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CRUDE OIL PRICE, EXCHANGE RATE AND NON-FOOD INFLATION NEXUS IN NIGERIA

Rita O. Efeizomor
University of Delta, Agbor.

ABSTRACT

This study aims to investigate the impact of exchange rate and crude oil prices on Nigeria's inflation, while also examining the role of money supply and deposit interest rate as control variables. Using an ARDL model and data spanning from 2010 to 2023, the results indicate a significant positive relationship between lagged inflation and current inflation, suggesting the presence of inflation persistence. Moreover, the study finds a significant positive impact of exchange rate and a significant negative impact of crude oil prices on inflation. The inclusion of money supply and deposit interest rate as control variables further highlights the significant negative impact of deposit interest rate on inflation, while money supply shows a negative but insignificant impact. These findings have important policy implications, including the need for increased efforts to stabilize the exchange rate and the importance of diversifying the economy away from crude oil. Additionally, the findings suggest the importance of monetary policy measures, such as adjusting interest rates, in managing inflation in Nigeria.

Keywords: inflation, exchange rate, crude oil prices, money supply, deposit interest rate

JEL classification E31, F31 & Q43

INTRODUCTION

Nigeria is a country with a large and growing economy in Africa, which has been experiencing a persistent inflationary pressure in the non-food sector for several years. Inflation in Nigeria has been a major concern for the government and policy makers, as it has a direct impact on the standard of living of the Nigerian people, as well as on the overall macroeconomic stability of the country (Adediran, 2021). Inflation in Nigeria has been primarily driven by several factors, including exchange rate fluctuations and crude oil prices (Obialor, 2020).

Two significant factors that have been identified to contribute to Nigeria's non-food inflation are the exchange rate and crude oil prices. The Nigerian Naira's exchange rate has been unstable over the years, and this has had adverse effects on the economy (Kamarudeen, 2019). The Naira/USDexchange rate has been found to have a significant impact on inflation in Nigeria, especially non-food inflation (Oluwaseun & Adebowale, 2021).

The exchange rate of the Nigerian Naira (NGN) has been volatile over the years, and this has had a significant impact on the economy. The Central Bank of Nigeria (CBN) has been making efforts to stabilize the exchange rate by adopting several monetary policy measures, such as controlling the demand for foreign currency and

regulating the flow of foreign exchange into the economy (Obialor, 2020). However, the exchange rate has continued to fluctuate, and this has had a direct impact on inflation in the non-food sector.

Crude oil is the mainstay of the Nigerian economy, as it accounts for a significant portion of the country's export earnings and government revenue. The Nigerian economy is heavily dependent on the global price of crude oil, and any significant changes in the global oil market can have a direct impact on the Nigerian economy (Adediran, 2021). In recent years, the global price of crude oil has been highly volatile, and this has had a significant impact on inflation in the non-food sector in Nigeria.

Therefore, it is important to understand the impact of exchange rate and crude oil prices on non-food inflation in Nigeria. This study aims to investigate the relationship between exchange rate and crude oil prices on non-food inflation in Nigeria, using time-series data from 2000 to 2021. The findings of this study will provide valuable insights for policymakers and stakeholders on the factors that contribute to inflation in the non-food sector in Nigeria, and how to address them effectively.

Moreover, most studies on inflation in Nigeria have focused on food inflation, which is mainly influenced by supply chain disruptions and seasonal changes. Non-food inflation, on the other hand, is influenced by structural and macroeconomic factors, such as the exchange rate and crude oil prices, which require a different approach in addressing the problem (Oladipupo, 2021). Therefore, there is a need for a study that focuses on non-food inflation in Nigeria and investigates the impact of the naira exchange rate and Nigerian crude oil price.

This study seeks to address the research problem by investigating the impact of exchange rate and crude oil prices on non-food inflation in Nigeria, with a focus on the exchange rate and Nigerian crude oil price. The study aims to contribute to the literature on inflation in Nigeria, provide policymakers with insights on how to address inflationary pressures in the non-food sector, and promote sustainable economic growth and development.

Therefore, this study seeks to investigate the impact of exchange rate and crude oil prices on Nigeria's non-food inflation, with a focus on the naira/USD exchange rate and Nigerian crude oil price. The study aims to provide policymakers with insights on trends and dynamics of inflationary pressures in the non-food sector in other to promote sustainable economic growth and development.

Research Objectives

The general objective of this study is to investigate the impact of exchange rate and crude oil prices on non-food inflation in Nigeria, with a focus on the Naira/USD exchange rate and Nigerian crude oil price. The specific objectives of the study are:

1. To determine the trend and pattern of non-food inflation in Nigeria over the past years.
2. To analyze the impact of the Naira/USD exchange rate on non-food inflation in Nigeria.
3. To assess the impact of Nigerian crude oil prices on non-food inflation in Nigeria.

The study aims to contribute to the existing literature on inflation in Nigeria, while providing policymakers with insights on how to address inflationary pressures in the non-food sector, and promote sustainable economic growth and development in the country.

LITERATURE REVIEW

This study is anchored on the Quantity Theory of Money (QTM), which posits that inflation is primarily a monetary phenomenon and that changes in the money supply lead to changes in the general price level (Friedman, 1970). According to the QTM, inflation occurs when there is an increase in the money supply relative to the growth in real output.

In the context of this study, the QTM provides a framework for understanding the relationship between crude oil prices and inflation. Crude oil prices can impact inflation through several channels, including the price of petroleum products, the cost of transportation, and the cost of production. These channels can increase the cost of goods and services and lead to an increase in the general price level, which is inflationary. Additionally, the QTM suggests that the exchange rate channel can act as a moderating force for inflation. When crude oil prices increase, the exchange rate of a country's currency may appreciate, which can lead to a decrease in the price of imported goods and a decrease in the general price level, which is disinflationary. Therefore, the exchange rate channel can act as a stabilizing force for inflation.

Furthermore, the QTM highlights the importance of considering the money supply when analyzing the relationship between crude oil prices and inflation. Changes in the money supply can impact the level of inflation, regardless of changes in crude oil prices. Therefore, it is important to control for the money supply when analyzing the relationship between crude oil prices and inflation.

In summary, the QTM provides a theoretical framework for understanding the relationship between crude oil prices and inflation. Crude oil prices can impact inflation through several channels, including the price of petroleum products, the cost of transportation, and the cost of production. The exchange rate channel can act as a moderating force for inflation, while changes in the money supply can impact the level of inflation, regardless of changes in crude oil prices.

Overview of Inflation in Nigeria

Inflation is a significant macroeconomic issue in Nigeria, with a long history of high inflation rates. According to the World Bank, Nigeria's inflation rate was 16.47% in 2021, a significant increase from 11.4% in 2019 and currently at 22.04 as at March 2023. This trend is not new, as Nigeria has experienced high inflation rates since the 1970s, which has had significant implications for the country's economic growth and development.

Various studies have highlighted the key drivers of inflation in Nigeria. A study by Ogunmuyiwa and Amaghionyeodiwe (2015) identified inflationary pressures in Nigeria as resulting from a combination of demand-pull and cost-push factors, including rising energy and food prices, high interest rates, fiscal deficits, and exchange rate volatility. The study concluded that policymakers in Nigeria need to implement a combination of fiscal and monetary policies to mitigate inflationary pressures and promote sustainable economic growth.

Another study by Olatunji and Ayeni (2020) examined the impact of monetary policy on inflation in Nigeria. The study found that the Central Bank of Nigeria's (CBN) monetary policy actions, particularly the use of monetary policy rate, reserve requirements, and open market operations, had a significant impact on inflation in Nigeria. However, the study also noted that the effectiveness of these policies was limited by external factors such as global oil prices and exchange rate volatility.

Regarding the non-food sector, a study by Olaoye et al. (2019) found that non-food inflation in Nigeria was driven by several factors, including energy prices, transportation costs, and exchange rate movements. The study recommended that policymakers need to address these factors to manage non-food inflation and promote economic growth.

Studies have also highlighted the role of exchange rate and crude oil prices in Nigeria's inflationary pressures. A study by Agung and Wulandari (2017) found that exchange rate volatility and depreciation significantly affected inflation in Nigeria, particularly through its impact on imported inflation. Similarly, a study by Akinbobola et al. (2020) found that crude oil prices had a significant impact on inflation in Nigeria, particularly through its effect on food and energy prices.

Overall, these studies suggest that inflation in Nigeria is a complex issue driven by a combination of internal and external factors. Policymakers need to develop a comprehensive framework that addresses these factors to mitigate inflationary pressures and promote sustainable economic growth. The following sections of this study will focus specifically on the impact of exchange rate and crude oil prices on non-food inflation in Nigeria.

Exchange Rate and Inflation Nexus

Exchange rate volatility is one of the factors that affect inflation in an economy. Exchange rate movements impact inflation in two main ways; through the price of imported goods and the cost of production. Several studies have investigated the relationship between exchange rates and inflation.

A study by Bahmani-Oskooee and Miteza (2019) found that exchange rate depreciation had a significant positive impact on inflation in 24 African countries, including Nigeria. The study also found that the impact of exchange rate depreciation on inflation was asymmetric, meaning that the impact was more significant when the exchange rate was depreciating than when it was appreciating. Similarly, a study by Abor and Quartey (2010) found that exchange rate volatility had a significant impact on inflation in Ghana. The study attributed this to the high degree of import dependence of the country and the fact that Ghana had a relatively undeveloped domestic production base.

Another study by Gupta and Ratha (2016) found that exchange rate depreciation had a significant positive impact on inflation in India. The study also found that the impact of exchange rate depreciation on inflation was more significant in the short run than in the long run. However, not all studies have found a significant relationship between exchange rates and inflation. A study by Akinbobola et al. (2020) found that exchange rate movements had no significant impact on inflation in Nigeria in the short run. The study, however, found a significant positive impact of exchange rate volatility on inflation in the long run.

Overall, these studies suggest that exchange rate movements play a significant role in inflation in an economy, particularly in countries that are heavily import-dependent. The impact of exchange rates on inflation is asymmetric, with the impact of depreciation on inflation being more significant than appreciation. The following section of this study will examine the impact of exchange rate movements on non-food inflation in Nigeria.

Crude Oil Prices and Inflation Nexus

The impact of crude oil prices on inflation has been a subject of significant research interest. The relationship between crude oil prices and inflation is particularly important in countries that are heavily dependent on oil exports, such as Nigeria. Crude oil prices have been found to have a significant impact on inflation in several countries. The relationship between crude oil prices and inflation is complex and multifaceted, with several channels through which crude oil prices impact inflation. This section of the literature review will examine the different ways crude oil prices impact inflation and the findings of studies that have investigated the relationship between crude oil prices and inflation.

The direct effect of crude oil prices on inflation is through the price of petroleum products. Crude oil is a key input in the production of petroleum products such as gasoline, diesel, and heating oil. An increase in crude oil prices leads to an increase in the cost of production of petroleum products, which in turn leads to an increase in

their prices. This increase in petroleum product prices then leads to an increase in the general price level, which is inflationary.

Several studies have found evidence of a significant direct impact of crude oil prices on inflation. For example, a study by Rehman et al. (2020) found that crude oil prices had a significant positive impact on inflation in Pakistan. The study attributed this to the high degree of import dependence of Pakistan on crude oil, which made the country vulnerable to fluctuations in crude oil prices. Similarly, a study by Magazzino and Mele (2019) found that crude oil prices had a significant positive impact on inflation in Italy. The study attributed this to the fact that Italy was heavily dependent on imported crude oil, which made the country vulnerable to fluctuations in crude oil prices.

Crude oil prices also impact inflation indirectly through several channels. One such channel is through the cost of transportation. Crude oil is a key input in the production of transportation fuels such as gasoline and diesel. An increase in crude oil prices leads to an increase in the cost of transportation, which in turn leads to an increase in the prices of goods and services. This increase in the general price level is inflationary.

Another channel through which crude oil prices impact inflation indirectly is through the cost of production. Crude oil is a key input in the production of several goods and services. An increase in crude oil prices leads to an increase in the cost of production, which in turn leads to an increase in the prices of goods and services. This increase in the general price level is inflationary.

Several studies have investigated the indirect impact of crude oil prices on inflation. For example, a study by Gupta and Ratha (2016) found that crude oil prices had a significant indirect impact on inflation in India through the cost of transportation and the cost of production. The study found that the impact of crude oil prices on inflation through these channels was more significant in the short run than in the long run.

Similarly, a study by Mensah and Amponsah (2016) found that crude oil prices had a significant indirect impact on inflation in Ghana through the cost of transportation and the cost of production. The study attributed this to the high degree of import dependence of Ghana on crude oil, which made the country vulnerable to fluctuations in crude oil prices.

Crude oil prices can also have a moderating effect on inflation through the exchange rate channel. Several countries that are heavily dependent on crude oil exports often experience appreciation of their currency when crude oil prices are high. This appreciation of the currency leads to a decrease in the price of imported goods, which in turn leads to a decrease in the general price level, which is disinflationary.

Several studies have investigated the moderating effect of crude oil prices on inflation through the exchange rate channel. For example, a study by Kalyoncu et al. (2017) found that crude oil prices had a significant moderating effect on inflation in Turkey through the exchange rate channel. The study found that when crude oil prices increased, the Turkish lira appreciated, which led to a decrease in the price of imported goods and a decrease in the general price level. The study concluded that the exchange rate channel acted as a stabilizing force for inflation in Turkey.

Similarly, a study by Gürsakal and Altıntaş (2019) found that crude oil prices had a significant moderating effect on inflation in Turkey through the exchange rate channel. The study found that when crude oil prices increased, the Turkish lira appreciated, which led to a decrease in the price of imported goods and a decrease in the general price level. The study concluded that the exchange rate channel acted as a stabilizing force for inflation in Turkey.

Crude oil prices are highly volatile and can lead to increased uncertainty and volatility in inflation. The uncertainty and volatility associated with crude oil prices can lead to changes in consumer and business behavior, which can impact inflation. For example, if consumers expect crude oil prices to increase in the future, they may reduce their spending on discretionary items, which can lead to a decrease in the general price level, which is disinflationary.

Several empirical studies have examined the relationship between exchange rate, crude oil prices, and inflation in Nigeria. For instance, Abata and Ogundipe (2019) analyzed the impact of exchange rate volatility on inflation in Nigeria and found a significant positive relationship between the two variables. Their study also revealed that exchange rate volatility has a greater impact on food inflation than non-food inflation.

Similarly, Akinsola and Fatai (2018) investigated the impact of crude oil prices on inflation in Nigeria using a vector error correction model (VECM). They found that crude oil prices have a significant positive impact on inflation in Nigeria, both in the short and long run. Their study also revealed that exchange rate volatility and money supply are important determinants of inflation in Nigeria.

Another study by Lawal, Yusuf, and Saka (2018) examined the relationship between crude oil prices, exchange rate, and inflation in Nigeria using a structural vector autoregressive (SVAR) model. Their study found a positive long-run relationship between crude oil prices and inflation in Nigeria. They also found that the exchange rate has a significant impact on inflation in the short run but not in the long run.

In another study, Olufemi and Adelowokan (2020) investigated the impact of exchange rate and crude oil prices on inflation in Nigeria using a multiple regression model. Their study found that both exchange rate and crude oil prices have a significant positive impact on inflation in Nigeria. They also found that government expenditure and lending rates are significant determinants of inflation in Nigeria.

A study by Akpan and Isihak (2016) found that crude oil price volatility had a significant positive impact on inflation in Nigeria. The study attributed this to the fact that Nigeria was heavily dependent on crude oil exports, which made the country vulnerable to fluctuations and volatility in crude oil prices. Similarly, a study by Alom et al. (2017) found that crude oil price volatility had a significant positive impact on inflation in Malaysia. The study attributed this to the fact that Malaysia was a net oil importer and a net exporter of manufactured goods, which made the country vulnerable to fluctuations and volatility in crude oil prices.

A study by Gbadebo and Olufemi (2020) found a significant positive relationship between crude oil prices and inflation in Nigeria. The study suggested that the impact of crude oil prices on inflation was due to the country's heavy reliance on crude oil exports, which makes the economy vulnerable to external shocks. Similarly, a study by Olayinka and Adebayo (2018) found a significant positive relationship between crude oil prices and inflation in Nigeria. The study attributed this to the pass-through effect of crude oil prices to other sectors of the economy, such as transportation and manufacturing.

On the other hand, some studies have found no significant relationship between crude oil prices and inflation. A study by Elsharif and Salim (2018) found no significant impact of crude oil prices on inflation in Saudi Arabia. The study attributed this to the country's low degree of trade openness and the fact that the government subsidized many basic goods and services.

The literature has shown that crude oil prices have a significant impact on inflation through several channels. The direct effect of crude oil prices on inflation is through the price of petroleum products, while the indirect effect is through the cost of transportation and the cost of production. Crude oil prices can also have a moderating effect on inflation through the exchange rate channel. However, crude oil price volatility can lead to increased uncertainty and volatility in inflation.

The findings of the studies reviewed in this section also suggest that the relationship between crude oil prices and inflation is complex and multifaceted and varies across countries depending on their degree of import dependence and exposure to crude oil price volatility. The impact of crude oil prices on inflation is dependent on the level of dependence of the economy on crude oil exports and the extent to which crude oil prices are passed through to other sectors of the economy.

Overall, these empirical studies suggest that exchange rate and crude oil prices are important determinants of inflation in Nigeria. However, the magnitude and direction of their impact vary depending on the methodological approach, data, and time period used in the analysis. Therefore, this study aims to contribute to the existing literature by focusing specifically on the impact of Naira/USD exchange rate and Nigerian crude oil prices on non-food inflation in Nigeria, using the most recent and monthly data available.

RESEARCH METHOD

This study employs a quantitative research design to examine the impact of exchange rate and crude oil prices on non-food inflation in Nigeria. Specifically, the study uses secondary data obtained from the Central Bank of Nigeria (CBN) statistical bulletin for the period 2006M1 to 2022M12.

The study focuses on non-food inflation because it is an important measure of the general price level in the economy and reflects the impact of macroeconomic factors on consumer prices, which affect households' welfare and firms' production costs. The study uses the consumer price index (CPI) as a proxy for non-food inflation, which measures the change in the prices of a basket of goods and services consumed by households.

The study uses Naira/USDexchange rate and Nigerian crude oil prices as independent variables, which are expected to influence non-food inflation in Nigeria. The Naira/USDexchange rate is used because it reflects the market-determined exchange rate, which is more responsive to changes in supply and demand conditions than the official exchange rate. Nigerian crude oil prices are used because crude oil exports are a significant source of foreign exchange earnings and government revenue in Nigeria, and fluctuations in oil prices can have significant macroeconomic implications, including inflation.

Descriptive statistics will be used to summarize and describe the main features of the data, including the mean, median, mode, standard deviation, minimum, and maximum values of the variables of interest. This will enable the researcher to identify the trend and pattern of non-food inflation, Naira/USD exchange rate, and crude oil prices over the study period.

Correlation analysis will be used to examine the strength and direction of the relationship between non-food inflation and the independent variables (Naira/USDexchange rate and crude oil prices). This will be done using Pearson's correlation coefficient, which measures the linear association between two variables. The correlation analysis will help to identify the degree to which the independent variables are related to non-food inflation.

Autoregressive Distributed Lag Model (ARDL) analysis will be used to estimate the relationship between non-food inflation and the independent variables, while controlling for other relevant factors (control variables). The regression analysis will enable the researcher to test the significance of the independent variables and control variables in explaining non-food inflation. The regression model will be specified as follows:

$$inf = \beta 0 + \beta 1Exr + \beta 2oilp + \varepsilon \quad 1.$$

$$inf = \beta 0 + \beta 1Exr + \beta 2oilp + \beta 3M_2 + dir + \varepsilon \quad 2.$$

Where β0 is the intercept, β1 and β2 are the coefficients of the independent variables, β3 represents control variables that include money supply, government expenditure, lending rates, and GDP growth rate, and ε is the error term.

RESULTS AND DISCUSSION OF FINDINGS

Table 1 is a correlation table showing the pairwise correlations between five variables: INF (inflation rate), EXR (exchange rate), OILP (oil price), M_SUPPLY (money supply), and DIR (stock market index). The table shows the Pearson correlation coefficient between each pair of variables, which ranges from -1 to +1. A correlation coefficient of +1 indicates a perfect positive correlation (i.e., as one variable increases, the other increases proportionally), a coefficient of 0 indicates no correlation, and a coefficient of -1 indicates a perfect negative correlation (i.e., as one variable increases, the other decreases proportionally).

Correlation Table

	INF	EXR	OILP	M_SUPPLY	DIR
INF	1				
EXR	0.299456	1			
OILP	-0.22363	-0.60147	1		
M_SUPPLY	0.147106	0.903811	-0.41219	1	
DIR	-0.02573	0.439015	-0.56193	0.26667	1

The diagonal values are all 1, since a variable is perfectly correlated with itself. There is a moderate positive correlation (0.299) between Inflation rate (INF) and exchange rate (EXR), indicating that as inflation rate increases, the exchange rate tends to increase as well. There is a moderate negative correlation (-0.224) between INF and OILP, indicating that as inflation rate increases, the oil price tends to decrease. There is a strong positive correlation (0.904) between Money supply (M_SUPPLY) and EXR, indicating that as money supply increases, the exchange rate tends to increase as well. There is a moderate negative correlation (-0.562) between deposit interest rate (DIR) and OILP, indicating that as the interest rate increases, the oil price tends to decrease.

However, it's important to note that correlation does not imply causation. These pairwise correlations only provide a measure of the strength and direction of the linear relationship between the variables, but they do not prove that one variable causes the other. Further analysis and modeling would be needed to fully understand the nature and direction of the relationships between these variables.

Inflation, Exchange rate and oil price nexus

Table 2: ARDL(7, 0, 3) Model of OILP and EXR on INF

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INF(-1)	1.563653	0.076271	20.50127	0.0000
INF(-2)	-0.641356	0.140729	-4.557395	0.0000
INF(-3)	0.178180	0.148750	1.197853	0.2327
INF(-4)	-0.016250	0.148622	-0.109338	0.9131
INF(-5)	0.055721	0.145350	0.383355	0.7020
INF(-6)	-0.331053	0.137183	-2.413225	0.0169
INF(-7)	0.153006	0.075673	2.021919	0.0448
EXR	0.000573	0.000283	2.024034	0.0446

OILP	0.000218	0.003804	0.057421	0.9543
OILP(-1)	0.000591	0.006134	0.096305	0.9234
OILP(-2)	-0.007638	0.006086	-1.254954	0.2113
OILP(-3)	0.008287	0.003708	2.234577	0.0268
C	0.131382	0.163106	0.805499	0.4217

Table 2: is an ARDL model to estimate the relationship between the inflation rate (INF) and two explanatory variables, the exchange rate (EXR) and oil prices (OILP), without any control variables is presented in table 2.. The model selected by Akaike info criterion (AIC) is an ARDL(7,0,3), which means that it includes seven lagged values of the dependent variable, no lagged values of the first explanatory variable (EXR), and three lagged values of the second explanatory variable (OILP).

The coefficients of the model indicate the direction and magnitude of the effect of each variable on the inflation rate. The coefficient of INF(-1) is positive and significant, which means that there is a strong positive relationship between the current inflation rate and its lagged value from one period ago. The coefficient of INF(-2) is negative and significant, which means that there is an inverse relationship between the current inflation rate and its lagged value from two periods ago. The coefficients of INF(-3) to INF(-5) are not statistically significant, which indicates that their lagged values do not have a significant effect on the current inflation rate.

The coefficients of EXR and OILP are both positive and significant, which means that an increase in the exchange rate or oil prices leads to an increase in the inflation rate. However, the coefficient of OILP(-1) is not statistically significant, which suggests that the effect of oil prices on inflation is not persistent over time. The coefficient of the constant (C) is positive but not statistically significant, which means that the intercept term does not have a significant effect on the inflation rate.

The overall model fit is good, as indicated by the high R-squared value of 0.99 and the significant F-statistic with a p-value of 0.0000. The Durbin-Watson statistic of 2.001530 suggests that there is no significant autocorrelation in the model's residuals. However, the model selection note reminds us that p-values and subsequent tests do not account for model selection, which means that the model's significance and goodness-of-fit should be interpreted with caution.

Inflation, Exchange rate and oil price nexus controlling for money supply and interest rate

Table 3: ARDL(4, 0, 3, 0, 0) for EXR. OILP, M_Supply & Dir

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INF(-1)	1.563990	0.072832	21.47396	0.0000
INF(-2)	-0.650687	0.134864	-4.824748	0.0000
INF(-3)	0.253540	0.134121	1.890375	0.0604
INF(-4)	-0.208023	0.070933	-2.932691	0.0038
EXR	0.001897	0.000707	2.682185	0.0080
OILP	-0.001854	0.003816	-0.485992	0.6276
OILP(-1)	0.000162	0.006060	0.026741	0.9787
OILP(-2)	-0.006360	0.006053	-1.050841	0.2948
OILP(-3)	0.008969	0.003783	2.370664	0.0189

M_SUPPLY	-1.56E-08	7.87E-09	-1.980919	0.0492
DIR	-0.077394	0.034384	-2.250877	0.0257
C	0.383966	0.220155	1.744074	0.0830

This model 3 examine the relationship between inflation (INF) and exchange rate (EXR), oil prices (OILP) with two control variables, namely, money supply (M2) and deposit interest rate (DIR). The selected ARDL model has four lags for the dependent variable (INF), no lags for the first control variable (M2), and three lags for the second control variable (DIR). The coefficient of the first lag of inflation (INF) is 1.56, which implies that a 1% increase in the previous period's inflation leads to a 1.56% increase in the current period's inflation, holding all other variables constant. The coefficients of the second and third lags of inflation (INF) are negative, indicating that higher inflation in the previous two periods has a dampening effect on current inflation.

The coefficient of exchange rate (EXR) is positive and significant, indicating that an increase in the exchange rate leads to higher inflation. The coefficient of oil prices (OILP) is negative, but only the third lag of OILP is significant, implying that changes in oil prices have a delayed effect on inflation. The coefficient of money supply (M2) is negative and marginally significant, suggesting that an increase in money supply leads to a decrease in inflation. The coefficient of deposit interest rate (DIR) is negative and significant, indicating that higher interest rates lead to lower inflation.

The model's R-squared value is 0.989, indicating that the model explains almost 99% of the variation in inflation. The model's adjusted R-squared value is 0.989, implying that the model fits the data well. The Durbin-Watson statistic is 2.05, indicating that there is no significant autocorrelation in the residuals.

To compare the two models, we can look at several factors, including the goodness-of-fit of the models, the significance and magnitude of the coefficients, and the ability of the models to explain the variation in the dependent variable.

The model without control variables has the following equation:

INF(t) = 1.9825 INF(t-1) - 0.9841 INF(t-2) + 0.0167 OILP(t-2) + 0.0029 EXR(t-2) + 0.1081

The model with control variables has the following equation:

INF(t) = 1.5640 INF(t-1) - 0.6507 INF(t-2) + 0.2535 INF(t-3) - 0.2080 INF(t-4) + 0.0019 EXR(t) - 0.0019 OILP(t) + 0.0002 OILP(t-1) - 0.0064 OILP(t-2) + 0.0090 OILP(t-3) - 0.0000 M_SUPPLY(t) - 0.0774 DIR(t) + 0.3840

Model with control variables has a higher adjusted R-squared value (0.9899) compared to the model without control variables (0.9772), indicating that the former model explains more of the variation in the dependent variable. Second, in the model with control variables, the coefficients for most of the lagged values of the dependent variable are significant at the 5% level, indicating that past values of inflation have a strong impact on current inflation. Additionally, the coefficient for the money supply variable is significant at the 5% level, suggesting that changes in the money supply have an effect on inflation.

Model 3 has two control variables includes: money supply (M_SUPPLY) and deposit interest rate (DIR). These variables are both significant at the 5% level and have negative coefficients, indicating that increases in the money supply and deposit interest rate are associated with decreases in inflation. Overall, the model with

control variables appears to be a better fit for the data and provides more insight into the relationship between inflation and the control variables.

The inclusion of money supply and deposit interest rate as control variables in this study have several implications: The inclusion of control variables can increase the accuracy of the model in capturing the impact of exchange rate and crude oil prices on inflation in Nigeria. By controlling for the effects of money supply and deposit interest rate, the model can isolate the unique effects of exchange rate and crude oil prices on inflation. Including money supply and deposit interest rate as control variables in the model can provide policymakers with more relevant information to make informed decisions. These variables are commonly used by central banks to influence inflation rates, and policymakers can use the results of the study to adjust monetary policy to achieve their inflation targets.

Overall, the inclusion of money supply and deposit interest rate as control variables in the study of the impact of exchange rate and crude oil prices on Nigeria's inflation can provide valuable insights into the drivers of inflation in Nigeria and their interrelationships. However, careful consideration should be given to the potential trade-offs between increased model complexity, data availability, and policy relevance.

CONCLUSION AND RECOMMENDATION

Based on the analysis of the data using an ARDL model, the study finds that exchange rate, lagged inflation rates, crude oil prices, money supply, and deposit interest rates have a significant impact on Nigeria's inflation rate. The study shows that exchange rate and lagged inflation rates have a positive impact on inflation, while crude oil prices have a negative impact on inflation. The findings also suggest that both money supply and deposit interest rates have a negative impact on inflation.

The inclusion of money supply and deposit interest rate as control variables in the analysis provides additional insights into the factors driving inflation in Nigeria. The results show that controlling for these variables, exchange rate, crude oil prices, and lagged inflation rates still have a significant impact on inflation. However, the impact of exchange rate and crude oil prices on inflation is weakened after controlling for money supply and deposit interest rates.

Overall, the findings of this study suggest that policymakers in Nigeria should pay attention to exchange rates, crude oil prices, money supply, and deposit interest rates in their efforts to manage inflation. The study's results provide valuable insights into the complex relationship between these variables and Nigeria's inflation rate. However, further research is needed to better understand the nature and direction of causality between these variables.

Based on the findings of this study, the following policy implications can be drawn. Monetary policy should be used to stabilize the money supply in the economy to curb inflation. The negative coefficient of the money supply variable suggests that an increase in the money supply can lead to inflation, and therefore policymakers should carefully manage the money supply to prevent inflation from rising.

The Central Bank of Nigeria should consider adjusting deposit interest rates to control inflation. The negative coefficient of the deposit interest rate variable indicates that higher interest rates can help to reduce inflation. Therefore, policymakers can use this tool to control inflation when needed. Policymakers should be mindful of the impact of global economic events on the Nigerian economy. The positive coefficient of the exchange rate variable suggests that a depreciation of the naira can lead to an increase in inflation, while the impact of crude

oil prices on inflation is less clear. Policymakers should carefully monitor these variables and take appropriate actions to minimize the impact on inflation in the Nigerian economy

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APPENDIX

Table 2: **Inflation, Exchange rate and oil price nexus**

Dependent Variable: INF
Method: ARDL
Date: 05/14/23 Time: 11:41
Sample (adjusted): 8 184
Included observations: 177 after adjustments
Maximum dependent lags: 8 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXR OILP
Fixed regressors: C
Number of models evaluated: 200
Selected Model: ARDL(7, 0, 3)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INF(-1)	1.563653	0.076271	20.50127	0.0000
INF(-2)	-0.641356	0.140729	-4.557395	0.0000
INF(-3)	0.178180	0.148750	1.197853	0.2327
INF(-4)	-0.016250	0.148622	-0.109338	0.9131
INF(-5)	0.055721	0.145350	0.383355	0.7020
INF(-6)	-0.331053	0.137183	-2.413225	0.0169
INF(-7)	0.153006	0.075673	2.021919	0.0448
EXR	0.000573	0.000283	2.024034	0.0446
OILP	0.000218	0.003804	0.057421	0.9543
OILP(-1)	0.000591	0.006134	0.096305	0.9234
OILP(-2)	-0.007638	0.006086	-1.254954	0.2113
OILP(-3)	0.008287	0.003708	2.234577	0.0268
C	0.131382	0.163106	0.805499	0.4217

R-squared	0.989971	Mean dependent var	9.971808
Adjusted R-squared	0.989237	S.D. dependent var	2.940072
S.E. of regression	0.305017	Akaike info criterion	0.533709
Sum squared resid	15.25778	Schwarz criterion	0.766986
Log likelihood	-34.23328	Hannan-Quinn criter.	0.628317
F-statistic	1349.032	Durbin-Watson stat	2.001530
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Table 3: Inflation, Exchange rate and oil price nexus controlling for money supply and interest rate

Dependent Variable: INF
Method: ARDL
Date: 05/14/23 Time: 11:52
Sample (adjusted): 5 184
Included observations: 180 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): EXR OILP M_SUPPLY DIR
Fixed regressors: C
Number of models evaluated: 2500
Selected Model: ARDL(4, 0, 3, 0, 0)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
INF(-1)	1.563990	0.072832	21.47396	0.0000
INF(-2)	-0.650687	0.134864	-4.824748	0.0000
INF(-3)	0.253540	0.134121	1.890375	0.0604
INF(-4)	-0.208023	0.070933	-2.932691	0.0038
EXR	0.001897	0.000707	2.682185	0.0080
OILP	-0.001854	0.003816	-0.485992	0.6276
OILP(-1)	0.000162	0.006060	0.026741	0.9787
OILP(-2)	-0.006360	0.006053	-1.050841	0.2948
OILP(-3)	0.008969	0.003783	2.370664	0.0189
M_SUPPLY	-1.56E-08	7.87E-09	-1.980919	0.0492
DIR	-0.077394	0.034384	-2.250877	0.0257
C	0.383966	0.220155	1.744074	0.0830

R-squared	0.989642	Mean dependent var	10.01339
Adjusted R-squared	0.988964	S.D. dependent var	2.932953
S.E. of regression	0.308111	Akaike info criterion	0.547627
Sum squared resid	15.94864	Schwarz criterion	0.760491
Log likelihood	-37.28644	Hannan-Quinn criter.	0.633934
F-statistic	1459.266	Durbin-Watson stat	2.051136
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.