Effects of Anticipated and Unanticipated Monetary Policy on Output in Nigeria

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Abstract
Controversy abounds in both theoretical and empirical literature on the relative importance, and the real effects of anticipated and unanticipated monetary policy on output. Early authors argue that outputs are affected only by unanticipated monetary policy shocks while Keynesian theorists believe in the efficacy of the anticipated monetary policy shocks to orchestrate real effects on the economy. On this backdrop, this present study examines the effects of anticipated and unanticipated monetary policy on output in Nigeria using annual secondary data from 1986 to 2020. The study employs Autoregressive Distributed Lag (ARDL) model to estimate how anticipated and unanticipated monetary policy affects output in Nigeria. Our results show that there exists a long run level relationship among anticipated and unanticipated monetary policy and output in Nigeria. The results also show that the effect of anticipated monetary policy is neutral on output while unanticipated monetary policy has a significant positive effect on output. Therefore, the study aligns with the rational expectation theory that only the unanticipated monetary shocks affect the real economy.

Keywords: Anticipated monetary policy; Unanticipated monetary policy; Output; Growth; Autoregressive Distributed Lag (ARDL) model; Nigeria.

JEL Classification Codes: E5, E52, F43

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1. Introduction

The real effect of anticipated and unanticipated monetary policy on output is an important issue in macroeconomics as it remains an unresolved object of debate in economic literature. It is also of relative importance to monetary policy authorities such as Central Bank since it has significant consequences for the conduct of monetary policy. Early authors (such as Phelps, 1967, Friedman, 1968; Lucas, 1972) have argued that output and employment are affected only by money surprises or unexpected monetary policy shocks while Keynesian theorists (*see* Romer & Romer, 1994; Cochrane, 1997; Taylor, 1980) affirm that anticipated monetary policy shocks also have real effects on the economy. Correspondingly, the effects of monetary policy on output have also been polarized into two strands of empirical literature in line with the above schools of thoughts. A strand of extant literature (see Leiderman, 1978; Grossman, 1979; Barrow & Rush, 1980) posits that in the short run, unanticipated monetary policy has positive effects on output while anticipated monetary policy is neutral and has no real effect on output while others such as Hoover & Jordan (2001); Gottschalk & Hopper (2001) are of the belief that anticipated policy has real effects though lower compared to the impact of unanticipated policy.

Some business cycle models categorized anticipated policy shocks as news about the future policies and unanticipated shocks as surprised shocks that are unexpected by the market agents (Milani & Treadwell 2012; D'Amico & King 2016). Studies on the effects of unanticipated policy on output have been investigated more in the literature because of the believe that it is a surprise to the economy which affects output. However, studies on effects of anticipated policy on output are scare, received limited attention and barely investigated. It was noticed in the literature that most of these studies were on developed countries while there were only few studies for the developing countries. Also, some studies empirically verified and argued that anticipated monetary policy is as effective as unanticipated monetary policy but of the opinion that there exists some threshold level of anticipated monetary policy effectiveness (Khundrakpam, 2017).

Monetary policy is important to maintain stability in the general price level, promote output growth and employment and so adjust to macroeconomic development (Friedman, 2000). The effectiveness of monetary policy lies in the transmission mechanism through the Central bank (Friedman, 2000). One of the important roles of the Central banks is to conduct monetary policy to achieve price stability and manage fluctuations in the economy. The two major approaches adopted for monetary policy are monetary targeting and inflation targeting. Monetary targeting implies setting the target level or growth rate of monetary aggregates (such as money supply) to stabilize the economy. For inflation targeting, the central bank targets inflation and uses policy rate (interest rate) to achieve the target. Cost of inflation targeting may produce excessive output volatility in the sense that as inflation responds to output gap, output gap responds to interest rate (Philip & Malcom, 2002). Also, the variations in interest rate affects aggregate demand and inflation rate while money stock adjust to the price level (Philip and Malcom, 2002). Developed countries began to transit from monetary targeting framework to inflation targeting framework because of the development in the financial sector. The adoption of inflation targeting by many central banks gave rise to important implications for the discussion on anticipated and unanticipated monetary policy (Sentral, 2013). Some of the central banks have adopted inflation targeting framework for monetary policy since 1990 with New Zealand as the first country to adopt

and some other countries such as United Kingdom, Australia and South Africa adopted it afterwards (Sentral, 2013).

Nigeria adopted inflation targeting regime in the year 2000 because monetary targeting had failed to stabilize the economy through demand for money (Apanisle & Ajilore, 2013). Exchange rate, traditional interest rate, credit asset price channels are some of the various, though related channels through which monetary policy affects output (Disyatat & Vongsinsirikul, 2003). Also, the regulatory banking framework and practices, structures of assets and liabilities through interest rate influence monetary policy (Disyatat & Vongsinsirikul, 2003). Based on the above discussion, this study is set to fill the gap in literature by examining the effectiveness of anticipated and unanticipated monetary policy on output in Nigeria.

The rest of the paper is structured as follows. Section 2 provides a review of the literature. Section 3 presents model specification, data and estimation techniques. Section 4 presents the empirical results, interpretation and discussion of findings, while Section 5 concludes and proffers policy recommendation.

2. Literature Review.

Theoretically, classical economists believe in a dichotomy between nominal and real variables that when there is a change in the nominal variables, it does not affect the real variables such as output and employment in the long run and this is why money is considered neutral because it affects the price levels and not the real variables. However, the Keynesians argued based on the assumption of rigidities in the economy and thus rejects the view of classical dichotomy between nominal and real variables. They believed that prices and wages adjust sluggishly in the short run so that changes in the money supply affects other real macroeconomic variables and raises the aggregate demand. The reputed dichotomy between nominal and real variables raises the question on whether monetary policy has real effects or not. Lucas (1972) argued that with rational expectations, anticipated monetary policy cannot change real GDP neither in predictable nor regular way. Lucas implied that monetary authorities can only affect output by creating a surprise (unanticipated) and not through a predictable (anticipated) change in the monetary policy.

On the empirical side, Lucas (1973) and Sargent & Wallance (1975) proposed Rational Expectations Natural Rate (RENR) Hypothesis that says anticipated monetary policy will be incorporated into the economic agents' behaviour and will therefore have no effect on the real economic activity. This implies that the effects of anticipated changes in money supply on real variables are neutral irrespective of whether one considers the long run or the short run while unanticipated changes in money supply, has a significant effect on real variables in the short run but neutral in the long run. In summary, rational expectation theory states that only unanticipated monetary shocks can affect the real economy. Barro (1978) supported Sargent & Wallace (1975) claim with empirical evidence that in the United State, only the unanticipated component of monetary policy contributed to deviations of output from its natural level. Beladi & Samanta (1988) also tested the validity of RENR hypothesis in developing countries and their findings did not support the validity of the hypothesis. Also, Mishkin (1982) tested the validity of RENR hypothesis and found that both anticipated and unanticipated changes in policy matter.

Buiter (1983) criticized earlier studies that it failed to include some channels through which money can affect real variables. These channels are anticipation of future monetary growth; expectations of monetary growth in a given period and forecast of future monetary growth. It was discovered in their study that failure to include anticipation of future monetary growth could lead to biased estimates of the results. In a different work, Milani & Treadwell (2011) analyzed the role of news (anticipated) against surprises (unanticipated) in monetary policy with the use of a structural general equilibrium specification. They estimated New Keynesian model so as to compare the response of output to policy surprises and news. They found that the contribution of anticipated monetary policy to output fluctuations is larger than the contribution of unanticipated shocks to output. In another study, Milani & Treadwell (2012) concluded that news shocks (anticipated shocks) play a larger role in influencing the business cycle than the unanticipated policy shocks. In their study, Hoover & Jordan (2001) show that anticipated and unanticipated monetary policy may influence the conclusions on the real effects of monetary policy. Laseeni & Vestin (2011) examined the unanticipated effects of anticipated monetary policy shocks by exploring the difference between anticipated and unanticipated nominal shocks and their findings show that the economy reacts based on whether the deviation from the rule was expected or not.

However, in the study of Sentral (2013), unanticipated money shocks increase output gap and reduces inflation and policy rate when compared to the anticipated case in the short-run and likewise, nominal exchange rate adjusts slowly under the unanticipated case. Also, D'Amico & King (2016) examined how beliefs about future monetary policy affects the current state of the economy. Their result shows that at smaller horizons, monetary policy expectation shocks lead to huge and rapid increases in both GDP and inflation while at larger horizons, shocks effect is little and insignificant. Evaluating the welfare effects of anticipated and unanticipated oil price shocks, Wohltmann & Winkler (2008) used a stylized new Keynesian model of a small open economy that depends on intermediate input import to examine the interaction between oil price shocks and monetary policy. Their finding shows that welfare loss increases with anticipated oil shocks than unanticipated oil shocks.

In the United State, Mertens & Ravn (2010) examined the degree at which a DSGE model can account for the impact of tax policy shocks by estimating the response of macroeconomic aggregates to anticipated and unanticipated tax shocks. Their result shows that that unanticipated tax cuts have persistent expansionary effects on output, consumption, investment and hours worked while anticipated tax cuts give rise to contractions in output, investment and hours worked. An empirical update on the impact of an unanticipated change in monetary policy on output growth and inflation in Pakistan was found by Khan et al, (2006) and they found that unanticipated positive shock in monetary policy give rise to an increase in industrial output and inflation while nominal shocks remained the dominant factor in explaining variation in inflation. Unanticipated monetary policy was statistically insignificant in explaining output in the study of Chu and Ratti (1997) when they examined the effects of unanticipated monetary policy on aggregate Japanese output with emphasis on the role of positive and negative shocks.

McMillian & Laumas (2006) empirically analyzed the impacts of both monetary and fiscal policy actions on the stock market. It was assumed in their study that changes in the real value of the stock market affects investment spending and consumption likewise changes in anticipated and unanticipated fiscal and monetary policy also affects the stock markets. It was revealed in their

findings that anticipated as well as unanticipated expansionary fiscal actions raise real stock prices while anticipated expansionary fiscal action increases in money growth have similar effects. Quarterly data from 2010:1 to 2010:4 was used to examine the stance of inflation targeting monetary policy in Nigeria using Taylor policy rule by Apanisile & Ajilore (2013). They found that achieving price stability in the economy was effective through the implementation of monetary policy.

The study of Best & Kapinos (2016) also contribute to the interaction between anticipated shocks and Taylor rules using the US economy as a case study. They used Bayesian estimation techniques to examine if the response of interest rate to future macroeconomic fluctuations is economically necessary as proposed in the literature. Their findings show that for the US economy, anticipated monetary policy are very important. Laseen & Svensson (2011) also specifies an algorithm to estimate policy projections conditioned on alternative anticipated policy rate paths in linearized dynamic stochastic general equilibrium (DSGE) model. Their analysis shows that unusual equilibria may be caused from restrictions on the nominal policy rate for several periods if inflation is sensitive to the real policy rate. Pragidis et al, (2013) examined the asymmetric effects in monetary policy implementation and the effects of anticipated and unanticipated monetary policy shocks on the growth rate of real industrial production in the US and Brazil by employing Logistic Smooth Transition Autoregressive (LSTAR) of the Taylor rule which describes best the US FED funds rate while a linear Taylor rule including a dummy variable describes best the reaction of the Central bank of Brazil. They found that in US, only unanticipated monetary shocks have statistically significant impact on the real economy while in Brazil, there was a significant impact of a positive monetary shocks. Thus, their study supports the rational expectation theory.

Khundrakpan (2017) analyzed the asymmetric effects of monetary policy on aggregate demand and its components in India with a quarterly data from 1996-1997Q1 to 2013-2014Q3. They used the ordinary least square approach to get residual and fitted component. The residual component which were segregated into positive and negative components to represent unanticipated tightening policy rate and unanticipated loosening policy rate respectively while the fitted component was categorized into higher and lower threshold level. They found that unanticipated interest rate changes on inflation is negative and symmetric while anticipated policy rate change have a negative impact on aggregate demand and its components.

The study of Thanh et al, (2019) on asymmetric effects of unanticipated monetary shocks on stock prices in India over the period 1994M4-2018M11 found that unanticipated monetary shocks have significantly asymmetrically lagged effects on stock prices. Goshit et al (2020) also investigate the asymmetric effects of monetary policy shocks on output growth in Nigeria using Nonlinear ARDL and quarterly data from 1981Q1 to 2018Q4. They found that in the long run, monetary policy shocks have positive, elastic and statistically significant effect on output growth.

3. Model Specification, Data and Estimation Techniques

In inflation targeting framework, Central Banks often employ Taylor rule to guide its interest rate setting process. Taylor rule found that Central Bank changed its policy rate target because of the instability in inflation and output gap in most economies (Taylor, 1999). Taylor (2020) proposed that a relationship exist between interest rate and exchange rate. Based on CBN's policy reaction function, we have Equation 1 which generates data for fitted and residuals that measures the

expected and unexpected monetary policy respectively. The reaction function equation is shown in equation below

$$INTR_t = \propto_0 + \beta_1 INFL_t + \beta_2 OUTGAP_t + \beta_3 LEXRT_t + \mu_t \quad (1)$$

Where INTR is the interest rate, INFL is the inflation, OUTGAP output gap, LEXRT is the log of exchange rate and is the error term. Conventionally, monetary policy affects output and inflation through interest rate which influence aggregate demand and output gap. This will in turn through the Philip curve relationship affects inflation (Gerlach and Smets, 1999). The output gap is calculated as the percentage deviation of real GDP from potential GDP. Output gap is not directly observed but rather estimated. The process of estimating it is from data on actual output using Hodrick-Prescott (HP) filter. This is done by regressing the log of output on a polynomial in time and so interpret the outcome of the residuals as the output gap. We then proceed to specify the linear relationship among our variables and this is expressed in equation two and three below.

$$GDP = f(ANT, UANT, OUTGAP, INFL) \quad (2)$$

$$GDP_t = \varphi_0 + \omega_1 ANT_t + \omega_2 UANT_t + \omega_3 OUTGAP_t + \omega_4 INFL_t + \varepsilon_t \quad (3)$$

GDP measures the output; ANT measures the anticipated monetary policy while UANT measures the unanticipated monetary policy. OUTGAP and INFL are the control variables. Output Gap and Inflation are included in equation (3) above because monetary policy that uses policy instrument such as interest rate is usually in the form of Taylor rule. Also, Taylor rule has the ability to show the performance of inflation and output gap in an economy.

We employed the Phillips-Peron test by Phillip and Perron (1988) and Augmented Dickey –Fuller (ADF) tests by Elliot et al (1996) to test for the stationarity of our variables. Based on the result of our Unit root, our variables are stationary both at levels and at first difference. This implies that we have a combination of both I(0) and I(1) variables. We also test for the long run relationships among our variables by performing a bound test as shown in Table 3. Based on the result of our bound test, Autoregressive distributed lag (ARDL) model is fit to analyze our model. Pesaran and Shin (1997, 1999, 2001) have developed an ARDL model which has a number of advantages over other cointegrating techniques such as the Johansen cointegration approach (Ajisafe & Okunade, 2020; Olayiwola, *et al.*, 2021; Okunade, 2022).

First of all, the ARDL approach can be applied irrespective of whether the regressors are I(1) and I(0). Second, while the Johansen cointegration techniques require large data samples for validity, the ARDL procedure provides statistically valid result in small samples (Pesaran & Shin, 1997; 1999; Narayan, 2005;). That means it avoids the problem of biasness that arise from small sample size (Okunade & Ajisafe, 2022). Third, the ARDL procedure provides unbiased and valid estimates of the long run model even when some of the regressors are endogenous (Okunade, 2018; Pesaran & Shin, 1999). Furthermore, in using the ARDL Approach, a dummy variable can be included in the co-integration test process, which is not permitted in Johansen's method (Ajisafe & Okunade, 2016; Okunade, *et al*., 2017; Okunade, 2018). Therefore, based on the above mentioned advantages, this study employed the ARDL method of co-integration to investigate the

relationship among financial sector development, economic growth and poverty reduction. The generalized ARDL model is specified as equation 4:

$$Y_t = \alpha + \sum_{j=1}^{p} \theta_j Y_{t-j} + \sum_{j=0}^{q} \beta_j X_{t-j} + \varepsilon_t \quad (4)$$

Where X_t are a vector and the variables are either I(0) or I(1) and cointegrated; θ_j and β_j are the coefficients while α is the constant. From Equation 4, the ARDL equation for our variables can be expressed as Equation 5.

$$\Delta GDP_t = \alpha + \sum_{j=1}^{p} \beta_j \Delta GDP_{t-j} + \sum_{j=0}^{q_1} \sigma_j \Delta ANT_{t-j} + \sum_{j=0}^{q_2} \delta_j \Delta UANT_{t-j} + \sum_{j=0}^{q_3} \gamma_j \Delta INFL_{t-j} + \sum_{j=0}^{q_4} \varphi_j \Delta OUTGAP_{t-j} + \pi ECT_{t-j} + \varepsilon_t \quad (5)$$

π is the speed of adjustment while ECT is the error correction term

3.1 Description and Measurement of Variables

This study employed time-series data from 1986 to 2020. The data for GDP, output gap, anticipated and unanticipated policy were sourced from World Development Indicator while data on interest rate and exchange rate were sourced from Central Bank of Nigeria (CBN) Statistical Bulletin. Gross Domestic Product (GDP) measures the monetary value of final goods and services produced in a country at a given period. It counts all of the output generated within the borders of a country. Anticipated Monetary Policy (ANT) is the news about future policies and it delivers no price surprises while Unanticipated Monetary Policy (UNANT) simply means unexpected events by the market agents and it delivers a non-zero price surprise. Inflation (INFL) is the rate of increase in prices over a given period such as the overall increase in prices of goods, services, cost of living in a country, Output Gap (OUTGAP) is an economic measure of the difference between the actual output of an economy and its potential output, usually expressed as a percentage of gross domestic product. This study employed a time series data from 1986 to 2020 sourced from the World Development Indicator (WDI) and Central Bank of Nigeria (CBN) statistical bulletin.

4. Results, interpretation and Discussion of Findings

4.1 Preliminary Analyses

Table 1 gives the descriptive statistics of our variables which enables us to determine if our data are normally distributed and consistent. The result shows that all the variables are positively skewed; the values of our mean and median are close to each other and lie within the maximum and minimum values which implies that there is consistency in the data. The kurtosis measures how flat or skewed a distribution is and from our result, the kurtosis value of UANT, GDP, and ANT is approximately 3 which implies that it is normally distributed. The kurtosis of OUTGAP is

assumed to be flat and platykurtic relative to the normal because it is less than 3 while that of INFL exceed 3 which is assumed to be peaked and leptokurtic.

Table 1: Descriptive Statistics of the Variables

Variables	Mean	Median	Maximum	Minimum	Skewness	Kurtosis	Jar-Bera	Prob	Obs
UANT	2.86	0.11	10.69	-9.11	0.21	2.90	0.27	0.87	35
GDP	4.20	4.23	15.33	-2.04	0.47	3.27	1.40	0.50	35
ANT	12.13	11.11	18.64	8.96	0.75	2.52	3.63	0.16	35
OUTGAP	4.53	4.50	4.96	4.19	0.21	1.62	3.02	0.22	35
INFL	17.35	11.40	75.40	0.69	1.99	7.56	53.47	0.00	35

Source: Author's Computation, 2021

Table 2 shows the result of our unit root tests. The unit root test was carried out to test the stationarity of our variables so as to avoid a spurious result. We employed Augmented Dickey Fuller (ADF) and the Philip Perron (PP) test. The result indicated that the variables are combination of I(0) and I(1) where output (GDP), unanticipated policy (UANT), and inflation (INFL) are stationary at levels while Output gap (OUTGAP) and anticipated (ANT) are stationary at first difference.

Table 2: Result of the Unit Root Tests

		ADF			PP	
Variable	T-Stat	Prob.	Order	T. Stat	Prob.	Order
GDP	-3.6816***	0.0090	I(0)	-3.5662***	0.0120	1(0)
ANT	-1.1119	0.6997	I(1)	-0.9752	0.7509	1(1)
D(ANT)	-7.0516***	0.0000		-7.0707***	0.0000	
UANT	-3.3992**	0.0180	I(0)	-3.3150**	0.0220	1(0)
INFL	-3.1276**	0.0338	I(0)	-3.1392**	0.0330	1(0)
OUTGAP	-2.5127	0.1233	I(1)	1.5901	0.9992	1(1)
D(OUTGAP)	-2.8259*	0.0666		2.3490**	0.0267	

Source: Authors' Computation, 2021

Note: (***), (**) and (*) indicates significant at 1%, 5% and 10% level respectively.

4.2 Main Analyses: Cointegration and ARDL Results

Since our variables are significant both at levels and at first difference, we estimated the bound cointegration test in order to establish if there is a long run relationship among our variables or not. For us to be able to use the ARDL analysis, there should be an existence of cointegration (Menegaki, 2019). Table 3 shows the bound test result. The null hypothesis states that there is no cointegration while the alternative hypothesis states that there is cointegration. The decision rule says that we accept the null hypothesis if F-value or the absolute value of t-statistics is less than the I(0) and I(1) value and if otherwise, we reject the null hypothesis and accept the alternative hypothesis.

Table 3: Result of ARDL Bound Test for Cointegration

Test Statistic	Value	Sig. Level	I(0)	I(1)
F-statistic	8.922954	10%	2.45	3.52
		5%	2.86	4.01
K	4	2.5%	3.25	4.49
		1%	3.74	5.06

Source: Authors' Computation, 2021. Null Hypothesis: No levels relationship

We reject the null hypothesis of no cointegration and accept the alternative hypothesis of the presence of cointegration because our F-value is greater that the I(0) and I(1) bounds at all levels of significance. Therefore, long run relationship exists among our variables.

After establishing that long run relationship exists among our variables, we estimate equation (5) which gives the short run and long run estimates as shown in Table 4 and Table 5 respectively. The dependent variable is GDP which measures the output. From the result in Table 4, Unanticipated monetary policy shock has a significant positive relationship with output at 10% level of significance in the short run while inflation has a negative relationship with output and significant at 5% while anticipated monetary policy is positive but not significant. The result implies that an increase in unanticipated monetary policy will increase output by 27.57 percent while an increase in inflation will reduce output by 30.8 percent in the short run.

In Table 5, anticipated monetary policy and output gap are not significant; but unanticipated monetary policy is significant at 10% and has a positive relationship with output while inflation has a negative relationship with output and significant at 5% in the long run. This shows that an increase in unanticipated monetary policy will increase output by 19 percent while an increase in inflation will reduce output by 21 percent in the long run. Our results show that the impact of anticipated monetary policy is neutral in both short and long run because it is not significant while unanticipated monetary policy affects output though at a lower percentage of 27.57 percent and 19 percent in the short and the long run respectively. Our result support the rational expectation theory that says only unanticipated monetary shocks affect the real economy while the effect of anticipated shocks is neutral. This finding negates some extant studies (Hoover & Jordan, 2001; Gottschalk & Hopper, 2001; Milani & Treadwell, 2012) which conclude that the contribution of anticipated monetary policy to output fluctuations is larger than the contribution of unanticipated shocks to output.

Table 4: Result of Estimated Short Run ARDL model

Variables	Coefficient	Standard Error	T-Statistics	P-Value
ANT	3.1467	1.9854	1.5849	0.1256
UANT	0.2757*	0.1446	1.9058	0.0682
INFL	-0.3080**	0.1409	-2.1860	0.0384
OUTGAP	2085.503**	869.2026	2.3993	0.0242
C	-52.2562	72.8441	-0.7174	0.4798

Source: Authors' Computation, 2021

Note: (***), (**) and (*) indicates significant at 1%, 5% and 10% level respectively.

Table 5: Result of Estimated Long Run ARDL Model

Variables	Coefficient	Standard Error	T-Statistics	P-Value
ANT	2.1855	1.3327	1.6399	0.1136
UANT	0.1915*	0.0958	1.9987	0.0566
INFL	-0.2139**	0.0916	-2.3364	0.0278
OUTGAP	0.5827	7.0868	0.0822	0.9351
C	-36.2947	50.0834	-0.7247	0.4754

Source: Authors' Computation, 2021

Note: (***), (**) and (*) indicates significant at 1%, 5% and 10% level respectively.

4.3 Diagnostic Tests for the ARDL Model

In empirical research, checking the robustness of the estimated model is conventional and this was done by examining few diagnostic tests which include serial correlation test, heteroscedasticity test, regression specification Error test and stability test.

4.3.1 Testing for Serial Correlation, Heteroscedasticity and Regression Specification Error

To test for the presence of homoscedasticity in the model, the R-squared value in the Arch test in Table 6 accept the null hypothesis of homoscedasticity and reject the alternative hypothesis of presence of heteroscedasticity since the probability value is greater than 5%. In addition, Breusch-Pagan test of serial correlation states the null hypothesis of no serial correlation which is tested against the alternative hypothesis of serial correlation comparing the R-squared (Obs*R-squared) with its corresponding probability value (Pro. Chi-squared). The Obs*R-squared has a value of 2.1133, while its corresponding p-value has a value of 0.4853which is greater than 5%, we accept the null hypothesis that there is no evidence of serial correlation in the model. For the model specification error, the study chooses the Ramsey Reset Test. In the Reset test, the F-statistic value is checked with its corresponding probability value. We reject the null hypothesis if this probability value is less than 5%. From Table 6, since the probability value of 0.8123 is greater than 0.05, at

the 5% significance level, we accept the null hypothesis which suggests that the model is correctly specified.

Also, the results of cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests for structural stability were reported in Figure 1 and 2 in order to be sure that the estimated regression coefficients are not biased. As evident in Figures 1 and 2, the estimated parameters of the regression equations are stable since neither the CUSUM nor CUSUMSQ test statistics exceeds the lower and upper bounds at the 5% level of significance.

Table 6: Heteroscedasticity, Autocorrelation and Specification Error Tests

ARCH Heteroscedasticity Test

F-statistic	0.0401	Prob. F(2,17)	0.7101
Obs*R-squared	0.0439	Prob. Chi-Square(2)	0.4125

Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.8121	Prob. F(1,26)	0.5813
Obs*R-squared	2.1133	Prob. Chi-Square(1)	0.4853

Ramsey RESET Test

	Value	Df	Probability
t-statistic	0.3345	27	0.8123
F-statistic	0.0221	(1, 27)	0.8201

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	5.4420	1	4.7105
Restricted SSR	0.0672	26	0.0045
Unrestricted SSR	0.0672	26	0.0047

Source: Author's Computation, 2021

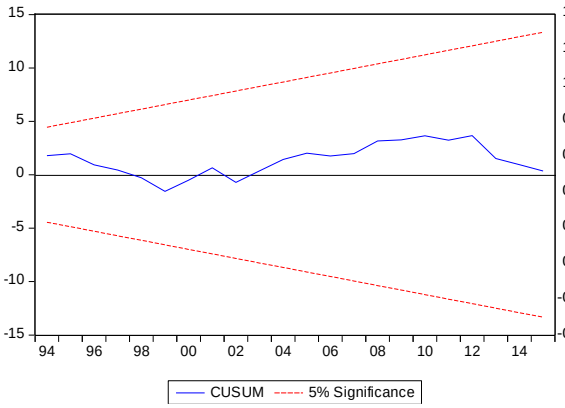

Figure 1: CUMSUM Test

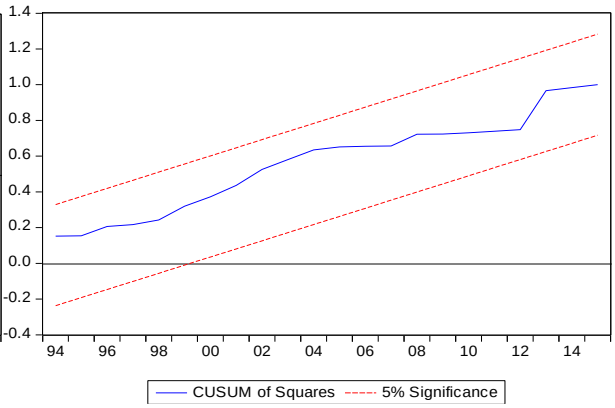

Figure 2: CUMSUM of Square Test

5. Conclusions and policy recommendation

This study examined the effects of anticipated and unanticipated monetary policy on output in Nigeria between 1986 and 2020. This is important because most authors found that unanticipated monetary policy shock affects the real economy but there is a controversy on whether anticipated monetary policy affects the real output or not. While some authors believe that anticipated monetary policy has a neural effect on the real economy, others are of the opinion that effects of anticipated monetary policy or shock on the real economy is also important even though its effects may not be as effective as unanticipated shocks or policy on the real economy but it is also very important to be accounted for. The study adopts bound test cointegration approach and Autoregressive Distributed Lag (ARDL) model. The bound cointegration test result shows that the variables have a long run relationship while the ARDL result shows that anticipated monetary policy does not have a significant effect on output while unanticipated monetary policy has a significant effect on output. Our findings therefore support the rational expectation theory that says only unanticipated monetary shocks affect the real economy but the effect of anticipated shocks is neutral. Therefore, our findings have a number of policy implications for policymakers. The effectiveness of the unanticipated monetary policy implies that monetary feedback rules can have real effects on the stability of Nigerian economy.

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