Exchange Rate Behaviour and Trade Balances in Nigeria: An Empirical Investigation

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Abstract

The study estimated the effect of exchange rate on the balance of trade of Nigeria for the period 1970-2012 using annual data. There is considerable disagreement in the literature on the effect of exchange rate behavior on trade balances and the effectiveness of currency devaluation as a tool for increasing a country's balance of trade. We used the real exchange rate for the analysis applying the Augmented Dickey Fuller test for unit root, Johansen test for co-integration among variables, error correction mechanism (ECM) to investigate the linkage of these variables. The co-integration test confirms that there is a long run relationship between trade balances and the variables of interest. The estimated result shows that the exchange rate has a significant negative influence on trade balance in Nigeria during the period. The result therefore suggested that devaluation of the domestic currency does not lead to improvement in the balance of trade and hence balance of payments position of the country. It was therefore recommended that measures to stabilize exchange rate and check its continuous free fall should be carefully considered as a policy option

Keywords: Exchange rate, Trade balances, Co-integration, Error Correction model, Nigeria

JEL Classification: C22, F31, F32

1. Introduction

Developing economies are consistently facing an important policy issue with respect to devaluation of exchange rates and their subsequent impact on the trade balance. Large trade deficits imply choosing between exchange rate devaluation and the internal or external financing of the deficit, which are challenging policy decisions to undertake, manage or sustain, especially in the long run for developing countries (Agbola, 2004). There is also a general agreement that there are differences between the short-run and long-run effects of a depreciating exchange rate on trade balance. For instance, there appears to be common consensus among researchers that there is no specific pattern that the trade balance follows in the short-run after devaluation (Gupta-Kapoor and Ramakrishnan, 1999, Bahmani-Oskooee and Alse,1994, Bahmani-Oskooee and Kantiapong, 2001). Over the last decade, international organizations such as the World Bank and the International Monetary Fund (IMF) have been proposing currency devaluation as a contrivance for alleviating balance of payments problems and promoting economic growth and stabilization in less developed countries (LDC). However, there were instances where exchange rate devaluation had had an unfavourable impact on the trade balance (Agbola, 2004).

The huge inflow of foreign exchange revenues that accompanied the oil boom in Nigeria in the 1970s diverted the attention of the government from its traditional agriculture commodities to crude oil exploitation. A considerable number of the producers of these commodities such as groundnut, cotton, oil palm moved into activities aimed at exploiting the economic opportunities created by increased oil revenues. This development brought about the decline of agricultural production and the resultant drop in both volume and value of traditional export commodities. The resultant effect of this is a mono-product economy with the national revenue in excess of eighty percent from crude oil earnings alone.

Nigeria's broad based macroeconomic aggregate – growth, had been among the most volatile in the developing world between the mid-1970s and the beginning of the twentieth century. For instance, while the aggregate output growth rate for Nigeria was -3.0 per cent for the period 1980-1985, it was 3.4 percent for the period 1990-1995 and 5.9 percent for the period 2000-2004. This is reflected in the pattern of trade which has continuously deteriorated in real terms during this period despite the reform and liberalization programmes pursued by successive governments in the country. This study therefore seeks to understand whether there is a stable long run relationship between trade balance and exchange rate in Nigeria, investigate the nature of this relationship and thus provide policy suggestions on short-term and long-term exchange rate- trade policy management in Nigeria.

2. Literature Review

The African and Asian region of the developing world have witnessed an increased trend in recent times concerning the relationship between exchange rate and trade balance. These studies show divergent opinions on the impact of exchange rate on trade balance. The results of some of these studies are reviewed below: Onafowora (2003) investigated the exchange rate –trade balance relationship for East Asia. He focused on short run and long run effects of real exchange rate changes on the real trade balance of Thailand, Malaysia and Indonesia, in their bilateral trade to the US and Japan. His findings suggest that there are short run J-curve effects for Indonesia and Malaysia in their bilateral trade to both the US and Japan, and for Thailand in its bilateral trade to the US. With a real depreciation there is an initial worsening in the trade balance that lasts about 4 quarters but this is followed by an improvement in the long run. Thailand has the opposite movement in its bilateral trade to Japan: a real exchange rate devaluation shock initially improved then worsened and then improved the trade balance. Bahmani-Oskooee and Gelan (2011) in their work tested whether there is a J-curve for Africa using nine African countries namely; Nigeria, South Africa, Egypt, Kenya, Tanzania, Mauritius, Morocco, Burundi and Sierra Leone. After using the bounds testing approach to co-integration and error-correction modeling, they were unable to find any support for the J-Curve.

Adeniyi et al (2011) attempted to query the existence or otherwise of a J-Curve in four West African Monetary Zone (WAMZ) countries: namely The Gambia, Ghana, Nigeria and Sierra Leone. They used data from first quarter in 1980 to fourth quarter of 2007 and a bounds testing approach, with an autoregressive distributed lag (ARDL) methodology to co-integration in capturing the impact of devaluation on the trade balance. The results indicate that there is co-integration among foreign income, trade balance, domestic income and the real effective exchange rate in all countries. More importantly, the results seem to support the J-Curve hypothesis only in the case of Nigeria with no exhibition of J-curve pattern for Sierra Leone. Real devaluation policy with its attendant differential impact across countries implies that such policies should engender incentives that are compatible with the growth and developmental objectives of member states. Omojimite and Akpokodje (2010) empirically compared the effect of exchange rate volatility on the exports of a panel of seven Communaute Financiere Africaine (CFA) countries with that of nine non-CFA counterparts during the period 1986-2006. The GARCH model was utilized in generating exchange rate volatility series for this period. These series were then incorporated into an export equation and estimated using techniques such as OLS, fixed effect, first difference GMM and the systems GMM equation. The system GMM technique, as shown in the result, performed better than the other estimation techniques. It was found that exchange rate volatility negatively impacts on the exports of both panels of countries with a larger effect on the panel of the non-CFA than on the CFA countries. They concluded on the need to take appropriate monetary and fiscal policy actions to stem the rising exchange rate volatility.

In Nigeria, a study carried out by Ojo (1978) on the effect of exchange rate on the country's trade balance suggested that exchange rate changes do not play any significant role in the explanation of Nigerian import-export balance. Rano-Aliyu (2010) quantitatively assessed the impact of exchange rate volatility on non-oil export flows in Nigeria, employing fundamental analysis where the flow of non-oil exports from the Nigerian economy is assumed to be predicated on fundamental variables: the naira exchange rate volatility, the US dollar volatility, Nigeria's Terms of Trade (TOT) and Index of Openness (OPN). The co-integration results revealed that non-oil exports and the fundamental variables had a stable long-run equilibrium relationship. With the use of quarterly data for a twenty year period, it was shown from the vector co-integration estimates that the naira exchange rate volatility decreased non-oil exports by 3.65%, while the same estimate for the US dollar volatility increased export of non-oil in Nigeria by 5.2% in the year 2003.

Onafowora and Owoye (2008) examined the impact of exchange rate volatility on Nigeria's exports to its most important trading-partner–the United States using quarterly data from January 1980 to April 2001. They employed the co-integration and vector error correction (VECM) framework. Empirical analysis points to the presence of a unique co-integrating vector in the long run linking real exports, real foreign income, relative export prices and real exchange rate volatility. Also, increased volatility of the real exchange rate raised uncertainty about profits to be made which exert significant negative effects on exports both in the short- and long-run. Their results also show that improvements in the terms of trade (represented by declines in the real exchange rate) and real foreign income exert positive effects on export activity. Most importantly, they found that the trade liberalization and economic reform policies implemented in the post-1986 structural adjustment period contributed to Nigeria's export performance. Overall, the findings suggest that Nigeria's exporting activities can be further boosted by policies aimed at achieving and maintaining a stable competitive real exchange rate. Omojomite and Akpokodje (2010) investigated the effect of exchange rate reforms on Nigeria's trade performance during the period 1986-2007. The study was carried out given that exchange rate reform (combined with trade policy reforms) under Nigeria's economic reform programme which was anticipated to diversify the export base of the economy from oil to non-oil exports through competitiveness in the relative price of non-oil exports in addition to reducing imports, especially of consumer goods. It finds a small positive effect of exchange rate reforms on non-oil exports when the value of the country's currency is reduced via depreciation. However, the structure of imports which is pro-consumer goods remained unchanged even after the adoption of exchange rate reforms. Contrary to expectation, exchange rate reforms were found to stimulate imports rather than constrain it, even though in an insignificant manner.

Oyinlola et al (2010) examined the long-run and short-run impacts of exchange rate and price changes on trade flows in Nigeria using exports and imports functions. The bounds testing (Auto regressive distributive lag model) approach to co-integration was applied on a quarterly data from 1980Q1 to 2007Q4. The results indicate that in the short-run and long-run, Nigeria's trade flows are majorly influenced by relative prices, domestic and foreign income, nominal effective exchange rates and the stock of external reserves. It was also revealed from the result that in the long-run, devaluation is more effective than relative prices in altering imports demand at both baseline and augmented models. In exports demand however, the reverse is the case. Shehu and Youtang (2012) examined the causal relationship between exchange rate volatility (ERV), trade flows and economic growth of Nigeria which is considered as small open economy. The empirical study is based on time series data over the period of 1970-2009 applying time series econometrics methodology. The results indicate significant effects of ERV on trade flows in Nigeria. Their research finding supports preference for a flexible exchange rate regime over the fixed regime as it facilitates more trade flows to Nigeria. They recommended effective diversification of the Nigerian economy by encouraging more manufacturing firms' production output sufficient enough to meet the demand of both domestic and regional markets of West Africa followed by full implementation of floating exchange rate system.

While some studies have shown that currency devaluation will lead to improvement in the trade balance in the long run (Gupta-Kapoor and Ramakrishnan, 1999), other studies have shown that exchange rate devaluation has had unfavourable impact on trade balance (Bahmani-Oskooee and Alse, 1994). Even when there is an observed favourable trade flow, the pattern that the trade balance follows in the short-run after devaluation is incoherent in some cases (Bahmani-Oskooee et al, 2001).This study is therefore intended to lend its voice to the increasing debate on the subject of exchange rate and trade balance in Nigeria. Also, most studies focus on the effect of exchange rate volatility, exchange rate reforms, devaluation or deregulation on non-oil exports, external sector performance or imports and exports separately. The distinguishing mark of this study therefore is the extension of time series data in determining the long run relationship between exchange rate behavior and trade balances.

3. Theoretical Framework and Econometric Methodology

The theoretical literature of the relationship between exchange rate and trade balances can be explained by three major approaches. These are: trade or elasticity approach, absorption approach and monetary approach. The elasticity theory states that the effect of devaluation on trade balance depends on the elasticity of imports and exports. The proponents of this theory are of the view that a short term change in the exchange rate may be dominated by transactions which could lead to a fall in the trade balance. This phenomenon changes in the long run and exports and imports quantities adjust resulting in increase in their elasticities and thereby trigger a quantity change.

As quantity changes, there is a reduction in the foreign price of the devaluing country's exports but a rise in the price of imported goods and hence lowers its demand. The absorption approach, due to Sidney Alexander and popularized by Miles, posits that the devaluation of a country's currency may cause the terms of trade to deteriorate, scratching expenditure away from foreign goods to domestically produced ones, thereby improving the trade balance of the country. It was developed as a reaction to the more restrictive assumptions of the elasticity approach and emphasises the macroeconomic effect of currency devaluation. The monetary approach, which is due to Robert Mundell and Harry Johnson, became fully developed in the 1970s and views the exchange rate-trade balance relations as a purely monetary phenomenon positing that money plays a vital role in the long run both as a disturbance and an adjustment in a nation's balance of payment. According to this theory, exchange rate is determined by the intersection of the supply of and demand for money between two countries. The monetary model is based on the argument that devaluation reduces the real value of cash balances and/or changes in relative prices of traded and non-traded goods, and causes the trade balance and the balance of payments to improve. This study adopts an eclectic approach to the study of the factors that affect trade balances and attempts to draw relevant elements from the conventional theories, such as those mentioned above. It then adapts these elements to deal with particular parameters within the economic system. An eclectic approach is imperative since no one theory is adequate to explain changes in trade balance in any given economy. More so, most developing countries such as Nigeria are characterised by structurally unique features that are often not addressed in any one of the conventional theories explained above.

3.1 Econometric Methodology

The non-stationarity of most time series economic variables may result in spurious results, unreliable inference and even misleading recommendations and conclusions, thus the need to apply techniques in econometric analysis such as error correction modeling. Stationarity test assures non-spurious result; co-integration captures equilibrium long-run relationships between (co-integrating) variables, and error correction mechanism is a means of reconciling the short-run behavior of an economic variable with its long-run behavior (Gujarati and Sangeetha, 2007). The order of integration of the variables is examined using the 'Augmented Dickey-Fuller'(ADF) and Phillips-Perron test statistic of unit roots. After confirming order of integration of the variables, the study proceeds to test the long-run behaviour of economic variables through co-integration test. We carried out the Johansen maximum likelihood co-integration testing procedure to find out if there is a long-run stationary steady state. Finally, a general-to-specific parsimonious dynamic model based on the Engle-Granger residual was derived

The derived variant of the eclectic model which this study seeks to estimate can be stated as follows:

$TB_t = f(REER_t, GDP_t, WGDP_t)$.....1.1

This can be re-stated as follows

$TB_t = \beta_0 + \beta_1 REER_t + \beta_2 GDP_t + \beta_3 WGDP_t + \varepsilon_t$ 1.2

A log-linear specification of the model can be stated as follows:

$InTB_t = \beta_0 + \beta_1 InREER_t + \beta_2 InGDP_t + \beta_3 InWGDP_t + \varepsilon_t$ 1.3

Where,

LnTBt =logarithm of balance of trade taken to be lnXt-lnMt,(Xt=exports and Mt=imports) at time t respectively
lnREERt, = logarithm of real effective exchange rate
InGDPt, = logarithm of gross national product of Nigeria.
InWGDPt, = logarithm of world real industrial production index (proxy of trade partners income).

The theoretical expectation is that exports and imports increase as the real income of the trade partners and domestic income rises respectively, and vice versa. In that case we could expect $\beta 2<0$ and $\beta 3>0$. However, imports may decline as income increases if the real income rises due to an increase in the production of import-substitute goods, and in that case we would expect $\beta 2>0$ and $\beta 3<0$. The effect of changes in real effective exchange rate on balance of trade is ambiguous. Hence, $\beta 1$ could take any sign, positive or negative. Generally, if real depreciation/devaluation takes place, which causes the real effective exchange rate to increase, the exports go up, the imports fall as a consequence and it improves the trade balance. This study, first of all, attempted to examine the order of integration of the variables using the 'Augmented Dickey-Fuller'(ADF) and Phillips-Perron test statistic of unit roots.

After confirming that all the variables are stationary either at level or first differencing, the study proceeded to test the long-run behaviour of economic variables through co-integration test. We carried out the Johansen maximum likelihood co-integration testing procedure to find out if there is a long-run stationary steady state. Finally, a general-to-specific parsimonious dynamic model based on the Engle-Granger residual was derived. To test for the order of integration of the variables, i.e. the stationarity or otherwise of the natural logarithm of the variables, Augmented Dicker Fuller (ADF) test for stationarity is applied to know the order of integration of the variables in the model. We specify the ADF test as follows:

$$\Delta TB_t = \beta_1 + \beta_2 + \delta\ TB_{t-1}\ \alpha\Sigma\Delta TB_{t-1} + \ell_t \quad \text{.....1.4}$$
$$\Delta REER_t = \beta_1 + \beta_2 + \delta\ REER_{t-1}\ \alpha\Sigma\Delta REER_{t-1} + \ell_t \quad \text{.....1.5}$$
$$\Delta GDP_t = \beta_1 + \beta_2 + \delta\ GDP_{t-1}\ \alpha\Sigma\Delta GDP_{t-1} + \ell_t \quad \text{.....1.6}$$
$$\Delta WGDP_t = \beta_1 + \beta_2 + \delta\ WGDP_{t-1}\ \alpha\Sigma\Delta WGDP_{t-1} + \ell_t \quad \text{.....1.7}$$

Where ℓ_t in the four equations above are assumed to be identical independently distributed random variable. The null hypothesis for their test is that $\delta = 0$ or p=1 that is unit root exist. In testing the variables for co-integration, we use the Johansen statistic estimation approach (Johansen and Juselius, 1990). The Johansen's test for the following econometric model

$$Y_t = U_{y\,t} + \ell_{y\,t} \quad \text{.....1.8}$$
$$Z_{t=} U_{z\,t+} \ell_{z\,t} \quad \text{.....1.9}$$

Co-integrated variables share common stochastic trends. Each of the Us is a random walk and that ℓ is stationary. Given that Y_t and Z_t are co-integrated of order (1, 1) there must be non-zero values of β_1 and β_2 for which the linear combination of $\beta_1 Y_t + \beta_2 Z_t$ is stationary. Thus:

$$\beta_1 Y_t + \beta_2 Z_t = \beta_1 (U_{yt} + \ell_{yt}) + \beta_2 (U_{zt} + \ell_{zt}) \quad \text{.....1.10}$$
$$= \beta_1 U_{yt} + \beta_2 U_{z\,t} + \beta_1\ \ell_{yt} + \beta_2\, \ell_{zt} \quad \text{..... .1.11}$$

This is stationary only if $(\beta_1 U_{yt} + \beta_2 U_{z\,t})$ vanishes so that

$$\beta_1\ \ell_{yt} + \beta_2\, \ell_{\,zt} = 0V_t \quad \text{.....1.12}$$

The parameters of the co-integrating equation must be such that they purge the trend from the linear combination of the variables. To validate point (iii) above, we used the Error Correction Model (ECM) which was popularised by Engel and Granger (1987). This test involves the treatment of the error term in the test above as equilibrium error. It uses this error term to tie the short run behaviour of the TB_t to its long run value.

The error correction dynamic specification is of the general form

$$\Delta TB_t = \beta_0 + \beta_1 L(\Delta Z) - \beta_2 ECM_{t-1} + \varepsilon_t \quad \text{.....1.13}$$

Where:

Z is a vector of variables that co-integrate with trade balances, L is a general operator, and ECM_{t-1} is the error correction term lagged by one period while ε_t is the error term. This can be expanded to include the vector of variables thus:

$$\Delta TB_t = \beta_0 + \beta_1 InREER_{t-1} + \beta_2 InGDP_{t-1} + \beta_3 InWGDP_{t-1} + \beta_4 ECM_{t-1} + \varepsilon_t \quad \text{..... 1.14}$$

It should be noted that Δ denotes first difference and the coefficient of the ECM_{t-1} provides an estimate of the speed of adjustment.

4. Analysis of Result and Discussion of Findings

The unit root test result as presented in Table 1 shows that all the variables of interest were stationary at level except REER that was stationary at first difference. With the non-existence of unit (variables being stationary at level and at first differencing), we proceeded to conducting a co-integration test to determine whether there is a long run equilibrating relationship among the variables.

Table I: Unit Root Test			
Variable	ADF test statistic	1% critical values	Remark
TB	-1.59	-4.22	1(0)
REER	-1.75	-4.22	1(1)
GDP	-1.60	-4.22	1(0)
WGDP	-3.49	-4.22	1(0)
ADF is Augmented Dickey Fuller unit root test			

In Table 2, the trace test statistic leads to the rejection of the null hypothesis of r = 0 (no co-integrating vectors) against the alternative hypothesis of r >0 (one or more co-integrating vectors) since the trace test statistic of 77.93 is greater than its 5% level of 47.21. This also follows for the null hypothesis of r≤1 and r≤2 which has to be rejected for the alternative hypothesis of r=2 and r=3. From the foregoing therefore, we can deduce that there are at least three co-integrating vectors in the model.

Table II: Johansen Co-Integration Test						
Null hypothesis	Alternative hypothesis	Eigen value	Likelihood ratio	5percent critical value	1 percent Critical value	Hypothesized No of CE(s)
r=0	r=1	0.687200	77.93291	47.21	54.46	None **
r≤1	r =2	0.391135	34.93182	29.68	35.65	At most 1 *
r≤2	r=3	0.322740	16.57395	15.41	20.04	At most 2 *
r≤3	r=4	0.056581	2.155045	3.76	6.65	At most 3
*(**) denotes rejection of the Hypothesis at 5% (1%) significance level.						
L.R test indicates 3 co-integrating equation(s) at the 5% significance level.						

The co-integration test confirms that there is a long run relationship between exchange rate, gross domestic product, world gross domestic product and trade balances in Nigeria.

Table III: Parsimonious Error Correction Model				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.81	1.66	-0.88	0.385
REER	-0.36	0.65	2.09	0.046
REER(-1)	-1.46	1.75	-1.83	0.078
REER(-2)	-1.22	0.57	-3.23	0.003
GDP	0.78	1.85	0.70	0.490
GDP(-1)	1.22	0.29	6.37	0.000
GDP(-2)	-0.64	0.11	-4.32	0.000
WGDP(-1)	-3.91	1.91	-2.054	0.050
ECM(-1)	-0.52	0.23	4.99	0.000

There is a negative and statistically significant relationship between exchange rate and trade balances in Nigeria. An increase in exchange rate (depreciation or devaluation) by one percentage point, the trade balance depreciates by 0.4 percentage points in the current year. When exchange rate increases by one percentage point in the first and second year lag periods, it brings about 1.5 and 1.2 percentage point depletion in the current periods balance of trade respectively. This implies that as real depreciation or devaluation takes place causing real exchange rate to increase, rather than exports to improve, it deteriorates while imports rather increase and as a consequence, the balance of trade situation worsens.

A one percentage increase in the country's gross domestic product improves trade balance by 0.8 percentage points in the current year and 1.2 percentage points in the first year lag period. However, in the second year lag, GDP increase brings about a deterioration of the trade balance situation. The result of the second year lag of domestic GDP on TB is contrary to a priori expectation because improvement in the production level of an economy brings about increase in domestic level of income which in turn causes less availability of goods to export with detrimental effects on the balance of trade. Conversely, the result of the effect of domestic GDP on TB for the current and first year lag periods supports our a priori expectation because an improvement in a country's income brings about an improvement in the trade balance.

The WGDP which is a proxy for trade partner's income has a negative and significant impact on trade balance in Nigeria. The result shows that a one percentage increase in WGDP brings about a 3.9 percentage drop in trade balance in the country. This means that an increase in world income results in a decrease in the demand for Nigeria's locally made goods and this would serve to discourage exports and negatively impact on the trade balance. The ECM which indicates the speed of adjustment of the short and long run equilibrium behaviour of the trade balance and the explanatory variables has the expected negative sign and confirms stability in the adjustment process with 52 percent of trade balance adjusting towards its long run value in one year.

5. Policy Implications and Conclusion

This study examined the impact of changes in exchange rate and other related variables on the trade balance of Nigeria. The co-integration test confirms that there is a long run relationship between exchange rate, gross domestic product of Nigeria and world gross domestic product and trade balances in Nigeria. The Gross Domestic Product of Nigeria has a positive relationship with trade balance which shows that improvement in domestic income leads to positive trade balance in Nigeria. The trade partners' income has a negative and significant impact on trade balance which shows that increase in income of Nigeria's trading partners' results in reduced demand for Nigeria's goods, reduced exports and a negative trade balance. The study suggest that the real exchange rate has a significantly negative impact on balance of trade in Nigeria both in the short-run and in the long run, as shown in the negative association between real exchange rate and balance of trade suggesting that devaluation is not beneficial to Nigeria's export. Exchange rate depreciation, as shown in the study, is not desirable in order to achieve positive trade balance. Therefore if the economic policy objective is to achieve a positive trade balance, measures should be taken to stabilize exchange rate while policy should be geared towards increasing the rate of growth of the country's gross domestic product. Secondly, there should be deliberate effort by the regulatory authorities to strictly monitor the foreign exchange market to avoid continuous speculative attacks and free fall of the domestic currency in relation to the United State dollar and other major world currencies. A continuous deterioration of the domestic currency will translate into a deficit in the balance of trade in the long run.

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