

# Effects of Monetary Policy Shocks on Output and Prices in Nigeria

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## Abstract

This study examined the effects of monetary policy shocks on output and prices using the state of the economy in Nigeria. Quarterly data from 1986: Q1 to 2016:Q4 on output (GDP), interest rate, money supply, inflation rate, investment and real effective exchange rate were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin, 2016 and World Development Indicator (WDI), 2018. Data collected were analyzed using econometric techniques of Autoregressive Distributive Lag (ARDL). The investigation analysis on the effectiveness of monetary policy shocks showed that in the long run, monetary policy shocks have positive effect on output in boom and negative effect during recession periods but the significant effect in boom is more than the effect in recession period (1.06 and -0.05) while monetary policy shocks in Nigeria have more effects on prices during recession than in boom period (-1.45 and 0.66). The study concluded that monetary policy shock is more effective on output in boom period than recession and have more effects on prices during recession than boom period. Therefore, this study provides fresh empirical evidence on the effectiveness of monetary policy shocks on the state of the economy in Nigeria.

**Keywords:** Asymmetric, shocks, policy, boom, recession, output, prices

## 1. Introduction

Monetary policy is one of the tools used by macroeconomic management to influence outcomes in the real sector of the economy to its desired goal. The goal of every macroeconomic management is to achieve price stability, economic (output) growth, full employment and balance of payment equilibrium which can be achieved through the use of stabilization policy. Stabilization policy refers to the use of fiscal and monetary policies in an economy for the purpose of achieving broad macroeconomic objectives and monetary policy has always been seen as a fundamental instrument over the years for the attainment of these macroeconomic objectives. Studies have shown that monetary policy exerts a great impact on economic activity in developing countries more than fiscal policy (Nigeria inclusive) and greater reliance should be placed on monetary policy actions (Ajayi, 1974, Ajisafe and Folorunso, 2002 and Ekpo, 2009).

The basic goals of monetary policy are the promotion of stable prices, sustainable output growth and employment. In Nigeria, the Central Bank of Nigeria (CBN) is the monetary authority with the mandate of manipulating monetary policy through policy instruments and also uses inflation rate to track the growth rate of the domestic prices. Thus, monetary authorities have often set targets on intermediate variables which include the short term interest rate, growth of money supply and exchange rate in the pursuit of macroeconomic objectives. According to Milton Friedman, Monetary Policy is the action taken by the monetary authorities usually the Central Bank to influence monetary and financial conditions through the availability and cost of credit in pursuit of the broad objectives of sustainable output growth, price stability and healthy balance of payments equilibrium. The discretionary control of money supply involves the expansion or contraction of money and influencing interest rate to make money cheaper or more expensive depending on the prevailing economic conditions and thrust of policy. Monetary policy influences the economy through a variety of channels: interest rates, credit or bank lending, asset prices via exchange rates, equity and housing prices and its actions can be measured through the amount of money in circulation (money supply), exchange rate, interest rate and the level of inflation in an economy, in line with the level of economic activity (Mishkin, 2007).

Some empirical studies have suggested that monetary policy may have asymmetric effects on macroeconomic variables. The idea of symmetric and asymmetric effects of monetary policy could be viewed as what happens when the monetary authority introduces a policy shock or innovation into the economy. Symmetric effect suggests that a 1% increase in the interest rate which is a contractionary monetary policy have the same magnitude effects on the economy as a 1% decrease in the interest rate which is an expansionary monetary policy and in this case monetary authority can use its policy measure in the same manner at any point in time while asymmetric effect occurs when contractionary and expansionary policy shocks do not have the same magnitude effects on the economy and monetary authorities will need to effectively manage these asymmetric effects so as to get the desired results (Hafstain, 2011). Therefore, investigating the rate at which an economy responds to the asymmetric effects of monetary policy actions has important implications for macroeconomic management. It is important to note that the level of changes in the output growth will affect prices. According to the Phillips curve analysis which represents a direct relationship between the growth rate of

output and inflation (i.e., high output growth in the short-run gives rise to inflationary pressures) which implies a positive relationship between output growth and prices.

There are quite a number of studies from Nigeria that have investigated the effects of monetary policy on how aggregate output, as well as other microeconomic variables respond to monetary policy shocks. However, literature is scant on the asymmetric effects of monetary policy on output and prices in Nigeria and the available studies have produced mixed results especially due to sign asymmetric effects; also neglect the simultaneous effects of monetary policy shocks on output and prices; as well as the effects of these policy shocks on the state of the economy in Nigeria (Saibu and Oladeji, 2007; Akanbi, 2015; Apanisile, 2017 and Olayiwola, 2018).

Based on this, the pertinent question to ask is whether the simultaneous effects of monetary policy shock on output and prices in Nigeria is symmetric or not in the short run and in the long run periods using business cycle components. Therefore, the objective of this study is to examine the effects of monetary policy shocks on output and prices using the state of the economy in Nigeria between 1986 and 2016.

This study is organized into five sections and the remaining part is as follows: Section 2 focuses the literature review; section 3 deals with Methodology, variable measurement and sources of data. Section 4 discusses the results with their detailed analysis. Finally, Section 5 attempts to bring together the main findings for concluding remarks

## 2. Empirical Literature Review

The issue of possible asymmetric effects of monetary policy shocks on output and prices has been under discussions since the Great depression era when it was realized that an expansionary policy may not be effective because changes in nominal demand may not necessarily have symmetric effects on output. However, researchers did not empirically test this issue until early 1990s beginning with the seminal work of Cover (1992). Before then, the first distinction made in the effects of changes in nominal demand was about the different effects of anticipated and unanticipated changes in monetary policy on output and prices. According to Cover, expansionary and contractionary monetary policy has different effects on macroeconomic variables (sign asymmetry). Some other researchers then like Morgan (1993); DeLong and Summers, (1998) conclude that positive and negative monetary shocks have asymmetric effects. On the other hand, Ravn and Sola, (1996) find that positive and negative monetary shocks have symmetric effects. This controversy has generated the issue of whether or not this symmetric effect of monetary policy shocks is with respect to the direction of policy action, size of policy shocks and the state of the economy.

Recently, many studies in advanced countries have claimed that contractionary and expansionary monetary policy shocks have asymmetric effects by providing empirical evidences for asymmetry between tight and loose monetary policy shocks (Parker and Rothman, 2004; Hayford, 2006; Crawford, 2007; Sznajderska, 2014; Ulkea and Berument, 2016). Also, Komlan (2013) argues that the effects of monetary policy in Canada show asymmetric preference and his result is consistent with previous findings by Favero and Rovelli, (2003) for the case of USA and Rodriguez(2008) for Canada.

Some other theories based on credit market imperfections, downward wage rigidities and menu cost model suggest that monetary policy is more effective and stronger in a recession than in a boom. Authors such as Garcia and Schaller, (2002); Lo and Piger, (2005); Guerrieri and Iacoviello, (2016) conclude that effect of monetary policy actions during various phases of business cycle were different and support the existence of asymmetry related to the state of economy. Likewise, a considerable amount of empirical research on this issue has emerged as case studies for different developing countries (Aye and Gupta, 2012; Kumar, 2013; Zakir and Malik, 2013).

Based on these existing research results in the literature, there are three main types of effects of monetary policy action tested in the empirical literature so far: First, asymmetry related to the state of the economy. The state asymmetry is defined as a situation when the effect of monetary policy action on output (prices) in recession is different from the effect in the boom period of the economy. Secondly, asymmetry related to the direction of policy action. Here, expansionary monetary policy affects output (prices) differently as compared with a contractionary monetary policy (sign asymmetry) and lastly, Asymmetry related to the size of policy action which implies the effect of big monetary policy shocks is different from the effect of small monetary policy changes.

In Nigeria, Saibu and Oladeji, (2007) examine the asymmetric effects of monetary and fiscal policies on real output growth in Nigeria as a small open economy. The empirical results show that monetary policy in most of the output measures was negative and insignificant while fiscal policy had asymmetrical positive effect in most cases. Also, Akanbi, (2015) examines the relationship between monetary policy shocks and industrial output in Nigeria. The study concludes that the size of negative monetary policy shocks is bigger than that of positive monetary policy shocks using Autoregressive Distributed Lags (ARDL) procedure. But this investigation is only based on the effects of monetary shocks on industrial output without considering the effects of policy shocks on prices and aggregate output. Recently, Apanisile, 2017 examines the long- run asymmetry

effects of monetary policy shocks on output in Nigeria (sign asymmetric). The results show that both component of money supply have positive long-run effect on output in Nigeria and conclude that the long run effects of monetary policy on output are symmetric (not asymmetric) because their coefficients are the same but the study neglects the simultaneous effect of policy shocks on output and prices as well as the short and long run effectiveness of the policy shocks on the state of the economy. This implies that only sign asymmetric effects of monetary policy on output (majorly) has been considered so far in Nigeria with mixed findings and no attention was paid to the effects of different stance (tight or loose) of monetary policy action taken on output and prices at different state of the economy (recession or boom).

### 3. Methodology, variable Measurement and Data Sources

#### 3.1 Model Specification

Drawing from the need to examine the effectiveness of monetary policy shocks on output and prices which may be asymmetric or not using state of the economy in Nigeria, the empirical methodology that is employed by this study follows a modification approach to the two step procedure given by cover (1992), as used by Akbar *etal.*(2012) and Zakir and Malik,( 2013).

To test whether monetary policy action affects output and prices differently in Nigeria using different state of the economy, this study separates the recession and boom period through output (price) growth by decomposing output (price) into business cycle components, boom period for high growth period when the output (price) growth is positive and recession means a low growth period when the output (price) growth is negative. According to Azali (2003); Bernanke and Gertler, (1989) and Taylor (2014), it is expected that when monetary authorities undertake an expansionary monetary policy to improve economic activities in recession, money supply increases while interest rate should reduce and this will enable investors to have access to more funds which will ultimately boost output (price) growth. Likewise, when monetary authorities undertake a contractionary monetary policy to slow down economic activities in boom period in order to reduce inflationary pressure (prices) and output growth, money supply decreases and interest rate would increase.

Therefore, this study uses the output (price) series in boom as those which correspond to the period when output (price) growth is positive, while output (price) in recession as those which occur in the period when output (price) growth is negative.

Therefore, two additional series of output and prices are applicable in line with the state of the economy.

That is:

For output:

$$Y_t = [Y_t^{Bm}, Y_t^{Rec}] \quad (1)$$

$$Y_t^{Bm} = \max(Y_t^{Bm}, 0) \quad (2)$$

$$Y_t^{Rec} = \max(Y_t^{Rec}, 0) \quad (3)$$

And for prices:

$$P_t = [P_t^{Bm}, P_t^{Rec}] \quad (4)$$

$$P_t^{Bm} = \max(P_t^{Bm}, 0) \quad (5)$$

$$P_t^{Rec} = \max(P_t^{Rec}, 0) \quad (6)$$

Where  $Y_t^{Bm}$  ( $P_t^{Bm}$ ) represents output (price) growth in boom or high growth periods, otherwise equal zero and  $Y_t^{Rec}$  ( $P_t^{Rec}$ ) is output (price) growth in recessions or low growth periods otherwise equal to zero.

Now, output and price equations can now be estimated by including monetary policy variables as explanatory variables in the new equations of output and prices as:

$$Y_t^{Bm} = \alpha_0 + \sum_{i=1}^a \alpha_i Y_{t-i}^{Bm} + \sum_{j=0}^b \alpha_j INT_{t-j} + \sum_{k=0}^c \alpha_k M2_{t-k} + \sum_{l=0}^d \alpha_l INVT_{t-l} + \dots + U_t \quad (7)$$

$$Y_t^{Rec} = \alpha_0 + \sum_{i=1}^a \alpha_i Y_{t-i}^{Rec} + \sum_{j=0}^b \alpha_j INT_{t-j} + \sum_{k=0}^c \alpha_k M2_{t-k} + \sum_{l=0}^d \alpha_l INVT_{t-l} + \dots + U_t \quad (8)$$

Also, the new price equations as:

$$P_t^{Bm} = \theta_0 + \sum_{i=1}^a \theta_i P_{t-i}^{Bm} + \sum_{j=0}^b \theta_j INT_{t-j} + \sum_{k=0}^c \theta_k M2_{t-k} + \sum_{l=0}^d \theta_l EXC_{t-l} + \dots + U_t \quad (9)$$

$$P_t^{Rec} = \theta_0 + \sum_{i=1}^a \theta_i P_{t-i}^{Rec} + \sum_{j=0}^b \theta_j INT_{t-j} + \sum_{k=0}^c \theta_k M2_{t-k} + \sum_{l=0}^d \theta_l EXC_{t-l} + \dots + U_t \quad (10)$$

If the coefficients of monetary policy variables in output and price equations are significant, using these coefficients as a measure of monetary policy shock effectiveness, this implies that the effects of monetary policy shocks in recession (low/negative growth period) and boom(high/positive growth period)are significant and

effective in the economy. After testing the stationarity properties of all the series employed through the conventional Augmented Dickey–Fuller (ADF) unit root tests, the objective of this study is achieved by estimating equation (7, 8, 9 and 10) using Autoregressive Distributive Lag (ARDL). The ARDL is considered best methods because it uses Error Correcting Mechanisms in detecting the hidden co integration in both long- and the short-run periods and can be applied irrespective of whether the regressors are stationary at level I(0) or at the first difference I(1).

### 3.2 Measurement of Variable and Sources of Data

In order to examine the effectiveness of monetary policy shocks on output and prices in Nigeria using the state of the economy, this study used quarterly data from 1986:Q1 to 2016:Q4 containing variables like: output (proxy by Nominal GDP), money supply (M2), interest rate (proxy by Treasury bill rate), inflation rates as measured by the consumer price index and investment (proxy by Gross fixed capital formation). Data were measured in current local currency (Naira) and sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and World development indicators (WDI) online version.

## 4. Data Analysis and Discussion of Results

The unit root tests on all variables were carried out using Augmented Dickey- Fuller (ADF) test with intercept and trend and the result is presented in Table 1. Only interest rate was stationary at levels I(0) while other variables(GDP, Investment, Money Supply, Exchange and Inflation rate ) were stationary at first difference I(1) (that is, they were not integrated at order zero but they became stationary after first differencing).

Table 1. Unit Root Test

Variables	M2	EXCH	INTR	INFL	GDP	INVESTMENT
ADF	-4.034997*	-4.037668*	-3.446765**	-4.047795*	-4.034997*	-3.150986**
Stationary Status	I(1)	I(1)	I(0)	I(1)	I(1)	I(1)

\* / \*\* / \*\*\* represent stationary at 1, 5 and 10 percent level respectively.

To achieve the stated objective of this study, Autoregressive Distributive Lag (ARDL) was adopted to examine the effectiveness of monetary policy on the state of the economy using relative effects of various monetary policy instruments on output and prices. The results on the effectiveness of monetary policy shocks from Tables 2; showed that in the short run monetary policy shocks have positive and significant effect on output in boom period for money supply and exchange rate, but interest rate does not have significant effect on output. This implied that monetary policy shocks have meaningful effects on output in Nigeria using money supply and exchange rate instruments during boom period and ineffective with interest rate policy instrument and also suggested that monetary policy shocks in the short run do not have meaningful effect on output during recession period. However, monetary policy shocks in boom and recession periods indicated that only money supply (M2) out of the three policy instruments has significant effect on output in Nigeria in the long run. The findings showed that monetary policy shocks have positive and significant effect in boom and negative effect during recession periods while the effect in boom is more than the effect in recession period (1.06 and -0.05). Furthermore, findings from Table 3; also revealed that monetary policy shocks appear to be more effective in boom than recession period as the shocks affect price level strongly in the short run. On the other hand, the results suggested that monetary policy shocks in Nigeria have more effects on prices during recession than boom period in the long run (-1.45 and 0.66). That is monetary policy shocks have significant effects on prices in Nigeria both in boom and recession periods in the long run for the three policy instruments but money supply appears to be more effective. In recession, money supply and exchange rate are negative and significant but money supply appears to have more effect on prices while interest rate has no significant effect.

Table 2: Short and Long run Effectiveness of Monetary Policy Shocks on Output(2 Lags)

Short run Coefficients of Monetary policy shocks on output Boom period ARDL(1, 1, 0, 0, 1)				Short run Coefficients of Monetary policy shocks on output Recession period ARDL(1, 0, 0, 0, 0)			
Variables	Coefficient	t-Statistic	Prob.	Variables	Coefficient	t-Statistic	Prob.
D(INTR)	0.006621 (0.004285)	1.545177	0.1252	D(INTR)	0.000207 (0.000573)	0.360989	0.7188
D(M2)	0.150105* (0.053802)	2.789934	0.0062	D(M2)	-0.003828 (0.002811)	-1.362076	0.1759
D(EXCH)	0.180569** (0.080891)	2.232255	0.0276	D(EXCH)	-0.004666 (0.005914)	-0.788997	0.4318
ECM(-1)	-0.141616* (0.047117)	-3.005651	0.0033	ECM(-1)	-0.082298** (0.035437)	-2.322398	0.0220
Long run Coefficients of Monetary policy shocks on output Boom period ARDL(1, 1, 0, 0, 1)				Long run Coefficients of Monetary policy shocks on output Recession period ARDL(1, 0, 0, 0, 0)			
Variables	Coefficient	t-Statistic	Prob.	Variables	Coefficient	t-Statistic	Prob.
INTR	0.000077 (0.021261)	0.003610	0.9971	INTR	0.002513 (0.007074)	0.355279	0.7230
M2	1.059943* (0.074799)	14.170472	0.0000	M2	-0.046519*** (0.027305)	--1.703697	0.0912
EXCH	0.131493 (0.202744)	0.648569	0.5180	EXCH	-0.056702 (0.073367)	-0.772862	0.4412

*Source: Author's E-views computation results 2018. Note: figures in ( ) are Std. Error and \*/ \*\*/ \*\*\* represent 1, 5 and 10 percent level of significant respectively*

Table 3: Short and Long run Effectiveness of Monetary Policy Shocks on Prices (2 Lags)

Short run Coefficients of Monetary policy shocks on price Boom period ARDL(1, 1, 0, 2, 1)				Short run Coefficients of Monetary policy shocks on price Recession period ARDL(1, 0, 1, 0, 2)			
Variables	Coefficient	t-Statistic	Prob.	Variables	Coefficient	t-Statistic	Prob.
D(INTR)	0.001892 (0.003840)	0.492763	0.6232	D(INTR)	0.001781 (0.003264)	0.545695	0.5864
D(M2(-1))	0.447754* (0.150867)	2.967864	0.0037	D(M2)	-0.118595* (0.036731)	-3.228733	0.0016
D(EXCH)	0.083319 (0.071912)	1.158623	0.2492	D(EXCH)	-0.235634** (0.106819)	2.205912	0.0295
ECM(-1)	-0.194262* (0.050959)	-3.812135	0.0002	ECM(-1)	-0.081875* (0.030881)	-2.651325	0.0092
Long run Coefficients of Monetary policy shocks on price Boom period ARDL(1, 1, 0, 2, 1)				Long run Coefficients of Monetary policy shocks on price Recession period ARDL(1, 0, 1, 0, 2)			
Variables	Coefficient	t-Statistic	Prob.	Variables	Coefficient	t-Statistic	Prob.
INTR	-0.026227*** (0.013473)	-1.946638	0.0542	INTR	0.021755 (0.037120)	0.586069	0.5590
M2	0.657737* (0.047265)	13.915826	0.0000	M2	-1.448484* (0.186819)	-7.753404	0.0000
EXCH	-0.430074* (0.131002)	-3.282959	0.0014	EXCH	0.92042** (0.382117)	2.408737	0.0177

*Source: Author's E-views computation results 2018. Note: figures in ( ) are Std. Error and \*/ \*\*/ \*\*\* represent 1, 5 and 10 percent level of significant respectively*

## 5. Conclusion

The general conclusion that could be drawn from the analysis of the effectiveness of monetary policy shocks on the state of the economy revealed that monetary policy shocks have positive and significant effect on output in boom and negative effect during recession periods but the effect in boom is more than the effect in recession period. However, monetary policy shocks in the short run do not have meaningful effect on output during recession period. Also, only money supply (M2) out of the three policy instruments has significant effect on output in the long run during boom and recession periods and concluded that due to the ineffectiveness of interest rate, money supply (M2) is the most effective monetary policy instrument in Nigeria. On the other hand, the study concluded that monetary policy shocks are more effective on price level in boom than recession period in the short run while monetary policy shocks in Nigeria have more effects on prices during recession than boom period in the long run. Therefore, it is recommended that monetary authority and policy makers in Nigeria make use of money supply more as the most relevant measure of monetary policy in the economy; regulate interest rate downward moderately to a more competitive level and make credit market more accessible to the private investors with strict guidelines and monitoring.



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