MONETARY POLICY AND BALANCE OF PAYMENTS DISEQUILIBRIUM IN NIGERIA

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ABSTRACT

Negative disequilibrium in Nigeria's external sector has over time defied all measures employed to correct it and ensure equilibrium in the balance of payments (BOP). To this end, different monetary policies have been adopted and implemented with no appreciable degree of success. As a result, it is pertinent to examine the effectiveness of these monetary policy measures. This study adopted the ARDL bounds test approach, following the monetary approach to BOP adjustment for the analysis. The study used annual data that covered the period 1970 to 2016. The findings show that gross national income and cash reserve ratio had significant positive impact on BOP while credit to the private sector and monetary policy rate had negative significant impact on BOP. Interest rate was significant at 10% level while inflation rate had insignificant impact on BOP. Based on these findings, the study concludes that the monetary approach to BOP and monetary policy variables are effective for correcting balance of payments deficits in Nigeria. The study recommends that the Central Bank of Nigeria (CBN) should curtail the rate of increase in credit to the private sector through stringent monetary regimes and properly manage the monetary policy variables (monetary policy rate and cash reserve ratio) to solve BOP problems in Nigeria.

JEL classification: E520

1. Introduction

An important macroeconomic objective pursued by national governments is the attainment of internal and external stability. This is necessitated by the prevalence of macroeconomic disequilibrium in most economies, particularly developing economies. While internal disequilibrium is defined by the existence of a gap between an economy's full employment level of output and the equilibrium level, the existence of a gap between foreign receipts and payments defines external disequilibrium. As a matter of fact, disequilibrium in one sector (internal or external) affects the way resources are allocated in the other sector (Aliyu, 2007). Where a gap(s) exists, macroeconomic adjustments become of great importance to eliminate disequilibrium in both the internal and external sectors (Webb, 1991).

In Nigeria, efforts to ensure external and internal macroeconomic stability have taken the form of direct monetary control and subsequently the use of market-based instruments of monetary policy. Exchange rate targeting and monetary targeting were measures adopted under the regime of market-based instruments of monetary policy (Onuchuku, Chukueggu, Nenbee & Wosu, 2018). Exchange rate targeting is aimed at evolving a realistic exchange rate for the naira that could match exports with imports. On the other hand, monetary targeting is aimed at regulating the level of currency in circulation to ensure the attainment of interest rate stability through the use of monetary policy rate (MPR). Despite the adoption of these measures, the naira keeps depreciating against major international currencies, with minimal degree of stability. Interest rate has not performed any better. However, the individual impacts of these and other components of monetary policy under a regime of market-based instruments of monetary policy remain an empirical issue yet to be resolved.

Evidence regarding the performance of BOP, given the above measures, point to the fact that the Nigerian economy has witnessed more BOP deficits under the regime of market-based instruments than in the period of controls (Aliyu, 2007). Subsequent statistics lend further support to this assertion, as more recent studies provide evidence of sustained deficits in Nigeria's external balance despite measures taken by the monetary authorities to reverse the trend (Onuchuku et al., 2018). Measures taken by the CBN include switch in exchange rate regimes, as well as use of MPR to stabilize interest rates. In spite of these measures, the situation remains unchanged. This is substantiated by a statistical

plot showing the performances of BOP within the period under examination as elaborated in figure 1 below.

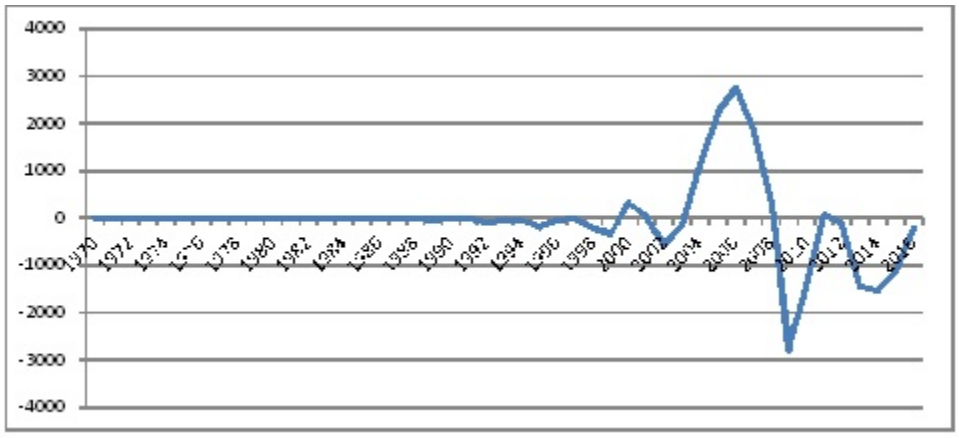

Figure 1. Balance of Payments Variable in Nigeria (1970-2016).

Source: Authors' plot using data from *CBN Statistical Bulletin* (2009, 2016).

A critical examination of figure 1 shows that Nigeria had a surplus in her BOP account in only seventeen (1970-1975, 1979, 1980, 1984, 1997, 2000, 2001, 2004, 2006, 2007, 2008 and 2011) out of forty-seven observation periods. A summary of this indicates that Nigeria had deficit in her BOP account in thirty observations, making 64% of the study period.

Empirical literature on this line of investigation reveal the presence of a good number of Nigeria-specific studies, but these are limited in one way or the other. This has created an empirical gap that calls for further examination. For instance, studies such as Ditimi, Nwosa and Olaiya (2011), Onuchuku et al. (2018), Imoisi, Olatunji and Ekpenyong (2013), Udude (2015), and Imoughele and Ismaila (2015) failed to include cash reserve ratio, and minimum rediscount rate (monetary policy rate). A recent study by Inimino, Akpan, Otubu and Alex (2019) equally failed to address this important gap. As a matter of fact, macroeconomic stability can be attained through the use of monetary policy rate (MPR), cash reserve ratio (CRR), or both, to complement market-based instruments of monetary policy such as open market operation (OMO). For instance, CBN can encourage credit delivery to the real sector by means of a lower CRR regime incentive. Likewise, the monetary authority can determine

the direction of banks' lending and deposit rates through the use of MPR. The effects of these possible actions by the monetary authority have the tendency to be transmitted promptly and widely to the external sector through exchange rate and commodity prices. As a result, the conclusion that monetary policy has significant impact on BOP in the absence of these variables cannot be valid and reliable for policy. Therefore, this study aims to fill this existing gap in literature in the context of Nigeria by the inclusion of monetary policy rate and cash reserve ratio in the monetary approach to a BOP adjustment model for Nigeria. The objective of this study therefore is to investigate the effectiveness of monetary policy variables in correcting balance of payments disequilibrium in Nigeria.

2. Monetary Policy Regimes and Response of BOP: An overview

During the period of control (1960 – 1986), direct monetary control approaches were put in place with the objectives of maintaining relative price stability and a healthy balance of payments position. The dominant monetary policy instruments used during this period include selective credit control, credit ceiling, administrative exchange rates, administered interest rates, special deposits, and prescription of cash reserve requirements (Anyanwu, Oaikhenan, Oyefusi, and Dimowo, 1997).

The adoption of the Structural Adjustment Programme (SAP) in July 1986 necessitated the introduction of indirect monetary control techniques aimed at inducing the emergence of a market-oriented financial system for effective mobilization of savings and efficient resource allocation (Anyanwu et al., 1997). Prior to this, monetary policy framework was based on direct controls which relied heavily on sectoral credit allocation, credit ceiling, cash reserve requirements, administrative fixing of interest rate and exchange rate, etc. Two major policy regimes used in the post-SAP period of indirect/market approach to monetary policy are short- and medium-term frameworks (CBN, 2011). Within the short-term framework (1986-2001), OMO was the primary monetary instrument and it was complemented by the liquidity ratio (LR) and the cash reserve ratio (CRR). Discount window operations, mandatory sale of special treasury bills to banks and a requirement of 200% treasury instrument to cover for banks' foreign exchange demand at the Autonomous Foreign Exchange Market (AFEM) were the other instruments used. Within this period, interest rate

was deregulated through the proactive adjustment of minimum rediscount rate (MRR).The medium-term framework (2002-2005) was aimed at easing the problem of time inconsistency and minimizing over-reaction due to temporary shocks because monetary policy requires substantial time lag to achieve its ultimate aim. The major objective of monetary policy since 2002/2003 has been to maintain single digit inflation rate using OMO as the primary tool. This was complemented by reserve requirements, discount window operations, foreign exchange intervention and movement of public sector deposits in and out of the deposit money banks (DMBs). In 1999, the CBN was granted autonomy and has been mandated to deliberate on monetary and economic conditions and take necessary decisions using the Monetary Policy Committee (MPC). This Committee meets every two months and takes decisions on CRR, MPR and LR. It has applied a number of strategies and techniques to achieve its ultimate objectives. These involve setting a goal or choosing an intermediate variable and setting a desirable target of the variable that the monetary authority wants to achieve. Such strategies include monetary targeting, interest rate targeting, nominal GDP targeting, exchange rate targeting, inflation targeting, price level targeting and quantitative easing that was used by most economies as a consequence of the 2007/2008 financial crisis. The CBN used the exchange rate targeting between 1959 and 1973. Currently, the CBN has adopted and uses the monetary targeting strategy (CBN, 2017).

During each of these periods, CRR and MPR were used as complementary instruments of monetary policy to achieve the desired objectives of price stability and economic growth and to maintain BOP equilibrium. To this end, both CRR and MPR were increased or decreased over time as the need arose. Observation shows that relative increases or decreases in each of the instruments were done in alternation, in greater proportion during the period under review. For instance, over the period 1979 – 1982, the minimum value of CRR was 9.5, while the ceiling for MPR was 8; for the period 1987 – 1992, CRR had 4.4 as its maximum, while the minimum for MPR was 12.75. For these periods, BOP balance remained in deficit, except in 1979 and 1980. The reason for this, most likely, is the fact that each of these monetary instruments is used for liquidity management. The effects that each has on macroeconomic aggregates are exerted through financial sector liquidity. The monetary authority, in this case, alternates relative magnitude of these instruments in ways that best suit a given

situation. Figure 2 shows time trend behaviour of BOP in response to regimes of MPR and CRR.

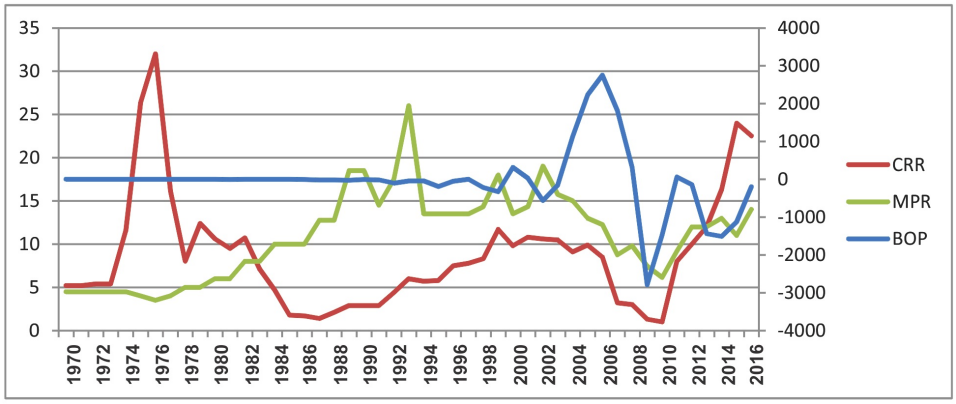

Figure 2. Periodic Response of BOP to MPR and CRR in Nigeria.

Source: Authors' plot using data from *CBN Statistical Bulletin* (2009, 2016).

Analysis of figure 1 shows that the potency of monetary policy variables on BOP was felt more in the period of deregulation than in the period of controls; its impact became visibly observable in 1993 when OMO was introduced, and also corresponded with the IFEM regime of exchange rate deregulation. Another point worthy of note is the fact that BOP fluctuates more during regimes of higher MPR relative to CRR. For instance, all the years in which Nigeria recorded surplus balance since 1986 (1997, 2000, 2001, 2004, 2006, 2007, 2008, and 2011) were regimes of higher MPR relative to CRR. The highest deficits in BOP were also recorded within the period (2009 and 2010) that MPR was higher than CRR. The BOP was closer to equilibrium within the periods (1970-1982) that CRR was higher than MPR.

3. Empirical Literature

The position that disequilibrium in the BOP is a monetary phenomenon rather than a deviation of exports from imports and therefore requires the monetary approach to resolve the disequilibrium has been investigated empirically. All the studies reviewed, apart from Ali (2010) and Danjuma (2013), confirmed that BOP disequilibrium is actually a monetary phenomenon. However, these studies differed on the monetary policy variable used in the analysis and the method of

data analysis. Most of the Nigeria-specific studies failed to follow the normal monetary approach to determining the impact of monetary policy on BOP and included broad money supply in their studies. The studies are: Onwe (2014); Imoughele and Ismaila (2015); Udude (2015); Azubuike (2016); Timothy, Salubi and Okoye (2016); Mukolu, Ilugbemi and Otalu (2017) and Onuchuku et al. (2018). Studies such as Ditimi, Wosa and Olaiya (2011); Imoisi, Olatunji and Ekpenyong (2013); Udude (2015); and Imoughele and Ismaila (2015), that used ordinary least squares (OLS) found that broad money supply has a positive significant impact on BOP while Azubuike (2016) found a negative significant impact on BOP. Exchange rate was also used intensively as a prominent monetary policy variable by the following studies: Imoisi, Olatunji and Ekpenyong (2013); Onwe (2014); Imoughele and Ismaila (2015); Udude (2015); Azubuike (2016); Timothy, Salubi and Okoye (2016), Onuchuku et al. (2018); Inimino et al. (2019) and Kahn (2008). Udude (2015) and Inimino et al. (2019) reported that exchange rate had a positive significant impact on BOP while Azubuike (2016) found a negative significant impact. Imoughele and Ismaila (2015) is the only study that included trade openness in her study and found a positive and insignificant impact on BOP.

Few of the studies that examined the monetary approach to BOP disequilibrium included balance of trade as one of the standard variables in the approach (Tijani, 2014 and Mukolu et al., 2017). The findings of Nigeria-specific studies that investigated the monetary approach to BOP adjustment are diverse. Ali (2010) and Danjuma (2013) reported that the approach is not effective in correcting BOP disequilibrium while Jimoh (2004) and Akpansung (2013) showed that the approach is effective in correcting BOP in Nigeria.

Evidence from the reviewed empirical literature shows that none of the studies incorporated any of the important monetary policy variables being used by the monetary authority [in Nigeria to stabilize prices, encourage economic growth, and maintain BOP equilibrium such as monetary policy rate, cash reserve ratio, liquidity ratio, open market operations, etc. into the standard monetary approach to BOP adjustment, with the purpose of finding their effectiveness in correcting BOP disequilibrium in Nigeria. This study fills this important gap by including MPR and CRR in the standard monetary approach to BOP adjustment.

4. Methodology

4.1 Theoretical framework

This study follows the monetary approach to the balance of payments adjustment theory. This theoretical approach adjusts the BOP in terms of the demand and supply for money. According to the theory, a deficit in balance of payments is always and everywhere a monetary phenomenon, and it can only be corrected by monetary measures (Jhingan, 2013). The monetary approach can be expressed thus:

$$M_d = f(Y, P, I) \tag{1}$$

where:

M_d = demand for money
Y = income
P = price level
I = interest rate

$$M_s = D + R \tag{2}$$

where:

M_s = money supply
D = domestic credit
R = foreign exchange reserves

In equilibrium: $M_d = M_s$ (3)

i,e., $M_d = D + R$ $[M_s = D + R]$ (4)

Disequilibrium is represented by changes in foreign exchange reserves:

$$\Delta R = \Delta M_d - \Delta D \tag{5}$$

Substituting M_d in equation (5):

$$\Delta R = \Delta[f(Y, P, I)] - \Delta D \tag{6}$$

$$\Delta R = BOP \tag{7}$$

where *BOP* is the balance of payments.

Equation (6) is the monetary approach to the BOP adjustment equation. It shows that BOP has a negative relationship with the rate of change in domestic credit and a positive relationship with the rate of change in money demand. Theoretically, income (*Y*) and price level (*P*) have a positive relationship with money demand while interest rate has a negative relationship with money demand. BOP deficit means negative BOP which reduces foreign exchange reserves, while BOP surplus is positive BOP which increases foreign exchange reserves and money supply. Under a fixed exchange regime, an increase in domestic money supply more than money demand ($M_s > M_d$) will result in BOP deficit. The effort of the central bank to peg the exchange rate by selling foreign exchange reserves and buying domestic currency will return the BOP to equilibrium. Under a flexible exchange system, an increase in domestic money supply more than the money demand will result in BOP deficit but will return to equilibrium without any outflow of foreign exchange reserves. This shows that any monetary policy variable whose adjustment can change the volume of domestic money supply can be used to correct BOP disequilibrium.

4.2 Model specification

Modifying the monetary approach equation to include the vital monetary policy variables used by the monetary authority in Nigeria, the functional form of the model is stated thus:

$$lnEXTR = f\,(lnGNI, lnINFLR, lnINTR, lnCPS, lnMPR, lnCRR) \tag{8}$$

Econometrically, equation (1) becomes:

$$lnEXTR = \beta_0 + \beta_1 lnGNI + \beta_2 lnINFLR + \beta_3 lnINTR + \beta_4 lnCPS + \beta_5 lnMPR + \beta_6 lnCRR + \epsilon \tag{9}$$

where:

lnEXTR= log of external reserves (change in foreign exchange reserves equals BOP)

lnGNI = log of gross national income (proxy for the rate of change in income)

lnINFLR = log of inflation rate (proxy for the rate of change in prices)

lnINTR = log of interest rate (proxy for the rate of change in interest rate

lnCPS = log of credit to private sector (proxy for the rate of change in domestic credit)

lnMPR = log of monetary policy rate (proxy for the rate of change in monetary policy rate)

lnCRR = log of cash reserve ratio (proxy for the rate of change in cash reserve ratio)

ϵ = error term

β_0 = intercept term

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$ = partial slope coefficients

The a priori expectations of the variables are: $\beta_1 > 0, \beta_2 > 0, \beta_3 < 0, \beta_4 < 0, \beta_5 < 0, \beta_6 > 0$

The empirical model adopted in this study is the autoregressive distributed lag model (ARDL) bounds test for cointegration which was originally introduced by Perasan and Shin (1999) and later extended by Pesaran, Shin and Smith (2001). The bounds test approach can be applied even if the regressors are integrated of order zero or one (I(0) or I(1)) or are mutually cointegrated (Pesaran and Shin, 1999). The bounds test is also appropriate in situations of small sample size. The ARDL (p, q,) model is stated thus:

$$\begin{aligned} lnEXTR = {} & \beta_0 + \beta_1 lnEXTR_{t-1} + \ldots + \beta_p lnEXTR_{t-p} + \alpha_0 lnGNI + \alpha_1 lnGNI_{t-1} + \ldots + \\ & \alpha_q lnGNI_{t-q} + \delta_0 lnINFLR + \delta_1 lnINFLR_{t-1} + \ldots + \delta_q lnINFLR_{t-q} + \lambda_0 lnINTR \\ & + \lambda_1 lnINTR_{t-1} + \ldots + \lambda_q lnINTR_{t-q} + \eta_0 lnCPS + \eta_1 lnCPS_{t-1} + \ldots + \eta_q lnCPS_{t-} \\ & {}_q + \upsilon_0 lnMPR + \upsilon_1 lnMPR_{t-1} + \ldots + \upsilon_q lnMPR_{t-q} + \psi_0 lnCRR + \psi_1 lnCRR_{t-1} + \\ & \ldots + \psi_q lnCRR_{t-q} + \mu_t \end{aligned} \quad (10)$$

where *p* and *q* are the lag orders that will be determined through Akaike information criterion (AIC).

The unrestricted ARDL ECM (bounds test) equation is stated thus:

$$DlnEXTR = \beta_0 + \sum_{i=1}^{p} \beta_i DlnEXTR_{t-i} + \sum_{j=0}^{q} \alpha_j DlnGNI_{t-j} + \sum_{k=0}^{q} \delta_k DlnINFLR_{t-k} +$$
$$\sum_{l=0}^{q} \lambda_1 DlnINTR_{t-1} + \sum_{m=0}^{q} \eta_m DlnCPS_{t-m} + \sum_{n=0}^{q} \upsilon_n DlnMPR_{t-n} +$$
$$\sum_{o=0}^{q} \psi_o DlnCRR_{t-1} + \varphi_0 lnEXTR_{t-1} + \varphi_1 lnGNI_{t-1} + \varphi_2 lnINFLR_{t-1} +$$
$$\varphi_3 lnINTR_{t-1} + \varphi_4 lnCPS_{t-1} + \varphi_5 lnMPR_{t-1} + \varphi_6 lnCRR_{t-1} + e_t \quad (11)$$

The bounds test for cointegration is based on an asymptotic non-standard F-test on the lagged level variables in equation (11). In this regard, two bounds critical values are generated. The upper bounds critical value serves as a benchmark for I(1) variables while the lower bounds critical value is the benchmark for I(0) variables. The null hypothesis of no cointegration: H_0: $\varphi_0 = \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = \varphi_6 = 0$ is tested against the alternative hypothesis of presence of conintegration: H_1: $\varphi_0 \neq \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq \varphi_5 \neq \varphi_6 \neq 0$. The null hypothesis of no cointegration is rejected if the computed F-statistic exceeds the upper bounds critical value. If the calculated F-statistic is lower than the lower bounds critical value, the null hypothesis cannot be rejected. The test is inconclusive when the calculated F-statistic is between the lower and upper bounds critical values.

An important theorem, known as the Granger representation theorem, states that if two variables Y and X are cointegrated, the relationship between the two can be expressed as ECM (Engel and Granger, 1987). To correct the existence of a long-run relationship among the variables, the ARDL error correction model that generates the short run dynamics is stated thus:

$$DlnEXTR = \beta_0 + \sum_{i=1}^{p} \beta_i DlnEXTR_{t-i} + \sum_{j=0}^{q} \alpha_j DlnGNI_{t-j} + \sum_{k=0}^{q} \delta_k DlnINFLR_{t-k} +$$
$$\sum_{l=0}^{q} \lambda_1 DlnINTR_{t-1} + \sum_{m=0}^{q} \eta_m DlnCPS_{t-m} + \sum_{n=0}^{q} \upsilon_n DlnMPR_{t-n} +$$
$$\sum_{o=0}^{q} \psi_o DlnCRR_{t-1} + \Psi ECT_{t-1} + \varepsilon_t \quad (12)$$

where the variables are as defined in equation (9). ECT is the residual generated from equation (9). The parameter Ψ measures the speed of adjustment to previous period disequilibria achieved in the current period. It must have a statistically significant negative sign for an efficient result. The coefficient indicates the percentage of the disequilibria in the dependent variable that would be adjusted from one period to another.

4.3 Data

Data on external reserves, inflation rate, interest rate, credit to private sector, monetary policy rate and cash reserve ratio were sourced from the *Central Bank of Nigeria (CBN) Statistical Bulletin* (2009, 2016) while that for gross national income were sourced from the World Development Indicators (2018).

5. Empirical Results

5.1 Unit root test

The Augmented Dickey-Fuller (ADF) unit root test was used to determine the stationarity properties of variables in the model. Variable graphs in appendix A were utilized in determining whether the unit root test of the variables should be with constant or constant and trend. The summary of results of the tests are presented in table 1.

Table 1. Result of Unit Root Tests

Variable	ADF Statistic				Order of integration
	Level with constant	First difference with constant	Level with constant and trend	First difference with constant and trend	
lnEXTR			-2.266	-7.022***	I(1)
lnGNI			-1.668	-6.332***	I(1)
lnINFLR	-4.247***	-6.942***			I(0)
lnINTR			-1.208	-9.618	I(1)
lnCPS			-2.567	-4.907***	I(1)
lnMPR			-1.749	-7.674***	I(1)
CRR	-1.858	-5.455***			I(1)

Source: Authors' computation using the sourced data.

Note: **indicates significance at 5%, ***indicates significance at 1%

The unit root tests result in table 1 shows that external reserves, interest rate, credit to the private sector, monetary policy rate and cash reserve ratio are stationary at first differences while inflation rate is stationary at level form. Hence, none of the variables is integrated of order two, Pesaran et al. (2001) ARDL bounds test is appropriate for the cointegration test.

5.2 ARDL model selection result

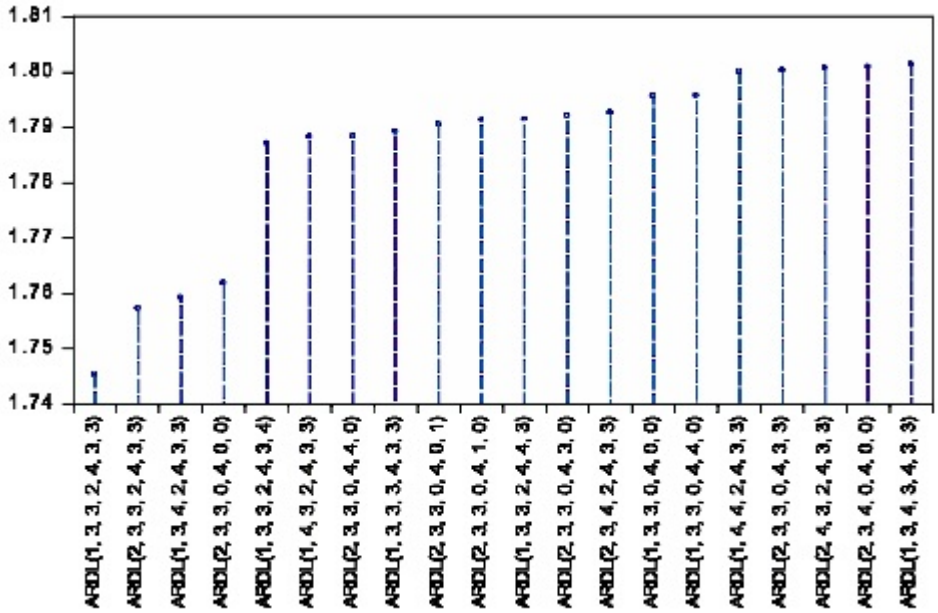

Figure 3. Akaike Information Criteria Model Seclection.

Source: Authors' computation using the sourced data.

The model ARDL (1, 3, 3, 2, 4, 3, 3) with the minimum value of Akaike Information Criteria (AIC) was selected for the analysis. The ARDL (1, 3, 3, 2, 4, 3, 3) regression result in appendix B has an R^2 of 0.991, indicating that the explanatory variables account for 99.1% of changes in BOP. Similarly, the entire regression model is adjudged to be statistically significant given the F-statistic value of 74.210, with a p-value of 0.000.

5.3 Cointegration test

The result of the cointegration test is presented in table 2. The result shows that the F-statistic is higher than the 5% significance level of the upper critical bound, indicating the presence of a long-run tie between the dependent and independent variables in the model.

Table 2. ARDL Bounds Test

Null Hypothesis: No long-run relationships exist

Calculated F-statistic = 3.72		
Level of significance	Critical bound value	
	Lower bound I(0)	Upper bound I(1)
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Authors' computation from the ARDL model

5.4 Serial autocorrelation test

Table 3. Correlogram-Q-Statistic Test Result

Q-statistic probabilities adjusted for 1 dynamic regressor

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
.*| . |	.*| . |	1	-0.171	-0.171	1.3525	0.245
.*| . |	**| . |	2	-0.192	-0.228	3.0982	0.212
.*| . |	**| . |	3	-0.172	-0.273	4.5237	0.210
. |*. |	. | . |	4	0.121	-0.032	5.2553	0.262
.*| . |	**| . |	5	-0.157	-0.274	6.5096	0.260
. | . |	.*| . |	6	0.062	-0.087	6.7124	0.348
. | . |	.*| . |	7	-0.003	-0.118	6.7129	0.459
. |*. |	. | . |	8	0.075	-0.058	7.0251	0.534
. | . |	. | . |	9	0.004	0.008	7.0259	0.634
. | . |	. | . |	10	0.063	0.046	7.2609	0.701
.*| . |	.*| . |	11	-0.191	-0.152	9.4628	0.579
. |*. |	. | . |	12	0.095	0.057	10.025	0.614
. | . |	.*| . |	13	-0.062	-0.099	10.272	0.672
. | . |	.*| . |	14	-0.030	-0.134	10.333	0.737
. | . |	. | . |	15	-0.010	-0.051	10.340	0.798
. |*. |	. | . |	16	0.124	-0.054	11.441	0.781
. | . |	. | . |	17	-0.003	-0.002	11.441	0.833

Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
. |*. |	. |*. |	18	0.075	0.098	11.877	0.854
.*| . |	. | . |	19	-0.076	-0.008	12.343	0.870
. |*. |	. |*. |	20	0.076	0.172	12.831	0.885

*Probabilities may not be valid for this equation specification.

Source: Authors' computation from the ARDL model.

The non-significance of the lags of the correlogram-Q-statistic at 5% level, shows that serial autocorrelation does not exist in the model. Again, CUSUM and CUSUM squares test results show that the coefficients of the model are stable, since the plot of the statistic remained within the 5% level of significance (see figure 4).

5.5 Stability test

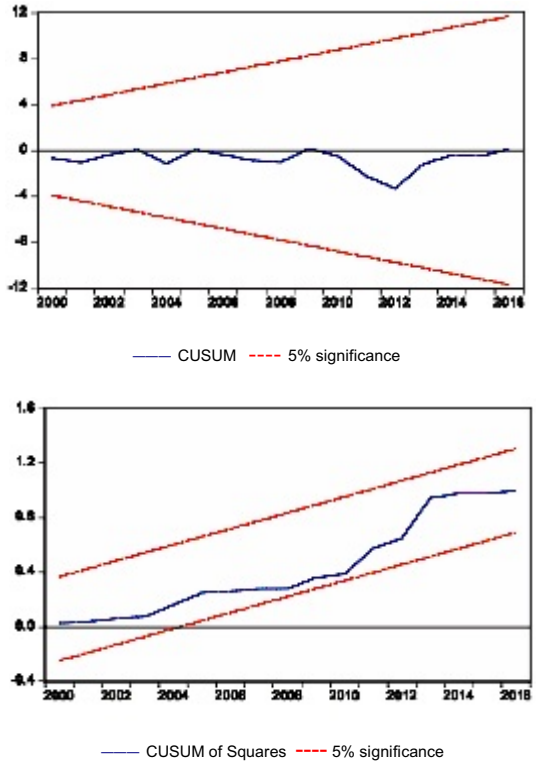

Figure 4. Recursive Estimates (OLS Only) – CUSUM and CUSUM of Squares Tests.

Source: Authors' computation from the ARDL model.

5.6 Normality, heteroskedasticity, and specification tests

Table 4. Jarque-Bera Normality test, Breusch-Pagan-Godfrey Heteroskedasticity test, and Ramsey RESET Specification test

Test	Statistic		Prob.
Jarque-Bera Normality	Jarque-Bera	0.941	0.625
Breusch-Pagan-Godfrey Heteroskedasticity	Obs*R-squared	30.218	0.216
Ramsey RESET Specification	F-statistic	1.806	0.198

Source: Authors' computation from the ARDL model regression result.

The non-significance of the Jarque-Bera normality test in table 4 shows that the error terms of the model are normally distributed. The non-significance of the Obs*R-squared of the Breusch-Pagan-Godfrey Heteroskedasticity test indicates that the error variances of the model are constant (homoskedastic). Similarly, the Ramsey RESET Specification test is also insignificant, showing that the model is well-specified.

5.7 Short-run result

Table 5. Result of the short-run model

Dependent variable: D(lnEXTR) = D(BOP)

Variable	Coefficient	Std. Error	t-Statistic	P-value
D(LNGNI)	1.613	0.737	2.188	0.043
D(LNGNI(-1))	0.477	0.977	0.489	0.631
D(LNGNI(-2))	-3.043	0.910	-3.343	0.004
D(LNINFLR)	-0.048	0.261	-0.183	0.857
D(LNINFLR(-1))	-1.040	0.383	-2.718	0.015
D(LNINFLR(-2))	0.415	0.155	2.681	0.016
D(LNINTR)	2.842	1.178	2.412	0.027
D(LNINTR(-1))	1.501	0.943	1.592	0.130
D(LNCPS)	2.630	1.025	2.566	0.020
D(LNCPS(-1))	4.858	2.596	1.872	0.079
D(LNCPS(-2))	-3.800	1.530	-2.484	0.024
D(LNCPS(-3))	1.599	0.918	1.741	0.100
D(LNMPR)	-0.797	0.837	-0.952	0.354
D(LNMPR(-1))	-1.395	0.960	-1.453	0.165
D(LNMPR(-2))	2.755	1.026	2.686	0.016
D(LNCRR)	0.610	0.239	2.550	0.021

Variable	Coefficient	Std. Error	t-Statistic	P-value
D(LNCRR(-1))	0.743	0.400	1.859	0.081
D(LNCRR(-2))	-0.778	0.350	-2.226	0.040
CointEq(-1)	-0.547	0.202	-2.713	0.015

Source: Authors' computation from the ARDL model.

CointEq(-1) in the short-run result represents the speed of adjustment to any disequilibrium in the short run. It is negative and statistically significant. Its coefficient of -0.547 indicates that about 55% departure from long-run equilibrium is corrected in the short run; showing a high adjustment speed. The negative sign also satisfies the existence of long-run relationships among the variables and serves as a good indication that our model is parsimonious. Gross national income, interest rate, credit to the private sector and cash reserve ratio have positive significant impact on BOP, while monetary policy rate has a negative significant impact on BOP. Inflation rate however has an insignificant impact on BOP. The non-conformity of the most standard explanatory variables of the monetary approach to BOP adjustment in the short run is an indication that the approach is a self-correcting long-run equilibrium in BOP, since money demand cannot be stable in the short run.

5.8 Long-run result

Table 6. Result of the long-run model

Dependent variable: Balance of Payments (lnEXTR) = BOP

Variable	Coefficient	Std. Error	t-Statistic	P-value
lnGNI	5.740	2.251	2.550	0.021
lnINFLR	1.121	1.162	0.964	0.349
lnINTR	4.502	2.520	1.786	0.092
lnCPS	-4.030	1.876	-2.148	0.046
lnMPR	-5.463	2.535	-2.155	0.046
lnCRR	1.273	0.449	2.833	0.012
C	-22.567	7.640	-2.954	0.009

Source: Authors' computation from the ARDL model

With the exception of inflation rate, the explanatory variables conformed to a priori expectations in the long run. Gross national income had a positive

significant impact on BOP. This is in line with the postulate of the monetary approach to BOP adjustment. Its coefficient of 5.740 shows that a one percent increase in gross national income will increase the BOP by 5.7%. The negative significant relationship between credit to the private sector and BOP conformed to the postulate of the monetary approach to balance of payments adjustment, which implies that credit to the private sector must be curtailed for Nigeria to achieve equilibrium in her balance of payments. The finding is consistent with results from the works of Dhliwayo (1996), Jimoh (2004), Kahn (2008), and Adam and Itsede (2010). A one percent increase in credit to the private sector will reduce BOP by 4.03%. Interest rate had a positive significant impact on BOP at 10% level while inflation rate had a positive insignificant effect on BOP. Monetary policy rate and cash reserve ratio exhibited negative and positive significant impact on BOP respectively. A one percent increase in monetary policy rate will reduce the BOP by 5.5% while that of cash reserve ratio will increase the BOP by 1.3%. This shows that a well calculated adjustment of monetary policy rate and cash reserve ratio by the monetary authority will restore Nigeria's BOP to equilibrium. Generally, the long-run result shows that monetary approach to BOP adjustment and monetary policy variables (monetary and cash reserve ratio) are effective for correcting BOP disequilibrium in Nigeria.

6. Conclusion

This study appraised the relationship between monetary policy variables and BOP disequilibrium in Nigeria, with a view to ascertaining the effectiveness of tools of monetary policy in correcting BOP disequilibrium following the monetary approach to BOP adjustment. From the policy view point, it was observed that Nigeria has employed different monetary policy instruments at one time or the other in attempts to attain both internal and external balance and economically improve the fortunes of the economy. These measures involved a move from regulation to use of market-based instruments. The instruments under the market-based arrangement were primarily aimed at influencing economic activity through monetary policy rate, cash reserve ratio, interest rate, etc. On the basis of the findings, the study concludes that the monetary approach to BOP adjustment is effective in correcting BOP disequilibrium in Nigeria. It also concludes that monetary policy variables (monetary policy rate and cash

reserve ratio) are effective in correcting BOP disequilibrium in Nigeria. The study recommends that the Central Bank of Nigeria (CBN) should curtail the rate of increase in credit to the private sector through stringent monetary discipline and properly manage the monetary policy variables (monetary policy rate and cash reserve ratio) to solve BOP problems in Nigeria.

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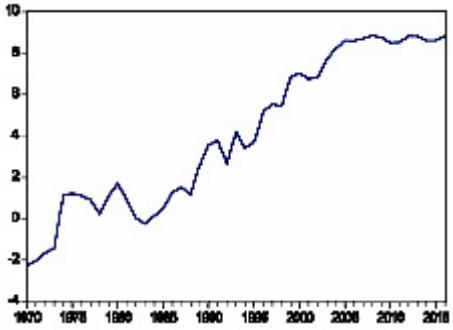
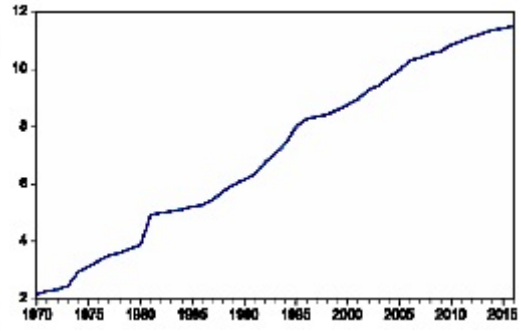
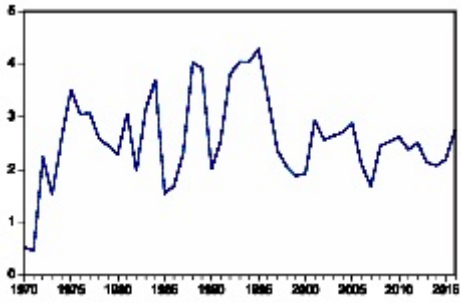
Appendix A: Graphs of the variables



LNEXTRA

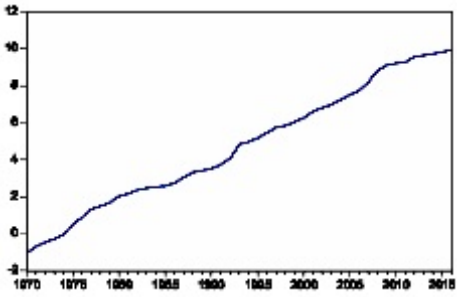


LNGNI

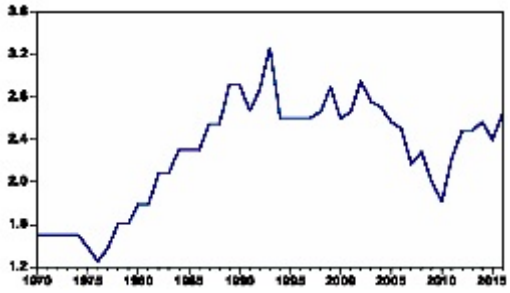


LNINFLR

LNINTR



LNCPS



LNMPR

LNCRR

Appendix B: ARDL model result

Dependent Variable: LNEXTR

Method: ARDL
Sample (adjusted): 1974 2016
Included observations: 43 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): LNGNI LNINFLR LNINTR LNCPS LNMPR LNCRR
Fixed regressors: C
Number of models evaluated: 31250
Selected Model: ARDL(1, 3, 3, 2, 4, 3, 3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LNEXTR(-1)	0.452733	0.201695	2.244639	0.0384
LNGNI	1.613169	0.737436	2.187539	0.0430
LNGNI(-1)	-1.038036	0.779665	-1.331388	0.2006
LNGNI(-2)	-0.477070	0.976600	-0.488501	0.6314
LNGNI(-3)	3.043281	0.910209	3.343499	0.0039
LNINFLR	-0.047748	0.260959	-0.182973	0.8570
LNINFLR(-1)	0.035834	0.219558	0.163211	0.8723
LNINFLR(-2)	1.040363	0.382758	2.718072	0.0146
LNINFLR(-3)	-0.415184	0.154843	-2.681324	0.0158
LNINTR	2.842247	1.178187	2.412392	0.0274
LNINTR(-1)	1.122411	1.135785	0.988225	0.3369
LNINTR(-2)	-1.500748	0.942876	-1.591670	0.1299
LNCPS	2.629539	1.024656	2.566265	0.0200
LNCPS(-1)	-2.178286	1.904721	-1.143625	0.2686
LNCPS(-2)	-4.858081	2.595753	-1.871550	0.0786
LNCPS(-3)	3.800318	1.529660	2.484420	0.0237
LNCPS(-4)	-1.599158	0.918422	-1.741202	0.0997
LNMPR	-0.797031	0.836985	-0.952265	0.3543
LNMPR(-1)	-0.832330	1.046123	-0.795633	0.4372
LNMPR(-2)	1.394561	0.959918	1.452792	0.1645
LNMPR(-3)	-2.754722	1.025693	-2.685717	0.0156
LNCRR	0.610318	0.239365	2.549741	0.0207
LNCRR(-1)	0.051616	0.370402	0.139352	0.8908
LNCRR(-2)	-0.743362	0.399919	-1.858781	0.0805
LNCRR(-3)	0.778135	0.349542	2.226159	0.0398
C	-12.34992	3.508898	-3.519602	0.0026

R-squared	0.990920	Mean dependent var	4.662014
Adjusted R-squared	0.977567	S.D. dependent var	3.359137
S.E. of regression	0.503119	Akaike info criterion	1.745334
Sum squared resid	4.303181	Schwarz criterion	2.810245
Log-likelihood	-11.52468	Hannan-Quinn criteria.	2.138040
F-statistic	74.21002	Durbin-Watson stat	2.308424
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model