Marshall-Lerner Condition and J Curve Phenomenon: Evidence from Nigeria

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Abstract: This study was commissioned to investigate for the presence of Marshall-Lerner condition and J-curve phenomenon in Nigeria's foreign trade bustles. We implemented co-integration approach in data analysis. The results obtained indicate that in both long and short runs, Marshall Lerner condition is not verified for Nigeria and that the concept of J-curve effect is not identified either. This suggests that elasticity approach to balance of payments adjustments may not be intended for efficient and effective management of developments in trade balance of Nigeria. On the above note, the study recommends that rather than relying on exchange rate policy of devaluation (price effect) for management of deficits in the balance of trade, government may evolve comprehensive policies, inclusive of direct control such as import quota and restrictions, increased investments in import substitution industries, increased investment and diversification of export base through appropriate incentives.

Keywords: Trade elasticity; Marshall-Lerner condition; J-curve; Trade balance; Nigeria
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I.   INTRODUCTION

The Marshall–Lerner condition (after Alfred Marshall and Abba P. Lerner) is the condition that an exchange rate devaluation or depreciation will only cause a balance of trade improvement if the absolute sum of the long-term export and import demand elasticity is greater than unity. In the international trade literature, the arguments as to whether devaluation (for fixed exchange regime) or depreciation (for floating exchange rates regime) of the domestic currency will improve the trade balance abound and that flows of goods respond to this effect takes a time lag to reflect. This led to the concept of the J-Curve effect, which is the phenomenon where a country's balance of trade in the first instance, at the instance of a devaluation or depreciation of the domestic currency, prior to its recovery to a higher level than where it started. Economic theory states that depreciation of the nominal exchange rates will impact a country's balance of trade in three dimensions as follows: First is the decrease in the volume of import resulting from increase in the price of imports sequel to the depreciation of the domestic currency. Secondly, devaluation leaves the price of exports more competitive in the global market arena thus leading to increase in demand for exports. The third scenario is that the total export revenue drops in the short run due to the drop in export prices. The overall effect of devaluation on the trade balance remains uncertain as it can only be determined by the relative sizes of each of these three effects, meaning that it is the price elasticity of exports and imports with respect to the exchange rate variation that will determine the final impact of the devaluation on the trade balance.

The exchange rate policies of Nigeria has left the domestic currency in constant depreciation without stability, with the nation's imports still keeping a rising profile and exports appearing to remain non-responsive to this scenario. This appears to contradict the appriori expectation. It is to this extent that this study is commissioned to investigate for the presence of Marshall-Lerner condition in Nigeria's foreign trade bustles. To this extent therefore, the objective of this study is to establish if Marshall-Lerner condition is satisfied for Nigeria and know whether J-Curve effect is present.

This remaining part of this work will be structured as follows: Section two, presents brief review of related literature; section three, the methodology; section four, empirical results and discussion, section five: summary and conclusion.

II.   BRIEF REVIEW OF THE RELATED LITERATURE

This section presents the various theories and empirical results on the effect of currency devaluation on trade balance of a nation. The association between exchange rates is basically founded in three theories of elasticity, absorption and monetary approaches to balance of trade. To this effect, trade balance effects of exchange rate movements in developing countries have been analyzed using three basic international trade

theories of the elasticity theory, the Keynesian and the monetary theories. The Marshall Lerner condition also widely referred to as Marshall Lerner Robinson (MLR), condition is the basis of the elasticity approach to the balance of payments. The elasticity theory argues that the price effect outweighs the volume effect in the short run while the volume effect dominates the price effect in the long run (Krueger, 1983). The monetary theory on the other hand, insists that devaluation increases the domestic price and this leads to a fall in real money supply. As a result of the fall in real money supply, imports decreases and trade balance improves. On the other hand, monetary theory also argues that higher money supply leads to trade deficit, whereas lower money supply causes surplus in trade balance. The last but not the least one is the Keynesian theory or absorption approach which assumes that devaluation improves a trade balance of a nation if the substitution towards domestic goods in response to the change in relative price boosts output more than spending (Pilbeam, 1998). All these theories notwithstanding, this work is hinged on elasticity approach to balance of payments adjustment.

Furthermore, some empirical studies in this sphere have been consulted to expose us to the experiences and observations of some other authors in the area of our study. To this extent we look at the works of Rincon (1995), who used the Johansen and Juselius' approach for estimation of multivariate cointegration systems to examine the role of exchange rates in determining the short-and-long-run trade balance behavior for Colombia. The author used a regression model formulation which includes income and money so that the monetary and absorption approaches to the balance of payments are also examined. The hallmarks result provided evidences that: (i) exchange rates do play a significant role in determining the short-and-long-run behavior of the Colombian trade balance. (ii) devaluation improves the trade balance, which is consistent with the BRM or ML conditions. (iii) the long-run effect of exchange rate devaluation on the trade balance is enhanced if accompanied by reduction in the money stock and/or an increase in income.

Abstract Akbostanci, E. (2004) tested the validity of J-curve hypothesis which suggests that a real depreciation initially worsens the trade balance, but through time the trade balance improves, thus making for the response of the trade balance over time to generate a tilted J-shape. The study specifically investigated for the existence of a J-curve using Turkish quarterly data for the period of 1987-2000 employing co-integration approach to data analysis. Error correction model was implemented to differentiate between the long-run equilibrium and short-run dynamics. The results, even though suggested the existence of long-run relationship, which is indicative of improvement in the trade balance in response to areal exchange rate depreciation, did not exactly support the J-curve hypothesis in the short run.

In the same vein, Caporale, Mudida and Gil-Alana (2015) examined the Marshall–Lerner (ML) condition for the Kenyan economy. In specific terms, they used quarterly data on the log of real exchange rates, export/import ratio and relative (US) income for the time period 1996q1-2011q4, and employ techniques based on the concept of long memory or long-range dependence. For the purpose of analysis, they used fractional integration and co-integration methods, which appear to be more general than the standard approaches based exclusively on integer degrees of differentiation. The results obtained show that there exists a long run steady state relationship between the dependent and the independent variables within the period under review and that the ML condition is satisfied in the long run, although the convergence process is relatively slow. Their results further implies that a moderate depreciation of the Kenyan shilling may have a stabilizing effect on the balance of trade through the current account without the need for high interest rates.

Ishtiaq, Qasim and Ahmad (2016) employing co-integration approach tested for the presence of Marshall-Lerner condition and the J-curve Phenomenon for the economy of Pakistan using quarterly data for the period of1970-2012. Results of the study suggest that Marshall-Lerner condition holds for Pakistan in the long run but not in the short run, thus indicating support for J curve the phenomenon.Their results further show that the absolute sum of the price elasticities of imports and exports demands barely exceed 1, meaning that a real devaluation of Pakistan domestic currency will only improve her trade balance marginally. By implication, this suggests that for Pakistan, devaluation/depreciation of rupee cannot be considered as an important policy instrument for the management of balance of payments.

Siklarey and Kecili (2018) employed co-integration approach to determine if Marshall-Lerner condition and the attendant J curve effect are present in the Turkish economy. Turkey transited from fixed to float exchange rate regime in 2001and this informed for their choice of study period to 2003-2016 using monthly data of the relevant variables for the analysis. The estimated VECM results indicated the presence of Marshall-Lerner condition with the results of the impulse-response functions suggesting the existence of J curve effect for the Turkish economy in the long run. In study, the researchers failed to establish the validity of their results by flagrantly abandoning the conduct of all post estimation tests for model stability, serial correlation, and normality of the equations amongst others.

Eshetu (2017) examined the effect of Birr devaluation on trade balance of Ethiopia for the period 1970-2014 using the Vector Error Correction Model. Results of the study revealed that, within the period under review, devaluation of the domestic currency leads to the worsening of trade balance in Ethiopia in the short run but improves it in the long run. Their estimation of the relevant models further revealed that real effective

exchange rate, money supply, domestic real income and term of trade are the major determinants of the trade balance of Ethiopia both in the short and long run periods. The results of the impulse response function suggested that a J –curve effect exists for the trade balance of Ethiopia. To this effect, it could be observed from the study that elasticity, monetary and absorption theories are significant in explaining the trade balance dynamics in Ethiopia. The study recommended that policies that encourage increased productivity, export diversification and expansion of import substitution industries are alternative policies for devaluation.

Loto (2011) employed the elasticity approach to the balance of payments adjustment to examine the effect of depreciation of the domestic currency on Nigeria's balance of trade (BOT) position for period of 1986 - 2008. He used exchange rate devaluation of the naira against the United States dollar, as a policy instrument; to evaluate the effect of exchange rate dynamics on the trade balance of Nigeria during the period under review, focusing on the concept of the Marshal Lerner condition. The ordinary least square (OLS) method was used to estimate the import and export demand functions. The empirical result shows that devaluation/depreciation does not improve the trade balance; since the sum of price elasticity of imports and exports is less than unity, meaning that the theory of Marshall-Lerner condition does not hold for Nigeria. According to Loto, devaluation/depreciation can only benefit countries that are originally export based before the devaluation/depreciation of their currencies as economies of high import dependent can hardy benefit from the devaluation/depreciation of its currency.

The results of this study may likely be tinted for use of inappropriate methodology. This followed from the fact that despite that all the variables employed indicated stationarity at first differencing 1(1) going by the ADF test statistic, the researcher still went ahead to use Ordinary Least Square (OLS) in his data analysis.

Sulaimon, Omotunde and Haorayah (2017) used cointegration approach to test specifically whether Marshall-Lerner condition holds for Nigeria in the event of real exchange rate depreciation of the Naira against the United States Dollar. The impact of devaluation of exchange rate on Nigeria's trade balance was central to the entire investigation. The results indicated the existence of long run negative relationship between the trade balance and real exchange rate depreciation in Nigeria. This suggests that an increase (appreciation/ revaluation) in the value of REXR results in a deterioration in the trade balance, when all things are held constant and vice versa. This provided the needed evidence that the Marshal Lerner condition holds for Nigeria. These results imply that at any point in time, factors leading to exchange rate depreciation of the naira needs to be monitored closely and interest rate differentials in favor of Nigeria will attract large capital inflows, which is good for investments.

Rafindadi and Yusof (2014) used quarterly time series data from 1971QI-2012QVI to find out if nominal effective exchange rate could lead to real effective exchange rate and if this can be a synergistic strategy towards spurring competitive trading relationship between Nigeria and the rest of the globe. In the study, they used the traditional and structural break unit root tests; the Bayer-Hanck cointegration approach and the VECM-Granger causality test methods of data analysis. The results of the estimations revealed that nominal effective exchange rate leads to real effective exchange rate and that inflation exerts positive impact on real effective exchange rate in Nigeria. Their results further suggest that while real effective exchange rate has positive impact on nominal effective exchange rate, inflation erodes it. The results of the causality tests provided a veritable evidence that there exist a bidirectional causality between real and nominal effective exchange rates, between nominal effective exchange rate and inflation and between inflation and real effective exchange rate. According to them, these findings suggest that there exist a lot of competitive opportunities for the country to jettison all its economic vices and move progressively in international trade with minimal hurdles, thus fitting in with the Marshall-Lerner (M-L) assumption.

The motivation for this study stem from the fact that studies on the concept of marshall-lerner condition and the J-curve phenomenon with recourse to Nigeria economy is yet extremely very scanty and very few available have been inconsistent in rejecting or supporting the ML condition. It is to this extent and to contribute to the debates that this study is commissioned.

III. METHODOLOGY
3.1 The Model Specification

This section of the study analyzes the consequences of exchange rate depreciation on trade balance of Nigeria for the period of 1981 - 2017. In modeling the relationship between exchange rate and trade balance, we adopt the approach of Siklar & Kecili (2018) by first of all defining real effective exchange rate (RER) as:

$$\text{RER} = \frac{NER_t.P_t}{P_t^*} \qquad\qquad (1)$$

Where: P is domestic prices, P* is foreign prices and NER is nominal exchange rate. Export value of the country was obtained by multiplying the export volume with domestic prices $(X_t.P_t)$, while import value was arrived at with the multiplication of import volume, foreign price level and nominal exchange rate $(M_t. P_t^*.NER_t)$. Taking ratio of export to import as proxy for balance of trade (BOT), we therefore write trade balance as:

$$BOT_t = \frac{Xt.Pt}{Mt.P_t^*.NERt} \qquad (2)$$

Trade balance in most instances is worked out as the value of net exports (X – M), but in the instant study, we measure balance of trade as the ratio of the values of aggregate export (X) to the aggregate (M). The X/M approach has been employed in many empirical studies to investigate trade balance exchange rate association (Siklar & kecili, 2018, Rincon, 1998; Bahmani-Oskooee and Brooks, 1999, Ogbonna, 2008 and Gupta-Kapoor and Ramakrishnan, 1999). Bahmani-Oskooee (1991) observed that one of the motivations for the use of this approach is that this ratio is not sensitive to the unit of measurement and can be interpreted as nominal or real trade balance. Boyd et al (2001) in the same vein pointed out that this ratio in a logarithmic model yields the exact Marshall-Lerner condition rather than approximation.

For the purpose estimating the real exchange rate trade balance association we transform our equation to linear form of Equation as follows:

$$BOT_t = X_t - M_{t-}(NER_t . P_t + P_t^*)_{=} X_t . M_t . \mu_t \qquad (3)$$

Where $\mu_t = NER_t . P_t + P_t^*$ is the real exchange rate in equation (3) above.

At this point, we specify the Long- term export and import demand functions as follows:

$$X_{t=}\alpha_{0+}\alpha_1 Y_t^* {}_{+}\alpha_2\mu_t + \pi_{xt} \qquad (4)$$

$$M_t = \beta_0 + \beta_1 Y_t + \beta_2\mu_t + \pi_{mt} \qquad (5)$$

Where Y* = foreign real income, Y = domestic real income, while α_2 and β_2 = the export and import elasticities respectively. With recourse to equations 4 and 5 we specify the long run trade balance model as follows:

$$BOT_t = (\alpha_0 - \beta_0) + \alpha_1 Y_t^* - \beta_1 Y_t + (\alpha_2 + \beta_2 - 1)\mu_t + (\pi_{xt} - \pi_{mt}) \qquad (6)$$

Equation (6) above contains information about the existence or otherwise of Marshall – Lerner (ML) condition. We rely on the rank of the coefficient of μ_t to determine satisfaction or otherwise of ML condition. For balance of payment to witness improvement, the coefficient of real exchange rate (μ_t) must be positive and statistically significant. According to Marshall (1923) and Lerner (1944), the demand elasticity for both exports and imports must exceed one, if the trade balance is to improve after a devaluation and the J-curve effect is attributed to a lagged adjustment of quantities to changes in relative prices (Magee 1973). The decision rules for the validity of ML condition, with recourse to the reduced form equation (6) above, are as specified below:

$(\alpha_2 + \beta_2 - 1) > 0$: means that ML condition is verified for Nigeria economy.

$(\alpha_2 + \beta_2) > 1$: means that ML condition is verified for the Nigeria.

IV. RESULTS
Table 1: Unit Root Test Results

Variables	Level			First Difference			Decision
	Lag	t-Statistic	P-Value	Lag	t-Statistic	P-Value	
BOT	2	-4.813940	0.0024	1	6.402214	0.0000	1(1)
LY*	1	-2.418822	0.3641	0	-4.723607	0.0005	1(1)
LRY	9	-2.204296	0.4684	8	-5.095193	0.0003	1(1)
LREER	0	-1.945228	0.6104	0	-4.075899	0.0032	1(1)

Author's estimation using e-view 9.0

The main motivation for undertaking stationarity test is to get a time series variable which has a constant mean, variance and covariance to avoid the problem of spurious regression Eshetu (2017). As seen in the result column of Table 1, all of the time series used in this study are stationary in the first differences at 5% level of significance, meaning that all series are integrated of order one. This characteristic of the employed variables us to suspect that there may be at least one cointegration between the dependent and independent variables. This provides us with the justification to test for cointegration using Johansen and Jeslius approach. The results are as presented in table 2 below:

Table 2: Unrestricted Co-integration Rank Test (Trace)

No of CE (s)	Trace Statistics	0.05 Critical Value	Prob.**
None*	57.060	47.856	0.0054
At most 1	14.758	29.797	0.7955
At most 2	4.371	15.494	0.8714
At most 3	0.129	3.841	0.7190

Author's calculation using e-views 9.0
Trace test indicates 1 cointegrating equation at the 0.05 level
- Denotes rejection of the hypothesis at the 0.05 level

Table 2b: Unrestricted Co-integration Rank Test (Maximum Eigenvalue)

No of CE (s)	Max-Eigen Statistics	0.05 Critical Value	Prob.**
None*	42.302	27.584	0.0003
At most 1	10.387	21.131	0.7077
At most 2	4.371	14.264	0.8330
At most 3	0.129	3.841	0.7190

Author's calculation using e-views 9.0

Max-Eigenvalue test indicates 1 cointegrating equation at the 0.05 level

- Denotes rejection of the hypothesis at the 0.05 level

Relying on the co-integration results as shown in table 2 and 2b above, it is observed that both Trace and Maximum Eigenvalue statistics reveal the existence of at least 1 co-integrating vector among the variables at the 0.05 level of significance, meaning that there exist a steady state long run equilibrium relationship between the depend variable and the independent variables. Stemming from existence of co-integrated vector among concerned variables, we employ Vector Error Correction Model (VECM) to gauge the relationship among the variables of interest; trade balance, domestic income, foreign income and real exchange rate.VECM estimation results are given in Table 3 below:

Table 3: Estimation results of the static long run model of the trade balance equation

BOT	C	LREER	LY*	LRY
1.000000	5497	-2.524	-0.503	-4.50E-10
Standard error		1.859	0.100	1.6E-09
t statistics		-1.357	-5.023	-0.282
Critical values of Student's *t* distribution with *v* degrees of freedom@0.05				2.132

Note: i. Author's calculation using e-views 9.0, ii. T-Distribution critical value table

As shown in Table 3, both the Trace and maximum Eigenvalue tests indicated one co-integrating vector each, meaning that there is one dependent variable (BOT) and three independent variables of, real effective exchange rate (REER), domestic income (RY) and foreign income (Y*). The single co-integrating vector suggests that there is only one equation with one dependent variable. All the variables in the long run model above are taken into log form excepting for the trade balance of Nigeria which is identified with some negative values. To this effect, we interpret the coefficients of the logged variables that entered the long run equation as elasticities. Table 3 provides the summary of the results of the long run trade balance model estimation for Nigeria. We rely strictly on the decision rules to interpretation of the above results.

$(\alpha_2 + \beta_2 - 1) > 0$ or $(\alpha_2 + \beta_2) > 1$: means that ML condition is verified for Nigeria economy. The log of REER with a coefficient of -2.524 indicates a negative long run relationship between the REER and trade balance. $(\alpha_2 + \beta_2 - 1) =$ coefficient of LREER = -2.524. This shows that 1 unit increase (revaluation/appreciation) in the exchange rate value of the naira to the United States dollar will deplete Nigeria's trade balance by 2.524 units, meaning that 1 unit decrease (devaluation/depreciation) in the exchange rate value of the naira to the United States dollar will improve Nigeria's trade balance by 2.524 units basis points.

The result appears to be in line with appiori expectation with recourse to the elasticities approach to trade balance adjustment, which states that, when the sum of price elasticities of demand for exports and imports in absolute terms is greater than unity, devaluation will improve the country's balance of trade. However, the result further indicates that the coefficient of real effective exchange rate though negative, is not statistically significant, implying that the sum of the price elasticity of export and import demand in absolute term is not greater than one. This, by implication, means that Marshall- Lerner condition does not holds for Nigeria economy in the long run.

Table 4: Regression Results of the Short Run Model

Variables	Coefficient	Prob.**
EC(-1)	-0.3346	0.0275
D(BOT(-1))	0.2851	0.0435
D(BOT(-2))	-0.2484	0.1377
D(LREER(-1))	-0.7421	0.6585
D(LREER(-2))	0.5005	0.7511
D(LY*(-1))	3.43E-09	0.0000
D(LY*(-2))	4.54E-09	0.0000

|		
D(LRY(-1))	0.8771	0.1524
D(LRY(-2))	-0.6604	0.2490
C	55.4366	0.8401

Author's calculation using e-views 9.0
**Denotes rejection of the hypothesis at the 0.05 level

Having established that Marshall Lerner condition is not satisfied for Nigeria economy on the long run within the period under review, we analyze the results of the short run model as presented in table 4 above. The coefficient of vector error correction term ECT (-1) of -0.3346 is observed to be negative and statistically difference from zero at 5 percent level. This suggests that the independent variables jointly and significantly influence the dependent variable with causality running from real effective exchange rate, foreign income and real domestic income to trade balance. This result further indicates that the system corrects its previous period disequilibrium at a speed of 33.46 percent annually in correspondence with the annual data in use. The coefficient of LREER lagged one period of -0.7421 though negative in line with appriori expectation is statistically not different from zero at 5 percent significant level, meaning that the price effect of devaluation of the domestic currency on import demand is inconsequential. This finding may not be unconnected with tinted foreign trade practices such as import over invoicing and export under invoicing for the purpose money laundering and foreign exchange irregularities which appear to have rendered exchange rate as a means of balance of payments adjustment impotent. Another suspected reason for this finding may not be unconnected with the fact that Nigeria export basket is dominated by crude oil, which provides over 80 percent of Nigeria's foreign exchange earnings and whose price is predetermined in the global oil market and thus may not respond to local currency depreciation (Adedokun, 2016).

These results by implication indicate that in both long and short runs, Marshall Lerner condition is not verified for Nigeria. This suggests that elasticity approach to balance of payments adjustments may not be intended for efficient and effective management of developments in trade balance of Nigeria. On the above note, the study recommends that rather than relying on exchange rate policy of devaluation (price effect) for management of disequilibrium in the balance of payments, government may evolve comprehensive policies, inclusive of direct control such as import quota and restrictions, increased investments in import substitution industries, increased investment and diversification of export base through appropriate incentives, in the management of deficits in trade balance. This result corresponds with those of Loto (2011) and Nwanosike, Uzoechina, Ebenyi and Ishiwu (2017), but contradicts that of Sulaimon, Onotunde and Haorayah (2017) for Nigeria.

The J-curve Phenomenon

Response to Cholesky One S.D. Innovations

Response of BOT to LREER
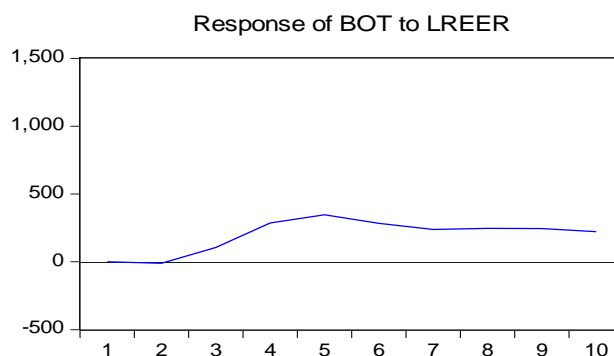
Figure 1: Graph of the J-Curve Effect

The J-curve effect is detected in trade balances adjustment processes for the reason that the weaker currency (devalued/depreciated currency) initially translates into more costly imports and cheaper exports. This leads to a larger initial trade deficit or a smaller surplus. However, because the affected country's exports are now cheaper in currency terms, they start to rise as foreign demand for the lower-priced option increases. Local consumers now reduce their demand for foreign goods and services which have now become more expensive and in alternative increase their demand for domestic import substitutes which have now become less expensive and thus more affordable. Consequently, the trade balance eventually begins to improve and may bounce back to a higher level beyond its level before the drop in exchange rate. The delayed lag effect may have been caused by the fact that importers and exporters were already in existing contract obligations which they are bound to

honor. To this effect, the trade volumes initially remain unchanged even though the exchange rate and relative prices have changed, resulting in volume effect dominating the price effect. All these notwithstanding and relying on figure 1 above, it could be observed that the concept of J-Curve effect is not verified for Nigeria economy.

Table 5: Diagnostic Tests Results

Tests	F-Statistic	P-Value
Breusch-Godfrey Serial Correlation LM Test	1.174144 (2, 22)	0.3277
Heteroskedasticity Test: Breusch-Pagan-Godfrey	1.824232 (12, 21)	0.1099

Given that the null hypothesis is that the residuals are serially uncorrelated, the F-statistic of 1.174144 with the p-value of 0.3277 indicates that we fail to reject this null and therefore conclude that the residuals are serially uncorrelated.

Furthermore, since the null hypothesis is that the residuals are homoskedastic, the F-statistic of 1.824232 with the p-value of 0.1099 suggests that we fail to reject this null and therefore conclude that the residuals are homoskedastic. Furthermore, the errors appear to be normally distributed as evidenced in the Jarque-Bera normality tests with the Jarque-Bera value of 0.519338 and probability value of 0.7710307.

V. CONCLUDING REMARKS

This study was commissioned to investigate for the presence of Marshall-Lerner condition in Nigeria's foreign trade bustles. We implemented co-integration approach in data analysis. The results obtained indicate that in both long and short runs, Marshall Lerner condition is not verified for Nigeria and that the concept of J-Curve effect is not identified for Nigeria economy. This suggests that elasticity approach to balance of payments adjustments may not be intended for efficient and effective management of developments in trade balance of Nigeria. On the above note, the study recommends that rather than relying on exchange rate policy of devaluation (price effect) for management of disequilibrium in the balance of payments, government may evolve comprehensive policies, inclusive of direct control such as import quota and restrictions, increased investments in import substitution industries, increased investment and diversification of export base through appropriate incentives, in the management of deficits in trade balance.

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