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Monetary Policy and Price Stability in Nigeria

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Abstract *Irregular price changes, with its economic consequences of market risks and uncertainties, have been one of the most challenging problems facing the Nigerian economy. Successive financial sector reforms, which seek to enhance the role of monetary policy instruments in macroeconomic management, in view of the theoretical and empirical link between monetary policy and general price level, have been implemented with less than satisfactory results. This paper examines the monetary policy in stabilizing price level in Nigeria. We employ the Vector Autoregressive (VAR) model, with in-built differencing to take care of unit root in these time series data, to capture this relationship. From our findings, we discover that, money supply has no significant relationship with price level in Nigeria. This, we believe, may be due to the influence of the large informal financial sector which controls a very significant fraction of money in circulation. Thus, policy reforms that would curb the influence of the informal financial sector should be implemented in order to allow the central monetary authority to work better, and enhance the role of monetary management in Nigeria.*

Key words Monetary policy, price stability, money supply, vector autoregressive, Granger causality

JEL Codes: E52, E63

1. Introduction

Price stability has become one of the most desirable objectives of macroeconomic management. Economists all over the world are unanimous in their affirmation of this position. This is because, frequent price fluctuation, whether persistent increase (inflation) or decrease (deflation), create risks and uncertainties in an economic environment. Fielding (2008) reveals that price instability creates uncertainties about future prices, increases business risks and unanticipated changes in the distribution of wealth. It is important to know that, risks and uncertainties make planning by both consumers and producers difficult, by implication, lead to a fall in the efficiency of the free market in allocating scarce resources and solving other societal and/or economic problems. Whenever prices rise above interest rate of savings, savings is discouraged. This however led to a fall in loanable funds for investment, and consequently, a fall in potential output and employment.

Interestingly, steady and gradual changes in the price level also come with some desired implications. Chiefly among these is its ability to serve as impetus for growth if properly controlled. There is a general believe that at least 3 percent steady growth in the price level in an economy would help boost economic growth. This position is based on the premise that investors are motivated to commit their scarce resources into production of goods and services when they expect a steady rise in the prices of these goods and services. On the other hand, deflation benefits the consumers. It increases their level of demand and consumption and, as a result, increases their standard of living. However, as rightly opined by Berlemann and Nelson (2002), the negative distributional and allocative effects of price instability are typically supposed to dominate the positive ones. There is therefore a need to stabilize prices in such a way that it retains its powers to boost economic growth and employment while ensuring it does not create market risks uncertainties. This has been the target of fiscal and monetary policy instruments which have been jointly administered by most economies today in promoting the macroeconomic goal of price stability.

The Nigerian economic environment is experiencing its own unfortunate share of uncontrollable price fluctuations. Till date, inflation continues to be one of the most challenging of all the numerous economic problems faced the by Nigeria economy. Kumapayi *et al.* (2012) attributed Nigeria's inflation problem to the oil boom of 1970s, and the rise in government expenditure in the wake of the government's determination to enhance post-civil war reconstruction and development. The implication was a rise in domestic money supply without a corresponding increase in domestic production of goods and services. This adversely affects funds mobilization and disbursement for investment, thereby adversely affecting output and employment. This result is an uncontrollable rise in domestic prices of goods and services. Current available economic indicators, which present her as a poverty engulfed country and an unfavourable business environment, point to this fact.

Policy implementations which seek to address Nigeria's inflation problem, by successive governments, can be grouped under fiscal and monetary policy. However, over the years, undue reliance has been placed on fiscal policy rather than monetary policy with very little satisfactory results (Darrat, 1984). There was therefore the need to restructure the money market in order to enhance the role of monetary policy instruments in macroeconomic management in Nigeria. This was the

core of the financial sector liberalization (deregulation) exercise which came under the auspices of the Structural Adjustment Programme (SAP) of 1986 (Ajisafe *et al*., 2002).

Prior to the deregulation exercise, the financial sector operated under financial regulations and interest rates were said to be repressed. Ceilings were imposed on deposit and lending nominal interest rates. The pre-reform period (1960-1986) is considered a period of financial repression and was characterized by a highly regulated monetary policy environment in which policies of directed credits, interest rate ceiling and restrictive monetary expansion were the rule rather than exception (Soyibo and Olayiwola, 2000). The financial liberalization exercise was aimed at enhancing the development of the money market, thereby laying a foundation for proper monetary policy implementation. This, it was hoped, would help control money supply and consequently, control inflation. The functions of the Central Bank, as the apex of the money market, were also boosted. According to Iyaji *et al*. (2012) and Bătrâncea *et al.* (2012), the Central Bank of Nigeria (CBN) was to implements policies through Deposit Money Banks (DMBs) that guarantee the orderly development of the economy through changes in money supply. The target was to control inflation at a rate which would not negate the objectives of economic growth and employment.

Unfortunately, many years after the introduction of SAP, price instability still maintains top ranking position on the list of economic problems affecting the Nigerian economic environment. Even the CBN annual single-digit inflation rate target remains a mirage till this day. This raises questions about the effectiveness of monetary policy in controlling inflation in Nigeria. It is against this backdrop that this research sought to investigate the role of monetary policy in attaining the objective of price stability in Nigeria. More specifically, attempts were made to determine the relationship between money supply and the price level in Nigeria. The estimation technique of this research was developed around the methodology of Vector Autoregression (VAR) model.

It is the expectation of the researcher that this study shall boost already existing literature in this area of economics, and that the findings of the study shall lay a sound foundation for researchers who wish to advance this study by attempting to provide answers to the inconclusive findings that the work has presented. Finally, the study would provide monetary policy authorities with information on the effects of monetary policy actions in Nigeria. This would serve as a guide in the implementation of monetary policy guidelines that promote sound macroeconomic management in Nigeria.

2. Literature review

The relationship between effective monetary policy management and the objective of price stability has a lot of empirical studies. In the study of Kumapayi *et al.* (2012), that used a simple linear regression method to regress inflation rate against Domestic Credit (DCM), Broad Money Supply (M) Fiscal deficit (FD), Trade openness (TO), Interest Rate (INT) Exchange Rate (EXR) and one year lag INF (INF), their findings revealed that while FD, M_2 and INT were possibility related to INT, EXR and TO, INF (-1) were inversely related to inflation (INF). Similarly, Emmanuel (2000) evaluated the impact of monetary policy on inflation in Nigeria between 1980 and 1995. Using ordinary least squares technique (OLS), he regressed inflation on domestic credit, money supply, exchange rate and gross domestic product. In his study, while both domestic credit and gross domestic credit showed a positive and significant relationship with inflation, both Money supply and exchange rate were negatively related inflation.

The study by Iyaji *et al.* (2012) investigated the effectiveness of monetary policy in combating inflation in Nigeria. Using the classical least squares technique, they found liquidity ratio and interest rate to be leading monetary policy instruments that can be used in combating inflation in Nigeria. They however claim that, due to unethical practices by commercial banks in Nigeria, cash reserve ratio, broad money and exchange rate have lost their potency as effective monetary policy instruments in Nigeria. Using ordinary least squares technique, Ajayi (1974) revealed that monetary policy instruments are more potent than fiscal policy in promoting macroeconomic objectives in Nigeria. His findings are similar to those of Ajisafe and Folorunso (2002) who investigated the relative effectiveness of monetary and fiscal policy in macroeconomic management in Nigeria.

In a similar study, using the econometric methods of co integration and error correction mechanism, Folorunsho and Abiola (2000) examined the long –run determinants of inflation in Nigeria between 1970 and 1998. Their result revealed that inflation in Nigeria could be caused by the level of income, money supply, and public sector balance. The results also indicated that in the long-run, exchange rate, money supply, income and fiscal balance determine the inflation spiral in Nigeria. Their conclusion is that a reduction in fiscal deficits, an increase in domestic production and a stable exchange rate should be pursued as means of controlling inflation in Nigeria. The studies by Fielding (2008), and Olubusoye and Oyaromade (2008) showed that efforts of the monetary authorities to stabilize the domestic prices would continuously be disrupted by volatility in the international price of crude oil.

3. Methodology of research

3.1. Data and technique of analysis

The technique of analysis used in this study is the Vector Autoregressive (VAR) model, estimated using monthly time series data covering the period: January, 1996 and October, 2016. This period is significant because various money market reforms, aimed at improving the role of monetary policy in macroeconomic management in Nigeria, were carried out within the period. The data for this study are the Consumer Price Index (CPI) and Broad Money (M_2), used as an embodiment of the monetary policy decisions in Nigeria. They were sourced from the CBN Statistical Bulletin and National Bureau of Statistics (NBS) publications. However, as a precondition for the use of time series data, the unit root properties of the data were first of all verified using the Augmented Dickey Fuller (ADF), the Phillip Peron (PP) tests and KPSS test for unit root. The Johansen test for cointegration was applied to determine the evidence of a long-run relationship among the variables. Thereafter, the VAR model was estimated by differencing the variables in each model to account for unit root. Although one of the shortcomings of the VAR technique pointed out by Gujarati (2009), is that differencing of data to take care of unit root makes VAR to produce unsatisfactory results, this position has been refuted by Marcet (2004) in his paper titled 'Over-differencing VAR's is OK' and by Chris (2002). They argued and showed that differencing non-stationary series produces more satisfactory results than running a VAR in levels. The choice of the optimum lag length was determined by all three of Akaike Info Criterion (AIC), the Schwarz Info Criterion (SIC) and Hannan and Quinn (HQ). Consequently, several VARs were estimated with different lags for each of the models. In line with the argument of Gujarati (2009), the optimum lag is that minimizes the AIC, SIC and HQ.

3.2. Model specification

In line with the objective of this study, the CPI model, expresses the relationship between consumer price index (CPI) and monetary supply (M_2). Both variables were transformed into their natural logs. In our model, equation *eq*1 below, *ln*CPI is expressed as a function of *ln*M_2.

$$\ln CPI = f(\ln M_2) \quad (1)$$

Where:
$lnCPI$ => Log of Consumer Price Index (a proxy for price level)
lnM_2 => Log of broad money (a proxy for money supply)
Both $\alpha_0 + \alpha_1$ were expected to be positive.

4. Empirical findings

4.1. Descriptive statistics

Figure 1 below is the graph of the raw data of CPI and M_2 between with the period under review. These graphs reveal consistent upward trend in the both variables, with M_2 showing little fluctuations beginning from its 125th observation.[1]

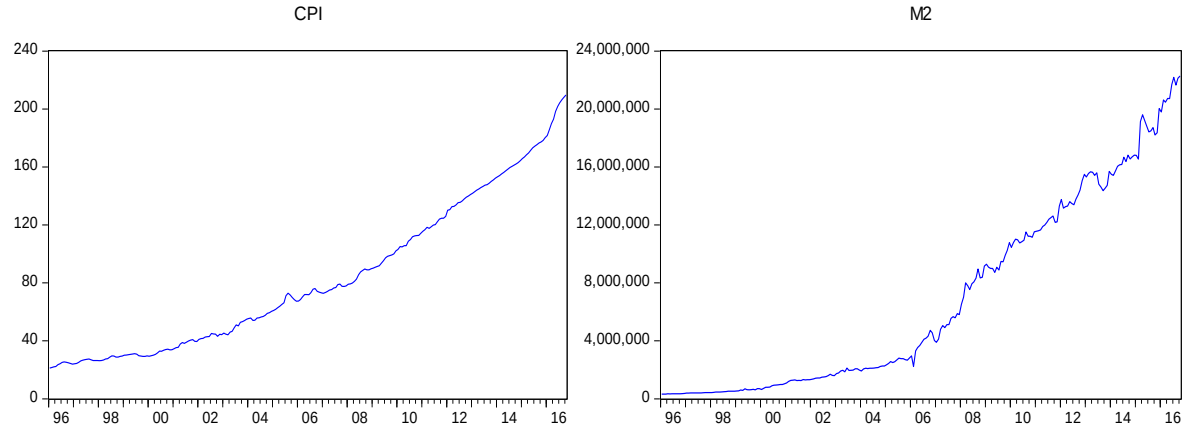

Figure 1. Graphical Presentation of CPI and M_2

[1] The time line of both variables, having 125 observations, runs from January, 1996 to October, 2016.

4.2. Unit root test

The results of the unit root tests are reported in Table 1. The ADF test for CPI reveal that CPI is not stationary but integrated of order I(1).[2] This is confirmed, also, by the PP test. Similarly, both the ADF and PP tests for unit root found money supply to be integrated of order I(1). Next, we verified the existence of cointegration relationship between money supply and CPI. However, in specifying the cointegration test, it is appropriate to indicate the optimum lag (see Chris, 2002). For this reason, the specified VAR model was estimated in levels, and the optimum lag determined. The lag selection procedure is presented in the sub-section below.

Table 1. ADF and PP unit root test results

	ADF		PP	
Variables	*In*	*In + T*	*In*	*In + T*
		Level		
LNCPI	-0.34	-3.38	-0.41	-2.56
LNM2	-1.44	-0.88	-1.54	-0.86
		Δ		
LNCPI	-11.97*	-11.95*	-11.53*	-11.50*
LNM2	-19.63*	-19.71*	-20.15*	-20.47*

*Note: * Significant at 1 percent level.*

Source: Author's estimation, 2017.

4.3. Lag selection

The AIC, SIC and HQ were used to select the optimum lag for the proposed VAR model. The result is shown in table 2 below. The AIC selected a lag of 4, as against 2 lags suggested by SIC and HQ. However, the HQ criterion is superior when they are contradictions between the AIC and SIC. For this reason, the optimum lag of 2 was selected.

Table 2. Lag Selection Criteria Test

Lag	AIC	SC	HQ
0	1.589903	1.618737	1.601519
1	-8.697622	-8.611120	-8.662776
2	-8.780879	-8.6367*	-8.7228*
3	-8.779382	-8.577542	-8.698074
4	-8.792288*	-8.532780	-8.687749
5	-8.789480	-8.472304	-8.661710

* *Selected Optimum Lag*

Source: Author's estimation, 2017.

4.4. Cointegration test

The unit root properties of *In*CPI and *In*M_2, which have been determined to be integrated of order I(1), was necessary to evaluate the possibility of cointegration between them. This test was conducted using the Johansen (1988) test for cointegration, and the result is presented in table 3 below. Here, the null hypothesis of 'one cointegrating equation' is not rejected at 5%, for both Trace statistic and Max. Eigen-value. The conclusion is that both variables do not have long-run relationship. To capture the short-run dynamics, therefore, the first differences of both variables were taken, and an Unrestricted Vector Autoregression was estimated[3].

[2] Though the condition for testing applying the Johansen cointegration test is that both variables must be integrated of order I(1), the cointegration test is usually conducted on variables in their levels.

[3] The absence of a long-run relationship among the two integrated variables implies only a short-run analysis, which an unrestricted VAR model is designed to capture, can be estimated to predict their relationship.

Table 3. Johansen Cointegration Test

Regression model	CPI = *f*(M2)			
No of cointegration equation	Trace test	*P-value*	Maximum eigenvalue test	*P-value*
None	7.0053	*0.5770*	4.4232	*0.8122*
At most 1	2.5821	*0.1081*	2.5822	*0.1081*

Note: There is no cointegration among the variables

Source: Author's estimation, 2017.

4.5. Unrestricted Vector Autocorrelation

The VAR model was estimated with the first difference of both variables following the determination of their I(1) properties, and the absence of cointegration among them. As seen in the table below, in the *ln*CPI equation, only the intercept and coefficient of $lnM_2(-2)$ are significant, as the coefficients of the other terms have t-values that are less than two (2). This implies that, even in the short-run, only the 2 lagged predetermined money supply can only influence CPI in Nigeria. It is therefore safe to say that, there is insufficient information contained in predetermined values of money supply to explain variations in CPI, in both its contemporaneous and future values.[4] This was further evaluated by the result of the VAR granger causality test presented in the next sub-section.

Table 4. Vector Auto-regression Results

Regression model	*lnCPI = ƒ(lnM2)*		*M2 =f(lnCPI)*	
Variable	*Coefficient*	*t-stat*	*Coefficient*	*t-stat*
Cons	0.0065*	3.98	-0.0153	*-0.071*
CPI(-1)	*0.2575*	*0.175*	*0.3023*	1.407
CPI(-2)	*0.0113*	*0.713*	*-0.2473*	-0.386
M2(-1)	*0.0137*	*-0.491*	*-0.128*	-1.991
M2(-2)	*-0.0094**	*5.261*	*0.021**	4.979

*Note: * Significant at 1 percent level*

Source: Author's estimation, 2017.

4.6. VAR Granger causality test

The VAR Granger causality test is usually conducted to determine the direction of relationship among variables. In this case, from the upper part of the table 5 below, the researcher fails to reject, at 5%, the null hypothesis that money supply does not ganger cause CPI. Also, from the lower part of the table, the null hypothesis of no granger causality is rejected. This means there is no granger causality running from either direction between the variables. The implication is that, predetermined values of money supply cannot be used as predictive variables of current and future values of price level in Nigeria, as it does not hold enough information to predict the price level.

Table 5. VAR Granger Causality Tests

∆(LNCPI)			
Excluded	Chi-sq	Df	Prob.
∆(LNM2)	0.960238	2	0.6187
∆(LNM2)			
∆(LNCPI)	2.074447	2	0.3544

Source: *Author's estimation, 2017.*

4.7. Variance decomposition analysis

Table 6 below presents the result of the variance decomposition tests for both *ln*CPI and *ln*M2. This result shows that the impact of own shock on *ln*CPI is above 99 percent across the 10 point time horizon. This result is a clear indication of the low, lagged and contemporaneous, influence of money supply on price level in Nigeria. Similarly, from the lower component

[4] The insignificant relationship revealed by the estimated model raises a lot of questions about the role of monetary policy in promoting price stability in Nigeria.

of table 6, the own shock impact on *ln*M2 accounts for about 98% of total variations in *ln*M2 across the 10 point time horizon. These results indeed confirm the results of the VAR granger causality test above.

Table 6. Variance Decomposition

Period	S.E.	D(LNCPI)	D(LNM2)
1	0.01472	100.0000	0.000000
2	0.01524	99.80786	0.192141
3	0.01528	99.72100	0.279001
4	0.01529	99.72051	0.279494
5	0.01529	99.71944	0.280560
6	0.01529	99.71933	0.280675
7	0.01529	99.71932	0.280681
8	0.01529	99.71932	0.280684
9	0.01529	99.71932	0.280685
10	0.01529	99.71932	0.280685
Period	S.E.	D(LNCPI)	D(LNM2)
1	0.04925	1.450691	98.54931
2	0.05074	1.477916	98.52208
3	0.05101	2.095573	97.90443
4	0.05107	2.095382	97.90462
5	0.05107	2.098361	97.90164
6	0.05108	2.099067	97.90093
7	0.05108	2.099079	97.90092
8	0.05108	2.099093	97.90091
9	0.05108	2.099094	97.90091
10	0.05108	2.099094	97.90091

Source: Authors' Computation, 2017.

4.8. Analysis of Impulse Response Function

Figure 2 below is the Impulse response functions of *ln*CPI and *ln*M_2. This result indicates a positive but insignificant impact to CPI, resulting from shocks to the error of Money Supply across the 10 point time horizon. Also, this impact converges very fast.

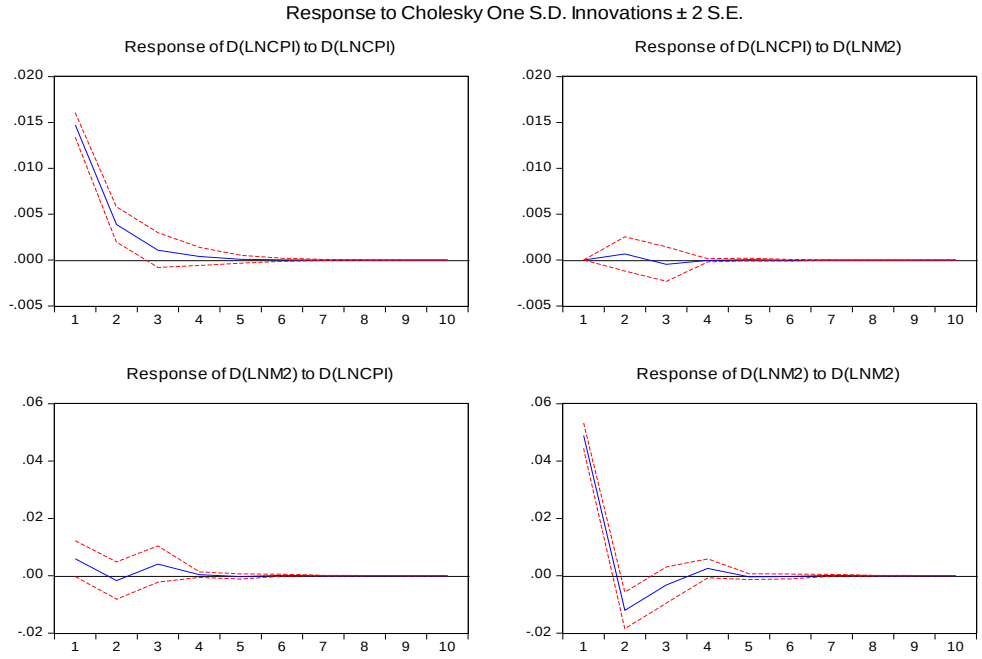

Figure 2. The Impulse Response Functions

4.9. Analysis VEC Residual Serial Correlation LM Test

Table 7 presents the test of residual serial correlation. Under the null hypothesis that the residual of the estimated VAR are not serially correlated, we found no serial correlation in residual of the estimated model, for all 5 lags, at 5% level of significance.

Table 7. The Result of VEC Residual serial Correlation LM Test

Lags	LM-Stat	Prob
1	6.496930	0.1650
2	8.658334	0.0702
3	6.808490	0.1464
4	7.346280	0.1187
5	1.095232	0.8950

***Source*:** Author's estimation, 2017.

5. Conclusions

This paper investigated the role of monetary policy in price stability in Nigeria between 1981 and 2015 by measuring the relationship between the price level in Nigeria (captured by the Consumer Price Index) and money supply (measured by broad money supply). In order to achieve this set objective, the study applied the methodology of Vector Autoregressive (VAR) Model with in-built differencing to take care of unit root in these time series data. The results of the empirical estimates revealed that money does not significantly impact on price level in Nigeria. This position was further strengthened by the result of the VAR granger causality which failed to find causality between the price level and money supply.

On the whole, the role of monetary policy in promoting price stability leaves a gap to be bridged. This may be due to the high influence of 'Outside bank money' and the high level of participation in the informal financial sector in Nigeria. This has significantly reduced the influence of monetary policy instruments targeted at influencing money supply, in keeping with the macroeconomic objective of price stability. One this basis, the researcher recommends that policy reforms, which would help reduce the influence of the informal financial sector, be implemented. This would enhance the influence of the central monetary authority in the financial sector, and by implication, enhance the role of monetary policy in macroeconomic management in Nigeria. We also recommend a further investigation directed at unveiling the role of the entire money market in promoting price stability in Nigeria.

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