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Currency Devaluation and Trade Balance Nexus: A Test of Marshall-Lerner Condition in Nigeria

Abstract

Devaluation on the trade balance in recent times emerged as a vital policy issue in Nigeria due to the recent economic crisis. This paper examines the nexus between devaluation and Nigeria's trade balance by empirically investigating the Marshall-Lerner condition using annual data covering the period of 1986-2015. It also examines the dynamics of the relation between Nigeria's trade balance and the real exchange rate. The Engel-Granger OLS-based Cointegration technique and the Error Correction Mechanism (ECM) modelling technique were employed to conduct these analyses. Findings suggest that the Marshall-Lerner condition is not satisfied in Nigeria and that real exchange rate has no significant effect on the trade balance both in the long-run and short-run. Also, findings revealed that income effects dominate price effects on trade in Nigeria.

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1. Introduction

In many countries, including Nigeria, the deliberate downward adjustment of the official exchange rate, has been used to address various macroeconomic issues such as increasing international competitiveness, correcting a currency overvaluation, reducing a current account deficit, and in most cases, improving the trade balance (see Loto, 2011: 624-633). It is also stipulated in the International Monetary Fund (IMF) policy that a country should devalue its currency to solve any essential disequilibrium issues in its balance of payments.

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From 1960 to early 1970s, Nigeria was predominantly an agrarian economy depending on the agricultural sector. During this period, a fixed exchange rate regime was practised with the Naira fixed at par to the British Pounds Sterling. After the discovery of Oil in Nigeria, followed by the oil boom period in the early 1970s, the oil sector relegated the agricultural and other sectors of the economy to the ground to become the backbone of the economy accounting for 90% of export, 80% of government revenue and 85% of foreign exchange earnings. However, when the oil price crashed, the economy was faced with serious internal and external imbalances that led to macroeconomic instability. In response to this macroeconomic instability, the Federal Government adopted the Structural Adjustment Programme (SAP) proposed by the IMF in 1986 to tackle these crises.[1] Following the adoption of the SAP, the Naira was devalued to achieve internal and external balance in the medium term, which marked the beginning of the flexible exchange rate regime in Nigeria. After the implementation of SAP, the economy did achieve both a favourable balance of payments position and an improved macroeconomic condition.

In 2014, history repeated itself and the international oil price crashed from as high as $115 per barrel in June 2014 to as low as $35 at the end of February 2016, which plunged the economy into recession (Evans, 2019). Because proceeds from oil export revenue still account for more than 70% of government revenues and about 90% of foreign exchange earnings, this crash engendered massive distortions in the economy. However, even though this current crisis is similar to what was experienced in the early 1980s, the Central Bank of Nigeria (CBN) resisted against devaluing the Naira as advised by some economists and the IMF. The argument put forward by the CBN governor and others who were against the devaluation of the Naira was that the structure of the present Nigeria economy and Foreign trade structure did not support devaluation improving the trade balance and creating external balance.

In Nigeria foreign trade structure is characterized by major export of crude oil, however, crude oil prices do not respond to policy instruments especially in the short run because they are inelastic (Odili, 2007: 21). This controversial debate on the economic notion of using a devaluation to achieve economic growth by improving the trade balance, before now, has attracted the attention of many researchers who have addressed this contentious issue by evaluating the impact of devaluation on the trade balance either by directly examining the impact of devaluation on trade balance or by investigating the Marshall-Lerner condition. There are various empirical studies that have attempted to examine the validity of Marshall-Lerner condition in Nigeria with no consensus as to what the impact of devaluing the Naira will be on the trade balance. Hence, the need to re-evaluate how and what is the impact of devaluing the Naira on Nigeria's trade balance.

[1] The Structural Adjustment Programme is as economic reform package aimed at enhancing local productivity, achieving balance of payments equilibrium, expanding economic base and boosting the growth potential of developing countries.

Therefore, this paper seeks to contribute to the existing literature by critically re-examining the impact of devaluing the Naira on Nigeria's trade balance. This was done by empirically investigating the M-L condition using Nigeria's total imports and exports data and also by empirically analysing the long-run and short-run relationship between the trade balance and the real exchange rate.[2]

The remaining sections of this paper are organised as follows: section II provides a review of relevant existing literature; section III explains the data and method; section IV discusses the empirical results while section V provides the conclusion and policy implications.

2. Literature Review

2.1 Theoretical Framework

The question of how devaluation impacts trade (current account) balance or the balance of payments in general has been addressed over the decade using these three different approaches; the elasticity approach to trade balance, the absorption approach to trade balance, and the monetary approach to balance of payments. This paper employed the conventional elasticity approach to trade balance.

The traditional elasticity approach is the most commonly adopted approach by many empirical studies in assessing the impact of a devaluation on the trade balance. The elasticity approach focuses on the degree of responsiveness of import and export volumes to a change in relative prices through the exchange rate. This approach was propounded by Bickerdike (1920), and popularised by Robinson (1937) and Metzler (1948).

According to the elasticity approach, devaluation has two effects on the trade balance which are the value effect and volume effect, and the net effect depends on which of the two effects dominate. Following a devaluation, the domestic price of imports and exports are affected as follows: The foreign price of domestic export falls relative to foreign prices, while the foreign price of imports rises relative to domestic prices, both in proportion to the devaluation. This makes the domestic exports cheaper for foreigners and foreign imports more expensive for domestic residents. The volume effect occurs when foreigners demand more of the domestic export which has become relatively cheaper while domestic residents reduce their demand for foreign import and substitute that with cheaper domestic good.

However, while less is demanded of foreign goods, more money is spent to purchase the same quantity or less due to the fall in the purchasing power of the domestic currency relative to the foreign currency. This translates into the value effect that only worsens the current account. Therefore, if the value effect dominates the volume effect after a devaluation, which is mostly the case in the short-run, the trade balance

[2] Exports in Nigeria are usually segregated into oil and non-oil with oil exports accounting for more than 90% of the total exports. Also, the trade balance can be divided into trade balance with oil and trade balance without oil.

will worsen. On the other hand, should the volume effect dominate, which is more likely to occur in the long-run due to an adjustment lag that takes place in the short-run following a devaluation, the trade balance will improve.

According to Alexander (1952: 263), the effect that dominates both on the export and import side depends on these four elasticities; (1) elasticity of foreign demand for the devaluing country's export, (2) elasticity of domestic demand for foreign import, (3) elasticity of domestic supply of export and (4) elasticity of foreign supply of import. Based on these four elasticities, the Bickerdike-Robinson-Metzler (BRM) model provided a sufficient condition (BRM condition) for a trade balance improvement following a devaluation. From the BRM condition, Marshall (1923) and Lerner (1944) described the condition under which a devaluation will promote the trade balance based on the following assumptions: that the price elasticity of supply at home and abroad both equal infinity, ignoring the monetary effects of exchange rate variations, assuming an initial balance of trade and that import, and export depends on exchange rate variations (see Loto, 2011: 624-633).

Hence, the M-L condition stipulates that, devaluation will improve the trade balance if the export and import volumes are sufficiently elastic with respect to relative prices. The condition requires that the sum of the trade elasticities to changes in relative prices be greater than unity in absolute terms, and the satisfaction of this M-L condition guarantees devaluation will improve the trade balance. The M-L condition can be mathematically expressed as $\eta_x + \eta_m > 1$, where η_m and η_x are the price elasticity of demand for imports and exports respectively.[3]

2.2 Empirical Literature Review

In international economics, the traditional elasticity approach to devaluation has been the most widely adopted theoretical approach to evaluating the impact of devaluation on the trade balance. This approach forms the basis for the M-L condition which is what most studies empirically investigate for different countries. The M-L condition requires that the sum, in absolute terms, of the import and export price elasticities be greater than one for the trade balance to be improved by devaluation.

Robinson (1937) described the condition under which the trade balance will be improved due to a change in the exchange rate and also derived the corresponding elasticities which have formed the foundation for various empirical analysis ever since (see Eita, 2013: 511-518). Several studies have employed different techniques in estimating these elasticities to test if M-L condition holds for different countries with mixed results.

Goldstein and Khan (1978) used the full-information maximum likelihood method to estimate reduced form export demand and export supply functions simultaneously for eight industrial countries (viz., Belgium, France, Germany, Italy, Japan, the

[3] A step by step derivation of the mathematical expression of the M-L condition is provided in Appendix C.

Netherlands, the United Kingdom, and the United states) using quarterly data over the period of 1955-1970. The price elasticities estimated from these functions were combined with the elasticities of demand for import and export estimated in Goldstein and Khan (1976) for the same countries. The combined results provided support for the M-L condition for all countries except for Japan. However, a study by Sinha (2001) estimated the price and income elasticities for five Asian countries (Japan, Philippines, Sri Lanka, India and Thailand) using different techniques and found that the M-L condition is met for four of those countries including Japan.

Miles (1979) established a direct link between the trade balance and the exchange rate and employed several econometric techniques to examine the effect of devaluation on the trade balance for 16 devaluations in 14 countries, both DCs and LDCs, over the period of 1967-1962. Miles concluded that devaluation has no significant improvement effect on the trade. In contrast, Himarios (1989), after criticising Miles's model of using the trade balance to income ratio has the dependent variable rather than the trade balance, employed the OLS method to analyse 60 devaluation experience for 27 countries from two different samples: 1953–73 and 1975–84. The author found that changes in the relative price as a result of devaluation, has significantly positive effect on the trade balance.

Taking a step further from what was done by these two studies, Bahmani-Oskooee (1994) employed the cointegration and error correction modelling technique to re-examine the long-run and short-run relation between the trade balance and the real effective exchange rate of 19 DCs and 22 LDCs using quarterly data from 1971 to 1990. The result from this study showed that the trade balance and the exchange rate have no significant long-run relationship for most of the countries which is consistent with the result of Miles (1979).

Arinze (1994) employed the cointegration technique to test if a relation exists between the trade balance and the exchange rate in the long run for nine Asian countries using quarterly data from 1973Q1 to 1991Q1. Contrary to the results above, this study found a significant long-run equilibrium between the trade balance and the real exchange rate. Likewise, Bahmani-Oskooee (1998), employed a Maximum-likelihood cointegration technique to estimate the trade elasticities for six LDCs using quarterly data over the period of 1973I-1990IV. From those estimates, it was concluded that the trade balance of these counties did not improve by devaluing their currencies.

The literature review for Nigerian studies indicate lack of consensus on how devaluation will impact the trade balance and if the M-L condition does or will holds in Nigeria. For example, Odili (2014) employed an autoregressive distributed lag (ARDL) cointegration estimation technique to analyse the long-run and short-run relationship that exists between the balance of payments and some macroeconomic variables from 1971-2012. While using the export and import estimates to test if the M-L condition holds for Nigeria, the study revealed that a positive and significant relationship exists between the exchange rate and the trade balance and found support for the M-L condition in Nigeria.

In corroboration with this finding is the result of Ogbonna (2011) which found that M-L condition hold for Nigeria and devaluation can be used to improve the trade balance. Ogbonna (2011) employed the Johansen cointegration approach to estimate a multivariate cointegration system to examine the empirical relationship between the real exchange rate and the trade balance both in the long-run and short-run, over the period of 1970-2005. Results from this study confirm that the M-L condition holds for Nigeria.

Similarly, Igue and Ogunleye (2014), using the OLS method, Johansen cointegration technique and vector error correction methodology, estimated an import demand equation, export supply equation and a trade balance equation using quarterly data series from 1985Q1 to 2010Q4. The results from the study confirmed that the M-L condition is satisfied for Nigeria and also established that if the exchange rate is devalued by just 1%, the trade balance will improve by at least 1.16% implying that devaluation will significantly improve the trade balance in the long-run.

In contrast, Ogundipe, Ojeaga and Ogundipe (2013) empirically investigated the impact of devaluing the Naira on the trade balance over the period of 1970-2010 using a Johansen cointegration and variance decomposition analyses. They found that exchange rate induces an inelastic and significant effect on the trade balance and therefore worsens the trade balance in the long-run. In support, Loto (2011) investigated the M-L condition in terms of total imports and non-oil exports during the period of 1986-2010, using the OLS method. The results confirmed that devaluation cannot improve the trade balance (without oil) due to the structure of the Nigerian economy and its foreign trade.

Also, Eke, Eke and Obafemi (2015), using larger time period covering 1970 to 2012, spanning both the pre and post 1986 devaluation of the Naira, used the Johansen cointegration technique and error correction mechanism modelling technique to estimate the effect of on the trade balance of exchange rate. The estimated results from this study suggested that devaluation cannot lead to an improvement of the trade balance. Thus, providing support for other negative results.

Similarly, Anoke, Odo and Ogbonna (2016), examined the effect of a depreciation on the trade balance using the cointegration test, Vector Error Correction Model and other technique from 1986-2014. The authors concluded from their estimates Nigeria's trade balance cannot be improved in the short run from depreciation of the Naira, as only countries that are initially export based before deprecation only benefit from such depreciation which is similar to the point raised by Loto (2011), as an argument of lack of support for M-L condition in Nigeria.

However, this ongoing debate on the relationship that exists between the Nigeria's trade balance and a devaluation of the Naira calls for a re-evaluation of this relationship and the M-L condition given the current situation of the Nigerian economy.

3. Data and Methods

3.1 Models

The elasticity approach to the trade balance will be employed in preference to the other approaches, because the focus is to empirically examine the M-L condition and it is the conventional approach generally adopted in the literature to investigate the M-L condition (see, Ogbonna, 2011; Igue et al. 2014). Hence, employing this approach provides a basis for situating our findings within the existing literature.

To estimate the necessary elasticities, both an import demand and export supply model were specified. In addition, a trade balance model was also formulated and estimated as specified in existing literature (e.g. see Igue et al, 2014: 347-358)

The import demand model is expressed as a function of domestic income and the relative price of imports, while the export supply model is expressed as a function of world income and relative export prices as shown below in their most general forms:

The import demand model can be specified in a functional form as;

$$M_t = f(Y_t, RPM_t) \quad (1)$$

$$X_t = f(YW_t, RPX_t) \quad (2)$$

To have the estimated coefficients interpreted in elasticity form, the models are expressed in a log-linear form as long-run import and export equations:

$$lnM_t = \beta_0 + \beta_1 lnY_t + \eta_m lnRPM_t + \varepsilon_t \quad (3)$$

$$lnX_t = \delta_0 + \delta_1 lnYW_t + \eta_x lnRPX_t + \mu_t \quad (4)$$

where M_t and X_t are the volume of domestic imports and exports during year t to the world respectively; Y_t and YW are the domestic and world income in period t respectively; RPM_t and RPX_t are the relative price of imports and exports in period t respectively; ε_t and μ_t are the error terms for which standard assumptions are made;

β_1& δ_1 represent the elasticities with respect to income, while η_m& η_x, represent the elasticities with respect to relative prices.

These equations will be used to estimate demand elasticities for both imports and exports with respect to relative prices and income on an aggregate and bilateral basis. It is expected that:

$\eta_m < 0$, since a devaluation should cause the prices of imports to rise relative to domestic prices, leading to an increase in relative price of imports.

$\eta_x < 0$ because devaluation should make domestic export prices fall relative to the world's export prices.

$\delta_1 > 0$ such that when the world' income increase, it is expected to increase the demand for Nigerian exports.

$\beta_1 >< 0$, as the expected sign is ambiguous. The sign is generally taken to be positive because as domestic income increases, demand increase and the volume of import demand increases. However, it could be negative if the rise in real income is due to increase in national output or production, especially when these outputs are substitutes for imported goods. Then, imports will decrease as the domestic income increases.

In other for the M-L condition to be satisfied it is expected that the absolute value of the sum of the import and export demand elasticities be greater than one. Hence, we test the following hypothesis;

Null hypothesis = $H_0: |\eta_m + \eta_x| = 1$

Alternative hypothesis = $H_1: |\eta_m + \eta_x| > 1$

Another model formulated and estimated in this paper is a trade balance model which does not formally test for the M-L condition. But it used to determine the effect of the exchange rate on the trade balance.

However, there has been debate as to the appropriate measure of the trade balance. Several studies e.g. (see Bahmani-Oskooee, 1991:403-407) measured the trade balance as the ratio of export to imports and has convincingly argued that it is a more convenient and appropriate measure as it is insensitive to the units of measurements of exports and imports and also insensitive to whether the imports and exports value are in domestic or foreign currency. This method of measuring the trade balance is also employed in this study and expressed thus in line with Boyd and Smith (2001:5):

$$TB_t = {(X_t P_t)}/{(M_t E_t P_t^*)} \qquad (5)$$

where, TB_t is the trade balance measured as the ratio of the export volume X_t multiplied by the domestic prices P_t, to import volume M_t multiplied by the foreign prices P_t^* and the nominal exchange rate E_t.

The trade balance equation to be analysed in line with the M-L condition prescription is specified thus:[4]

$$lnTB_t = \theta_0 + \theta_1 lnRER_t + \theta_2 lnY_t + \theta_3 lnYW_t + \epsilon_t \qquad (6)$$

Where $\theta = (\beta_0 - \delta_0); \theta_1 = (\eta_m + \eta_x - 1)$; $\epsilon_t = (\varepsilon_t - \mu_t), Y_t$ is the domestic income in period t; YW_t is the world income in period t; RER_t is a trade-weighted real effective exchange rate, defined as the foreign price of the Naira in period t. For the trade balance to improve from devaluation, it is expected that;

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[4]The mathematical derivation of the trade balance equation estimated is provided in appendix C.

$\theta_1 < 0$, is expected to be significantly negative since a decrease in RER_{t_t} reflects a devaluation of the Naira.

$\theta_2 >< 0$, because an increase in domestic income should increase import demand if the increase in income is not as a result of an increase in the production of import substitutes goods which will, in turn, worsen the trade balance. However, if increase in the production of import substitutes brought about the increase in income, this will improve the trade balance by reducing the volume of import demands.

$\theta_3 > 0$, since an increase in world's income is expected to increase the demand for Nigeria export and improve the trade balance.

3.2 Data

Data employed in this study were collected over the period covering 1986-2014 inclusive. The choice of 1986 was influenced by the fact that it marked the period when the Naira was first devalued following the adoption of the IMF's Structural Adjustment Programme (SAP). This ensures our empirical analysis is over a period governed by a flexible exchange rate regime in Nigeria. The data collected, and their sources include: Nigeria's total imports and exports volume index sourced from UNCTAD STAT; Nigeria's real GDP in constant local currency units; the world's real GDP in constant 2005 US$; the GDP deflator for Nigeria drawn from IMF international Financial Statistics; the world export unit index sourced from IMF international Financial Statistics; and the real effective exchange rate for Nigeria collected from the World Bank database. Some of the variables constructed from these data are defined as:

$lnRPM_t$ which is the natural logarithm of the relative price of imports and it is defined as the ratio of Nigeria import prices to the Nigeria GDP price deflator.

$lnRPX_t$ which is the natural logarithm of the relative price of exports defined as the ratio of Nigeria's export price to World export unit index.

$lnREER_t$ which represents the natural logarithm of the real effective exchange rate of Nigeria is constructed by dividing the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) by a price deflator or index of costs (World Bank database).

3.3 Methodology

Annual time series data are used in this study to empirically analyse equations (3), (4) and (6) specified above. These time series data are examined to avoid encountering common problems that time series data generally possess (Evans et al, 2018). The most crucial of those problems for this analysis is the problem of non-stationarity. Time series are said to be nonstationary because their probability distribution are not stable overtime and as such exhibit a stochastic trend. A non-stationary time series data is practically invalid for forecasting purpose. Also, regressing two or more nonstationary time series may lead to spurious regression.

Unit roots tests were conducted to confirm the stationarity of the individual data series and also to determine the order of integration for each variable. The Dickey-Fuller unit root test was generally employed, and the Augmented Dickey-Fuller test was used in few cases where the error term in the equations are serially correlated. The presence of unit-root in each variable are tested for using the following equation:

$$(1-L)lnZ_t = \rho_0 + \rho_1 lnZ_{t-1} + \mu_t \qquad (7)$$

where, $(1-L)lnZ_t$ is the first difference of the log of the time series; $lnZ_{t-1}$is a one period lag of the time series; t is a trend variable; ρ_0 is a constant term and μ_t is a stochastic error term. Equation (7) depicts a random walk with drift while and the decision of whether a time series is stationary or not depends on the estimates of ρ_1. A time series free of unit root will have a significant estimate of $\rho_1 < 0$, whereas, a time series with unit root or stochastic process will have an estimate of ρ_1 that is statistically not different from zero. Therefore, the following hypotheses are put to test using the appropriate critical values:

$$\text{Ho: } \rho_1 = 0$$

$$\text{Ha: } \rho_1 < 0$$

These tests were conducted using the formula for a t-test. However, the distribution of these tests is non-standard and special critical values devised by Dickey-Fuller must be used for inference purposes.

After identifying non-stationary data and determining their level of stationarity of the data, cointegration test is conducted to determine if a long-run relationship exists between the set of nonstationary variables. A residual based cointegration test based on the Dickey-fuller test is employed to determine if a linear combination of these nonstationary series cancels out the stochastic trends in the series. The residual based Dickey-Fuller test for cointegration is employed to test for cointegration between the variables in the import demand, export supply and trade balance equations. This is done by regressing each of the three equations using OLS method and subjecting the residuals from each set of regression to a unit root test to determine if the residual is integrated of a lower order of integration than the order of integration of the variables in the long-run levels model. The OLS regression technique is applied to the following equation to estimate the residuals;

$$lnM_t = \beta_0 + \beta_1 lnY_{it} + \beta_2 lnRPM_{it} + \pi_t \qquad (8)$$

$$lnX_t = \delta_0 + \delta_1 lnYW_{it} + \delta_2 lnRPX_{it} + \rho_t \qquad (9)$$

$$lnTB_t = \theta_0 + \theta_1 lnRER_t + \theta_2 lnY_t + \theta_3 lnYW_t + \sigma_t \qquad (10)$$

where, all variables remain as earlier defined; π_t, ρ_t, σ_t are the estimated residuals from each regression which are tested to confirm the presence of cointegration in each model.

The residuals from these regressions represent a linear combination of these variables at levels and it is this linear combination that should be integrated of order zero to ensure a cointegrated relationship. If it is the case that the residuals are integrated of order zero, the regression is not spurious because it implies that the variables are cointegrated and there exists a long-run equilibrium relationship amongst the dependent and the independent variables in each regression.

The estimated residuals from each regression are then subjected to unit root test. The Dickey-Fuller test in the context of cointegration is known as the Engle-Granger or Augmented Engle-Granger with no intercept and no trend term because the estimated residuals are normally distributed with zero mean and constant variance i.e. NIID (0,1). Hence the estimated residuals are tested for unit root using the model below:

$$(1 - L)\epsilon_t = \omega_1\epsilon_{t-1} + \mu_t \quad (11)$$

where, L is the lag operator; ϵ_{t-1} is a one period lag of the estimated residual; and μ_t is a stochastic error term. The decision of whether a cointegration exists between the regressor and the regressand in each model depends on the estimates of ω_1. Hence, we test the following hypothesis using the appropriate critical value:

$$\text{Ho: : } \omega_1 = 0$$

$$\text{Ha: : } \omega_1 < 0$$

The Mackinnon critical values for cointegration used in testing this hypothesis are separately computed at 1%, 5% and 10% level of significance using this response surface regression:[5]

$$C_k(p) = \beta_\infty + \beta_1 T_k^{-1} + \beta_2 T_k^{-2} + e_k \quad (12)$$

where $C_k(p)$ denote the estimated p% quantile from the k^{th} experiment, $T_k$denotes the sample size, $\beta_\infty$is an estimate of the asymptotic critical value for a test at level p, $\beta_1$and $\beta_2$determine the shape of the response surface for finite values of T.[6]

Using the Mackinnon critical values computed, the variables will be cointegrated if the null hypothesis is rejected in favour of the alternative which implies that the estimated residual is unit root.

After confirming if the variables in each of the three models are cointegrated, we estimate an error correction mechanism model for the import demand, export supply and trade balance equations. The error correction mechanism model is usually formulated as follows;

$$(1 - L)Y_t = \varphi_0 + \varphi_2(1 - L)lnZ_t + \varphi_0 ECM_{t-1} + v_t \quad (13)$$

where, $(1 - L)$ is the first difference operator; ECM is the estimated residual from the cointegration regression. Y_t, is the dependent variable which includes lnM_t, lnX_t, $lnTB_t$ for the import, export and trade balance equation respectively; andZ_t represents the exogenous variables from each equation.

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[5] see MacKinnon (2010), Critical Values for Cointegration Test.

[6] The response surface estimates of critical values are provided in a table in appendix E.

Equation (13) is used to analyse the short-run relationship between the dependent and independent variables and the estimated coefficients give the short-run impact. The coefficient of interest in this regression is φ which gives the speed of adjustment to a long-run equilibrium relationship implied by cointegration regression when there is a shock to this equilibrium in the short-run. A negative and statistically significant φ imply there is an adjustment to this long-run equilibrium relationship.

Although regressing a non-stationary variable on another non-stationary variable may not be spurious because they are cointegrated, the standard errors from such regressions are however potentially inefficient due to serial correlation and endogeneity problem. Hence, we employ the Newey-west technique to correct the OLS standard errors. Accordingly, the optimum lag length required for the Newey-West regression is calculated using the truncation lag determination rule of thumb of $0.75T^{1/3}$.

Also, the ECM model will be subjected to a series of diagnostic tests to confirm if one or more of the following assumptions of: no serial correlation, homoscedasticity, no autoregressive conditional heteroscedasticity (ARCH) effect and no omitted variable is/are violated. The Breusch-Godfrey serial correlation LM test is used to test for the presence of serial correlation in the error term. In the case where this assumption is violated, the Newey-West method of correcting the OLS standard error is employed in order to correct for the serial correlation. For the assumption of homoscedasticity, we employ the Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. If the null hypothesis of a constant variance is rejected, we correct for this problem by constructing a variance-covariance matrix that provides a consistent estimator of the matrix. This adjustment will yield a heteroscedasticity consistent standard errors that are known as White standard errors. A test that the assumption of no ARCH effect is satisfied in our model is conducted using the LM test for autoregressive conditional heteroscedasticity. The Ramsey's RESET test is employed to determine if the assumption of no omitted variables is not violated in the ECM model.

4. Empirical Results

Table 1 presents the results of the unit root tests conducted and the results show that lnM, lnX, lnY, $lnYW$, $lnRPX$ and $lRPX$ are non-stationary and integrated of order one. The $lnTB$ on the other hand is integrated of order zero I(0). However, given the weak power of the test due to the short time period annual data available to us, for the purpose of this study, $lnTB$ was treated as an I(1) series.

Table 1. Unit Root test results for Aggregate Variables

	Level	First Difference	
$Import$	-1.757	-6.348*	I(1)
$Export(A)$	-1.848	-7.427*	I(1)

$D\ Income$	1.151	-5.254*	I(1)
$W\ Income$	-1.238	-4.224*	I(1)
RPM	-1.984	-6.218*	I(1)
$RPE(A)$	-0.940	-6.142*	I(1)
$Trade\ Bal$	-4.019*	-6.858*	I(0)
$REER(A)$	-2.487	-3.414**	I(1)

*NB: *, **, *** indicate statistical significance at 1%, 5%, and 10% level of significance respectively.*
** (A) denotes Augmented Dickey-Fuller test.*
**Critical values for model with constant are: -3.730 (1%), -2.992(5%) and -2,626(10%).*

Having established that the variables are of the same order of integration, a cointegration test was conducted, a cointegration analysis was done using the Engel-Granger OLS-based cointegration technique. Equations (3) and (4) were estimated using the OLS method and the estimated residuals from each equation were subjected to a unit root test using equation (8). Also, to analyse the short-run dynamics and the long-run dis-equilibrium, we estimated an error correction mechanism (ECM) model to reconcile the short-run behaviour of import and export with their long-run behaviour. The ECM models were subjected to rigorous diagnostic test to determine if they are well specified and fit for the purpose of this study. The results of the tests are reported in (Table 2).

Table 2. Cointegration and ECM Result for the Import and Export Function

Variables	Import Function	Export Function
Long-Run		
Const.	-13.5783	-21.7770
	(7.2649)	(15.7059)
Income	0.6026*	0.8451***
	(0.2324)	(0.5011)
Relative price	-0.6456*	-0.0979
	(0.2406)	(0.1183)
Dickey-Fuller test	-5.60*	-7.54*
R^2	0.7732	0.3587
Short-run		
Const.	0.0145	0.0119
	(0.0495)	(0.0526)
Income	-0.3661	-0.4356
	(0.7557)	(1.6850)

Relative price	-0.4215*	-0.1767*
	(0.1508)	(0.0729)
$ECM_{(t-1)}$	-0.9254*	-0.8323*
	(0.1875)	(0.1101)
F-stat	14.14	20.30
Diagnostic test		
Heteroscedasticity $x^2$1]	5.27	0.26
Serial correlation x^2[2]	3.23	5.246
ARCH TEST x^2[2]	0.028	1.836
OV test F [3,21]	2.19	0.67

*NB: *, **, *** denotes statistical significance at 1%, 5%, and 10% level of significance respectively.*
-The t critical value with 26 degree of freedom for a two tail test are: 1%(±2.479) 5%(± 2.056) and 10%(±1.706) respectively.
-The standard errors reported are corrected for serial correlation using Newey-West regression.
-The optimum lag length used in the Newey-West regression is approximately 2, calculated using the truncation lag determination rule of thumb of $0.75T^{1/3}$.
-Dickey Fuller test is the t(tau) value for the unit root test conducted for each residual.
-Income in the import function is the domestic income while income in the export function is the world income.
-The MacKinnon critical value for cointegration test for three I(1) series with no trend are: -4.829(1%), -4.047(5%), and -3.670(10%).

The Dickey-Fuller test in each table is the t(tau) value from the unit root test conducted for each set of residuals, while the estimated coefficients are the long-run elasticities. The OLS standard errors are not reported because the series used are non-stationary which implies that the regression suffers from serial correlation and endogeneity problems. Hence, we employed the Newey-west technique to correct for these problems.

The estimated t(=tau) value, from the unit-root test for the aggregate import demand and export supply equation residuals are -5.60 and -7.54 respectively, which are both significant at 1% level using the MacKinnon critical values for cointegration. These stationary residuals imply the existence of cointegration, which suggest a long-run equilibrium relationship amongst the import and export function variables.

It is also of interest to determine how the volume of imports and exports respond to changes in relative prices and income in the long-run which are provided by the long-run elasticities. In terms of the aggregate relative price elasticities, both signs are consistent with economic theory. However, only the price elasticities of demand for imports is statistically significant in the long-run.

From our estimation, if the Naira falls by 1%, it is expected that Nigerians will reduce their demand for foreign goods by 0.65% which is significant at all conventional levels. This decline in demand for foreign goods, everything else constant, is more likely to result into inflation than having a positive impact on the economy. This is because Nigeria import most of the raw materials used for domestic production and this increase in the cost of importation will increase the cost of domestic production which will results into inflation in the long-run.

More significant in our analysis in the long-run are the income elasticities. The domestic and world income suggest an inelastic and significant relation both on the volume of imports and exports in the long-run. Such that in reaction to a similar 1% increase in domestic income, Nigerian imports from the rest of the world will be increased by 0.60% while exports to the world will also increase by 0.85%. The value of the adjusted R^2 for the import and export functions of 0.77 and 0.36 respectively, indicates that variation in relative prices and incomes explain about 77% of the variation in imports and 36% of the variations in exports. The economic implication here is that, on average, in the long-run, income has a more significant and dominating effects on the trade than prices. Also, the import functions are more fit for the purpose of this study than the export function.

The short-run elasticities estimated and the results of the regression diagnostic tests are reported in (Table 3). The diagnostic tests result reveals that the import demand specification is heteroscedastic, which implies that the standard errors from this OLS regression are inefficient. This was corrected using the robust option to obtain heteroscedastic consistent standard errors reported in the table.

Unlike the long-run analysis, only price has a significant impact on imports and exports in the short-run. In response to a 1% fall of the Naira, Nigeria's import is expected to decrease by 0.42% while Nigeria's export supply to the world is expected to increase by 0.17% which are both statistically significant at 5%. The economic implication from our estimates is that price matters in the short-run but not in the long-run for exports.

The error correction mechanism coefficient of the import and export functions, though negative and significant at the 5%, indicate the rapid adjustment to shocks in the short-run which is implausible in international trade. The coefficient suggests that when the volume of imports or exports deviates from their equilibrium value given by the cointegration regression, all of this deviation will be corrected for within a year. These instantaneous adjustments to shocks within one year appears implausibly fast and assumes no adjustment is required to attain long-run equilibrium indicating that this model may not reflect the reality of Nigeria's trading relationships. Therefore, our estimates will be interpreted with utmost cautions to avoid misleading inferences.

Having laid the background for our analysis, we proceed to testing the M-L condition using the relative price elasticities. In acknowledgement of the insignificance of the relative price elasticity in the long-run, we test for the M-L condition based on the existence of a long-run equilibrium relationship amongst the variables. Also, bilateral M-L condition tests are conducted while admitting that most of the price elasticities are insignificant in the long-run with reverse signs which might give unreliable results. The results for the M-L condition tests are reported in (Table 3).

The result from testing the null hypothesis (that the sum of the price elasticities is equals to one in absolute terms) shows that we cannot reject the null at a 5% level of significance. The calculated t-value and prob value for rejecting the null are -0.957 and 0.1685. Hence, we tentatively conclude that the condition is not satisfied for Nigeria in this study. This result corroborates findings from Loto (2011). However, our lack of support for the M-L condition could be because the estimated export price elasticities are insignificant in the long-run. Overall, we tentatively reject the M-L condition for Nigeria due to the various limitations from our estimation and models.

Table 3. Test of Marshall-Lerner Condition

Trading Partners	t-values (prob)	Decision Rule
World	-0.957 (0.1685)	Not satisfied

*NB: *, **, *** denotes statistical significance at 1% , 5%, and 10% level of significance respectively, and -The prob value for rejecting the null are reported in the brackets.*

The trade balance analysis was done to examine the long-run and the short-run relationship between the trade balance and the real exchange rate using the Engle-Granger OLS-based cointegration technique and error correction mechanism (ECM) modelling technique. The results reported in table 9 confirm the existence of a long-run equilibrium relationship between the real effective exchange, domestic income, foreign income and the trade balance in Nigeria. However, the elasticities indicate that real effective exchange rate do not have significant impact on the trade balance in the long-run. This provides support to our findings from investigating the M-L condition that devaluation will not improve the trade balance in Nigeria in the long-run.

In addition, the lower panel of table 4 presents the results of the regression diagnostic tests and the ECM regression which captures the short-run dynamics. The regression diagnostic test results are satisfactory, but the insignificant short-run real exchange rate elasticities imply that devaluing the Naira will have no impact on the trade balance in the short-run. The error correction model coefficient of -0.85 is statistically significant at 5% level of significance. This is similar to the estimated speed of adjustment for the aggregate import and export function. This suggests that this trade balance ECM model suffers from aggregation bias and not relying on these estimates might led to misleading conclusions.

However, our finding from this empirical analysis suggests that devaluation cannot improve the trade balance both in the long-run and also in the short-run for Nigeria. This is consistent with the finding of Ogundipe, Ojeaga, and Ogundipe (2013), Eke, Eke and Obafemi (2015), and Olaniyi (2019).

Table 4. Cointegration and ECM Regression Results for the Trade Balance Analysis

Variables	Cointegration Regression	ECM Regression
Const.	-14.4645	4.3994
	(10.1927)	(6.3147)
Income	-0.1762	1.3143
	(0.2454)	(0.7633)
Relative price	-0.1459	-0.2165
	(0.1155)	(0.1189)
World Income	0.6769	-0.1422
	(0.5346)	(0.2018)
D. F. Test	-4.12*	
ECM(t-1)		-0.8525*
		(0.2012)
R^2	0.1891	
F-stat		5.86
Diagnostic test		
Heteroscedasticity $x^2[1]$	0.09	
Serial correlation $x^2[2]$	1.643	
ARCH TEST $x^2[2]$	2.890	
OV test F [3,21]	0.60	

NB:-The cointegration standard errors reported are corrected for serial correlation using Newey-West regression.
-The optimum lag length used in the Newey-West regression is 2, calculated using the truncation lag determination rule of thumb of $0.75T^{1/3}$.
-Dickey Fuller test is the t(tau) value for the unit root test conducted for each residual.
-The MacKinnon critical value for cointegration test for four I(1) series with no trend are: -5.312(1%), -4.497(5%), and -4.104(10%).
-A decrease of the real exchange rate implies a devaluation of the Naira.
-The reported ECM standard errors are corrected for violation of the critical assumptions when necessary.

5. Conclusion and Policy Implication

The notion that a devaluation will improve the trade balance in the long run has for decades been a fundamental tenet and has formed the basis of several empirical research. Several studies have analysed and assessed the validity of this tenet using data from different countries and using different econometric techniques with mixed and conflicting results. This is also the case in Nigeria where there is no consensus as to what the impact of a devaluation will have on the trade balance in Nigeria in the long-run despite several decades of research. Hence the need for a re-examination given the Nigeria's current economic situation.

This paper re-examined this contentious issue by investigating the Marshall-Lerner (M-L) condition for Nigeria. It also examined the long and the short-run relation between the trade balance in Nigeria and the real exchange rate. The results from testing for the M-L condition failed to find support for the condition in Nigeria. Hence, it was tentatively concluded that the M-L condition does not appear to hold persuasively for Nigeria. In addition, the empirical analysis of the relationship that exists between the trade balance and the real exchange rate suggests that either in long-run or in the short-run, the real effective exchange rate does not appear to have any significant impact on Nigeria's trade balance.

Given these results, it was concluded that the M-L condition does not hold for Nigeria and a real devaluation of the Naira would have no significant improvement on the trade balance both in the short-run and in the long-run. In addition, the findings from this research corroborate an important economic principle that income effects dominate price effects. This is evident from the long-run analysis which revealed that even when prices are flexible, income elasticities are larger and have more significant effects on trade.

A suggestion for further research, based on the findings and limitations encountered in this research, is that that further investigation of the M-L condition for Nigeria needs to be conducted on bilateral basis. This allows for the heterogeneity in bilateral trading transaction to be captured which will be very informative for trade policy purpose. Also, more can be done on this literature for Nigeria by conducting research that analyses oil exports separately from non-oil exports, covering longer period beyond 1986, to adequately account for the role of oil exports on the trade balance in Nigeria. In addition, a policy recommendation from the findings is that monetary authorities should employ other policy instrument to improve the trade balance as the Nigeria trade structure does not support a devaluation improving the trade balance of the nation.

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