

Imports, Exports and Foreign Reserves in Nigeria: Exploring the Long and Short-Run Relationships from the Vector Error Correction Model (VECM) Approach

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Abstract

The imports of goods and services, a component of international trade, can boost economic progress when carried out on productive commodities. However, excessive imports of goods and services also stifle the growth of indigenous industries. Understanding the short and long-run relationships between imports and other macroeconomic factors is necessary for planning by managers of the economy. This study examined the relationship between imports, exports, and foreign reserves in Nigeria for 10 years spanning from 2012 to 2021. Monthly time series data were tested for stationarity using the Augmented Dickey-Fuller test, which showed that all the variables were integrated at the order I (1). The Johansen co-integration test showed a stable long-run relationship between imports, exports, and foreign reserves. The regression estimates from the vector error correction model showed a long-run causal relationship (negative) between imports, exports, and foreign reserves. Furthermore, the foreign reserve has a significant short-run causal relationship with imports. Export did not show any short-run causal relationship with imports. Both imports and foreign reserves do not have any causal relationship with exports in the short run. However, an insignificant causal relationship exists in the short run between exports and foreign reserves, while imports do not have any causal relationship with foreign reserves. The study recommends an optimum level of foreign reserve which can put to check the tendency of excessive importation which is detrimental to the growth of local industries.

Keywords: Import, Export, Foreign reserves, Vector Error Correction Model.

1.0 Introduction

Nigeria like other countries of the world engages in trade with other countries. The existence of trade treaties and agreements among nations of the world has facilitated the exchange of goods and services among them. The rate of external trade in a country indicates a nation's degree of openness to external businesses. In this way, importation and exportation are stimulated across borders, and these foreign trade transactions are crucial for a nation's economic development (Inyang & Effiong, 2021). Imports, a component of international trade transactions, can boost economic progress when carried out on productive commodities (Nteegah & Mansi, 2016).

Imports represent that part of the trade in goods and services sourced from economies outside a country. This may be the result of zero capacity in producing the good or service locally because the input resources are lacking or the local demand for the good or service is higher than the indigenous capacity to meet commensurate demand; thereby necessitating import to meet the deficit in demand. According to The Observatory of Economic Complexity (2023), the top imports of Nigeria are refined petroleum (\$11.3B), wheat (\$3.32B), cars (\$2.42B), parked medicaments (\$972m), and broadcasting equipment (\$934M), importing mostly from China (\$21.9B), India (\$4.75B), Netherlands (\$4.58B), United States

(\$4.42B), and Belgium (\$2.34B). Furthermore, Nigeria's imports for 2021 were \$52.19B, a 46.65% increase from 2020; \$35.59B in 2020, a 59.9% decline from 2019; \$88.74B in 2019 a 20.16% increase from 2018; and \$73.85B in 2018, a 49.17% increase from 2017 (Macrotrends, 2023).

Adegboyega (2017) observed that following the Structural Adjustment Programme in Nigeria, there was growth in the volume of goods imported into the country, which was attributed to the need to pursue economic development, the expansion in crude oil export that considerably raised foreign earnings, and the over-valuation of the local currency, which artificially cheapened imports in preference to local production. The astronomical expansion of domestic absorption is a key factor that should not be ignored. As a result, part of the growth in domestic absorption had to be satisfied by imports. Referring to the CBN annual statistical bulletin, Adegboyega, submitted that by and large, the Nigerian economy is import-dependent with very few non-oil exports.

Importation is likely to be constrained by various factors, such as the availability of the required external reserves to facilitate import transactions. It has been noted that excessive importation is likely to exert pressure on the external reserves of the country, thereby creating a negative impact on the economy. However, the positive impact of imports has been that they increase the varieties of goods available to domestic consumers, generate positive competitive pressures on the domestic economy, promote standardization, and could be used to bridge the gap in domestic supplies of essential commodities to poor households (Inyang & Effiong, 2021; Alex & Ebipumere, 2020).

Historically, export trade in raw agriculture products in Nigeria dates back to the 16th century. This resulted in bilateral trade between Nigeria and the Western World with Nigeria having a comparative advantage over agricultural produce in exchange for finished goods and this broadened Nigeria's foreign earnings through the export of palm oil, cocoa, palm kernel, etc. up to the late 60's as this constituted the mainstay of Nigerian economy contributing about 54.7% to GDP (Adegboyega, 2017). Adegboyega added that the detection of oil changed the composition and structure of export trade in Nigeria with a radical shift from agriculture, as our major export to oil exportation. The Nigerian economy expanded rapidly, as oil production and export rose phenomenally. During and some few years after SAP, the main manufactured exports were textiles, beer and stout, cocoa butter, plastic products, processed timber, tyres, bottled water, soap, and detergents as well as iron rods. However, some of these products have disappeared from the export list owing to poor enabling environment. The oil and gas sector accounts which exports crude oil accounts for about 90% of foreign exchange earned by the country while non-oil exports account for the balance. The economy is, therefore, susceptible to external shocks via the oil industry. These shocks have been caused by either development in the international crude oil market or the restiveness in the Niger Delta region of the country (Adegboyega, 2017).

Generally, the import and export of goods and services are important elements in the computation of the balance of payment of any economy. Domestic investment, export, and import are seen as the tools used to manipulate economic growth and development. The export of goods and services serves as a way in which an economy generates foreign exchange. Contrarily, import is a source of outflows of foreign exchange. The manipulation of both export and import affects domestic investment and also has implications for economic growth (Ahmed, et al. 2018). Furthermore, according to Andriyan, et al., (2020), exports can also affect foreign exchange reserves and the foreign exchange obtained from exports is the foreign exchange that becomes the country's income so that when exports increase, the foreign exchange reserves can also increase.

The export of goods and services contributes to increase in foreign reserves for exporting countries. The growth in foreign reserves is attributed to the volume of their exports of goods and services. Thus, countries strive to increase the level of their exports to accumulate more foreign reserves owing to the importance of foreign reserves to the growth process of an economy (Akighir & Kpoghul, 2020). According to Nteegah and Okpoi (2016), foreign reserves play key roles in the growth process of economies of the world which include: protection of the value of the local currency, settlement of international payments such as trade needs and payments of external debts, accumulation of wealth, exchange rate management, provide confidence for investors, provide capital to fund sectors of the economy and provide a safety net for future external shocks. The roles mentioned above of foreign reserves culminate in the economic growth of nations.

From the foregoing, it is obvious that there is a link between imports, exports, and foreign reserves. Given the time-series nature of the data of the study, we are interested in differentiating between the long-run and the short-run impact of exports and foreign reserves on imports provided there exists a long-run equilibrium relationship among the variables. In this paper, we draw upon recent advances in econometric time-series modeling and use these techniques as tools to examine three empirical issues. First, we examine whether a long-run relationship exists among imports, exports, and foreign reserves. Subsequently we show the long-run equilibrium exists, and we determine the direction, extent, and statistical significance of the long-run effects of export and foreign reserves on import. Finally, we investigate the short-run dynamics of import.

The rest of this paper is as follows. Section 2 is devoted to a literature review covering conceptual, theoretical, and empirical reviews. Section 3 presents the methodology of the study. The fourth section reports and discusses the empirical results. Section 5 contains the major conclusions and policy implications of the paper.

2.0 Literature Review and Hypotheses Development

Conceptual Review

Export is an effort to sell commodities to other countries with the expectation of payment in foreign currency (Andriyan, et al. 2020). Generally, the import and export of goods and services are important elements in the computation of the balance of payment of any economy. Domestic investment, export, and import are seen as the tools used to manipulate economic growth and development. The export of goods and services serves as a way in which an economy generates foreign exchange.

Import represents the aggregate goods and services that are brought into local consumption from foreign countries. These goods and services may be required because of shortfall in their local production due to lack of capacity by local producers or sudden rise in demand of the goods and services which local production capacity cannot meet at a certain point in time. Alex and Ebipumere (2020) posit that the justification for import in trade between countries is attributed to the unequal distribution in human and natural resources that exist among nations of the world, which necessitates the imports by the less endowed territories. In the view of Inyang and Effiong (2021), import is a source of outflows of foreign exchange, and its manipulation affects domestic investment and also has implications for economic growth. When imports are concentrated on productive commodities, it can enhance economic growth (Nteegah & Mansi, 2016); imports increase the varieties of goods available to domestic consumers, generate positive competitive pressures on the domestic economy and could lead to standardization (Alex & Ebipumere, 2020)

Foreign exchange reserves are all foreign assets controlled by the monetary authority and can be used at any time. It is further explained that these reserves are a tool to finance imbalances in the balance of payments or the context of monetary stability by intervening in the foreign exchange market and for other purposes (IMF, 2013). Foreign reserves are the available balances or assets adopted to address distortions in the country's balance of payments, including cash gold, and capital currencies for use in making inter-state payments and financing the country's trade (Abd & Allwsh, 2022). Foreign exchange reserves are an essential aspect of the economy in each country. The growth and size of reserves serve as signals for global financial markets regarding the credibility of a country's monetary policy and creditworthiness (Andriyan, et al. 2020). Furthermore, foreign reserves are used to finance international transactions (Rahmawati & Suriani, 2022); serve as a buffer stock to prevent external shocks during a global financial crunch (Tran & Le, 2020), and are used as a basis for bridging the national balance of payments deficit (Chen et al., 2007).

Theoretical Review

International trade theories which are relevant to this study are classical theory and neo-classical theory, also called the modern theory, with its main variant dubbed the Heckscher-Ohlin theory. The proponents of these two theories argued that international trade plays an important role in promoting the economic growth of nations. The theories also recognized that export trade is important for generating foreign exchanges that are needed for the importation of goods that cannot be domestically produced. Both theories being based on the principle of comparative advantage, extol the virtue of specialization, division of labor, and free trade. In fact, for those two theories, the advantage of external trade is maximized when it is entirely free from natural and man-made hindrances. Both theories emphasize the gains from external trade (Ahmed, et al. 2018).

Empirical Review

Inyang and Effiong (2021) examined the effect of the exchange rate on the demand for imports in Nigeria. The study is conducted over the period 1981 – 2019 and is done using the autoregressive distributed lag (ARDL) model. The results of the study revealed that the exchange rate had a negative and insignificant effect on import demand in the short run but a negative and significant effect in the long run. The real income exerted a negative and insignificant effect on the demand for imports in the short run, while in the long run, import demand is influenced by real income in a positive and significant manner.

In a bid to investigate the determinants of importation in Nigeria, an earlier study by Egwaikhide (1999) modeled an import demand function using the balance of payments framework and the consumer theory model. The study utilized the co-integration and error correction technique and found that foreign exchange dynamics affect import decisions. Similarly, Ogbonna (2016) revisited the import-demand function by employing the VAR method. The result of his study revealed that real exchange rates, world price index, and disposable income exerted a significant long-run effect on import demand. This was however not the case in the short run.

Oluyemi and Isaac (2017) used monthly time series data from January 1996 to June 2015 to study the effect of the exchange rate on imports and exports under a vector autoregression (VAR) approach. Results of the VAR model, show that exchange rates exert a positive and insignificant effect on imports while a negative and insignificant effect of exchange rate on exports at lag 1 was also reported.

The study of Ibtisam, et al. (2023) empirically investigated the dynamics of the relationship between import demand and foreign exchange reserves for an oil-rich and high-income developing country,

Oman. This study employs the Autoregressive Distributed Lag (ARDL) model to investigate the impact of real income, domestic prices, and foreign exchange reserves on aggregate and disaggregated import demand function. Results reveal that total imports are significantly affected by domestic prices only; whereas, demand for goods import is influenced by income. The level of foreign exchange reserves does not influence the import demand function.

Perhaps, one of the earliest studies that used foreign reserves as a possible determinant of import is the work of Heller (1966). The study derived the level of optimal international reserves using a cost-benefit function in which the marginal propensity to import was a major component. Results of the study show a negative relationship between the two possibly because a country's high inclination to import would reduce the marginal cost of adjustment and hence bring down the demand for international reserves. Some years later, Moran (1989) extended the research on the relationship between imports and foreign reserves. The study focused on developing countries and used import prices as endogenous variables in the model. Moran's work revealed that when there is low foreign currency inflows and low international reserves, the government will use several trade barrier measures such as increasing domestic import prices to reduce aggregate import demand.

3.0 Methodology

The study employs the trend research design. The scope of this research was focused on matters relating to the long and short-run relationship between imports, exports, and foreign reserves. Data for the series were secondary and sourced from the Central Bank of Nigeria statistics database. The study used monthly data for imports, exports, and foreign reserves from January 2012 to December 2021. The original monetary values of the data series were used in the descriptive statistics, while the logged values were used for the presentation and analysis of the stationarity, co-integration, VECM and granger causality tests. The Vector Error Correction Model (VECM) is employed in this study. The VECM is a multivariate dynamic model that entrenches a co-integrating equation. It is important when the variables used to conduct the research are integrated in order one or $I(1)$, thus if the variables are stationary at the first difference and exhibit a linearly independent co-integrating relationship. The co-integration test is such that if the residuals of the linear regression of the system variables are stationary at order zero or $I(0)$, then the variables are cointegrated. Since the research uses three system variables, identifying the rank of co-integration for the VECM is important, hence Johansen (1988) and Johansen and Juselius (1992) co-integration and VECM approaches are applied. We, therefore, used the co-integration term of VECM in investigating the long-run relationship between imports, exports, and foreign reserves

4.0 Results and Discussion

Descriptive Analysis

Table 1: Descriptive Statistics

Statistics	IMPORTS (Million US\$)	EXPORTS (Million US\$)	FOREIGN RESERVES (Million US\$)
Mean	4112.10	5103.08	36818.57
Median	4138.05	4770.76	36468.19
Maximum	7895.15	10906.1	47903.09
Minimum	2297.11	1920.61	23689.87
Standard deviation	1110.24	2041.74	6413.234
Sum	493452	612369	4418229
Skewness	0.59933	0.56789	-0.091946
Kurtosis	3.73872	2.40245	2.046916
Jarque-Bera	9.91234	8.23458	4.710923
Prob.>Jarque-Bera	0.00704	0.06289	0.094850
Observations	120	120	120

The 120 observations consist of monthly data on imports, exports, and foreign reserves from January 2012 to December 2021. The average imports, exports, and foreign reserves during the period were \$4,112.10m, \$5,103.08m, and \$36,818.57 respectively. During the period under review, the maximum export was \$10,906.10m, the maximum imports were \$7,895.15m and the maximum amount of foreign reserves was \$47,903.09m. The standard deviation value shows a wide dispersion from the mean for the foreign reserve's series; while that of imports and exports did not show a wide dispersion from the means. Furthermore, the total (sum) of exports (\$612,369m) in the period is greater than the total imports of \$493,452m. This is an indication of a favourable balance of trade during the period. The kurtosis values of export (2.40245) and foreign reserve (2.046916) are not more than 3.5. This is an indication that the series is free of outliers. However, the kurtosis value of 3.73872 for imports suggests that the series may contain some outliers. (Gujarati, 2007). In addition, all the Jarque-Bera probability values are greater than 5% for exports and foreign reserves, a suggestion that the series is normally distributed.

Table 2: ADF Stationarity Test Results

Variable	t-statistics	Critical value (5%)	Probability	Order of stationarity	Remarks
Import (LOGIMP)	-12.21418	-3.448681	0.0000	I (1)	Stationary
Export (LOGEXP)	-7.831181	-3.448348	0.0000	I (1)	Stationary
Foreign Reserve (LOGFRS)	-12.19962	-3.448348	0.0000	I (1)	Stationary

The Augmented Dickey-Fuller (ADF) stationarity results shown in Table 2 are for the 1st difference unit root test. The t-statistics for all the series are lower than their corresponding critical values at 5% and produced significant probability values at 1% significant value. These results provided evidence to reject the null hypothesis that the series has a unit root.

Table 3: Table 2. Lag length Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
1	277.3991	NA	1.66e-06	-4.792840	-4.57481*	-4.704208
2	297.4672	37.98618	1.37e-06*	-4.990486*	-4.553584	-4.813221

The results of the lag length criteria test as the second stage are shown in Table 3. The values of the Final Prediction Error (FPE), and Akaike Information Criterion (AIC), is in lag 2, while that of the Schwarz Information Criterion (SC) is in lag 1. The lowest Akaike Information Criterion (AIC) value is also in lag 2, where the lowest AIC value obtained from the estimated VAR with various lags shows that the lag length is the best to use (Gujarati, 2007). Thus, the optimum lag used in the next stage of testing is optimum lag 2. For brevity, values for lags 3 to 8 are not shown here. Details are shown in the appendix.

Table 4: Johansen Co-Integration Test

Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace statistics	5% critical value	Probability
None*	0.175619	35.61594	29.79707	0.0095
At most 1	0.072075	13.02055	15.49471	0.1141
At most 2*	0.035825	4.268448	3.841465	0.0388

Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistics	5% critical value	Probability
None*	0.175619	22.59540	21.13162	0.0309
At most 1	0.072075	8.752099	14.26460	0.3073
At most 2*	0.035825	4.268448	3.841465	0.0388

Co-integration implies the existence of an error correction model of the form that describes the dynamic behavior of change in the target variable (Engle & Granger, 1987), imports in the case of this study. The error correction model links the long-run equilibrium relationship implied by co-integration with the short-run dynamic adjustment mechanism that describes how the variables react when they move out of long-run equilibrium. Table 4 presents the Johansen-Juselius Co-integration test at the Lags interval in first differences with the linear deterministic trend. The result shows that both tests indicated 2 co-integrating equations at the 0.05 level. Therefore, both the Trace test and Maximum Eigenvalue test are statistically significant to reject the null hypothesis of $r = 0$ at the 5% significance level.

Table 5. Vector Error Correction Model Results

Co-integrating Eqn:		CointEq1	
LOGIMP (-1)			1.0000
LOGEXP (-1)			-0.226294 (0.12153) [-1.86202]
LOGFRS (-1)			-0.283728 (0.27026) [-1.04982]
C			-3.395415
Error Correction	D(LOGIMP)	D(LOGEXP)	D(LOGFRS)
CointEq1	-0.43129 (0.09011) [-4.81771]	-0.092037 (0.07192) [-1.27975]	-0.03447 (0.01799) [-1.93160]
D(LOGIMP (-1))	-0.311219 (0.08415) [-3.69820]	0.095292 (0.06716) [1.41880]	0.015130 (0.01680) [0.90062]
D(LOGEXP(-1))	0.186397 (0.11844) [1.57383]	-0.16381 (0.09452) [-1.73301]	-0.017902 (0.02364) [-0.75719]
D(LOGFRS(-1))	-1.272141 (0.47219) [-2.69414]	0.189635 (0.37685) [0.50320]	0.251315 (0.09426) [2.66616]
C	-0.000740 (0.01785) [-0.04143]	-0.007078 (0.01425) [-0.49669]	0.001005 (0.00356) [0.28190]
R-squared	0.408922		
Adj. R-squared	0.387999		
F-Stat.	19.54407		

Table 5 shows values of coefficients, standard error, and t-statistics for the series (LOG IMP, LOGEXP, and LOGFRS). Looking at the co-integrating equation section, the coefficient of LOGEXP is 0.226294. This means that a 1% change in exports will result in a 0.23% increase in imports. Similarly, the coefficient of LOGFRS is 0.283728, implying that a 1% change in foreign reserve will lead to a 0.28% increase in imports.

Theoretically speaking, the speed of adjustment parameters α (Y) (the coefficients on "cointeq1") should be negative and lie between (0, -1). According to the VEC model, the point estimate should imply that output (Y) in time "t" converges to the long-run equilibrium relationship. If Y is above its long-term value (ECM term >0), Y must decline ($\alpha(Y) < 0$), and if Y is below its long-term value (ECM term <0), Y must rise ($\alpha(Y) < 0$). Therefore, the negative signs of the estimated coefficient of the variables imply that the series cannot drift too far apart, and convergence will be achieved in the long run. The estimated coefficient of the LOGIMP (-0.43129) shows the speed at which it converges to its long-run equilibrium. This means that 43.1% of this disequilibrium is corrected monthly. The -0.092037 estimated coefficient of LOGEXP, is implying that export is diverging from its steady state by 9.2% monthly. The foreign reserve coefficient suggests that foreign reserve is diverging from a steady state and requires monthly convergence to equilibrium with a -0.03447 (3%) estimated coefficient. However, convergence to

equilibrium for export and foreign reserves is not achieved in the long run due to their insignificant coefficients.

The R-squared value of 0.408922 indicates that 40.89% of the total variation in Nigeria's imports is influenced by changes in exports and foreign reserves over the period under investigation.

Table 6: Granger Causality Test

Null Hypothesis	Obs.	F-Statistics	Probability
LOGEXP does not granger cause LOGIMP	118	3.88040	0.0234
LOGIMP does not granger cause LOGEXP		1.20398	0.3038
LOGFRS does not granger cause LOGIMP	118	6.05069	0.0032
LOGIMP does not granger cause LOGFRS		1.26210	0.2870
LOGFRS does not granger cause LOGEXP	118	1.91902	0.1515
LOGEXP does not granger cause LOGFRS		0.5602	0.5727

The results of the Granger causality test analysis can be seen in Table 6. The results show that the causal relationship only occurs in export that affects imports, with a probability value of 0.0234. Likewise, foreign reserves affect imports with a probability of 0.0032. While the causality relationship between other variables is not significant.

Diagnostic Tests

Diagnostic tests were carried out on the data which is necessary to validate the inferences drawn from the study's results. The tests are shown in Table 7.

Table 7: Diagnostic Tests

Test	Chi-sq.	F-Stat/LM Stat.	Probability
Heteroscedasticity	88.23145	F (14,102)	0.3548
Autocorrelation		5.2676	0.8104

The results in Table 7 showed Chi-sq and probability values of 88.23 and 0.3548 respectively for the Heteroscedasticity test. The probability value being greater than 5% is an indication constant variance signifying that there is no problem of heteroscedasticity in the data sets. Furthermore, the LM Stat. figure of 5.2676 and probability of 0.8104 for the autocorrelation test revealed that error terms are uncorrelated across different time periods in the series used for the study, thus, there is no problem of serial correlation in the series used for the study.

Discussion of Findings

The results of the Vector Error Correction Model presented in Table 5 showed that in the short run, the exports at lag one period had a positive but insignificant effect on imports. However, the foreign reserves in lag one period had a negative and insignificant effect on imports. This reveals that high foreign reserves are not necessary an incentive to increased importation. This does not support the theory of that high imports leads to the depletion of foreign reserves. This may be because for the period of the study, total imports were lower compared to total exports indicating that Nigeria did not depend on imports to meet local demands. This finding is in line with the study of Ibtisam, et al. (2023) which reported that the level of foreign exchange reserves does not influence the import demand function; and with the

submission of Heller (1966) and Moran (1989) which reported a negative relationship between imports and foreign reserves.

Furthermore, the error correction term has the hypothesized negative sign and statistically significant in the imports function at 10 percent level indicating a moderate convergence to long run equilibrium after the short run shocks. Specifically, 43.12% of the previous year's disequilibrium in imports is been corrected by exports and foreign reserves. The R^2 value was 0.4089 showed that that about 41% of the total variation in Nigeria's import is influenced by changes in exports and foreign reserves over the period under investigation representing a good fit. The F-statistic, showed that the overall explanatory variables are significant in explaining imports in Nigeria.

5.0 Conclusion and Recommendations

This study examined the relationship between imports, exports, and foreign reserves in Nigeria for 10 years spanning from 2012 to 2021. Monthly time series data were tested for stationarity using the Augmented Dickey-Fuller test, which showed that all the variables were integrated at the order I (1). The Johansen co-integration test showed a stable long-run relationship between imports, exports, and foreign reserves. The regression estimates from the vector error correction model showed that there is a long-run causal relationship (negative) between imports, exports, and foreign reserves. Furthermore, the foreign reserve has a short-run causal relationship with imports, but the relationship is significant at 10%. Export did not show any short-run causal relationship with imports. Both imports and foreign reserves do not have any causal relationship with exports in the short run. However, an insignificant causal relationship exists in the short run between exports and foreign reserves, while imports do not have any causal relationship with foreign reserves. Therefore, the study recommends an optimum level of foreign reserve that can check the tendency of excessive importation which is detrimental to the growth of local industries.

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