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Assessing the Dynamic Impact of Petroleum Pump Prices on Industrial Sector Growth: A Case for or Against Subsidy Removal in Nigeria

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Abstract

This study explores the dynamic interaction among petroleum pump prices, diesel price, money supply, exchange rate, and industrial growth using data from 1981 to 2023 for Nigeria. Dynamic ARDL simulation estimator was utilized, and the outcomes from the analysis demonstrated that the rising prices of petrol and diesel retard industrial growth in Nigeria, increase in money supply reduces industrial growth in the shortrun, but stimulates industrial growth in the longrun. Moreover, appreciation in exchange rate demotes industrial growth in the short run, but promotes it in the longrun. Considering the findings therefore, this study recommends that removal of petroleum pump price subsidies should be accompanied by government support for small and medium scale enterprises (SMEs) which will go a long way in offsetting the impact of rising petroleum prices and help businesses cope with increased costs and sustain their operations. While in the long run, supporting Research and Development (R&D) drives with focus on advancing novel technologies and processes that reduce energy consumption and improve efficiency in industrial operations will be helpful in making businesses cop with the challenges. Also, enhancing local petroleum refining capacity will reduce dependence on imported fuels and mitigate the impact of global oil price fluctuations.

Keywords: Petroleum, Inflation, Industrial growth, Nigeria, Dynamic ARDL, Price
JEL Classification: C51, E64, L9, Q41

1.0 Introduction

Economic stability and industrial development globally are dependent upon the level of economic activities, which bring both renewable and non-renewable energy resources into active play as intermediate inputs (Aruofor & Ogbeide, 2023). Snappy economic expansion, broad industrialization, increased motivity and expanding infrastructure have all play a pivotal role in raising energy consumption in recent decades (Nuta et al. 2024). The linkage between the level of industrial activities and oil prices has, over the years, been the matter of much consideration as there has been widespread empirical studies on the association of prices of oil as well as industrial production within the last three decades. This, therefore, makes crude oil and its products outstandingly important in the global economy (Balouga, 2020). A volatility in petroleum pump prices is directly related to the rate of inflation and the level of industrial growth. Oil is a major intermediate input of production. It is used in virtually all sectors of the economic activities, like industrial sector, transportation, manufacturing activities, domestic cooking and electricity generation in plants or domestic uses, especially in developing nations, where electricity supply is epileptic, so also in the agricultural sector. Thus, rise in the intermediate costs of input is expected to raise the output prices (Sakanko et al., 2021), hence the introduction of fossil fuels subsidies to reduce the adverse effects of global oil price fluctuation and inflationary pressure and increase competitiveness of the local economy by keeping input fuel prices low, (Kojima, 2016).

Agriculture was the mainstay of the Nigerian economy at the time the country became independent, contributing approximately 70 percent of the Gross Domestic Product (GDP), employing about 70% of the workforce, and contributing about 90 percent of foreign earnings and Government revenue (World Bank, 2024). From the early post-independence period until the mid-1970s, there was rapid growth in industrial capacity and output, with the manufacturing sector's contribution to GDP increasing from 4.8% to 8.2% (World Bank, 2024). This trend shifted when oil became strategically important and a major export commodity to the Nigerian economy (Worldometer, 2024). The country possesses significant energy resources, including oil reserves estimated at 37.1 billion barrels, and gas reserves of 206.53 trillion cubic feet (Department of Petroleum Resources [DPR], 2021), but oil production falling from 2.016 million barrels per day in 2018 to 1.27 million barrels per day in June, 2024 (Energy Information Administration [EIA], 2024).

Thus, understanding the complexity between petroleum pump prices and industrial growth in Nigeria is essential for formulating policies that can stabilize the sector, foster industrial advancement, and tame inflationary heat. This investigation is particularly pertinent considering the Nigeria’s efforts to diversify the economy and reduce its reliance on the oil sector. By visualizing the effects of petroleum pump prices on industrial development, policy formulators can better navigate the complex nature of economic stabilization and management of an oil resource-dependent nation. Thus, this study contributes to the body of prior knowledge in a number of ways. Firstly, in order to achieve the ambitious goal of nationally determined stability in energy prices and industrial sector in Nigeria, findings from this study will spotlight the implications of the economic policy uncertainty within the context of the petroleum pump price and industrial growth. Secondly, this work deviates from the previous studies by adopting the non-traditional Dynamic Autoregressive Distributed Lag (D-ARDL) Model for robust econometrics simulations. The D-ARDL is believed to be unbiased, consistent, and is capable of resolving endogeneity issues of the variables, and produces best forecast even with small sample size. Additionally, it can be applicable regardless of the order of integration of the variables, except for the ones that are I(2), and has the ability to generate graphs and area plots forecasting positive and negative changes in the regressors (Inuwa et al., 2024). Other segments of this study are split into the review of literature, gaps in literature, methodology, results and discussions of the results, while the last section discusses the conclusion and policy direction.

2.0 Literature Review

There are many research studies on petroleum pump pricing policies, energy subsidies and industrial productivity worldwide, and many studies focus on energy subsidies, inflationary pressure, as well as the industrial sector growth. Some of these studies confirmed that subsidized petroleum pump prices are positively related to industrial growth (Christopher et al., 2024; Sakiru & Festus, 2024; Liu et al., 2024; Ikenga & Oluka, 2023; Bala, 2023; Adepoju et al., 2023; Onyinye, 2023; Darlington & Monday, 2023; Samuel et al., 2023), while other studies contradict these findings and concluded that regulated petroleum pump prices and inconsistencies in petroleum pump pricing policies negatively affect industrial growth (Abdullahi & Abdullahi, 2023; Mohamad et al., 2023; Nosa & Oseiweh, 2023; Umar et al., 2023; Abderrahman & Chaouti, 2022; Mohamad et al., 2022; McCulloch, et al., 2021 Aldubyan & Gasim, 2021;)

For instance, Christopher et al. (2024) investigated the contextual and conceptual effect the recent fuel subsidy removal on small business accounting system, approach for bank loan and their performance in Nigeria, using descriptive survey design and Linear regression method, and the finding revealed that the recent fuel subsidy removal have negatively, and significantly affected small business in terms of accounting system, discouraged them to approach banks for loan and their performance dwindled to the negatives. In another study conducted by Ali et al (2024) in Adamawa State discovered that employment status, income prospects, and entrepreneurial opportunities are inversely affected by subsidy removal in the long term. Another study by Sakiru and Festus (2024) using Chi-square to analyse the effects of 2023 fuel subsidy removal on business operations, entrepreneurial businesses profitability in Lagos, Nigeria, and found that fuel subsidies removal resulted in the escalation of operational costs, decline in sales, stock levels reduction, and low profitability for the enterprises. Liu et al. (2024) analyzed the impacts of subsidy removal on households and industrial productivity of developing countries in Asia, PRISMA and discovered that subsidy removal impacts household more adversely than the industrial sector. Ikenga & Oluka (2023) discovered that skyrocketing prices of fuel have high negative effects on the citizens and businesses after examining the benefits and consequences of fuel subsidies removal on the manufacturing sector of Nigeria using Descriptive analysis.

Similarly, Bala (2023), carrying out a systematic literature review on petroleum pricing policy in Nigeria using PRISMA approach discovered that fuel subsidy removal translates to fall in aggregate demand and rising production costs. In a similar study, Adepoju et al. (2023) evaluated economic problem of escalating costs of transportation resulting from the removal of fuel subsidy in Nigeria using secondary data from 2011-2023. By employing Pearson Product Moment Correlation Coefficient, the outcome indicated that, business output decreases with increased fuel price which reduces economic growth, Onyinye (2023) explored the implications of fuel price volatility on SMEs in Anambra State, Nigeria by adopting Chi-square statistics. The outcome showed that fuel price volatility negatively affects SMEs in form of increase in the production cost, reduced profit, sales and income decline resulting from low patronage and financial strain.

On the contrary, some studies concluded that removal of subsidies on petroleum pump price promotes household and industrial growth. For instance, Abdullahi and Abdullahi (2023) evaluated the impact of oil subsidy regimes in Nigeria using documentary approach, where information was sourced via newspaper reports, monographs, journals and books covering the period 2015 to 2022 and concluded that oil subsidy constitutes waste considering scarcity of funds needed for governance. Similarly, Mohamad et al. (2023) investigated the impact of subsidy removal on diesel consumption in Iran by employing dynamic model and error-correction model from 1976 to 2017and discovered that diesel demand responds slightly to changes in price. Nosa and Oseiweh (2023) explored the effects of fuel subsidy removal on large, medium, and small businesses and on the overall economic growth in Nigeria using a qualitative approach. Their findings showed that large corporations, with greater absorption capacity to increase in costs, often experience minimal hiccups and may even enjoy reduced competition level, whereas Medium and small-scale businesses are faced with a more challenging situation of increased operational costs while struggling to maintain market share.

In another study conducted by Abderrahman and Chaouti (2022) identified some key challenges associated with fuel prices regulation that include fiscal strain on the governments and economic costs of energy subsidies, after assessing the drivers and obstacles of fossil fuel energy reforms in developing countries using review approach covering 2000 to 2020. Mohamad et al. (2022) investigated the effects of energy price volatility and the level of income on the fossil fuel demand in Iran. Demand elasticities of diesel, gasoline, fuel oil and kerosene were estimated using static, dynamic and error-correction models, and they discovered that demand for fossil fuel disproportionately responds to price changes than income changes. Similarly, Umar et al. (2023) analysed the effects of subsidy elimination on inflation rates, consumer purchasing power, overall societal welfare in Nigeria, and also assessed the consequences of the shift to a floating exchange rate regime. They discovered that, the fuel subsidies withdrawal created avenue for the redirection of significant funds that were formerly budgeted to subsidies into poverty alleviation programs, infrastructural expansion, and social welfare initiatives.

2.1 Literature Gap

After careful evaluation of the previous studies, this study observes that, several studies have taken into account different methodologies to express the relationship among petroleum pump prices and exchange rate on industrial sector growth in terms of various economies. Such previous studies did not take into account the use of innovative dynamic ARDL, which is helpful in sketching out the graphs and area plots that depict the positive and negative changes to the regressors that can impact the explained variable. In addition, the model is highly suitable in case convergence speed is not at par, and that it can be applied irrespective of the order of integration of the variables other than I(2). In addition, none of the previous studies examined the combined impact of petroleum pump prices, money supply and exchange rate on industrial sector growth in Nigeria. According to Inuwa, et al. (2022), incorporating money supply and exchange rate is essential when studying the impact of energy prices on industrial growth due to the fact that these macroeconomic variables directly influence industrial costs, profitability, and growth, especially in economies where petroleum is a significant input for production, logistics, and energy.

3.0 Methodology

3.1 Data Sources and Variables Justification

This study uses annual time series data from 1981 to 2023 to dynamically simulate the impact of petroleum pump price, exchange rate, and money supply on industrial growth in Nigeria. The period covered is sufficient enough to produce robust results based on the Central Limit Theorem. The period also marked a complex interaction of domestic and global forces that result in significant fluctuations in petroleum pump prices in Nigeria (Antimiani et al. 2023), hence, exploring these forces on the industrial sector will be of great relevance to researchers and policymakers. Industrial output is used as proxy for industrial growth. The following variables are encompassed in this multivariate study: prices of Premium Motor Spirit (PMS), prices of Diesel, and industrial output are sourced from the National Bureau of Statistics (NBS) and World Development Indicators respectively. Other control variables were included such as money supply and exchange rate (sourced from the World Development Indicators), which are theoretically linked to oil prices and industrial growth, based on the postulation of the quantity theory of money and the monetary approach to exchange rate (Raifu & Afolabi, 2024).

Table 1. Description of the Variables

Variables	Code	Description	Source
Inflation Rate	INF	Inflation proxied by Consumer Price Index (CPI) reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly..	WDI, WB
Industrial sector Growth	ISG	Industrial sector growth (including construction, constant 2015 US$) encompasses value added in mining, manufacturing, construction, electricity, water, and gas.	WDI, WB
Price of Petrol	POP	The price of petrol, also known as Premium Motor Spirit (Measured in LCU) denotes the price at which gasoline are bought domestically.	NBS, NG
Price of Diesel	POD	Price of Diesel fuel (Measured in LCU), widely used in various applications, including transportation (cars, trucks, buses), agriculture (tractors), and industry (generators).	NBS, NG
Exchange Rate	EXCR	Official exchange rate (LCU per US$), refers to the rate determined by national authorities or determined in the legally sanctioned exchange market, calculated as an annual average based on monthly averages (local currency units relative to	WDI, WB

		the U.S. dollar).	
Money supply	MOS	Money supply (MOS) is the broad money which measures total sum of money in the economy, defined as narrow money plus savings, time, and savings deposits with banks including foreign currency deposits as a percentage of GDP.	WDI, WB

Source: Author's Compilation

3.2 Model Specification

In line with the reviewed literature, Babalola and Salau, (2020) model that analysed the impact of petroleum pump prices subsidies on inflation rate in Nigeria between 2000 and 2019 was adapted with slight modifications. By adapting their pattern, the model is specified as:

$$ISG = \beta_0 + \beta_1 POP_t + \beta_2 POD_t + \beta_3 MOS_t + \beta_4 EXCR_t + \varepsilon_t \quad (1)$$

Where β1- β4 are the parameter coefficients of the independent variables. ISG denotes the Industrial sector growth, POP denotes the price of petrol, POD is the price of diesel, MOS is money supply, EXCR is the exchange rate, and ε is the stochastic error which is assumed to be normally distributed.

There is need to log-linearize the model for the purpose of estimation as specified in equation (2). This is necessary in order to minimize fluctuations in the data and to streamline the scales of the variables.

$$lnISG = \beta_0 + \beta_1 lnPOP_t + \beta_2 lnPOD_t + \beta_3 lnMOS_t + \beta_4 EXCR_t + \varepsilon_t \quad (2)$$

3.3 Estimation procedure

Choosing suitable pre-tests methods for model estimations is essential to ensure validity of the findings for drawing valid policy inferences. The most essential pre-tests involve assessing the stationary status of the study variables to avoid spurious results. In this paper, Dickey-Fuller GLS, Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and NG Perron unit root tests were used. However, to address the issues that may arise in the event of structural breaks, Lee and Strazicich unit root test, which can determine the stationary properties of variables even in the presence structural breaks was utilized.

The ARDL bounds test to co-integration approach developed by Pesaran et al., (2001) was used to explore the co-integration relationship among the variables, specified as follows:

$$ln\,\Delta\,ISG_t = \alpha_0 + \alpha_1\,ln\,I\,SG_{t-1} + \alpha_2\,ln\,P\,OP_{t-1} + \alpha_3\,ln\,P\,OD_{t-1} + \alpha_4 MOS_{t-_1} + \alpha_5 EXCR_{t-_1} + \sum_{i=0}^{q}\beta_1\,\Delta\,ln\,I\,SG_{t-1} + \sum_{i=0}^{k1}\beta_2\,\Delta\,ln\,P\,OP_{t-1} + \sum_{i=0}^{k2}\beta_3\,\Delta\,ln\,P\,OD_{t-1} + \sum_{I=0}^{K_3}\beta_4\,\Delta MOS_{t-_1} + \sum_{I=0}^{K_4}\beta_4\,\Delta EXCR_{t-_1} + \mu_t \ldots\ldots\ldots\ldots (3)$$

Here, short-term parameter coefficients are denoted by βi, while long-term coefficients are denoted by αi with I = 1…. n. The instant effect of the explanatory variables on the explained variable is explained by short-run analysis, while the speed of adjustment toward equilibrium level is determined by the long-run report.

This study adopts the innovative Dynamic Autoregressive Distributed Lag (D-ARDL) model developed by Jordan and Philips (2018) after confirming the existence of long-run relationship among the study variables. This advanced technique excels in visualizing and plotting graphs that are instrumental in forecasting both positive and negative shocks in the regressors, which enhances accuracy, and providing potential solutions to the complexities of the classical ARDL approach (Udeagha & Ngepah, 2022). Additional benefits of using the dynamic ARDL technique include: (i) its suitability when the speed of convergence is not uniform; (ii) it is applicable irrespective of the variables' order of integration, except for I(2) (Inuwa et al., 2024). The D-ARDL estimator with the error correction specification can be written as follows:

$$\Delta\,ln\,I\,SG_t = \alpha_0 + \alpha_0\,ln\,I\,SG_{t-1} + \rho_1\Delta\,ln\,P\,OP_t + \phi_1\,ln\,P\,OP_{t-1} + \rho_2\Delta\,ln\,P\,OD\_1_t + \phi_2\,ln\,P\,OD_{t-1} + \rho_3\Delta MOS_t + \phi_3 MOS_{t-_1} + \rho_4\Delta EXCR_t + \phi_4 EXCR_{t-_1} + \hbar ECT_{t-1} + \mu_t \ldots\ldots\ldots\ldots (4)$$

The error correction term is denoted by ECT, which has to be negative and significant in order to achieve long term convergence. The post-estimation measures employed by this study ar; Breusch-Godfrey test to check the autocorrelation issues, the WHITE test to examine the heteroscedasticity issues, the Ramsey RESET test for model specification issues and the Jarque-Bera test to examine the distribution of errors. CUSUM and CUSUMQ tests were also utilized to check the stability status of the model.

4.0 Empirical Results and Discussions

To understand the basic characteristics of variables used in the study, descriptive statistics is applied, where the upper part of Table 2 presents the results.

TABLE 2 Descriptive statistics and correlation matrix.

Variables	ISG	EXCR	MOS	POD_1	POP
Mean	25.08998	4.611103	28.93045	3.641282	3.537100
Median	25.11089	4.869412	29.21654	4.317488	3.688879
Maximum	25.34508	6.054390	31.58586	5.663273	5.274486
Minimum	24.81421	2.293493	25.09357	-3.218876	-0.356675
Std. Dev.	0.163607	1.054905	1.985651	1.955847	1.447970

Skewness	-0.188452	-0.715286	-0.322177	-1.686553	-1.173468
Kurtosis	1.668925	2.342001	1.749146	6.183581	4.114729
Jarque-Bera	2.551756	3.305997	2.639770	28.68405	9.000968
Probability	0.279186	0.191475	0.267166	0.000001	0.101104
Observations	42	42	42	42	42

Correlation matrix

ISG	1.000000				
EXCR	0.637978	1.000000			
MOS	0.274556	0.433973	1.000000		
POD_1	0.748437	0.701797	0.414760	1.000000	
POP	0.775825	0.028447	0.640488	0.674228	1.000000

Source: Author's computation

The mean and median figures are approximately identical for all the variables. However, the volatility as revealed by the standard deviation is high in money supply and price of diesel compared to exchange rate, and price of petrol, while industrial sector growth has the lowest volatility. The Jarque-Bera statistics suggests that all the variables are approximately normally distributed, except price of diesel, suggesting that further empirical analysis is required. While all the variables are negatively skewed, the kurtosis are platykurtic with the exception of price of petrol and the price of diesel that are leptokurtic. Also, the results of the correlation analysis are presented in the lower part of Table 2 which demonstrates the presence or otherwise of multicollinearity in the model. The higher coefficient of correlation ($r \geq 0.8$) shows severe multicollinearity among the variables. The results indicate that explanatory variables are weakly correlated.

The study employs the conventional Dickey Fuller GLS, ADF, PP and NG Perron tests, and the outcomes are displayed in Table 3.

TABLE 3 Unit root test.

Variables Level	Dickey Fuller GLS T-statistics	Phillips–Perron T-statistics	Augmented Dickey–Fuller T-statistics	Ng & Perron MZa	MZt	MSB	MPT
LISG	-3.685015**	-2.553064	-2.687227	-13.8626	-2.6327	0.18992	6.57344
LPOP	-2.080097	-2.210951	-3.859930**	-28.1495	-3.7471	0.13311	3.26331
LPOD_1	-9.781534***	-2.547663	-2.627663	-9.30345	-2.1546	0.23159	9.80328
MOS	-1.527684	-1.730248	-3.174423	-4.74294	-1.4935	0.31488	18.9037
EXCR	-1.621250	-1.730248	-3.274423	-4.74294	-1.4935	0.31488	18.9037
Difference							
LISG	-5.461407***	-6.81901***	-5.709585***	-12.8626***	-2.7327	0.18992	6.57344
LPOP	-4.587550***	-5.07113***	-5.424767***	-14.1093***	-86.717	0.00575	0.00614

LPOD_1	-3.826214**	-4.19021***	-5.399693***	-13.3986***	-2.5327	0.18284	6.61516
MOS	-3.660090**	-8.60115***	-4.298853***	-12.8788***	-2.4972	0.18713	6.77350
EXCR	-5.746182***	-5.60115***	-4.698853***	-11.8788***	-2.6972	0.18713	6.77350

***, ** and * show significance at 1, 5 and 10% levels respectively.
Source: Authors' computations

Table 3 results reveal that all the variables have unit root at their level values with the exception of ISG and POD_1. However, the variables were subjected to first difference and they became stationary. The results from all the unit root tests showed that the stationary properties of the variables are I(0) and I(1), hence, satisfying the condition for the application of dynamic ARDL.

Table 4 Unit root test with structural breaks

Variables	Lee Strazicich LM at Level		Lee Strazicich LM at first difference	
	T-statistics	Break points	*T*-statistics	Break points
LISG	-5.5420553**	2001 2013	-8.424438***	2006 2017
LPOP	-9.402381**	2003 2014	-9.672048***	2004 2009
LPOD_1	-7.664109***	2004 2018	-6.266374**	2001 2006
MOS	-6.710921*	2000 2009	-11.28959***	2006 2016
EXCR	-5.498956*	2006 2014	-8.137877***	2002 2007

***, ** and * show significance at 1%, 5% and 10% levels respectively
Source: Authors' computations.

The classical unit root tests described in table 3 do not take structural breaks into consideration, hence the use of Lee and Strazicich LM test as presented in Table 4. The empirical findings indicate that, in the presence of two structural breaks, the variables are integrated. Thus, the variables are qualified to run for dynamic ARDL approach.

The result of the optimal lag length is presented in the table below:

Table 5. Lag Length for F- Bound Cointegration Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	9.721195	NA	0.043702	-0.295075	-0.066053	-0.219161
1	35.50428	41.89751	0.009303	-1.844017	-1.569192	-1.752921
2	47.38762	18.56772*	0.004725*	-2.524226*	-2.203596*	-2.417946*
3	47.39149	0.005813	0.005047	-2.461968	-2.095534	-2.340506

*Indicates lag order selected by the criterion
Source: Author's Computations.

The lag order selection by five different criteria is presented in Table 5 suggested a lag length of two (2) is optimal for the F-bound cointegration test.

The results of the bound F-test presented in Table 9 shows the presence of a long-run equilibrium relationship among the variables of the study.

Table 6. Bound Test for Cointegration

H0: No cointegration

F-Statistic	Significance Level	Bound Critical Values		K
		I(0) Bound	I(1) Bound	
9.051288	1%	3.74	5.06	4
	2.5%	3.25	4.49	
	5%	2.86	4.01	
	10%	2.45	3.52	

Source: Author's Computation.

From the result in Table 9, the null hypothesis of no cointegration is rejected because the F-statistics exceeds the upper-bound critical values at all the levels of significance, confirming the presence of cointegration among the variables of the study.

The outcome of ARDL dynamic simulations for the industrial sector growth model is displayed in Table 7.

Table 7: Dynamic ARDL Simulation Result

Variables	Coefficients	T-Stat	Prob.
Cons	5.986248	2.88	0.0075
L_nlisg	-.2578052	-2.85	0.0078
D_lpop	-.0871291	-3.86	0.0003
L_nlpop	-.0475117	-2.02	0.0421
D_lpod_1	-.0181445	2.29	0.0234
L_nlpod_1	-.0054773	1.83	0.0896
D_mos	-.1430471	-1.81	0.0805
L_mos	.0166413	2.02	0.0382
D_excr	-.0092488	-0.25	0.8005
L_excr	.0432288	1.34	0.1906
ECT(-1)	-0.052623	-3.50	0.0003
R-squared	0.713580	Adjusted R-squared	0.639690
F-statistics	3.528567(0.009029)		

Source: Author's Computation.

From results, the coefficient of petroleum pump prices displayed a negative and significant effect on industrial sector growth both in the short run and the long run at a 1% significant level. This implies that 1% increase in petroleum pump prices will demote industrial sector growth by 0.08% in the short run and 0.047% in the long run, respectively. This outcome is in line with the finding of Onyinye, (2023) and Bala, (2023). Similarly, prices of diesel displayed a negative and significant impact on industrial growth in the short and long run, indicating that any 10% increase in the prices of diesel retards industrial growth in Nigeria by 0.02% in the short run and 0.005% in the long run. This result validates the findings of Abderrahman and Chaouti, (2022) and Osiweih (2023). Money supply is negative and statistically insignificant in the shortrun but significant in the long run. 1% increase in money supply reduces industrial growth by 0.14% in the shortrun, while in the longrun, 1% increase in money supply stimulates industrial growth by 0.017%. This can be explained in this sense that, when the central bank increases the money supply, it often does so by accompanying it with lower interest rates or engaging in open market operations that increase the availability of credit. Lower interest rates reduce the cost of borrowing for businesses, making it cheaper to finance investment in capital, technology, and expansion. This encourages industrial firms to take out loans for new projects, leading to growth in industrial production, as opined by Osiweih, (2023). Furthermore, exchange rate is negative and statistically insignificant in the shortrun but positive and statistically insignificant in the longrun. 1% appreciation in exchange rate demotes industrial growth by 0.009% in the short run and promotes it by 0.43%, in the longrun. The fall in industrial growth in the shortrun is as a result of the fact that a strong currency makes imported goods cheaper for domestic consumers. This increased competition from lower-priced imported goods and services can negatively impact domestic industries, as consumers and businesses may prefer cheaper imported goods over locally produced ones, making domestic manufacturers to face declined demand and lower sales, which can hinder industrial growth. These findings are consistent with the results from the work of Ali et al (2024). The correct sign of ECM and its statistical significance indicated that the speed at which disequilibrium in the short run can be corrected in the long run is high.

The study utilizes the conventional ARDL diagnostic tests in the form of normality, autocorrelation, heteroscedasticity, functional specification, and the estimated empirical model have passed all the tests. The study further utilized the CUSUM and CUSUMSQ to test the constancy of the residuals and stability of the estimated model. The result presented in Figure 6 established that the residuals are constant and stability of the estimated model at a 5% significant level because the blue lines of the two stability tests lie between the lower and upper bounds.

Table 8. Diagnostic statistics tests.

Diagnostic Statistics Tests	**X^2 (p Values)**	**Results**
Breusch–Godfrey LM test	0.6794	No problem of serial correlations
Breusch–Pagan–Godfrey test	0.5217	No problem of heteroscedasticity
Ramsey RESET test	0.3471	Model is specified correctly
Jarque–Bera Test	0.8513	Estimated residuals are normal

Source: Authors' Computations.

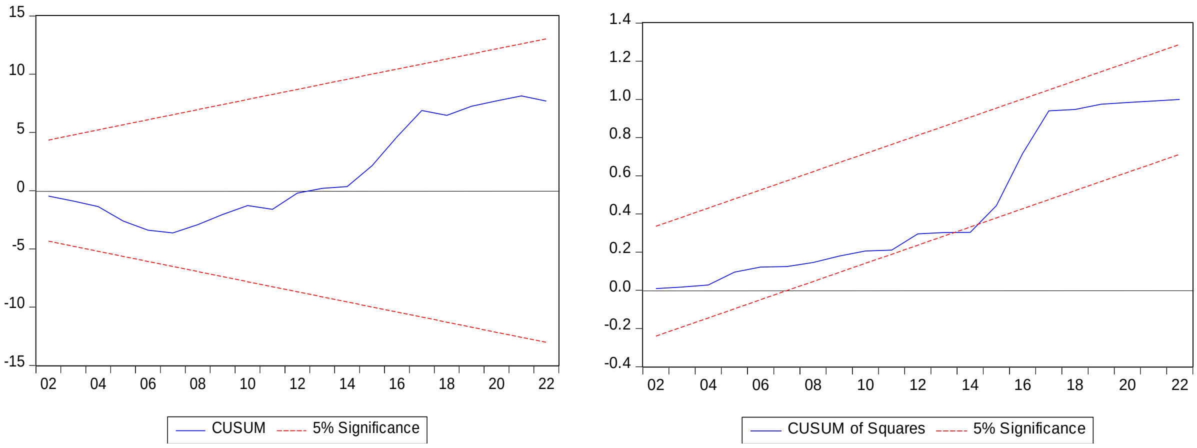

Figure 1 Plot of CUSUM and CUSUMQ**.**

To have a crystal guide for policy implication, the farther impact of the explanatory variables on the explained variable has been depicted via the impulse response obtained from the dynamic ARDL simulations presented in Figures 2-5. It is evident from Figure 2 that the positive shock in petrol pump prices in Nigeria adversely demotes the industrial growth, while its negative shocks promote industrial growth. Similarly, the impact of negative and positive shocks in diesel prices is revealed in Figure 3. It is evidently clear that the positive and negative shock of diesel price have minimal impact on industrial growth, respectively. Figure 4 depicts the nexus between money supply and industrial growth using an impulse-response plot. The plot depicts that 10% increase in money supply indicates a strong long-term and short-term positive impact on industrial growth, while a 10% decrease in money supply indicates its negative impact on industrial growth in the shortrun, and longrun. Moreover, a positive shock in exchange rate promotes industrial growth in the long run, implying that a strong currency is a sign of economic stability and sound fiscal policies, which can increase business confidence. This is because when businesses feel confident about the economic environment, they are more likely to make long-term investments in infrastructure, research and development, and manpower training, all of which contribute to sustained industrial growth.

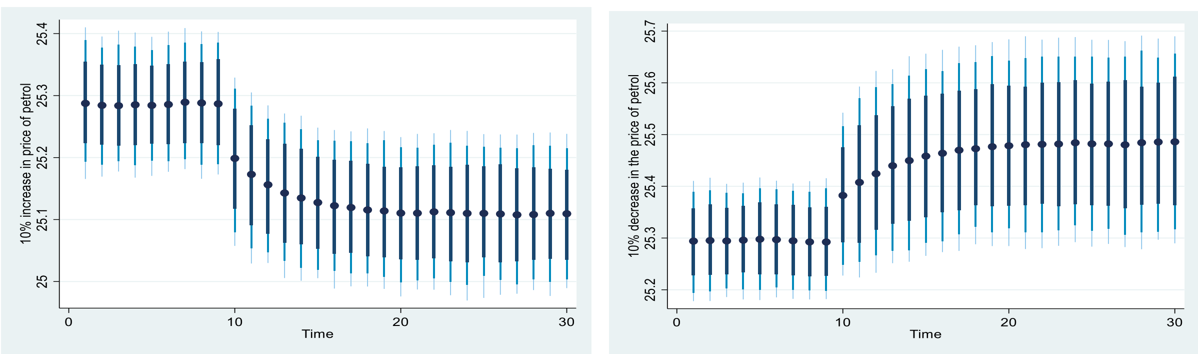

Figure 2. This figure depicts a 10% increase or decrease in petroleum pump price and its impact on industrial sector growth in Nigeria.

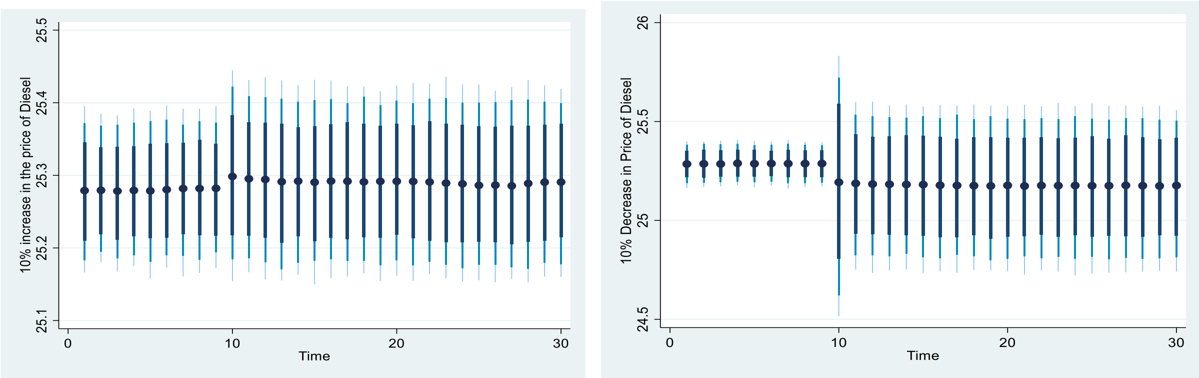

Figure 3. This figure depicts a 10% increase or decrease in price of diesel and its impact on industrial sector growth in Nigeria.

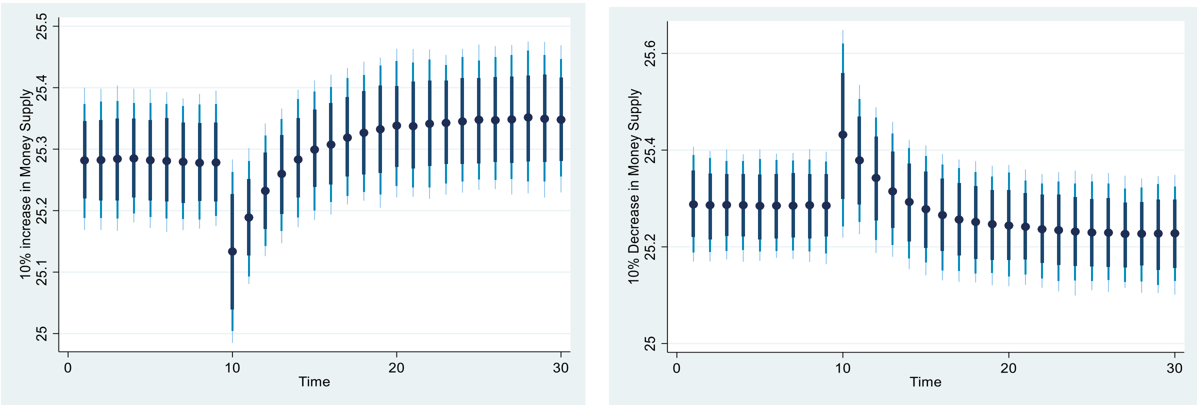

Figure 4. This figure depicts a 10% increase or decrease in money supply and its impact on industrial sector growth in Nigeria.

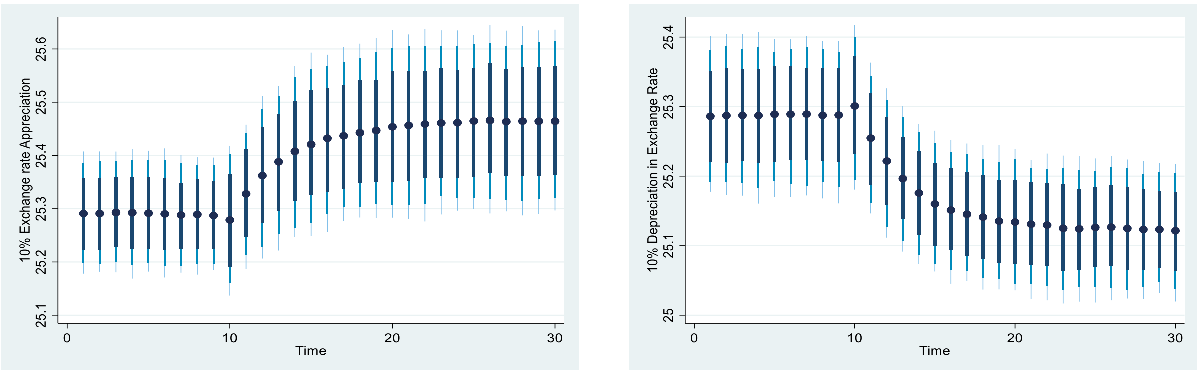

Figure 5. This figure figure depicts a 10% increase or decrease in exchange rate and its impact on industrial sector growth in Nigeria.

5.0 Concluding Remarks and Policy Recommendation

This research aims to interrogate the dynamic impact of petroleum pump prices, prices of diesel, money supply, exchange rate, on industrial sector growth in Nigeria, using data from 1981 to 2023 and the innovative dynamic ARDL simulation model was used for the analysis. Findings revealed that price of petrol coefficient displayed a negative and significant effect on industrial sector growth both in the short run and the long run, implying that an increase in petroleum pump prices slows down industrial sector growth both in the short run and long run. Similarly, coefficient of prices of diesel displays negative and significant impact on industrial growth in the short and long run, indicating that any increase in the prices of diesel retards industrial growth in Nigeria. Furthermore, increase in money supply reduces industrial growth in the shortrun, while in the longrun, it stimulates industrial growth. In the case of exchange rate, appreciation in exchange rate demotes industrial growth in the short run, and promotes it in the longrun.

Considering the findings, this study recommends that, removal of petroleum pump price subsidies should be accompanied by government support for small and medium scale enterprises (SMEs) which will go a long way in offsetting the impact of rising petroleum prices and help businesses cope with increased costs and sustain their operations. While in the longrun, supporting Research and Development (R&D) initiatives with focus on developing new technologies and processes that reduce energy consumption and improve efficiency in industrial operations will be helpful in making businesses cop with the challenges. Encouraging industries to adopt energy-efficient technologies and practices like energy audits, retrofitting old equipment, and using energy-efficient machinery will reduce overall energy consumption. Also, enhancing local petroleum refining capacity will reduce dependence on imported fuels and mitigate the impact of global oil price fluctuations. Finally, government should ensure a stable and predictable regulatory environment. Clear and consistent policies can help industries plan and manage costs better to foster harmonious industrial environment.

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