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Coronavirus (Covid-19) Cases in Nigeria and Global Crude Oil Prices: An Empirical Investigation between 2020 and 2022

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Abstract: Before the advent of the Russia-Ukraine war, Nigeria has been consistently experiencing short falls in meeting the OPEC quotas in the international market for crude oil. As one of the major players in this market, the persistent short falls could orchestrate price dynamics in the international oil market. Meanwhile, continuous rise in Covid-19 cases in 2020 in Nigeria led to the closure of the economic activities in the country, of which could spell doom for both the local and the global aggregate demand and supply of crude oil. Against this backdrop this study utilized the susceptible-infected-recovered (SIR) model to research the influence of Covid-19 cases in Nigeria on global crude oil prices, utilizing information from the relevant sources from the period of 1st March, 2020 to 30th June, 2022. Consequently, this study's conclusions include the following; the confirmed cases and the death cases of Covid-19 in Nigeria had positively induced the global crude oil prices, though not in a significant way. Whereas, the Covid-19 recovery cases in Nigeria had negatively and significantly induced global crude oil prices. However, none of the variables is causally related to one another. From these findings, it is strategic to enunciate that any time the policymakers in OPEC wish to ensure stability in the prices of crude oil in the international market, the Nigerian government in particular and other crude oil exporting countries should take a pragmatic step in curbing the emergence of new waves of Covid-19 cases in their countries.

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1. Introduction

Due to the coronavirus pandemic 2019 (COVID-19), the global economy has been adversely affected, in which some countries in the developing world are currently in a state of chaos and catastrophic recession. The World Health Organization (WHO) located in China got an official first-hand information about this unknown virus on December 31, 2019. The virus was discovered in Wuhan City, China's Hubei province, and as such the virus was tagged Coronavirus Disease in the year 2019 (COVID-19) by the World Health Organization, though previously known as the 2019nCoV acute respiratory disease. The virus is an infectious disease produced by the coronavirus 2 that causes SARS. Coronavirus disease (COVID-19) has expanded over the world since its first infections in China, appearing in all continents and affecting more than 200 nations and territories. The virus, which has a fatality rate of around 2.3%, has spread to every continent (Chinese Center for Disease Control and Prevention, 2020), as dark side of economic integration (Aderemi *et al.,* 2020: a).

However, Nigeria is one of the major forces that should dominate the global oil market because its principal export is crude oil, which also serves as the nation's main source of income. The oil and gas industry, which accounts for the majority of Nigeria's foreign revenue, is very important to the country's economy. The oil and gas industry in Nigeria is a significant source of foreign revenue, and the Covid-19 outbreak has recently caused a sharp decline in oil prices (CODE, 2020). The Nigerian government was unprepared for the coronavirus-induced spike in oil prices, and the consequences have created significant obstacles for the 2020 budget, necessitating a review and change to account for current global oil prices (Maijama'a *et al.,* 2020). The consequences are disastrous as the entire economy starts to experience economic shocks such as supply chains disequilibrium, the unavailability of personal protective equipment for healthcare personnel, food supply crisis and job insecurity especially among unorganized private sector. Some other critical issues that validate the Nigeria's susceptibility to these external shocks are rising reliance of the country on international economies for fiscal income, foreign exchange inflows, fiscal deficit financing and capital movement. It has been observed even before the advent of the Russia-Ukraine war that Nigeria has been consistently experiencing short falls in meeting the OPEC quotas in the global crude oil market. It is important to stress that these persistent short falls could orchestrate price dynamic in the international market for crude oil. Meanwhile, continuous rise in Covid-19 cases in Nigeria led to the closure of the economic activities in the country of which could spell doom for both the local and

the global aggregate demand and supply of oil and gas. Against this backdrop this study raises these research questions. What is the trend and pattern of Covid-19 confirmed cases and the prices of crude oil in the international market? What is the impact of Covid-19 pandemic on the prices of crude oil in the globe? Therefore, this study establishes the trend and pattern of Covid-19 cases in Nigeria and global crude oil price. In the same vein, it establishes the relationship between the Covid-19 cases in Nigeria and global crude oil price movement.

Thus, the article is organized as follows: the introduction identifies the study's problem, the research questions and objectives, followed by a discussion of the associated literature review in section two, the research methodology in section three, the data and findings discussion in section four, and the conclusion and policy recommendation in section five.

2. Literature Review

Though, literature surrounding Covid-19 cases and its influence on critical macroeconomic variables is evolving continuously across the globe, as such, this section provides empiric studies regarding this subject matter as follow;

Alou *et al.* (2020) used time series from the 2nd of January to the 29th of April in the year 2020 to analyze the effect of the Covid19 pandemic on the S&P GS Indicator for oil and gas production. The results shows that the power commodity markets Indicators reacted to shocks due to Covid-19 as a result of underlying, psychological, and behavioral factors. A structural VAR model was used to understand the impact of shocks due to Covid-19 on future energy markets, specifically on crude oil and natural gas Index. In addressing the connection between globalisation and COVID-19 cases in Africa, Aderemi *et al.* (2020:a) submitted that the spread of Covid-19 to the continent of Africa was orchestrated by the negative influence of globalisation posited that corona virus (COVID-19) dispersed to the continent of Africa as negative influence of globalization. Maijama'a *et al.* (2020) used status reports from the Nigeria Center for Disease Control (NCDDC) from March 11th to March 19th, 2020 to appraise how the Covid-19 pandemic impacted the Nigerian economy. According to the findings, 91 persons were tested for Covid19 across 13 states, with 63 people testing negative and ruled out, 17 people awaiting results, and 11 people testing positive. Using daily observations on the total number of confirmed Covid-19 cases, global oil prices, and food security for the study period of 20th January to 31st March, 2020, Musa *et al.* (2020) investigate the impact of the Covid-19 pandemic on global oil prices and food security. The findings demonstrated the strong co-integration relationship between the variables. The long-term interlink between the prices of crude oil and Covid-19 is negative and statistically significant, but the relationship between food prices and Covid-19 is just marginally favorable.

In the near term, there is a statistically significant inverse correlation between the price of food and crude oil and Covid-19. The Covid-19 equation possesses long-run causality, according to the VECM discovery, having short-run unidirectional causation going from the price of crude oil to Covid-19 and from the price of food to the price of crude oil.

Ozili (2020) assessed the economic impact of the COVID-19 crisis in Nigeria. The current economic crisis is a result of the devouring COVID-19 pandemic. Based on the paper, which identified five avenues through which the pandemic spread to Nigeria. Borrowers' failure to repay loans, oil demand shocks, global supply chain shocks, a weakened national budget, and poor stock market performance are all examples. The influence of the COVID-19 cases on the Nigeria`s economic activities was exacerbated by movement restrictions, economic lockdown, fear of contracting the virus, and poor institutional quality, according to the report. Covid-19 pandemic had a serious implication of microfinance banks and SMEs in Nigeria (Bako *et al.*, 2021). Aderemi *et al.* (2020: b) assessed the implication of Covid-19 cases on the productivity of SMEs in Nigeria. The conclusion from the study argued that a normal fall in outputs generated and sales in which the SMEs engaged in occurred during the pandemic. Likewise, the SMEs experienced a huge decline in contracts and service deliveries during the closure of the Nigerian economy. Oko *et al*. (2022) investigated how CBN Post COVID-19 stimulus packages affected the economic sustainability of 600 SMEs in the COVID-19 epic centres of Nigeria. It was evidenced from the study that the CBN Post COVID-19 stimulus packages enhanced the economic sustainability of the SMEs in question.

Chikwe, Ujah, and Uzoma (2016) evaluated the effect of oil prices on macroeconomic variables in Nigeria from 1990 to 2015. The results of using multiple regression approaches revealed that the unemployment rate has a positive and significant impact on crude oil prices. While interest rates had a considerable inverse effect on the prices of crude oil, Inflation, currency rate, and real aggregate productivity have little effect on the prices of crude oil, according to the findings.

Various investigations on the Covid-19 pandemic have suggested certain models. The susceptible-infected-recovered (SIR) paradigm is superior and more reliable. This model has been updated to include both recovered and deceased individuals. The SIR model (Kermack and McKendrick, 1927; Brauer and Castillo-Chavez, 2012) is a straightforward Markov model that depicts how an illness spreads over time in a population. Susceptible (S), Infected (I), and Recovered (R) are the three groups that this model divides a population (N) into (R). The number of susceptible persons who become infected in each period is a product of the susceptible population, the number of already infected individuals, and an infection rate. In each phase, a certain percentage of afflicted people (r) recovers.

3. Methodology

Ex-post facto design, which examines how a dependent variable is changed by an independent variable that was present in the participants before the investigation, is the most suited research design for this study. Similar to that, secondary data from March 2020 to June 2022 was taken into account for the empirical analysis in this study and simultaneously gathered from the CBN Statistical Bulletin and Nigeria Center for Disease Control (NCDC).

3.1. Model Specification

The model used in this study was adapted from the works of Omitogun *et al*. (2021), Puaschunder (2020) and Maijama'a *et al.* (2020) by eliminating some variables that are not related to this study. In addressing the second objective of the study;

Crude Oil Price = F (COVID-19) (1)

Equation (1) could be re-written in econometric term to form equation (2)

$LogCOP_t = \beta_0 + \beta_1 LogCOV19CA_t + \beta_2 LogCOV19RO_t + \beta_3 LogCOV19DE_t + \beta_4 INFL_t + u_t$ (2)

Where,

COP = Crude Oil Price

COV19CA = Covid-19 Confirmed Cases

COV19RO = Covid-19 Recoveries

COV19DE = Covid-19 Deaths

INF = Inflation

u = Stochastic Error Term

From the above model $\beta_{1...}\ \beta_4$ refers to

B_1 = Coefficient of Covid-19 Confirmed Cases (COV19CA)

B_2 = Coefficient of Covid-19 Recoveries (COV19RO)

B_3 = Coefficient of Covid-19 Deaths (COV19DE)

B_4 = Coefficient of Inflation (INF)

t= time; refers to the period time observations and in the case of the present study t = March 2020 – June 2022. These periods represent the critical periods of Covid-19 cases in Nigeria.

3.2. Estimation of Analysis

The research used the Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit roots tests to determine whether the data series were stationary, and the Johansen Co-integration test was used to determine whether the variables were in a long-term equilibrium. The co-integration test is required to determine whether the variables in the data set have a long-run relationship because if they have a unit root, they only have a short-run connection. The study also used the Fully-Modified OLS model to examine and assess whether there is a long-run relationship between Covid-19 pandemic and crude oil price in Nigeria. The Pairwise Granger Causality method was used in the study to examine for a causal connection between the important variables.

4. Results and Discussion

4.1. Trend of Covid-19 Confirmed Cases and Crude Oil Price in Nigeria

The trend of Nigeria`s Covid-19 confirmed cases and the prices of crude oil in the globe are plotted using a graph and as presented in figure 1 and 2. The analysis of trend enables an overview of the pattern of covid-19 confirmed cases of Nigeria, exchange rate and crude oil price performances since 2020 up until 2022.

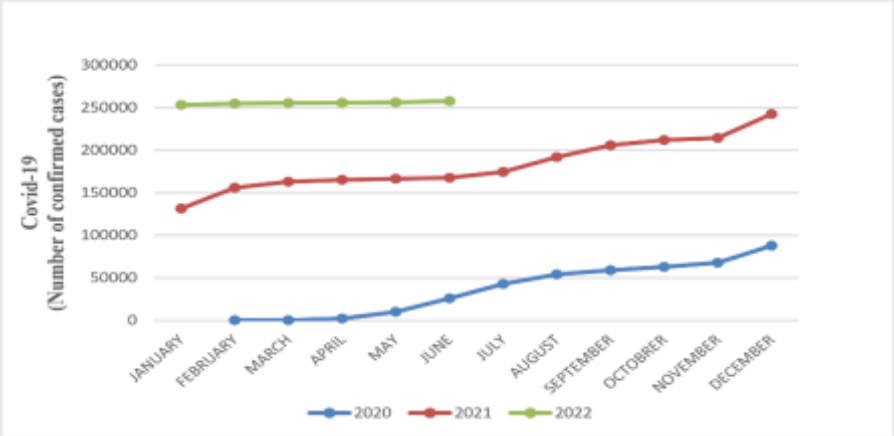

Figure 1. Trend of Covid-19 Confirmed Cases between March, 2020 and June, 2022 in Nigeria

Source: Author's computation (2022)

From the above diagram, in March 2020 covid-19 cases was 135 when government implemented its first round of lockdown in three states (FCT, Lagos and Ogun) in a bid to prevent the spread of covid-19. In May 2020, the covid-19 cases rose to 9,855 when the lockdown was eased to nationwide. In June 2020, covid-19 cases

rose to 25,694 and from then the cases have been on the rise reaching 87,607 in December 2020. Following the covid-19 pandemic in 2020, the covid-19 cases rose to 131,242 in January 2021 and further to 155,657 in February. The covid-19 cases began to increase gradually from March 2021, which was 162,891 and rose to 165,055 in April. There was decline in covid-19 cases to 166,315 (the reason for the decline could have been awareness of the virus, social distancing and covid-19 vaccine roll out) which was observed in May before the covid-19 cases continues on a steady rise in August onwards, with significant jumps in the covid-19 cases between October when covid-19 cases was 211,887 and December when covid-19 cases was 242,341. Noticeable from figure 4.2.1 is a decline in the covid-19 cases from January 2022 till June 2022. In general, the phenomenal increase in covid-19 cases of Nigeria over time, while increased lockdown and measures have contributed to the low covid-19 cases has compared to other countries.

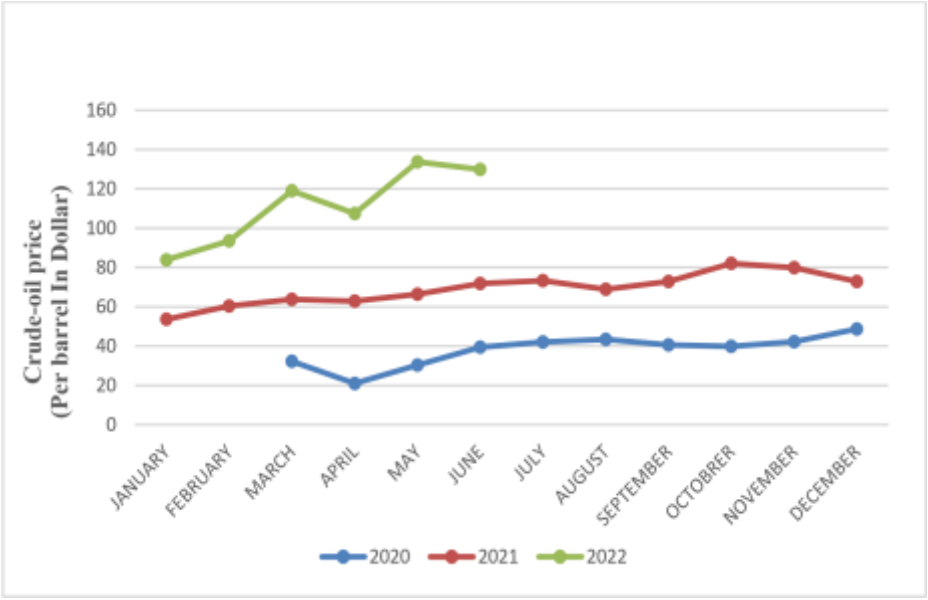

Figure 4.2.2. Trend of Crude Oil Price

Source: Author's computation (2022)

Figure 2 above is a graph showing the trend of pries of crude-oil for the periods in which this study`s coverage (March 2020-June 2022). The graph shows that the prices of crude oil in global oil market was $32.2 in March 2020 and fell to $21.04 in April after which rose to $30.38 in May 2020. The graph shows that crude oil price was slightly constant from June (because of low demand in aviation system due to the restriction of movement) to November which was $42.3 and rose to $48.73 in December 2020 (U.S. government reported potential vaccinations that could build the immune system to fight against covid-19 and people who work essential jobs were given leeway to transit. This in-turn encouraged the demand

for crude oil and investors started investing). Following a rise in crude oil price to $56.6 in January 2021, crude oil price $60.46 in February and further to $63.83 in March. A fall in crude oil price to $62. 95 is observed in April and it rose to $66.4 in May 2021, before crude oil price continues on a steady rise in June onwards, with significant jumps in crude oil price between January 2022 when crude oil price was $83.92 (this could be as a result of speculations about inflation in the U.S. which caused investors to rush to invest in commodities) and February when crude oil price was $93.55 which significantly rose to $119.07 in March. Aside a slight decline in crude oil price in April to $107.41, crude oil price rose to $133.73 in May and $129.87 in June. The reason for the rise in crude oil price is due to the war between Russia and Ukraine and the U.S. was not in support of Russia. The U.S. sanctioned Russia and that affected the oil global market because Russia is one of the top three crude oil exporters and they could not export oil to the U.S. Another reason is the rising inflation is the U.S. and people are running to invest their money in commodities. Commodities serve as a good investment due to high inflation of the U.S. dollar.

Table 1. Descriptive Statistics

Descriptive Statistics	COP	LCOV19CA	LCOV19DE	LCOV19RO	INF
Mean	68.30778	11.58959	7.377989	11.33696	15.72148
Median	66.40000	12.02164	7.649216	11.97528	15.92000
Maximum	133.7300	12.45931	8.053251	12.43036	18.17000
Minimum	21.04000	7.566311	4.060443	5.765191	12.34000
Std. Deviation	29.24322	1.146087	0.895052	1.567423	1.863196
Skewness	0.685692	-2.017879	-2.219111	-2.202364	-0.533966
Kurtosis	2.877504	7.060355	8.335925	7.596834	2.093721
Jargue-Bera	2.132664	36.87055	54.19115	45.59907	2.207047
Probability	0.344269	0.000000	0.000000	0.000000	0.331700
Sum	1844.310	312.9188	199.2057	306.0978	424.4800
Sum. Sq. Deviation	22234.31	34.15142	20.82906	63.87719	90.25894
Observation	27	27	27	27	27

Source: Authors` Computation (2022)

Table 1 presents a clear picture of descriptive statistics of the relevant variables in this study.

According to the table above, the minimum value of crude oil price (COP) is $21.04000 while the maximum value is $133.7300 with a mean of 68.30778 and a median of 66.40000 indicating that over the years in view, the contributions of the oil sector have been rising gradually. The mean value of the covid-19 confirmed cases (LCOV19CA) is 11.58959 and the median value is 12.02164 with a maximum value of 12.45931 and a minimum value of 7.566311. Covid-19 death cases (LCOV19DE) has the mean value and the median value that are very close. Covid-19 death cases has increased attaining a maximum value of 8.053251 and a minimum value of 4.060443. Also, Covid-19 recovery cases (LCOV19RO) have the mean value and the median value that are very close. Inflation rate (INF) has the mean value and the median value that are very close. The rate of inflation has increased steadily attaining a maximum value of 18.17000 and a minimum value of 12.34000 respectively. All the variable means are bigger than their standard deviations.

This implies that the data is fairly deviated from its mean. Furthermore, the skewness values from the table revealed that all the variable used are positively skewed. The kurtosis values demonstrate that certain variables are play-kurtic in nature because the values are less than 3 and they mirror a normal distribution while some variables are peaked distribution.

The Jarque-Bera statistics rejected the null hypothesis of normal distribution for all the variables which values are highly significant and the distributions are clearly not normal, covid-19 confirmed cases (LCOV19CA), Covid-19 death cases (LCOV19DE) and Covid-19 recovery case (LCOV19RO) at five percent critical value with exception to crude oil price (COP) and inflation rate (INF). For crude oil price (COP) and inflation rate (INF), the Jarque-Bera statistics could not rejected the null hypothesis of normal distribution for the variables at five percent critical value.

Table 2. Unit Root Test

Variables	ADF Test				
	Level	Prob.	1st Diff.	Prob.	Decision
COP	-3.711457	0.9958	-3.752946	0.7983	I (2)
LCOV19CA	-3.752946	0.0550	-3.724070	0.0102	I (1)
LCOV19DE	-3.752946	0.1222	-3.724070	0.0341	I (1)
LCOV19RO	-3.769597	0.0000	-	-	I (0)
INF	-3.711457	0.1908	-3.711457	0.2729	I (2)
Variables	PP Test				
	Level	Prob.	1st Diff.	Prob.	
COP	-3.699871	0.9929	-3.711457	0.0000	I (1)
LCOV19CA	-3.699871	0.0000	-	-	I (0)
LCOV19DE	-3.699871	0.0000	-3.711457	0.0001	I (1)
LCOV19RO	-3.711457	0.0000	-	-	I (0)
INF	-3.699871	0.4541	-3.711457	0.2667	I (2)

*Source: Authors' Computations (2022)*** %5 level*

The results of the Augmented Dickey-Fuller Test and the Phillips Perron Test, which were used to test the variables for stationarity, are shown in Table 2 above. According to the projected results in the previous table, COP and INF are stationary following the second differencing. The data are I(2) data, as demonstrated by this. However, after first differencing, LCOV19CA and LCOV19DE in log form are stationary. The data are I(1) data, as demonstrated by this. While in its normal level, LCOV19RO is stationary. The data are apparently I(0) data, as implied. The variables in the study are made up of several orders of integration, ranging from order zero to orders one and two, as shown in the table. This shows that there is a good chance that these variables may diverge in the short run Due to this, it is necessary to apply the Johansen co-integration test to verify the long-run convergence of these variables, which is used to determine the long-run equilibrium relationship and is shown in table 3 below;

Table 3. Johansen Co-integration Test (Trace Statistics) and (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	P-Value	Max-Eigen Statistic	P-Value
None *	0.860283	112.6075	0.0000	0.860283	0.0004
At most 1 *	0.746038	63.40399	0.0009	0.746038	0.0060
At most 2 *	0.538980	29.13976	0.0594	0.538980	0.0869
At most 3 *	0.308898	9.781909	0.2979	0.308898	0.2670
At most 4 *	0.021572	0.545197	0.4603	0.021572	0.4603

Source: Authors' Computations (2022).

In light of the Johansen Co-integration Test, the table above displays the estimated findings of the long-run equilibrium relationship between the covid-19 epidemic and crude oil price. Therefore, it may be inferred from the preceding table that there were at least four co-integration vectors between the variables. Thus, the covid-19 pandemic and crude oil price are likely to coincide in the long run in Nigeria.

Fully-Modified OLS Model

Table 4. Impact of covid-19 Pandemic on Crude Oil Price in Nigeria.

Dependent Variable: LCOP

Method: FMOLS

Regressors	Coefficient	T-statistics	Prob. Value
C	-2.946195	1.557144	0.1344
LCOV19CA	0.895401	0.932717	0.3616
LCOV19DE	0.884082	0.777142	0.4457
LCOV19RO	-0.899275	3.099448	0.0054
INF	0.024016	0.346850	0.7322
R-Squared	0.835826		

Source: Authors' Computation (2022)

From table 4 above, LCOV19CA and LCOP had a direct and non-significant relationship in Nigeria. This implies that covid-19 confirmed cases had a positive but insignificant influence on the performance of crude oil price in the global market. Likewise, the LCOV19DE had a positive but insignificant relationship

with LCOP suggesting that an increment in covid-19 death cases will make the prices of crude oil in the global markets and a decline in LCOV19DE will make the COP to decline by 0.884082 units. Additionally, LCOV19RO had a negative but significant relationship with LCOP with a coefficient of -0.899275 suggesting that a unit increment in covid-19 recovery cases will make crude oil price to decline while a decrease in LCOV19RO will make LCOP increase by 0.899275 units. At last, INF and LCOP had a positive but insignificant relationship in Nigeria. This implies that inflation had a positive but insignificant impact on the performance of crude oil price in the global market. This discovery can be intelligently explained by the fact that higher inflation leads to higher oil prices and lower oil price reduces inflation. The R-squared is 0.835, which indicate that 83.5% changes in the dependent variable are explained by changes in the independent variables while the remaining 16.5%are explained by variables not included in the model.

Table 5. Pairwise Granger Causality Test

Null hypothesis	F-statistic	Prob.	Decision	Causality
LCOV19CA does not Granger Cause LCOP	1.08705	0.3554	Accept	No Causality
LCOP does not Granger Cause LCOV19CA	0.17486	0.8408	Accept	No Causality
LCOV19DE does not Granger Cause LCOP	0.38210	0.6871	Accept	No Causality
LCOP does not Granger Cause LCOV19DE	0.07076	0.9319	Accept	No Causality
LCOV19RO does not Granger Cause LCOP	1.22493	0.3149	Accept	No Causality
LCOP does not Granger Cause LCOV19RO	0.58693	0.5653	Accept	No Causality
INF does not Granger Cause COP	0.98019	0.3918	Accept	No Causality
COP does not Granger Cause INF	0.23768	0.7906	Accept	No Causality

Source: Authors' Computation (2022)

In addition to the co-integrating relationships between the study's numerous variables of interest, the researchers also made an effort to apply the study's relevant variables to causal analysis using the Pairwise Granger Causality technique. The results presented in the above table demonstrates that there is no causation between any of the variables. This suggests that there is no feedback relationship between Covid-19 cases in Nigeria and global crude oil prices.

5. Conclusion and Recommendation

The Covid-19 pandemic's effect on Nigeria's crude oil price between March 2020 and June 2022 has been addressed empirically by this study. The paper's objectives was addressed by embracing trend and pattern, methods like the Fully-Modified OLS Model and Granger causality. Other pre-tests, including unit root test and co-integration, were conducted. This study's conclusions include the following the confirmed cases and the death cases of Covid-19 in Nigeria have positively induced the global crude oil prices, though not in a significant way. Whereas, the Covid-19 recovery cases in Nigeria have negatively and significantly induced global crude oil prices. However, none of the variables is causally related to one another. Therefore, the Covid-19 pandemic in Nigeria did not have a causal relationship with the prices of crude oil in the global market. Considering how the study's findings have come to light, it is strategic to enunciate that any time the policymakers in OPEC wish to ensure stability in crude oil price in the global market, the Nigerian government in particular and other crude oil exporting countries should take a pragmatic step in curbing the emergence of new waves of Covid-19 cases in their countries.

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