Measuring the Effect of Regime Change on Petroleum Price in Nigeria Using Moving Index

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Original Research Article

Abstract

The ongoing volatility of crude oil prices on the international market has harmed every sector of the Nigerian economy. Every Nigerian government regime experiences fluctuations in the price of petroleum. Thus, this research studied the effect of change in government regime on change in petroleum prices using a moving index with a constant and moving base year. Data on government regime and prices of petroleum were collected (1960 to 2021) from the Office of the Secretary to the Government of the Federation, Central Bank

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of Nigeria (CBN) Statistical Bulletin, and National Bureau of Statistics (NBS), spanning 62 years, and the changes in these prices over all the regime were observed via the time plot. The results of the analysis showed that regime change in Nigeria has significantly impacted the price of petroleum. The trend of change in petroleum prices using 1960 as a constant base year showed that regime change has a significant effect on change in petroleum price, while the moving index with varying base years showed no significant effect on the change in the petroleum price. Therefore, it can be concluded that variations in the price of petroleum in Nigeria are caused by both changes in time and regime. The estimated trend of change in the prices of petroleum with the period under study showed an upward trend. The movement showed that the price of petroleum is not likely to reduce shortly but rather will increase if nothing is done to stabilize it.

1 Introduction

1.1 Background to the study

Nigeria is endowed with a wealth of natural resources, the primary one being petroleum products. Nigeria currently ranks seventh in terms of crude oil exports and eleventh in terms of production. Over 90% of Nigeria's foreign exchange earnings come from the petroleum industry, which also employs people in various capacities. Furthermore, Nigeria's international relations have been greatly impacted by the extraordinary rise in oil profits, and occasionally, during the past few decades, the politics of oil have taken centre stage in the history of the country's international relations [1]. Crude oil is the source of oil products, which include bitumen, kerosene, diesel, gasoline, and natural gas. After a century of searching, oil was found in Nigeria in 1956 at Oloibiri in what is now Bayelsa State [2,1]. The majority of oil products are imported from developed nations and are primarily used in industries to produce goods and services as well as for domestic personal consumption [3,1].

Nonetheless, the ongoing volatility of crude oil prices on the international market has had a negative impact on every sector of the Nigerian economy. Nigeria's economy has suffered from the volatility of crude oil prices on the global market in several areas, including manufacturing, services, and production. Nigeria's economy is a monoculture, which explains this. Petroleum product prices were reviewed over ten times between 1990 and 2016. A turning point in the economy was the adjustment made in 2000 under the democratically elected government, which saw the price of gasoline rise to N30 per litre, diesel to N29, and kerosene to N27 [4,5,6,7, 8]. The high spot price of crude oil and the requirement for larger margins for the Nigerian National Petroleum Corporation (NNPC) to cover operating and capital costs, according to the government, were the driving forces behind the upward review of domestic petroleum product prices [9,1].

The First, Second, and, to some extent, Fourth Republics of Nigeria's bloody narratives of democratic transition and election behaviour were appalling. Though there is documented evidence of sanity and transparency in the transition programs and elections overseen by military regimes, the successes of the military era were ultimately cut short by the desire for self-succession, the personification of political office, and the military leaders' susceptibility to corruption enabled by the infiltration of civilian politicians [10,11]. At some point, almost every country goes through a change in political governance. It involves switching from one political party to another, as well as a president or leader. For example, in May 2015, Goodluck Jonathan of the People's Democratic Party, which had ruled Nigeria since the country's return to democracy in 1999, was defeated by General Muhammad Buhari of a different political party and ideology to become the country's president. After 55 years of independence, Muhammad Buhari is the 14th head of state as shown in Table 1. Changes in political outcomes could impact economic outcomes [12].

In light of this, the phenomenon that government turnover can account for the dynamics in macroeconomic variables like real output growth has been studied. The term "government turnover" refers to the periodic replacement or alteration of the head of state. A change in leadership suggests that a new administration will likely change or reject the economic policies of its predecessor, which could have an adverse effect on the economy [13,12]. Slightly more than 18% of Nigeria's total crude oil production was made available for domestic use in 1994, despite the country being ranked 11th in the world by OPEC. Amounts of crude oil that were also available for domestic use in 1995, 1996, 1997, 1998, and 1999 were 13.0%, 12.4%, 11.9%, 11.4%,

and 13.8% of the total amount. Before sharply declining to 7.9 per cent in 2005, there was a significant spike to 25.1 per cent in 2003. There was, however, an additional increase to 20.2% in 2006. Money and petroleum are necessary for modern life to such an extent that their shortages cause problems for necessary transactions. It is true that incompetence and corruption on the part of bureaucrats and the business class cause the sporadic gasoline shortages that Nigerian towns and villages endure because of inefficient distribution [9,12].

Table 1. Chronologies of past presidents and head of state

Sn	Head of Government	Regime
1	Sir. Abubakar Tafawa Balewa	Oct. 1, 1960 – Oct. 1, 1966
2	Chief Benjamin Nnamdi Azikiwe	Oct. 1, 1963 – Jan. 16, 1966
3	Major General Johnson Thomas UmunnakweAguiyiIronsi	Jan. 16, 1966 – Jul. 29, 1966
4	General Yakubu Gowon	Aug. 1, 1966 – Jul. 29, 1975
5	General Murtala Ramat Mohammed	Jul. 29, 1975 – Feb. 13, 1976
6	General Olusegun Aremu Okikiola Matthew Obasanjo	Feb. 13, 1976 – Oct. 1, 1979
7	AlhajiShehu Usman Aliyu Shagari	Oct. 1, 1979 – Dec. 31, 1983
8	Major-General Muhammadu Buhari	Dec. 31, 1983 – Aug. 27, 1985
9	General Ibrahim BadamasiBabangida	Aug. 27, 1985 – Aug. 27, 1993
10	Chief Ernest Adekunle OladeindeShonekan	Aug. 26, 1993 – Nov. 17, 1993
11	General Sani Abacha	Nov. 17, 1993 – Jun. 8, 1998
12	General Abdulsalami AlhajiAbubakar	Jun. 9, 1998 – May 29, 1999
13	Chief Olusegun Aremu Okikiola Matthew Obasanjo	May 29, 1999 – 29 May, 2007
14	AlhajiUmaru Musa Yar'adua	May 29, 2007 – May 5, 2010
15	Dr.GoodluckEbele Jonathan	May 6, 2010 – May 29, 2015
16	Major-General Muhammadu Buhari (Rtd.)	May 29, 2015 – Dec 31, 2021.

Source: Office of the Secretary to the Government of the Federation (OSGF)

Recent studies have tried to understand the volatility in petroleum prices. Hammed & Arawomo [14] examined the impact of oil shocks on manufacturing output in Nigeria using the SVAR framework and annual data from 1981 to 2019 obtained from the Central Bank of Nigeria (CBN). They discovered that oil prices explain government revenue in the short and long term, while expenditures only slightly explain revenue in the long run. They therefore recommended that efforts be made to diversify the economy so that government expenditures are financed by revenue generated rather than borrowing or needlessly relying on foreign aid. Ighosewe et al. [15] used the Auto-Regressive Distributed Lag Model to study the relationship between crude oil fluctuation and the Nigerian economy. Their findings indicated that fluctuations in crude oil contributed significantly to the country's economy and that the only factor that in the short term significantly boosted the country's economy was fluctuations in the price per barrel (FOBP). They also concluded that, for the Nigerian economy to perform exceptionally well, neither public nor private entities should meddle with the apex bank surveillance on the excess crude account.

Agbo [16] investigated the impact of fluctuations in oil prices on Nigeria's market performance as measured by the all-share index using monthly frequency data spanning the period from January 1997 to August 2020, The study utilized the Non-linear Autoregressive Displaced Lag methodology for data analysis. According to their findings, Nigeria's stock market performance is positively impacted by both increases and decreases in oil prices. As a result, market participants should keep an eye on changes in oil prices as a key indicator of changes in Nigeria's stock market performance. Adedeji et al. [17] examined the dynamic effect of COVID-19 on four major oil prices concerning China and Nigeria and predicted that oil prices would likely rise in the coming weeks as oil demand and major economies are anticipated to fully open and recover quickly. Okongwu & Imoisi [18] examined the proposed removal of petrol subsidy, its legal implication for the Nigerian economy and the effect of its removal.

Korley & Giouvris [19] used both the quantile regression and Markov switching models to investigate the joint effect of oil price and oil volatility (OVX) to address the problem, which they found to be significant determinants of economic activity. They also found that, while oil price shocks only affect the exchange rate of oil-importing countries, OVX shocks significantly impact the exchange rate for all countries. Agya et al. [7] investigated the transmission of shock and volatility between the oil price and exchange rate markets. They found that asymmetric shocks affected the price of WTI oil and exchange rates, while symmetric shocks were

observed in the price of Brent oil. They also found that past shocks and volatilities significantly contributed to current volatilities in the exchange rate and oil price markets. They reiterated that modelling exchange rate shock and volatility and formulating exchange rate policy must take innovation in oil prices into account.

Anyars & Adabor [20] applied the Nonlinear Autoregressive Distributed Lag (NARDL) Model to quarterly data spanning from the first quarter of 2000 to the first quarter of 2021 to investigate the effects of changes in oil prices on aggregated and disaggregated inflation, where the disaggregated inflation comprises energy CPI, food CPI, Core CPI, and transport CPI. Their findings from the NARDL model indicated evidence of the asymmetric impact of changes in oil prices on aggregated and disaggregated inflation, implying that policies should be developed to fortify the transportation sector to contain shocks related to oil prices and stabilize inflation. Abubakar et al. [21] examined how Nigeria's government balance responded to changes in oil prices using both linear and non-linear Autoregressive Distributed Lag models. They discovered that while the government's long-term response to these changes was symmetric, its short-term response was asymmetric.

Nwagu et al. (2023) studied oil price fluctuations and exchange rates in Nigeria and employed Johansen Cointegration to ascertain long-term relationships and Augmented Dickey-Fuller to identify a unit root. Their results demonstrated that there is no relationship between exchange rates and the price of crude oil. Therefore, it can be said that the volatility transmission or leverage caused by changes in the price of crude oil does not affect the Nigerian currency rate. Ekpeyong [22] investigated the dynamics of inflation volatility in Nigeria to capture the time-varying volatility in the inflation rates, using Autoregressive Conditional Heteroskedasticity (ARCH) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models, with a focus on the Food Consumer Price Index (CPI), Core CPI, and Headline CPI. According to their findings, all three inflation series exhibit time-varying volatility, which denotes differing degrees of uncertainty and volatility in price movements over various periods.

The above studies have not considered the changes in the price of petroleum as a result of government regime change in Nigeria. So, considering the big relationship between the price of petroleum and the economy of the nation, it simply implies that petroleum cannot be separated from the well-being of the nation economically. Based on the preceding argument, this study aims to measure the effect of regime change on petroleum prices in Nigeria using a moving index. To achieve this aim, the following objectives are stated. Investigate the impact of change in regime on petroleum prices in Nigeria as it affects the economy; determine whether there is a significant difference in the average price of petroleum for the different regime changes in Nigeria; and estimate the trend of change in the prices of petroleum for the period understudy. The government will find value in the research's findings when making decisions that will enhance Nigeria's petroleum resources and alter the country's political structure. It will give a general overview of how changes in the regime have affected Nigeria's petroleum prices over time. This will guide future researchers who might be interested in the same area of study and contribute to the body of knowledge.

2 Materials and Methods

2.1 Research design

The study adopted the quantitative and ex-post facto research design in obtaining, analyzing and interpreting data relating to the objectives of the study. The ex-post facto design is most suitable in studies in which the investigation starts after the fact has occurred without interference from the researcher. The choice of this type of design allowed the researcher the privilege of observing variables over a long period.

The research hypothesis for the research will be stated as follows:

H_0: There is no significant difference in the average changes in prices of petroleum in all the regimes
H_1: There is a significant difference in the average changes in prices of petroleum in all the regimes

2.2 Data description

Secondary data was used for this study; the data was sourced from online. It was obtained from the Office of the Secretary to the Government of the Federation (OSG), Central Bank of Nigeria (CBN) and the National Bureau

of Statistics (NBS). The study is limited to the territory of Nigeria. The data comprises the pump price of petroleum in Nigeria (in Naira) from 1960 to 2021. It also comprises different regimes of government for the same period. The data span 62 years (62 observations). There are 16 governmental regimes in Nigeria, so, the data is reduced to 16 observations, with each observation representing the average price of petroleum for that regime.

2.3 Method of data analysis

Data analysis was done using index number, Simple Price Index (SPI) method, Moving Price Index (MPI) method and t-test. The SPI is used to measure the relative change in the price of petroleum from one regime to the other using a fixed base year, which might be far from the current year; In contrast, the MPI is used to measure the relative change in the price of petroleum using the immediate past year as the base year, which measures changes not only based on the regime but also on period. The t-test is used to test whether there is a significant difference in the mean price of petroleum between the two regimes.

2.4 Simple price index method

$$SPI_t = \frac{P_{1t}}{P_0} \times 100 \tag{1}$$

Where

SPI_t is the simple price index at time t, $t = 1,2,…$, T.
P_{1t} is the current year's price for petroleum at time t, $t = 1,2,…$, T. (P_{1t} changes with time).
P_0 is the base year's price for petroleum at time $t = 1$. (P_0 is constant all through the period).

2.5 Moving price index method

$$MPI_t = \frac{P_t}{P_{t-1}} \times 100 \tag{2}$$

Where

MPI_t is the moving price index at time t, $t = 1,2,…$, T.
P_t is the current year's price for petroleum at time t, $t = 1,2,…$, T. (P_t changes with time).
P_{t-1} is the base year's price for petroleum at time t - 1. (P_{t-1} changes with time).

2.6 Student's t-test

The one-sample t-test was used to test if there is a significant difference in the changes in petroleum price with a regime change. If the difference is significant, we conclude that a regime change significantly affects the change in petroleum price, but if the change is not significant then we conclude that the change in regime does not have a significant effect on the price of petroleum in Nigeria.

The one-sample t-test is given by

$$t = \frac{\bar{x} - \mu}{s/\sqrt{n}} \tag{3}$$

where

$$\bar{x} = \frac{1}{n} \sum_{i=1}^{n} x_i$$

and

$$s = \frac{1}{n-1} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

and $\mu = 100$ is assumed since the price index is given in percentage. If all the indices are equal to 100 or are not different from 100, then it shows that the changes are not significant.
The hypothesis is stated thus:

H_0: $\mu = 100$
H_1: $\mu \neq 100$

The level of significance, $\alpha = 0.05$.

Decision rule: Reject H_0, if the p-value is less than the level of significance,

3 Results and Discussion

3.1 Data presentation

In this research, the data collected was presented and analysed based on the governmental regime. The data on the price of petroleum (in Naira) from 1960 to 2021 is averaged across the 16 governmental regimes from October 1st 1960 to December 31st 2021. The data is presented using tables, time plots, bar charts, and histograms.
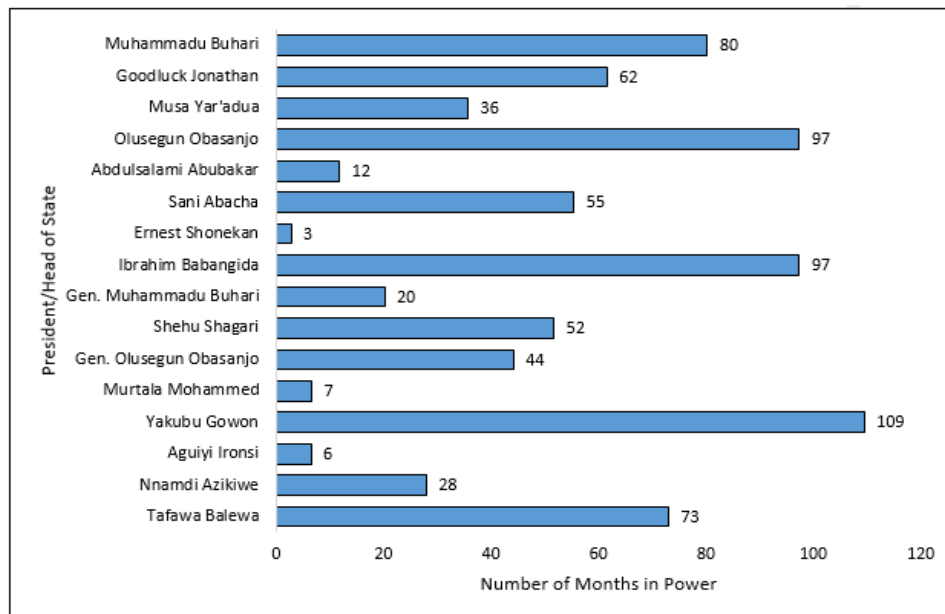
Fig. 1. Past Nigerian government regimes' number of years in power

Fig. 1 shows the governmental regimes in Nigeria with their various prices of petroleum. The figure depicts that there are 16 distinct regimes in Nigeria from Independence (1960) to date (2021). The figure shows that Yakubu Gowan's regime was the longest (109 months) while Ernest Shonekan had the longest duration (3 months). The time plot of the price of petroleum from 1960 to 2021 is depicted in Fig. 2. Fig. 2 depicts the yearly trend of the price of petroleum from 1960 to 2021 depicting various regimes in price change. It is observed that there are some cases where there is more than one price change within the same governmental regime and some cases where we have constant prices across different regimes. Fig. 2 shows that there is an upward trend in the price of petroleum. It also shows the various price regimes (price change points).
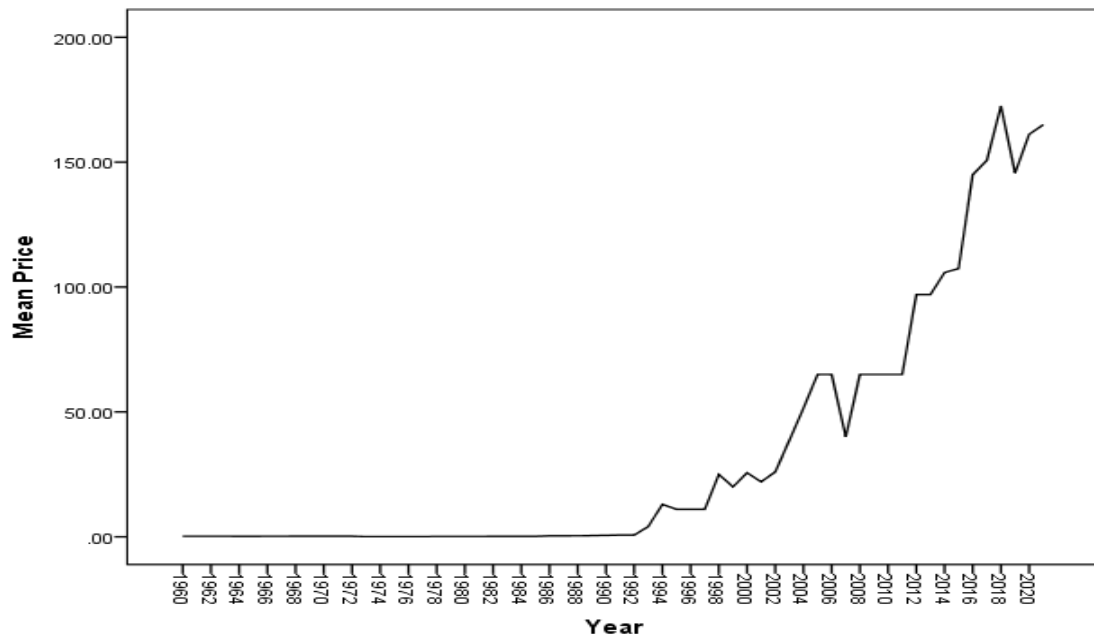
Fig. 2. Time plot showing the trend in the price of petroleum (in Naira) from 1960 to 2021
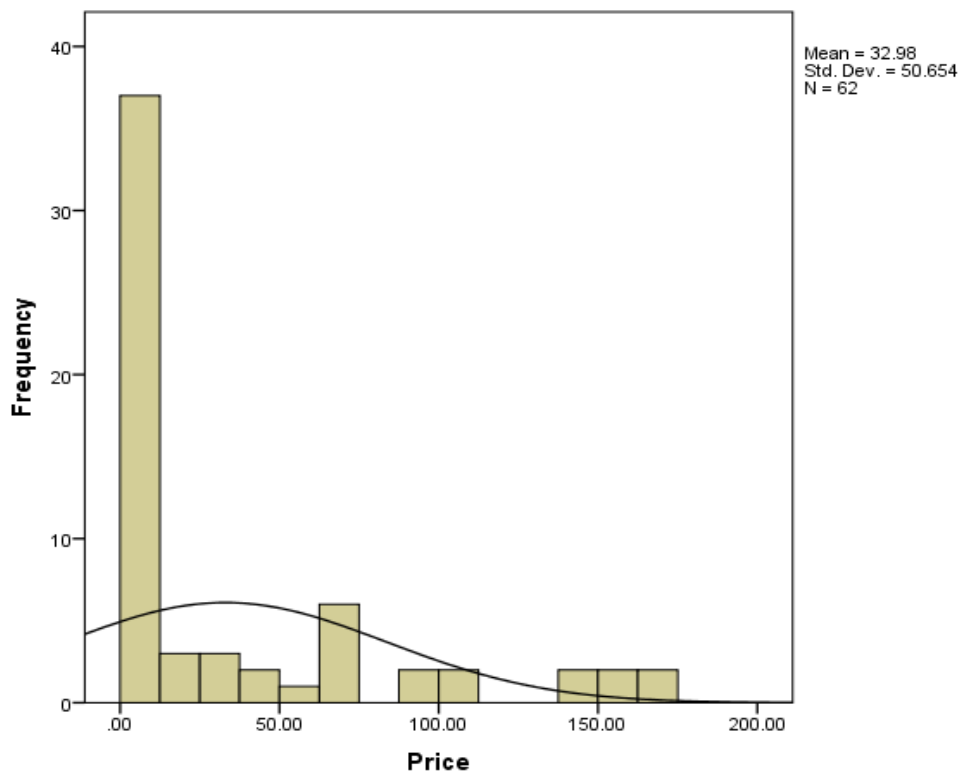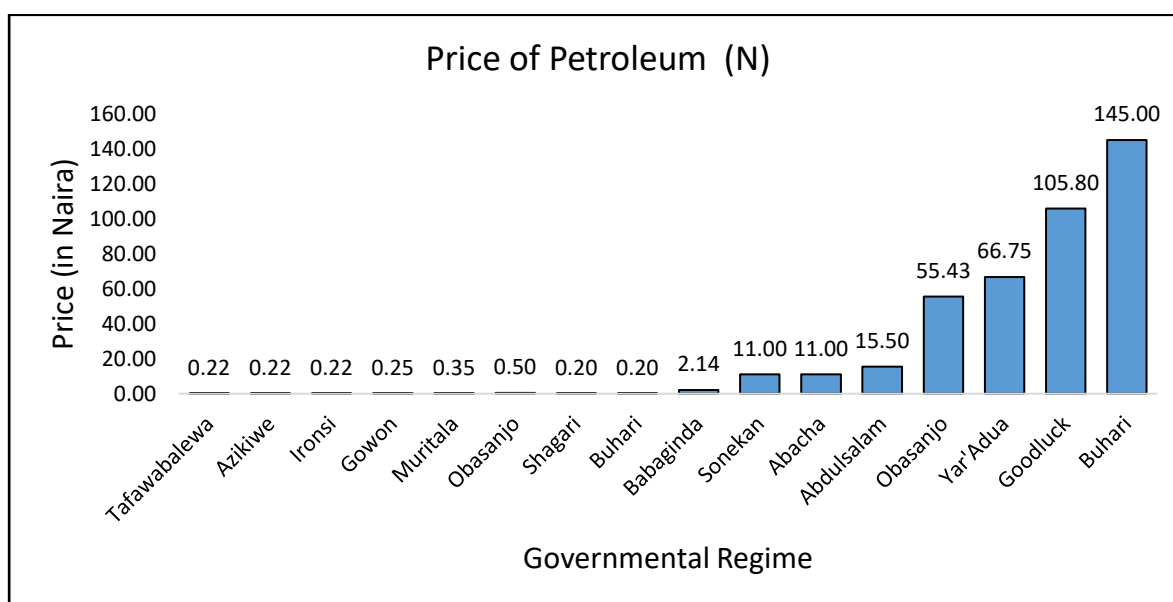

Fig. 3. Histogram showing the shape of the price of petroleum (in Naira) from 1960 to 2021
Source: Researcher's Output

Fig. 4. Bar chart showing various government regimes and their average price of petroleum (in Naira) from 1960 to 2021

Source: Researcher's Output

Fig. 3 shows that the data on petroleum prices in Nigeria is skewed to the right and has gaps. The data is not normally distributed. The modal class is less than ₦10. Fig. 4 shows the various regimes and their prices of petroleum in Nigeria. It was during the Babaginda regime price of petroleum rose above ₦ 1.00, that is, ₦2.14, and it was during the Sonekan regime it entered double digits (₦11.00). It was during the Goodluck regime it entered three digits (₦105.80) and during the Buhari regime, it rose to ₦145.00.

3.2 Data analysis

The data was analysed using a simple price index (SPI) and a moving price index (MPI). The simple price index was computed for the various governmental regimes using the price of petroleum in 1960 as the base year, while other governmental regime prices were used as the current year.

Table 2. Government regimes and their price indices

Sn	Head	Regime	Price (₦)	Price Index	Moving Price Index
1	Tafawabalewa	1960-1963	0.22	100.0	-
2	Azikiwe	1963-1966	0.22	100.0	100.0
3	Ironsi	1966-1966	0.22	100.0	100.0
4	Gowon	1966-1975	0.25	113.6	113.6
5	Muritala	1975-1976	0.35	159.1	140.0
6	Obasanjo	1976-1979	0.50	227.3	142.9
7	Shagari	1979-1983	0.20	90.9	40.0
8	Buhari	1983-1985	0.20	90.9	100.0
9	Babaginda	1985-1993	2.14	972.7	1,070.0
10	Sonekan	1993-1993	11.00	5,000.0	514.0
11	Abacha	1993-1998	11.00	5,000.0	100.0
12	Abdulsalam	1998-1999	15.50	7,045.5	140.9
13	Obasanjo	1999-2007	55.43	25,195.5	357.6
14	Yar'Adua	2007-2010	66.75	30,340.9	120.4
15	Goodluck	2010-2015	105.80	48,090.9	158.5
16	Buhari	2015-2020	145.00	65,909.1	137.1

Table 2 shows the head of government in the 16 regimes, their fuel prices, the simple price index and the moving price index. For the moving price index (MPI), the prices of two successive regimes were compared, the succeeding years are the base years, while the previous years are the current years. The first data point is omitted since it is the first data point and is not to be compared with. For the simple price index, the Buhari regime has the highest inflation rate in the price of petroleum, while for the moving price index, the Babangida regime has the highest inflation rate in the price of petroleum.
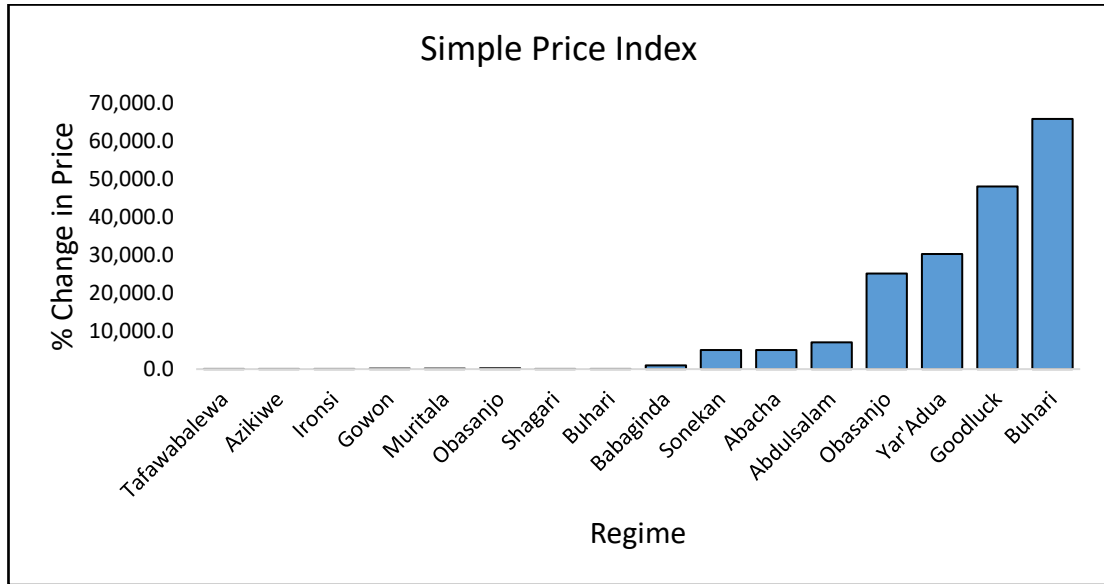

Fig. 5. Bar chart showing various government regimes and their simple price index

Fig. 6 shows the simple price index for various regimes in Nigeria. The simple price index shows that the Buhari regime has the highest inflation rate when compared with the base year of 1960. Since the Babaginda regime, the average change in prices has been trending up.
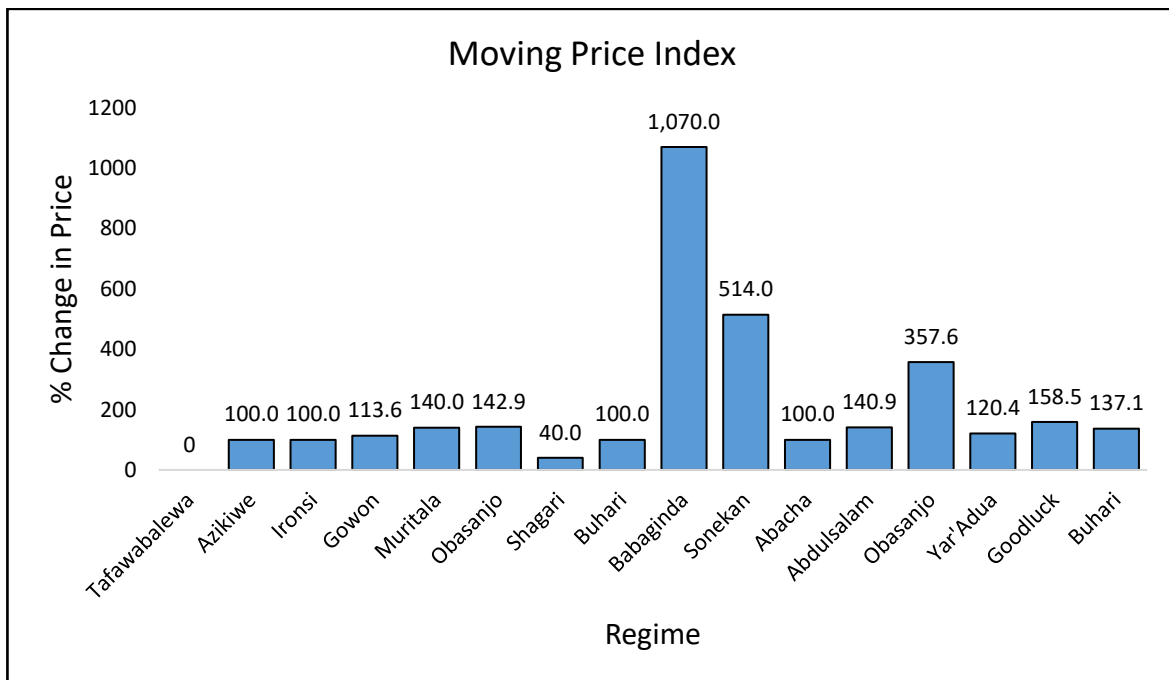

Fig. 6. Bar chart showing various government regimes and their moving price index

Fig. 6 shows the moving price index for various regimes in Nigeria. The moving price index showed that the Babangida regime has the highest inflation rate. It is necessary to test if the changes in prices of petroleum from one regime to another are significantly different or not. The t-test was used to achieve this.

3.3 One sample t-test for simple price index

H_0: There is no significant difference in the average changes in prices of petroleum in all the regimes
H_1: There is a significant difference in the average changes in prices of petroleum in all the regimes

Table 3. Mean for simple price index of price of petroleum regime change

	N	Mean	Std. Deviation	Std. Error Mean
Simple Price Index	16	11783.525	20151.4694	5037.8674

Table 4. One-Sample T-Test for Simple Price Index of Price of Petroleum Regime Change

				$\mu = 100$		
	t	df	P-value	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Simple Price Index	2.319	15	0.035	11683.5250	945.565	22421.485

Table 3 shows the mean of the percentage change in price, which is 11783.525% with a standard deviation of 20151.4694. This shows a very large percentage change in the simple price index. Table 4 shows that there is a significant difference in the average changes in prices of petroleum in all the regimes at a 5% level of significance using the simple price index method. It implies that some regimes have inflated the price of petroleum in Nigeria than other regimes. The descriptive statistics showed that the Buhari regime has the highest inflation rate compared with other regimes.

3.4 One sample t-test for moving price index

H_0: There is no significant difference in the average changes in prices of petroleum in all the regimes
H_1: There is a significant difference in the average changes in prices of petroleum in all the regimes

Table 5. Mean for moving price index of price of petroleum regime chang

	N	Mean	Std. Deviation	Std. Error Mean
Moving Price Index	16	214.688	255.9056	63.9764

Source: Researcher's Output

Table 6. One-Sample t-test for moving price index of price of petroleum regime change

				$\mu = 100$		
	t	df	P-value	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Moving Price Index	1.793	15	0.093	114.6875	-21.675	251.050

Source: Researcher's Output

Table 5 shows the mean of the percentage change in price, which is 214.688% with a standard deviation of 255.9056. This shows an average of 114.68 increase in changes in prices of petroleum using the moving price index. Table 6 shows that there is no significant difference in the average changes in prices of petroleum in all the regimes at a 5% level of significance using the moving price index method. It implies that the regimes have not significantly inflated the price of petroleum in Nigeria. This showed that any observed difference might be due to chance. The simple price index showed a significant difference because the base year was too far from

the current year as time increased, but the moving price index showed no significant difference because the base year was the immediate past year.
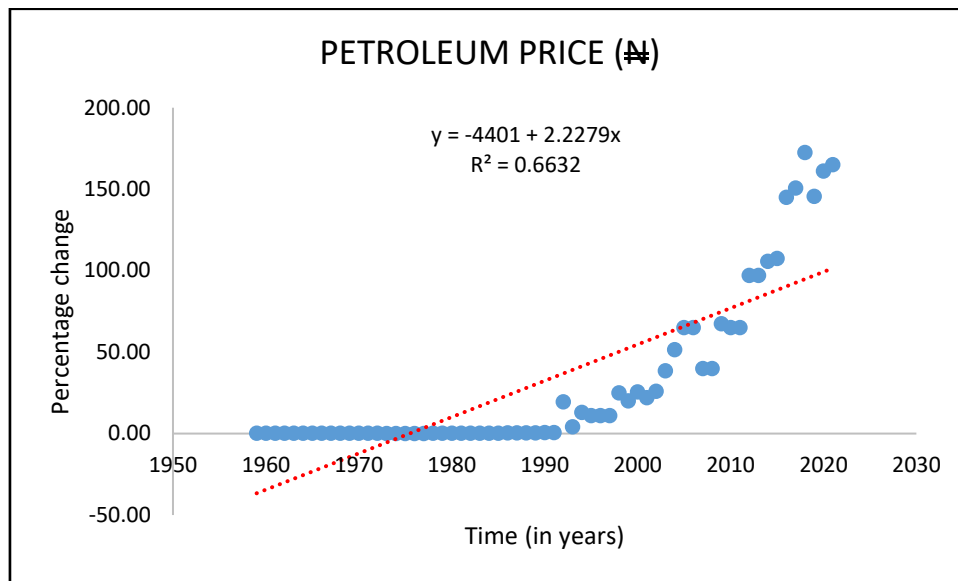
Fig. 7. Trend of petroleum price in Nigeria (1960-2021)

Fig. 7 shows the linear trend in the price of petroleum. The trend showed an upward direction. This implies that the price of petroleum is trending upward.

The trend line is given by

$$y = -4401 + 2.2279x$$

The coefficient of determination R² = 0.6632. This implies that 66.32% of the variance in the price of petroleum can be explained by the time factor and the remaining 33.68% can be explained by other factors such as regime change, and other governmental policies other than time effect.

4 Conclusion

The conclusion is made based on the objectives of the research and the summary of the findings. The study investigated the mean difference in petroleum pump prices for the different governmental regimes in Nigeria. The research gives the following conclusions. During independence, the price of petroleum was less than ₦1.00, but after 16 changes in regimes, the price of petroleum rose to more than ₦145.00 in 2021 in Nigeria. The trend of change in petroleum prices using 1960 as the base year shows that the change as a result of regime changes in Nigeria is significant. After investigating the difference in the average changes in prices of petroleum in all the regimes in Nigeria using the moving price index, it is concluded that the changes in the price of petroleum in Nigeria are not a result of the regime change only but as a result in a change in time. The estimated trend of change in the prices of petroleum within the period under study shows an upward trend. The movement of the trend in petroleum prices shows that the price of petroleum is not likely to reduce shortly but rather will increase if nothing is done about controlling the price.

This work is consistent with the findings and suggestions of Kyarem and Dodo [23] who looked at how changes in the price of petroleum products affected the cost of food in the Nigerian economy. They suggested that the government should put policies in place that support agricultural productivity, which has a significant potential to increase food supply and lower food prices nationwide. In this sense, timely increases in the price of petroleum would increase revenue without causing food inflationary trends. It is also consistent with the research conducted by Ezuem and Ejeka [24] who used an ex post facto research design to examine the Petroleum Product Price adjustment and Nigeria's economic performance between 1984 and 2023. They suggested that the Nigerian government look into alternate sources of public revenue, establish a progressive tax

system, adopt austerity budgets for responsible public spending, diversify the country's economy, and invest in sustainable businesses and services [25,26].

This present study recommends that policy on petroleum pump price should be made so that change in government regime would not automatically translate to change in petroleum pump price. Since it is obvious from historical data used in this study that the price of petroleum is reviewed upward as the government regime changes, it is, therefore, necessary to look inward at what causes those changes, which could mostly be a result of unsolved problems carried from one regime to another. Thus, these problems can be solved by adequate and prompt economic policies [27].

5 Suggestion for Further Studies

Further studies should include the duration of a governmental regime in the model and also look at economic variables such as the official exchange rate and how it affects the pump price of petroleum in Nigeria. Change point analysis can be carried out to show the major points where changes occurred apart from the one depicted by the plots in this study.

Competing Interests

Authors have declared that no competing interests exist.

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