



Monetary Policy Measures and Commodity Price in Nigeria: An Auto-Regressive Distributive Lag Approach

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Abstract. This study investigated the impact of monetary policy measures on commodity price in Nigeria from 1990 to 2022. Data for the study were obtained from the Central Bank of Nigeria data source and the World Bank's World Development Indicators 2022. Real interest rate, cash reserve ratio, Broad money supply, Treasury bill rate, and exchange rate are adopted to proxy monetary policy while commodity price index is employed to capture commodity price. The individual series were subjected to unit root tests using the Augmented Dickey Fuller approach and the diagnoses established mixed orders of $I(0)$ and $I(1)$ integrations, thereby necessitating application of the Auto-Regressive Distributive lag bounds test as well as the long-run and error correction versions. The analyzed model's result established that real interest rate is positive but statistically insignificant with commodity price in the long-run and the most current year period of the short-run while cash reserve ratio had a positive and significant relationship with regress and in the long-run. Also, it was evident that broad money supply had a negative but significant relationship with commodity price in the current period of the short-run. Moreso, Treasury bill rate and commodity price revealed that the former had a negative but significant relationship with the latter in the current period of the short-run. Finally, the official exchange rate exerted a positive but insignificant ramification on commodity price both in the long-run and previous year period of the short-run. Hence, it is concluded that monetary policy fundamentals as captured here had significant push-up effect on commodity price in Nigeria. Thus, the need for suggesting amongst others that the monetary policy authority should attractively peg the price of federal government's securities, moderate money supply and interest rate to enhance monetary stability for driving diversified private sector investments which if

sustained will dampen commodity price in the long-run.

Keywords: Monetary Policy, Commodity Price, Real Interest Rate, Cash Reserve Ratio, Treasury Bill, Exchange Rate Broad Money Supply.

1. Introduction

Crucial to economic dynamics is the complex relationship between monetary policy and changes in commodity prices. A nation's money supply and interest rates are shaped by monetary policy choices made by central banks. These decisions have repercussions across many sectors and affect the economy as a whole. Money supply, interest rates, and economic activity are all managed and controlled by a country's central bank or monetary authority. This is known as monetary policy. Amadi & Amadi (2014) state that monetary policy is the set of actions taken by governments to control the money supply in order to accomplish certain long-term economic goals. Government methods, procedures, or processes employed by the CBN to manage the flow of cash in the economy are what monetary policy is all about, according to ThankGod and Igbinovia (2022).

In order to control the economy's money supply, value, and cost, the Central Bank of Nigeria (the Monetary Authority) implements monetary policy, according to Fasanya (2013). In order to keep the value, supply, and cost of money in an economy in line with the anticipated level of economic activity, monetary policy employs a variety of tools (Adesoye, 2012). Achieving broad macroeconomic objectives including full employment, price stability, economic development, and balance of payments (BOP) equilibrium are the aims of monetary policy, which encompasses the tactics used by the central bank to

manage the money supply. Monetary policy's goals and priorities shift throughout time in response to changes in national economic growth and national fortunes (CBN, 2010). Commodity prices, however, are a measure of resource allocation and the state of the world economy. It is essential in determining consumer spending power and influencing inflationary pressures. Thus, the market value of basic agricultural and mineral products, as well as raw materials, is what we mean when we talk about commodity prices. The worldwide marketplace's demand and supply dynamics dictate these pricing. Importantly, commodities are often classified as either "hard" or "soft" commodities. Soft commodities are those that are cultivated rather than extracted, such as agricultural goods, while hard commodities are those that are extracted, like gold, rubber, and oil. Products such as coffee, cotton, sugar, and cattle are examples. It is important to remember that there are many different ways in which changes in monetary policy may affect commodity prices, and that this relationship is complex. For example, changes in interest rates and other monetary policy measures may influence commodity-related investment choices, which in turn affects output and consumption patterns.

Inflation targets are another common monetary policy aim of central banks. Commodity prices may be impacted by inflation expectations. Assuming that the goal of monetary policy is to rein in inflation. The expected future value of a commodity might be affected by it. But currency rates are influenced by monetary policy, and changes in exchange rates may impact commodity prices. For instance, a country's export prices may be impacted by a depreciation of its currency because its commodities become more competitive in global markets. Furthermore, the state of global liquidity may be affected by shifts in monetary policy. Speculation in commodities markets, which affects prices, could increase if liquidity is increased. Traders and investors often alter their commodities holdings in reaction to changes in monetary policy. Thus, the state of the economy's credit is influenced by monetary policy. Reduced output and demand for commodities might result from enterprises being constrained by tightening lending conditions. The inverse is also true: loosening lending standards may boost commodity demand and economic activity. In conclusion, monetary policy affects economic activity as a whole, which in turn affects commodities pricing.

Since commodity prices serve important economic functions, they have a major impact on inflation and its effects on producers and consumers alike. Keep in mind that in an ideal market, supply and demand

dictate the price of commodities. This suggests that commodity prices are unchangeable, regardless of actions taken by producers or consumers. Monetary policy factors, including interest rates, exchange rates, and the money supply, are an important factor that affects commodity prices. To illustrate the point, a high exchange rate may cause raw material prices to skyrocket, which in turn can drive up manufacturing costs, commodity prices, and even inflation. Commodity pricing and output are both severely impacted by rising interest rates.

While an increase in the money supply would ultimately cause prices to rise, lowering monetary policy variables like interest rates and exchange rates may mitigate the effects of increasing commodity prices in the short term. On the other hand, if these policies are reversed, it's possible that prices may fall and the economy could flourish as a result of the government's efforts to fulfill economic goals. Statistical evidence from the last five years, however, suggests that commodity prices have persisted despite the monetary policy authority implementing a number of interventions. As an example, the commodity price index increased from 240.1 in 2018 to 267.5 in 2019. Following this, the commodity price index continued its ascent, reaching 302.9 in 2020 and 35,354.3 the following year. In 2022, the commodity price index (WDI, 2022) reached a new high of 421.1.

The complex process by which monetary policy affects commodity prices and the ramifications this has for economic stability has also not been well investigated in the literature. Examples of previous research that found monetary policy factors to have a positive and substantial effect on prices are Ali et al. (2021) and Yakubu et al. (2013). The opposite is true according to the research of Haruna et al. (2022), who found that all monetary policy variables—including the money supply, the exchange rate, and the real interest rate—had a negative and insignificant impact on prices.

Several studies have shown that monetary policy factors have a positive or negative relationship with product and service prices; for example, Gorham (2023), Taken and Ita (2020), Bank-ola and Jemiluyi (2020), Salihu (2020), and Babatunde and Kehinde (2016). Crucially, it was found that previous research only examined interest rates, money supply, money reserve ratios, money supply, Treasury bill rates, and official exchange rates as proxies for monetary policy; none of the studies examined all of these factors together. Furthermore, the commodity price index was not used as a dependent variable in any of these researches. There seems to be a lack of coverage in

this area. Thus, the purpose of this research project is to fill that need.

2. Literature Review

2.1 Theoretical Framework

2.1.1 Quantity Theory of Money

Irving Fisher proposed the quantity theory of money in 1911. If this hypothesis is correct, then changes in the money supply are the primary factors that influence price levels generally. The idea is that when the economy is in long-run equilibrium, a change in the money supply will cause prices to move proportionally, but this isn't always the case when things aren't in equilibrium. According to Diamond's (2003) argument, the only thing that money affects on economic aggregates is price. Jean Baptist Say, Adam Smith, David Richardo, Pigu, and other prominent classical school economists worked together and contributed to its development. The faith in a market that could regulate itself and provide socially acceptable outcomes was shattered, and monetary policy was seen as a useless tool in the battle against depressions. A doubling of the money supply will result in a doubling of prices and a halving of the money's worth. Equation of exchange, another name for Fisher's theory, is expressed as follows:

$$MV = PT \quad (2.1)$$

Where:

M = actual money stock or money supply V = the transaction velocity of circulation of money.

P = the average price level T = the real volume of all market transactions made during a period of time. Fisher posited that the quantity of money (M) times the velocity (V), must equal average price level (P) times the aggregate transaction (T). The equation equates the demand for money (PT) to the supply of money (MV).

In the equation, T is better replaced with Q "quantity of goods involved" hence the Fisherian equation can be written as $MV = PQ$

$$(2.2)$$

The average turnover of money, often known as money velocity, is a volitional factor that Fisher defined as the product of the average price in the economy (P), the volume of transactions (T), and the money stock (M) that is, $V = PT/M$. Since neither T nor V change, doubling the money supply will cause prices to double. The causes that might cause the velocity of money to change develop slowly, therefore

for the time being we will treat velocity as constant. Factors such as population density, payment frequency (weekly or monthly), access to credit, proximity to retailers, etc. It follows that the money supply and price level are directly related to one another. So far as the theory is concerned, Ajudua et al. (2015) have shown that money is considered to be neutral.

2.1.2 Monetarist Theory

In 1953, Milton Friedman put out the monetarist idea. This theory states that inflation is a universal phenomenon that occurs in monetary systems. Monetary authorities should exercise prudence while increasing the money supply, as Milton Friedman (1953) points out that doing so in the short term might lower unemployment but also produce inflation. As a theory of money demand rather than production, price, or income in monetary terms, monetarists drew on Fisher's equation of exchange to establish a functional relationship between the quantities of real balances demanded by a small set of variables. According to monetarists like Milton Friedman (1953), the money supply is the most important component in determining the economy's health. Since an increase in the money supply has a liquidity impact on both income and prices, monetarists include price expectations as a new component in interest rate determination. The neoclassical school of thought, according to the writings of Onouorah et al. (2011), placed an emphasis on monetary policy since monetarists believed that money played a more significant role in explaining macroeconomic behavior.

These are the key points of the monetarist view of the transmission mechanism of money: $\text{Enjoy } \uparrow \text{OMO} \rightarrow \text{MS} \rightarrow \text{Spending} \rightarrow \text{GNP}$ The classic notion of money's quantity lies at the heart of the monetarist case. A change in the money supply will have an immediate impact on pricing and production or income if the velocity of money in circulation remains constant. The central bank's ability to print money is directly related to the amount of money in circulation, according to monetarist theory. According to Friedman and Schwartz (1963), this transmission mechanism is as follows: when the central bank conducts an expansive open market operation, the stock of money increases. This, in turn, increases the ability of commercial banks to create credit and increases their reserves, which in turn increases the money supply through the multiplier effect. Banks and non-bank organizations buy assets similar to those offered by the Central Bank to diversify their holdings and encourage spending in the real economy. In support of this idea, Tobin (1978) looks at the

transmission effect via the lens of asset portfolio choice, showing that changes in monetary policy cause people to move between different types of assets, such as stocks, bonds, commercial paper, and bank deposits. According to him, banks and liquidity concerns caused by restrictive monetary policy limit loans to businesses and prime borrowers, limiting their access to credit for things like mortgages and consumer expenditure, which in turn reduces investment and effective demand.

On the other side, Keynesians argue that changes in the money supply influence interest rates, investment, production, and employment by facilitating market activity (1930). Although he proposed the idea of capital rationing and said that banks' lending intentions impact the transmission of monetary policy, Modigliani (1963) lent credence to this position. Oliner and Rudebush (1995) found that bigger enterprises pushed out smaller ones during periods of restrictive monetary policy, but that neither the usage of bank funds nor non-bank funds changed much. Tight monetary policy reduces credit facilities for small firms, and changes to bank-related aggregates, such as the broad money supply, have a disproportionately negative impact on these companies, according to Gertler and Gilchrist (1991).

2.2 Empirical Literature

Gökhan (2023) the impact on the pricing of agricultural commodities produced by various entities of the US dollar and Turkish lira exchange rates (EXR) and the money supply (M2). The VECM Vector Error Correction Model was used to determine the direction and magnitude of the association among the data. The findings show that in the short term, the causation goes from agricultural price (AP) to M2, but not the other way around. Over time, EXR has a greater impact than M2. In the agricultural pricing equation, the coefficient of error correction is 0.0726, which is statistically significant at the 1% level. All of the system's instability can be corrected, according to it, in around 14 months. This study demonstrates that M2 and the exchange rate (EXR) significantly impact agricultural prices (AP) in the long term. Keeping a careful eye on these macro factors is essential for agricultural price management.

Using a data-rich framework covering the years 1986–2020, Haruna et al. (2022) investigated the impact of monetary policy on price stability in Nigeria. The researchers were interested in learning which monetary policies have been successful in promoting price stability and how inflation reacts to changes in monetary policy. The research used the Auto-

regression Distributed Lag (ARDL) Bound Test to estimate the Error Correction Model (ECM) and integrate the data. While the monetary policy rate (MPR) and real interest rate (RIR) were found to be stationary at level 1 (0), the ADF test showed that the following variables were stationary: inflation (INF), exchange rate (EXR), and wide money supply (M2). There seems to be a long-run influence between monetary policy variables and price stability, since the null hypotheses of no link were all rejected by the ARDL bounds test. Our research demonstrates that RIR has a negative and substantial effect on price stability, but EXR, M2, and MPR all have a negative and minor effect.

For the years 2001–2019, Ali et al. (2021) use the Generalized Method of Moments (GMM) technique to analyze how monetary policy shocks affected the prices of various food and industrial agricultural commodities. As a stand-in for national monetary policy, the money supply has been used. To detect shocks in monetary policy, one uses the Hodrick-Prescott (HP) filter. This research found that agricultural commodity prices are affected by both expected and unexpected shocks to the money supply, but the severity of these effects differs. In this way, agricultural commodity prices benefit greatly from the expected shocks in the food and industrial commodities categories. The group of agricultural industrial goods had a favorable and statistically significant impact on prices from the unexpected monetary shock, but the group of agricultural food commodities showed almost no effect. Furthermore, there is a two-sided relationship between the two groups' responses to monetary policy shocks and the pricing of agricultural commodities. So, monetary shocks, both expected and unexpected, have different impacts on food prices.

In their 2020 study, Takon and Ita looked at how monetary policy affected price stability in Nigeria. In particular, we aimed to determine how changes in the money supply, interest rates, and exchange rates related to price stability. A research design based on exploration was used. This study relies on secondary data retrieved from CBN Bulletin. In order to determine the correlation between the variables, the ordinal least square of multiple regression statistical method was used. The years 2007–2016 were the scope of the research. While interest rates did not show a statistically significant correlation with inflation, the data showed that money supply did. A country's inflation rate is very sensitive to its currency rate.

In their study covering the years 1986–2018, Bank-Ola and Jemiluyi (2020) analyze how monetary policy

affected price stability in Nigeria. Inflation consumer prices was used to gauge price stability, while monetary policy variables included cash reserve ratios, liquidity ratios, exchange rates, money supply, and imports of goods and services. After performing a diagnostic test, the researchers used secondary time series data retrieved from the WDI and the CBN Statistical Bulletin 2018 to construct the Auto-Regressive Distributed Lag (ARDL) model. According to the study's findings, the cash reserve ratio was the only monetary policy tool that significantly and positively impacted price stability. During the time period under consideration, imports of goods and services had a positive but negligible effect on price instability, but liquidity ratio, exchange rate, and money supply had a negative and small influence.

Using secondary yearly data from 1981 to 2019, Salihu (2020) examined how successful monetary policy was in managing inflation in Nigeria. The research monitored inflation using the following variables: money supply, rate of Treasury bills, rate of monetary policy, and exchange rate. The paper used the following tests to determine if the variables were related over the long term: the cointegration method, the Granger causality test, and the Augmented Dickey Fuller unit root test. Ordinary Least Square (OLS) was chosen as the best linear unbiased estimator because of its properties. In the first part of the investigation, we used the Augmented Dickey Fuller (ADF) unit root test to examine the relevant variables. We found that, while the variables were stationary at first differences, they were non-stationary at level. The variables were shown to have a long-run association according to the Johansen co-integration test. There was a positive correlation between inflation in Nigeria and the money supply, monetary policy rate, and Treasury bill rates, according to the empirical results of the OLS test. As a result, inflationary pressures increase as the value of a currency declines. The study found that inflation was affected by the money supply, the rate of treasury bills, monetary policy, and the exchange rate during the study period. It suggests that open market operations should not use the annual Treasury bill rate as a proxy for inflation management.

From 1970 to 2014, Babatunde and Kehinde (2016) analyze how monetary policy affected price stability in Nigeria. This research used the statistics bulletin from the Central Bank of Nigeria to compile its data, which was then evaluated using a unit root test, Johansen co-integration test, and ordinary least square regression (OLS) model. The overall price level is represented by the described variable, and the Consumer Price Index (CPI) is used as a surrogate for it. Two explanatory variables were employed: the

money supply and the exchange rate. Budget deficits, changes in policy formulation, a lack of a conducive financial market environment, and political instability are some of the monetary policy issues that the study tackled. The research shows that the money supply and exchange rate have an effect on price stability in Nigeria over the long and short term. The 90% coefficient of determination and F-Statistics of 168.30, which exceed the calculated F-Statistics, provide support of this.

The study by Yakubu et al. (2013) looks at how the interplay between fiscal and monetary policy affects the rise of prices and production in Nigeria. Policy factors like as money supply and government income seem to have a stronger beneficial influence on pricing and economic development in Nigeria, according to innovation assessments. However, this effect is long-lasting and lags behind other variables. While fiscal and monetary policy factors do impact economic activity, our analysis shows that for most periods, economic activity is driven mostly by its own dynamics. This paper's calculations imply that fiscal and monetary policy have a larger influence on inflation and real GDP in Nigeria. Although certain policy factors are seen to be more helpful to social and economic development than others, it is clear that the effect of policies much depends on the policy variables chosen.

So, the research analyzed John Maynard Keynes's general theory of employment, interest, and money and Milton Friedman's monetarist theory. Inflation is a monetary occurrence in every place and time, according to Milton Friedman's monetarist theory from 1953. Milton Friedman (1953) points out that monetary authorities should exercise caution when increasing the money supply, as doing so in the short run can lead to inflation and reduce unemployment. In contrast, John Maynard Keynes's 1936 Keynesian theory proposed a combination of interest rate reduction (monetary policy) and government infrastructure investment (fiscal policy) to stimulate the economy and thereby alleviate the Great Depression. The government encourages commercial banks to lower their interest rates for clients by lowering the rate at which the central bank loans money to them.

As a result, there is a conflict between the monetarist and Keynesian postulates. Take, for example, Keynes' belief that a combination of fiscal measures is necessary to control price (inflation) instead of the various monetary policies advocated by monetarists. These policies include changes to the money supply, interest rates, cash reserve ratios, monetary policy

rates, and balance sheets. Evidently, there is a void. Based on its empirical evaluation of many prior investigations, the current investigation found inconsistent and sometimes contradictory findings. Examples of previous research that found monetary policy factors to have a positive and substantial effect on prices are Ali et al. (2021) and Yakubu et al. (2013). The opposite is true according to the research of Haruna et al. (2022), who found that all monetary policy variables—including the money supply, the exchange rate, and the real interest rate—had a negative and insignificant impact on prices. Gorham (2023), Taken and Ita (2020), Bank-ola and Jemiluyi (2020), Salihu (2020), and Babatunde and Kehinde (2016) all found that monetary policy factors had a positive or negative relationship with prices of goods and services in their individually performed studies. Notably, previous research only examined interest rates, money supply, money reserve ratios, and Treasury bill rates as proxies for monetary policy; none of the studies took a more comprehensive approach by considering all of these variables together. Furthermore, it was discovered that not a single one of these studies used the commodity price index as a stand-in for the dependent variable "commodity price." This finding implies a lack of coverage in the literature.

3. Methodology

Secondary data for this article came from the World Bank's development indicators and the Central Bank of Nigeria's (CBN) statistics bulletin; the research methodology used was ex-post facto. In the context of this study, this data source is deemed trustworthy and reliable. There will be thirty-two(32) years of data, spanning the years 1990 to 2022. To represent monetary policy, we used the following proxies: real interest rate (RIR), cash reserve ratio (CRR), broad money supply (MS), Treasury bill rate (TBR), and exchange rate. To capture commodity pricing, we used the commodity price index (CPI).

Model Specification

This study's model is an adaptation of Gökhan's (2023) work on the impact of monetary policy indicators on crop prices. The one they used was;

$$AP = f(EXR, M2) \quad (3.1)$$

Where:

AP = Agricultural Commodity Price, EXR = Exchange Rate, M2 = Money supply

Thus, the researcher adjusted the model to include more factors in order to accomplish the goal of this study. The Interest Rate (IR), Cash Reserve Ratio

(CRR), and Treasury Bill (TBR) are all part of this set. Monetary policy is represented by including these three factors. The following is a statement of the new enlarged model:

$$CPI = f(IR, CRR, MS, TBR, EXR) \quad (3.2)$$

$$CPI = \beta_0 + \beta_1 IR + \beta_2 CRR + \beta_3 MS + \beta_4 TBR + \beta_5 EXR \quad (3.3)$$

$$CPI_t = \beta_0 + \beta_1 IR_t + \beta_2 CRR_t + \beta_3 MS_t + \beta_4 TBR_t + \beta_5 EXR_t + \mu_t \quad (3.4)$$

Where:

CPI = Commodity Price, RIR = Real Interest Rate, CRR = Cash Reserve Ratio, MS = Broad Money Supply, TBL = Treasury bill Rate, EXR = Official Exchange Rate, μ = Error term, β_0 = Constant and β_1 to β_5 = Parameter Estimates.

The expectations are: β_1 , β_2 , and $\beta_5 > 0$, β_3 , and $\beta_4 < 0$, suggesting that, the sign of β_1 , β_2 and β_5 are by theory expected to have a positive relationship with commodity price index, since increase in RIR, CRR and EXR will limit financial institution from creating funds thereby leading to cost of capital which will in turn increase commodity price, while β_3 and β_4 are expected to have a negative relationship with commodity price.

Description of Variables in the Model

i. Commodity Price Index (CPI): The commodity price index, which is a measure of the average changes in the prices paid or received by producers and consumers for a basket of commodities over time, is a good indicator of commodity prices. Consequently, the index of commodity prices is employed as a stand-in for the dependent variable.

ii. Interest Rate (IR): Rate of interest is the percentage charged or paid on a sum of money over a certain time period; it is usually represented as an annual percentage rate. The cost of borrowing money goes up in direct proportion to the interest rate. Companies engaged in the manufacturing and distribution of goods subsequently incur more costs as a result of this. Thus, the purpose of this study was to test the hypothesis that interest rates and commodity price indices are positively related. A yearly percentage is the unit of measurement for interest rate. Economic theory predicts a positive correlation between interest rates and commodity price indices, according to the research. Therefore, β_1 is greater than 0.

iii. Cash Reserve Ratio (CRR): This instrument of monetary policy allows the central bank to regulate the needed level of liquidity among deposit money institutions relative to their total deposits. Importantly, if the cash reserve ratio were to rise, banks would have less cash on hand, which would reduce liquidity in the

financial system and dampen investment and consumer spending. The researchers in this study thus presupposed that the cash reserve ratio and the commodity price index were positively related. The ratio of cash on hand to total assets is a yearly percentage. The study's theoretical foundations in economics lead it to conclude that a positive correlation exists between the cash reserve ratio and the commodity price index. Therefore, β_2 is greater than zero.

iv. Broad Money Supply (MS): The whole amount of currency in circulation, or the wide money supply, is an important measure of economic health. Coins and notes, other kinds of demand deposits, savings accounts, and other assets that may be turned into cash fast are all part of this category. Increasing the money supply has the potential to stimulate the economy as a whole. Thus, the commodity price index and the broad money supply are anticipated to have an inverse relationship. The monetary base is quantified in billions of Naira each year. Three, less than zero

v. Treasury Bill (TBL): Typically having a maturity of one year or less, they are government-issued debt

securities. Treasury bills will become more appealing to investors looking for low-risk returns if the rate is increased. For this reason, the commodity price index and Treasury bill are likely to move in the opposite direction. ($\beta_4 < 0$)

vi. Exchange Rate (EXR): The phrase "exchange rate" may mean either the rate set by the government of a country or the rate found in a regulated market. The exchange rate is the price at which one country's currency is traded for another's currency. The study's underlying economic theory predicts a positive correlation between the currency rate and the commodity price index. Meaning, β_5 is greater than 0.

4. Empirical Data Analysis

Unit Root Test

In order to minimize false regression, the research used the Augmented Dickey Fuller (ADF) unit root test to determine the order of integration of the variables under consideration. This helped in selecting the proper technique.

Table 1: Unit Root Test Using Augmented Dickey Fuller (ADF)

Variables	Levels		First Difference		Order of Integration	P-value
	ADF Statistics	5% Critical Value	ADF Statistics	5% Critical Value		
LCPI	-3.859777	-2.957110			1(0)	0.0050
RIR	-5.450007	-2.967110			1(0)	0.0001
CRR	-0.134258	-2.957110	-5.566727	-2.960411	1(1)	0.0001
LMS	-4.490728	-2.957110			1(0)	0.0002
TBR	-2.940797	-2.957110	-5.585149	-2.960411	1(1)	0.0000
LEXR	-1.888532	-2.957110	-5.243789	-2.960411	1(1)	0.0002

Source: Author Computation 2024* Level of significance at 5%

This study employs the Augmented Dickey-Fuller (ADF) unit root tests to check the order of integration of the variables and the results are presented in Table 4.3.1 The results of Augmented Dickey-Fuller (ADF) showed that the variables are integrated in different order or a combination of I(0) and I(1) series. The ADF result revealed that LCPI, RIR and LMS are stationary at levels 1(0) while, CRR, TBR, and LEXR, are stationary after first differencing 1(1). This condition makes the Autoregressive Distributive Lag (ARDL) Bounds test approach to co-integration appropriate for investigating the long-run relationship among these variables.

Table 2: ARDL Bound Test

Test Statistics	Value	K
F-statistics	6.791282	5
Significance	I (0)	1(1)
10%	2.26	3.35
5%	3.62	3.79
2.5%	2.96	4.18
1%	3.41	4.68

Source: Authors Computation 2024

Table 2 shows that the variables are related to one another over the long term, as the F-statistic of 6.791282 is greater than the critical values for both the lower and upper bounds. We conclude that there must be a long-term association and reject the alternative hypothesis. This indicates that the commodity price in Nigeria is related to monetary policy over the long term.

Table 3: ARDL Long-run Result (LCPI)

Variables	Coefficient	Std. error	t-Statistic	Prob-Value
RIR	0.013450	0.019204	0.700369	0.5036
CRR	0.029765	0.010644	2.796572	0.0233
LMS	0.367597	0.084835	4.333073	0.0025
TBR	-0.033567	0.017063	-1.967295	0.0847
LEXR	0.120123	0.203748	0.589563	0.5718

Source: Authors computation 2024

As shown in table 4-3.3 of the Autoregressive Distributive Lag (ARDL) Long term result, there was a positive link (+0.013450) between the real interest rate (RIR) and the log value of the commodity price index (LCPI), which is a proxy for commodity pricing in Nigeria. If the real interest rate (RIR) were to increase by one unit, the log value of the commodity price index (LCPI) would climb by about 0.01%. The p-value of 0.5036 suggests that the correlation between real interest rate and the log value of the commodity price index is not statistically significant. This negates economic theory which predicts that, a rise in the real interest rate is likely to cause the logarithm of the commodity price index to rise.

In addition, the cash reserve ratio (CRR) showed a positive correlation (+0.029765) with the commodity price index (LCPI), which is a stand-in for commodity pricing in Nigeria. If the cash reserve ratio (CRR) in Nigeria grows by one unit, the log value of the commodity price index (LCPI) would increase by almost three percent. Cash reserve ratio has a statistically significant effect on the log value of the commodity price index, nevertheless, with a probability value of 0.0233.

As a surrogate for Nigerian commodity prices, the log value of the commodity price index (LCPI) showed a

positive association (+0.367597) with the long-run ARDL result of the log of broad money supply (LMS). There is a statistically significant correlation between the logarithm of broad money supply and the logarithm of its commodity price index ($p = 0.0025$).

In addition, the value of the commodity price index (LCPI) as a proxy for commodity pricing in Nigeria had a negative correlation of -0.033567 with the value of the Treasury bill rate (TBR). Thus, the log value of the LCPI in Nigeria would decrease by about 3% for every unit rise in the value of the Treasury bill rate (TBR). But with a probability of 0.0847, the effect of the Treasury bill rate on the log value of the commodity price index is not statistically significant. Lastly, the value of the commodity price index (LCPI) as a surrogate for commodity pricing showed a positive association (+0.120123) with the log value of the exchange rate (EXR). So, for every one-unit depreciation in the log value of the exchange rate (EXR), the log value of the commodity price index (LCPI) in Nigeria would rise by almost 12%. There is no statistically significant relationship between the logarithm of the exchange rate and the logarithm of the commodity price index, according to the probability value of 0.5718.

Table 4: ARDL Short-run Result (LCPI)

Variable	Coefficient	Std. Error	t-Statistics	Prob
C	0.621049	0.120285	5.162979	0.0009
D(RIR)	0.004396	0.003163	1.390128	0.2019
D(RIR(-1))	0.001274	0.003500	0.363914	0.7254
D(RIR(-2))	0.000653	0.002387	0.273470	0.7913
D(CRR)	0.006125	0.005325	1.150211	0.2833
D(CRR(-1))	-0.015653	0.006263	-2.499288	0.0247
D(CRR(-2))	-0.004012	0.006122	-0.655331	0.5306
D(LMS)	-0.017928	0.142856	-0.125500	0.9032
D(LMS(-1))	-0.543209	0.176315	-3.080901	0.0110
D(LMS(-2))	-0.227301	0.183181	-1.240854	0.2498
D(TBR)	-0.007851	0.003406	-2.305093	0.0401
D(TBR(-1))	0.005358	0.004103	1.305960	0.2279
D(TBR(-2))	0.003571	0.003785	0.943634	0.3730
D(LEXR)	-0.043307	0.051015	-0.848909	0.4206
D(LEXR(-1))	-0.055060	0.060213	-0.914410	0.3872
D(LEXR(-2))	0.013354	0.054523	0.244930	0.8127
Ecm (-1)*	-0.582834	0.095863	-6.079885	0.0003
Adj R ² = 0.712957, F-statistics = 5.501888 (0.001753), DW = 1.832983				

Source: Authors computation 2024

The coefficient estimates for the error correction term, ECM (-1) has a negative value and is significant at the 0.05 level. It suggests that the model will reach long-run equilibrium at a rate of 58% every year. This means that a yearly adjustment speed of 58% may fix the mistake from the previous year.

The independent variables (RIR, CRR, MS, TBR & LEXR) explain 71% of the total variance in the dependent variable (CPI), according to the corrected R-Square (R²) value. As a whole, the model is noteworthy since the F-statistic is significant at the 5% level of significance. Without serial correlation, the model would not work, according to the Durbin-Watson statistics of 1.832983, which is close to 2.

Table 4.3.4 displays the model's short-run outcome. A positive real interest rate (RIR) of (+0.004396, +0.001274, and +0.000653) was seen in the present, the preceding, and the second year periods when the log value of the commodity price index (LCPI) was used as a surrogate for commodity price in Nigeria. This means that the log value of the commodity price index (LCPI), which is a proxy for commodity price, would rise by approximately 0.0004%, 0.001%, and 0.0006% for every unit increase in the real interest rate (RIR) in Nigeria. Real interest rate and commodity price index log value do not correlate statistically (p=0.02019, 0.7254, and 0.7914, respectively). Economic theory predicts this outcome. The log value of the commodity price index is likely to rise in response to an increase in the real interest rate.

Using the log value of the commodity price index (LCPI) as a surrogate for commodity prices in Nigeria over the preceding year, the cash reserve ratio (CRR) also has a negative value of -0.015653. If the cash reserve ratio (CRR) in Nigeria increases by one unit, the log value of the commodity price index (LCPI), which is a proxy for commodity pricing, would fall by about 0.002%. Based on the p-value of 0.0247, it can be concluded that the cash reserve ratio is significantly related to the log value of the commodity price index. Economic theory does not support this outcome. The predicted outcome is that the log value of the commodity price index will rise in response to an increase in the cash reserve ratio.

As a surrogate for commodity prices in Nigeria over the preceding year, the log value of the commodity

price index (LCPI) is negative (-0.543209) when applied to the broad money supply (MS). This means that the log value of the commodity price index (LCPI), which is a proxy for commodity pricing, would decline by about 0.54% for every unit rise in the log value of the broad money supply (LMS) in Nigeria. The correlation between the logarithm of the broad money supply and the logarithm of the commodity price index is statistically significant (p=0.0110). Economic theory predicts this outcome. As the money supply expands, the log value of the commodity price index is anticipated to fall.

Similarly, using the log value of the commodity price index (LCPI) as a stand-in for commodity prices in Nigeria in the most recent year, the value of the Treasury bill rate (TBR) is negative (-0.007851). If the Treasury bill rate (TBR) in Nigeria were to rise by one unit, the log value of the commodity price index (LCPI), which is a proxy for commodity pricing, would fall by about 0.008%. The correlation between the yield on Treasury bills and the logarithm of the commodity price index is statistically significant (p = 0.0401). Economic theory predicts this outcome. The predicted outcome of a rise in the rate of interest on Treasury bills is that the log value of the commodity price index will fall.

Last but not least, as a surrogate for commodity prices in Nigeria during the second year period, the value of the exchange rate (LEXR) is positive (+0.013354) using the log value of the commodity price index (LCPI). This means that the log value of the commodity price index (LCPI), which is a proxy for commodity pricing, would rise by about 0.01% for every unit depreciation in the log value of the exchange rate (LEXR) in Nigeria. A statistically significant association between the exchange rate and the log value of the commodity price index is shown by the p-value of 0.8127. Economic theory predicts this outcome. The predicted outcome of a rise in the rate of interest on Treasury bills is that the log value of the commodity price index will fall.

Diagnostic Test

Table 5: Ramsey Reset Test, Serial Correlation LM Test and Homoscedasticity Test Results

	F-Statistic	Prob-Value
Ramsey Reset Test	8.809990	0.0709
Breusch-Godfrey Serial Correlation LM Test	6.104384	0.0658
Breusch-Pagan-Godfrey Heteroskedasticity Test	0.977193	0.5507

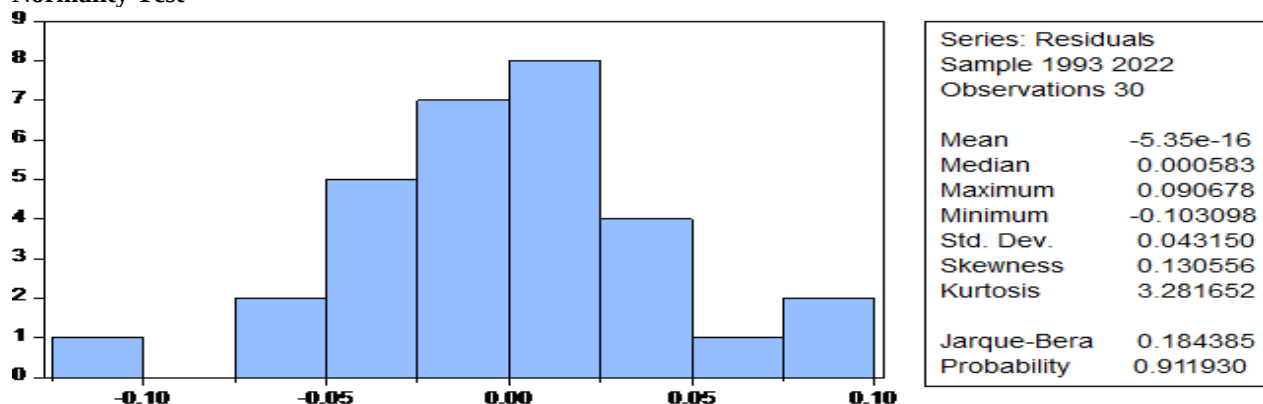
Source: Authors computation 2024

From the diagnostic test results in Table 4.3.5, we can see that the Ramsey Reset test for linearity found an f-statistic of 8.809990 and a computed p-value of 0.0709, both of which are greater than the 5% (0.05) critical value. Consequently, we can reject the null hypothesis and conclude that the model is correctly specified.

The f-statistic is 6.104384 and the Chi-Square probability value is 0.6329, according to the Serial or Autocorrelation Test utilizing the Breusch-Godfrey Serial Correlation LM Test. This proves that there is no serial correlation in the model, as the probability value of around 7% (0.0658) is higher than the crucial value of 5% (0.05).

An f-statistic of 0.977193 and a Chi-Square probability value of 0.5507 were produced by the heteroscedasticity test that used the Breusch-Pagan-Godfrey test. With a probability Chi-square value more than 5% ($P > 0.05$), the results point to the absence of heteroskedasticity in the model. Thus, residuals are homoscedastic, meaning they have a constant variance, an ideal property for regression.

Normality Test



The residuals are normally distributed, as shown in Figure 7, which summarizes the normalcy test. The Jarque-Bara value is 1.184385, and the associated probability value is 0.911930, both of which are more than the 0.05 threshold of significance.

5. Discussion of Findings

5.1. Real Interest Rate and Commodity Price Index in Nigeria.

In the most recent years' time period of the short-run, the results of the regression analysis using the Auto-Regressive Distributive Lag (ARDL) method showed that the real interest rate (RIR) has a negative association with the commodity price index (CPI). It defies economic theory that the real interest rate (RIR) and the commodity price index (CPI) have a negative relationship. The general public anticipates that when the real interest rate (RIR) rises, consumer prices will follow suit. But the result's p-value shows that real interest rate (RIR) has a statistically significant effect on the CPI. Therefore, the analysis concludes that the null hypothesis that the RIR and CPI are not significantly related is incorrect. The results of this study are in line with those of earlier research by Haruna et al. (2022).

5.2 Cash Reserve Ratio and Commodity Price Index in Nigeria.

A favorable association between cash reserve ratio (CRR) and commodity price index (CPI) was inferred using regression analysis. It is consistent with economic theory that the cash reserve ratio (CRR) has a positive connection with the commodity price index (CPI). Since deposit money banks have less cash on hand, an increase in the cash reserve ratio (CRR) is likely to cause interest rates to rise, making borrowing more expensive and, in turn, driving up the cost of goods and services in the country. Cash reserve ratio (CRR) has a statistically significant effect on commodity price index (CPI), according to the p-value of the finding. Therefore, the analysis concludes that the null hypothesis that the cash reserve ratio (CRR) and commodity price index (RIR) do not have a significant link is false.

5.3 Broad Money Supply and Commodity Price Index in Nigeria.

From what we can see, in the short term, there is an inverse link between the broad money supply (MS) and the commodity price index (CPI) during the last year. Economic theory predicts a negative correlation between the MS and the CPI (commodity price index).

A rise in the broad money supply (MS) is thought to boost economic liquidity, which in turn increases the number of commodities and, eventually, lowers prices across the board. Real wide money supply (MS) does have a statistically significant effect on the commodity price index (CPI), according to the p-value of the outcome. Since the research found a substantial link between broad money supply (MS) and commodity price index (CPI), the null hypothesis that there is no relationship between the two is rejected. Previous research by Takon and Ita (2020) casts doubt on the results of this investigation.

5.4 Treasury Bill Rate and Commodity Price Index in Nigeria.

Also, in the most recent years' worth of data, we see that the short-term link between the Treasury bill rate (TBR) and the commodity price index (CPI) is negative. Economists' predictions about a negative correlation between the TBR and the CPI are spot on. The anticipated slowdown in the growing costs of goods and services in the nation is a result of a rise in the Treasury bill rate (TRB). The result's p-value, however, suggests that the Treasury bill rate (TBR) has a statistically significant effect on the CPI. Accordingly, the study's results disprove the null hypothesis that the correlation between the TBR and CPI is not statistically significant.

5.5 Exchange Rate and Commodity Price Index in Nigeria.

Finally, the estimated model's results showed that a positive exchange rate (EXR) has a long-term and short-term beneficial effect on the commodity price index (CPI) after the second year. Economic theory predicts a positive correlation between the exchange rate (EXR) and the commodity price index (CPI). As a result of the local currency's depreciation, which drives up interest rates and the cost of goods and services, an increase in the exchange rate (EXR) is anticipated to amplify the prices in the nation. Exchange rate (EXR) does have a statistically significant effect on commodity price index (CPI), according to the p-value of the finding. It follows that the investigation does not support the null hypothesis that the correlation between the CRR and the RIR is not statistically significant. Research by Haruna (2022) contradicts the results of this research.

6. Conclusions and Recommendations

According to the study's conclusions, commodity prices are significantly affected by changes in monetary policy variables including interest rates,

cash reserve ratios, money supply, etc. Regression analysis on the link between real interest rate and commodity prices found that, in the most recent years' worth of data, real interest rate is positively and significantly correlated with commodity prices, whereas broad money supply is negatively and significantly correlated with commodity prices in the same time period. For the present short-term timeframe, it was also determined that the rate of Treasury bills had a negative and statistically significant correlation with commodity prices. Lastly, according to the regression results, there is a positive but negligible association between the exchange rate and commodity prices in the long run and in the short run compared to the previous year.

Recommendations

The securities held by the federal government should be priced in a way that makes them appealing, and this should be done by the monetary policy authority.

Furthermore, the CBN ought to exercise caution when raising the reserve ratio, as an ongoing hike will certainly impact the cost of goods and services. •Final point: Rather than transferring funds to deposit money banks or shadow banks, the foreign exchange should be distributed directly to registered investors, especially those in the agricultural and manufacturing sectors.

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