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RELATIONSHIP BETWEEN MONETARY POLICY AND OUTPUT GROWTH IN OIL PRODUCING COUNTRIES IN AFRICA: ERROR CORRECTION MODEL BASED ON PANEL COINTEGRATION ANALYSIS

OGUNOYE, Aderounmu Adebayo (Ph.D)
Department of Economics, Adekunle Ajasin University Akungba, P.M.B. 001 AkungbaAkoko, Ondo State, Nigeria, Email: princeaogunoye@yahoo.com Phone: +2348066721777

ABSTRACT*: This study broadly examined the relationship between monetary policy and output growth in selected oil producing countries in Africa, using time series data spanning from 1980 to 2016. Specifically, the study analyzed the long-run relationship between macroeconomic variables and output growth in selected oil producing countries in Africa. The study confirmed thestationarity of the time series properties of all the variables in the study, using ImPersaran and Shin (IPS) panel unit root test. The study employed Westerlund Error Correction Based Panel Co-integration test to unify the short run and the long run dynamics. Findings from the study showed that there is a long term co-movement between output growth and macroeconomic variables in the selected oil producing African countries. The results from the long – run model of the fixed effect Regression further corroborate the report from the Westerlund Panel Co-integration test where all macroeconomic variables (RINTR, EXR, WOP and USRINTR) have significant long term impact on output growth. Although, the short – term impacts of these macroeconomic variables on output growth are also significant as shown by the short – run model of the fixed effect regression. Based on the findings of this study, it was therefore suggested that the regulatory and supervisory framework for the financial sector should be strengthened in order to improve the effectiveness of monetary policies of the government.*

KEYWORDS*:* monetary policy, output growth, oil producing countries, error correction model, panel co-integration analysis.

INTRODUCTION

Monetary policy is one of the most effective instruments of achieving macro-economic objectives both in developed and developing countries. It involves measures designed to regulate and control the volume, cost, availability of credit and appropriate direction of money in an economy to achieve some specified macro-economic policy objectives which of course output growth is one of them (Akanbi& Ajagbe,2012). The goal of attaining sustainable economic growth and development has been the major focus of every government, policy makers and policy institutions all over the world. Therefore, monetary policy has been one of the effective policy tools to achieve this.

The shocks from monetary policy have always been considered as one of the reasons for fluctuation in domestic macro-economic variables such as inflation and output (investment).

However, economic shocks to the supply side or demand side of the economy may cause unpredictable changes in aggregate supply and aggregate demand and therefore require some macro-economic policy response mostly in developing countries (oil producing countries in Africa inclusive). Monetary policy has leveraged over the short term course of the real economy. The monetary authority has expectations of the source and magnitude of external economic shocks and it acts to mitigate their impact. It does so by varying its monetary policy instrument-short term nominal interest rate. This in turn affects the target variables of monetary policy-the output gap and inflation rate (Alain,2007).

Oil is one of the most essential inputs and output in the world economy and the crude oil market is the largest commodity market in the world. Oil market is different from other commodities, because is one of the few or the only production input that can have positive and negative impact on the economy growth, which might even lead to a recession (Gonzalez & Nabiyev,2009)). In Africa, oil had played a crucial role in the economic growth and development of the continent and sustaining growth. However, growth and development of some selected oil producing countriesin Africa continent entirely depend on earning from oil, as oil revenues make up a significant contribution of their Gross Domestic Product WEO,(2016).

In view of the forgoing, several studies have been conducted to consider the issue of the impact of monetary policy on macro-economic performance and this has been well established theoretically. In such studies, Keynesian economics claim that an expansionary monetary policy i.e decrease in the short term interest rate can affect long term rates, lending to reduce investment and ultimately impact output negatively. However, the channels for this outcome are the reduction of the cost of capital and liquidity increment (Loannis, Periklis& Benjamin,2013).

It is fundamental for every nation to aim at achieving macro-economic stability and output growth. However, the experience of global economic and financial crisis brought about challenges for oil producing countries that necessitate employing various monetary policies to alleviate the challenges. These policies include, interest rate deregulation, inflation targeting, contractionary and expansionary monetary policies and others. This is because majority of countries in Africa depend entirely on importation and earning from crude oil. These make them an import dependent economy which is prone to the external economic shocks which has significant negative impact of their economies. Therefore, as a result of continuous occurrence of external shocks, countries in Africa especially oil producing ones enhanced macro-economic policies such as monetary policy so as to reduce the negative impact of external shocks on their economies, with this, macro-economic policies required to be manipulated frequently (AFDB, 2014). Therefore, monetary policy as one of the instrument of macro-economic policy is captured through specific variables such as money supply, monetary policy rate and interbank rate.

Additionally, African region is indeed ascribed by low income, high level of unemployment, low capacity utilization and low savings rate (Obadan,2004). In addition, Africa's economic growth is estimated at 4.5 percent in 2015 down from 4.5 percent in 2014 and an average of 5.3 percent in 2013. The slow down reflects largely on the economic difficulties among the regional oil producing countries (REO, 2013).The high levels of economic afflictions have been blamed on the

inappropriate usage of monetary policies in most of the Africa countries. This has attributed to the inability of some of the selected oil producing countries in Africa to accomplish macro-economic objectives. Furthermore, economic growth in Africa has devastatingly slowed down compared with the economic growth of Asian countries which were almost matched with that of many African countries before 1980. The concern of this limited growth rate of African countries has brought about the formulation of financial sector reforms which (World Bank,2013) saw as a key and panacea to this SAP. Many government of African countries have also embarked on other measures such as increased interest rate and inflation targeting in order to boost growth and crowd in private investment but these policy measures are yet to be effective and efficient in the developing countries particularly Africa due to lack of independence in the operation of many Central Banks in some African countries. On the other hand, despite the global crises of 2008 in the developed countries such as U.S.A and other European countries, they were able to achieve macro-economic objectives through the channel of monetary policy measure as a result of absolute autonomy given to their Central Banks to operate, there is high degree of independence, hence, priorities may be established followed by a more discretionary approach. Consequently, the design of monetary policy either by expansionary or contractionary in achieving the desired goals can be accomplished without hindrance or conflicts. It is obvious that the operations of some Africa's Central Banks are not yet in line with the aforementioned criteria. Therefore, investigation into effect of monetary policy in Africa economies has continued to generate active research interest. The broad objective of this study is to examine the relationship between monetary policy and output growth in the oil producing countries.The paper is organized into five sections. Following these introductory remarks is a section on the review of literature. This is followed by the research methods, the results and discussion in section three and four respectively. The study ends in section five with concluding remarks

LITERATURE REVIEW

Empirical Literature

Several studies have been conducted on the relationship among monetary policy, oil price dynamics and output growth both in developed and developing nations. However, some of these studies are hereby presented. Rafiq&Mallick, (2008), employed the new VAR identification procedure to examine the effects of monetary policy on output in the three largest euro area economies (Germany, France and Italy). Quarterly observations from 1981-2005 were used. The Results revealed that monetary policy innovations are at their most potent only in Germany. Apart from Germany, it remains ambiguous as to whether a rise in interest rates concludes with a fall in output, thereby showing a lack of homogeneity in the responses. Berument&Dincer, (2008), studied the effects of monetary policyshocks in Turkey through structural Vector Autoregressive (SVAR). The study covered the period 1986-2000. The results showed that a tight monetary policy has a temporary effect on output, causing output to decline for three months in a statistically significant fashion. The findings are in consonance with the work of previous studies (Sousa &Zaghini, 2008; Sims, 1992; Eichenbaum& Evans, 1995), employedthe same estimation technique. Bhuiyan,(2008), examined the effects of monetary policy shock in Canada by using the overnight target rate as the monetary policy instrument. Using monthly data from 1994-2007. The findings from the study showed that the transmission of the monetary policy shock to real output

operates through both the interest rate and the exchange rate .Using money supply as a measure of monetary policy.

Willem, (2015), examined the relationship between monetary policy shocks and aggregate supply in United Kingdom between 1970 and 2014. The study employed Vector Autoregressive (VAR) method as estimation technique. The findings of the study revealed that accommodative productivity or loose monetary policy shocks temporarily boost labour by increasing work effort and the workweek of capital. Alain,(2007), analyses the effect of monetary policy shocks on the Philippine economy. Vector Autoregressive(VAR)method was used to estimate the effect of monetary policy in Philippine economy. The result showed that the response of monetary policy shocks, inflation rate, World oil price and narrow money supply have significant impact on the Philippine economy. Alessio, Marco&Patrizio,(2010),delved into the empirical investigation between United State of America monetary policy and commodity prices. Standard Vector Autoregressive model was employed to analyse the effects of monetary policy shocks. The results from the study showed that expansionary US monetary policy shocks shoot up the broad commodity prices index and all of its components.Rokon&Roberth,(2008), examined the real nominal effect of monetary policy shocks in Canada between 1980 and 2002. The study employed Recursive Vector Autoregressive model as estimation technique and the findings from the study revealed that negative policy shocks increases both nominal and external exchange rate, decreases inflationary expectations and real industrial outputs and appreciates the Canadian dollar.

Crawford, (2007), examined the relationship between monetary policy shocks and sectoral output in Australia. The estimation technique used is Structural Vector Autoregressive (SVAR). Findings from the study showed that the response of sectors considered were not the same. The response of agriculture, forestry and fishing to shocks from monetary policy were positive and persistence in the first three period of the analysis. However, the response of construction sector was the least.
Volkan&Berument, (2015), investigates the asymmetric effects of monetary policy shocks on economic performance: Empirical Evidence from Turkey, by using monthly data between 1990 and 2014. The study employs Vector Autoregressive model (VAR).The study reveals that tight monetary policy, which is captured with a positive shock to interest rate, decrease the exchange rate, output and prices. The effects of the loose monetary policy, which is captured with a negative shock to interest rate, have opposite an effect on these variables. However, the effects of the loose monetary policy are less than the effect of the tight monetary policy, the easy monetary policy shocks are less effective than the tight monetary policy shocks. Moreover, as the magnitude of shock increases, the difference between the effects of tight and loose monetary policy policies increase.

Chipote&Makhetha, (2014), examined the role played by monetary policy in promoting economic growth inSouth African economy over the period 2000-2010.The study employed Johansen co-integration and Error Correction Mechanism. The result from the study showed that a long run relationship exists among the variables. Also, the core findings of the study showed that money supply, repo rate and exchange rate are insignificant monetary policy instruments that drive growth in South Africa whilst inflation is significant. The study therefore recommends that monetary policies should be used to create a favourable investment climate that attracts both domestic and

foreign investments thereby promoting a sustainable economic growth. The government should also increase government spending on the productive sectors of the economy so as to promote economic growth as monetary policy alone is unable to effectively spur economic growth.

Mehmet &Zekeriya, (2013), investigates both the effects of domestic monetary policy and external shocks on fundamental macroeconomic variables in six fast growing emerging economies: Brazil, Russia, India, China, South Africa and Turkey—denoted hereafter as BRICS_T. The authors adopt a structural VAR model with a block erogeneity procedure to identify domestic monetary policy shocks and external shocks. The findings reveals that a contractionary monetary policy in most countries appreciates the domestic currency, increases interest rates, effectively controls inflation rates and reduces output. The findings also shows that the exchange rate is the main transmission mechanism in BRICS_T economies and there areinverse J-curves in five of the six fast growing emerging economies and there are deviations fromUIP (Uncovered Interest Parity) in response to a contractionary monetary policy in those countries. Moreover, world output shocks are not a dominant source of fluctuations in those economies.

Alam&Waheed, (2006), investigated the monetary policy transmission mechanism in Pakistan at the sectoral level between 1973 and 2003. The study employed VAR as estimation techniques. Findings showed that the existence of sectors specific variation to the real effects of monetary policy changes. For instance, the response of some sectors manufacturing, construction, finance services was negative, while, agriculture, forestry and fishing, mining and quarrying, electricity, gas and water were relatively insensitive to interest rate changes. Mutuku&Koech,(2014), examined monetary and fiscal policy shock and economic growth in Kenya. The study employed recursive vector autoregressive (VAR) framework. The analysis of variance decomposition and impulse response functions reveled that fiscal policy has a significant positive impact on real output growth in Kenya while monetary policy shocks are completelyinsignificant, fiscal policy shock significantly alters the real output for a period of almost eight quarters.

Osei,(2015), examines the joint impact of fiscal and monetary policy shocks on some fundamental macroeconomic indicators in three emerging African economies: Ghana, Nigeria and South Africa. The study uses vector autoregressive (VAR) method with recursive ordering to explain the relationships between the variables over the years 1970 to 2013. The macroeconomic variables considered include real GDP, Inflation and Trade. Granger causality tests was used to determine the causality behavior among the variables. Orthogonal impulse response functions (IRF) and forecast error variance decompositions are then constructed to identify the effects of both fiscal and monetary policy shocks on the macroeconomic variables. The results shows that the impacts of fiscal policy shocks are more pronounced and significant than monetary policy shocks. Over the period, the macroeconomic variables are seen to respond considerably to both contractionary and expansionary fiscal policy shocks. Thus fiscal policy shocks can stimulate economicactivity significantly in these countries. The effects of the monetary policy shocks on the otherhand are observed to be long term in nature. Contractionary monetary policy shocks are seen to generally reduce the levels of output.

Mwabutwa, Viegi&Bittercourt,(2016), investigates the evolution of monetary transmission mechanism in Malawi between 1981 and 2010 using a time varying parameter vector autoregressive (TVP-VAR) model with stochastic volatility. The study evaluates how the responses of real output and general price level to bank rate, exchange rate and credit shocks have changed over time since Malawi adopted financial reforms in 1980s. The findings reaveals that inflation and real output response to monetary policy shocks changed over the period under the research work, also beginning mid-2000s, the monetary transmission performed consistently with predictions of economic theory partly due to stable macroeconomic conditions and positive structural changes in the economy. However, the statistical significance of the private credit supply remains weak and this calls for more financial reforms targeting the credit market which can contribute to monetary transmission and promote further economic growth in Malawi.

Magda, (2014), examines the effects of monetary policy shock in developing countries using annual data for a sample of developing countries. The time-series evidence indicates the allocation of monetary policy shocks, both expansionary and contractionary, between price inflation and output growth. Subsequently, cross-country regressions evaluate factors that underlie the difference in these allocations and their implications. The real effects of monetary shocks increase as the elasticity of aggregate demand increases with respect to monetary shocks. Nonetheless, capacity constraints hamper the output adjustment to monetary policy shocks and increase price inflation. Across countries, trend output growth increases with the output response to monetary shocks as well as consistent with the stabilizing function of monetary policy, the variability of output growth decreases in the face of monetary fluctuations across countries. In contrast, monetary fluctuations increase the trend and variability of price inflation across countries.

Ronald,(2012), analyzed the effects of monetary policy on prices in Malawi. Evidence on the transmission mechanism of monetary policy is quite non-uniform, particularly across countries with different economic structures. Complications to theoretical propositions tend to arise when economies are less market-oriented and less sensitive to policy interventions, when monetary authorities are not adequately independent, or when market-based and administrative policy instruments are used concurrently. It is important, therefore, to appreciate the unique dynamics of the transmission mechanism in any jurisdiction, in order to understand and possibly predict the macroeconomic effects of monetary policy. This study assessed the effects of monetary policy in Malawi by tracing the channels of its transmission mechanism, while recognizing several factors that characterize the economy: market imperfections, fiscal dominance and vulnerability to external shocks. vector autoregressive modeling, Granger-causality and block erogeneity tests as well as innovation accounting analyses were conducted. The study established lack of unequivocal evidence in support of a conventional channel of the monetary policy transmission mechanism, and found that the exchange rate was the most important variable in predicting prices. Therefore, the study recommends that authorities should be more concerned with imported cost-push inflation rather than demand-pull inflation. In the short term, pursuing a prudent exchange rate policy that recognizes the country's precarious foreign reserve position could be critical in deepening domestic price stability. Beyond the short term, price stability could be sustained through the implementation of policies directed towards building a strong foreign exchange

reserve base, as well as developing a sustainable approach to the country's reliance on development assistance.

Onyiewu, (2012), examines the impact of monetary policy on the Nigerian economy between 1981 and 2008. The study employs Ordinary Least Squares Method (OLS). The result of the analysis shows that monetary policy presented by money supply exerts a positive impact on GDP growth and Balance of Payment but negative impact on rate of inflation. The recommendations are that monetary policy should facilitate a favourable investment climate through appropriate interest rates, exchange rate and liquidity management mechanism and the money market should provide more financial instruments that satisfy the requirement of the ever-growing sophistication of operators.

Apere&Karimo, (2015), investigates the transmission channel of monetary policy shocks to agricultural output growth over the period 1970 – 2012. Data were drawn from the Central Bank of Nigeria Statistical Bulletin. The study estimated a VAR model and showed that producers are able to effectively transfer increases in cost of production to the final consumer through increased prices; and that though monetary policy shocks, interest rate and consumer prices have dominant impacts on agricultural output growth in Nigeria, but that monetary policy shocks transmitted through the interest rate channel are more effective. It was therefore recommended that monetary policy efforts to revitalize the agricultural sector should focus more on the use of differential interest rates amongst other policy tools.

Apere&Karimo,(2014), examined the effectiveness of monetary policy on economic growth and inflation in Nigeria over the period 1970 to 2011. The lag selection criteria all indicated an optimum lag length of one, therefore a VAR (1) model was estimated using GDP, INTR, CPI, and M2 as endogenous variables.The model was dynamically stable and showed no evidence of serial correlation. Estimation results showed that in the short run it is output and inflation that drives monetary growth, while output growth is affected by inflation only. Results from the impulse response and variance decomposition showed that monetary policy variables may not have an instantaneous impact on output, but are key determinants of output growth in the long–run. Furthermore, in the short–run the levelof production is more important in controlling inflation, but it is monetary policy variables that matter in the long–run. Therefore, there is need to differentiate between short and long run monetary policy targets. It was recommended that, policy makers should concentrate on short-run output expansion policies and put measures in place to sustain growth in the long-run to control inflation. But to maintain long-run output expansion, monetary authorities should aim at adjusting the inter-bank rate but with caution as this can instead cause the problem it is meant to solve.

RESEARCH METHOD

The section presents model specification, description of variables, a prior expectation, estimation techniques and sources of data.

Model Specification

In a bid to integrate both global and domestic macroeconomic variables so as to test the response of output growth in selected oil producing countries in Africa and coupled with the theoretical framework propounded by Flaschel, Ganggolf, proano and Semmler (2006), the model used in the study is explicitly specified as follows:

$GDPgr_{it} = \propto_{it} + \propto_2 RINTR_{it} + \propto_3 EXR_{it} + \propto_4 MS_{it} + \propto_5 MPR_{it} + \propto_6 IBR_{it} + \propto_7 WOP_{it} + \propto_8 USRINTR_{it} + \mu_{it}$ ……..…….3.14

Where:

GDPgr = Gross Domestic Product growth rate
RINR = Real Interest Rate
EXR = Exchange Rate
MS = Money Supply (Broad)
MPR = Monetary Policy Rate
IBR = Interbank Rate
μ = Error Term
$\propto_1$ = Intercept
$\propto_2 - \propto_8$ = Parameter Estimates
i = Countries
t = 1980-2016

Note: These six variables represent the domestic macroeconomic variables
Wop is the World oil price
USRINTR is the US Real Interest Rate (which captures foreign interest rate)
(Note: These two variables represents the global macroeconomic variables

Description of Variables

Variables	Description
Real Gross Domestic Product(RGDP)	Real GDP growth rate represents the change in each country's GDP from one period of time (usually a year) after being adjusted for inflation
Monetary policy Rate (MPR)	The MPR is the official interest rate of the CBN, which anchors all other interest rates in the moneymarket and the economy. It is a measure of monetary policy.
Broad Money Supply(MS2)	This is the combination of both currency and demand deposit that has been corrected from prices fluctuation.
Exchange Rate(EXR)	Exchange rate represents the price of each country's currency in terms of another currency. These were expressed as units of local currencies to US dollars
Interbank rate (IBR)	It is the interest rate charge on short term loans among banks
Real interest Rate (RINTR)	This represents the lending rate adjusted for inflation in the selected African nations.
World Oil Price (WOP)	World Oil Price represents the bench mark price for purchases of oil worldwide and it was measured in US dollars per barrel.
US Real Interest Rate (USRINTR)	US Real Interest Rate represents the United State of America's lending rate adjusted for inflation.

A priori Expectation

$\frac{\partial RGDPgr}{\partial MPR}>0$

It is expected that there will be positive relationship between, real gross domestic product growth rate and Monetary Policy Rate

$\frac{\partial RGDPgr}{\partial MS_2}>0$

It is expected that there will be positive relationship between Real Gross Domestic Product growth rate and Broad Money Supply.

$\frac{\partial RGDPgr}{\partial IBR}<0$

It is expected that there will be negative relationship between Real Gross Domestic Product growth rate and Interbank Rate

$\frac{\partial RGDPgr}{\partial EXR}< 0$

It is expected that there will be inverse relationship between Real Gross Domestic Product growth rate and Exchange Rate

$\frac{\partial RGDPgr}{\partial RINTR}< 0$

It is anticipated that there will be negative relationship between Gross Domestic Product and Real Interest Rate

$\frac{\partial RGDPgr}{\partial WOP}> 0$

It is expected that there will be positive relationship between Real Gross Domestic Product growth rate and World oil price

$\frac{\partial RGDPgr}{\partial USRINTR}< 0$

It is anticipated that there will be negative relationship between Gross Domestic Product and US Real Interest Rate

Estimating Techniques

The estimating technique employed in this study is Panel Co-integration and Error Correction Model based on Panel Co-integration test. Panel Co-integration analysis(macro panels) proposed by (Westerlund, 2007) is used to test for long-run relationship while Error Correction Model Panel Co-integration test is employed to unify short-run relationship with long-run relationship.

Sources of Data

This study relies on secondary data. Data such as Exchange Rate, Real gross domestic product growth rate, Interbank rate were sourced from World Bank Development Indicator, World Bank Data Base, World Bank Global Development Network Growth Data Base, National bureau of statistics and Central Bank of various African countries selected. Data such as Money supply, Monetary policy Rate and Real Interest Rate were sourced from IMF's International Financial Statistics (IFS) and United Nation statistical bulletin (2016).

RESULTS AND DISCUSSION OF THE FINDINGS

This chapter reports and analyzes some empirical tests conducted to carry out the objectives of this study. These empirical tests include: panel unit root test, Panel co-integration and error correction based panel co-integration test. The chapter is concluded by discussing some of the findings drawn from this study.

Results of the Panel Unit Root Tests

The panel dimension of data is examined here so as to investigate the time series property of the variables used in the model of this study. This is done by carrying out a unit root test on each variable. This process is also known as determination of stationarity of the variables. According to Engle and Granger (1957), a variable is stationary when it has no unit root. This is necessary to know how sensitive is each variable to shocks or disturbance over time. A non- stationary variable is the one in which a shock is recommended for long or sustained over time. While a stationary variable may not have its shocks sustained for long. Therefore, in order to perform the unit root test and determine the order of integration of all variables, this study employs the IM Pesaran and Shin (IPS) unit root test as follows:

Table 4.1: IM Pesaran and Shin (IPS) Unit Root Test

IPS UNIT ROOT TEST

Variables	T-Statistics	P-Value	Order of Integration
GDPgr	-8.8364	0.0000***	I(1)
RINTR	-8.5806	0.0000***	I(1)
EXR	-4.1824	0.0000***	I(1)
MS	-6.1743	0.0000***	I(1)
MPR	-5.7613	0.0000***	I(1)
IBR	-5.7818	0.0000***	I(1)
WOP	-7.7120	0.0000***	I(1)
USRINTR	-5.8173	0.0000***	I(1)

Source: Author's Computation

(***) represents statistical significance at 1%. Each model includes trend and constant term.

The results in the table 4.1 show that all the time series variables attain their stationarity at first difference. This indicates that all the variables are integrated of order one, i.eI(1). The economic implication of stationary variable is that any disturbance or shock to it will not be sustained for a long period of time, that is, a shock to the variable will die out over time. Therefore, the properties exhibited by the time series variables in the model create the necessary condition for Panel Co-integration test. In this regard, we proceed to Error Correction based panel Co-integration test.

Error Correction Based Panel Co-Integration Test

Under this test, four basic types of tests are designed for the purpose of testing for panel Co-Integration. These tests are conducted based on both asymptotic distribution and cross-sectional

dependence, that is, boostrapping. Therefore, results of the asymptotic distribution for the four tests are shown in the table 4.2 below.

Table 4.2: Westerlund Panel Co-Integration Test: Asymptotic Distribution Value.

Statistical	Value	Z-Value	P-Value
Gt	-9.939	0.969	0.034
Ga	-10.692	7.412	0.002
Pt	-11.393	0.047	0.005
Pa	-12.999	5.941	0.027

Source: Author's Computation

Each test includes trend and constant terms. The lag and lead length are selected based on AIC and Bartlett Kernel Window. Width is set according to 4[T/100] 2/n which gives approximately 3 in this study.

Judging from the results of probability values of all the four tests in the table 4.2 above, the results strongly show a rejection of the null hypothesis of no long-run relationship between the output growth and Macroeconomic variables. This therefore implies that there is co-movement between output growth and macroeconomic variables in the selected oil producing countries in Africa. We therefore proceed to estimate the Error Correction Model using the fixed effect within regression. Fixed Effects, unlike the Ordinary Least Square, considers heterogeneity across groups and time, hence the estimates from Fixed Effect model are more efficient (Torress, 2010). The results are presented in table 4.3 below

Table 4.3: Fixed Effects (Within) Regression Results of output growth and Macroeconomic variables.

Long-Run Model

Variables	**Coefficient**	**Standard Error**	**Probability**
GDPgr			
RINTR	0.61298264	0.3934742	0.027
EXR	0.6634491	0.3112495	0.010
WOP	0.4191556	0.2291159	0.012
USRINTR	-0.73438512	0.4548279	0.051
Short-Run Model			
DRINTR	0.6533487	0.4523903	0.008
DEXR	0.5894869	0.3185789	0.069
DWOP	0.6153987	0.4559621	0.014
DUSRINTR	-0.5201148	0.5260864	0.024
CONSTANT	146.7479	259.5091	0.573
SIGMA-U	2.7775348		
SIGMA-E	6.2864915		
RHO	0.16332704		

Source: Author's Computation.

F(4,148) = 3.26, Prob> F = 0.00652, R-Squared: Within = 0.7478, Between = 0.5227, Overall = 0.8631

Table 4.3: exhibits the Error – Correction Based Panel Co-Integration regression using the Fixed Effect Model. The results are divided into two parts: The long run and short-run models. The first part shows the variables in their non-differenced forms and thus indicating long-run relationship, while the second segment exhibits the variables in their differenced forms showing the short-run relationships. From the long-run model, empirical results indicate that all the macroeconomic variables have significant relationship with the output growth. This is quite evident as Real Interest Rate, Exchange Rate and World Oil Price have significant positive impacts on the GDPgr while US Real Interest Rate exerts significant but negative impact on GDPgr. In the same vein, the results from the short-run model show that all the four macroeconomic variables have significant relationships with the output growth in the selected oil producing countries in Africa. Moreover, the overall R-squared of the results indicates that 86% variation in the output growth is explained by all the macroeconomic variables. The Fixed Effect estimated model is also statistically significant when we consider the F-statistics of 3.26 at 10% level of significance and the F-probability value of 0.00652. The implication is that the macroeconomic variables may jointly have a significant effect on output growth in the selected oil producing countries in Africa during the period under review.

As a result of the possibility of cross sectional dependence among the cross sectional units, it is very pertinent we conduct a cross-sectional dependence test. This is very necessary as most African countries share a common characteristic particularly the oil producing African countries, thereby giving room for the tendency of sharing similar factors among themselves. However, the responses of cross-sectional units to these common factors will determine whether there is presence of cross-sectional dependence or not. If the test shows a presence of cross-sectional dependence, the indication is that each cross-sectional unit responds differently to the common factors. But if the test shows no presence of the cross-sectional dependence, then, it means the responses of the cross-sectional units to the common factors are the same. The results of the cross-sectional dependence test which is based on the correlation matrix of the residual and Breusch-Pagan LM test of independence are presented below:

DISCUSSION OF FINDINGS

In a bid to guide against spurious regression in this study, time series properties of all the variables were tested by the use of IM Persaran and Shin (IPS) panel unit root test. Going by the results of the unit root test, all the variables are stationary after the first difference i.e. they are integrated of order one I(1) which indicates that any disturbance or shock to the variables will not be sustained for a long period of time. The results further necessitate the reason to proceed to panel cointegration test. The results of Westerlund Panel Co-integration test, confirm that there is long – run relationship between the output growth and macroeconomic variables. The implication of this results is that there is a long term co-movements between output growth and macroeconomic variable in the selected oil producing African countries. Both the long and short – run model of the fixed effect regression results confirmed that all the macroeconomic variables have significant impact on the output growth in the selected oil producing African countries.

CONCLUDING REMARKS

This study examined the relationship between monetary policy shocks and output growth in the selected oil producing African countries using annual, time series data from 1980 to 2016. Specifically, the study also determined the asymmetric effect of macro-economic variables on monetary policy rate. Judging from the results and discussion of findings in this research work, it is therefore concluded that there existed a long term co-movement between output growth and macroeconomic variables in the oil producing Africa countries during the period under review.More so, based, on the findings shown in this study, it is therefore necessary to conclude that the relationship between monetary policy shocks and output growth is asymmetric in the selected oil producing countries in Africa, considering the two business cycle regimes (expansion and recession period) examined in this research work. In line with the findings of this research work, the following are recommended: The output growth of the economy should be the topmost consideration when implementing monetary policy measures in the oil producing Africa countries. In this regard, strong and effective macroeconomic policies should be pursued to stimulate and strengthen the output growth at large. Also, the regulatory and supervisory framework for the financial sector should be strengthened in order to assist the effectiveness of monetary policies of the government in the selected oil producing Africa countries.

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