Real Money Supply, Price and Fiscal Deficit in Nigeria: Evidence from Multivariate Granger Causality Tests

Jimoh Olajide Raji[1], Juzhar Jusoh[2] and Mohd-Dan Jantan[3]

In this paper, Granger causality test is implemented within the context of Autoregressive distributed lag (ARDL) framework to determine the directions of causality between a pair of price level, real money supply, government fiscal deficit, interest rate and real output in Nigeria over the period 1970 to 2010. Result of the study shows that in the short run, there is a unidirectional causality running from real money supply to inflation, government deficit to price level, real output to inflation, and interest rate to inflation. The long run results indicate that bidirectional causality runs between the real money supply and price level, and also between price level and interest rate. The results suggest that pro-cyclical has been the practice in Nigerian fiscal policy which has accounted for the country's public deficit. Therefore, there is a need for fiscal policy rule that will guide all the tiers of government to a particular level of fiscal conduct and budgetary management to the extent of making it credible over time. This result is important in that it provides the likely implications of fiscal deficits on some macroeconomic variables such as output, price level, money supply and balance of payment. Knowing these implications is likely to provide an insight into the formulation and design of appropriate fiscal policy by the Nigerian policy makers because far from the efficient provision of public goods, fiscal policy performs stabilizing role.

1. Introduction

The choices of fiscal policy have been argued to have significant effects on the economic performance of the oil producing and exporting nations like Nigeria. This is due to the significant nature of the country's oil sector and because the income realized from oil mostly accrue to government's coffer (Sturm, Gurtner and Alegre, 2009). However, fiscal

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[1] School of Economics Finance and Banking, University Utara Malaysia,
Email: rajiolajide2006@yahoo.com
[2] Juzhar Jusoh School of Economics Finance and Banking, University Utara Malaysia
[3] Mohd-Dan Jantan School of Economics Finance and Banking, University Utara Malaysia

policy in oil producing nations has faced some challenges of how to sustain government expenditures and revenues in the future, and how to stabilize macroeconomic variables in the economy by a well fiscal plan. Reactions by the concerned authorities in response to the fiscal challenges in Nigeria have involved fiscal rules, basing budget on oil price assumptions, how to stabilize oil and incomes realized from high oil prices. In spite of these reactions, fiscal policy continues to be expanding rapidly without completely been met by the increase in the revenue generated. As a result, Nigeria periodically faces fiscal imbalances and her fiscal deficits have been increasing since 1975 (CBN, 2010).

Fiscal deficits have become an important issue in the area of public finance when considering the level of economic growth. Three major opposing views can be distinguished. Keynesian economics posited that through the multiplier, the influence of budget deficit on the macroeconomic activity is positive. In the context of endogenous growth models, if budget deficits are employed to offset expenditures that improve economic growth such as public infrastructure, research and development, education and health, then budget deficits can have positive influence on long-term growth (Barro, 1990; Lucas, 1988; Romer, 1990). Neoclassical economists put up a contrary view by arguing that budget deficits compete with the private sectors and so affect the long-term economic growth negatively. Finally, the demonstration of Ricardian equivalence approach by Barro (1989) shows that change in budget deficit has no effect on the growth of the economy. Due to these contrasting opinions, the employment of public expenditures for the enhancement of economic activity has not been encouraging. Recently, the conventional wisdom is of the view that deficits are not desirable due to their negative macroeconomic effects. This opinion serves as a guide to a country wishing to undertake sensible and careful fiscal policies for the purpose of decreasing the deficits (Keho, 2010).

According to theory, large fiscal deficits can have negative impacts on many macroeconomic variables such as domestic interest rates, investments, and trade deficits. For instance, large fiscal deficits often lead to high interest rates following the government's demand for funds. This conflicts with the financing needs of private sector to the extent that such high interest rates dampen private investment. Cebula (2000)

and Dawyer (1985) note that government deficit can exert an upward pressure on real interest rates thereby decreasing the level of capital formation, business activities in terms of investment, and the real level of output. This connection also provides a basis in support of the argument that budget deficits are positively related to long-term interest rates (Barnes, 2008). In addition, fiscal deficits may affect interest rates via the channel of reduced savings and thereby saving ratios (Cebula, 1993).

From the Ricardian equivalence perspective, an increase in government debt results in a future increase in taxes and this does not add to private sector wealth. Given this view, the public expects future increase in taxes to compensate recent government excess spending (fiscal deficits). Therefore, households reduce their consumption spending now and raise saving to smooth out the expected reduction in their future disposable income when government eventually taxes them. This implies that deficit and taxes are equivalent in their effect on consumption, investment and hence current account. Thus, the Ricardian equivalence implies that fiscal deficit has no effect on consumption, interest rates, aggregate demand and the external sector. Concerning this issue, some studies (Bernheim, 1989; Brunner, 1986; Hoelscher, 1986; Tobin and Buiter, 1980) have provided empirical and theoretical evidences against the Ricardian equivalence, while empirical results of other studies (Evans, 1985, 1987b; Fackler and McMillin, 1989) have supported the proposition.

Fiscal deficits can also have impact on other macroeconomic variables such as inflation and money supply. If an increase in aggregate demand is a result of fiscal deficit, the price levels are likely to rise and consequently, the domestic currency tends to depreciate (Evans, 1985, 1987b). The level of inflation could be high through the crowding out effect. In this case, the effect reduces the real capital stock in the economy, and retards the growth rate of output. Consequently, the price levels will rise at a given level of money supply. Another factor that could make inflationary conditions to be worse is the excessive issues of government bonds, since they form a large part of money supply. Lastly, inflationary conditions may also be worse through monetary accommodation. Given these linkages, it can be understood that higher fiscal deficits may aggravate the inflationary conditions in the economy, contributing to the domestic currency depreciation.

The role of fiscal policy in the determination of inflation can also be analysed under the so-called "monetary dominant" and "fiscal dominant" regime according to the new fiscal theory of price level (Sims, 1994; Woodford, 1994). In the former case, the classical quantity equation or monetary policy determines the price level. Government reacts to this by balancing its budget and accepts the rate of inflation as determined by the monetary policy. It plans its budget such that the present value of its future surpluses should be enough to offset the public net real debt. Under the "fiscal dominant" regime, the public budget constraint determines the price level. In this case, if the future surpluses cannot sufficiently offset the debt, the price level tends to adjust upward and reduces the real value of the public debt. To restore equilibrium, money supply reacts to price's adjustment to equate the money demand (Sims, 1994; Woodford, 1994).

Government fiscal deficits are often financed by the domestic credits from the banking system (particularly the Central Bank). Fiscal deficit financed by the banking system can increase the supply of money and general price level. This is because government fiscal deficits tend to force the central bank to monetise the deficit either now or in the future depending on the level of independence between monetary and fiscal authorities (Sargent and Wallace, 1981) or on the exchange rate regime (Turnovsky and Wohar, 1987). As the monetary authorities purchase large amount of government debt or monetize it (by printing money) in response to large deficits, the monetary base and money supply expand. Consequently, the price level increases. Hassan, Mustafa and Basher (2003) note that money multiplier provides the linkage between the monetary base and the money supply. If the multiplier is taken to be constant, the variation in money supply is equivalent to the multiplier times the change in the monetary base. Thus, the percentage change in money corresponds to the percentage change in the money multiplier plus the percentage change in monetary base. With respect to the influence of fiscal deficits on money supply, Allen and Smith (1983) have found evidence in support of the debt-monetisation hypothesis while the results of Niskanen (1978), and Burdekin and Wohar (1990) have contradicted it.

The connections among the interest rate, money supply and price level can further be understood better by supposing an economy in full-employment equilibrium according to Parkin (2014). If money supply

increases, the nominal interest rate falls. The quantity of money that people are willing to hold is less than the quantity supplied. Therefore, people try to get rid of the "excess" money they are holding by buying bonds. As people buy bonds, the real interest rate falls. As a result, consumption expenditure, investment and aggregate demand increase. With the economy at full employment, the price level rises. The rise in the price level causes the quantity of real money to decrease. In this case, the nominal interest rate and the real interest rate rise. As the real interest rate increases, expenditure plans are reduced and ultimately the initial full employment equilibrium is restored. In the new long-run equilibrium, the price level has risen by the same percent of rise in money supply (Parkin, 2014).

Far from the forgoing analysis is the argument that inflationary developments can have impact on government expenditure and revenue, components of fiscal policy, thereby leading to fiscal deficits (Aghevli and Khan, 1978; Ogunmuyiwa, 2008). According to the proponents, inflation causes the public sector services and investment to be costlier than used to be when there is no inflation. This raises the costs of providing physical and social infrastructure by the government and subsequently increases the expenditures of government. If such increase in government expenditure is not fully offset by the increase in revenue, a deficit is likely to be recorded.

Based on the linkages among the government fiscal deficit, real money supply, price level, real output and interest rates, this paper examines the directions of causality between a pair of these variables in the short and long run in the Nigerian context. The rest of the paper is arranged as follows: section 2 reviews the relevant literature while section 3 deals with the model and method of estimation. In section 4, the empirical results are presented. The final section presents the conclusion and policy recommendation.

2. Literature Review

Studies have examined the causal link between fiscal deficit, money supply and price/inflation in both developed and developing countries, and have reported mixed and contradictory results. For instance, King and Plosser (1985) reported insignificant causality flowing from government fiscal deficit to monetary base and inflation in the United

States. On the other hand, Burdekin and Wohar (1990) indicate that in the United States, deficits that are not monetized negatively affect inflation in the short-run. In Greece, Hondroyiannis and Papapetrou (1994) showed that the direction of causality between the price and public budget is bidirectional. The study of Habibullah, Cheah and Baharom (2011) for Asian countries suggests that in the long run, unidirectional causality flows from government fiscal deficits to inflation. Parida, Mallick and Mathiyazhaga (2001) report that in India, fiscal deficit and money supply cause the price level while price level has no influence on these two variables. In Nigeria, the results of Ogunmuyiwa (2008) indicate that budget deficit is caused by inflation. The results suggest that unidirectional causality flows from inflation to budget deficit. Far from this result, Olusoji and Oderinde (2011) using Toda-Yamamoto granger non-causality test from 1970 to 2006 find no clear cut proof of causation between fiscal deficit and inflation in Nigeria. Similarly, Dockery, Ezeabasili and Herbert (2012) use vector error correction model to examine a connection between fiscal deficits and inflation in Nigeria over the period 1970 to 2006. They find no significant link between fiscal deficits and inflation. However, their results indicate a positive relationship between money supply and inflation. On the impact of budget deficits on other macroeconomic variables such as inflation and money supply, some other studies (Hamburger and Zwick, 1981; Miller, 1983; McMillin, 1986; Grier and Neiman, 1987) have also reported that fiscal deficits influence inflation. On the contrary, the results of other studies such as Dwyer (1985), Barnhart and Darrat (1988, 1989), Landon and Reid (1990), and Karras (1994) have suggested that deficits have no positive significant influence on inflation.

Studies have also investigated the direction of causality between money supply and price/inflation across the developed and developing countries and have also reported conflicting results. For example, Bengali, Khan, and Sadaqat (1997) reported bidirectional causality between money (measured by combining broad and narrow money) and consumer price index for Pakistan using a quarterly data covering the period 1972 to 1990. Other studies with bidirectional causality between money supply and price include Khan and Siddiqui (1990) for Pakistan; Frenkel and Johnson (1977) for Germany, and Sergent and Wallace (1973) for Austria, Germany, Russia, Greece, Poland, and Hungary. On the other hand, Brillembourg and Khan (1979) investigated the causal association

between money and general price level in United States by employing Sims and pierce causality approach over the period 1870 to 1975 and found that money caused price level in the short run without a feedback. The result suggested that a unidirectional causality existed between the two variables.

Another study by Beltas and Jones (1993) employs Granger causality approach to examine the causality between money and inflation in Algeria over the period covering 1970 to 1988. Findings show that money causes inflation in the short run without a feed back from inflation, thus suggesting a unidirectional causality between them. On the contrary, Akhtar (2005) finds the effect of inflation on the increase in money supply to be significant and the level of inflation strongly Granger-causes the increase in narrow money supply in the short run over the period of the study. However, the flow of causality from inflation to real output level is found to be insignificant in the short run. Parida, Mallick and Mathiyazhaga (2001) use vector autoregression to investigate how fiscal deficits, money, supply, and price level are related in India from 1960-1961 to 1999-2000. Their results indicate bidirectional causality between fiscal deficits and money supply. Both fiscal deficit and money supply cause the price level while neither of these variables is caused by the price level. Another study by Vuyyuri and Seshaiah (2004) examines the causal link among budget deficit, nominal effective exchange rate, GDP, consumer price index and money supply in India using vector error correction models during 1970 to 2002. Finding indicates a bi-directional causality between budget deficit and the exchange rates, and unidirectional causality flows from GDP to budget deficit. On the other hand, no significant link is found between budget deficit and GDP, and between money supply and consumer price index.

The reviewed literatures have shown that most of the studies conducted in both developed and developing countries on the association of the government fiscal deficit, money supply and price/inflation have provided mixed and conflicting results in both short run and long run. Therefore, the validity of the results remains inconclusive and more studies are needed in this area. In addition, the current paper extends the years of study from 1970 to 2010 as these years reflect the period of fiscal imbalances following the fluctuations in the world prices of crude oil.

On the causal association between interest rate, fiscal deficit, price and money supply, some studies have been documented. For instance, Aliyu and Englama (2009) use vector autoregressive and Granger causality tests to investigate the causal links among inflation, price, exchange rate, credit and interest rate in Nigeria. Their findings indicate that inflation is not affected by monetary transmission. There is evidence that price bears no strong relationship to credit and interest rate, instead strong negative relationship is found between exchange rate and price. Hassan, Choudhury, and Waheeduzzaman (1995) examine the impacts of black market exchange rate expectations on the demand for money in Nigeria. Their findings suggest that the appropriate scale and opportunity cost variables are real income and expected inflation rates for the demand for money function in Nigeria. In addition, depreciation in black market exchange rate has significant negative effect on the country's demand for money.

In Malaysia, Sukmana and Kassim (2010) examine the importance of Islamic banks' financing and deposit in channelling the monetary policy effects to the real economy using the co-integration test, impulse response functions, and variance decomposition analysis over the period 1994 to 2007. Their findings indicate that both Islamic banks' financing and deposit are statistically significant in linking the monetary policy indicator to the real output. The study suggests that the monetary authority should also consider the Islamic banks in the implementation of monetary policy in Malaysia. In addition, it implies that the stability of the Islamic financial institutions as well as the conventional counterpart is the best way to realize an effective transmission of monetary policy in the economy. Also, in Malaysia, Kassim and Manap (2008) evaluates the information content of the Islamic interbank money market rate (IIMMR) vis-a-vis the conventional interbank money market rate (CIMMR) by considering their interactions with some macroeconomic variables such as output, inflation, exports, imports, bank loans and stock market index. Using the Toda-Yamamoto causality approach for the analysis over the period 2000 to 2006, their findings suggest that IIMMR has high information content compared to its counterpart. That is, the "best policy indicator" is the overnight Islamic interbank money market rate due to its ability to explain the movements in the macroeconomic variables. An important implication of this result is that the IIMMR can be a reliable variable for the implementation of monetary policy in Malaysia.

In a study of demand for money in Bangladesh, Hassan (1992) examines the role of the foreign interest rates, inflation rate, credit constraint, currency depreciation, and domestic income. The author shows that real income and expected inflation play significant role in determining demand for money in Bangladesh. However, no significant relationship is found between the variables (foreign interest rates and currecy depreciation) and demand for money in that country. Another study by Hassan, Khan, and Haque (1993) examines the determinants of income velocity of money in Bangladesh using a Savin-White Box-Cox parametric transformation with first order serial correlation method of estimation. Their findings suggest that income and inflation positively influence velocity while the proxy of financial development has negative effect on velocity. Their result implies that the level of financial development increases as the proxy decreases and consequently, the velocity of money increases. In addition, as the national income level increases, the velocity also increases and this informs the central bank to reduce the money supply to reduce inflation with the overall expenditure remaining unaffected in the economy. Furthermore, Hassan and Al-Dayel (1998) examines the stability of the demand for money in fifteen countries under two different financial systems, one is similar to the western financial system and the other is similar to the Islamic financial system. This study finds that the velocity of money and its variance are lower for interest-free banking system than for interest-bearing banking system. The result supports the hypothesis that interest-free money (in the Islamic financial system) is more stable than interest-bearing money (in the western financial system).

The study by Alatiqi and Fazel (2008) employs the Engle-Granger method of co-integration and the Granger causality test to provide evidence of no negative causal association between money supply and interest rates. In Pakistan, Noor-e-Saher and Herbert (2010) examine the influence of fiscal deficit on long-term interest rate during 1975 to 2008 using the method of cointegration. Result suggests that increase in the budget deficit causes an increase in long-term interest rate thus making the investment fund to be costlier. In a study of United Kingdom during 1960 to 1992, Al-Saji (1993) report that the expected rate of inflation, the real stock of money, the real fiscal deficit, the real public expenditure, and the real trade balance have significant influence on nominal and ex-ante real long term interest rates. Barnes (2008) uses cointegration method to examine how budget deficits are related to the

long-term interest rates for ten European countries. Finding reveals that for all countries, budget deficits and the long-term interest rates are cointegrated and that budget deficits affect long-term interest rates positively. On the one hand, some other studies (Al-Saji, 1992; Barth *et al.*, 1985; Cebula, 1988, 1993; Cebula and Koch, 1989; Hoelscher, 1986; Knoester and Mak, 1994; Miller and Russek, 1991; Zahid, 1988) have found that government fiscal deficits lead to higher levels of interest-rate yields. On the other hand, some other studies (Barro, 1987; Evans, 1985, 1987a, 1987b; Hoelscher, 1983) have found no relation between fiscal deficits and interest rates.

The nature of midway link between budget deficit and interest rate has been argued to be very important (Noor-e-Saher and Herbert, 2010). Interest rate can serve as midway link in the study of the causality among budget deficit, money supply, price/inflation, and output. This, however, has been neglected in the previous studies of Nigeria available for review. Therefore, the current paper includes interest rate as one of the independent variables among others to gain more insight into the role of interest rate.

3. Model and Method of Estimation

Autoregressive distributed lag (ARDL) approach of Perasan and Shin (1999), and Perasan, Shin and Smith (2001) was applied for the bound testing of cointegration among the price level, real money supply, government fiscal deficit, interest rate and real output. The adoption of the approach is considered desirable because it provides opportunity to test whether or not there is long run association (co-integration) among the variables not minding whether the explanatory variables (regressors) are integrated of order 0 or 1. In this case, there is no need to pre-test the variables and this lessens the task involved in deciding the order of integration. Furthermore, the method of bounds testing is advantageous in that it possesses better properties that accommodate small sample size more than the Engle and Granger (1987), and Johansen and Juselius (1990) procedure of co-integration (Narayan and Smyth, 2005). The approach of ARDL also gives room for different optimum lags to be assigned to variables which cannot be possible while using the conventional approaches to co-integration. In addition, the ARDL approach makes use of single reduced form equation as compared to the conventional approach of co-integration where estimation of long run

associations is done within a system equation (Ozturk and Acaravci, 2010).

The steps involved in bound testing for co-integration requires the estimation of the unrestricted error correction model of the form of equation (1) where each of the variables subsequently takes turn to serve as endogenous variable after the others.

$$\Delta lnP_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 \Delta lnP_{t-i} + \sum_{i=0}^{k} \gamma_2 \Delta lnMS_{t-i} + \sum_{i=0}^{k} \gamma_3 \Delta GFD_{t-i} + \sum_{i=0}^{k} \gamma_4 \Delta lnIR_{t-i}$$

$$+ \sum_{i=0}^{k} \gamma_5 \Delta lnRY_{t-i} + \alpha_1 lnP_{t-1} + \alpha_2 lnMS_{t-1} + \alpha_3 GFD_{t-1} + \alpha_4 lnIR_{t-1}$$

$$+ \alpha_5 lnRY_{t-1} + U_t \qquad\qquad (1)$$

From the equation (1), Δ is the first difference operator, ln is the natural logarithm, K is the optimum lag, P is the price level, MS is the real money supply, GFD is the government fiscal deficit, IR is the interest rate and RY is the real gross domestic product (real output) and U is the error term. All the variables are in natural logarithm form with the exception of government fiscal deficit. Equation (1) provides the opportunity to establish whether there is long run association among the variables. To do this, Pesaran et al. (2001) bound test procedure is employed as the first step of ARDL approach to co-integration whose determination relies on Wald statistics or F-test. The null hypothesis that the variables are not co-integrated is stated as $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ against the alternative hypothesis that the variables have long run association, stated as $H_1: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$. These specifications are applicable to the equation (1). The F-statistics test the joint significance of the parameter estimates. The F-test employed in the bound test has a non-standard distribution.

Perasan et al. (2001) has two levels of critical value (lower and upper) in respect of the level of chosen significance. The assumption of the lower level of critical value is that all variables are integrated of order 0 or I(0) while the upper level of critical value is of the assumption that all variables are integrated of order 1 or I(1). To take decision, the F-

statistics are compared with the two levels of the critical value, from the chosen ARDL model whether it has intercept and/or trend. According to the rules, reject the null hypothesis and accept that there is presence of co-integration if the F-statistics computed is more than the upper level of critical value. On the other hand, accept the null hypothesis that co-integration is not present if the F-statistics calculated is lesser than the lower level of critical value. If the value of F-statistics calculated is greater than the lower level but lesser than the upper level of critical value, then the test is inconclusive.

Following the establishment of the existence of long run association, Granger causality test is performed to determine the short run and long run causalities between a pair of variables. Engle and Granger (1987) incorporate the idea of co-integration into causality. Given that the variables have long run relationships according to Granger, causal association among the variables could be investigated by modelling the series where co-integration exists with augmented one period lagged error correction term. By following Narayan and Smyth (2005) a multivariate K^{th} order VECM is specified in equation (2) for Granger causality test.

$$\Delta lnP_t = \gamma_0 + \sum_{i=1}^{k} \gamma_1 \Delta lnP_{t-i} + \sum_{i=1}^{k} \gamma_2 \Delta lnMS_{t-i} + \sum_{i=1}^{k} \gamma_3 \Delta GFD_{t-i} + \sum_{i=1}^{k} \gamma_4 \Delta lnIR_{t-i}$$

$$+ \sum_{i=1}^{k} \gamma_5 \Delta lnRY_{t-i} + \alpha_1 ECT_{t-1} + U_{1t} \qquad (2)$$

From the equation (2), (Δ) represents the difference operator, k is the optimum lag, ln is natural logarithm and U is the uncorrelated random error term for each variable's respective equation. The series where co-integration exists is augmented with one period lagged error correction term (ECT_{t-1}) with its coefficient represented by respective α. On the other hand, in any equation where there is no co-integration among the variables, the error correction term (ECT_{t-1}) is not included in the modelling of the series for Granger causality test. The term (ECT_{t-1}) is collected from the long run co-integration association. As described in equation (2), the previous values of the endogenous variable and those

of other exogenous variables are included in the regression of the endogenous variable concerned.

The data used in this study are annual time series data covering the period 1970 to 2010. The consumer price index is used as a proxy for price and the gross domestic product is used as a proxy for real output. All data including the interest rate, government fiscal deficit and money supply are sourced from the Central Bank of Nigeria statistical bulletin. To obtain the real money supply, we deflated the nominal money supply by the consumer price index.

4. Empirical Results

As a first step of the procedure, the properties of the variables are required to be examined to ensure that the dependent variable (price level) is integrated of order one or I(1) and the independent variables are either integrated of order one, I(1) or integrated of order zero, I(0). The requirements which if not met make the adoption of ARDL invalid (Perasan et al., 2001). Besides, all the variables must be integrated of order one for the implementation of Granger causality tests in spite of the advantage that bound test for co-integration can be applicable not withstanding the order of integration of the variables (Narayan and Smyth, 2005). In order to verify the preconditions, unit root tests are conducted on each variable used. Two methods of unit root test adopted are the ADF test and Phillip Perron (PP) test. The estimation of PP statistics makes use of Bartlett kernel with Newey-West Bandwidth. The two tests ensure robustness of the results. In particular, PP test corrects for higher order autocorrelation in the series and also deals with the likely problem of heteroscedasticity (Kouakou, 2011). The lags used for the estimations under the two methods are automatically selected. The results of the tests on the variables at levels are displayed in Table 1.

Results in Table 1 show that all the variables tested at level demonstrate to have unit roots under the ADF test. Their ADF statistics are lower than their critical values at 5%. Therefore, the null hypotheses that the variables have unit root at level are accepted at these critical values.

Table 1: Unit roots tests (ADF & Phillips Perron statistics) in levels

Variable	Model Types	ADF Statistics	CV	PP Statistics	CV
l_P	Constant	-0.750219	-2.936942	-0.785848	-1.660163
	Constant/trends	-1.563025	-3.526609	-2.936942	-3.526609
l_MS	Constant	-0.394369	-2.936942	-0.430920	-2.936942
	Constant/trends	-1.830444	-3.526609	-1.926402	-3.526609
GFD	Constant	-2.369044	-2.936942	-2.369044	-2.936942
	Constant/trends	-3.105876	-3.526609	-3.157048	-3.526609
l_RY	Constant	-2.329465	-2.936942	-5.437061	-2.936942***
	Constant/trends	-2.066128	-3.526609	-1.896588	-3.526609
l_IR	Constant	-1.312778	-2.938987	-1.455345	-2.936942
	Constant/trends	-1.255103	-3.529758	-2.031427	-3.526609

Note: CV is critical values at 5%, and *** is CV at 1%.   All the variables are in natural log
          except GFD.

The results of the PP statistics confirm the results obtained from ADF
test at level with the exception of real output (RY) whose constant
model exhibits significance at level. With the exception of this variable
(RY), the null hypotheses of presence of unit root cannot be rejected at
5% level of significance for all the variables because the PP statistics for
each of these variables (RY under constant model not included) fails to
be greater than their 5% critical values.

Having confirmed that all the variables are almost non stationary at
level, they are therefore subjected to first differences under the two
testing methods. The results of ADF and PP tests displayed in Table 2
show that all the variables become stationary after differenced once.
These imply that the null hypotheses of the existence of unit root for
each variable after differenced once are rejected at 5% level of
significance since their ADF and PP statistics are each more than the
5% critical values. The results of the unit root tests confirm the
satisfaction of the Perasan et al.'s (2001) preconditions for the adoption
of the ARDL approach to co-integration since each of the variables
become I(1) after differenced once, beyond which would have made the
ARDL adoption invalid. Therefore, the study proceeds to test the
existence of long run relationships among the variables using ARDL
Bound test procedure.

Table 2: Unit roots tests (ADF & Phillips Perron) in first differences

Variable	Model Types	ADF Statistics	CV	PP Statistics	CV
l_P	Constant	-6.124223	-2.938987	-6.140571	-2.938987
	Constant/trends	-6.145869	-3.529758	-6.312910	-3.529758
l_MS	Constant	-5.672190	-2.938987	-5.686079	-2.938987
	Constant/trends	-5.598228	-3.529758	-5.613804	-3.529758
GFD	Constant	-6.745416	-2.938987	-7.917590	-2.938987
	Constant/trends	-6.173137	-3.548490	-7.778581	-3.529758
l_RY	Constant	-5.829829	-2.938987	-	-
	Constant/trends	-6.130763	-3.529758	-6.916525	-3.529758
l_IR	Constant	-8.939444	-2.938987	-8.913736	-2.938987
	Constant/trends	-8.906099	-3.529758	-8.952878	-3.529758

Note: CV is critical values at 5%. All the variables are in natural log except GFD.

In order to test whether the variables have relationship in the long run, ARDL bound test method of Perasan et al. (2001) is adopted. The null hypothesis that the variables are not co-integrated is stated as H_0: $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ against the alternative hypothesis that the variables have long run association, stated as H_1: $\alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 \neq 0$. Two levels of critical values are provided with the lower level showing that all variables are I(0) while the upper level indicating that all variables are I(1). A Perasan et al.'s (2001) model with intercept and no constant is used. To take decision, the F-statistics are compared with the two levels of the critical value, from the chosen ARDL model. Each variable takes a turn to be considered as dependent variable for others. Table 3 reports the results obtained for the F-statistics computed and the Perasan et al. (2001) critical values are displayed along side the F-statistics.

Table 3: Results of bound test (F-tests) for co-integration

F-Statistics	Bound CV: 90%		Bound CV: 95%		Bound CV: 99%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
	2.425	3.574	2.850	4.049	3.817	5.122
F_P(P|MS,GFD,RY,IR) = 4.2060***						
F_{MS}(MS|P,GFD,RY,IR) = 4.5117***						
F_{GFD}(GFD|P,MS,RY,IR) = 0.4735						
F_{RY}(RY|P,MS,GFD,IR) = 1.7566						
F_{IR}(IR|P,MS,GFD,RY) = 2.7861*						

Note: * and *** represent 90% and 99% significant level respectively. CV is the critical value from Perasan et al. (2001). Null Hypothesis: there is no co-integration

According to the rules, reject the null hypothesis and accept that there is presence of co-integration if the F-statistics computed is more than the upper level of critical value. On the other hand, accept the null hypothesis that co-integration is not present if the F-statistics calculated is lesser than the lower level of critical value. If the value of F-statistics calculated is greater than the lower level but lesser than the upper level of critical value, then the test is inconclusive. By considering price level as dependent variable from the results, Table 3, the F-statistics computed equals to 4.2060 and is greater than the upper bound at 95% critical value band. This implies that the null hypothesis of no co-integration among price level (P), real money supply (MS), government fiscal deficit (GFD), real output (RY), and interest rate (IR) is rejected notwithstanding their co-integration order. When real money supply is considered as dependent variable, the F-statistics computed equals to 4.5117 which exceed the upper bound at 95% critical value band. This also implies that the null hypothesis of no co-integration among the variables is rejected when money supply takes turn as dependent variable. When government fiscal deficit and real output are individually considered as dependent variable, the F-statistics (0.4735) and (1.7566) computed for each of them respectively are each below the lower bound at 90%, 95% and 99% level of significance. This implies that the null hypothesis of no co-integration among the variables is accepted for each of government fiscal deficit and real output when served as dependent variable in an equation.

By considering interest rate as dependent variable, the results indicate that the F-statistics (2.7861) computed falls between the lower and upper bound at 90% level of significance, thus making the result inconclusive. Given that the result of interest rate is inconclusive, Kremers, Ericsson, and Dolado (1992), and Marashdeh (2005) have suggested that co-integration can also be established through the application of error correction model (ECM). Therefore, from the long run co-integration relationship, the error correction terms are obtained for the variables confirmed to be co-integrated with other variables.

The results obtained from bound test suggest the existence of long run association among the variables (price level, real money supply, government fiscal deficit, real income and interest rate). This is further confirmed by the results of error correction model where the coefficient of one period lagged error correction tern (ECT_{t-1}) is negative and

significant when price level, money supply and interest rate individually serves as dependent variable. Therefore, there must be a minimum of one-directional causality between the variables, whose direction however, is not indicated from the co-integration results. The determination of such direction is implemented by Granger causality tests involving the estimation of a multivariate form of vector error correction model (VECM) (stated in equation (2) within the context of ARDL framework. Each variable takes turn to serve as dependent variable in equation 2 and the one period lagged error correction term (ECT_{t-1}) obtained from the long run co-integration relationship is only added to the equation of price level, money supply and interest rate when each of them serves as dependent variables since they are co-integrated. On the other hand, (ECT_{t-1}) is excluded in the equation 2 when government deficit and real output serves as dependent variable since they are not co-integrated.

The results of Granger causality show the long run and short run causality in the context of the error correction mechanism. Chi-square statistics associated with the lagged regressors (independent variables) of the ECM determines the significance of the causal impacts in the short run while the t-statistics associated with the lagged ECT determines the significance of the causal impacts in the long run. The results of Granger causality obtained are displayed in Table 4. Starting with the analysis of short run effects, real money supply, government fiscal deficit, real output, and interest rate are significant at 1% level in the price equation but price is not significant in the equation where real money supply is dependent variable which suggests that there is no feedback. Therefore, there is a unidirectional causality running from real money supply to inflation in the short run.

Similarly, government fiscal deficit causes price level at 1% significant level but price is not significant in the equation where government fiscal deficit serves as dependent variable, suggesting the absence of feedback from price. For this reason, a unidirectional causality runs from government deficit to price level in the short run. Short run causality also runs from real output (significant at 1% level) to inflation without any feedback since price is not significant in the equation where real output serves as dependent variable.

Table 4: Results of Granger causality between pair of variables

Dependent Variable	Δl_P	Δl_MS	ΔGFD	Δl_RY	Δl_IR	ECT_{t-1}
Δl_P	-	16.889*** [0.000]	3.10E+13*** [0.000]	28.001*** [0.000]	220.419*** [0.000]	-0.997*** (-4.154)
Δl_MS	2.155 [0.142]	-	2.39E+11*** [0.000]	0.402 [0.526]	322.086*** [0.000]	-0.114*** (-10.454)
ΔGFD	2.563 [0.109]	0.160 [0.689]	-	0.205 [0.651]	2.724* [0.099]	-
Δl_RY	0.257 [0.612]	6.326** [0.012]	1.79E+12*** [0.000]	-	5.107** [0.024]	-
Δl_IR	0.105 [0.746]	0.425 [0.515]	2.94E+11*** [0.000]	0.001 [0.972]	-	-2.220** (-2.9008)

Note: Chi-square statistics in squared bracket [ ] and t-statistics in parenthesis ( ) are reported for all variables and ECT respectively. Also, 10%, 5% and 1% level of significance are represented by *, ** and *** respectively. Null Hypothesis: there is no Granger Causality.

Thus, a unidirectional causality exists between the inflation and real output in the short run. Lastly, interest rate also becomes significant at 1% level implying a causal to price level in the short run without a feedback from price level since it is not significant in the equation where interest rate serves as dependent variable. Therefore, a unidirectional causality exists between interest rate and inflation in the short run. The short run unidirectional causality result from real money supply to inflation supports those obtained by Brillembourg and Khan (1979) for United States and Beltas and Jones (1993) for Algeria while the one running from fiscal deficit to inflation supports the results obtained by Parida, Mallick and Mathiyazhaga (2001) for India.

Next is to consider the long run causality effect. The parameter estimates of one period lagged error correction terms are negative and significant in the equations of price level, and real money supply at 1% level while in the interest rate equation it is also negative and significant at 10% level. These support the initial bound test results which suggest the presence of co-integration. For government fiscal deficit and real output equations, one period lagged error correction terms is omitted in each equation when each of them serves as dependent variable since there are absence of co-integration.

From Table 4, the Granger causality results show that the lagged error correction term is significant at 1% level in the price equation. This means that variations in price level are function of disequilibrium in the long run association. That is, in the long run, real money supply, government fiscal deficit, real output, and interest rate granger cause price level. It can also be explained to imply that there are interactive running of causality from real money supply, government fiscal deficit, real output, and interest rate via the error correction term. With the real money supply as the dependent variable in another case, and its lagged error correction term is significant at 1% level, it means that price level, government fiscal deficit, real output, and interest rate granger cause real money supply in the long run. In other words, there is bidirectional causality running between the real money supply and price level in the long run. This result is parallel to the one obtained by Khan and Siddiqui (1990), and Bengali, Khan, and Sadaqat (1997) for Pakistan, Frenkel and Johnson (1977) for Germany, and Sergent and Wallace (1973) for Austria, Germany, Russia, Greece, Poland, and Hungary. The results of Granger causality in Table 4 also indicate that the lagged error correction term for interest rate as dependent variable is also significant at 5% level. This as well shows that bidirectional causality in the long run is flowing between price level and interest rate.

5. Conclusion and Policy Recommendation

The results of ARDL bound test for co-integration confirm the existence of long run relationships when each of price and money supply serves as dependent variable with their explanatory variables while the result of interest rate remains inconclusive. On the other hand, there is no cointegration when each of government fiscal deficit and real output serves as dependent variable. In the short run, unidirectional causality runs from real money supply to inflation, from government deficit to price level, from real output to inflation, and from interest rate to price. In the long run, bidirectional causality runs between the real money supply and price level, and also bidirectional causality runs between price level and interest rate. In what follows as the consequences of fiscal deficit on real money in Nigeria, the growth of real money supply influences price level. Evidently, at the early period, unidirectional causality runs from real money supply to inflation in the economy while at later period it manifested into bidirectional causality, implying that both the real money supply and price level cause each other. The roles of

real output and interest rate on inflation are also pronounced in the economy. In addition, evidences of interest rate influence show that bidirectional causality in the long run is flowing between price level and interest rate.

It can be inferred from the results that pro-cyclical has been the practice in Nigerian fiscal policy which has accounted for the country's public deficit. Therefore, there is a need for fiscal policy rule that will guide the all tiers of government to a particular level of fiscal conduct and budgetary management to the extent of making it credible over time. The results of the current study provide the likely implications of fiscal deficits on some macroeconomic variables such as output, price level, money supply and balance of payment. Knowing these implications is likely to provide an insight into the formulation and design of appropriate fiscal policy by the Nigerian policy makers because far from the efficient provision of public goods, fiscal policy performs stabilizing role.

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