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Fiscal-Monetary Policy Interactions and Macroeconomic Performance in a Small Open Economy: A GMM Approach

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Abstract

The study investigates the nature and the effect of fiscal and monetary policy interactions on major macroeconomic variables in a small open economy of Nigeria between 1981 and 2018. The paper employs the generalized method of moment as technique of analysis due to its potential to address the endogeneity issues among the explanatory variables. Findings from the study reveals that interest rate and government expenditure have significant effect on output and inflation. Also, the study finds that fiscal and monetary policy interact as strategic substitutes in Nigeria. This implies that when one policy authority pursues a contractionary measure, the other policymaker counteracts the action using an expansionary policy. It is also revealed that the effect of fiscal and monetary policy interactions on output and inflation is negative and significant. This implies that the two policies perform better when combined in achieving price stability and sustained output growth in the country. Based on the findings, there is a need for macroeconomic policy coordination in Nigeria to optimise the macroeconomic objectives of the country.

Keywords: Fiscal policy, Monetary policy, Inflation, Output, Small open economy and generalized method of moment.

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Contents

Contribution of this paper to the literature
The study investigated the nature and the effect of fiscal and monetary policy interactions on output and inflation in a small open economy of Nigeria on quarterly data between 1981 and 2018.

1. Introduction

There two major macroeconomic objectives that every economy strives to achieve. These are sustained output growth and price stability. To achieve these goals, policymakers rely on some domestic macroeconomic policies to provide some measures that can assist in stabilising their economies. Macroeconomic policies can be defined as measures and controls put in place by policymakers to correct domestic imbalance and protect the economy from unexpected external disturbances. Specifically, in Nigeria like in every other country, government relies on monetary and fiscal policies as two principal stabilisation policies to enhance stable macroeconomic performance. Monetary policy involves the use of monetary tools such as credit, money supply, and interest rate to achieve internal and external balance and price stability (Central Bank of Nigeria, 2011). On the other hand, fiscal policy is the use of government expenditure, debt and taxes to influence the level of aggregate demand in an economy, maintain stable economic growth and ensure full employment (Central Bank of Nigeria, 2011). Meanwhile, fiscal policy is coordinated by the government through the Federal Ministry of Finance, and monetary policy is implemented by the Central Bank of Nigeria.

However, one major area of contention in the literature is on the efficacy of the two policies in achieving macroeconomic objectives of government. Theoretically, there are two major competing theories on the need for policy intervention in an economy. These are the Classical school and the Keynesian school. On one hand, the Classical school is based on the notion that government intervention in the form of fiscal and monetary policy to stabilise the economy is neither necessary nor desirable as the economy is self-correcting especially in the long run (Iyeli, 2013; Snowdon & Vane, 2003). This strand therefore argued that the economy is stable enough and that stabilisation policies are not needed in the economy. On the other hand, the Keynesian school advocates active stabilisation policies and conclude that the economy suffers in the absence of stabilisation policies (Modigliani, 1988). Hence, these scholars contend that fiscal policy such as government expenditure remains a veritable tool to stimulate economic activity and pull out the economy out of recession.

On the empirical fronts, there is increasing evidence that supports the need for policy intervention in the economy (Ajisafe & Folorunso, 2002; Andlib, Khan, & Hag, 2012; Harting, 2015; Leith & Wren-Lewis, 2000; Tanzi, 1986). However, the argument in the literature has been focused on the relative important of fiscal and monetary policy in the economy. In essence, most studies have either focused on the impact of monetary policy or fiscal policy separately but with mixed findings. For instance, Leith and Wren-Lewis (2000) argued that macroeconomic policies are active in economic stabilisation but claimed that emphasis should be accorded to fiscal policy. However, bulk of literature have focused largely on monetary policy as a stabilisation measure (Ajisafe & Folorunso, 2002; Allegret & Benkhodja, 2015; Saibu & Apanisile, 2013). These studies argued in favour of monetary policy and contended that fiscal policy tends to crowd-out private investment in the economy. On the other hand, authors such as Olaloye and Ikhide (1995); Rahman (2009) argued for the efficiency of fiscal policy over the monetary policy.

Moreover, studies that incorporate fiscal and monetary policy for Nigeria have largely focused on their relative effectiveness rather than their interactions (Ajisafe & Folorunso, 2002; Saibu & Apanisile, 2013). Since the two policies are implemented by separate organs of government, proper coordination of both fiscal and monetary policies is required for the realisation of a country's macroeconomic stability. This precludes the need to focus on the policies' interaction in the economy. To the best of our knowledge, few studies including (Adegboye, 2015; Oye & Alege, 2018) that focused on the effect of fiscal and monetary policy interactions on output and inflation in Nigeria did not explicitly account for the impact of external variables on the behaviour of these policy instruments. One major flaw of previous studies is that they were conducted under a closed economy structure. In the recent times, there is increase in economic integration among countries of the world and as such, there is a need to incorporate the effect of external shocks via the open economy model in macroeconomic analysis. In addition, Nigeria is integrated into the global economy through various channels and as such, any policy analysis in Nigeria should account for the effect of external shocks on domestic economic variables. Hence, there is a need to examine the interaction of these two policies in achieving sustained output and price stability in an open economy of Nigeria.

Besides, the last recession witnessed in Nigeria, from the second quarter of 2016 revealed that the role of fiscal policy in economic stabilisation cannot be ignored (Akinbobola & Ojeyinka, 2017). During the recession, fiscal stimulus such as "bailout funds" was released to many states in Nigeria to cushion the effect of the recession on people's welfare. This again lend credence to the assertion of Friedman (1968) who identified monetary policy as a "string" that could be pulled to stop inflation but could be not be pushed to halt recession. In addition, the global pandemic resulted from the outbreak of Corona Virus (COVID-19) in year 2020 compelled many countries to roll out different fiscal stimulus packages to alleviate the impact of economic downturn on their citizens. This clearly reveals that monetary policy alone might not be sufficient to ease the adverse effect of external disturbance and achieve macroeconomic stability in the country (Corsetti, Dedola, Jarociński, Maćkowiak, & Schmidt, 2019). Hence, in this study, we examine the nature of interactions between the two policies and the extent of their impact on output and price stability in an open economy model such as Nigeria. The present study is relevant because the nature and the extent of coordination of the two policies would determine the country's response to economic disturbances, either from domestic or foreign sources. In addition, inappropriate policies can aggravate and worsen the effect of shocks on domestic macroeconomic variables while a well-coordinated fiscal-monetary policy framework would go a long way in attaining the macroeconomic objective of an economy (Central Bank of Nigeria., 2012).

2. Literature Review

The debate on the effectiveness of fiscal and monetary policies on macroeconomic performance has occupied a central stage in the discussion of macroeconomic analysis. Following the theoretical argument on the relative effectiveness of the two policies, empirical studies in this area, both in the developed and developing countries, have produced conflicting results. Meanwhile, empirical studies in the literature have either focused on monetary policy or fiscal policy especially in the context of closed economy structure. Findings from these studies can best be described as inconclusive. Studies such as Anderson and Jordan (1968); Senbet (2011); Rakić and Rađenović (2013); Havi and Enu (2014); Ajayi and Aluko (2017) argued that monetary policy is more effective in stimulating economic growth while studies such as Olaloye and Ikhide (1995); Latif and Chowdhury (1998); Rahman (2009); Darrat (1984) advocated for the use of fiscal policy in stimulating output.

In Pakistan, Andlib et al. (2012) investigated the response of output and inflation to monetary policy and fiscal policy. Employing an unrestricted VAR technique over the study period of 1980 to 2011, finding from the study showed evidence of weak coordination between monetary and fiscal policy in the country. Besides, inference from the Granger Causality test revealed no evidence of causality between the two policies. Hence, the author advocated for proper coordination of the two policy to protect the economy from external disturbances.

In analysing the effectiveness of fiscal policy changes, Akanbi (2013) examined the role of government expenditure and tax changes in the economic stabilisation of South Africa. The author adopted a two-step estimation technique which included a supply-side constraint model and demand-side constraint model to capture the structural characteristic of the South African economy. Results from the study revealed that changes in government expenditure are more effective in stabilizing output under the demand-oriented constraint model while the use of tax as a policy instrument proved effective in the supply-side constraint model. In like manner, Harting (2015) explored the impact of fiscal stabilisation policy on long term growth. The author adopted a close-agent-based business cycles to present the role of fiscal stabilisation policy. Also, the author identified a demand-oriented consumption policy and two investment subsidising policies. Findings emanated from the study revealed that the three policies were effective in smoothing output fluctuations but with different implications for medium and long term growth.

In Croatia, Coric, Simovic, and Dskar-Skrbic (2015) studied the effectiveness of fiscal and monetary policies on economic growth and exchange rate. Adopting the SVAR method in the Mundell-Flemming theoretical framework for open economy on monthly data between 2004:7 and 2012:11, finding emanating from the study indicated that expansionary fiscal and monetary policies stimulate economic activity. However, it was also established that expansionary fiscal policy was accompanied by domestic currency appreciation while an increase in the money supply had a depreciation effect on the exchange rate.

Employing the Bayesian VAR methodology, Karagöz and Keskin (2016) analyzed the role of fiscal policy on macroeconomic structure of Turkey. Findings from the study revealed that fiscal policy played a limited stabilisation role on output, inflation and stock market index in the economy. Buttressing the finding of Karagöz and Keskin (2016); Sen and Kaya (2015) investigated the relative effectiveness of fiscal and monetary policies on economic growth in Turkey. The study employed the SVAR approach on quarterly data on budget deficit, interest rate, debt stock and real GDP over the study period of 2001:Q1 to 2014: Q2. Empirical findings from the paper indicated that both policies were effective in stimulating economic growth in Turkey. In relative terms, the study, however, found that monetary policy is more effective than fiscal policy based on the findings from variance error decomposition analysis conducted. In magnitude, the interest rate accounted for 11.8% of fluctuations in GDP. This result was in tandem with studies such as Senbet (2011) and Rakić and Rađenović (2013). All these countries confirmed the efficacy of monetary policy over fiscal policy for their respective country of study.

Contrary to the findings of Karagöz and Keskin (2016), Kabanda (2016) investigated the relative effectiveness of fiscal and monetary policies in understanding the changes in output in Rwanda. Using quarterly data between 2006 and 2014 with recursive VAR model, the study suggested that monetary policy is more effective than fiscal policy. Similarly, the study confirmed the existence of interaction between fiscal and monetary policies in Rwanda. In contrast to those studies that validate the effectiveness of monetary policy, Chowdhury and Afzal (2015) evaluated the effectiveness of fiscal and monetary policies in Bangladesh. The authors employed annual data on GDP, broad money and government expenditure over the study of 1980 to 2012 using Augmented Dickey-Fuller, Eagle and Granger, and Johansen test. The study found a co-integrating relationship among the variables of interest. The authors concluded that both fiscal and monetary policy had a relative important effect on GDP in Bangladesh. However, the author failed to show clearly how he arrived at his conclusion.

Rossi and Zubairy (2011) examined the role of monetary and fiscal policy in understanding macroeconomic fluctuations in the United States. The authors used government spending and Federal Fund Rate to proxy fiscal and monetary policy respectively. The study employed quarterly data on output, private consumption, the number of hours worked and investment expenditure. Major finding from the study revealed that fluctuations in output at business cycle frequency was driven by monetary policy while fiscal policy accounted for significant variability in output and consumption over the medium and long term periods. Based on the findings, the authors concluded that fiscal policy is effective in stabilizing output fluctuations in the medium and long run while monetary policy performed a major stabilisation role in the short-run period.

Similarly, a number of studies have investigated the nature of interactions between the fiscal and monetary policies and their effect on output and inflation. However, empirical evidence in this area has produced mixed results. Some studies argued that the relationship between the two policies can be described as substitutes (Adegboye, 2015; Afonso, Alves, & Balhote, 2019; Chukwu, 2012) while some observed a complementary relationship between the two policies (Oye & Alege, 2018; Sahid, Qayyum, & Malik, 2016). For instance, Sahid et al. (2016) examined fiscal and monetary interaction in Pakistan by constructing a DSGE model. The study also assessed the effect of policy interaction in smoothing the effect of external shocks stemming from world output shocks. Results from impulse response analysis revealed that world output shock had positive effect on domestic output. Besides, the study revealed that the interest rate significantly influence output and economic growth in

Pakistan. The effect of interaction showed that an increase in interest rate was accompanied by an increase in tax rate thereby confirming a complementary relationship between the two policies for the Pakistan economy.

In a recent study, Afonso et al. (2019) examined the nature of fiscal and monetary policy interactions on output and inflation among 28 European Union countries between 1970 and 2015. The authors established that the two policies interacted negatively suggesting evidence of substitute relationships among the countries examined. However, Cazacu (2015) investigated the joint effect of both fiscal and monetary policies on output and inflation in Romania. Quarterly data between 2000Q1 to 2014Q2 were employed with SVAR technique. Unlike previous studies, the author could not establish any relationship between the two policies. It was also observed that the effects of fiscal policy are not significant on both output and inflation while the effect of monetary policy is neural over the study period.

In Nigeria, studies such as Chukwu (2012); Adegboye (2015) and Oye and Alege (2018) examined the nature of the interaction between fiscal and monetary policies and how their interactions affect output and inflation in Nigeria. Chukwu (2012) investigated the interactions between fiscal and monetary policy in Nigeria. The study applied a State-space model with Markov Switching technique on quarterly data between 1970 and 2008. The study found that the two policy instruments interacted in a counteractive manner for the period between 1980 and 1994 while there was no evidence of policy interaction between the two policy instruments between 1998 and 2008. The study concluded that fiscal and monetary policy in Nigeria acted as a weak strategic substitute over the study period in Nigeria. However, the author also found evidence of fiscal dominance in the interaction between the two policy variables in Nigeria.

Similarly, Adegboye (2015) analysed the optimal policy mix and the effect of fiscal and monetary policy interactions on output and inflation in Nigeria. The study employed DSGE model on quarterly data covering the period between 1961 and 2013. Data on GDP, public spending, terms of trade, interest rate, domestic inflation foreign interest rate. The study found a complementary relationship between fiscal and monetary policy in the short run while the two policies were found to be substitute in the medium run. On the other hand, Oye and Alege (2018) examined the joint effect of fiscal and monetary policies on output and inflation in Nigeria. The study also investigated the nature of the relationship between fiscal and monetary policy. The author constructed an interaction variable that captures the combined effect of both policies in a DSGE framework with Bayesian estimation technique. The study found a positive association between the two policies. This suggested that the two policies acted as complement to each other in Nigeria. This implies that expansionary policy (increase in government expenditure) is supported by an expansionary monetary policy (reduction in interest rate). On the effect of interaction on output and inflation, finding emanating from the study showed that the effect of policy interaction on output and inflation is positive but not significant. The author concluded that the two policies must be complemented with other policies to achieve the stabilisation objective in Nigeria. This result is in contrast with the finding of Chukwu (2012) and Adegboye (2015) that the policies acted as a substitute in the long run. Variances in the results might be due to differences in data span employed for the study. For instance, Adegboye (2015) covered a longer period with data covering the period between 1961 and 2013 while Oye and Alege (2018) focused on the period between 1970 and 2015.

Also in Nigeria, a recent study by Lawal, Somoye, Babajide, and Nwanji (2018) examined the impact of fiscal policy and monetary policy interactions on stock market behaviour in Nigeria using quarterly data from 1985: 1 to 2012: 4. Adopting the ARDL and EGARCH techniques, the author found the existence of a long-run relationship between the two policies and stock market performance, proxy with All-Share index. Furthermore, findings from the study revealed that interaction between fiscal and monetary policies significantly affect the performance of the stock market in the country.

3. Methodology

3.1. Theoretical Debate

The debate on stabilisation policies can be traced to the Real Business Cycle (RBC) - New Keynesian Theory (NKT) dichotomy in the literature. Essentially, the RBC is based on the Classical school with emphasis on perfectly competitive market, price flexibility and money neutrality. One major implication of the RBC assumption is that money has little or no role to play in explaining output fluctuations in the economy. Hence, exponents of classical school did not believe any policy action or intervention by the government can affect output, employment and price level since automatic price adjustment mechanism will work to restore full employment in the economy. In essence, the classical school concludes that government policies, in the form of stabilisation policies, do not affect output. On the other hand, the New-Keynesian strand developed as a reaction to some of the tenets of the RBC. The New Keynesians argue that macroeconomic stabilisation by the government (using fiscal policy) or by the central bank (using monetary policy) would produce a better macroeconomic outcome than a laissez-faire policy would. Principally, there are three defining assumptions of N-K theory and these are nominal rigidity (in price and wages), imperfect competition and monetary non-neutrality. On the assumption of the non-neutrality of money, the N-K theory faulted the RBC theorists by arguing that money is not neutral in the economy. This means that monetary policy plays a prominent role in price and output stabilisation in the new Keynesian world. In line with the N-K tenet, Galí (2018) identified two implications of monetary policy non-neutrality in the economy. One, exogenous monetary policy does not only affect nominal variables like inflation, but it also affect the real variables such as output, consumption, employment and investment. Second, monetary non-neutrality arises because the response of real variables to a non-monetary shock depends on the monetary policy rule adopted by the monetary authority.

Based on this propositions, the theoretical framework underpinning this study is the New- Keynesian theory due to the relevance of its assumptions to a small open economy such as Nigeria.

3.2. Model Specification

Following the studies by Gali and Monacelli (2005) and Gali. (2008) there are three structural equations in the New-Keynesian model and these are the dynamic IS curve, the New-Keynesian Philip curve and the monetary policy rule. The dynamic IS equation describes the evolution of output gap while the New-Keynesian Philip

equation explains the behavior of inflation. Also, the monetary policy rule describes the behavior of interest rate as policy instrument in the economy. However, to achieve the study's objective, we replaced output gap with output measured by the real gross domestic product. In addition, we modify the output and inflation equations by incorporating the two policy instruments (interest rate and government expenditure) and some external variables to reflect the openness of the economy. We focus only output and inflation equations as the two dependent variables in the analysis. Lastly, we introduced the interaction variables in the two models to account for the role of fiscal and monetary policy interactions on output and inflation. Hence, the output and inflation behavior estimated in the study are specified as:

$$gdp_t = \alpha_1 + \alpha_2 \inf_t + \alpha_3 \text{int}_t + \alpha_4 \exp_t + \alpha_5 exr_t + \alpha_6 op_t + \alpha_7 fgdp_t + \alpha_8 f\,\text{int}_t + \alpha_9 \text{int}_t * \exp_t + \mu_{1t} \quad (1)$$

$$\inf_t = \beta_1 + \beta_2 gdp_t + \beta_3 \text{int}_t + \beta_4 \exp_t + \beta_5 exr_t + \beta_6 op_t + \beta_7 fgdp_t + \beta_8 f\,\text{int}_t + \beta_9 \text{int}_t * \exp_t + \mu_{2t} \quad (2)$$

Where gdp_t is output proxy with real gross domestic product in period t; $\inf_t$ denotes domestic inflation rate in period t; int_t is nominal interest rate to represent the monetary policy in the domestic economy; $\exp_t$ is government expenditure as a proxy for fiscal policy, exr_t is nominal exchange rate, op_t is oil price, $fgdp_t$ and $f\,\text{int}_t$ represent trade-weighted output, trade-weighted inflation rate and trade-weighted interest rate respectively and $\text{int}_t * \exp_t$ describes the interaction terms between the interest rate and government expenditure.

3.3. Estimation Technique

Considering the specification of equations 1 and 2, some variables on the right hand side which are assumed to be exogenous can be endogenously determined within the model. For instance, the output can influence the behavior of interest rate and inflation in equation 1 as theoretically derived by New Keynesian Philip curve (Cevik, Dibooglu, & Kutan, 2014). On the other hand, inflation is a major determinant of output as presented in the dynamic IS equation. This suggests that some independent variables in Equations 1 and 2 might not be strictly exogenous. Similarly, when any of the exogenous variable is correlated with error term, estimation technique such as ordinary least square produced biased and inconsistent estimates. In other words, when a variable cannot be treated as being strictly exogenous in the model, there is endogeneity problem. To overcome such endogeneity issue, a class of technique known as instrumental variable technique was developed by Hansen (1982). Generalised Method of Moment (GMM) belongs to a class of instrumental variable techniques designed to deal with potential endogeneity bias due to omitted variables; simultaneity and measurement error usually associated with simultaneous equations, where exogenous variables are interdependent and jointly determined (Ojeyinka & Adegboye, 2017). Similarly, Wooldridge (2001) argued that GMM technique provides a consistent estimate that helps solve the problems of endogeneity and non-normality in the data series. Hence, the choice of the GMM over other estimation techniques in this study.

To comprehensively capture the impact of external shocks, the study identifies oil price, exchange rate, foreign output and foreign interest rate as major external shocks in Nigeria. For the external variables such as foreign output and foreign interest rate, the study constructed trade-weighted variables from five major trading partners of Nigeria. According to the data from IMF (2018) Nigeria shares more than 50% of her total trade with China, India, the United States, United Kingdom and Netherlands. Hence, foreign output, foreign inflation and foreign interest rate are calculated as trade-weighted real GDP and interest rate from these five major trading partners. A similar approach was used by Zaidi, Karim, and Kefeli (2018); Othman, Zaidi, Karim, and Yusop (2015); Nizamani, Gilal, Khushik, Shah, and Abid (2017); Zaidi et al. (2018) for Malaysia and Pakistan. Lastly, all the variables are in their logarithm form. Sources and measurement of variables are presented in Table A under the appendix.

4. Results

4.1. Correlation Matrix

In this section, the relationship between different instruments of fiscal and monetary policies and output and inflation are examined. The results from the correlation matrix are presented in Table 1 and 2. In Table 1, interest rate was used as a monetary policy instrument while government expenditure was employed as a fiscal policy variable. Information from Table 1 revealed that inflation and gross domestic product are negatively correlated over the study period. The correlation coefficient between the two variables was -0.627. The result implies that an increase in general price will lower domestic output due to a fall in consumers' purchasing power during the inflationary periods.

Table-1. Results of correlation matrix.

Variables	gdp	inf	int	exp
gdp	1.000			
inf	-0.627	1.000		
int	-0.231	0.353	1.000	
exp	0.681	-0.331	-0.175	1.000

Note: gdp is real gross domestic product, inf represents inflation.
int is interest rate and exp is government expenditure.

Considering the nexus between the policy variables and output and inflation, it can be observed that the interest rate was negatively and weakly correlated with gross output. The magnitude of the relationship between the interest rate and the output was found to be -0.23 which is relatively the same with 0.37 derived by Oye., Alege, and Olomola (2018). In contrast, Oye. et al. (2018) found a positive relationship between the interest rate and

output in Nigeria. Variances in findings might be due to the measurement of variables used in their study. However, our result is in concord with the theory as tight monetary policy is expected to discourage investment and hence reduce aggregate output in the economy. However, there was a positive relationship between interest rate and inflation in Nigeria as confirmed in Table 2. This implies that monetary authority responded through a contractionary policy during the inflationary period. This is incongruent with the price stability objective of the monetary authority in that Central Bank will tighten its policy instrument to suppress rising inflation. Also, it can be deduced from Table 1 that interest rate, as a monetary policy instrument, was weakly correlated with both output and inflation in Nigeria based on the correlation coefficient of 0.35 reported.

On the link between fiscal policy (using government expenditure) and output and inflation, inference from Table 1 showed that government expenditure was positively and strongly correlated with the gross domestic product over the study period. This suggests that an expansionary fiscal policy stimulates aggregate demand and hence GDP in Nigeria. This is in tandem with Keynesian theory that a positive relationship exists between government expenditure the aggregate output. Whereas, there was a weak negative relationship between government expenditure and inflation in Nigeria. The result from the correlation matrix in Table 1 revealed a correlation coefficient of -0.331 between government expenditure and inflation. This follows that the government pursues a contractionary fiscal policy to curtail inflationary pressure in the economy. The result also confirmed the finding of Oye. et al. (2018) who found a weak negative correlation of -0.139 between government expenditure and inflation in Nigeria.

In terms of the relationship between fiscal and monetary policy, result from Table 1 showed a correlation coefficient of -0.175 which indicated that the two policies interacted as weak substitute during the periods. This further implies that when monetary authority pursues expansionary (contractionary) policy, the fiscal authority responded with contractionary (expansionary) policy. The result validates the finding of Adegboye (2015) who found that fiscal and monetary policies interacted as a substitute in Nigeria.

For robustness, Table 2 provided additional evidence on the relationship between fiscal and monetary policy and output and inflation in Nigeria. Here, money supply and fiscal deficit were used as monetary and fiscal policy instruments respectively.

Using money supply as a monetary instrument, the result from Table 2 revealed a positive relationship between money supply and gross domestic product. This confirmed the result in Table 1 that expansionary monetary policy stimulates aggregate output in the economy. However, there was a strong positive correlation between money supply and gross domestic product. Similarly, there was a negative correlation between budget deficit, as a fiscal instrument, and gross domestic product. This connotes that an increase in budget deficit retards economic growth in the country. Theoretically, there should be a positive relationship between inflation and money supply. However, information from Table 2 revealed an opposite given the negative correlation of -0.29 between money supply and inflation. One possible reason for this finding is that monetary authority observed the dynamics in the economy and hence responded accordingly. For instance, Central Bank might mop up excess cash in circulation to curtail potential inflation in the economy.

Table-2. Correlation matrix.

Variables	gdp	inf	ms	def
gdp	1.000			
inf	-0.627	1.000		
ms	0.662	-0.290	1.000	
def	-0.449	0.2000	-0.909	1.000

Note: gdp is real gross domestic product, inf represents inflation.
ms is money supply and def is fiscal deficit.

Therefore, monetary authority would pursue a contractionary monetary policy during an inflationary period and vice–versa. Besides, evidence from Table 2 suggested a positive correlation between fiscal deficit and inflation. The result showed a correlation coefficient of 0.200 between the two variables. This implies that an increase in budget deficit spurs inflation in the economy. Again, on the nature of the relationship between fiscal and monetary policies, money supply and fiscal deficit are negatively correlated based on the finding in Table 2, although, there was a strong correlation between the two policy instruments. This confirms the earlier finding when interest rate and government expenditure were used as monetary and fiscal policy variables respectively. This clearly showed that the two policies interacted as substitute irrespective of the measures of fiscal and monetary policies' variable adopted.

4.2. Unit root Tests

One major step in econometric analysis is the examination of unit root property of variables used in the model. This is important because some macro-economic and financial variables might be non-stationary and hence may produce spurious results with inconsistent and biased estimates. In this section, three different tests for stationarity were carried to establish the order of integration of series in the model. These are the Augmented Dickey-Fuller (ADF), Phillip-Perron and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) developed by Dickey and Fuller (1981); Phillips and Perron (1988) and Kwiatkowski, Phillips, Schmidt, and Shin (1992) respectively. The KPSS test was performed as an additional test to reconcile the discrepancy observed in the results of the ADF and PP tests for some variables. The results from the three tests are presented in Table 3. For both ADF and PP tests, the null hypothesis is that the variable has a unit root while the null hypothesis for KPSS is that the variable is stationary. Looking at the results in Table 3, the three tests confirmed that inflation rate (inf) is stationary at level thereby rejecting the null hypothesis of unit root under both ADF and PP. Furthermore, the three tests agreed that nominal exchange rate (exr), foreign output (fgdp), trade-weighted foreign interest rate (fint) and oil price (op) are stationary at first difference. However, PP and KPSS tests result showed that the domestic interest rate is stationary at level while the ADF test revealed that the variable is stationary at first difference. Also, both PP and KPSS confirmed that gdp is stationary at first difference against that of ADF which found the variable to be

stationary at level. Similarly, the result of ADF on government expenditure (exp) disagrees with that of PP and KPP which found that government expenditure assumed stationarity at first difference. The overall conclusion for the unit root test results is that variables in the model are combination of I(0) and I(1) series. Lastly, it is evident from Table 3 that none of the variables is integrated of order 2 and above. Given these results, an approach that does not pre-empt stationarity of variables, such as the generalized method of moment (GMM) is appropriate to solve the problem of endogeneity among the explanatory variables.

Table-3. Unit root test results.

	ADF			PP			KPSS		
Variables	**Level**	**1st diff**	**Order**	**Level**	**1st diff**	**Order**	**Level**	**1st Diff**	**Order**
gdp	-5.463***	-	I(0)	-5.606***	-	I(0)	0.032***	-	I(0)
inf	-4.558***	-	I(0)	-3.448**	-	I(0)	0.252	-	I(0)
int	-2.309	-2.910**	I(1)	-3.25**	-	I(0)	0.204***	0.062***	I(1)
exp	-3.16**	-	I(0)	-1.654	-7.207***	I(1)	1.442	0.290***	I(1)
exr	-1.739	-3.431**	I(1)	-2.782	-13.428***	I(1)	1.357	0.247***	I(1)
op	-1.678	-10.548***	I(1)	-1.562	-12.037***	I(1)	1.007	0.091***	I(1)
fdgp	-0.892	-3.327**	I(1)	-1.365	-6.292***	I(1)	1.353	0.050***	I(1)
fint	-0.892	-11.203***	I(1)	-1.034	-11.219***	I(1)	1.412	0.043***	I(1)
Critical Values	ADF	PP		KPSS					
1%	-3.474	-3.474		0.739					
5%	-2.88	-2.88		0.463					
10%	-2.577	-2.577		0.347					

Note: ***,**,* denotes 1%, 5% and 10% level respectively.
gdp is real gdp, inf represents inflation, int is domestic interest rate, exp is government.
expenditure, exr is nominal exchange rate, op is oil price, fgdp, finf and fint are trade-weighted foreign.
GDP and interest rate respectively.

4.3. Effect of Fiscal and Monetary Policy Interactions on Output

One major step in Generalised Method of Moment (GMM) estimation is the determination of appropriate or suitable instruments. Theoretically, for a variable to serve as an instrument, it must be correlated with explanatory variables but uncorrelated with the residual term. Such instruments are used to eliminate the potential correlation between explanatory variables and the error term. In the choice of instruments, the standard practice in the literature is to select the lag values of explanatory variables in the model. This is based on the assumption that past values of variables are uncorrelated with error terms (Wooldridge, 2001). In line with this, previous studies such as Cevik et al. (2014); Ojeyinka and Adegboye (2017) employed lag values of independent variables as instruments. Hence, in this study different lag values of exogenous and dependent variables were used as internal instruments.

Before the estimation of the model, it is important to test for the presence of serial correlation of the residual to validate and justify the usage of the chosen GMM model. The study followed previous studies on GMM by using the Arellano-Bond serial correlation AR (1) and AR (2) tests developed by Arellano and Bond (1991). Specifically, AR (1) and AR (2) tests for the presence of first-order and second-order serial correlation of residual were carried out. Evidence from Table 4 shows that there is first-order autocorrelation in the model as the probability of AR (1) was statistically significant at 5% for the two models. Hence, the null hypothesis of no serial correlation is rejected at AR (1). However, as displayed in the Table, the probability of AR (2) is not statistically significant and this leads to the acceptance of the null hypothesis of no autocorrelation at second order. Therefore, it can be concluded that the problem of serial correlation in the first order was corrected at AR (2) and so there was no evidence of serial correlation in the two models.

Similarly, Hansen j-statistic, developed by Hansen (1982) was performed to check for the validity of the instruments in the two models. According to Hansen (1982), an instrument is valid if the probability of j -statistic is significant. Based on the results in Table 4, we cannot reject the null hypothesis of valid instruments for the two models as the probability of j-stat revealed that the instruments used in the two models are valid as the probability of j-statistic for the two models is less than 5%. In Table 4, two models were estimated to account for the effect of fiscal and monetary policy interactions on output measured by real GDP of Nigeria. The individual effects of the two policies on output were estimated in model 1 while model 2 contained the joint effects of the two policies to gain insight on the nature and effect of fiscal and monetary policies on output in Nigeria.

Starting with model 1, the results showed that government expenditure, as a proxy for fiscal policy, had a positive and significant effect on output in Nigeria. Specifically, a 1% increase in government expenditure increased aggregate output by approximately 0.2%. This further implied that expansionary fiscal policy increased aggregate output in Nigeria and this suggested that the impact of expansionary fiscal policy was strong enough to stimulate aggregate demand, especially in recessionary periods because an increase in government expenditure is expected to boost household consumption and investment which will, in turn, revamp economic activities in the country. The result is in line with Akanbi (2013); Coric et al. (2015); Karagöz and Keskin (2016) and Sen and Kaya (2015) that increase in government expenditure stimulates economic growth in Nigeria, Croatia and Turkey respectively. In addition, the result confirms the earlier study of Saibu and Apanisile (2013) and a recent study by Adegoriola (2018) who found a positive and significant effect of government expenditure on GDP in Nigeria. However, the effect of interest rate on output was positive but not significant in the first model. The magnitude of 0.246 suggests that 1% increase in interest rate will stimulate output by approximately 0.25%. Similar results were found by Kamaan (2014) for Kenya and Anowor and Okorie (2016) for Nigeria. However, the result is in contrast with previous studies such as Ajisafe and Folorunso (2002) and Falade and Folorunso (2015) who observed that monetary policy significantly promotes economic growth in Nigeria. Meanwhile, the two studies did not account for the role of external shocks in influencing the performance of monetary policy in the economy. Based on the results in Table 4, it can be inferred that the role of monetary policy in an open economy such as Nigeria is weak when compared to a closed economy. Similarly, the limited impact of monetary policy in Nigeria might be linked to

structural weakness and poor institutional frameworks that characterised the Nigerian economy. This underscores the fact that monetary authority in Nigeria needs to complement interest rate (monetary policy rate) with other monetary instruments to achieve its desired objective in the economy.

As expected, the effect of inflation on aggregate output was significant and negative. In terms of the coefficient, a 1% increase in domestic inflation reduced aggregate output by 0.9%. This reflects that the general increase in price level produced adverse effect on aggregate output in Nigeria. This in line with the theory because when the general price increases, people's purchasing power will fall which in turn discourage private investment and consequently aggregate output in the economy. The influence of oil price on output was positive and significant in that a 1% increase in oil price stimulates domestic output by 0.3%. The result is in line with the theory because an increase in oil price is anticipated to increase gross domestic product in an oil-exporting country such as Nigeria. The significance of oil price further alluded to the fact that the economy is mostly driven by the oil sector. This is majorly through the wealth transfer channel in which an increase in oil price increases the transfer of wealth from oil-importing countries to the oil-exporting countries. The result confirms the earlier study by Oyelami and Olomola (2016) that oil price had a significant impact on output in Nigeria.

Other external variables such as trade-weighted foreign GDP from the country's major trading partners also assumed the expected sign. The result showed that a 1% increase in foreign GDP boost domestic output in Nigeria by 0.2%. The coefficient of foreign GDP was statistically significant at 10% level. This suggests that an increase in GDP of Nigeria's trading partners prompted an increase in Nigeria's export which in turn, stimulate domestic output. This can be explained from the trade channel effect whereby an increase in external trade improves domestic economic performance. Further evidence from Model 1 in Table 4 revealed that the nominal exchange rate had a negative and significant effect on output at 10% level of significance. The coefficient of 0.176 suggests that a 1% increase in nominal exchange rate dampens domestic output by 0.18% in Nigeria. Lastly, the effect of trade-weighted foreign interest rate from Nigeria's major trading partners, though negative, but not significant on domestic output. This consequently suggests that the Nigerian economy is more sensitive to the trade channel than the financial channel.

To examine the nature and the effect of fiscal and monetary policy interactions on output, the study interacted fiscal policy variable (government expenditure) and monetary policy instrument (interest rate) in a multiplicative way. The result is presented as model 2 of Table 4. The results showed that the coefficient of interaction term is negative and statistically significant on domestic output. To be specific, a 1% increase in fiscal and monetary policy interaction reduced domestic output by 0.44%. This further confirmed the earlier finding presented in the correlation matrix between the two policies.

Table-4. GMM results on the effect of fiscal and monetary policy interactions on output.

Variable	Model 1			Model 2		
	Coef.	**t-stat**	**prob. value**	**Coef.**	**t-stat**	**prob. value**
Intercept	18.793	5.441	0.000	12.606	1.651	0.101
Inf	-0.919***	-22.482	0.000	-1.054***	-11.77	0.000
Int	0.246	1.487	0.139	2.691***	3.355	0.001
exp	0.176**	2.191	0.030	1.390***	3.571	0.001
exr	-0.178*	-1.899	0.060	-0.504***	-2.907	0.004
op	0.313***	3.633	0.000	0.154	1.216	0.226
fgdp	0.201*	1.680	0.095	0.325	1.313	0.191
fint	-0.456	-1.564	0.120	-1.096**	-2.209	0.029
int*exp	-	-	-	-0.439***	-3.483	0.001
R^2		0.980			0.944	
AR(1) p-value		0.000			0.000	
AR(2) p-value		0.393			0.537	
Prob-j stat		0.110			0.280	
Instrument Rank		9			10	

Notes: *,**,*** represent 10%,5% and 1% level of significance respectively.
List of Instruments:
Model 1: gdp(-4),inf(-3),int(-3),exp(-5),exr(-3),op(-4),fgdp(-3),fint(-3).
Model 2: gdp(-3),inf(-3),int(-3),exp(-3),exr(-3),op(-3),fgdp(-3),fint(-3),int*exp(-3).

In terms of the nature of fiscal and monetary policy interaction, evidence from Table 4 indicated that the two policies interacted as substitutes over the study periods. This implies that the joint effect of the two policies on output was negative and significant. This further suggests that when monetary (fiscal) authority pursued an expansionary policy, fiscal (monetary) authority reacted by counteracting the effect on output by contractionary policy. Hence, it can be deduced from the finding that fiscal and monetary policies acted as strong substitutes for each other in affecting domestic output in Nigeria. The result is in tandem with the conclusion of Adegboye (2015) who found that the two policies interacted as a substitute in Nigeria. Also, a similar finding was obtained in a recent study of Afonso et al. (2019) for 28 European countries and Petrevski, Trenovski, and Tashevska (2019) for Macedonian economy. The result conforms to the empirical data in Nigeria as Central Bank continues to pursue contractionary monetary policy (increase in interest rate) while evidence suggests that Nigerian government has been pursuing an expansionary policy (increase in government expenditure and budget deficit) over the years. However, the result invalidates the finding of Oye. et al. (2018) that fiscal and monetary policies interacted as strong complements in Nigeria. Again, the differences in findings might be attributed to different in the measurement of fiscal policy variable employed.

Another striking revelation from the results in model 2 of Table 4 is that the impact of domestic interest rate and trade-weighted foreign interest rate from Nigeria's major trading partners became significant when the interaction variable was incorporated in the analysis. In addition, the effect of interest rate on domestic output was significant at 1% level. This suggests that proper coordination of the two policies amplify the effect of domestic interest rate in affecting domestic output in Nigeria. The result implies that fiscal and monetary policies performed

optimally when they interacted together in affecting domestic output. Similarly, the effect of foreign interest rate on domestic output was negative and significant on domestic output in Model 2. Therefore, tight monetary policy in foreign economies adversely affected domestic economic activity in Nigeria. It is instructive to state that with the interaction of both policies, the effect of oil price on domestic output was not significant. This reveals that the proper coordination of the two policies can assist in reducing the vulnerability of the Nigerian economy to movement in oil price.

4.4. Effect of Fiscal and Monetary Policy interactions on Inflation

The central objective of monetary authority is to achieve price stability in the economy. In Nigeria, this has been a major challenge over the years as the economy continues to experience a general increase in price level. This section is set to investigate the effect of fiscal and monetary policy interactions on inflation measured by the consumer price index. A cursory look at the diagnostic tests in Table 5 revealed that the two models do not suffer from serial correlation as suggested by the probability of AR (2) for model 1 and model 2. In the two models, the probability of AR (2) was found to be 0.130 and 0.099 respectively. This suggests that the problem of autocorrelation observed at AR (1) in the two models was corrected at the second order. Also, Hansen-j-statistic which tests for the validity of chosen instruments accepts the null hypothesis that instruments used in the study were valid. This is further confirmed by the probabilities of j-stat for the two models which were statistically insignificant at 5%. The absence of serial correlation in residual and valid instruments supported the fact that parameter estimates obtained from the GMM results were consistent and unbiased.

Considering the outcomes of model 1 in Table 5, interest rate, as an instrument of monetary policy, had a positive and significant effect on domestic inflation at 10% level of significance. The result indicates that a percentage rise in interest rate raises inflation by approximately 0.22% within the study period. The positive impact of interest rate can be linked to the cost-push theory of inflation in which tight monetary policy increased the cost of production and thus depressed investment. An increase in the cost of production and reduction in private investment will reduce aggregate output which will consequently fuel inflation in the economy. This further implies that the interest rate is a major determinant of inflation in Nigeria. The result confirmed the finding of Oye. et al. (2018) that a positive relationship exists between interest rate and inflation in Nigeria.

Table-5. GMM results on the effect of fiscal and monetary policy interactions on inflation.

Variables	Model 1			Model 2		
	coefficient	**t-stat**	**prob. value**	**coefficient**	**t-stat**	**prob. value**
Intercept	22.234	6.205	0.000	18.628	3.666	0.000
gdp	-1.072***	-24.729	0.000	-1.063***	-30.519	0.000
Int	0.215*	1.796	0.075	0.974**	2.604	0.010
exp	0.129	1.282	0.202	0.602***	3.368	0.001
exr	-0.122	-1.108	0.270	-0.241**	-2.524	0.013
op	0.390**	2.877	0.005	0.184***	2.661	0.009
fgdp	0.134	0.882	0.379	0.267	1.420	0.158
fint	-0.579*	-1.786	0.076	-0.878**	-2.437	0.016
int*exp	-	-	-	-0.173***	-3.116	0.002
R^2		0.968			0.974	
AR(1) p-value		0.000			0.000	
AR(2) p-value		0.413			0.685	
Prob-j stat		0.130			0.099	
Instrument Rank		9			10	

Notes: *,**,*** represent 10%,5% and 1% level of significance respectively.
List of Instruments:
Model 1: gdp(-3),inf(-2),int(-2),exp(-3),exr(-4),op(-5),fgdp(-3),fint(-3).
Model 2: gdp(-3),inf(-2),int(-2),exp(-3),exr(-3),op(-3),fgdp(-4),fint(-4),int*exp(-5).

Furthermore, the impact of government expenditure on inflation was positive but not significant. Inference from model 1 in Table 5 showed that a 1% rise in government expenditure led to a 0.135% increase in inflation. The result is in line with the theory as expansionary fiscal policy is expected to induce inflationary pressure in the domestic economy. The finding might be related to the fact that fiscal authority tends to focus more on output growth and reduction in unemployment than price stability which is presumed to be the core mandate of the monetary authority. Consequently, it can be concluded that fiscal policy plays a limited role in inflation in an open economy such as Nigeria. The finding validates the assertion of Cebi (2011) that monetary authority reacted to inflation but only weakly to the output gap. Similarly, the finding is inconsonant with previous studies on the Nigeria economy such as Otto and Ukpere (2016); Egbulonu and Wobiloh (2016). The two studies found that the effect of government expenditure on inflation was positive but not significant in Nigeria.

Considering other variables in the model, domestic output negatively and significantly influenced inflation at 1% level of significance. The magnitude of gdp (-1.072) reveals that a 1% increase in domestic output reduces inflation by approximately 1.1% in Nigeria. The result confirmed the theoretical prescription of the New Keynesian Philip curve that domestic output is a major determinant of price level in the economy. This is because, as output expands, there will be reduction in demand pressure which will consequent ease the price level in the economy. The finding validates the conclusion of Okoye, Olokoyo, Ezeji, Okoh, and Evbuomwan (2019) on the Nigerian economy. Additional evidence from Model 1, Table 5 suggests that oil price significantly influence inflation in Nigeria. In quantitative terms, a 1% rise in oil price spurred inflation by 0.39% over the study period. From the supply side, oil constitutes a major input in production and so any hike in oil price will increase the cost of production and hence generate inflationary pressure in the economy. The result aligns with the conclusion of Lacheheb and Sirag (2018) for Algeria and that of Choi, Furceri, Loungani, Mishra, and Poplawski-Ribeiro (2018) for advanced and developing countries. On the contrary, the impacts of exchange rate and trade-weighted foreign output on domestic inflation were not significant. For the estimate of the exchange rate, a 1% rise in the nominal exchange rate (depreciation)

caused the inflation rate to fall by 0.12% while a percentage increase in foreign gdp increase inflation by 0.13% in Nigeria. Lastly in model 1, the trade-weighted foreign interest rate had a significant negative effect on inflation at 10% level of significance.

In model 2, the study incorporated the interaction variable (int*exp) to examine the effect of fiscal and monetary policy interactions on inflation. As observed from Table 5, the magnitude of the interaction term was negative and significant at 1% level suggesting that the two policies acted as substitutes within the study periods. Additionally, the result shows that a 1% increase in the interaction term significantly reduce inflation in Nigeria by 0.17%. This further suggested that the interaction between the two policies was significant in influencing the behaviour of inflation in Nigeria. Essentially, when fiscal authority embarked on expansionary policy (increase in expenditure), the Central Bank of Nigeria responds with contractionary policy to curtail the potential rise in inflation. The finding agrees with the study of Oye. et al. (2018) who found that fiscal and monetary policies interacted as substitutes to affect inflation in Nigeria. This again reiterates the need for proper policy coordination between the government, through the Ministry of Finance, and Central Bank of Nigeria to coordinate their activity for the economy to achieve the objective of price stability in the economy.

It is noteworthy to state that the influence of fiscal policy (government expenditure) on inflation become significant only after the two policy interacted to control inflation. It can be observed from Model 2 in Table 5 that a percentage increase in government expenditure leads to an increase in the general price level in the countries. Similarly, after incorporating the interaction term, the nominal exchange rate became a significant determinant of inflation and this further buttresses the need for policy convergence in Nigeria.

5. Concluding Remarks

The study investigates the nature and the effect of fiscal and monetary policies on major macroeconomic variables in a small open economy of Nigeria. Quarterly data between 1981 and 2018 were sourced from the WDI (2018). The paper employs the generalized method of moment to account for endogeneity issue among the explanatory variables. Findings from the study suggest that when the two policies were implemented independently, fiscal policy significantly affected output while the effect of monetary policy on inflation was statistically significant. This validates the theoretical assertion that the core objective of fiscal policy is output growth while that of monetary authority is price stability. However, when the two policies interact, the effect of fiscal and monetary policy became significant on inflation and output respectively. In addition, external variables such as oil price, nominal exchange rate, foreign output and foreign interest rate significantly domestic output and inflation in Nigeria. Additionally, findings from the study showed that fiscal and monetary policies acted as strategic substitutes over the study periods. In addition, the coefficient of the interaction term had negative and significant impact on output and inflation. The finding also supported the fact that the two policies tend to move in opposite direction in Nigeria. Based on the findings, there is a need for macroeconomic policy coordination among the two policy authorities in Nigeria to optimise the macroeconomic objectives of the country and to protect the economy against unanticipated shocks.

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Table-A. Description and Measurement of Variables.

Variables	Description and measurement	Sources
Output (gdp)	It is defined as the monetary value of total good and services produced in Nigeria in a year. It is measured by the logarithm of real gross domestic product	World Development Indicators (WDI) (2018)
Inflation ($\inf$)	Inflation reflects the annual percentage change in the average cost of goods in an economy. It is measured by the consumer price index as $\pi_t = \log p_t - \log p_{t-1}$	World Development Indicators (WDI) (2018)
Interest rate (int)	Short term interest rate. It was measured by the Lending Rate.	International Financial Statistics(2018)
Government expenditure ($\exp$)	It represents the total expenditure incurred by the government on current and capital projects. Government expenditure was used as a proxy for fiscal policy instrument.	Central Bank of Nigeria's Statistical Bulletin (2018)
Nominal exchange rate (exr)	The nominal exchange rate defines the value of Naira to a US dollar	World Development Indicators (WDI) (2018)
Oil price (op)	This is the average price for Nigerian crude oil in the international market. The study used oil price data from World Texas Intermediate (WTI).	Energy Information Administration (2018)
Foreign output gap ($fgdp$)	The foreign output represents the trade-weighted average of real GDP from Nigeria's major trading partners.	World Development Indicators (WDI) (2018)
Foreign interest rate ($f\,\text{int}$)	Foreign interest represents the trade-weighted average of short term interest rate from Nigeria's major trading partners.	International Financial Statistics(2018)
Money supply (ms)	It represents by the aggregate money supply in the economy. It is measured by the broad money supply (M2).	Central Bank of Nigeria's Statistical Bulletin (2018)
Fiscal deficit (def)	It is the difference between government payments expenditure and total receipts from expenditure	Central Bank of Nigeria's Statistical Bulletin (2018)

Source: Author's compilation (2020).