WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

An Econometric Analysis of the Effects of Fuel Imports and Exchange Rates Volatility on Inflation in Nigeria (2006–2023)

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ABSTRACT

This study examines the effects of fuel imports and exchange rate volatility on inflation in Nigeria from 2006 to 2023, addressing the paradox of an oil-producing nation's dependence on imported refined petroleum products. Using annual time series data from the World Bank Development Indicators, we employed unit root tests (ADF and Phillips-Perron), Johansen cointegration analysis, and Ordinary Least Squares regression to analyse the relationships between fuel imports (FIMP), exchange rates (EXR), and inflation (INF). The unit root tests confirmed that all variables are integrated of order one I(1), establishing the basis for cointegration analysis. The empirical results indicate that fuel imports have a positive and statistically significant impact on inflation, while exchange rate volatility exhibits a positive and statistically significant relationship with inflation. The findings underscore Nigeria's vulnerability to external price shocks through its structural dependence on imported refined petroleum products, despite being a major crude oil producer, and highlight the critical need for enhanced domestic refining capacity, exchange rate stability, and comprehensive energy sector reforms to achieve sustainable inflation control and macroeconomic stability.

Keywords: Fuel imports, Exchange rate, Inflation, Co-integration model, Nigeria.

1. Introduction

According to Akpan U.M. et al., (2018), increased fuel importation can contribute to inflationary pressure, particularly when global oil prices increase or domestic subsidies are reduced. Rising international oil prices increase the cost of imported fuel, which then translates to higher domestic prices for fuel and other goods and services. Similarly, if domestic fuel subsidies are reduced, fuel prices will increase, leading to inflationary pressures.

Inflation remains a persistent macroeconomic issue in Nigeria, affecting consumer purchasing power, distorting investment decisions, and hindering economic growth. A primary factor affecting inflation in Nigeria is the instability of the exchange rate, as well as the nation's significant dependence on imported fuel products. Although Nigeria is a substantial crude oil producer, it lacks adequate refining capability, necessitating the importation of refined petroleum products to meet domestic demand. This dependency on fuel imports exposes the economy to external price shocks and currency fluctuations, which influence the general price level (Adeniran et al., 2020; CBN, 2022).

The relationship between exchange rate fluctuations and inflation in Nigeria has been extensively discussed. The exchange rate serves as a transmission channel for imported inflation, particularly in economies characterised by weak industrial sectors and high import dependence, such as Nigeria (Aliyu et al., 2009). The depreciation of the naira increases import costs, particularly for essential goods such as refined fuel, thereby exacerbating inflationary pressures. This situation has intensified recently, notably with the Central Bank of Nigeria implementing various currency rate regimes, which have led to heightened volatility in the foreign exchange market (CBN, 2021; IMF, 2023).

Furthermore, the importation of petroleum has emerged as a crucial determinant of inflation. The National Bureau of Statistics (NBS, 2022) indicates that fuel prices constitute a significant portion of family expenditures and transportation costs, directly influencing the consumer price index (CPI). Nigeria's inflationary trend has become increasingly susceptible to rising fuel import expenses and fluctuating global oil prices (Obi et al., 2019). The removal of fuel subsidies in recent years has exacerbated the transmission of international price shocks to the domestic economy (World Bank, 2023).

2. Literature review

Numerous studies have demonstrated that Nigeria's dependence on imported refined petroleum products exposes it to cost-push inflation. Adeniran et al., (2020) assert that the increasing trend in fuel importation substantially increases inflationary pressure, especially during rising international oil prices or reductions in national subsidies. Obi et al. (2019) demonstrated that increased fuel imports directly impact transportation and production expenses, thereby raising the consumer price index (CPI).

Okonkwo and Ezeaku (2020) demonstrate that Nigeria's inadequate refining capacity has engendered a structural reliance on imports, with domestic inflation reacting significantly to fluctuations in fuel import volumes and prices. In their analysis, they contend that domestic fuel price adjustments—frequently a reaction to subsidy reforms or escalating import expenses—serve as critical conduits of inflation.

2.1.1 Exchange Rate Volatility and Inflation

Fluctuations in exchange rates have a significant impact on inflation dynamics, particularly in countries that rely heavily on imports. Aliyu et al. (2009) identified a significant exchange rate pass-through impact in Nigeria, indicating that naira depreciation increases the costs of imported items, such as fuel. Adeniran et al. (2020) employed a GARCH model to evaluate volatility and found that both official and parallel market rates significantly impact inflation predictions. Likewise, CBN (2022) studies highlighted that inflation surges frequently correspond with currency rate misalignment or devaluation. Eliminating the official currency rate peg in 2016 and following market liberalisations exacerbated inflationary tendencies due to increased import costs (IMF, 2023).

2.1.2 Combined Effects of Fuel Imports and Exchange Rate on Inflation

Although numerous studies have independently analysed the influence of fuel imports and exchange rate volatility on inflation, fewer have investigated their combined effect. Adediran and Yusuf (2021) performed a co-integrated time-series analysis from 1990 to 2019, revealing that both factors exert statistically significant and combined impacts on inflation in Nigeria. Their findings indicate that measures targeting exchange rates or import volumes in isolation may be inadequate for controlling inflation.

Ibrahim and Garba (2023) expanded on this work, utilising contemporary data and an ARDL model, and concluded that while exchange rate volatility had an immediate short-term effect on inflation, fuel imports had more enduring long-term effects. They underscored the significance of exchange rate stability and changes in the energy sector for sustainable inflation management.

2.2 Empirical Review

Okeowo et al. (2023) analysed the impact of exchange rates, oil prices, and wage structures on the country's economic growth from 1991 to 2022. Their study found a positive relationship between inflation and wage structure, while exchange rates and oil prices affected economic growth negatively. They recommend policies such as effective wage management, exchange rate adjustments, and economic diversification to mitigate these challenges and promote growth. Pagih et al. (2022) examined the influence of variable energy costs on inflation in Nigeria during the COVID-19 pandemic. The analysis employing the ARDL approach revealed that, while there was no long-term effect, short-term lags in oil and petrol prices had a considerable impact on inflation from 1985 to 2018. Okeke et al. (2024) investigated the impact of crude oil price fluctuations on inflation and exchange rates in Nigeria from 1990 to 2022. Their findings revealed that these shocks hurt inflation and exchange rates, primarily due to the continuous devaluation of the Naira against the US dollar. To mitigate high cost-push inflation, the report recommends that the government increase funding to the surplus crude account and implement stricter monetary and fiscal policies to reduce overall demand and manage inflation.

Ojemuyide Victor Oladayo and Dr. Ikponmwosa Noruwa Abu (2025) conducted a comprehensive empirical assessment of the relationship between crude oil price fluctuations and Nigeria's economic growth from 1981 to 2023. The authors employed statistical analysis to investigate the relationship between oil prices and key macroeconomic indicators, utilising secondary data from reputable sources, including the Central Bank of Nigeria, OPEC, and the World Development Indicators.

Their findings reveal a strong and statistically significant relationship between crude oil prices and GDP in Nigeria, confirming the country's high economic sensitivity to oil price volatility. The study also highlights a positive correlation between imports and GDP, which is attributed to Nigeria's substantial reliance on imported goods, particularly refined petroleum products. In contrast, exports exhibit a negative correlation with GDP, which the authors link to the dominance of unrefined crude oil in Nigeria's export portfolio and the nation's insufficient economic diversification. Ojemuyide and Ikponmwosa further observe that while exchange rates and inflation are associated with GDP movements, their direct influence appears to be less substantial than that of oil prices. The study emphasises the need for economic diversification, suggesting that agriculture, manufacturing, and technology sectors could reduce dependence on oil and foster more stable growth.

Although the current literature offers important insights, there is limited empirical analysis of the most recent years, particularly post-2020, when global fuel markets and exchange rate regimes underwent substantial disruptions due to the pandemic and domestic currency devaluations. This paper enhances the literature by examining the joint impact of fuel imports and currency rate fluctuations on inflation in Nigeria from 2006 to 2023, utilising updated data and advanced econometric techniques.

3. Methodology

This study investigates the effects of fuel imports and exchange rate volatility on inflation in Nigeria (2006–2023). The study employs quantitative tools of analysis, and secondary data are collected from the World Bank Database Indicator (WDI)

3.1 Model Specification

The model's functional form is defined as: $INF_t = f(FIMP_t, EXR_t, INF_{t-1}, FIMP_{t-1}, EXR_{t-1}, \mu_t)$

Location:
INF_t= Inflation rate

$FIMP_t$ = Fuel imports

EXR_t = exchange rate

μ_t = Error term

3.2 Sources of Data and Their Descriptions

Annual time series data spanning from 2006 to 2023 were obtained from the World Bank World Development Indicators (WDI)

Description	Source	Sign
Fuel import	WDI	FIMP
Exchange rate	WDI	EXRT
Inflation	WDI	INF

4. Results and Discussions

This section presents data analyses and interpretation. The analysis encompasses stationarity tests,

Johansen co-integration results, Ordinary Least Squares, and diagnostic assessments.

Unit root test:

Table 1. Unit Root Tests ADF

	ADF Statistics		Critical Values 5%		
Variable	At Level	1st Difference	At Level	1st Difference	Order of Integration
FIMP	-1.188358	-4.793176	-3.052169	-3.065585	I (1)
REXR	-3.206426	-3.884821	-3.065585	-3.065585	I (1)
INF	-0.504489	-3.627468	-3.052169	-3.065585	I (1)

Author's Computation Using E-Views 12

We can see from Table 1 above that the ADF unit root test results, FIMP, and INF ADF statistics are -1.188358 and -0.504489 with critical values of -3.052169 and -3.052169, while the REXR ADF statistic is -3.206426 with the critical value of -3.065585. The results indicate that the ADF statistics of FIMP and INF are less than their critical values at a 5% significance level, which suggests that they are not stationary at the level. In contrast, the ADF statistic of EXR is greater than the critical value, which indicates that EXR is stationary at the level.

At first glance, the results of the ADF statistics for FIMP, EXR, and INF are -4.793176, -5.039931, and -3.627468, and their critical values are -3.065585, -3.081002, and -3.065585. This indicates that all the variables are stationary in first difference because their ADF statistics are greater than their critical values.

Table 1. Unit Root Tests PP

	S PP Statistics		Critical Values 5%		
Variable	At Level	1st Difference	At Level	1st Difference	Order of Integration
FIMP	-0.926562	-7.834970	-3.052169	-3.065585	I (1)
REXR	-2.305904	-5.640843	-3.052169	-3.065585	I (1)
INF	-0.504489	-3.627468	-3.052169	-3.065585	I (1)

Author's Computation Using E-Views 12

Table 2 above shows that not all variables are stationary at the level because their PP statistics are less than their critical values at a 5% significance level. The PP unit root statistics of FIMP, EXR, and INF are -0.926562, -2.305904, and -0.504489, with their critical values of -3.052169, -3.065585, and -3.065585. The variables are all stationary at the first difference because their PP statistic is greater than their critical value at the first difference. See the above table.

Johansen Cointegration Test:

The purpose of Johansen cointegration is to test and identify if there is a long-run relationship among the variables.

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical value	Prob**
None	0.612003	20.47230	29.79707	0.3914
At most 1	0.219641	5.324195	15.49471	0.7735
At most 2	0.081268	1.356168	3.841465	0.2442

Author's Computation Using E-Views 12

The Johansen cointegration test results revealed that all trace statistics are <0.05% critical values and p-values >0.05%, which shows that there is no cointegration at all ranks. Therefore. There is no evidence of a long-run relationship among the variables.

Ordinary Least Squares

Dependent Variable: INF

Method: Least Squares

Date: 07/07/25 Time: 11:03

Sample (adjusted): 2006 – 2023

Included observations: 17 after adjustments

Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Probability**
FIMP	0.217265	0.072653	2.990458	0.0104
EXR	0.466376	0.562564	0.829019	0.0221
ECM (-1)	0.465083	0.345737	1.345195	0.2016
C	13.02203	4.662621	2.792857	0.0152

$R^2 = 0.449547$

Adjusted $R^2 = 0.336316$

Prob(F-statistic) = 0.039982

R-squared (R2): 0.449547 (44%) of the variation in inflation is explained by the independent variables.

Adjusted (R^2): 0.336316 (33%) is moderate

The probability (F-statistic): 0.039982 is significant at the 5% level, indicating that the model is jointly significant.

FIMP (coefficient 0.217265): indicates a positive and statistically significant effect in inflation (p = 0.0104). This indicates that an increase in fuel imports may contribute to rising domestic fuel prices. Furthermore, the high price of fuel will lead to cost-push inflation and external shocks, which will directly strain households and small and medium enterprises. The government should find an alternative source of energy that will enable the country to reduce its dependency on imported refined fuel, and this would help stabilise the price and protect the economy from external shocks.

REXCR (coefficient 0.466376) indicates a positive sign and is statistically significant (p value 0.0221). This reveals that a depreciating exchange rate makes imported goods more expensive, especially when the currency of the importing country is weak, resulting in a higher overall price level. This also leads to macroeconomic instability, particularly in countries that are heavily dependent on imports.

4.4 DIAGNOSTIC TEST

Serial Correlation

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.560853	Prob. F(2,11)	0.5862
Obs*R-squared	1.573128	Prob. Chi-Square(2)	0.4554

The serial correlation result above indicates that p-values are greater than 0.05%; therefore, we fail to reject the null hypothesis of no serial correlation. This implies that there is no evidence of serial correlation in the residuals.

Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Homoskedasticity

F-statistic	0.510874	Prob. F(3,13)	0.6817
Obs*R-squared	1.792832	Prob. Chi-Square(3)	0.6165
Scaled explained SS	0.834102	Prob. Chi-Square(3)	0.8413

The result of heteroskedasticity indicates that all p-values are greater than 0.05%, so we fail to reject the null hypothesis of heteroskedasticity. There is no evidence of heteroskedasticity, and the residuals are said to be homoskedastic

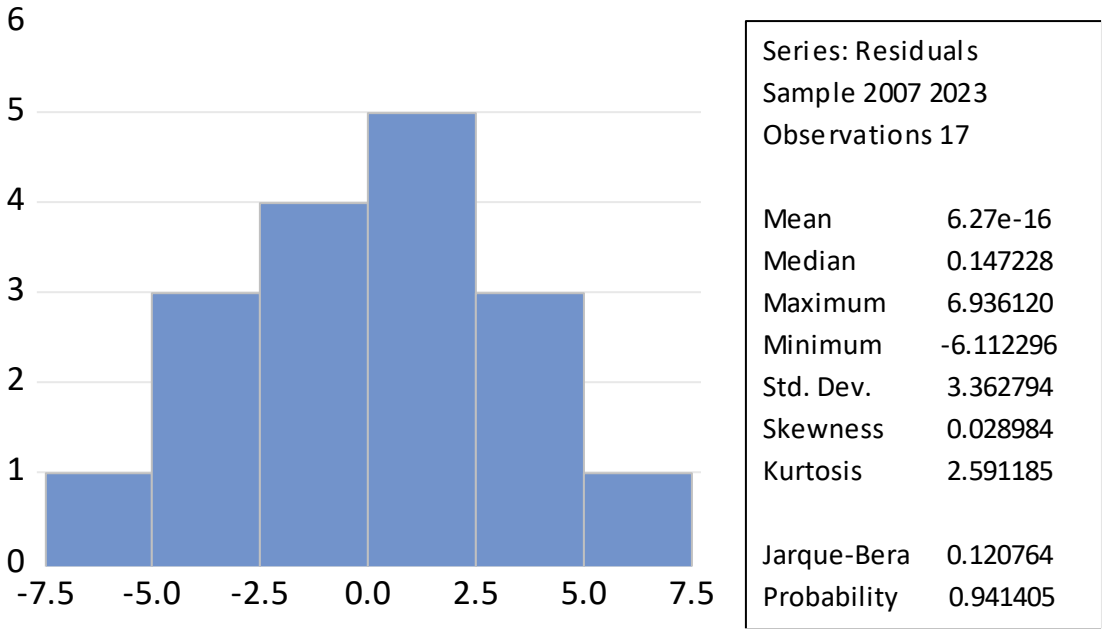
Ramsey Reset Test

Ramsey RESET Test
Equation: UNTITLED
Omitted Variables: Squares of fitted values
Specification: INF FIMP REXCR ECM(-1) C

	Value	df	Probability
t-statistic	1.095312	12	0.2949
F-statistic	1.199709	(1, 12)	0.2949
Likelihood ratio	1.619899	1	0.2031

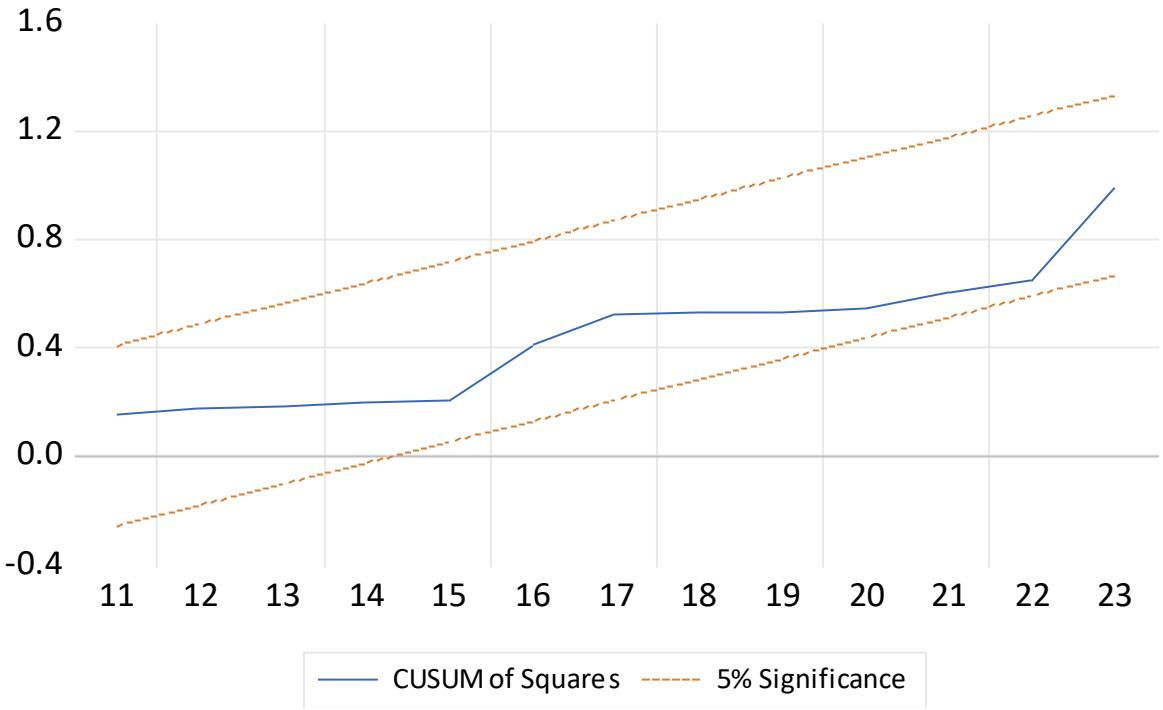
The p-value of 0.2949 is greater than 0.5%, so we fail to reject the null hypothesis that the model is appropriately specified. This implies that no evidence of omitted variables or incorrect functional form in the model.

Normality Test



The p-value of 0.941405 is far greater than 0.05%; therefore, we fail to reject the null hypothesis of normality. This indicates the model is normally distributed, satisfying the assumptions of OLS.

CUSUM Square



From the graph above, the CUSUM of squares line remains within the 5% significance bounds throughout the sample period. Since the CUSUM square line does not cross the 5% significance boundaries, we fail to reject the null hypothesis. This indicates that the model remains stable over time, with no structural breaks in the regression coefficients.

5. Conclusions and Policy Recommendations

5.1 Conclusion

The implications of this study extend beyond the immediate findings to encompass broader questions about Nigeria's economic transformation and development strategy. The persistent reliance on fuel imports, despite being a major crude oil producer, reflects deeper structural challenges in Nigeria's industrial base and technological capabilities. The country's oil refinery throughout was merely 18,000 barrels per calendar day as of 2023, highlighting the vast gap between crude oil production capacity and refining capabilities (Statista, 2024). This structural imbalance not only perpetuates Nigeria's vulnerability to inflation but also constrains its ability to capture value-added benefits from its natural resource endowments. The recent operationalisation of the Dangote Refinery and the announced restart of the Warri Refinery represent positive steps toward addressing this structural deficit. However, their full impact on reducing import dependence and inflation will require sustained policy support and continued investment in downstream petroleum infrastructure.

The study's findings have significant implications for Nigeria's monetary policy framework and inflation targeting strategies. The Central Bank of Nigeria's monetary policy decisions must take into account the complex interactions between exchange rate movements, fuel import costs, and domestic price levels. The current study suggests that while exchange rate stability is important, addressing the structural causes of import dependence may yield more sustainable outcomes for inflation control. This perspective is supported by recent International Monetary Fund assessments, which noted that inflation reached 32% year-on-year in February 2024, driven mainly by food price inflation and loose financial conditions (IMF, 2024). The gradual decline in inflation, projected by the IMF to 24% by the end of 2024, conditional on continued monetary tightening, demonstrates the importance of coordinated policy responses that address both demand-side and supply-side inflationary pressures.

Looking forward, the study's findings underscore the critical importance of diversifying Nigeria's economic base and reducing vulnerability to external shocks. The positive correlation between fuel imports and inflation, combined with the ongoing volatility in global energy markets, suggests that Nigeria's macroeconomic stability will remain precarious until fundamental structural reforms are implemented. The country's crude oil production, which decreased to 1.25 million barrels per day in May 2024, coupled with its continued dependence on imported refined products, exemplifies the resource curse phenomenon where natural resource abundance does not translate into economic prosperity (Trading Economics, 2024). Future research should examine the effectiveness of ongoing refinery projects and energy sector reforms in breaking the cycle of import dependence and inflation volatility. Additionally, the development of alternative energy sources and the promotion of energy efficiency measures could provide additional pathways for reducing the economy's vulnerability to fuel price shocks while supporting sustainable development objectives.

5.2 Recommendations

1. Enhance Exchange Rate Stability: Nigeria must implement consistent and transparent currency rate regulations to mitigate volatility and speculative behaviour. A consolidated exchange rate system would aid in stabilising expectations and mitigating the inflationary effects of currency devaluation.

2. Enhance Domestic Refining Capacity: To diminish dependence on imported refined fuel, the government should prioritise investments in refining infrastructure via public-private partnerships. The complete operationalisation of projects such as the Dangote Refinery and the refurbishment of current refineries will diminish import expenditures and alleviate cost-push inflation.

3. Advocate for Energy Sector Reform: The deregulation of the downstream oil sector, coupled with specific subsidies for the impoverished, can improve efficiency and mitigate inefficiencies in gasoline prices. Regulatory transparency and market-based pricing can enhance investor confidence.

4. Diversify the Economy and Promote Non-Oil Exports: Mitigating Nigeria’s excessive reliance on oil earnings will fortify the economy against external shocks. Enhancing agriculture, manufacturing, and services can augment foreign exchange revenues and alleviate strain on the naira.

5. Data Transparency and Policy Coordination: Accessible data on fuel imports, inflation determinants, and exchange rate fluctuations must be publicly disclosed to support academic research and informed decisions. Collaboration between fiscal and monetary agencies is essential for comprehensive inflation management.

This research enhances the empirical understanding of inflation dynamics in Nigeria and highlights the need for structural reforms. By diminishing import reliance and stabilising the exchange rate, Nigeria can substantially advance towards attaining price stability and inclusive economic growth.

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