exchange of items in which they have a competitive edge to maintain a favourable balance of payment. This theoretical proposition has made countries always target dominating others through export as it supports the advocacy of import substitution strategy which practically improved India's transition to a globally oriented economy (Subho, 2017). The trade protectionism of import substitution policy has thus become a fundamental macroeconomic objective of developing countries as it is believed that export will drive employment, productivity, the balance of payment, and living standard. Over the years, the Nigerian government has implemented policies to stimulate and drive export. The country, like every other SSA country, depends on primary product exportation which includes oil and non-oil export (Osinusi et al., 2022).

The Nigerian export sector is dominated by oil export and contributes a major part of its foreign exchange earnings. The major export items aside from crude oil are natural gas, cocoa, cashew nuts, rubber, and palm products. As stated in the Central Bank of Nigeria report of 2015, Nigeria's export has been increasing over two decades but fell recently in 2015, 2016, and 2020 (see Figure 1.1).

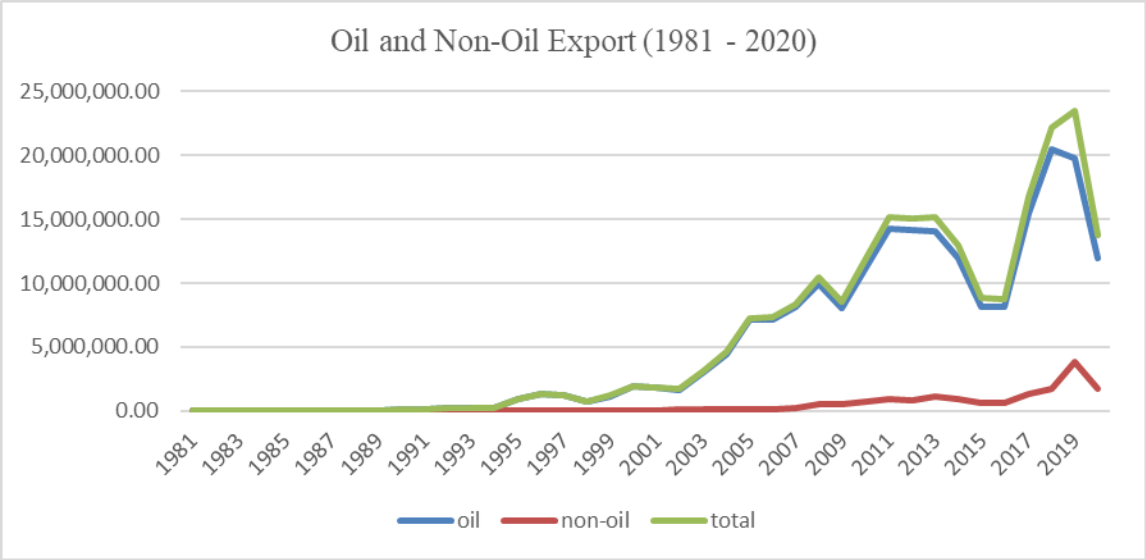


Figure 1.1: Nigeria Export Performance
Source: Researcher's Computation, 2023

However, the export promotion policies of the Nigerian government have directly and indirectly been affecting macroeconomic factors including the exchange rate, rate of interest, and government expenditure within the country. For example, the Nigerian government has adopted policies to variegate the economic base of the country majorly to shift export concentration from oil to the non-oil sector. Export has a direct relationship with the exchange rate and government expenditure on social services. When a nation's exports outweigh its imports on the global market, its exchange rate tends to appreciate and vice versa (UNCTAD, 2005). Similarly, when the government increases its spending on social services to provide infrastructure, the cost of production for export tends to reduce, thereby increasing production capacity for export among firms (UNCTAD, 2005).

The tremendous sustainable export performance experienced by the East Asian tigers among other emerging countries such as Chile, Tunisia, Botswana, and Mauritius have called for a robust investigation by researchers, policymakers, and economic analysts to inquire export determinants across countries (Sousa et al., 2010; World Bank, 2012; Hauge, 2019; Leonidou et al., 2007; Mazeto et al. 2021; Badmus et al., 2022). It is in line with this introduction this study models Nigeria's export functions. The review of literature, methodology, results, and conclusion follow this section.

2. Literature Review

In economic literature, trade has been promoted as one of the fundamental causes of nations' wealth (Jouini, 2015; Zahonogo, 2016; Osinusi et al., 2022; Bisiriyu et al., 2021). However, for the theoretical explanation of the factors that determine export and its overall trend, credit has always been made to the Hecksher-Ohlin (H-O) framework which is among the widely accepted conventional theories of trade. The theory was propounded in the 19th century by Eli Heckscher and Bertil Ohlin based on countries differences in resource endowment which earlier theories of foreign trade like the comparative advantage of David Ricardo does not consider (Krugman et al., 2018). According to H-O, nations have varied factor endowments and factor prices, meaning, some countries have surplus capital, while others have an abundant labour. Thus, the need for determining the comparative advantage of factor endowment in production and export. From the theory analysis, rich nations will export capital-intensive commodities, and labor-intensive nations will export things made with a lot of labor. Invariably, developing economies like Nigeria with abundant and relatively cheap

labour accompanied by less capital will import capital-intensive items from industrialized countries and focus on exporting labour-intensive commodities.

The H-O argument on export is for countries to benefit from the difference in the price of commodities based on relative factor endowments and factor prices assuming there is perfect competition among countries, no economies of scale, and costless availability of technology. Subject to the H-O assumptions, the theory claims that the proximate causes of foreign trade differences are relative commodity prices that are caused by varied relative demand and supply of factors, majorly resulting from differences in factor endowments between the involved countries. However, as countries expand with reliance on technology, H-O theory has been criticized that factor endowments are not the main driver of international trade in the full wave of technology. This fact has been empirically proved by the trade relation between the West European countries and North-South trade. Thus, the driving force of international trade that complements factor endowment is technology and then serves as justification for the neo-technology or technology-gap theories (Krugman et al., 2018).

On empirical grounds, there has been vast research on the factors determining export as well as general trade pattern across the globe. Banga (2006) investigated how foreign direct investments (FDI) from the US and Japan affected the export-diversifying of the Indian manufacturing sector. The study found that if FDI has a favorable impact on the export intensity of industries with a low percentage of global exports, it may result in export diversification in the host nation. Prasanna (2010) explored the significance of FDI inflows on India's export sector performance and found that FDI inflows impact export diversification in a significantly positive manner. Tadesse and Shukralla (2011) looked at 131 countries and the quantity of products that each shipped to see how FDI affected horizontal export diversification. The impacts were measured using parametric (quantile) and semi-parametric econometric techniques, and the study found that a rise in FDI stock enhances these nations' horizontal export diversification. In response to the question of what spurs export diversification in Africa, Kamuganga (2012) confirmed that trade frictions related to infrastructure, such as export costs, export times, and export procedures, as well as inadequate export-supporting institutions, negatively impact African export diversification. Furthermore, the examination found intra-regional Africa trade cooperation to enhance the exportation of new products across African markets. Conclusively, the study informed that volatility of exchange rate, financial underdevelopment, and improper flow of foreign direct investment impedes African countries' chances of diversifying export.

Kiprono (2019) examined coffee export performance of Kenya with the Error Correction Model (ECM). The study results revealed that Kenya's institutional quality, FDI inflow, and real effective exchange rate positively and significantly impact coffee export. Another study by Thuy and Thuy (2019) used quarterly data to analyse the effect of real exchange rate instability on Vietnam's export. The bound testing approach was adoption for analyses and the estimation results showed that Vietnam's exchange rate and export over time conforms to J-curve phenomena. That is, the country's exchange rate instability and devaluation negatively affect export in the short term but otherwise in the long term. Furthermore, Hassan et al. (2022) conducted time series investigation on the determinants of export in Canada using the Autoregressive Distributed Lag (ARDL) model. Their study findings revealed that in both short and long run export performance is drive by energy consumption per capita and government expenditure. Similarly, they found evidence of positive impact of population size on export performance of Canada in the long run. On the contrary, their short and long run analyses result showed that export performance is being significantly impede by real effective exchange rate. El-Agri et al. (2024) modelled export function determinants in Morocco using structural breaks Autoregressive Distributed Lag (ARDL) bound test approach. Their results revealed that the major significant determining factor of Morocco's export behaviour are foreign investment, financial development, and natural resources.

In Nigeria Onayemi and Akintoye (2009) studied the diversification of the Nigeria export base using the vector error correction mechanism. The study established that non-oil export statistically affected by the exchange rate and its lag, as well as institutional factors while loans on export were on the other hand insignificant to the volume of non-oil export. Similarly, Enoma and Isedu (2010) examined how financial sector reforms have impacted Nigeria's non-oil export performance using the multiple ordinary least square. The study found that there is an existence of a long-run relationship between non-oil export and financial parameters. Efobi and Osabuohien (2011) submitted that the agricultural credit scheme is a promoter of non-oil export in Nigeria in their analysis on the promotion of non-oil export using the variance decomposition approach. On the examination of macroeconomic variables' impact on non-oil export performance in Nigeria, Exchange rates, government capital, and recurrent expenditure have all had a significant impact on and contributed to non-oil export, according to Anthony and Somiara (2010), while the manufacturing subsector, interest rates, and the agriculture sector is otherwise during the period of the study. Ezike and Ogege (2012)

shifted their focus to analyze how trade policy impacts non-oil export in Nigeria. The study analyses revealed Nigeria's non-oil exports and trade policy have an inverse relationship.

Arawomo et al. (2014) examined export diversification extent in Nigeria with consideration of the role of FDI. The analysis was done using the generalized method of moments and the examination revealed that foreign investment, exchange rate, and democratic accountability impede export diversification while domestic investment on the other hand promotes it. The study Adama and Ohwofasa (2015) focused on determinants of export earnings in the Nigeria agricultural sector from 1980 to 2011. Their analyses were based on the cointegration and VAR model, and the result revealed that world income and exchange rate are key variables that explain changes in the agricultural export earnings of Nigeria. Okonkwo and Douglas (2016) studied the determinants of export instability in Nigeria using the ordinary least square method on data gathered from 1997 to 2013. The analysis result showed that instability in oil export earnings is the prime cause of export instability in Nigeria over the period studied. Oriavwote and Eshenake (2017) examined the determinants of agricultural export in Nigeria between 1980 and 2015 using the cointegration approach. The empirical result of the study showed that nominal exchange rate, trade openness, and agricultural output have a significant positive impact on agricultural export while oil export has an insignificant positive impact on agricultural export of Nigeria.

Etukafia and Udoidem (2019) analyzed the short and long-run implications of domestic macroeconomic variables on export performance in Nigeria using the autoregressive distributed lag technique. The long-run estimate of the analyses showed that export performance does not respond significantly to changes in imports, government expenditure, inflation, and exchange rate. Abdullahi et al. (2021) explored the determinants and potential of agri-food trade in Nigeria between 1995 and 2019 using the stochastic frontier gravity model. The empirical results revealed that bilateral distance, domestic population, exchange rate, language, and landlocked adversely affect agri-food exports from Nigeria to its 70 major trading countries. Abasiakan et al. (2021) investigated international trade determinants in the Nigeria services sector using the Autoregressive Distributed Lag (ARDL) method. The study results showed that exchange rate, economic growth, volume of merchandise trade, and value added in services are the positively and significantly determinants of Nigeria service sector international trade while secondary school enrolment is a negative determinant.

The above review of literature has helped to ascertain the progress of export function modeling in Nigeria and as well identify conceptual and methodological limitations of past studies. The exploration of empirical literature revealed focus has not been on modeling export function in totality within Nigeria's economy. This empirical gap is what this study intends to fill by providing a model function for Nigeria's total export with a robust methodology of dynamic ordinary least square.

3. Methodology

The framework to model export function in Nigeria is formulated by considering the major factors that could significantly impact export in Nigeria. As suggested in all trade models, export growth is externally driven; for this reason, export is modelled to be a function of exchange rate and government expenditure with interest rate and foreign direct investment included as control variables (Kiprono, 2019). The exchange rate is considered a significant variable because it is cogent in the analysis of international trade as no cross-country trade will be possible without an exchange rate. Also, government expenditure is included as a cogent variable due to its influence in providing social amenities that could aid the production of goods and services for export. Similarly, its indirect impact on improving technology will in turn increase productivity for exportation as submitted by neo-technology and technology-gap theorists. Furthermore, interest rate and foreign direct investment are included as control variables for their role in domestic investment (El-Agri et al., 2024). The export model function is thus specified as:

$$EVI = f\ (REER, GCEX, RIR, FDI) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where EVI = Export Value Index; REER = Real Effective Exchange Rate; GEX = Government Expenditure (Capital); RIR = Real Interest Rate and FDI = Foreign Direct Investment (net inflow % of GDP).

Equation 1 is transformed to an econometric functional form as given below:

$$EVI_t = \gamma_0 + \gamma_1 LEVI_{t-1} + \gamma_2 REER_t + \gamma_3 GCEX_t + \gamma_4 RIR_t + \gamma_5 FDI_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots (2)$$

where $\gamma_0 - \gamma_5$ = parameters to be estimated; $LEVI_{t-1}$ = lag of EVI; t = time (i.e., years); and ε = error term.

The study adopted secondary data which were sourced from the bulletin of the central bank of Nigeria and world bank data set from 1981 to 2020. The estimation technique of the study follows the

conventional means of estimating time series data which involves the conduct of a preliminary test to ascertain the characteristics of the data employed. As such, the descriptive, and unit root tests were conducted while the Dynamic Ordinary Least Square (DOLS) was adopted to determine the impact of the explanatory variables on the explained variable. This methodology was chosen to fill the methodological gap identified in the previous study such as Okonkwo and Douglas (2016) that adopted the conventional ordinary least square that is prone to the problem of autocorrelation. In addition, the dynamic ordinary least square is superior to the ordinary least square based on its applicability to both small and large size, its suitability for data of different orders, and ability to deal with any arising autocorrelation problem in models.

4. Results and Discussion

Table 4.1 presents the description of each variable employed in the study analysis with a focus on their average, median, variation, skewness, kurtosis, and Jarque-Bera statistics. The mean of each variable employed except RIR is greater than the median meaning the distributions are positively skewed. These results are further confirmed by the skewness value of each variable. The standard deviation results showed that EVI, REER, and FDI inflow have values lesser than their mean values. The kurtosis which measures how flattened or peaked the distribution of the series are shows that EVI is mesokurtic, that is, has a normal distribution while REER, GCEX, FDI inflow, and RIR are leptokurtic for their values are greater than the expected value of 3. Finally, the Jarque-Bera statistic which measures how normally a distribution series is informed that the null of normal distribution will be rejected while the alternate will be accepted since the p-values are less than 5%.

Table 4.1: Descriptive Statistics

	EVI	**REER**	**GCEX**	**FDI**	**RIR**
Mean	173.1765	147.9720	502.5050	1.5001	0.4342
Median	85.8641	100.5465	315.1968	1.1263	4.3264
Std. Dev.	154.8592	117.1855	551.7994	1.2453	14.4403
Skewness	1.0932	1.9056	1.2747	1.7223	-2.6804
Kurtosis	3.0307	5.8394	4.3147	6.0231	12.5835

Jarque-Bera	7.9690	37.6457	13.7131	35.0071	200.9676
Probability	0.0186	0.0000	0.0011	0.0000	0.0000

Source: Researcher's Computation, 2023

Table 4.2 presents the result of the confirmation of the unit root property of each variable employed. The test was conducted using the popular Augmented Dickey-Fuller approach and the result reveals that all the series are stationary. Categorically, EVI, FDI inflow, and RIR are stationary at level, that is, I(0) while REER and GCEX are stationary after their first differences, that is, I(1). The result of the unit root tests thus confirms the usability of the data series employed in the study model for econometric analysis.

Table 4.2: Unit Root Test

Variables	**ADF Stat.**	**5% Crit. Value**	**Prob.**	**I(0) / I(1)**	**Inference**
EVI	-3.9832	-3.5629	0.0201	I(0)	Stationary
REER	-4.2765	-3.5331	0.0087	I(1)	Stationary
GCEX	-7.4406	-3.5684	0.0000	I(1)	Stationary
FDI	-3.7877	-3.5298	0.0280	I(0)	Stationary
RIR	-7.5795	-3.5298	0.0000	I(0)	Stationary

Source: Researcher's Computation, 2023

The econometrics result of the study model is presented in Table 4.3 using the Dynamic Ordinary Least Square technique. The result from the output shows that all the variables that are used to model export in this study are positively related to it. The coefficient of REER is positive and statistically insignificant at the 5% probability level; this means changes in the exchange rate do not significantly affect the level of export in Nigeria. On the other, GCEX is positive and has a significant coefficient, this implies an increase in government expenditure on capital infrastructure increased the export index in Nigeria. Similarly, the coefficient of FDI is found to be positive and significant at 5% which informs that increase in FDI inflow is a determinant of export in Nigeria. Finally, the second control variable – RIR is also found to be positive but statistically insignificant. This result shows that a change in the real interest rate does not determine the changes that happen to exports. From the above

results, it is evident that the result of government capital expenditure and FDI inflow conforms to a-priori expectation that increasing government expenditure on capital infrastructures will increase the volume of goods and services available for local consumption and exportation.

Table 4.3: Dynamic Ordinary Least Square
Dependent Variable: EVI
Fixed leads and lags specification (lead=1, lag=1)

Variables	Coefficients	Std. Errors	t-statistics	Prob.
REER	0.6149	0.4518	1.3610	0.1886
GCEX	0.3696	0.0940	3.9307	0.0008
RIR	5.5061	6.5450	0.8413	0.4101
FDI	109.6934	49.0525	2.2362	0.0369
C	-249.9475	146.7205	-1.7036	0.1040
	R^2	0.8181	Adjusted R^2	0.6726

Source: Researcher's Computation, 2023

In addition, an increased inflow of foreign direct investment tends to increase technology know-how and availability of capital for investment which in turn increases output for exportation. This supports the assertion of the neo-technology and technology gap theorists that technology is the major determinant of export in the present-day economies aside from resource endowment. The study empirical findings are consistent with the previous submissions of Kiprono (2019), Thuy and Thuy (2019), Hassan et al. (2022), El-Agri et al. (2024), Adama and Ohwufosa (2015), Oriavwote and Eshenake (2017), and Abasiakan et al. (2012). On the contrary, the findings oppose the submission that export does not respond to government expenditure by Etukafia and Udoidem (2019). The result divergent of Etukafia and Udoidem (2019) can be attributed to data sources and methodological differences, however, the early study of Somiara (2010) had reported significant positive impact of government expenditure on export performance in Nigeria.

The result of the coefficient of determination is about 82% while its adjusted value is 67%. This means about 67 percent variation in Nigeria's export over the years of analysis are explained by the study model explanatory variables while the remaining 23 percent are other economic and non-economic parameters that are not captured by the study model. Furthermore, the study normality test

for post estimation check reveals the model residual series are normally distributed for its Jarque-Bera statistical probability value is greater than 10% (see Figure 4.1). The CUSUM result presented in Figure 4.3 is used to confirm the stability of the study model. The plotted line is within the 5% upper and lower limits of significance, this output thus depicts the estimated parameters of the model are stable for 1981 to 2020.

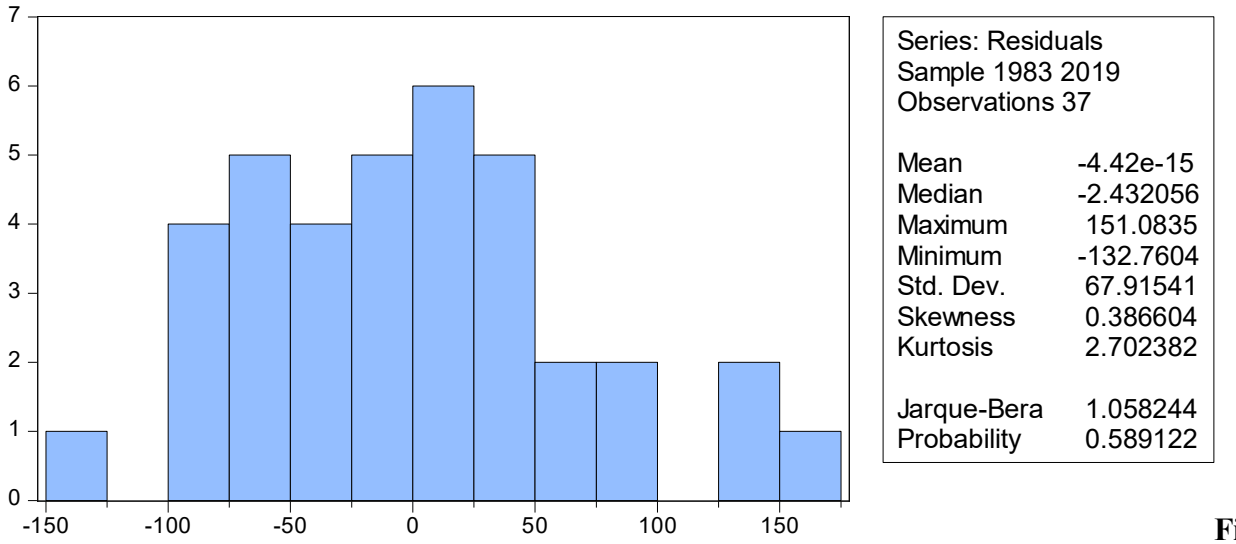


Figure 4.1: Normality Test

Source: Researcher's Computation, 2023

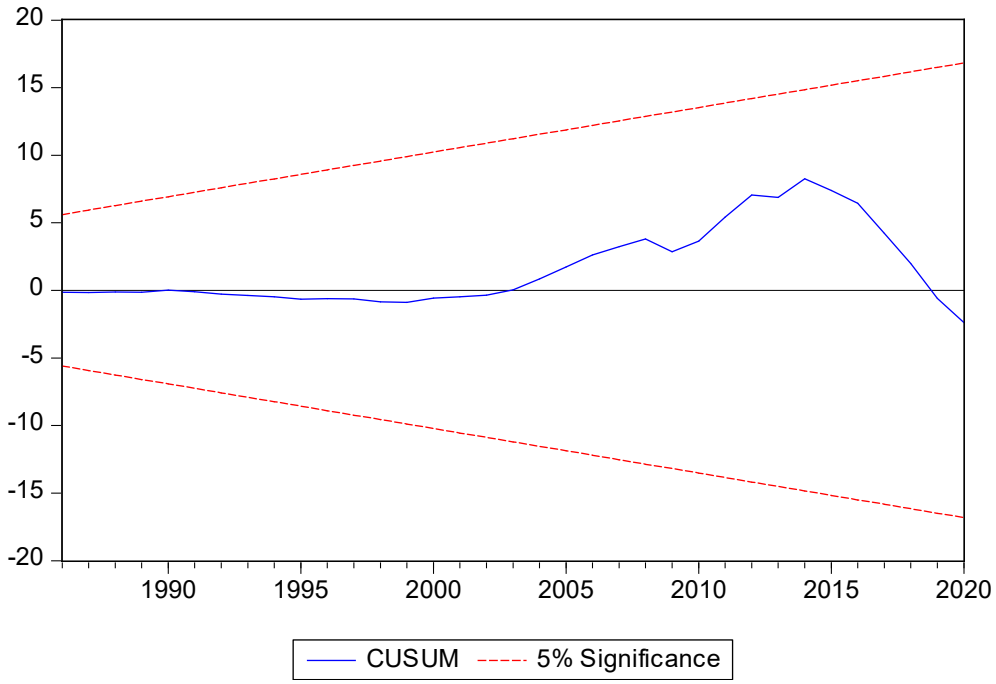


Figure 4.3: Stability Test
Source: Researcher's Computation, 2023

5. Conclusion and Recommendations

This study models export functions in Nigeria to ascertain what factors drive the growth of export in Nigeria. The analysis was conducted on secondary data obtained from two different secondary sources – the central bank of Nigeria statistical bulletin and world bank data from 1981 to 2020 with the adoption of Dynamic Ordinary Least Square. The estimated result showed that the employed variables – real effective exchange rate, government capital expenditure, real interest rate, and foreign direct investment inflows are determining factors of export growth in Nigeria. Categorically, it was found that government capital expenditure and foreign direct investment inflow are the major significant determinants of export growth in Nigeria. The study thus concludes that export in Nigeria is externally determined as submitted by the majority of export growth theories or models. Based on the findings of this study, it is recommended that expenditure on capital infrastructure by the government should be increased to have more increase in the volume of export as infrastructure increases the chances of higher productivity. Similarly, the macroeconomic environment of the Nigerian economy should be made favourable to encourage more inflow of foreign direct investment to provide technology and finance to domestic producers. Finally, the study recommends that the monetary authority should maintain real interest rate and exchange rate to make production and export favourable to producers of goods and services.

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