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Balance of Payments Adjustment and Productivity Growth in Nigeria: A Small Macroeconometric Analysis

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Abstract
This study using aggregate data from 1970 to 2012, investigates balance of payments adjustment and productivity growth in Nigeria by specifying a small macro- econometric model to analyze the various channels through which the economy's Bop position could be enhanced. The empirical model identifies real exchange rate, government expenditure/revenue, real trade, and foreign direct investment as the various channels that drive productivity growth of the Nigerian economy. The simultaneous equation model was analyzed using the ECM – error correction model approach rather than the conventional Ordinary Least Square (OLS) to overcome simultaneity bias while the unit roots and co-integration tests was carried out using ADF and Johansen/Juselius techniques. The stability test of the parameters of the model was also carried out using the cumulative sum of squares residuals (CUSUM). The result shows that the elasticity of oil revenue, real trade balance, and credit to the private sector, foreign direct investment, government expenditure and degree of openness have positive and significant effect on real GDP while the CUSUM test falls within the 5% critical bound showing the stability of the simultaneous equation models and thus validating the model. Among the findings of the study is that there is a relationship between changes in real exchange rate misalignment and changes in actual exchange rate. This, therefore suggest that the monetary authorities can use exchange rate alignments to develop the external sector of the Nigerian economy, via the non-oil export thereby solving the BoP disequilibrium Problem.
(JEL Codes): F4,F32, C5
Keywords: Balance of Payments mechanism, adjustment policies, macro- econometric model, ECM, CUSUM Test.

1. Introduction

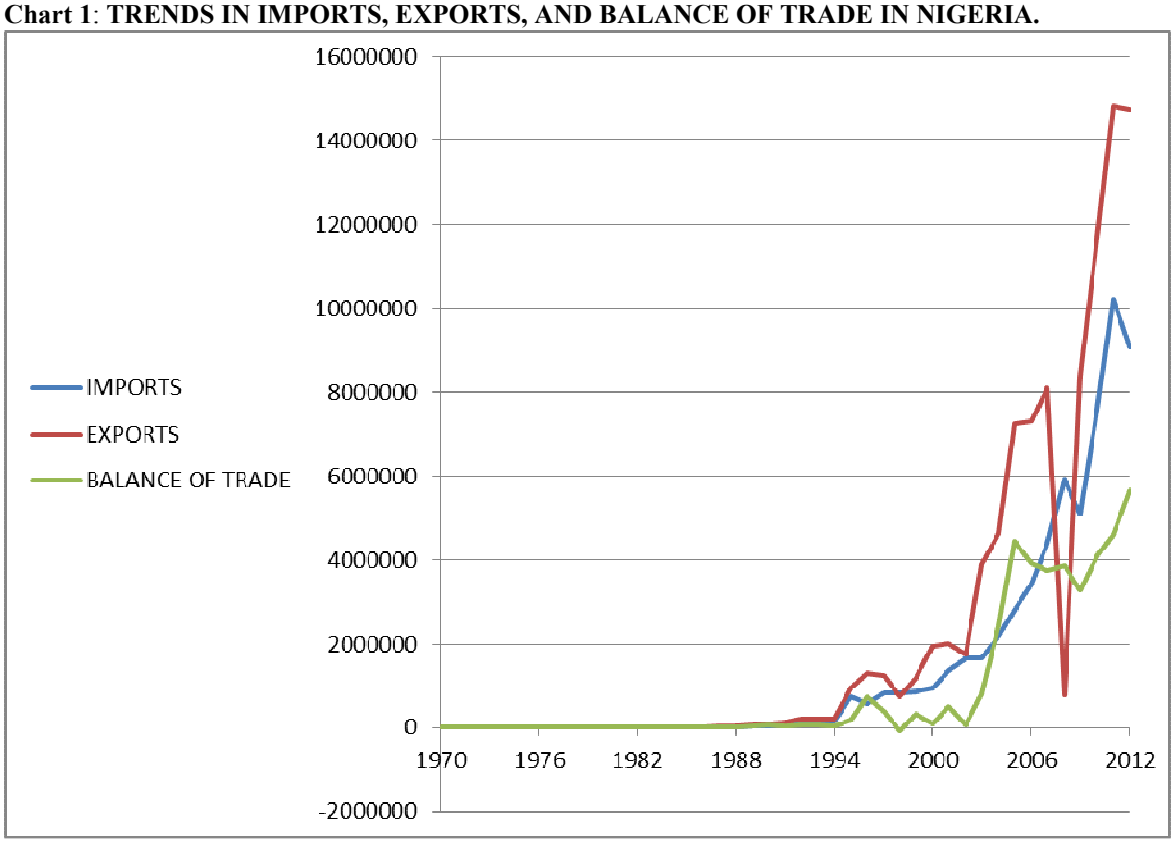
One notable feature of the Nigerian economy since independence in 1960 is the recurrence of current account deficits and an increase in external debt, which grew from about US $960 million in 1970 to an average of about $32 billion in the 1990s. As a ratio to GDP, external debt was 10 per cent in 1970, reached 110 per cent in 1986 and stood at approximately 71 per cent. Balance of payment was under pressure for the most of the years between 1975 and 1996. The pressure on the balance of payments account only eased for three years, that is ,1979, 1980 and 1990(IMF, 2001). The positive shocks for these three years are the result of the oil boom of the late 1970s, the positive effects of the structural adjustment programme (SAP), operated from the second half of the 1980s and the Gulf war of 1990.

In terms of structure, balance of payments accounts have the following components: current and capital accounts. The current account side includes trade account- merchandise import and export, service account (inflow and outflow). On the capital side of the balance of payments there are: direct investment, portfolio investment and other capital accounts investments. However, the overall balance of payments at any point in time is determined by shifts in the status of the various components that make up the account.

The profile of major components of the balance of payments accounts indicates that the pressure on the balance of payments accounts was generated by periodical changes in the magnitude of all the major accounts, that is, balance on the trade, the service and the capital accounts. The service account balance shows a consistently increasing trend of deficits for the periods between 1963 and 1999. The average annual deficit increased from an average of US $156.3 million in 1963 to 1966 to about US $249.5 million in 1967, and by 1979 to 1982 the average annual services account balance had increased to US $3637 million. The deficit witnessed a relatively modest decline for the period 1987 to 1991, thereafter; it increased to US $3380.3 million in 1996 to 1999. Unfavorable term- of-trade and intensive growth in imports may have accounted for the negative trend recorded in the services account balance. The capital account balance also contributed significantly to the seemingly re-occurring deficit level of Nigeria's balance of payments accounts. The capital account balance, which was modestly positive between 1971 and 1986, ran into substantial deficits between 1987 and 1999. It has to be noted that the Nigerian economy, like other developing economies, has operated within a relatively hostile international environment. The feature of this environment include worsening terms of trade, volatility of primary commodity prices, increasing international protectionism and external debt burden and overhang (Obadan, 2012). The Nigerian external sector recorded a continous crisis most of the 1970s through 1990s, which resulted in severe deficit on the balance of payments accounts. There has also been the problem of weak market for primary commodities, reflecting an observed decline in the price of non-commodity

exports, in the world market coupled with excess supplies of the commodities. The price index of Nigeria's agricultural commodity exports declined by an annual average of 7.0 per cent between 1988 and 1992. But it increased by 13.1 percent between 1996 and 1998. Thereafter, the index sharply declined by 54.6 percent in the year 2000. The commodity problem is not restricted to agricultural commodities alone. The price of crude oil, upon which Nigeria depends for over 95 percent for foreign exchange earnings, have also been unstable as can be seen from chart 1. Over the 1980 – 1993 periods, the prices were lowest in 1986 and 1993. The price of Nigeria's crude oil fell continuously from $1.90 in December 1992 to $13.6 in December 1993, with destabilizing effects on the balance of payments and government finances. In the 1990s, crude oil price was at $12.83 barrel. However, from the 2000s, crude oil prices trended upwards, averaging $26.96 from 2000 – 2003. In July 2008, crude oil price was over $140.00 per barrel in the world market. But towards the end of 2008, crude oil prices collapsed in the world market as a result of the global economic and financial crises which engulfed most parts of the world economy, Nigeria inclusive.

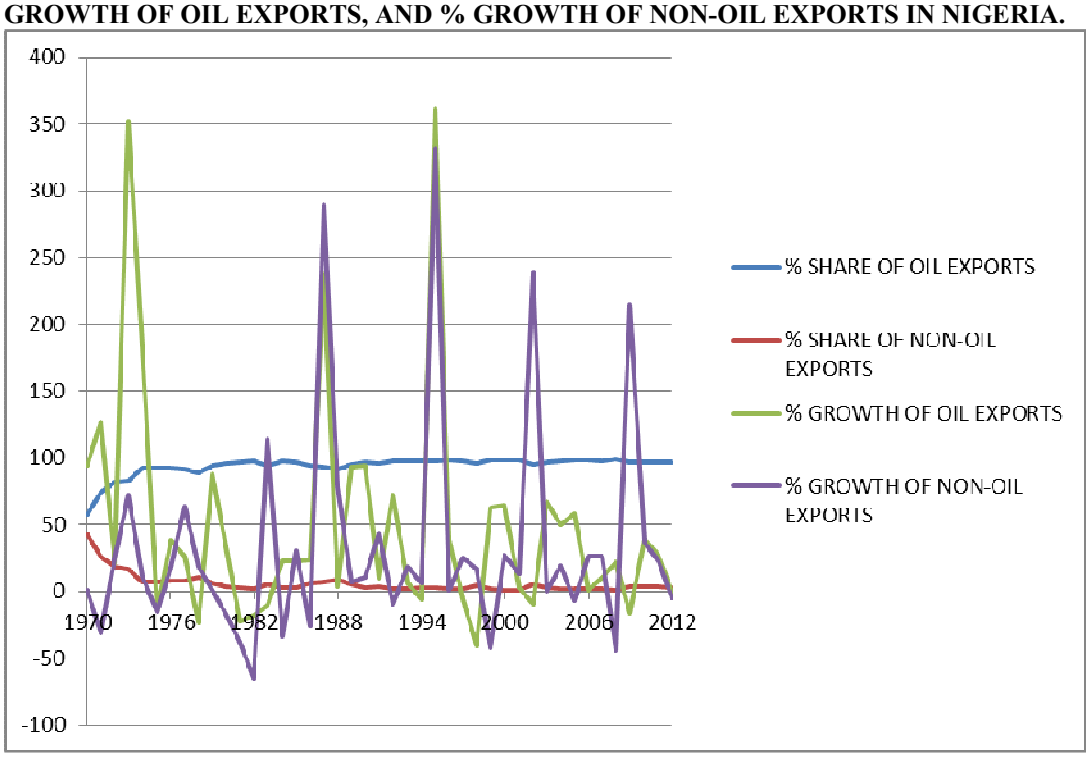
Chart 1: **TRENDS IN IMPORTS, EXPORTS, AND BALANCE OF TRADE IN NIGERIA.**



Source: Authors' Initiative Using Data obtained from WDI, 2013

Chart 2 further shows the pattern of oil and non-oil export performance in Nigeria. The value of total exports increased significantly from ₦330.00 million in 1960 to ₦885.4 million in 1970 and to ₦14, 186.7 million in 1980. Following the collapse of international oil price in 1981 and the decline in world demand for primary commodity exports, the value of exports reduced to ₦10, 876.3 million. Thereafter, in 1986, export value was less than ₦10, 000.0 million each year except in 1985. During the period of the structural adjustment programme, the naira values of merchandize exports increased substantially due to the large depreciation of the Naira exchange rate. Accordingly, exports increased from ₦8, 920.5 million in 1986 to ₦30, 443.5 million in 1987 and ₦1, 241,662.7 million in 1997. As at 2007, total exports stood at ₦8, 120,147.9 million. While the share of non-oil exports in total exports consistently declined from 42.4 per cent in 1970 to 10.9 per cent in 1978 and 3.3 per cent in 2003. The one commodity structure, reflecting the dominance of oil, has made the economy to be very vulnerable to short – term booms and busts, with the characteristics of the 'Dutch Disease' effect, low level productivity and low level of competitiveness.

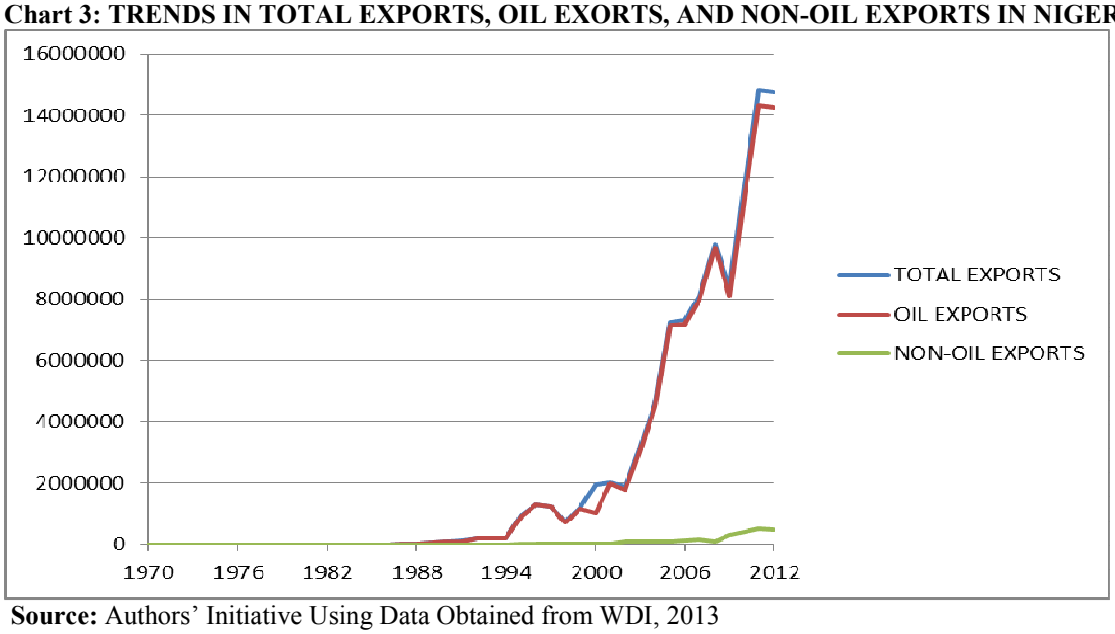
Chart 2: TRENDS IN % SHARE OF OIL EXPORTS, % SHARE OF NON-OIL EXPORTS, % GROWTH OF OIL EXPORTS, AND % GROWTH OF NON-OIL EXPORTS IN NIGERIA.



Source: Authors' Initiative Using Data obtained from WDI, 2013

The profile of merchandise imports, exports and balance of trade presented in chart 3 indicates that the value of Nigeria's merchandise import has tended to grow very fast our the years. From a value of ₦431.8 million in 1960 import rose to ₦756.4 million in 1970 and ₦12, 839.6 in 1981. It declined to ₦4, 484.5 million in 1984. The economic crisis of the early 1980s and the subsequent economic stabilization measures accounted for the sharp reduction in the volume of and value of imports. The value of import recorded an upward trend from 1985, with a value of ₦2, 800,856.3 million. The magnitude and structure of merchandise imports have been determined majorly by increased income and foreign exchange levels of the oil boom eras, dependence of the economy on foreign technology and industrial development, domestic economic policies aimed at promoting agricultural and industrial development, the needs of the various national development plans and programmes, and trade and commercial policies.

Chart 3: TRENDS IN TOTAL EXPORTS, OIL EXORTS, AND NON-OIL EXPORTS IN NIGERIA



Source: Authors' Initiative Using Data Obtained from WDI, 2013

The policy responses failed to address these fundamental balance of payments problems. One would

have expected an efficient adjustment in terms in terms of a reduction in government consumption expenditure in terms of a reduction in government consumption expenditures, nominal devaluation of the currency, and a reduction in real wages to increase competitiveness in the tradable sector. The actual adjustment resulted in current account and balance of payments deficits reduced foreign exchange reserves and an increase in external debt obligation. The government policy of exchange control and restrictions aimed at reducing the outflow of foreign exchange was inadequate in dealing with the current accounts deficits problems emanating from excessive domestic absorption. The nature of exchange control administration created uncertainties among private investors that reduced incentives for private investment and encouraged corruption, rent- seeking activities, and smuggling. In addition to the heightened impediments to trade, the pervasive nature of the exchange control mechanism introduced serious distortions into the economy that greatly affected its overall performance.

The persistence of balance of payments problems has given rise to a lot of empirical studies. However, the result of most of the previous studies and their estimation techniques suffer from the followings:

- Simultaneous equation bias and inefficient estimates
- The studies focused more on the monetary approach to the balance of payments.
- These limitations from the previous studies create a big gap in the literature concerning BoP adjustment and productivity growth in Nigeria.

These problems in previous studies have necessitated an in-depth inquiry into the probable effects of balance of payment adjustment policies on productivity growth in Nigeria using the simultaneous approach and in that way contribute to the body of existing knowledge.

As a result of the foregoing, the obvious questions to ask are: what is the impact of balance of payments adjustment policies on productivity growth in Nigeria? What are the various channels though which BoP adjustment policies impact on productivity growth in Nigeria? And what are the nature and characteristics of these adjustment policies? An understanding of these questions can help policy makers in resolving the Nigerian balance of payment problems.

The objective of this study is therefore, to investigate the impact of BoP adjustment policies on productivity growth in Nigeria. Specifically, the study seeks to assess among others the various channels through which BoP adjustment policies impacts on productivity growth in Nigeria.

The analysis is structured as follows: section 1 above is the introduction highlighting the background of the study, section 2 is literature review. Section 3 provides theoretical framework and methodology, section 4 is on discussion of empirical results, while section 5 is on conclusion and recommendations.

2. Review of Literature

2.1 Theoretical Issues

The theoretical underpinning of the study is the income-absorption approach. The justification for this approach is based on the fact that most previous studies focused more on the monetary approach to balance of payments (MABP).Devaluation leads to increase in volume of exports and decrease in the volume of import. But even if the elasticity condition is satisfied, in order to say that the trade balance is improved, we have to consider how the country reacts to devaluation. Accordingly, Carbough (2006) states that the absorption approach gives insights on how a country reacts to devaluation by considering two points. These are: the impact of devaluation on the spending behaviour of the domestic economy and the influence of domestic spending on the trade balance
The balance of trade is the difference between the total domestic output and the domestic absorption. Positive trade balance means the total domestic output exceeds the domestic spending and negative means the spending exceeds output. The absorption approach starts with the idea that the value of total domestic output(Y) equals the level of total spending, where total spending is composed of consumption(C), investment (I), and government expenditure (G) and net export(X-M). This can be written as:

$$Y=C+I+G+(X-M)\ldots\ldots\ldots\ldots(1)$$

The absorption approach consolidates the three economic aggregates C, I and G, which are often called absorption(RØdseth, 2000). This can be summarized in a single term 'A' and 'Z' represented by net export(X-M). Total domestic output thus equals the sum of absorption plus the level of net exports(X-M) and the equation 1 above can be rewritten as follows by substituting 'A' and 'Z':

$$Y=A+Z\ldots\ldots\ldots\ldots(2)$$

In order to get the balance of trade A has to be expressed in terms of Y and Z, such that

$$Z=Y-A\ldots\ldots\ldots\ldots(3)$$

If national output (Y) exceeds domestic absorption (A) as suggested by equation (3), the economy's trade balance will be positive. Conversely, a negative trade balance suggests that the economy is spending beyond its ability tom produce. (Carbough, 2006)
The absorption approach predicts that if currency devaluation is to improve an economy's trade balance, national

output must rise relative to absorption. This means that the country must increase its total output, reduce its absorption or do some combination of the two. The absorption approach may also depend on the price level or other factors related to the devaluation, so that:

$$a=cy-d \quad \ldots\ldots (4)$$

where c is the propensity to absorb, equal to the propensity to consume plus an analogus effect of income on investment, which may be called the propensity to invest. The term d may be called the direct effect of the devaluation on absorption. It expresses whatever tendency there may be for the devaluation to induce a change in the amount of real absorption at any given level of real income. The equation therefore states that the change in the absorption of goods and services in real terms as a result of devaluation is made up of two parts. The first part, cy, is the change in real consumption plus real investment that is induced by the change in real income that result from the devaluation. The other part, d, is the change in absorption which results other than through the income effect.

The absorption approach goes beyond the elasticity approach, which views the economy's trade balance as distinct from the rest of the economy. Instead, devaluation is viewed in relation to the country's utilization of resources and the level of production. Cooper (1972) shows that the two approaches are not substitute to each other rather they are complimentary. Therefore, the absorption approach goes beyond the elasticity approach by looking at the country's reaction to devaluation, by considering the impact of devaluation on the spending behaviour of domestic economy and the influence of domestic spending on the trade balance. This means that devaluation can improve trade balance if national output of a country increases relative to its domestic absorption.

Miller(1986) concludes that the main conclusion of the income absorption approach is well known, that the trade balance cannot be improved unless output rises relative to the absorption of tradable goods. Thus, the policy conclusion about reducing absorption relative to income amounts to increasing bond demand relative to bond supply, and thereby eliminating the excess supply of bonds that is at the heart of the balance of trade deficit

2.2. Empirical Literature

Empirical studies on BoP adjustment mechanism abound. In Nigeria, since the structural adjustment programme (SAP) to the current economic reform measures , several studies have been carried out on the impact/relationship between BoP adjustment policies and productivity growth in Nigeria though with different estimation approaches. For instance, Nyong and Obafemi(1995) investigated the impact of exchange rate adjustment (devaluation) in Nigeria's balance of payments using the instrumental variable approach. He observed that the Central Bank of Nigeria has carried out complete neutralization of the domestic money supply within the sampled period of 1960 to 1993.

Akpansung (1998) explored the applicability of the monetary approach to the balance of payments in Nigeria between the periods 1960 to 1995 using the two stage least square (2SLS) estimation technique. He observed that Nigeria's balance of payments has been dominated by monetary variables. His result confirmed the postulation that reserve accumulation is negatively related to the rate of growth of domestic output.

Furthermore, Udah (2011) investigated adjustment policies under current account behaviour in Nigeria between the periods 1970 to 2008, employing co-integration and error correction technique. He observed that the causality between exchange rate and current account is uni-directional while the same holds true for current account and trade openness. Oladipupo (2011) in his study observed and concluded that improper allocation and misuse of domestic credit, fiscal indiscipline and lack of appropriate expenditure control policies due to centralization of power in government are some of the causes of persistent balance of payments deficits in Nigeria.

Imoisi (2012) examined trends in Nigeria's balance of payments using the ordinary least square (OLS) technique. He observed that the relationship between balance of payments and inflation rate was not significant. He therefore advised that the government should increase the non-oil export and diversify the productive base of the current account of the country's balance of payments.

In summary, the contribution of the empirical review points to the following: First, the studies reviewed confirmed the fact that balance of payments is a monetary phenomenon and that the disequilibrium of the BoPs or the reserve flow are always necessitated by disturbances in the monetary variables of the countries concerned. Second, all the studies adopted the monetary model of the open economies developed by either Johnson (1972), Mundell (1968, 1971), Johnson and Frenkel (1978) or their modified versions. In either cases, the results were generally consistent with the pattern (signs and magnitudes) implied by the hypothesis of the monetary approach to the balance of payments. Third, the studies did no favour exchange rate variations (devaluation) as the only policy tool for either the correction of a deficit or the sustainability of equilibrium in the balance of payments. Rather, the studies accepted a side-by-side adoption of both devaluation and strict monetary policies by the monetary authorities especially in the absorbing and third world economies like Nigeria. Four, some of the

studies used single equation estimation technique in their model estimation. These studies no doubt suffer not only from simultaneous equation bias but inefficient estimates, since all the information available in the description of the system of equations are utilized in their estimation procedure (Pundyck and Rubinfeld, 1976; Koutsoyianis, 1977; Pokorny, 1992; Dougherty, 1992. Greene, 2003; Wooldridge, 2003, Gujarati and Sengeetha, 2007). Besides, the problem of identification of the behavioural equations has not been established by some of these studies. Nevertheless, some of the observed lapses were overcome by this study by employing the simultaneous equation approach

3. Theoretical Framework and Methodology

3.1. Theoretical Framework

Among the theories that explains the effect of BoP adjustment policies; it is only the absorption approach that analyses the effect on the exchange rate on the balance of payments from a broad macroeconomic perspective (Korsu, 2009). That is, unlike other theories; it takes into consideration many channels through which an exchange rate change passes to affect the balance of payments. Therefore, the theoretical framework underpinning the study is the absorption approach to the balance of payments. The approach derives the current account from the national income identity, which is given as:

$$Y = C + I + X - M \quad \text{----------(1)}$$

Where:

$$C = a + by, \; b>0 \quad \text{----------(2)}$$

$$I = g + hy, \; h>0 \quad \text{----------(3)}$$

Where b is the marginal propensity to consume, h is marginal propensity to invest, b + h is the marginal propensity to absorb (spend), y is the income, C is consumption, I is investment, X is export and M is import. The expenditure on goods by domestic residents (called absorption, A) and the balance of payments (B) are given respectively in equations (4) and (5) respectively.

$$A = C + I \quad \text{---------- (4)}$$

$$B = X - M \quad \text{---------- (5)}$$

Substituting (4) and (5) into (1) gives

$$Y = A + B \quad \text{----------(6)}$$

From equation (6), the balance of payments is given as:

$$B = Y - A \quad \text{----------(7)}$$

$$\text{Hence } \Delta B = \Delta Y - \Delta A \quad \text{----------(8)}$$

Hence equation (8) is the fundamental equation of the absorption approach to the balance of payments. The equation states that an increase in the nominal exchange rate will affect the balance of payments by changing income, absorption or both. Specifically, devaluation improves the balance of payments, if it increases income more than it increases absorption and if it reduces absorption more than it reduces income or if it increases income and reduces absorption.

According to the absorption approach, there are two channels through which an increase in the nominal exchange rate (devaluation/depreciation) affects income. These are the idle resources (also called the unemployed resource) channel and the terms of trade channel. The idle resource channel says that if there are unemployed resources in the economy, the changes in relative prices that follow an increase in the nominal exchange rate shifts expenditure from foreign goods to domestic goods. The resulting increase in aggregate demand will lead to an increase in income. The terms of trade channel opines that the increase in nominal exchange rate improves the terms of trade when real income increases, but if it deteriorates the terms of trade, real income will fall. Since the idle resource effect and the terms of trade effect interact to obtain the net income effect on income, the effect of an increase in the exchange rate on income is undefined.

By substituting (2) and (3) into (4), and assuming a+g = 0, we obtain:

$$\Delta A = (b+h)\,\Delta Y \quad \text{---------- (9)}$$

Hence, $\dfrac{\Delta A}{\Delta Y} = b+h$

But b>0 and h>0. Therefore, b+ h>0

Since b+h are positive, when an increase in the nominal exchange rate increases, income absorption will increase and if it decreases, income absorption will decrease, this is referred to as the indirect effect of devaluation on absorption because it affects absorption by changing income.

By substituting (9) into (8), the effect of an increase in the nominal exchange rate that changes income, on the balance of payment is obtained. This gives;

$$\Delta B = \Delta Y - (b+h)\,\Delta Y$$

$$= (1 - (b+h)\,\Delta Y$$

Hence, $\Delta A = 1 - (b+h)$ from this, $\Delta B > 0$ if
$\Delta Y \qquad \Delta Y$

$1-(b+h) > 0$. But this holds when $b+h < 1$
Therefore, $\Delta B > 0$ if $b + h < 1$ ---------- (10)
ΔY

Equation (10) shows that an increase in the nominal exchange rate that increases income improves the balance of payments if the marginal propensity to absorb is less than one.

3.2 Methodology

Within the framework of the absorption approach to BoP adjustment and productivity growth nexus, there exist networks of interrelationships which can only be adequately addressed by a system of simultaneous equation (macro-econometric models). To this end, a small macroeconomic model is specified. This model provides the various channels through which BoP adjustment policies impacts on productivity growth in Nigeria.

3.2.1 Model Specification and Definition of Variables

The model of the study using stochastic and identified variables as dictated by theory is specified below. However, it must be noted that the model is a reflection of the structure of the Nigerian economy. The current devaluation of the Naira in the current managed floating regime has fiscal implications and hence an external sector effect. The small macroeconometric model in specified below.

$$LnRER = a_0+a_1In(^{G}/_{R})+a_2Ln(^{CAPFL}/_{GDP})+a_3LnDOPEN+a_4LnToT+U_1 \quad \text{-------(11)}$$
$$a_1, a_2. a_3, a_4 >0$$

$$LnG =b_0+b_1LnRER+b_2LnGDP+b_3LnBoP_{-1}+b_4LnED_{t-1}+b_5LnSAP+U_2 \quad \text{------- (12)}$$
$$b_1, b_2. b_3, b_4, b_5 >0$$

$$LnR = \alpha_0+\alpha_1LnRER+\alpha_2LnRGDP+\alpha_3LnG_{t-1}+\alpha_4LnTOT_{t-1}+\alpha_5LnSAP+U_3 \text{ ------(13)}$$
$$\alpha_1, \alpha_2. \alpha_3 \ldots\alpha_5 >0$$

$$LnB = X_0+X_1LnERE+X_2LnCPS+X_3LnDOPEN+X_4LnOILR+U_4\text{---------- (14)}$$
$$X_1, >/<0, X_2. X_3, X_4, X_5 >0$$

$$LnRGDP = \theta_0+ \theta_1LnOILP+\theta_2LnFDI+\theta_3LnTRD+\theta_4LnCPS+U_5\text{---------- (15)}$$
$$\theta_1, \theta_2. \theta_3, \theta_4, >0$$

$$LnCPI = \delta_0+\delta_1LnMS+\delta_2LnY+\delta_3LnNER+\delta_4LnINTR+U_6 \text{ ---------- (16)}$$
$$\delta_1, \delta_2. \delta_3, \delta_4, <0$$

Identities

$Y = C + I + X - M$ ---------- ----------(17)
$A = C + I$ ---------- (18)
$C = Cp + Cg$ ----------(19)
$MS = MS + \Delta DC + \Delta NFA - \Delta NOI_t$---------- (20)
$\Delta DC = \Delta DCP + \Delta NDCg$ ---------- (21)
$\Delta NDCg = (G - G_R)_t - NEB_t$ ---------- (22)
$X = OX + NOX$ ----------(23)

Where,

RER= Real Exchange Rate, G = Government Expenditure, R = Government revenue, RGDP = Real Gross Domestic Product, B = Real Total Trade, CPI = Consumer Price index, M= Aggregate Import, X = Aggregate export, NOX = Non –oil export, FR = foreign reserve, CPI = Consumer Price Index, G/R = budget deficit exclusive of grants, CAPFLO/GDP = ratio of capital flow to GDP, DOPEN = Degree of openness measured as sum of import and export divided by GDP, BoP = balance of payment constraint represented by the stock of non-oil reserves as a percentage of GDP, ED = external debt as a percentage of GDP, SAP = dummy variable incorporating effect, TOT = Terms of trade, Y = aggregate income, INTR= Nominal interest rate, P = consumer price index (Proxy) for inflation, OX = oil export, EXR = Nominal exchange rate, CPS = credit to the private sector, OILR = oil revenue. NER = nominal exchange rate, FX = Foreign exchange, X aggregate export equation, MS, ΔDC and ΔNDCg = Money supply determination based on the consolidated balance sheet of the monetary authorities (CBN).

The data of the variables from 1970 to 2012 were sourced from Central Bank of Nigeria Statistical Bulletin of various issues, and World Development Indicators CD – Rom. The natural logarithms of all the variables in the stochastic equation were taken and estimation done in logarithm form so that the coefficients are interpreted as elasticities.

3.2.2 Estimation Procedure and Technique

Since our model is a simultaneous equation, the ordinary least square (OLS) cannot be used as the estimation technique; rather the error correction approach is adopted. This is to avoid biased and inconsistent estimates. In the simultaneous equation model, some of the endogenous variables may enter the model as independent variables. The will create simultaneity bias which correlates endogenous variables with the error terms. Unit root test was carried out to examine the stationarity of each variable in the model. Unit root test and co-integration test are important tests that are often used to circumvent the inherent limitations of traditional model as well as avoid spurious regression result (Hendry, 1986). To this effect, Augmented Dickey – Fuller test is used to test for the stationarity of the series to ensure that we are not analyzing inconstant regressions. To capture both the long-run and the short-run dynamics of BoP adjustment policies and productivity growth in Nigeria, the Johansson/Juselius(1990) multivariate co-integration techniques was estimated.

Furthermore, to enhance robustness of empirical results, the study applied the cumulative sum of recursive residuals (CUSUM) to the residuals of the parsimonious model as it is now a standard practice to incorporate short – run dynamics in testing for stability of the long – run parameters of the specified model

4. Discussion of Empirical Results

4.1 Tests for Stationarity and Co-integration

Test for stationarity and co-integration were conducted. The results show that all the variables of B, RGDP, R, OILR, NER, OILR, NER, MS, G, CPS, INTR, CPI and BoP are integrated of order one i.e. I (1). This implies that the non- hypothesis of non-stationarity for all the variables is rejected. Given the unit-root properties of the variables, we proceeded to establish whether or not there is a long-run co-integrating relationship among the variables in the system equations by using the Johansen full information maximum likelihood methods. The Johansen co-integration tests revealed that the trace and maximum eigenvalue statistics show the existence of one co-integrating relationship among the variables of the simultaneous equations at the 5 percent level of significance (Tables not reported for lack of space). Consequent upon the existence of stationarity and co-integrating relationship among the variables, the parsimonious ECM test was carried out on the individual functions and the results presented

4.2 The Real Exchange Rate Function

The real exchange rate equation shows that the elasticity of G/R (Budget deficit exclusive of grants), GAPFL/GDP (ration of capital to gross domestic product), DOPEN = degree of openness measured as sum of import and export divided by GDP and TOT (Term of trade) were significant and appropriately signed in line with economic theory. The coefficient of determination (adjusted R^2) at 0.65 is used to measure the goodness-of-fit of the estimated model and this indicated that the model is reasonably fit in predicting the behaviour of real exchange rate function. At 1.712, the Durbin Watson statistic does not suggest evidence of autocorrelation. The error correction term shows that about 14.4% of the deviation of the short-term real exchange rate from the long-run is covered within a year.

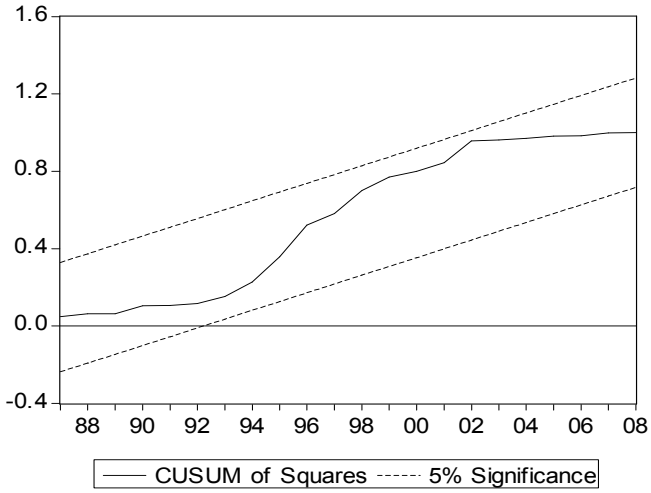
Table 5: The Real Exchange Rate Equation

Variable	Coefficient	t-statistic
Constant	**2.9642**	**0.7222**
ΔG/R	**9.5659**	**0.8614**
ΔCAPFL/GDP	**4.592861**	**0.214675**
DOPEN	**4.493128**	**1.91995**
ΔTOT	**0.249493**	**3.182375**
ECM	**-0.144**	**-2.27844**
R^2	**0.6521**	
Adj R^2	**0.5959**	
DW	**1.711**	

Source: Author's Computation

For stability of the short-run dynamics and long-run parameter of the real exchange rate function, it is important that the CUSUM of squares stay within the 5% critical bound (represented by two straight lines). As shown in Figure 1, the CUSUM of squares plot does not cross the 5 percent critical lines. Therefore, we can safely conclude that the estimated parameters of the short-run dynamics and long-run of the real exchange rate function are relatively stable.

CUSUM OF SQUARES TEST ON EQUATION (1)



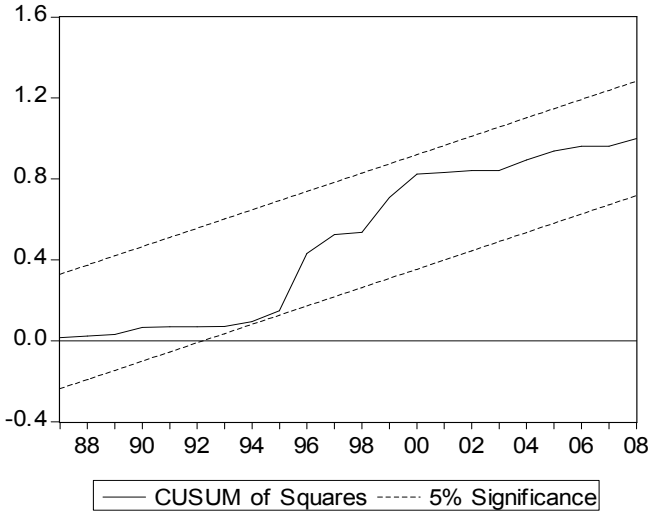
4.3 The Government Expenditure Function

The G function shows that the elasticity of RER (real exchange rate), RGDP (real gross domestic product), BoP adjustment, ED (external debt as a percentage of GDP, with the exception of dummy variable (SAP) were significant and adequately signed. The contrary sign of the dummy variable a proxy for the various BoP adjustment policies indicates policy ineffectiveness on the economy. The error correction term of 73.8% of the deviation of the short-run government expenditure from the long run is covered within the year. The coefficient of determination of 0.62 measures reasonably the goodness of fit while the DW of 1.68 indicates the absence of serial correlation.

Table 6: The Government Expenditure Function

Variable	Coefficient	t-statistics
Constant	0.130638	2.551872
ΔRER	0.007466	2.966497
ΔRGDP	0.370247	2.297354
ΔBoP (-1)	9.19E-08	1.656320
SAP	-0.003664	-0.057751
ΔED (-1)	0.293001	2.214602
ECm (-1)	-0.737735	-6.363847
R^2	0.6271	
Aadj R^2	0.566	
DW	1.6835	

CUSUM OF SQUARES TEST ON EQUATION (2)



The CUSUM sum of squares is also within the acceptable 5% critical bounds. This implies that the estimated parameters for the short-run dynamics and long-run of government expenditure function are stable.

4.4 Government Revenue Function

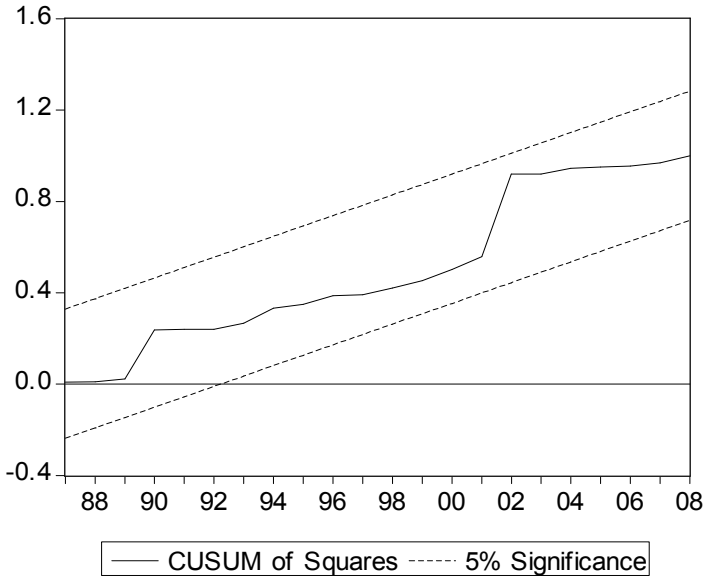
The government revenue equation shows that real exchange rate, real gross domestic product, and terms of trade have positive effect on government revenue with elasticity of 0.005, 1.159, and 0.418. Also, it was observed that previous government revenue has a positive effect on current government revenue. This implies that the government spends out of an increase in government revenue to increase its revenue in the next period, the policy dummy (SAP) has no effect with negative sign also showing policy ineffectiveness. The error correction coefficient shows that about 55% of the disequilibrium between the short-run and long-run government revenue in covered up within a year. The DW of 1.809 shows the absence of autocorrelation.

Table 7: The Government Revenue Function

Variable	Coefficient	t-statistic
Constant	0.024015	0.417560
ΔRER	0.005307	1.954913
ΔRGDP	1.159246	6.846506
ΔG(-1)	0.031609	0.261529
SAP	-0.048297	-0.724620
ΔTOT	0.418434	1-951354
ECM (-1)	-0.559091	-3.469028
R-squares	0.714905	
Adj R-squares	0.668922	
DW	1.809982	

Source: Author's Computation

CUSUM OF SQUARES TEST ON EQUATION (3)



4.5 The Real Total Trade (B) Function

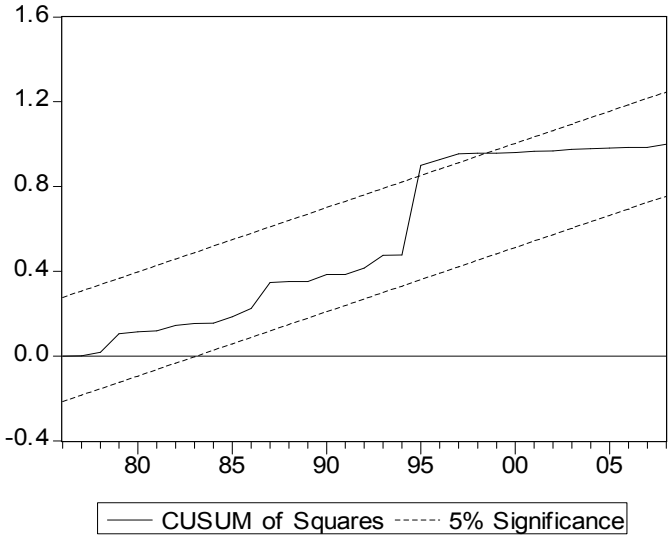
The real total trade function shows that the elasticity of CPS, OILR and DOPEN are significant and appropriately signed, with the exception of RER with elasticity of -0.0005. This insignificance could be as a result of the relationship between changes in real exchange rate misalignment and changes in actual exchange rate. The error correction term shows that 36% of the disequilibrium between the short-run and long-run real total trade is covered up within a year.

Table 8: The Real Total Trade Function

Variable	Coefficient	t-statistic
Constant	0.014330	0.144681
ΔRER	-0.000513	-0.129509
ΔCPS	0.335245	1.089590
ΔOILR	0.512661	5.074985
ΔOPEN	0.301256	3.043230
ECM (-1)	-0.360366	-2.77366
R-squares	0.460366	
Adj R-squares	0.394986	
DW	1.957	

Source: Author's Computation

CUSUM OF SQUARES TEST ON EQUATION (4)



The CUSUM sum of squares is within the acceptable 5% critical bounds. This implies that the estimated parameters of the short-run dynamics and long run of real trade function are stable.

4.6 The Real GDP Function

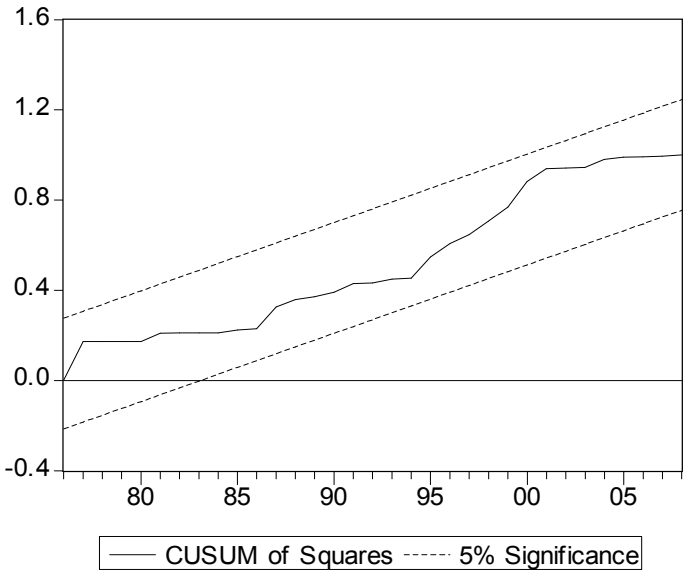
The RGDP function shows that oil revenue, trade balance, credit to the private sector and foreign direct investment all have positive effect on the real gross domestic product. The coefficient of determination of 0.85 indicates that the model is reasonably fit in prediction i.e the model explains about 85 percent of the behaviour of real gross domestic function. The error correction term shows that about 60% of the disequilibrium between the short – run and long-run real gross domestic product function is covered up within a year.

Table 9: The Real Gross Domestic Product Function

Variable	Coefficient	t-statistic
Constant	0.034184	0.755585
ΔOILR	0.344147	6.254570
ΔB	0.468361	6.434351
ΔCPS	0.019433	0.135687
ΔFDI	0.203214	2.377430
ECM (-1)	-0.605518	-3.783875
R-squares	0.858	
Adj R-squares	0.84	
DW	1.863181	

Source: Author's Computation

CUSUM OF SQUARES TEST ON EQUATION (5)



The CUSUM of squares stays within the 5% critical bounds (represented by two straight lines. Therefore, we can also conclude that the estimated parameters for the short-run dynamics and long-run of the RGDP function are relatively stable

4.6 The Inflation (CPI) Equation

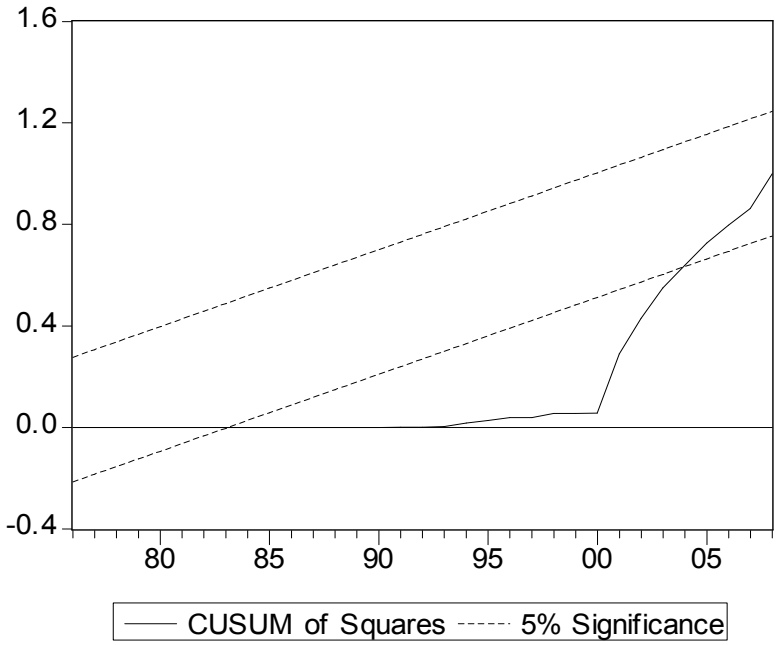
The result of the inflation function shows that money supply, real income, nominal exchange rate and interest rate are the determinants of inflation in Nigeria. Money supply and nominal exchange rate have positive effects on the rate of inflation while interest rate has negative effect. The significance of the nominal exchange rate having a direct effect on the rate of inflation is an indication of the existence of the exchange rate pass-through to domestic price in Nigeria. The interest rate has a significant negative coefficient in the inflation equation. This implies that as interest rate increases, investment expenditure reduces with government crowding-out effect and this reduces consumption since the amount for expenditure is lower. Meanwhile, the speed of adjustment to disequilibrium from the inflation model is 34%. Thus, about 34% of the disequilibrium between the short-run and long-run inflation rate dynamics in Nigeria is covered up within a year.

Table 10: The Inflation Equation

Variable	**Coefficient**	**t-statistic**
Constant	-224.1484	-11.44788
ΔM2	24.41079	12.67894
ΔY	0.453904	2.777326
ΔNER	6.435300	3.100044
ΔINTR	-2.124775	-2.556032
ECM (-1)	-0.340129	-3.056839
R^2-	0.861559	
Adj R-squares	0.849693	
DW	1.672303	

Source: Author's Computation

CUSUM OF SQUARES TEST ON EQUATION (6)



5. Conclusion and Recommendation

This study examines the impact of balance of payments adjustment and productivity growth in Nigeria, adopting the macro econometric model approach. This was done by modeling a small endogenous variables and identities and testing for the stability of the model. The study used data from 1970 to 2012. In the empirical analysis, the ADF, stationarity test and Johansen maximum likelihood co-integration procedure was employed, to show that there is a long-run relationship between the simultaneous equation models and its influencing variables. The ADF test shows that the variables are integrated of order one I(1) while the co-integration test shows that at least one of the variables is co-integrated at the 5% level of significance. The stationarity of the variables and the subsequent co-integration led to the determination of the parsimonious ECM. The error – correction term for the real exchange rate function shows that about 14.4% of the deviation of the short-term real exchange rate from the long-run is covered with a year, while 73.8% of the deviation of the short-run government expenditure from the long-run is covered within the year. For the government revenue function, 55% of the deviation is corrected. The ECM of the real trade function is 36% implying that deviations between the short-run and long-run dynamics are corrected within the percentage. The disequilibrium in the RGDP function is corrected by 60% while 34% of the disequilibrium between the short-runs and long-runs dynamics of the Inflation function is corrected.

The cumulative sum of squared residual stability tests (CUSUM) of the models falls within the 5% critical bound, validating the functions equation. A finding of the study indicates that there is a relationship between changes in real exchange rate misalignment and changes in actual exchange rate. This suggests policy wise, that the monetary authorities can use exchange rate policy alignment to develop the external sector of Nigeria, via the non-oil sector thereby solving the problem of balance of payments disequilibrium. Another finding of the study is that exchange rate depreciation increases import and depreciates the balance of payments and this implies that as a way of policy, domestic capacity utilization for import – competing goods should be encouraged by the government

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