Are Exports and Imports Cointegrated? Evidence from Nigeria

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Abstract his study examined the long-run relationship between Nigerian exports and imports between 1960 and 2014. Exports and imports were disaggregated into oil and non-oil components. The application of the Johansen, Bound testing and the Hansen parameter instability test cointegration techniques revealed that Nigerian exports and imports at the aggregate and disaggregated level are cointegrated with the cointegrating coefficient very close to unity. This indicated that Nigeria's macroeconomic policies have been effective in the long run and suggested that Nigeria is not in violation of its international budget constraint. The result is however sensitive to the choice of the dependent variable between exports and imports. Utilizing the Toda and Yamamoto granger non-causality tests, we also report bi-directional causality between aggregate exports and imports, but uni-directional causality from oil exports to oil imports and from non-oil imports to non-oil exports.

Key words: Exports, Imports, Cointegration, Budget Constraint, Nigeria
JEL Classification: C22, F14, F43.

1. Introduction

The important role of exports and imports in the economy cannot be overemphasized. Exports and imports play an integral role in determining the trade balance of a country. As a result, the dynamics of the relationship between these two variables hold significant importance for the economy and have attracted the interest of researchers in testing the nature of relationships between exports and imports. This is because an unsustainable trade deficit indicates a violation of international budget constraints over time. If the trade deficits should persist, the domestic interest rates will be very high and such an economy will metamorphosed into a heavily indebted country which may affects the welfare of the citizens. Consequently, the presence of a long run relationship between exports and imports is highly desirable for any economy. The occurrence of a cointegration relationship between imports and exports suggests that the trade deficits of a country are short-term and sustainable in the long run and confirm the existence of an effective macroeconomic policy. Hence, the need to investigate whether trade deficits is only a short-run phenomenon in Nigeria.

Although the literature has examined the relationship between exports and imports extensively in the last three decades, it is inconclusive with respect to their cointegration relationship. While some of the studies have reported long run relationship between exports and imports, other has found weak or no cointegration. This lack of consensus can be attributed to methodological problem, selectivity bias, and specification error. By way of illustration, while some of the studies have adopted exports as the dependent variable, other studies have made use of imports as the dependent variable, thereby leading to different empirical conclusion. A close observation of the literature revealed that the results seem to be mixed for cointegration techniques that require the specification of dependent and independent variables. However, in cointegration tests that requires variable ordering, the choice of dependent or independent variables seems not to matter. Since, the choice of the dependent variable adopted can influence the direction of result, this study examine the cointegration relationship between exports and imports in the context of the two variables as dependent and independent variables using different cointegration tests. In addition, we perform a disaggregated analysis by separating imports and exports into oil and non-oil components. The disaggregation is necessary to determine the extents of co-movement of the components of exports and imports with respect to achieving sustainable trade balance.

Similarly, some of the studies have reported unidirectional, bi-directional or no causality with respect to exports and imports. This lack of consistent causal pattern between exports and imports in the studies may be due to the use of the traditional Granger causality frameworks. The use of a simple traditional Granger causality test has been identified by several studies (Engle and Granger, 1987; Toda and Philips, 1993; Toda and Yamamoto, 1995; Dolado and Lutkepohl, 1996; Zapata and Rambaldi, 1997; Tsen, 2006) as not sufficient if variables are integrated of order one, i.e. I(1) and cointegrated. Many economic time-series are integrated of order one, i.e. I(1), and when they are cointegrated, the simple F-test statistic does not have a standard distribution. Hence, the choice of the Toda and Yamamoto's (1995) Granger non-causality tests in this study. The Toda and Yamamoto's test is useful because it allow tests of Granger causality between exports and imports while accounting for the long-run information often ignored in systems that require first differencing and pre-whitening prior to inference.

The choice of Nigeria as a case study is justified on several reasons. Nigeria has the largest population and the biggest economy in Africa. Trade continues to play an important role, with total trade (imports and exports) accounting for over 53% of GDP. Nigeria has experienced extensive and rapid trade liberalization, undertaken both in the context of unilateral, regional and multilateral trade negotiations. With respect to imports, Nigeria is committed to a gradual elimination of tariffs and to the abolition of non-tariff barriers that have the same effects as tariffs. As a result, its trade regime has become more liberal with the average applied MFN tariff falling from 28.6% in 2003 to 11.9% in 2009, due mainly to Nigeria aligning its tariff with that of the Economic Community of West African States (ECOWAS) common external tariff (CET).

Accordingly, the promotion of exports has been a decisive factor for improving economic growth and external payments, as part of the economic reform which began in 1986. With respect to export policies, the Nigerian government has implemented and heavily promoted export incentives for export-oriented firms' in the last three decades. The most significant measures include the Export Expansion Grant Fund Scheme (EEG) to increasing exports and diversifying export products and markets and the Export Development Fund (EDF) to assists in the finance of certain activities of private exporting companies. In order to support these measures, the Nigerian government created supporting institutions such as the Nigerian Export Promotion Council which is saddled with the responsibility of promoting and enhancing the volume and value of Nigeria's non-oil export in the international market and diversify the basket of exportable products from Nigeria and the Nigeria Export-Import Bank to provide export credit guarantee and export credit insurance facilities to exporters.

Secondly, Nigeria recorded a current account surplus of 7.10 percent of the country's Gross Domestic Product (GDP) in 2013. Current account to GDP in Nigeria averaged 1.67 percent from 1980 until 2013, reaching an all-time high of 37.90 percent in 2008 and a record low of -18.70 Percent in 1986. The strong current account surplus reveals that the Nigerian economy is still heavily dependent on oil exports revenues, with high savings rate but weak domestic demand. This implies that Nigeria is providing an abundance of resources to other economies, and is owed money in return. Thus, by providing these resources abroad, Nigeria with a current account balance surplus gives other economies the chance to increase their productivity. However, the problem is whether the current account surplus is sustainable in the long run given the fluctuations in the crude oil prices in the international oil market. This informed the examination of the long run relationship between imports and exports for Nigeria.

Thirdly, the choice of Nigeria is also motivated by the fact that there is no known study that has been conducted to examine the relationship between imports and exports in Nigeria. Tang (2006) in a study of 27 OIC countries could not proceed with cointegration tests because the variables were found to be integrated of different order. This is therefore the first major attempt in the literature to investigate the sustainability of Nigerian trade imbalance by testing for cointegration. In addition, the knowledge of the direction of causality between imports and exports is essential for the design and evaluation of current and future macroeconomic policies aimed at achieving trade balance. The sequence of this study is clear. Section II presents a review of the previous works on the subject. The methodology of estimation and the specification of the various equations are highlighted in Section III. This is followed by the estimation results and interpretation of results in Section IV. Section V concludes.

2. Review of Related Studies

The theoretical and empirical foundation of the examination of cointegration between imports and exports was laid by Husted (1992). Husted (1992) examined the long run association between exports and imports of the U.S. Husted used quarterly data of trade for the U. S. economy. The author concluded a long run relationship between the exports and imports and found that there was a tendency in U.S. exports and imports to converge in the long run. Export was used as the dependent variable in the Husted (1992) model. Following the pioneering work of Husted (1992) several researchers have investigated the long run relationship between exports and import in both developed and developing countries. However, there is no consensus about the relation between the long run relationship between exports and imports in the literature despite the importance of the co-movement of exports and imports as an important factor in the understanding of the sustainability of trade deficits. While some of the studies have found a long run relationship between imports and exports, other studies have considered the impact as being weak, conditional or non-existing.

Among the set of studies that reported the existence of cointegration, Bahmani- Oskooee (1994) investigated the long-run convergence between Australian imports and exports between 1960 and 1992. The application of the Engle and Granger (1987) cointegration technique revealed that Australian imports and exports are cointegrated with the cointegrating coefficient very close to unity which suggested that Australia's macroeconomic policies have been very effective. Using quarterly data and Johansen and Juselius’s (1990) cointegration technique, Bahmani-Oskooee and Rhee (1997) found that South Korea’s exports and imports are cointegrated and the coefficient on exports was positive. This result implies that South Korea does not violate its international budget constraint.

Also, Arize (2002) using quarterly data 1973-1998 and imports as the dependent variable, found that 35 of 50 countries in the study sample supported the existence of cointegration between imports and exports using the Johansen cointegration technique. Nevertheless, using Stock and Watson’s (1988) cointegration technique as a complementary test to the Johansen, all countries, except Mexico, revealed the existence of a cointegration relationship between imports and exports. Arize (2002) therefore, concluded that macroeconomic policies have been effective in the long run and suggests that these countries are largely not in violation of their international budget constraints. Using annual data from 1961 to 1999 (full sample period), and the Gregory-Hansen (1996) cointegration test, Baharumshah, et al. (2003) find support for a cointegration relationship between imports and exports for Indonesia, the Philippines, and Thailand, but not for Malaysia.

With a sample of 27 OIC member nations and adopting the Engle and Granger’s cointegration approach, Tang and Mohammad (2005) found that only four countries exhibited a long-term relationship between the volume of imports and exports. These countries are Benin, Burkina Faso, Cameroon and Guyana. They concluded that exchange rate and monetary or fiscal policies may be effective to improve a country’s trade balance in the long run. Arguing that conventional results of the unit root test and cointegration may yield unconvincing result, Tang (2006) reinvestigated the cointegration relationship between imports and exports for the Organization of the Islamic Conference (OIC) and applied unit root tests with unknown level shift (Lanne, Lutkepohl and Saikkonen, 2002 and Saikkonen and Lutkepohl, 2002) and the cointegration test with structural break developed by Gregory and Hansen (1996). Export was used as the dependent variable in the model. The study revealed that restrictions are not applicable for testing cointegration between imports and exports for OIC member countries. Interestingly, the study revealed cointegration between exports and imports for 9 of the 27 selected OIC member countries (Bangladesh, Cameroon, Chad, Guyana, Indonesia, Mali, Morocco, Niger and Senegal) compared to only 4 countries as demonstrated by Tang and Mohammad (2005).

More recently, Ali (2013) analyzed the long run association between Pakistan's exports and imports. Empirical analysis revealed a long run relationship between the two variables. The error correction model results showed that exports and imports converge towards the long run equilibrium. This indicates the effectiveness of macroeconomic policies in stabilizing the international trade balance in Pakistan. A similar finding was reported by Al-Khulaifi (2013) in the case of Qatar. Pillay (2014) examined the long run equilibrium relationship between South Africa's exports and imports using quarterly data from 1985 to 2012. Adopting the Johansen's Maximum Likelihood cointegration technique and using imports as the dependent variable, the study found a statistically significant cointegrating relationship is found to exist between exports and imports. This finding is consistent with the results of Herzer and Nowak-Lehman (2006) which reported cointegration between exports and imports for Chile. Import was used as the dependent variable in the Herzer and Nowak-Lehman (2006) study.

On the contrary, some other studies reported the non-existence of cointegration between exports and imports. Fountas and Wu (1999) used quarterly data for the periods 1967-1989 and 1967-1994 respectively, to examine whether exports and imports are cointegrated in the United States. The study found no long-run relationship between exports and imports in the case of United States. Also, Keong *et al.* (2004) explored the long run relationship between exports and imports of Malaysia by using cointegration techniques. The study concluded that short run fluctuations between the imports and exports were not sustainable and the imports and exports would ultimately converge to towards long run equilibrium. Irandoust and Ericsson (2004) found cointegrating relationship between exports and imports of some developed economies for Germany, Sweden, and the United States. But the study did not found any cointegration between the variables for the UK.

Similarly, Cheong (2005) in a commentary on Malaysian imports and exports argued that cointegration findings are not conclusive in the case of Malaysian economy. Using annual data for the period 1959-2000, he applied Johansen cointegration test and no cointegration was found. Konya and Singh (2008) investigated the presence of equilibrium relationship between exports and imports in India using annual data for the period from 1949/50 – 2004/05 using exports as the dependent variable. Indian exports and imports were found to be integrated of order one. Johansen cointegration method was then performed on data, and failed to reject the no-cointegration hypothesis. The paper concluded that Indian exports and imports do not exhibit a cointegration relationship and therefore, India is in violation of its international budget constraint.

In addition, Dumitriu, et al. (2009) explored the dynamic relations between the Romanian exports and imports using monthly data from January 2005 to March 2009. They tested the cointegration and causality between the two variables. The results of Engle-Granger, Johansen and cointegration tests are ambiguous while the Breitung test infirmed the hypothesis of cointegration between exports and imports. In these circumstances the study concluded that it cannot consider Romanian current account deficits as sustainable. Hye and Siddiqui (2010) also explored the link between exports earnings and imports expenditures for Pakistan using quarterly data for the period between 1985 and 2008 and utilized imports as the dependent variable. They applied the variance decomposition method and rolling window bound tests to check the stability of causal relationship. The study concluded that international budget constraint of Pakistan unsustainable; hence imports and exports are not cointegrated.

Recently, Hussein (2014) examined the long-run convergence (cointegration) between exports and imports for nine MENA (Middle East and North Africa) countries. The article explored the issue by applying the bounds testing approach to cointegration using annual data. Using imports as the dependent variable, the study reported cointegration between exports and imports for Iran, Israel, Jordan, and Tunisia indicate that these countries are not in violation of their international budget constraint. However, it failed to find long run relationship Algeria, Egypt, Morocco, Sudan, and Syria. The finding from these studies is an indication that the choice of the dependent variable between exports and imports partly influences the existence of cointegration result that is reported.

Some studies have also been conducted at the disaggregated level to examine the long run relationship between exports and imports. For example, Emmy, et al. (2009) explored the relationship between the export and import in the category of forestry domain for Malaysia which includes sub domain (1)industrial round wood; (2)wood pulp; (3)wood fuel; (4) paper and paper board; (5) sawn wood; (6) recovered paper and (7)wood base panel. The Johansen (1991) cointegration method was employed between 1961 and 2007 using monthly data. The results revealed that the export and import of forestry domain is highly cointegrated. Hye and Siddiqui (2010) also examined the link between agricultural raw material exports and agricultural raw material imports in Pakistan. Annual data were used for the period from 1971-2007 and evidence of cointegration was found between exports and imports.

Jiranyakul (2012) examined the relationship between manufacturing exports and imports of capital good in Thailand using monthly data between January 2000 and July 2011. An autoregressive distributed lag (ARDL) bound was applied and variables were found to be cointegrated. Similar results were reported by Rammadhan and Naseeb (2008) in the examination of the existence of long-run relationship between oil exports and imports in four Gulf Cooperation Council (GCC) countries. Those countries were Kuwait, Oman, Saudi Arabia and the United Arab Emirates (UAE). The slope coefficients in the Johansen regression were close to unity in the case of Oman, Saudi Arabia and the UAE. This suggests that the long-run trade balance between oil exports and imports will be in equilibrium, and trade policies were effective in sustaining this log-run equilibrium.

With respect to causality, Dumitriu, et al. (2009) evidence of the bidirectional Granger causality between the exports and the imports explained by the significant interactions between the two variables. Similarly, Hye and Siddiqui (2010) found that causality runs from agricultural raw material imports to agricultural raw material exports. Uddin (2009) evidenced a long run relationship between total imports and total exports of Bangladesh economy. The study concluded bidirectional causality between exports as percentage of GDP and imports as percentage of GDP both in short run and long run. Also, Alias *et al.* (2009) found bidirectional Granger causality between exports and imports based on the vector error correction model. A similar result was reported by Emmy, et al. (2009). Jiranyakul (2012) results supported the existence of causality from imports to growth rate of manufacturing output. Mukhtar and Rasheed (2010) noted that the granger causality tests confirmed bidirectional causality between the variables.

Also, Mohamed, et al., (2014) investigated the direction of causality between imports and exports in Tunisia using monthly data between January 2005 and August 2013 within the vector autoregressive (VAR) framework. Applying a modified version of the Granger causality test due to Toda and Yamamoto, the authors found a bi-directional causality between imports and exports. The result suggested that Tunisia is still relying on the imports of items, good and services to promote the development of its exports sector. The study concluded that it would be beneficial for Tunisia to enhance the country's international trade competitiveness in order to reduce the current account deficits.

In summary, there has been a steady increase in the research on the relationship between imports and exports, but the existing research efforts failed to provide clear evidence on the existence of cointegration between exports and imports. The divergence in the literature can be attributed to methodological issues, data quality and specification error, and the measurement of the variable adopted. The diversity of the empirical findings, together with the important role of imports and exports play in determining the trade balance of a country, necessitates further research for testing the relationship between imports and exports. As a result, the current study investigates the long run and causal relationship between imports and exports in Nigeria by employing different cointegration techniques and the Toda and Yamamoto Granger causality test.

3. Methodology

3.1 Analytical Framework

Following the works of Husted (1992), Herzer and Nowak-Lehman (2006), Al-Khulaifi (2013), and Pillay (2014), we present a simple framework that implies a long-run equilibrium relationship between exports and imports. It is assumed that the representative agent of a small open economy produces and exports a single composite good with no government. The representative agent can borrow and lend in international markets at the world interest rate using one-period financial instruments with the objective of maximizing lifetime utility subject to the budget constraints.

The representative agent current-period budget constraint in period *t* is given by:

$$C_t = Y_t + B_t - I_t - (1 + r_t)B_{t-1} \quad (1)$$

where C_t, Y_t, B_t, I_t represent current consumption, output, international borrowing, and investment, respectively; r_t is defined as the one-period world interest rate, and $(1+r_t)B_{t-1}$ is the debt of the agent from the previous period. Equation (1) must hold in every time period. In addition, the period-by-period budget constraints can be combined to form the country's intertemporal budget constraint which states that the amount a country borrows (lends) in international markets equals the present value of future trade surpluses (deficits). By iterating forward from some initial period and assuming that the world interest rate is stationary while exports (X_t) and imports (M_t) are non-stationary at levels, Husted (1992) derived the following testable model:

$$X_t = \alpha + \beta M_t + \varepsilon_t \quad (2)$$

Alternatively, Arize (2002) tested equation (2) as:

$$M_t = \delta + \mathrm{b}\mathrm{X}_t + \varepsilon_t \quad (3)$$

where *Mt* is imports of goods and services and *Xt* is exports of goods and services. The intertemporal international budget constraint is stable when there is long run relationship between imports and exports. The satisfaction of the intertemporal international budget constraint requires that β in equation (2) or b in equation (3) should be equal to one, otherwise the economy would not be able to fulfill its foreign liabilities.

3.2 Estimation Technique

We first investigate the time-series characteristics of the data (aggregate exports: RTX, aggregate imports: RTM, oil exports : ROX, oil imports : ROM, non-oil exports: RNX, and non-oil imports: RNM) to test whether these variables are integrated. The Dickey-Fuller Test with GLS Detrending (DFGLS) and Ng-Perron tests are employed. The choice of the two unit roots test is because of their sensitivity to the choice of lag length. In order to estimate the Dickey-Fuller Test with GLS Detrending (DFGLS), ERS (1996) propose a simple modification of the ADF tests in which the data are detrended so that explanatory variables are taken out of the data prior to running the test regression. Ng and Perron (2001) constructed four test statistics that are based upon the GLS detrended data y_t^d. These test statistics are modified forms of Phillips-Perron MZ_α and MZ_t statistics, the Sargan-Bhargava test statistic (MSB), and the ERS Point Optimal test statistic (MPT). However, for ease of result presentation and interpretation, we present only the result of the modified forms of Phillips-Perron MZ_α statistics.

For test of cointegration between exports and imports, we adopt three cointegration tests for robustness check. These are the Johansen multivariate cointegration technique, the autoregressive distributed lag (ARDL) bounds testing and the Hansen parameter stability test for cointegration. In the ARDL approach, the endogeneity problems and inability to test hypotheses on the estimated coefficients in the long run associated with the Engle - Granger (1987) method are avoided. Also, the long- and short-run parameters of the model in question are estimated simultaneously. In addition, as argued in Narayan (2005), the small sample properties of the bounds testing approach are far superior to that of multivariate cointegration (Halicioglu, 2007).

Finally, we examine the causality using the Toda and Yamamo non-causality test. This is because the standard Granger causality tests still contain the possibility of incorrect inference (Toda and Phillips, 1993; Toda and Yamamoto, 1995; Zapata and Rambaldi, 1997). In addition, standard Granger causality tests also suffer from nuisance parameter dependency asymptotically in some cases. Consequently, their results are unreliable. Therefore, Toda and Yamamoto (1995) proposed a simple procedure requiring the estimation of an 'augmented' Vector Autoregressive (VAR), even when there is cointegration, which guarantees the asymptotic distribution of the modified Wald-statistic. The important thing is to determine the maximal order of integration dmax (where dmax is the maximal order of integration suspected to occur in the system), which is expected to occur in the model, and construct a VAR in their levels with a total of $(k+d_{max})$ lags. Toda and Yamamoto point out that, for $d=1$, the lag selection procedure is always valid, at least asymptotically, since $k \geq 1 = d$. If $d=2$, then the procedure is valid unless $k=1$. Moreover, according to Toda and Yamamoto, the modified Wald-statistic is valid regardless whether a series is *I(0), I(1) or I(2),* noncointegrated or cointegrated of an arbitrary order (Shirazi and Manap, 2005).

3.3 Data

Annual data were employed between 1960 and 2013 to estimate equations (2) and (3). They were gathered from the *Statistical Bulletin* published by the Central Bank of Nigeria (CBN). Aggregate imports (RTM) aggregate exports (RTX), oil imports (ROM), oil exports (ROX), non-oil exports (RNX) and non-oil exports (RNM) are expressed in local currency. The variables are deflated with the gross domestic product deflator and expressed in natural logarithms to remove the effect of outliers.

4. Empirical Analysis

Figure 1 presents the graphical illustration of exports and imports. It is glaring that while exports and imports drift apart at the disaggregated level (Panels A and B in Figure 1)), they have a tendency to track each other and converge at the aggregate level (Panel C in Figure 1). While oil exports have consistently been higher than oil imports, non-oil imports were higher than non-oil exports. The aggregate exports and imports however showed a close relationship between exports and imports.

The descriptive statistics of the variables is presented in Table 1. It provides information about the means and standard deviations of the exports and imports variables. The mean value of the logarithm of total exports and imports are at 8.27 and 8.16 respectively while the mean of the log of oil exports stood at 8.10. Oil imports however the lowest mean logarithm value has at 7.10.

The study applies the Dickey-Fuller GLS and the Ng-Perron tests to test the order of integration at level and first difference of the variables. For ease of result presentation and interpretation, we present only the result of the modified forms of Phillips-Perron MZ_{α} statistics. According to the unit root tests in Tables 2 and 3, exports and imports are integrated of order one (I (1)). Total exports and imports in Nigeria are non-stationary at their levels but stationary at their first difference. Also, the disaggregated variables (oil exports, oil imports, non-oil exports and non-oil imports) were all stationary at the first difference during the period of analysis. Hence, the assumption that the series are stationary is rejected. The results of unit test of this study contradict Tang (2006) which found the logarithm value of export to be stationary at level and logarithm value of import to be stationary at the first difference. Tang (2006) therefore could not proceed with cointegration. The divergence in the result can be attributed to the Lanne, Lutkepohl and Saikkonen (2002) and the Saikkonen and Lutkepohl (2002) unit root tests adopted by Tang which are sensitive to the choice of the lag length chosen.

Prior to the test for cointegration, we first determine the lag length of the estimation which must be small enough to allow estimation and high enough to ensure that errors are approximately white noise. The lag length selection procedure is based on five different information criteria: AIC, SIC, HQ, FPE and LR. The five information criteria in Table 4 conclude that the optimal lag length criteria for the oil, non-oil and the aggregate exports and imports model is one. The uniformity of the conclusions from the Information Criteria is worthy of note due to the sensitivity of the Johansen procedure to lag length selection.

In order to determine the existence of long run relationship between the variables, the study conducts three types of cointegration tests. These include the Johansen cointegration tests, the Bounds test and the Hansen parameter instability test. The results of Johansen cointegration test is reported in Table 5. The results indicate that the null hypothesis of no cointegrating vector is rejected against the alternative hypothesis both by the trace statistics and maximum eigenvalue statistic at 5% and 1% significance level for the aggregate exports and imports (linear deterministic trend in the cointegrating equation and test VAR), non-oil exports and imports (no deterministic trend and restricted constant in the cointegrating equation and test VAR) and oil exports and imports (no deterministic trend in the cointegrating equation and test VAR). This implies that there is positive and significant long run relationship at the one and five percent level, implying that a common trend exists between exports and imports and export at the aggregate and disaggregated level.

Given the inconclusive findings from the literature with respect to the existence of cointegration between exports and imports, the study made use of exports and imports as both dependent and independent variables in the aggregate and disaggregated model. This because of the likely sensitivity of the choice of the dependent variable in the test for cointegration that requires the specification of dependent and independent variable.

The ARDL model is presented in Panel A of Table 6. We first report the cointegration of exports and imports using imports as the dependent variable following the approach of Arize (2002). For the three models — aggregate exports and imports model, oil exports and imports model and the non-oil exports and imports model — the calculated *F*-statistics are higher than the critical values of 6.045 and 4.925 at the 5% and 10% level. Hence, we reject the null hypothesis of no cointegration, and accept the alternative hypothesis of cointegration between exports and imports using imports as the dependent variable.

The result was however mixed when export was used as the dependent variable following the approach of Husted (1992). Only the disaggregated oil export and import model revealed the existence of cointegration at the 1% level of significance. This implies that we cannot reject the null hypothesis of cointegration for the non-oil export and import model as well as the aggregate export and import model. This finding reinforces our initial insight on the sensitivity of the result to the choice of the dependent variable in the investigation of the long run relationship between exports and imports.

In order to test for the robustness of the bounds test for cointegration, Panel B of Table 6 reports the Hansen parameter instability test of cointegration. Hansen (1992) outlines a test of the null hypothesis of cointegration against the alternative of no cointegration. He notes that under the alternative hypothesis of no cointegration, one should expect to see evidence of parameter instability. Hansen proposes the use of the *Lc* test statistic, which arises from the theory of Lagrange Multiplier tests for parameter instability (Hussein, 2014). Analogous to the ARDL model, we first used imports as the dependent variable and exports as the explanatory variable.

The *Lc* test results did not reject the null hypothesis that oil exports and oil imports are cointegrated at conventional levels for Nigeria when oil imports is used as the dependent variable. However, the *Lc* test results was able to reject the null hypothesis of no cointegration for the non-oil exports and imports model and the aggregate exports and imports model for Nigeria when non-oil imports and aggregate imports were respectively used as dependent variables. The choice of exports as the dependent variable confirmed our findings with respect to the ARDL model on the sensitivity of the choice of variable between exports and imports. The *Lc* test results did not reject the null hypothesis of cointegration in the non-oil exports and imports model. However, the *Lc* tests results revealed the existence of cointegration in the oil exports and imports model and the aggregate exports and imports model when exports was used as the dependent variable (Panel B, Table 6).

We can therefore conclude that there is a long run relationship between exports and imports in Nigeria at both the aggregate and disaggregated level (oil exports and imports; non-oil exports and imports). However, for tests of cointegration that requires model specification, the choice of the dependent variable between exports and imports is a fundamental factor that influences the direction of the result. Thus, the existence of cointegration is partilly dependent on the specification of the cointegration equation. Nevertheless, the existence of cointegration relationship for the case of Nigeria implies that Nigeria is not in violation of its international budget constraints and macroeconomic policies have been effective in bringing exports and imports at the aggregate and disaggregated level into a long-run equilibrium.

Table 7 also provides long-run estimates based on auto-regressive distributed lag ARDL (Schwarz Bayesian Criterion) and two other long-run estimators: Fully Modified Fully Modified Ordinary Least Square (FMOLS) and the dynamic Ordinary Least Square (DOLS). The results of the three approaches of long-run estimates are all positive, statistically significant, and very similar for the three models (oil exports and imports, non-oil exports and imports, and aggregate exports and imports) demonstrating the robustness of the results. In Table 7, the estimate of the slope coefficients for the aggregate exports and imports model were very close to unity for the ARDL, FMOLS and the DOLS. This is an indication that in the long run one Naira of imports is matched by one naira of exports, resulting in a long-run trade balance as well as a current account balance. Comparably, the ARDL for the oil exports and imports model revealed a slope coefficient of 1.278 while the FMOLS and the DOLS in the non-oil exports and imports model revealed slope coefficients of above 2.0.

However, in Table 8 when export was adopted as the dependent variable, the ARDL reported lower long run coefficients. Slope coefficients that were close to unity and slightly above unity were reported in the case of oil exports and imports model and the aggregate exports and imports model for the FMOLS and the DOLS. This confirmed the robustness of our initial result that the choice of the dependent variable influences the direction of results in the exports and imports estimation.

Nevertheless, the ARDL short run error correction model presented in Tables 9 (imports as dependent variable) and 10 (exports as dependent variable) indicated that short-run imbalances do occur since exports and imports may drift apart in the short-run. However, these short run imbalances are temporary and appear to be sustainable in the long run given the cointegration results reported earlier. The estimates of the error correction term for the ARDL results are also reported in Tables 9 and 10. They all bear the expected negative sign and are significant. This helps strengthen the findings of the long run relationship as reported by the bound test *F*-test. In summary, it is evident from the various methods of cointegration that Nigeria obeys the rules of its inter-temporal international budget constraint, i.e., existence of cointegration between export and import. The existence of cointegration between exports and imports is similar to the findings of Bahmani-Oskoee (1994) for Australia, Çelik (2011) for Turkey, Ali (2013) for Pakistan, Al-Khulaifi (2013) for Qatar, Pillay (2014) for South Africa. However, it diverges from the work of Konya and Singh (2008) for India and Dumitriu et al (2009) for Romania. They could not find long run relationship between exports and imports respectively. Perhaps, the divergence can be attributed to the specification error of using exports as the dependent variable.

The Toda and Yamamoto granger non-causality test is reported in Table 11. The results revealed that we can reject the null hypothesis that exports does not cause imports at 1% level of significance. Also, we can reject the null hypothesis that imports do not cause exports at the 10% level of significance. Thus, we can conclude that there is a bi-directional direction of causality between aggregate exports and imports in Nigeria. This implies that there is a simultaneous cause and effect between imports and exports in Nigeria. Our finding is consistent with the works of Dumitriu et al (2009) for Romania, Mukhtar and Rasheed (2010) for Pakistan, and Mohamed et al (2014) for Tunisia.

However, the non-causality tests result for the disaggregated model revealed a uni-directional result. Oil export was found to cause oil imports while non-oil imports causes non-oil exports. The explanation can be situated in the dominance of oil export in the Nigerian economy. Revenue from crude oil export accounts for over 80% of government revenue, and 95% of foreign exchange earnings. However, the mass of the crude oil extracted by the multinational oil companies in Nigeria is refined overseas and brought back into the country as oil imports. In addition, Nigeria is still heavily relying on the imports of items, good and services to promote the development of its exports sector. The driver of the bi-directional causality at the aggregate level is therefore clear. Oil exports components drives the oil imports, while non-oil imports causes non-oil exports. It is therefore the combine effects of these interactions that established the bi-directional causality between exports and imports in Nigeria.

5. Conclusion

The rationale of this paper was to conjecture the performance of the Nigerian trade balance and current account. Our main concern was to investigate the long run relationship between exports and imports in Nigeria at the aggregate and disaggregated level given the sensitivity of the choice of the dependent variable in determining the long run relationship. As a result, the Johansen cointegration test, the bound testing and the Hansen parameter instability test were employed using annual data between 1960 and 2013. While the results indicate the existence of long run relationship between exports and imports, the choice of the dependent variable between exports and imports in the case of cointegration tests that requires the specification of dependent and independent variables matter for the existence of long run relationship.[1] However, for cointegration models that require variable ordering, the order of the variables did not count up in the determination of long run relationship. In specific terms, adopting imports as the dependent variable as suggested by Arize (2002) yields a better cointegrating relationship than the Husted (1992) framework that utilized exports as dependent variable.

While the empirical evidence revealed short-run imbalances due to the drifting apart of exports and imports, the value of the long run coefficients were found to be close to unity. The result implies that Nigeria is not in violation of its inter-temporal budget constraint and Nigerian trade deficit is a short-run phenomenon but sustainable in the long-run. In addition, Nigeria's macroeconomic policies have been quite effective to make imports and exports converge toward equilibrium in the long-run. Finally, the Toda and Yamamoto non-causality test indicated bidirectional causality between exports and imports. However, the different levels of significance at the disaggregated level suggest that the influence of oil exports over oil imports is much higher than the impact of non-oil imports over non-oil exports. The policy lesson is that the Nigerian policy makers should make effort to diversify the economy from oil exports to non-oil exports since shocks to the price of crude oil in the international market can affect the economy adversely. In addition, the dependence of production on imported input should be reduced in Nigeria. Substantial efforts should be made to produce non-oil export products which have high domestic value added.

End Notes

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1. The Bounds testing and Hansen parameter instability test requires model specification while the Johansen cointegration requires only variable ordering.

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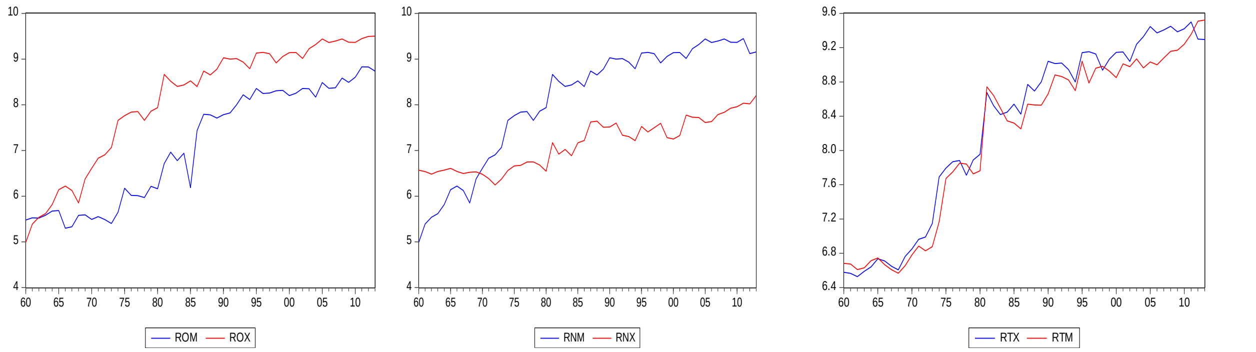

A: Oil Imports (ROM) and Oil Exports (ROX) **B: Non-oil Imports (RIM) and Non-oil Exports (RNX)** **C:Total Exports(RTX) and Total Imports (RTM)**

Figure 1: Trend of Exports and Imports in Nigeria

Table 1: Descriptive Statistics

	RNM	RNX	ROM	ROX	RTM	RTX
Mean	8.096259	7.142408	7.105559	8.109592	8.160014	8.279878
Median	8.657892	7.215096	7.571298	8.657892	8.535696	8.684850
Maximum	9.449632	8.201011	8.829985	9.500642	9.521898	9.499963
Minimum	4.992408	6.244599	5.298562	4.992408	6.567136	6.527723
Std. Dev.	1.315441	0.547694	1.262245	1.327924	0.988028	1.040174
Skewness	-0.893421	0.081924	-0.153612	-0.872476	-0.508141	-0.557881
Kurtosis	2.436787	1.663985	1.324856	2.414335	1.700319	1.761018
Jarque-Bera	7.897524	4.076508	6.526110	7.622691	6.124502	6.255008
Probability	0.019279	0.130256	0.038271	0.022118	0.046782	0.043827
Sum	437.1980	385.6900	383.7002	437.9179	440.6408	447.1134
Sum Sq. Dev.	91.71044	15.89832	84.44289	93.45928	51.73858	57.34394
Observations	54	54	54	54	54	54

Source: Author's Computation.

Table 2: Dickey-Fuller Test with GLS Detrending (DFGLS) unit root test results

Variables	Constant (Model 1)		Constant and Linear Trend (Model 2)		Order of Integration
	Levels	First Diff.	Levels	First Diff.	
Oil Imports (ROM)	0.074323	-9.229448*	-2.629194	-9.239677*	
Oil Exports (ROX)	0.347071	-3.220768*	-1.197102	-7.642416*	I(1)
Non-Oil Imports (RNM)	0.060327	-3.038807*	-0.957864	-7.908280*	I(1)
Non-Oil Exports (RNX)	-0.034226	-8.952732*	-3.111481	-9.075571*	I(1)
Total Imports (RTM)	0.351998	-7.409344*	-2.153480	-7.579731*	I(1)
Total Exports (RTX)	0.151067	-7.651121*	-1.540147	-7.980474*	I(1)
Asymptotic Critical Values:					
1%	-2.609324	-2.611094	-3.758600	-3.762400	
5%	-1.947119	-1.947381	-3.180400	-3.183600	
10%	-1.612867	-1.612725	-2.881000	-2.884000	

Note: The Null Hypothesis is the presence of unit root. Model 1 includes a constant; Model 2 includes a constant and a linear time trend. *, **, significant at 1% and 5% respectively. Lag length selected based on Schwarz information criterion (SIC). The Elliott-Rothenberg-Stock DF-GLS test statistics are reported.

Table 3: Ng-Perron unit root test results

Variables	Constant (Model 1)		Constant and Linear Trend (Model 2)		Order of Integration
	Levels (MZ_{α})	First Diff (MZ_{α})	Levels (MZ_{α})	First Diff (MZ_{α})	
Oil Imports (ROM)	0.35298	-24.3279*	-10.9107	-24.3169*	I(1)
Oil Exports (ROX)	0.73779	-14.9939*	-2.47701	-25.7047*	I(1)
Non-Oil Imports (RNM)	0.48047	-14.4788*	-1.87744	-25.5665*	I(1)
Non-Oil Exports (RNX)	0.14879	-24.5715*	-13.8650	-24.5204*	I(1)
Total Imports (RTM)	0.74647	-25.9512*	-8.05479	-25.8850*	I(1)
Total Exports (RTX)	0.46175	-25.8604*	-5.47106	-25.6274*	I(1)
Asymptotic Critical Values:					
1%	-13.800	-13.800	-23.800	-23.800	
5%	-8.100	-8.100	-17.300	-17.300	
10%	-5.700	-5.700	-14.200	-14.200	

Note: The Null Hypothesis is the presence of unit root. Model 1 includes a constant; Model 2 includes a constant and a linear time trend. *, significant at 1%. Ng-Perron test statistics are reported. Spectral GLS-detrended Auto Regressive based on Schwarz Information Criterion (SIC).

Table 4: VAR Lag Order Selection Criteria

Oil Exports (ROX) and Oil Imports (ROM)						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-108.9403	NA	0.289925	4.437612	4.514093	4.466736
1	13.14770	229.5254*	0.002576*	-0.285908*	-0.056465*	-0.198535*
2	15.47642	4.191698	0.002757	-0.219057	0.163348	-0.073435
3	17.31987	3.170738	0.003013	-0.132795	0.402572	0.071076
4	22.24722	8.080844	0.002916	-0.169889	0.518440	0.092231
Non-Oil Exports(RNX) and Non-Oil Imports (RNM)						
0	-80.05996	NA	0.091324	3.282398	3.358879	3.311523
1	35.99053	218.1749*	0.001033*	-1.199621*	-0.970179*	-1.112248*
2	38.15487	3.895807	0.001113	-1.126195	-0.743790	-0.980573
3	39.41967	2.175459	0.001245	-1.016787	-0.481420	-0.812916
4	44.05335	7.599234	0.001219	-1.042134	-0.353806	-0.780015
Total Exports (RTX) and Total Imports (RTM)						
0	-44.56892	NA	0.022082	1.862757	1.939238	1.891881
1	55.08253	187.3447*	0.000481*	-1.963301*	-1.733858*	-1.875928*
2	57.55055	4.442438	0.000512	-1.902022	-1.519617	-1.756400
3	59.83449	3.928385	0.000550	-1.833380	-1.298013	-1.629509
4	61.09179	2.061960	0.000616	-1.723671	-1.035343	-1.461552
* indicates lag order selected by the criterion						
LR: sequential modified LR test statistic (each test at 5% level)						
FPE: Final prediction error						
AIC: Akaike information criterion						
SIC: Schwarz information criterion						
HQ: Hannan-Quinn information criterion						

Table 5: Johansen Cointegration Test (Trace and Maximum Eigenvalue)

	Oil Exports (ROX) and Oil Imports (ROM): No deterministic trend		**Non-Oil Exports(RNX) and Non-Oil Imports (RNM):** No deterministic trend (restricted constant)		**Total Exports (RTX) and Total Imports (RTM):** Trend assumption: Linear deterministic trend	
Hypothesized No. of CE(s)	Trace Statistic	Max-Eigen Statistic	Trace Statistic	Max-Eigen Statistic	Trace Statistic	Max-Eigen Statistic
None*	13.84767	11.27529	23.01751	17.06880	17.37837	14.61472
At most 1	2.572386	2.572386	5.948709	5.948709	2.763655	2.763655
	Trace test indicates 1 cointegrating equation(s) at the 5% level		Trace test indicates 1 cointegrating equation(s) at both 5% and 1% levels		Trace test indicates 1 cointegrating equation(s) at the 5% level	
	Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level		Max-eigenvalue test indicates 1 cointegrating equation(s) at both 5% and 1% levels		Max-eigenvalue test indicates 1 cointegrating equation(s) at the 5% level	

* denotes rejection of the hypothesis at the 0.05 level

Table 6: ARDL Test for cointegration and Hansen Parameter Instability Test

	Panel A		Panel B	
Model	ARDL F-Test		Hansen Parameter Instability- (Lc Statistics)	
	F_{LM} Import|Export	F_{LX} Export|Import	F_{LM} Import|Export	F_{LX} Export|Import
Oil Exports (ROX) and Oil Imports (ROM)	6.1130**	11.2850*	0.867251 (< 0.01)	0.012738* (> 0.2)
Non-Oil Exports(RNX) and Non-Oil Imports (RNM)	8.5340*	2.1675	0.013250* (> 0.2)	0.762491 (< 0.01)
Total Exports (RTX) and Total Imports (RTM)	6.6993**	4.2968	0.016923* (> 0.2)	0.018570* (> 0.2)

Note: (1) *Note*: Critical values of *F* statistic at the 5% and 10% levels of significance are 6.045 and 4.925 respectively for case III: unrestricted intercept and no trend for n=55. The critical values are taken from Narayan (2005). Narayan (2005) noted that the Critical Values in Pesaran et al. (2001) are generated for sample sizes of 500 and 1000 observations and 20 000 and 40 000 replications respectively. Narayan (2005) argues that the critical values, because they are based on large sample sizes, cannot be used for small sample sizes. (2)*Hansen (1992b) Lc(m2=1, k=0) p-values, where m2=m-p2 is the number of stochastic trends in the asymptotic distribution.

Table 7: Estimates of the Long Run Cointegrating Regression - Dependent Variable: Imports

	Panel A			Panel B			Panel C		
	Oil Exports (ROX) and Oil Imports (ROM)			**Non-Oil Exports(RNX) and Non-Oil Imports (RNM)**			**Total Exports (RTX) and Total Imports (RTM)**		
Variable	Dependent Variable: Oil Imports			Dependent Variable: Non-Oil Imports			Dependent Variable: Total Imports		
	ARDL	FMOLS	DOLS	ARDL	FMOLS	DOLS	ARDL	FMOLS	DOLS
ROX	1.278* (2.880)	0.860* (8.740)	0.886* (7.778)						
RNX				0.817* (2.367)	2.032* (7.108)	2.047* (6.949)			
RTX							0.963* (23.586)	0.936* (36.504)	0.928* (37.529)

Note: (i) t-statistics in parenthesis. * significant at1%; ** significant at 5%; *** significant at 10%. (ii) Absolute value of the t-statistics are in parenthesis. The coefficient of the constant is omitted for ease of reporting the results.

Table 8: Estimates of the Long Run Cointegrating Regression - Dependent Variable: Exports

	Panel A			Panel B			Panel C		
	Oil Exports (ROX) and Oil Imports (ROM)			**Non-Oil Exports(RNX) and Non-Oil Imports (RNM)**			**Total Exports (RTX) and Total Imports (RTM)**		
Variable	Dependent Variable: Oil Exports			Dependent Variable: Non-Oil Exports			Dependent Variable: Total Exports		
	ARDL	FMOLS	DOLS	ARDL	FMOLS	DOLS	ARDL	FMOLS	DOLS
ROM	0.555* (6.233)	0.939* (9.755)	0.910* (9.539)						
RNM				0.706* (5.033)	0.340* (6.663)	0.346* (6.038)			
RTM							0.854* (6.894)	1.048* (33.960)	1.053* (37.834)

Note: (i) t-statistics in parenthesis. * significant at1%; ** significant at 5%; *** significant at 10%. (ii) Absolute value of the t-statistics are in parenthesis. The coefficient of the constant is omitted for ease of reporting the results.

Table 9: Estimates of the ARDL Short Run Error Correction Model (Dependent Variable: Imports)

	Part A		Part B		Part C	
	Oil Exports (ROX) and Oil Imports (ROM)		**Non-Oil Exports(RNX) and Non-Oil Imports (RNM)**		**Total Exports (RTX) and Total Imports (RTM)**	
Variable	Dependent Variable: Oil Imports		Dependent Variable: Non-Oil Imports		Dependent Variable: Total Imports	
	SBC ARDL(1,0)	ECM(-1)	SBC ARDL(1,1)	ECM(-1)	SBC ARDL(1,0)	ECM(-1)
ROX	0.408* (3.526)	-0.319* (3.752)				
RNX			0.463* (3.273)	-0.196* (3.283)		
RTX					0.59833* (6.9699)	-0.62120* (7.4773)

Note (i) t-statistics in parenthesis. * significant at1%; ** significant at 5%; *** significant at 10%. (ii) Absolute value of the t-statistics are in parenthesis. The coefficient of the constant is omitted for ease of reporting the results. SBC is the Schwarz Bayesian Criterion.

Table 10: Estimates of the ARDL Short Run Error Correction Model - Dependent Variable: Exports

	Part A		Part B		Part C	
	Oil Exports (ROX) and Oil Imports (ROM)		**Non-Oil Exports(RNX) and Non-Oil Imports (RNM)**		**Total Exports (RTX) and Total Imports (RTM)**	
Variable	Dependent Variable: Oil Exports		Dependent Variable: Non-Oil Exports		Dependent Variable: Total Exports	
	Coeff. SBC ARDL(1,0)	ECM(-1)	Coeff. SBC ARDL(1,1)	ECM(-1)	Coeff. SBC ARDL(1,2)	ECM(-1)
ROM	0.160* (2.740)	-0.288* (4.027)				
RNM			0.446* (3.273)	-0.259* (2.557)		
RTM					0.628* (5.908)	0.268** (1.991)

Note: (i) t-statistics in parenthesis. * significant at1%; ** significant at 5%; *** significant at 10%. (ii) Absolute value of the t-statistics are in parenthesis. The coefficient of the constant is omitted for ease of reporting the results. SBC is the Schwarz Bayesian Criterion.

Table 11: Toda and Yamamoto Non-Causality Test Results

Model	Export to Import		Import to Export		Causality
	Wald Stat	Sum of lagged coef.	Wald Stat	Sum of lagged coef.	
Oil Exports (ROX) and Oil Imports (ROM)	6.3948 (0.0114)	0.8313	0.1759 (0.6748)	0.9288	ROX → ROM
Non-Oil Exports(RNX) and Non-Oil Imports (RNM)	0.5044 (0.4775)	0.9632	4.2366 (0.0396)	0.8368	RNM → RNX
Total Exports (RTX) and Total Imports (RTM)	15.4610* (0.0001)	0.3587	2.6520*** (0.1034)	1.2074	RTX ↔ RTM

Notes: *p*-value in parenthesis. The sum of the lagged coefficients represents the summation of the lags excluding the second or fourth lag as discussed in Rambaldi and Doran (1996), Rambaldi (1997), Zapata and Rambaldi (1997) and Wolde-Rufael (2005). *, **, and *** denote significance at 10, 5 and 1%, 5% and 10% levels, respectively.