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The Effect of Monetary Policy on General Price Level in Nigeria

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Abstract

Studying how monetary policy and price levels interact is essential because price instability makes it more difficult for the government to implement policies that will raise living standards and maintain economic development. The study's time frame is from 1970 to 2020. The variables of interest were the Monetary Policy Rate (MPR) and the Money Supply (M2), which were employed as monetary policy variables and the Consumer Price Index (CPI) as a stand-in for the level of prices. The method used for the data analysis was Vector Autoregressive (VAR). The findings showed that price level and monetary policy shock—particularly the MPR—move in the same direction. The price level rises in response to shocks like an increase in MPR. Additionally, M2 has a negative impact on price level; as M2 rises, price level decreases. The long-run neutrality of money concept is refuted by this study. It was discovered that M2 is more successful in the near term in regulating the level of prices. However, monetary policy rate works better over the long term. Ultimately, the outcome demonstrates that the price level and monetary policy rate in Nigeria have an immediate feedback connection. Consequently, it is advised that M2 be utilised for short-term price level regulation. To reach the intended goal in Nigeria, monetary policy rate should be employed over the long term.

Keywords:
Consumer Price Index, Monetary Policy, Monetary Policy Rate, VAR

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Background to the Study

Governments everywhere are focused on managing the economy effectively. As a result, they are required to develop suitable policies aimed at accomplishing the desired macroeconomic goals. These goals include equilibrium in the balance of payments, full employment, economic growth, and an acceptable price level. For the majority of governments worldwide, achieving stable pricing and sustained economic development has been the primary goal of macroeconomic policies. This is because price levels also affect the attainment of other goals, such as full employment and balance of payments equilibrium (Ohale & Onyema, 2002).

One of the most closely followed economic indicators worldwide is price level. Most people agree that in order to keep the inflationary tendency from getting worse, prices should remain mostly unchanged from year to year. Stable prices facilitate informed decision-making about investments and consumption, as well as more effective resource allocation. Consumption of products and services as a whole varies in response to changes in price levels. Real interest rates and the motivation to invest are also impacted. The demand for money rises in response to price level increases. The interest rate will rise as a result of this. A decrease in investment and subsequent economic growth result from the interest rate rise discouraging businesses from borrowing money to purchase new capital goods. Stable prices also prevent wasteful spending, which protects against the damaging effects of inflation or deflation. Additionally, it promotes financial stability by preventing an arbitrary redistribution of income and wealth due to unanticipated inflation or deflation. Price level fluctuations affect the real value of contracts; in fact, unexpected reductions in price level raise the real value of nominal debt, while unexpected increases in price level have the opposite effect (Crawford, Meh, & Terajima, 2009). Price level is typically determined by government monetary policy, which consists of a range of actions intended to control the amount, cost, and supply of money in an economy according to the anticipated level of prices at a particular point in time. Interest rates and the money supply are two ways that monetary policy influences the level of prices.

If price instability is not experimentally examined before the government develops suitable pricing or inflation control measures, it may hinder efforts to establish a constant growth rate and an improvement in living standards. Over time, many policies and initiatives have been implemented by governments across various nations to guarantee the attainment of stable pricing. Nigeria has enacted a number of anti-inflationary policy measures since gaining independence in 1960 in an effort to maintain price stability. Although the goal of a stable price level has been attained, monetary policy measures have been used to halt the overall price level's steady rise.

Objectives of the Study

This article examined price level and monetary policy shocks in Nigeria against these contextual backgrounds.

The broad objective of this study is to empirically examine the relationship between monetary policy and price level in Nigeria. Specific objectives are to:

i. Investigate the effect of money supply on price level in Nigeria
ii. Examine the effect of CBN monetary policy rate on price level in Nigeria.

The hypotheses of this study are stated as follows:

Ho_1: Money supply has no significant effect on price level in Nigeria

Ho_2: There is no significant effect of monetary policy rate on price level in Nigeria.

Literature Review

Monetary Policy Channels

According to the monetarist theory, changes in the money supply inevitably affect changes in the actual amount of money. According to Friedman and Schwartz (1963), cited by Apere and Karimo (2020), a central bank's extensive open market operations increase the money supply by increasing the money stock. This, in turn, increases the reserves of commercial banks and their capacity to extend credit, which increases the money supply through the multiplier effect. The bank and non-bank organisations buy assets that resemble those offered by the Central Bank in an effort to lower the amount of money in their portfolios, which in turn stimulates activity in the real economy. Apere and Karimo (2020), who focused on asset portfolio choice and found that monetary policy stimulates asset switching between stock, bonds, commercial paper, and bank deposits, cite Tobin (1978) as supporting evidence for this viewpoint.

Conversely, proponents of Keynesianism contend that modifications to the money supply enable financial market operations that impact interest rates, investments, output, and employment. (Borio, 1995) who looked into the composition of loans to non-government borrowers in fourteen developed nations found that variables including interest rates, collateral requirements, and lending willingness had an impact.

Empirical Literature

Using data from 1970 to 2019, Ogbonnaya et al. (2022) examined Nigeria's monetary policy framework and price stability. Using the unconstrained VAR model, their analysis found that only the initial lagged predefined exchange rate may affect price stability in the short run while creating Nigeria's monetary policy framework. An unparallel shock to the stability of monetary policy is the outcome of the exchange rate having a positive and considerable influence on interest rates but a negligible impact on inflation rates, according to the impulse response function results. Furthermore, the variance decomposition test result showed that the overall fluctuations in the exchange rate, inflation rate, and interest rate throughout the 10-point time horizon were primarily attributable to the own shock impact, which was shown to account for around 88%, 83%, and 83% of the rates, respectively. Therefore, the CBN should implement better credit allocation, strict management of expected inflation, plodding and synchronisation of the exchange rate, and creation of an environment that will support Nigeria's rapid and

sustainable growth in order to ensure price stability in the country's monetary policy framework.

Nigerian economic development and monetary policy shocks were studied by Lateef et al. in 2021. Regression analysis was used in their study, which followed an ex-post-facto research method. The dependent variable was economic growth, while the explanatory factors were the money supply, inflation, and interest rate. Time series data from the World Bank Development Index (WDI) and the Central Bank of Nigeria (CBN) Statistical Bulletin covering the years 1986 to 2018 were used. The analysis used in the study made use of Vector Autoregression (VAR) methods. The money supply has a considerable positive impact on economic growth in Nigeria, but inflation and interest rates have a negligible positive impact, according to the results of the vector autoregression estimation. The outcome demonstrates that while interest rates and inflation have little bearing on economic development in Nigeria, monetary policy shocks have a major impact.

Bingilar, et al. (2020) studied, from 2000 to 2018, the extent to which the Central Bank of Nigeria employs Monetary Policies to foster economic development. Time series data from the Central Bank of Nigeria (CBN) Statistical Bulletin are used in the study. Multiple regression models were the primary statistical instrument of analysis used to examine the impact of money supply and lending rate on GDP. Research indicates that the CBN Monetary Policy procedures are successful in controlling aggregates from the monetary and real sectors, including prices, employment, lending rates, money supply, and the pace of economic growth. Findings from this study indicate that money supply have a positive and significant influence on GDP while lending rate was negative and statistically in significant relationship with the GDP.

Onehi, et al. (2022) explored which monetary policies have been most successful in promoting price stability and how inflation reacts to the adoption of monetary policies by examining the impact of monetary policy on price stability in Nigeria using a data-rich framework covering the years 1986–2020. The study used the Auto-regression Distributed Lag (ARDL) Bound Test to estimate the Error Correction Model (ECM) and co-integrate data analysis. The findings showed that whereas RIR has a negative and substantial impact on price stability, EXR, M2, and MPR had negative and minor effects. The analysis came to the conclusion that Nigeria's monetary policy had little bearing on overall stability.

Apere and Akarara, (2019), examined the connection between Nigerian pricing levels and monetary policies from 1970 to 2013. Price level swings in the same direction with monetary policy shock, particularly the MPR, according to the study, which employed the VAR estimate approach. The price level rises in response to shocks like an increase in MPR. Additionally, M2 has a negative impact on price level; as M2 rises, price level decreases. The long-run neutrality of money concept is refuted by this study. It was discovered that M2 is superior at short-term price level regulation. However, monetary

policy rate works better over the long term. Apere and Karimo (2014) examined the impact of monetary policy on inflation and economic growth in Nigeria from 1970 to 2011 using the VAR model. They discovered that, in the short term, inflation and output both drive monetary growth, while output growth is only impacted by inflation. The impulse response and variance decomposition results demonstrated that while monetary policy variables may not affect output immediately, they are important long-term drivers of output growth. As a result, they came to the conclusion that monetary policy aims should be distinguished between the short and long terms.

Onayemi (2013) used the ordinary least squares method to examine the relationship between price stability, monetary policy, and output growth in Nigeria. According to the study, the current price gap in Nigeria is positively influenced by the first lag of the price gap, the current money supply gap, the first lag of the money supply gap, the current real output gap, and the first lag of the real output gap. However, it was shown that the second lag of the pricing difference had a detrimental impact on Nigeria's inflationary pressure.

Vinayagathasan's (2013), study looked at the relationship between domestic macroeconomic factors and monetary policy. The study's duration is from 1978 to 2011. The VAR approaches were embraced by the author. The study's conclusions showed that interest rate shocks, as opposed to monetary aggregate shocks or exchange rate shocks, significantly and more effectively explain the movement of economic variables.

Hassan (2012) investigated how the money supply affects the pricing of agricultural products. Ordinary least squares methods were used in the study's analysis. It was found that the money supply significantly affected agricultural prices, and that changes in the money supply did not affect agricultural prices more than changes in aggregate prices. Arize and Nam (2012) attempted to examine how changes in exchange rates affected the demand for money in seven different nations between 1973 and 2009. The findings showed that the money demand in every country is impacted positively and negatively, respectively, by the exchange rate and local interest rates. The study came to the conclusion that in order to accomplish goals, wide money needs to be prioritised by monetary authorities throughout all nations.

Ihezukwu (2011) investigated how Nigerian price stability was affected by monetary policy between 1970 and 2010. For the investigation, ordinary least square methods were applied. The overall price level and monetary policy have a long-term positive link, but a short-term negative and substantial relationship, according to the author. It also shows that interest rates have a major and favourable impact on inflation.

The money demand function and its stability for Jordan from 1975 to 1990 were studied by Bashier et al. (2011). They brought up past research that evaluated Jordan's money demand and produced conflicting findings. The prior research' faults were ascribed to their failure to conduct a stability test, which resulted in false regression issues. A stable money demand function was demonstrated using the Cumulative Sum (CUSUM) and

Cumulative Sum of Squares (CUSUMSQ) tests. The empirical findings demonstrated a negative correlation between real money balances and interest rates and exchange rates and a positive correlation between real money balances and real income. This was consistent with the premise of money demand.

The dynamic demand for money function in Pakistan from 1960 to 1999 was assessed by Qayyum (2005). The study's findings demonstrated the long-term relationships between M2, real income, inflation, call money rates, and government bonds. The author came to the conclusion that since the favoured money demand model satisfies the stability test, it may be utilised for policy analysis in Pakistan. The currency rate and interest rate are useful instruments for policy in Iran, as Bahmani et al. (2005) showed using the bound testing technique to co-integration. According to their research, exchange rate volatility ought to be added to the money demand function. The estimated money demand function in Malaysia also showed currency substitution. It was demonstrated by Bahmani-Oskooee and Rehman (2005) that in some Asian nations, the calculated parameters were unstable despite the co-integration of the real M1 and M2 monetary aggregates. They came to the conclusion that both M and M aggregates should be taken into account when creating appropriate monetary policy, especially in emerging nations.

Hussain et al. (2006) attempted to examine Pakistan's demand for money function from 1972 to 2005. According to the study's findings, wide money (M2) is better suitable for Pakistan. Using the ARDL technique, Azim et al. (2010) examined Pakistan's money demand function from 1973 to 2007. They came to the conclusion that while creating Pakistan's monetary policy, both the M1 and M2 monetary aggregates should be taken into account.

Tuck (2007) discovered that for Malaysia, the Philippines, and Singapore, the real monetary aggregate, real spending components, exchange rate, and inflation rate are all co-integrated. Based on Hossain's (2007) description of Indonesia's narrow money demand, the empirical findings indicate that real income, inflation (a stand-in for predicted inflation), and the return on foreign financial assets are the main factors influencing the narrow money demand function.

Using Fiji's time series, Narayan et al. (2008) demonstrated that structural breakdowns should be taken into account in addition to the stability test when evaluating the money demand function. They employed the bound test, which is applicable regardless of the non-stationarity of the underlying variables. It was pointed out that the unit root null hypothesis was disclaimed (rejected) because prior research on Fiji's demand did take structural breakdowns into consideration. He argued that when the alternative hypothesis is correct and the break is ignored, structural breakdowns in the data reduce the capacity to reject a unit root.

After analyzing the money demand function in Sub-Saharan Africa, Hamori (2008) found empirical evidence of a co-integrating link between the money demand function

and the region. Stated differently, there exists a strong correlation between the money supply and the actual economy in the long run, and keeping an eye on the money supply is expected to be crucial in maintaining a stable level of prices in this area. Money demand (Ml) in Nigeria is stable and effective, according to data gathered by Kumar, Webber, and Fargher (2010) during their empirical investigation into the level and stability of Ml between 1960 and 2008; this suggests that Nigeria could effectively use the money supply as a monetary policy tool.

Furthermore, it has been shown that the absence of robust financial and capital markets in developing nations limits the options available to the general population for storing money (Lungu et al., 2012). Underdeveloped capital and financial markets may have an impact on the money demand function's stability, as stated by Lungu et al. (2012). Using the Johansen co-integration method, Rutayisire et al. (2008) came to the conclusion that Rwanda exhibits both the currency substitution effect and a positive connection with income. They concluded that the interest rate was negligible, which they attributed to the government's tightly managed system.

Despite the importance of price level in an economy, not much has been done in Nigeria, according to the literature assessment. Despite the efforts of the monetary authorities, the price level nonetheless poses a threat to Nigeria's economic activity. It is creating a conundrum on how monetary policy and price level are related. However, the majority of research focuses on how monetary policy affects macroeconomic activity, which in turn affects the economy's price level. However, very few researchers have used the Ordinary Least Square (OLS) approach to examine how monetary policy affects price stability (see Onayemi, 2013; Vinayagathasan, 2013; Hassan, 2012; and Ihezukwu, 2011). This method is deceptive because it fails to account for policy shocks. Therefore, this study adds value by employing the Vector Autoregressive (VAR) technique to directly examine the link between monetary policy and the level of prices in Nigeria.

Methodology and Data

Secondary data from the Central Bank of Nigeria Statistical Bulletin 2016 were used in this investigation. The data covers the years 1970–2020. The econometric approach is used in the study to achieve its goals. This method works well for capturing how the price level responds to changes in monetary policy. First, the Augmented Dickey-Fuller (ADF) is used for estimation. Afterwards, the long-term connection between the variables is examined using the Johansen co-integration approach. In addition, the direction of causality in each equation is tested using the VEC Granger-Causality. Ultimately, a range of residual analyses were performed on the model residuals to verify adherence to the assumptions underlying linear model estimations. Specifically, this study used a generalized method with non-recursive structures (Known as SVAR), which impose restrictions only on contemporaneous structural parameters; derived following Kim & Roubini (2000), Sims (1986), and Bernanke (1986). The basic VAR model is given by:

$$CPI_t = \varphi_{10} - \pi_{10}MS_t - \pi_{11}MPR_t + \Omega_{20}CPI_{t-1} + \Omega_{21}MS_{t-1} + \Omega_{22}MPR_{t-1} + \mu_{1t} \quad eqn\ 1$$

$$MS_t = \varphi_{20} - \pi_{20}CPI_t - \pi_{21}MPR_t + \Omega_{30}CPI_{t-1} + \Omega_{31}MS_{t-1} + \Omega_{32}MPR_{t-1} + \mu_{2t} \quad eqn\ 2$$

$$MPR_t = \varphi_{30} - \pi_{30}CPI_t - \pi_{31}MS_t + \Omega_{40}CPI_{t-1} + \Omega_{41}MS_{t-1} + \Omega_{42}MPR_{t-1} + \mu_{3t} \quad eqn\ 3$$

Where: CPI = consumer price index
MS = money supply
MPR = monetary policy rate
u_{1t}, u_{2t}, and u_{3t} = structural disturbances. The study assume that the structural disturbances are mutually uncorrelated. From the model, CPI_t has contemporaneous impact on MS_t and MPR_t (given by $-\pi_{10}$ and $-\pi_{11}$). MS_t on the other hand, has contemporaneous impact on CPI_t and MPR_t (given by $-\pi_{20}$ and $-\pi_{21}$), while MPR_t has contemporaneous impact on CPI_t and MS_t (given by $-\pi_{30}$ and $-\pi_{31}$).

Rewriting the system of equation in the form of matrix algebra results to the following:

$$\begin{bmatrix} 1 & \pi_{10} & \pi_{11} \\ \pi_{20} & 1 & \pi_{21} \\ \pi_{30} & \pi_{31} & 1 \end{bmatrix} \begin{bmatrix} CPI \\ MS \\ MPR \end{bmatrix} = \begin{bmatrix} \varphi_{10} \\ \varphi_{20} \\ \varphi_{30} \end{bmatrix} + \begin{bmatrix} \Omega_{20} & \Omega_{21} & \Omega_{22} \\ \Omega_{30} & \Omega_{31} & \Omega_{32} \\ \Omega_{40} & \Omega_{41} & \Omega_{42} \end{bmatrix} \begin{bmatrix} CPI_{t-i} \\ MS_{t-i} \\ MPR_{t-i} \end{bmatrix} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{bmatrix} \quad \ldots \quad \textit{eqn 4}$$

Where:

$\begin{bmatrix} 1 & \pi_{10} & \pi_{11} \\ \pi_{20} & 1 & \pi_{21} \\ \pi_{30} & \pi_{31} & 1 \end{bmatrix}$ = contemporaneous coefficient matrix (non-singular) in the structural-form equation.

$\begin{bmatrix} CPI \\ MS \\ MPR \end{bmatrix}$ = contemporaneous variable matrix

$\begin{bmatrix} \varphi_{10} \\ \varphi_{20} \\ \varphi_{30} \end{bmatrix}$ = vector of intercept coefficients

$\begin{bmatrix} \Omega_{20} & \Omega_{21} & \Omega_{22} \\ \Omega_{30} & \Omega_{31} & \Omega_{32} \\ \Omega_{40} & \Omega_{41} & \Omega_{42} \end{bmatrix}$ = non-contemporaneous coefficient matrix

$\begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{bmatrix}$ = Structural shocks

By impose restrictions on the contemporaneous structural parameters, and multiplying both side of equation (4) by the inverse of the contemporaneous coefficient matrix $\begin{bmatrix} 1 & \pi_{10} & \pi_{11} \\ \pi_{20} & 1 & \pi_{21} \\ \pi_{30} & \pi_{31} & 1 \end{bmatrix}^{-1}$, and rewriting the VAR model, the estimation of the reduced-form equation of the structural model (4) is described as:

$$CPI_t = \lambda_{50} + \lambda_{51} CPI_{t-i} + \lambda_{52} MS_{t-1} + \lambda_{53} MPR_{t-1} + \epsilon_{1t}^{cpi} \qquad \textit{eqn 5}$$

$$MS_t = \lambda_{60} + \lambda_{61} CPI_{t-i} + \lambda_{62} MS_{t-1} + \lambda_{63} MPR_{t-1} + \epsilon_{2t}^{ms} \qquad \textit{eqn 6}$$

$$MPR_t = \lambda_{70} + \lambda_{71} CPI_{t-i} + \lambda_{72} MS_{t-1} + \lambda_{73} MPR_{t-1} + \epsilon_{3t}^{mpr} \qquad \textit{eqn 7}$$

Where $[\epsilon_{1t}^{cpi}, \epsilon_{2t}^{ms}, \text{and } \epsilon_{3t}^{mpr}]$ are error terms and are composite of the shocks u_{1t}, u_{2t}, and u_{3t}. Also, $[\epsilon_{1t}^{cpi}, \epsilon_{2t}^{ms}, \text{and } \epsilon_{3t}^{mpr}]$ are white-noise processes. Now consider the structural disturbances as exogenous variables and apply the Wold's decomposition theorem, this yields the infinite Vector Moving Average (VMA) representation of the structural model. This allows for the computation of the system impulse responses functions.

Data Analysis and Discussion of Results

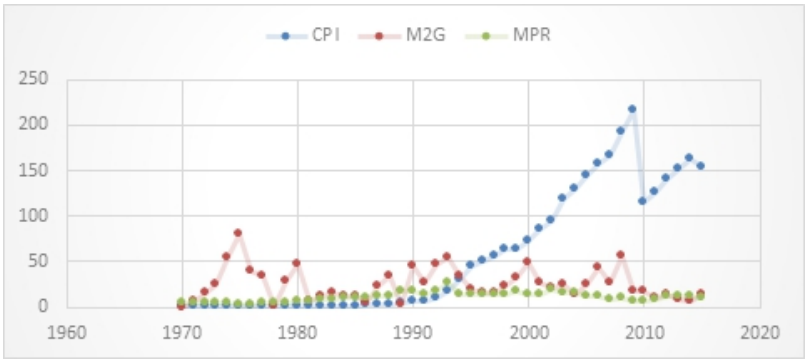

Figure 1: trend "analysis of Consumer Price Index, Money Supply and Monetary Policy Rate in Nigeria from 1970 – 2020"

According to the statistics above, the monetary policy rate and consumer price index were stable in the early 1970s before starting to fluctuate in the late 1970s. The data set is well understood in figure I above. It demonstrates how the variables behaved randomly during the course of the investigation. The late 2000s saw the highest consumer price index readings, while the 1970s saw the lowest. From 1970 to 2010, there was a consistent climb, followed by a decline, and then another rise. There was no time when the price level fell sharply. A like pattern was also observed in the money supply, with the exception of a sharp decline that was noted in the late 2000s. This is linked to the period's conflicting monetary policies, which resulted in a sharp decrease in the money supply. However, the 1990s saw the highest monetary policy rate ever noted. The mid-1970s had the highest and lowest rates. This demonstrated that during the research period, government policies on the monetary policy rate had fluctuated.

The mean price level, monetary policy rate, and money supply for the years 1970 to 2013 are 2.217, 10.828, and 10.7213, respectively, according to the descriptive data shown in table 1 below. Table 4.1 illustrates the greatest values observed for the price level, monetary policy rate, and money supply over the study period: 5.375227, 26.00000, and 15.20876. Comparably, throughout the research period, the minimum money supply is N6.885 billion, the minimum monetary policy rate is 3.5, and the minimum price level is -1.49. While the statistics on the money supply and monetary policy rate are favourably biassed, the data on price level is adversely distorted.

According to the statistically insignificant probability values, the data set is similarly normal. The relevant Jarque-Bera data for the money supply, monetary policy rate, and consumer price index further support this. The small tail of the data for each variable is indicated by the negligible coefficients of Kurtosis. As a result of the variables' lack of mean reversion, the data may have a unit root, which might provide false findings. As a consequence, a formal test is carried out via the Augmented Dickey – Fuller unit root test process, and the outcomes are shown in the subsection that follows.

Table 1: Descriptive Statistics of the Variables for the Study

Measure	LOG(CPI)	MPR	LOG(M2)
Mean	2.217089	10.82792	10.72127
Median	2.145066	11.00000	10.11784
Maximum	5.375227	26.00000	15.20876
Minimum	-1.486451	3.500000	6.885714
Std. Dev.	2.402405	5.218591	2.343241
Skewness	-0.140463	0.473635	0.315513
Kurtosis	1.445860	2.913692	2.061657
Jarque-Bera	4.572832	1.658746	2.344248
Probability	0.101630	0.436323	0.309708

Source: Authors' Computation (2017)

Augmented Dickey – Fuller Unit Root Test

The unit root of the study's variables is examined. Because non-stationary series may produce erroneous regression results, this test is crucial. Table 2 displays the test results. The absence of significant findings for any of the variables suggests the presence of a unit root.

Table 2: Augmented Dickey – Fuller Unit Root Test Results

Variable	ADF – Statistic		Model	Lag order	~I(d)
	Level	1st Difference			
LOG(CPI)	-1.334483	-3.534445**	Drift	1	I(1)
MPR	-1.821298	6.835792***	Drift	1	I(1)
LOG(M2)	-1.911292	-4.586652***	Drift	1	I(1)

Source: Authors' Computation (2017)

Where: *** and ** denotes significance at 1%, and 5% respectively and the rejection of the null hypothesis of presence of unit root. Akaike's FPE tests were used to determine the ideal lag durations. But after one differencing, every variable became stationary with the correct negative sign, meeting the requirement for testing for co-integration. As a consequence, a co-integration test is performed on the variables, and the results are shown in the section above.

Co-integration Test

The co-integration test is applied to the variables once again. This is to determine whether the variables have a long-term connection. Table 3 displays the test results. The results of the co-integration test revealed a single co-integrating equation, suggesting that the long-term development of the variables is governed by a single co-integrating vector.

Table 3: Co-integration test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.520624	34.64749	29.79707	0.0128
At most 1	0.097669	5.236676	15.49471	0.7832
At most 2	0.027751	1.125718	3.841466	0.2887

Trace test indicates 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Authors' Computation

This indicates that the price level has a tendency to oscillate and return to the long-run equilibrium path if there are short-term disturbances that cause it to stray from its long-run equilibrium path. The rate at which this adjustment occurs is dictated by the coefficient of adjustment in the error correction model. Thus, estimating an error correction model is required. Focus was on the LOG(CPI) outcomes of the Vector Error Correction Model since there was only one co-integrating equation. Error correction model estimation results from this.

Result of Discussion

After estimating the VAR model described in this paper's section three, the coefficient of adjustment was found to be negative and to be between 0 and 1, as predicted (see appendix). The outcome specifically shown that, in the event of short-term changes, the price level will swiftly return to its long-term equilibrium path at a rate of 6% annually.

The cumulative impulse response function (see appendix) showed that, in the long term, the price level increases in response to positive shocks such an increase in the monetary policy rate. It also showed a positive response of LOG(CPI) to one standard deviation shock in MPR. This might be explained by producers' capacity to successfully pass on to consumers the rise in production costs brought on by an increase in interest rates as a result of an increase in the monetary policy rate. Furthermore, even over an extended period, LOG(CPI) demonstrated a negative reaction to M2, indicating that a rise in money supply results in a decrease in price levels, so undermining the long-term neutrality of money theory. This could be attributable to the increasing availability of fund to investors in the production of goods and service which increases their supplies and ultimately reduces the price level.

Furthermore, "the Error Variance Decomposition (see appendix) revealed that MPR only accounted 0.077 percent of the variability in LOG (CPI) in the second horizon, compared to 4.06% for LOG(M2). Both became more significant, accounting for 10.77 and 77.58 percent of the variation in LOG (CPI) in the tenth projection horizon. This suggests that while M2 is more successful in the short term in regulating the level of prices, the monetary policy rate is more successful in the long term."

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Additionally, "bi-directional causation between D(LOG(CPI)) and D(MPR) was demonstrated by the VEC granger-causality results (see appendix); nevertheless, at the five percent level, LOG(CPI) is caused by MPR, and there is unidirectional causality from D(M2) to D(LOG(CPI)). This suggests that there is an immediate, contemporaneous, or short-term feedback relationship, also known as a feedback effect between the monetary policy rate and the price level, but that the monetary policy rate is more predictive of the price level. Additionally, a large money supply aids in short-term price level prediction."

Summary, Conclusion and Recommendations

This study "has looked at the link between monetary policy and price level between 1970 and 2020. According to the goals specified in 1.0 above, estimation was completed, and the results demonstrated:"

i. The price level moves the same direction with monetary policy shock (M_2). For example, shocks such as increase in monetary policy rate also leads to an increase in the price level."
ii. M_2 and MPR are effective tools of controlling the price level in the short and long – run respectively."
iii. Finally, there is instantaneous feedback relationship between the price level and monetary policy rate in Nigeria."

This study "concludes that the money supply (M2) and the monetary policy rate have a short- and long-term effect on the level of prices in Nigeria. M2 is more suited for short-term price level management, whereas monetary policy rates are better suited for long-term price control. This conclusion is in line with those of Apere, Karimo (2014), Vinayagathasan (2013), Hassan (2012), Ihezukwu (2011), and Qayyum (2005), who looked at how monetary policy affected price (stability) in Nigeria and discovered that variables related to monetary policy were important in determining price level, particularly over the long term."

Based on the conclusion drawn, the study recommends that:"

i. "For a short run price level target, money supply should be used. However, for a long run, monetary policy rate should be used to achieve the target."
ii. "The annual target of the monetary policy rate should closely be watched. This is because the current price level may affect the target rate. Here we recommend a flexible monetary policy, so that it can be adjusted at any time depending on the level and stability of prices."

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Appendix

Estimation Results

Vector Error Correction Estimates

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1		
LOG(CPI(-1))	1.000000		
MPR(-1)	-0.755969		
	(0.10865)		
	[-6.95794]		
LOG(M2(-1))	0.762149		
	(0.23392)		
	[3.25814]		
C	-2.306373		
Error Correction:	D(LOG(CPI))	D(MPR)	D(LOG(M2))
CointEq1	-0.060725	-0.452888	-0.238863
	(0.01298)	(0.34709)	(0.13776)
	[-4.67843]	[-1.30483]	[-1.73390]
D(LOG(CPI(-1)))	-0.024330	-0.388598	-0.853670
	(0.11462)	(3.06499)	(1.21651)
	[-0.21227]	[-0.12679]	[-0.70174]
D(LOG(CPI(-2)))	-0.189496	-7.221342	-0.743302
	(0.11110)	(2.97085)	(1.17915)
	[-1.70565]	[-2.43073]	[-0.63037]
D(LOG(CPI(-3)))	-0.222071	-4.795518	-0.251035
	(0.12086)	(3.23186)	(1.28274)
	[-1.83743]	[-1.48383]	[-0.19570]
D(MPR(-1))	-0.041589	-0.803930	-0.111964
	(0.01238)	(0.33093)	(0.13135)
	[-3.36058]	[-2.42928]	[-0.85241]
D(MPR(-2))	-0.023573	-0.649821	-0.055340
	(0.00987)	(0.26380)	(0.10470)
	[-2.38955]	[-2.46330]	[-0.52853]
D(MPR(-3))	-0.017478	-0.145255	-0.018784
	(0.00822)	(0.21979)	(0.08723)
	[-2.12655]	[-0.66089]	[-0.21533]

D(LOG(M2(-1)))	0.018698	0.317727	-0.083538
	(0.01764)	(0.47166)	(0.18720)
	[1.06010]	[0.67364]	[-0.44624]
D(LOG(M2(-2)))	0.006088	0.633529	-0.069876
	(0.01678)	(0.44875)	(0.17811)
	[0.36280]	[1.41178]	[-0.39232]
D(LOG(M2(-3)))	0.105667	0.369969	-0.097216
	(0.01716)	(0.45891)	(0.18215)
	[6.15718]	[0.80619]	[-0.53373]
C	0.228777	2.284479	0.393196
	(0.03900)	(1.04291)	(0.41394)
	[5.86592]	[2.19048]	[0.94989]
R-squared	0.747835	0.388790	0.150960
Adj. R-squared	0.660881	0.178028	-0.141812
Sum sq. resids	0.354632	253.5838	39.94820
S.E. equation	0.110583	2.957071	1.173680
F-statistic	8.600392	1.844686	0.515624
Log likelihood	37.75352	-93.69384	-56.73162
Akaike AIC	-1.337676	5.234692	3.386581
Schwarz SC	-0.873234	5.699134	3.851023
Mean dependent	0.157156	0.187500	0.057455
S.D. dependent	0.189895	3.261618	1.098379

Determinant resid covariance (dof adj.)	0.127437
Determinant resid covariance	0.048563
Log likelihood	-109.7749
Akaike information criterion	7.288743
Schwarz criterion	8.808735

VEC Granger Causality/Block Exogeneity Wald Tests

Dependent variable: D(LOG(CPI))

Excluded	Chi-sq	df	Prob.
D(MPR)	11.43781	3	0.0096
D(LOG(M2))	38.31321	3	0.0000
All	48.64374	6	0.0000

Dependent variable: D(MPR)

Excluded	Chi-sq	df	Prob.
D(LOG(CPI))	8.459209	3	0.0374
D(LOG(M2))	2.628737	3	0.4525
All	9.990264	6	0.1251

Dependent variable: D(LOG(M2))

Excluded	Chi-sq	df	Prob.
D(LOG(CPI))	0.904211	3	0.8244
D(MPR)	0.967660	3	0.8091
All	1.319080	6	0.9706

VEC Residual Serial Correlation LM Tests Result

Lags	LM-Stat	Prob
1	16.21363	0.0626
2	10.83856	0.2869
3	7.060668	0.6308
4	5.891138	0.7508
5	8.161711	0.5179
6	3.362207	0.9482
7	4.936628	0.8398
8	6.969745	0.6403
9	8.924376	0.4443
10	6.535401	0.6854
11	12.63682	0.1797
12	7.403007	0.5952

Probs from chi-square with 9 df.