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Monetary Policy Disturbance in Nigeria: What Puzzles, Price or Output?

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Abstract

This study examined the empirical relationships between money, price and output in Nigeria. A time series data for monetary policy variables (MPR, M1 and M2), Inflation (GDP deflator and CPI inflation) and real GDP were collected from Central Bank of Nigeria's statistical bulletin from 1981:Q1 to 2013:Q4. The study was carried out in threefold: firstly, is the estimation of the short run relationship between money, output and price using correlation coefficient. The evidence shows a positive and strong relation between money and output but negative and weak relation between money and price. Secondly, the study determined the nature of the short run causation between output and money using Granger causality test. The result reveals that money cause output and not the other way. Finally, the impact of monetary policy shock on price and output was estimated using structural vector autoregressive model (SVAR), the empirical evidence reveals the existence of puzzling relationship between monetary policy shock and output in Nigeria. Therefore, the study recommends that the central bank can lower interest rate in order to achieve some level of output gain in the short run. .

Keywords: Monetary Policy, Disturbance, Price, Output, Nigeria.

JEL Classification: E31, E32, E52, C22, C32.

Contribution/Originality:
This study contributed to the existing literature in terms of the puzzling relationship between monetary policy instrument, output and prices. It has examined the impact of monetary policy shock on output and prices, and concluded that the monetary policy shock in Nigeria leads to output puzzle. Thus, it has contributed to monetary policy issues.

1.0 Introduction

The policy debate on whether change in money supply is responsible for business cycle dynamics has received much attention from both the theoretical and empirical points of view. The first attempt to examine the role of money on output followed the work of Friedman and Schwartz (1963a) who found that money supply is correlated with output. The signs and magnitude of the correlation coefficient varies with the definition of money supply. Other studies that found similar results include, McCandless & Weber (1995); Coleman (1996); King & Plosser (1984). However, the correlation coefficient only explains the degree of the relationship but not the causal relation between the variables; see for example, Friedman & Schwartz (1963a). This led to the reverse causation debate argument by King & Plosser (1984) that the correlation between monetary aggregate and output arise from the response of the monetary authority via banking sector to economic disturbances; therefore, increase in economic activities is responsible for money expansion not the other way round. In order to examine causation, Friedman & Meiselman (1983) applied econometric time series model to estimate the relationship between output and money with view to find whether fiscal or monetary

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policy is responsible for output fluctuation. The equation was later popularized as Louis equation which shows that monetary not fiscal policy is responsible for output movement. These findings support the early conclusion of Friedman and Schwartz (1963a). With the improvement on the econometric techniques on estimating the causal relationship between economic variables, various attempts has been made to examine the nature of the causal relationship between money and output for different economies and both in the short and long run see for example; Sims (1980); Lucas (1996); Leeper, Sims & Zha (1996); Eichenbaum & Singletonthe (1987); Stock & Watson (1989) among others. The conclusion from these studies in particular and monetary policy literature in general is as follows: i) in short run, which last for about 8 quarters, money is responsible for the output fluctuation. This is the whole idea of output puzzling. It implies that, change in nominal stock of money will lead to change in output. ii) but in the long run, money exhibit neutrality; that is, it has no effect on output.

However, Eichanbaum (1992) found the opposite result, when he estimated four variables VAR for US, the result shows that when short term interest rate was used as measure of the monetary policy, no output puzzling was found, that is an expansionary or contractionary monetary policy leads to rise/fall in price level and that is how price puzzle emerge in the literature. Sims (1992) re-estimated Eichanbaum (1992) with addition of exchange rate index and commodity prices index for US, UK, Japan, France and Germany and the result shows that price puzzle disappeared. This implies that the possible source of price puzzle as found in Eichanbaum (1992) is due to limited information contained in the VAR.

For the Nigerian economy, empirical evidences trying to ascertain the relationship between money, output and prices exist. For example, the works of Chuku (2009) and Mordi and Adebayo (2014) among others. Chuku (2009) examines the impact of monetary policy disturbance in Nigeria using three measures of policy instruments; that is, base money (M2), monetary policy rate (MPR) and real effective exchange rate (REER). He found that the quantitative instrument have modest effect on output and price, whereas, the price instruments have no effect, the problem with Chuku (2009) findings is that he misinterpreted the VAR forecast impulse responses to the structural decomposition of the identified VAR (see page, 124) therefore his findings are likely to be those of VAR but instead of SVAR. Also, the Mordi & Adebayo (2014) analyzed the relationship using impulse response function of FAVAR model which is against the consensus way of assessing impact of monetary policy shock. The objective of this work is to re-examine the empirical evidence on the relationship between monetary policy disturbance, output and prices in Nigeria using the following strategy: first the study examined the correlation and causal relationships between money, output and prices. Secondly, forecast error impulse responses generated from SVAR were used to examine whether the evidence is in favor of output or price puzzle. The rest of the work is organized as follows: section two covers the theoretical and empirical models, the result was presented and discussed in section three while the paper was concluded in section four.

2.0 Theoretical and Empirical Models

2.1 Theoretical Model

A lot of efforts have been made both at theoretical and empirical grounds trying to analyze the monetary policy reaction function of the central banks with a view to explore the systematic and non-systematic response of monetary policy to changes in economic activities. At the theoretical level, Fisher's quantity theory of money was the first attempt in economic literature to model the relationship between prices, money and output. Other efforts includes: Friedman's K rule, Taylor's (1993) instrumental rules and Svensson (1997, 1999, 2003b & 2005) targeting rules. The choice of a rule that best describes the monetary reaction function of central banks is an open debate, see for example; the debate between McCallum & Nelson (2005) versus Svensson (2005). For the sake of

this study, we follow a Taylor (1993) instrumental rules type for the following reasons: firstly, the existence of central bank loss functions and even if it exists, the difficulty or impossibility of defining it as it's not made public. Secondly, the availability of targeted variables, especially in the case of Nigeria.

The Taylor (1993) type rule has widely been applied by empirical studies to analyze the policy reaction function of the central banks. The rule has been modified to include variables other than the inflation and output gap; Primiceri (2005); Milani & Belviso (2006) and for both forward and backward looking central banks behaviors. See for example; Clarida, Gali & Gertler (1999), Woodford (2010); Bernanke, Boivin & Eliasz (2005), Bernanke and Boivin(2003) and Cogley and Sargent (2005) among others. To understand the Taylor's rules consider the following relationship:

$$i_t = \lambda\pi_t + \gamma(y_t - y_t^n) + e_t \quad \text{..... (2.1)}$$

Where the short run interest rate assumed to be a function of inflation and deviation of output from its long run path, the basic Taylor (1993) rules assumed that the coefficient of inflation and output gap should be 0.5. Although in later study he assumed that the coefficient of inflation should be 0.5 while that of output gap should be greater than or equal to zero. Various versions of the rule assumed different magnitude of the inflation and output gap coefficients and the consensus is that the magnitude of the coefficient of inflation should lead that of output gap for an aggressive monetary policy response.

2.2 Empirical Model

Structural Vector Autoregressive (SVAR) is the econometric model that is popularly used in assessing the impact of monetary policy disturbance on macroeconomic variables, for example; see the works of, Sims (1972, 1980 & 1992), Leeper, Sims & Zha (1996), Eichenbaum (1992), Bernanke, Boivin & Eliasz (2005) among others. For the sake of this study, same model is utilized. In order to understand the model, consider the following structural equation:

$$AY_t = \alpha(L)Y_t + Be_t \quad \text{..... (2.2)}$$

Where; A is NxN contemporaneous impact matrix which measures the simultaneous response of the variables within the system, B is also an NxN matrix and it represent the instantaneous impact of the structural shocks. Y_t is a Nx1 vector of endogenous variables. The term $\alpha(L)Y_t$ represent the dynamics component of the explanatory variables and e_t is an Nx1 vector of structural shocks. Diving both side of equation (2.2) by A gives the reduced form of equation (2.2):

$$Y_t = \gamma(L)Y_t + U_t \quad \text{..... (2.3)}$$

Where $\gamma(L) = a(L) \times A^{-1}$ and $U_t = BA^{-1}e_t$. To make equation (2.3) clearer, let assumes that Y_t is a 4x1 vector which contains short term interest rate and base money; that is, the monetary policy instruments, inflation and output gap. These are the variables in equation (2.1) which is our theoretical framework. Re-writing equation (2.3) in matrix form and to reflect the variables of interest to this study gives the following:

$$\begin{bmatrix} i_t \\ m_t^i \\ \pi_t \\ \bar{} \\ y_t \end{bmatrix} = \gamma(L) \begin{bmatrix} i_t \\ m_m^i \\ \pi_t \\ \bar{} \\ y_t \end{bmatrix} + \begin{bmatrix} u_t^i \\ u_t^m \\ u_t^\pi \\ u_t^y \end{bmatrix} \quad \text{..... (2.4)}$$

Since our aim is to determine the impact of monetary policy disturbance on output and price. We examined the component that relates structural shocks parameters with their reduced form counterpart and imposed some restrictions in order to identify the relation. This can be done by equating the reduced form shocks with the structural shocks. Writing this relation in matrix form gives the following:

$$\begin{bmatrix} a_{11} & . & . & a_{1n} \\ . & a_{22} & . & . \\ . & . & a_{33} & . \\ a_{m1} & . & . & a_{anm} \end{bmatrix} \begin{bmatrix} U_t^i \\ U_t^m \\ U_t^\pi \\ U_t^y \end{bmatrix} = \begin{bmatrix} b_{11} & . & . & b_{1n} \\ . & b_{22} & . & . \\ . & . & b_{33} & . \\ b_{m1} & . & . & b_{mn} \end{bmatrix} \begin{bmatrix} e_t^i \\ e_t^m \\ e_t^\pi \\ e_t^y \end{bmatrix} \quad \text{.....(3.5)}$$

In order to retrieve the impact of the structural shocks from the reduced form shocks, we have to impose twenty (20) restrictions in order to make the matrices in equation (3.5) exactly identified. To achieve this, the study imposed the following restrictions which are consistent with the monetary economics literature on tracing the impact of monetary policy shocks; See for Example the works of Sims (2000); Bernanke & Bovin (2003 & 2005); Gali & Getler (2000):

i) We assumed that the structural shocks are orthogonal; that is, the structural shocks are instantaneously uncorrelated. This makes the covariance to be zero
ii) The variables respond to their own shocks fully and contemporaneously.
iii) Monetary policy doesn't respond contemporaneously to output and price. This happens for two reasons: firstly, the setting of policy instrument is done after an interval; this depends on the calendar of monetary policy committee (MPC) meeting. For example, in Nigeria monetary policy instruments are set once after every three months. Secondly, the time it takes to collect and analyze relevant statistical data on impact of monetary policy on economic activities.
iv) In the case of monetary policy in Nigeria, the MPC assumed that they can directly influence both price and quantity of money that is why they set monetary policy rate (MPR); which is directly linked to wholesale market interest rate, cash reserve requirement and liquidity ration; which directly affects base money.
v) The monetary policy transmission mechanism assumes that money affects output first before prices. That's the idea of non neutrality of money.
vi) In the long run, the monetary theory assumed that the impact of monetary policy will be on prices. That's the money is neutral.

By imposing restriction i) on matrix A of equation (2.5), the matrix becomes diagonal. Because the restriction assumes that the errors are not instantaneously correlated and his made all the elements up and below the leading diagonal to be zero. When restriction ii) is imposed on matrix A it becomes an identity matrix. Now, turning to matrix B which is by the right hand side of equation (2.5), if we impose restriction iii) on it which assumes that monetary policy can't respond to price and output shocks contemporaneously. Therefore the policy variable is ordered first and it assumes that all the elements in first row of matrix B became zero except b_{11}. Imposing restriction iv) on matrix B

assumes that base money response instantaneously to monetary policy shock but it respond to output and price shocks with lags. Therefore the money base is order second. Restriction v) assumes that output response to short term interest rate and base money shocks contemporaneously but both base money and short term interest rate respond to output shock with lags. Finally, restriction iv) allowed us to order price variable last.

Based on the above identification procedure, the following relationship between reduced form shocks and structural form shocks is found.

$$U_t^i = b_{11}e_t^i$$

$$U_t^m = b_{21}e_t^i + b_{22}e_t^m$$

$$U_t^y = b_{31}e_t^i + b_{32}e_t^m + b_{33}e_t^y$$

$$U_t^\pi = b_{41}e_t^i + b_{42}e_t^m + b_{43}e_t^y + b_{44}e_t^\pi$$

Given the stability of Y_t, the Wold moving average (MA) representation of the process with structurally decompose errors can be written as:

$$Y_t = \theta_0 u_t + \theta_1 u_{t-1} + \ldots\ldots\ldots\ldots + \sum_{j=1}^{q} \theta_{s-j} u_{t-q} A_j \quad . \quad . \quad . \quad . \quad . \quad . \quad (2.6)$$

Where; Y_t is 4x1 vector of macroeconomic variables, Θ is a 4x4 matrix of structurally identified coefficients and U_t represent 4x1 vector of reduced form shocks. The conditions is that as S tends toward infinity Θ_s will trends toward zero, therefore the impact of U_t on Y_t process is transitory.

2.3 Data and Strategy of the Work

This study was carried out using quarterly time series data of GDP, base money (M1 & M2), GDP deflator from 1981:Q1 to 2013:Q4. However, CPI inflation and MPR data were collected monthly from 2000:M1 to 2013:M12 and 2006:M1 to 2015: M12 respectively. The differences in spans and frequencies of the data arise as a result of the nature and availability of macroeconomic data in Nigeria. The logarithms of all the variables were used except MPR that entered as percentage and consumer price index (CPI) inflation as percentage growth rate. All the series were collected from Central Bank of Nigeria's Statistical Bulletin, 2014. In terms of the strategy used in the paper, we first estimate the short run correlation coefficients of the variables and then went ahead to determine the causal relationships. This is done using simple correlation coefficient and Granger causality test. For the impact analysis, the study estimated four sets of SVAR models which contained the following variables: MPR, M1, GDP and GDP Deflator; MPR, M2, GDP and GDP Deflator; MPR, M1, GDP and CPI-Inflation and MPR, M2, GDP and CPI for model I, II, III and IV respectively. The differences are in terms of base money and inflation variables. All the identifications and ordering are as discussed in section 2.2 above.

3.0 Empirical Results

In this section the study first present the simple short run correlation coefficients between monetary policy indicators, prices and output. The essence is to see whether the empirical evidence in Nigeria

will be consistent with general empirical regularities. The result is presented in Table 3.1. The study estimated the pair wise correlation coefficients between measures of monetary policy; that is, M1, M2 and MPR and output (GDP) and Inflation (CPI and GDP Deflator). The result shows that monetary aggregates are positively correlated with output with a coefficient of 0.960 and 0.966 for M1 and M2 respectively. Whereas, MPR shows a positive but low correlation coefficient.

Table 3.1: Short Run Correlation Coefficient between Money, Price And Output

Variable	GDP	CPI-Inflation	GDP deflator
M1	0.960	-0.025	0.982
M2	0.966	-0.026	0.976
MPR	0.20	0.04	0.04

Source: Author's Computation

Therefore, in terms of the correlation evidence, quantitative base monetary policy affects output in Nigeria more than the price base policy. This finding is consistent with the empirical regularities on the relationship between output and money. See for example, the works of Friedman and Schwartz (1963a); McCandless & Weber (1995). The result further reveals that the existence of negative but low correlation coefficients between monetary aggregate, and CPI Inflation. However, the MPR versus CPI-inflation correlation shows a positive but low coefficient. In the case of GDP deflator inflation, the result shows the opposite. It shows the presence of positive and high correlation between monetary aggregate and GDP Deflator inflation. But in case of MPR, the correlation coefficient is still positive but very low. This inconsistency of the correlation coefficient results between the two measures of inflation (GDP Deflator and CPI) happens as a result of what constitute the GDP deflator inflation. Therefore we take the evidence of CPI-inflation and disregard that of GDP deflator inflation as per as correlation is concern. Therefore the study concludes that the finding is in favor of positive and strong correlation between money and output and weak correlation between money and prices in the short run. This finding is consistent with the short run empirical regularities between money, prices and output in the short run, see for example the work of McCandless & Weber (1995).

Now since we determined the degree of the correlation coefficient, the study went further to determined the nature of the causal relationship as correlation doesn't imply causality. This is to see whether the argument in the case of Nigeria is in favor of money cause output of Friedman and Schwartz (1963a) or reverse causation; that output cause money of King & Plosser (1984) as explained in section one of this work. The result is presented in Table 3.2 below.

Table 3.2: Estimates of the Granger Causality of money and output

Null Hypothesis	F-statistic(s)	Decision
GDP Cause M1	0.84(0.43)	No Causality
M1 cause GDP	11.91(0.00)	Causality
GDP Cause M2	0.03(0.96)	No Causality
M2 cause GDP	13.7(0.00)	Causality
GDP cause MPR	0.88(041)	No Causality
MPR cause GDP	0.17(0.84)	No Causality

Source: Author's computation. The probability values are in parenthesis

The estimates of the pair wise Granger causality test is presented in Table 3.2. First we determined the order of integration in order to satisfy the theoretical expectation of Granger causality test that all

variables must be stationary. The stationarity evidence is presented in table 3.3 below. The conclusion from the unit root test of the money and output variables reveals the presence of unit root at level but after taking the first difference they became stationary. So, in the case of Granger causality, the differenced series entered into the estimation. The result reveals that presence of uni-directional causality that runs from monetary aggregates (M1 and M2) to output and no causality between MPR and output. Therefore the conclusion is in favor of Friedman & Schwartz (1963a) that money cause output in the short run. This finding is consistent with the correlation coefficients result as presented above and is also consistent with the empirical regularities on the short run relationship between money and output.

In order to see how output and prices respond to monetary policy disturbance, the study first determined the stochastic properties of the series, the study applied ADF and KPSS tests. The essence is to know the order in which the variables will be stationary and entered into the SVAR estimation. This is essential because it ensures the stability of the process. To know the data generating process(DGP) the variables follows which is used in determining the assumption of the deterministic component of the unit tests models, we plot a trend of the series and the result is presented in the appendix section. The pattern of the trend shows that except CPI inflation that has an intercept but shows no evidence of trend, all the other series exhibit evidence of trend and intercept. Therefore we assumed the deterministic component of all the series to include both trend and intercept except CPI-inflation that entered with level only.

Table 3.3: Unit Root Estimates

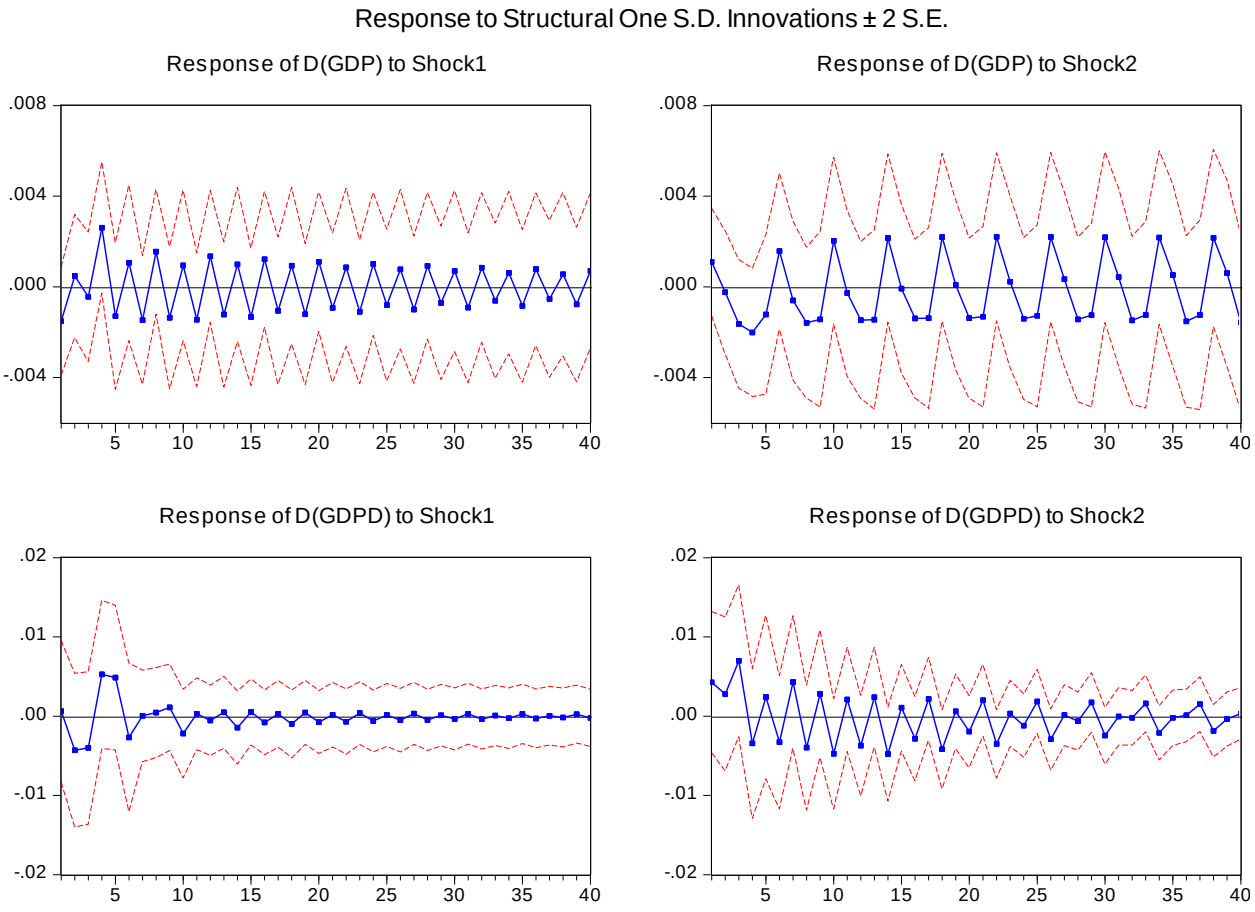
Variables	Level		Difference		
	ADF	KPSS	ADF	KPSS	Decision
CPI-INF	-10.74*	0.008	-9.50	0.460	I(0)
GDPD	-1.04	0.27*	-4.50*	0.10	I(1)
GDP	-1.55	0.29*	-5.59*	0.05	I(1)
M1	-1.81	0.12***	-12.74*	0.15	I(1)
M2	-2.09	0.12***	-12.10*	0.14	I(1)
MPR	-2.01	0.25*	-12.28*	0.07	I(1)

Source: Author's computation

The result of the stochastic properties of the series is presented in Table 3.3. The result shows that CPI-inflation is level stationary using both the ADF and KPSS tests. However, all the other variables are level non stationary using ADF but after taking their first difference they becomes stationary. In the case of KPSS result, base money (M1 and M2) shows insignificant result at 10% which implies that the evidence is in favor of null hypothesis of stationary. The result for GDP deflator, GDP and MPR shows that the series are level non stationary and after first difference they become stationary. Thus, the conclusion we made regarding the stochastic properties of the series are as follows: firstly, CPI-Inflation is level stationary and secondly, GDPD, GDP, M1, M2 and MPR are first differenced stationary. Therefore CPI-inflation entered the identified VAR model at level; whereas, the rest of the variables entered at first difference. This is done in order to ensure the stability of the VAR estimates and forecast error structural decomposition impulse response.

As discussed in section 2.3, the SVAR was estimated for the four models and the response of output and prices to shock 1 and 2; that is, the MPR and M1 shocks for model I and III; MPR and M2 shocks for model II and IV.

Figure 3.1: Forecast Error Structurally Decomposed Impulse responses of Money, Output and Price: Model I



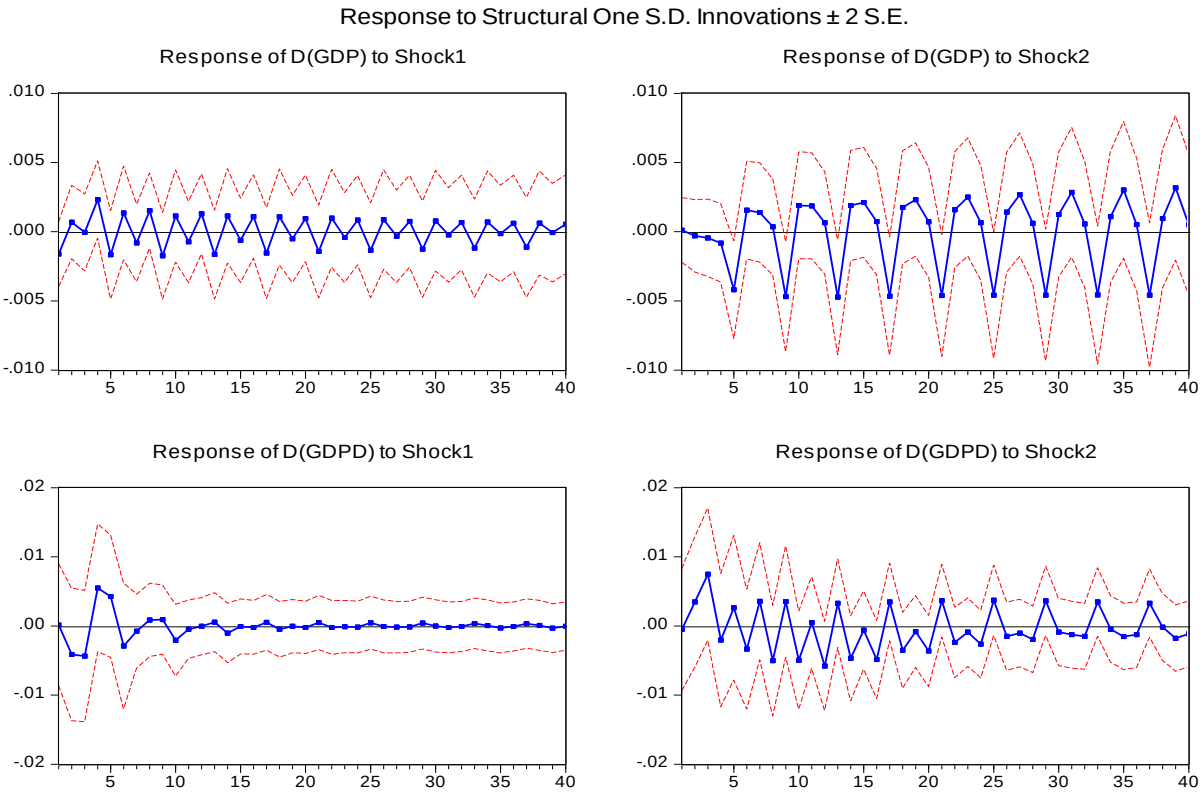
The first panel in figure 3.1 presents the response of GDP to MPR shock. The result reveals that a positive monetary policy shock will lead to rise in output. The impact will last for three quarters before the series will return to its natural trend. Whereas, the second figure in first row shows the response of output to alternative measure of monetary policy shock; that is, M1, it shows that a positive monetary policy shock will lead to decline in output, the shock will last for at least five quarters before it decline to its initial value. This is same across the entire sample horizon. The graphs in the down panel of figure 3.1 show the response of inflation (GDP Deflator) to monetary policy shock. The first graph show the response of inflation to MPR shock, the pattern reveals that monetary shock have an impact that lasted for eight quarters before it dies and from there, the response became statistically not different from zero. The second graph in second row shows the response of inflation to M1 shock. It shows that monetary policy will have a permanent impact on prices. That is, when

there is monetary policy shock prices will respond and impact of the shock will vanish after five quarters. This is consistent with the response of output to M1 shock.

One of the objectives of this work is to examine whether monetary policy shock will lead to output or price change. That is, whether a positive monetary policy shock will followed by an increase in output (output puzzles) or increase in price (price puzzles). This can be achieved by examining the graphs of the upper and lower panel of figure 3.1. The graphs reveals that a monetary policy shock will lead to rise in output and price remain constant. This can be seen by the pattern of the upper and lower graphs of first column in figure 3.1. However, the second column shows the opposite behavior. It shows that output and price response to monetary policy shock at same speed, timing but different magnitude.

Next the study examines the result of model II, this is to see whether the behavior will be relative to variables used in the estimation. In model II, the study used alternative measure of monetary policy shock; that is, M2 as against the M1 used in model I. the result is presented in figure 3.2 below. The result reveals that output response positively to shock 1 and negatively to shock 2. The impact of the shocks last for four quarters before it varnished. The speed, timing and magnitude are same with model I as described above. The response of inflation to monetary policy shocks also show similar pattern with model I. Therefore, we can conclude that quantitatively, there is no significant difference between the result of model I and model II. That is, when there is monetary policy shock (MPR shock) output puzzles, whereas, when alternative measure of monetary policy (M2) is used, policy shock leads to both output and price puzzles.

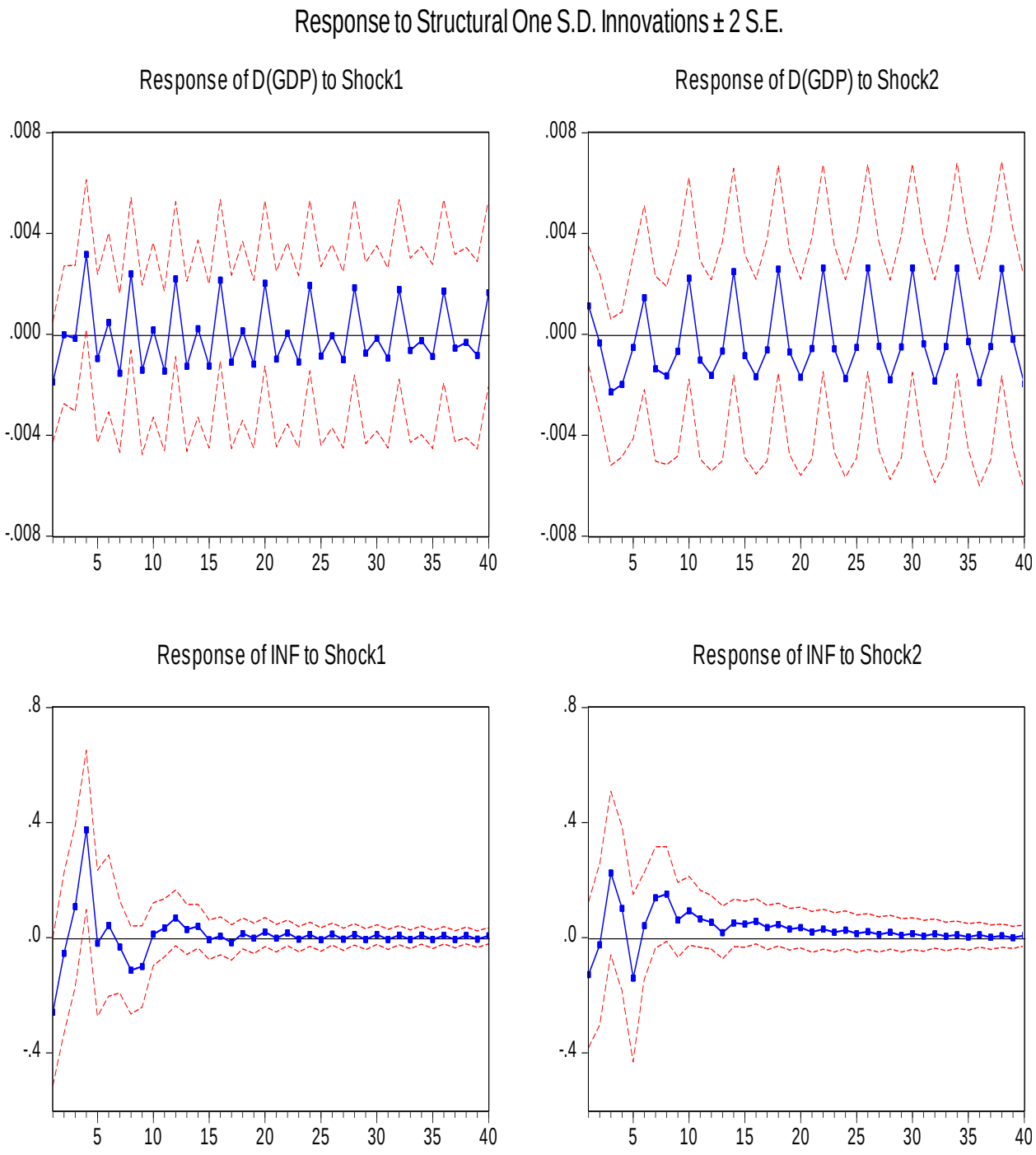
Figure 3.2: Forecast Error Structurally Decomposed impulse responses of Money, Output and Price: Model II



The study further examined the findings of Model I and II in order to see whether the result is sensitive to the variable selected or that is how the empirical regularities stands as per the Nigerian case. In models III and IV, alternative measure of inflation is used, which is based on CPI-inflation.

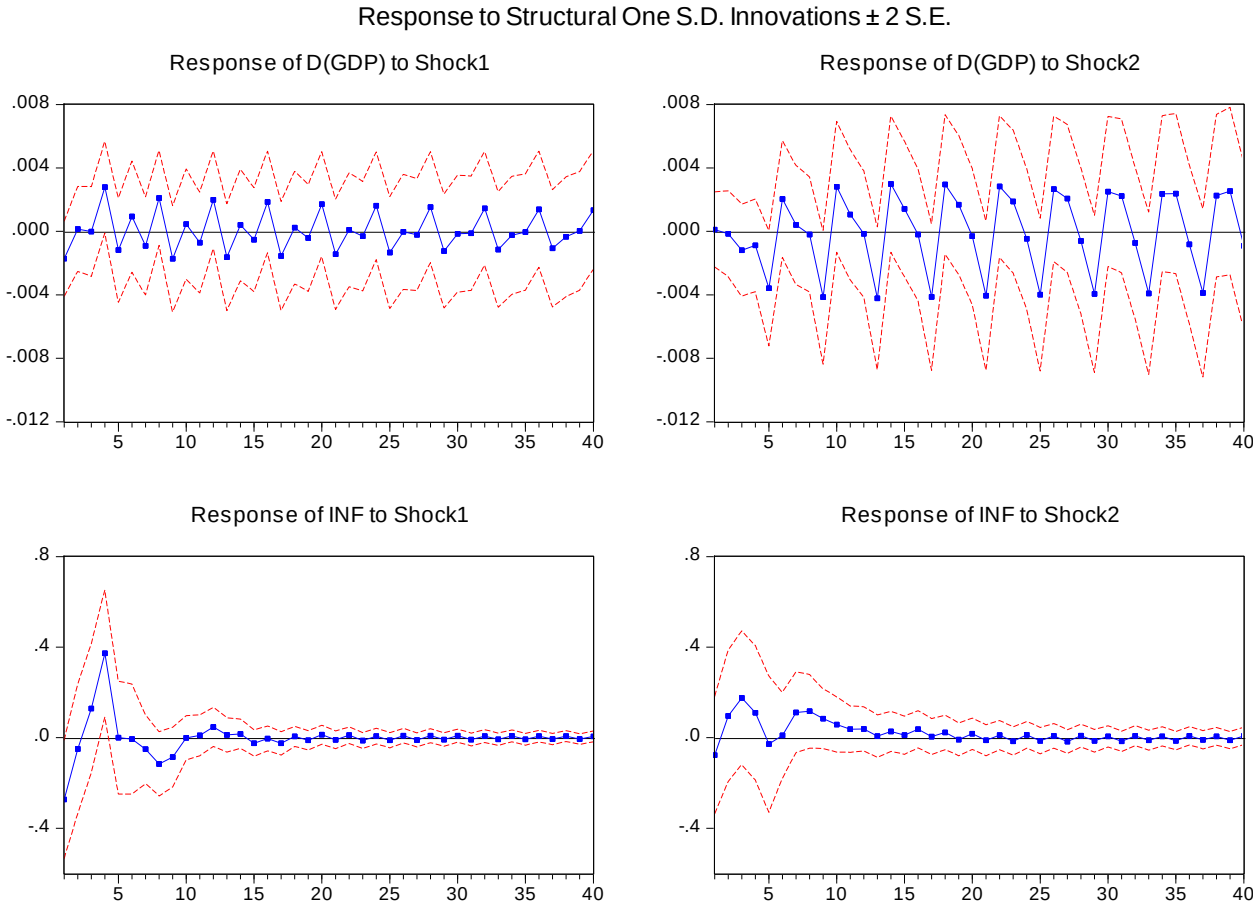
Remember that the CPI-Inflation gives better evidence in terms of the correlation coefficient than GDP deflator inflation. The result of the model III is presented in figure 3.3 below. The result reveals monetary policy shock lead to increase and decrease in output for the period of four quarters depending on where the policy shock is from MPR or M1. This can be seen in the top panel of figure 3.3 below. However, inflation (CPI) only responded to policy shock after eight quarters and then the impact of the shock vanished until the end of the forty quarter horizon. The response of inflation to monetary policy shock is same for the two measures of monetary policy used; that is MPR and M1.

Figure 3.3: Forecast Error Structurally Decomposed Impulse responses of Money, Output and Price: Model III



In terms of how output and price respond to monetary policy shock, the evidence is in favor of output puzzles. This finding is consistent with the empirical regularities on the impact of monetary policy shock on output. Unlike in the case of GDP Deflator inflation in model I and II that shows an evidence of output puzzle in case of MPR shock and both output and price puzzling in case of M1 and M2 shock, this finding is consistent across all the alternative measure of monetary policy shock. When we change the alternative policy variable that is from M1 to M2, the result is also consistent with the findings in model III. This can be seen in figure 3.4 below.

Figure 3.4: Forecast Error Structurally Decomposed impulse responses of Money, Output and Price: Model IV



In general the evidences we found in all the four models considered in this study are in favor of output puzzling. This implies that output response to monetary policy shock in the short run while price remain constant. The finding is consistent with the monetary economics literature on the impact of monetary policy shock on output and prices. This further support the initial evidence the study found on short run correlation coefficient that shows a positive and significant degree of association between different measures of monetary policy, output and prices. It also further confirmed the Granger causality evidence that shows a uni-directional causality that runs from monetary aggregate to output.

4.0 Conclusion

This study was conducted to examine empirically the evidence on the short-run relationship between monetary policy, prices and output. The study assumed two measures of monetary policy; that is, MPR and base money (M1 and M2) and also two measures of inflation (GDF deflator and CPI inflation). First, the study examined the short-run correlation coefficient between money, output and

price. The correlation evidence reveals a positive and strong degree of association between money and output, negative and weak relation between money and CPI inflation while a positive and significant coefficient between money and GDP deflator inflation. The study ignored the latter evidence and concluded the existence of positive correlation between output and money, and no correlation between money and prices in the short-run. Second, the study examined the casual relationship between output and money in order to determine the nature of the causation between the variables and assess whether the evidence in Nigeria is in favor of money causing output or reserve causation arguments. The result is in support of non neutrality of money. Therefore, we concluded that in the short-run, money cause output in Nigeria. Finally, the study examined the impact of monetary policy shock on output and prices. The result reveals that irrespective of the inflation variable, output response to price base monetary policy shock but inflation does not. However, for quantitative base monetary policy shock, the choice of the inflation variable matters as GDP deflator response to monetary policy shock whereas CPI inflation does not. In terms of the sign of the response, output responds positively to price base monetary policy shock and negatively to quantitative policy shock. Therefore, the study concludes that the monetary policy shock in Nigeria lead to output puzzle.

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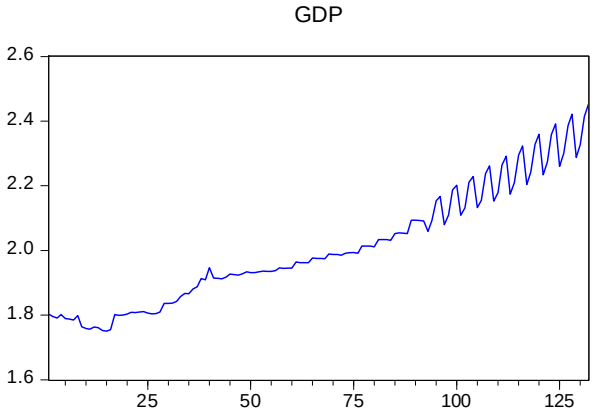
Appendix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1.8
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50
75
100
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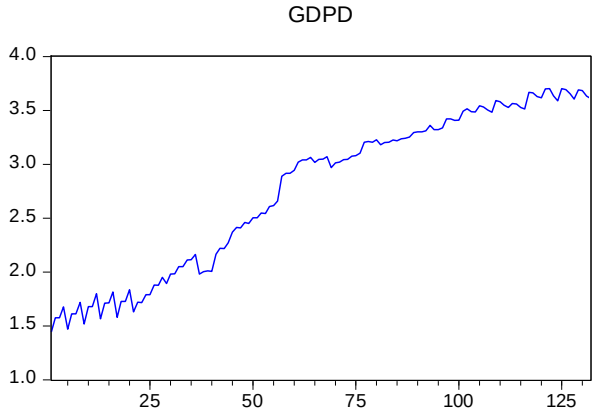
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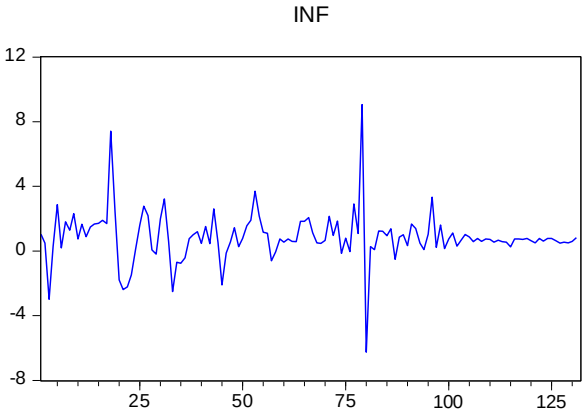
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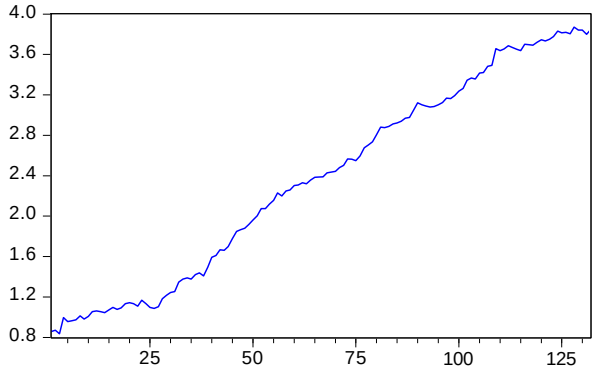
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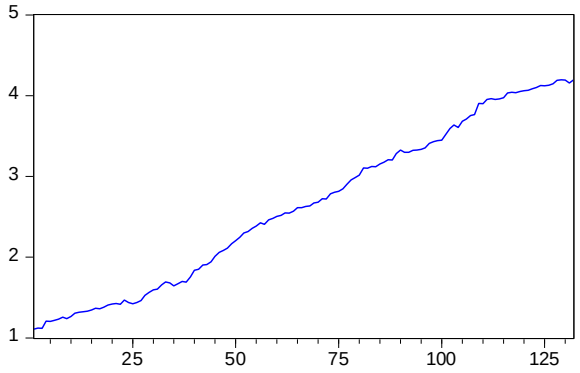
25
50
75
100
125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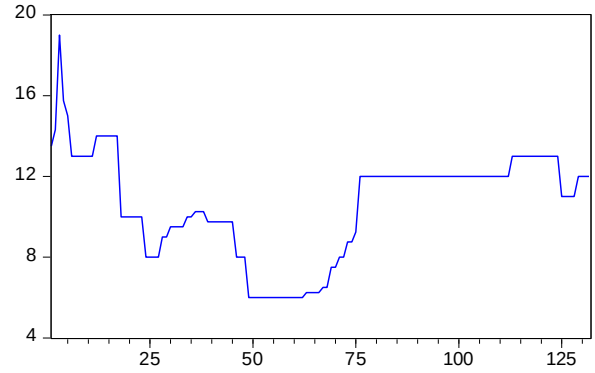
4
3
2
1
25
50
75
100
125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