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Measuring the Impact of COVID-19 Pandemic on Inflation in Nigeria Using ARDL Approach

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Abstract
Coronavirus also known as COVID -19, is a disease that emerged from China during last quarter of the year 2019. The diseases is a respiratory illness that can spread from person to person. It caused stagnation of many economic activities across the Globe. The economic damage of the pandemic represent the largest economic shock the world experienced in decades since 1930s. During the period of the covid-19 pandemic, Nigeria witnessed persistence increase in general price of goods and services. Thus, the study was carried to examine the relationship between covid-19 infections and inflation using weekly time series data on the variables of study. Auto-Regression Distributed Lag Model (ARDL) was employed to estimate the relation between the inflation and covid-19. The ARDL bound test indicated the absence of cointegration among the variables of study. Consequently, short-run ARDL was estimated and the findings are as follows: there is weak negative but significant relationship between Covid 19 and inflation. Furthermore, exchange rate has a positive and significant impact on inflation. Granger causality test found that covid-19 granger causes inflation. The study therefore concluded that, covid-19 based on literature can cause inflation through its transitory effect and measures especially lockdowns taken by government in the process of curbing the spread of the pandemic. The study recommended that government should be cautions when taking measures to curb a disease or any action that can cause production bottleneck in the economy, and it finally recommended further studies in the area to reveal more results.

Keywords: *Inflation, Covid-19, lock down, pandemic and inter-bank rate*

Introduction

Coronavirus also known as COVID -19 is a disease that emerged from China during last quarter of the year 2019. Covid-19 is a respiratory illness that can spread from person to person, (Henry, 2020). According to Centre for Disease Control (2020a), "the virus that causes Covid-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China". The spread of the disease has been linked to person to person transmission which is directly or indirectly infected. The nature of the transmission of the disease led to the total shut down of major cities and several businesses in the wake of agoraphobia and attempts to curb its spread, (Afaha *et al*, 2020.).

The first COVID-19 case was confirmed in Nigeria on 27th February, 2020 from an Italian infected person who flew from Europe to Lagos and passed to Ogun State. On 9th March, 2020 the second case of the covid-19 that is on Nigerian citizen was reported from the Ogun state. On the same day, a presidential Task Force (PTF) on

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covid-19 was constituted by President Muhammadu Buhari. The PTF under chairmanship of Boss Mustapha - the secretary to the Government of the federation (SGF), was mandated to play a pivotal role in curbing and controlling the spread of the virus in the country. As at 1st August, 2021 there was 178,086 confirmed cases, 165,763 recoveries, 2,187 deaths and 10,136 actives cases in Nigeria, (National Centre for Diseases Control, Weekly Report, 2021).

The Federal Government (FG) adopted various measures such as restriction of movement, social distancing, total lockdown, personal hygiene, palliatives (cash and materials) distribution among others to curb the spread of the virus. The FG through Central Bank of Nigeria (CBN), also adopted some economic oriented measures that include: extension of moratorium, interest rate reduction, creation of ₦50 billion targeted credit facilities, regulatory for balance and credits for health care industries (Buhari, 2020).

The pandemic caused stagnation of many economics activities across the economic sectors of the Globe. For instance, World Bank (2020) reported that the pandemic spreads in alarming rate, infecting millions of people and bringing economic activities to near-standstill due to tight restriction of movement imposed by countries' authorities. The economic damage of the pandemic represent the largest economic shock that the world experienced in decades since great depression of 1930s. There is substantial downgrade of economic growth across the globe. On average, in Sub-Sahara region of Africa, economies contracted by 22.8% (Victor *et al*, 2021).

Ozili and Arun (2020) opined that "the impact of the Covid-19 pandemic has affected the global economy in two ways. Firstly, the spread of the virus necessitated social distancing and total lockdown which led to the zero demand of crude oil thereby crashing the price of crude oil prices from $70 a barrel to as low as $20 a barrel, it also led to the shutdown of financial markets, corporate offices, businesses and global events. Secondly, the rate at which the virus spread and the heightened uncertainty about how bad the situation could get, led to flight to safety in consumption and investment among consumers and investors". So also, Armantier, *et al* (2020) opined that Covid-19 pandemic started as health crisis rather than a financial or economic crisis, but later it generated set of disruptions that are unusual.

These policies resulted to the disruption of trading networks and prevented the flow of goods and services. Of course, this situation affected different categories of traders, but most affected are the small-scale traders, vendors, hawkers, and transporters. On a global scale, increased uncertainty, lower confidence and tightened financial and credit conditions amplified falls in global spending and production. Additionally, firms were unable to generate increased demand through price cuts as consumers were less able and willing to spend, reducing the incentive to lower prices. More so, external cost pressures, such as movements in the exchange rate and commodity prices also influenced inflation. During the period of the covid-19 pandemic, Nigeria witnessed persistence increase in general price of goods and services. People generally believe that the inflation recorded during the period has link

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with the novel coronavirus disease, because Nigeria is highly dependent on export of crude oil for government revenue and foreign exchange earnings and the oil and gas market have been seriously affected by the covid-19. According to Klynveld Peat Marwick Goerdeler (KPMG, 2020), high reliance of Nigeria on oil and gas export made the economy more vulnerable to fluctuations in the global oil and gas market. The fall in global oil price and demand during the pandemic led to shortage of foreign exchange in Nigeria and increase the exchange rate and translated to higher cost of importation of goods and services. The consequences of the imported inflation caused domestic inflation. "A combination of rising inflation and exchange rates was inimical to the health of Nigerian economy".

Henry (2020) reported that, the coronavirus pandemic caused high rate of unemployment, crime and hike in prices of commodities. Cochrane (2020) and Binder (2020) as cited by Henry (2020) said "it has been difficult initially to predict that covid-19 would have an inflationary or deflationary effect". "Cutting federal funds rate to essentially zero, financial market support for effective functioning and the flow of credit are putting downward the pressure inflation that were already below the target" Diwan, Leduc and Mertens (2020).

Following a sharp drop in oil prices and capital outflows, real GDP in Nigeria contracted by 3.2 percent in 2020 amidst the pandemic-related lockdown. Headline inflation rose to 14.9 percent in November 2020, a 33-month high, reflecting core and food inflation increases emanating from supply shortages due to the lockdown effected to curb infections alongside, the land-border closure and continued import restrictions. Against this backdrop, the paper analysed the trends of inflation before and during covid-19 and also explored the relationship between covid-19 infections and inflation in Nigeria. The next section reviewed the literature. Section three described the methodology of the study. Section four presented the empirical results, while section five discussed the findings. Section six concluded and made recommendations.

LITERATURE REVIEW

Theoretical Review

From Classicals through Keynesians to Neoclassicals, economists have different and conflicting views on the causes of inflation in an economy. For the purpose of this research, four (4) popular theories are reviewed.

i. Quantity theory of money,
ii. Keynesian Theory of Inflation,
iii. Monetarist Theory of Inflation and
iv. Structural theory of inflation.

The Quantity Theory of Money (QTM)

The traditional quantity theory of money (QTM) holds that variations in price relate to variations in the money supply. It is most commonly expressed and taught using the equation of exchange and is a key foundation of the economic theory of monetarism. The QTM asserts that aggregate prices (P) and total money supply (M) are related according to the equation $MV = PY$. Thus, $P = MV/Y$, where Y is real output and V is velocity of money. With lower-case letters denoting percentage changes (growth rates), the QTM can be expressed as $p = v + m - y$, with p as the rate of inflation and y, v, and m as growth

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rates of output, velocity, and money stock, respectively. A central implication of the QTM is that a given change in the rate of money growth induces an equal change in the inflation rate, prompting Milton Friedman to claim that "inflation is always and everywhere a monetary phenomenon." A crucial assumption behind this claim is that the velocity of money or its growth rate is constant and money growth has no effect on real GDP growth—at least at a sufficiently long horizon.

Structural Theory Inflation

The structural theory of inflation was propounded by Myrdal & Straiten (1987) and believe that increase in investment expenditure and the expansion of money supply to finance it are the only proximate and not the ultimate factors responsible for inflation in the developing countries. According to them, there is a lack of balanced integrated structure in them where substitution possibilities between consumption and production and inter-sectoral flows of resources between different sectors of the economy are not quite smooth and quick so that the inflation in them cannot be reasonably explained in terms of aggregate demand and aggregate supply. Thus, structural inflation arises when producers cannot adapt their production structure in an efficient manner in response to changes in the structure of the economy. These changes may concern: demand for the product, its production technology and competition for which producers stand. The structural inflation may also appear when the general structure of what the consumers, companies or even the government are demanding will change suddenly and producers will not be able to easily change the structure of resource involvement, and thus the structure of production itself. In addition, it can also be triggered by implementing significant innovation. Changes in the structure of the economy cause the emergence of strategic deficiencies and the emergence of the so-called bottlenecks in supply channels. If the supply for any good suddenly increases and it will be such a bottleneck, its price it will also be higher, and this increase will be transferred to the prices of many products for which it is needed. Thus, it has been argued by the exponents of structural theory of inflation that economies of the developing countries like Nigeria are structurally underdeveloped as well as highly fragmented due to the existence of market imperfections and structural rigidities of various types.

Monetarist Theory of Inflation

The monetarist theory of inflation (also referred to as "monetarism") is a fundamental macroeconomic theory that focuses on the importance of the money supply as a key economic force. The theory, as popularized by Friedman (1956) asserts that money supply is the primary factor in determining inflation/deflation in an economy. Proponents of the theory believe that money supply is a primary determinant of price levels and inflation. Increasing money supply, according to the theory, inevitably leads to higher prices and inflation, while decreasing the money supply leads to deflation and risks, causing a recession. Changes in the money supply also affect employment and production levels, but the monetarist theory asserts that those effects are only temporary, while the effect on inflation is more long-lasting and significant. There is an underlying equation

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that forms the foundation of the monetarist theory. It is known as the "equation of exchange" (also referred to as the "quantity theory of money"). Although the equation's become quite complex due to its expansion and refinement by recent economists, the basic equation is expressed as follows:

$MV = PQ$

Where:

- **M** is the money supply
- **V** is the velocity of money (the rate of turnover at which a single unit of currency – e.g., one dollar – is spent in one year)
- **P** is the average price level for transactions in the economy (the purchase of goods and services)
- **Q** is the total quantity of goods and services produced – i.e., economic output or production.

According to the monetarist theory, V (the velocity of money) remains relatively stable. Therefore, it is changes M (the money supply) that primarily affects prices and economic production.

Keynesian Theory of Inflation

This theory was propounded by John Maynard Keynes in 1936. He simply does not agree with the quantity theory approach that it is the volume of money that is responsible for price rise. According to Keynes, inflation is caused by an excess of effective demand, and the state of true inflation begins only after the level of full employment, employment will change in the same proportion as the quantity of money, and when there is full employment, prices will change in the same proportion as the quantity of money. He believes that we do not unduly fear inflation because as long as there are unemployed human and material resources, an increase in the quantity of money will go to increase employment. After full employment all increases in money supply will increase the price level Keynes does not deny that prices may rise even before full employment but such a phenomenon he called as 'semi-inflation' or 'bottleneck inflation'. Keynes introduced a new concept called the inflationary gap. The inflationary gap shows a situation in the economy when anticipated expenditures (demand) exceed the available output (supply) at base prices or at the pre-inflation prices. Thus, the inflationary gap is measured by the difference between the disposable income on the one hand, and the output available for consumption on the other. In other words, when on account of increased investment expenditure or government expenditure or both, money income rises, but due to limitations of the capacity to produce, the supply of goods and services does not increase in the same proportion, an inflationary gap emerges, giving fillip to rise in prices. It arises only when the total money income that people are keen to spend on the consumption exceeds the total output available at pre-inflation prices.

The Concept of COVID 19

Coronaviruses is a viral disease and identified in 2019 asSARS-CoV-2. It causes a pandemic of respiratory illness, called COVID-19. The first case of COVID-19 was reported on Dec. 1, 2019, and its causes was a then-new coronavirus later named SARS-CoV-2. SARS-CoV-2 might have originated in an animal and changed (mutated) so it could cause illness in humans. In the past, several infectious disease outbreaks have been traced to viruses originating in birds, pigs, bats and other animals that mutated to become

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dangerous to humans. A person infected with the coronavirus is contagious to others for up to two days before symptoms appear, and they remain contagious to others for 10 to 20 days, depending upon their immune system and the severity of their illness. The symptoms of COVID-19 include: cough, fever or chills, shortness of breath or difficulty breathing, muscle or body aches, sore throat, new loss of taste or smell, diarrhoea, headache, new fatigue, nausea or vomiting, and congestion or runny nose.

COVID-19 transmits when infectious particles are breathed in or come into contact with the eyes, nose, or mouth. The risk is highest when people are in close proximity, but small airborne particles containing the virus can remain suspended in the air and travel over longer distances, particularly indoors. Transmission can also occur when people touch their eyes, nose or mouth after touching surfaces or objects that have been contaminated by the virus. People remain contagious for up to 20 days and can spread the virus even if they do not develop symptoms.

Preventive measures to reduce the chances of infection include getting vaccinated, staying at home, wearing a mask in public, avoiding crowded places, keeping distance from others, ventilating indoor spaces, managing potential exposure durations, washing hands with soap and water often and for at least twenty seconds, practising good respiratory hygiene, and avoiding touching the eyes, nose, or mouth with unwashed hands and community lockdowns. Globally, lockdown measures were implemented by majority of the countries. It is thus a restriction policy for people, community or a country to stay where they are to prevent people from getting in touch with infected persons.

Empirical Review

Despite its currency and short term duration, COVID-19 received the attention of scholars in Nigeria. Some scholars study its macroeconomic effects. While some narrowed their studies to specific effects. Thus, Doojav (2023) estimated the impact of covid-19 and its transmission mechanism on Macroeconomy of Magnolia over the period of 2020:Q2 – 2021:Q1. The study employed a Bayesian structural vector autoregression. Findings of the study revealed among other things a strong cross-border spillover effects of Covid-19 which transmitted through changes in commodity markets and the Chinese economy. Further, the study indicated that China's GDP and copper price shocks leads to respective three-fifths and one-fifths of decrease in real GDP in 2020Q1. The recovery was detected in 2020Q2-2021Q1 and attributed to positive external shocks. More precisely, Coulibay (2021) examined the socioeconomic impacts of the coronavirus disease 2019 (COVID-19) pandemic and the impact of government policy responses to the pandemic and their spillover effects on the consumer price index in West African Economic and Monetary Union (WAEMU) countries using a panel fixed effects for the period spanning January 2019–July 2020. Findings of the study revealed that COVID-19 confirmed cases have positive impact on consumer price index while the overall government policy responses index have negative effect on the consumer price index. Adesoji and Simplice (2020) used aggregate supply and aggregate demand and analysed the effects of Covid 19 on the Nigerian economy. They

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showed that the Covid-19 pandemic has insignificant negative impacts on basic macroeconomic variables in Nigeria such as inflation, employment, exchange rate, GDP growth, among others. Nigerian Economic Summit Group (2021) assessed the impact of COVID-19 Lockdown on Households in Nigeria. It was suggested that the costs of continuing COVID-19 restrictions could have huge economic consequences on households and health system. FAO (2021) examined National agrifood systems and COVID-19 in Nigeria. The study found that the pandemic increased Nigeria's unemployment rate and extent of food insecurity. Thelma, Chimere and Ezra (2021) examined the effects of Covid 19 on poverty, vulnerability, and income inequality in Nigeria. UNDP (2021) examined the impact of covid-19 on business enterprises in Nigeria. Abioye, Ogunniyi and Olagunju (2021) estimated the impact of COVID-19 on Small and Medium scale enterprises in Nigeria. The authors found that majority of the entrepreneurs have been affected (both severely and slightly) by the COVID-19 pandemics through the partial and total lockdown and movement restrictions. Ogunji *et al* (2021) analysed the effect of COVID-19 lockdown on households in South East Nigeria. Their findings showed that COVID-19 lockdown increased the prevalence of hunger affected the prices of commodities. Human Rights Watch (2021) focused on impact of Covid-19 pandemic on people living in poverty in Lagos, Nigeria. The study found that economic impact of the Covid-19 pandemic has worsened the plight of families living in poverty in Lagos State, Nigeria and left many people struggling to afford food and meet other basic needs. Global Alliance for Improved Nutrition: GAIN (2021) examined the impact of COVID-19 on Nigeria's Food Systems. Henry (2021) assessed the impact of COVID-19 on economic growth in Nigeria. Abiodun, *et al* (2021) assessed the immediate and potential long-term effects of COVID-19 on agriculture, food security and dietary intake in Nigeria. Thomas, *et al* (n.d.) examined the impact of covid-19 pandemic on the attainment of sustainable development goals. Harrison, Abomaye and Williams (2021) examined the structural effects of aggregate supply and demand in Nigeria. UNHR (2021) assessed the Socioeconomic Impact of COVID-19 on forcibly displaced populations in Nigeria. Ozili (2020) focused on the macroeconomic effects of the pandemic on oil price, aggregate demand and general economic activities Armantier, *at el* (2020) employed Survey of Consumer Expectations (SCE) and analysed how COVID-19 outbreak has affected the public's inflation expectations and found unprecedented increases in individual uncertainty—and disagreement across respondents—about future inflation outcomes. Banerjee, Medhrotra, and Zampolli (2020) found that output collapse due to the Covid crisis is associated mainly with greater downside risks to inflation in the near term. For some emerging market economies (EMEs), the exchange rate depreciation appears to lead to a prominent increase in upside risks to inflation.

Yahya and Francis (2022) examined the potential effect of COVID-19 on agricultural financing in African countries and documented that it has caused significant liquidity shortage in the banking

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and financial institutions sectors that led to widespread business failure. Seydo (2021) used a panel fixed effects model for estimated the impact of government policy responses to the pandemic and their spill over effects on the consumer price index for West African Economic and Monetary Union (WAEMU) countries. The study found that overall government policy responses index has a negative impact on the consumer price and global index world food prices and oil prices positively affect the consumer price index. Agyei, *et al* (2021) investigated the impact of the novel coronavirus disease 2019 outbreak on prices of maize, sorghum, imported rice and local rice in sub-Saharan Africa (SSA) using the dynamic panel data models and found that the COVID-19 outbreak led to increases in food prices of the sampled countries. Gunda-Alexandra, Sui-Jade and Özer (2022) used the New York Fed Survey of Consumer Expectations (SCE) and the Oxford COVID-19 Government Response Tracker (OxCGRT), and found that policies aimed at containing the pandemic lead to an increase in individuals' inflation expectations and inflation uncertainty. Ibukun and Adebayo (2021) examined the food security status of households and its determinants during the pandemic. They found that over two-thirds of households were threatened by food insecurity in Nigeria. The finding indicates the gross inadequacy of government palliative support and distribution. Coleman and Nautz measured long-term inflation expectations and the credibility of the inflation target in Germany. They found that credibility has decreased in the sample period, particularly in the course of the deep recession implied by the Covid-19 pandemic. Junaidu (2021) in his study of the impact of Covid 19 pandemic on Kano city of Nigeria, found that the pandemic resulted to the disruption of trading networks and prevented the flow of goods and services. Of course, this situation affected different categories of traders, but most affected are the small-scale traders, vendors, hawkers, transporters, food and sachet water vendors that depended on these markets for daily earnings. . Clearly, none of the empirical studies reviewed assessed the relationship between the covid-19 infections and the prevailing inflation in the country. Therefore, the study seeks to find out the effects of Covid19 on inflation in Nigeria.

METHODOLOGY

Data

The study utilized secondary weekly time series data from first week of March 2020 to the fourth week of May 2021 on inflation, Covid-19 infection, inter banks interest rate, and market exchange rate. The data was sourced from Central Bank of Nigeria (CBN), National Centre for Diseases Control (NCDC) and National Bureau of Statistics (NBS).

Estimation Technique.

The study employed Auto-Regressive Distributed Lag Model (ARDL) developed by Pesaran and Shin (1999) and Pesaran, et al. (2001) which is suitable technique for estimating a model with mixture of order of integration as in the case of this study. Estimated the relation between the inflation and Covid-19. The stationarity of the variables was tested using Augmented Dickey-Fuller (ADF)). To determine the causality between inflation and Covid-19 infection, Granger-causality test was used. Descriptive analysis was also used in the

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determination of the trend of inflation before and during the period of Covid-19, and the trend of the Covid-19 infections.

Model Specification

Consumer price index (CPI) was proxied for inflation and modelled as dependent variable. Weekly Covid-19 infection cases were used as proxy for Covid-19 (COVD) and served as independent variable together with exchange rate (EXCR) and inter-bank interest rate (INTR) as suggested by quantity theory of money, demand pull and cost push theories. Both the EXCR and INTR are measured in percentages. The model is specified as follow:

$CPI = f(COVD, EXCR, INTR)$ and econometrically specified as:

$$CPI_t = \beta_0 + \beta_1 CPI_{t-1} + \beta_2 COVD_t + \beta_3 COVD_{t-1} + \beta_4 EXCR_t + \beta_5 EXCR_{t-1} + \beta_6 INTR_t + \beta_7 INTR_{t-1} + \mu_t \text{ ----------(1)}$$

The model is logarithmically expressed as:

$$LCPI_t = \beta_0 + \beta_1 LCPI_{t-1} + \beta_2 LCOVD_t + \beta_3 LCOVD_{t-1} + \beta_4 LEXCR_t + \beta_5 LEXCR_{t-1} + \beta_6 LINTR_t + \beta_7 LINTR_{t-1} + \mu_t \text{ ----------(2)}$$

Where: μ = Error term

β_0 = constant (intersection of the model)

*$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ & β_6 are coefficients of the independent variables. The apriori expectation is that none of the coefficients will be zero.

Empirical Results

1.1. Descriptive Analysis

The descriptive statistics is presented in Table 1.

Table 1: Descriptive Statistic of the results

	CPI	COVD	EXCR	INTR
Mean	14.74424	11136.38	458.0980	7.646818
Median	14.23000	7234.000	471.6200	6.250000
Maximum	18.17000	43635.00	482.5100	30.00000
Minimum	12.26000	134.0000	376.8900	0.000000
Std. Dev.	2.194928	11740.48	28.57100	7.178956
Skewness	0.392595	1.567770	-1.767253	1.719780
Kurtosis	1.635496	4.879911	5.425049	6.229172
Sum	973.1200	735001.0	30234.47	504.6900
Sum Sq. Dev.	313.1510	8.96E+09	53059.63	3349.932
Observations	**66**	**66**	**66**	**66**

Source: Author computation (2023) using E-view 10

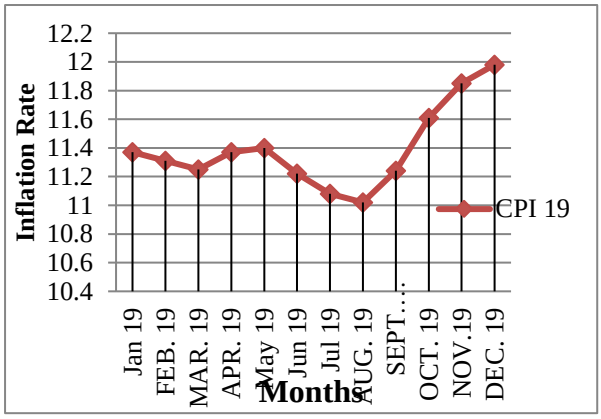
The result in table 1 shows that, the average inflation as measured by consumer price index (CPI) is 14.74424 with standard deviation of 2.19 as well as 12.26 and 18.17 respective minimum and maximum values of the inflation over the period of study. The result shows that the mean of Covid-19 weekly infection was 11136.38 with a standard deviation of 11740.48 and the weekly minimum and maximum infection

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values were 134 and 43635 respectively. This indicates a wide range in the weekly infection rate. The skewness shows that both the consumer price index COVD were positively skewed. The kurtosis on the other hand, shows that while the CPI has a light tail, the COVD recorded a fat tail over the period of study.

The trends of inflation before and during Covid-19 from first week of March 2020 to the fourth week of May 2021 are presented in figure 1 and 2. For precision, the figures captures month on month trend of inflation a year before the first reported covid-19 infection in Nigeria. The lowest rate in the period was found in the month of August 2020. It was on increase till the emergence of Covid-19 in the country.

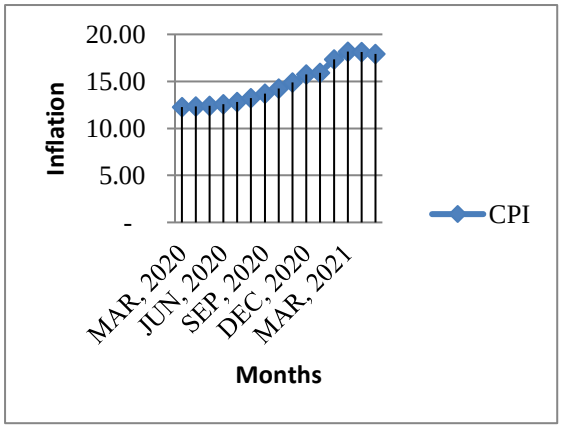
Fig. 1: Line graph of CPI (inflation) before Covid-19 in Nigeria



Source: Author's plot based on data from CBN.

The line graph in Figure 2 shows the trend of inflation during the period of Covid-19. The result indicates that there is persistence monthly increase in inflation from the lowest 11.4% in Mach 2020, to the highest was 18% in March, 2021.

Fig. 2: Line graph of CPI (inflation) during Covid-19 in Nigeria

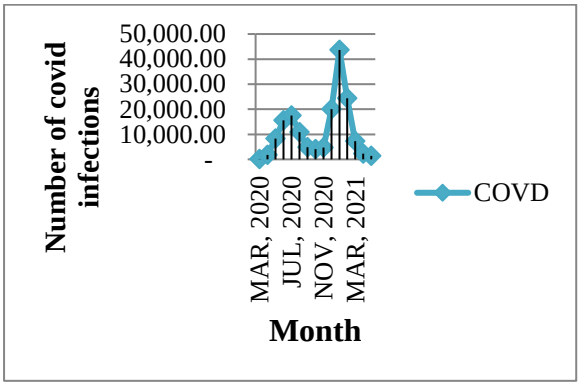


Source: Author's plot based on data from CBN.

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Figure 3 presents monthly Covid-19 infection cases in Nigeria. Based on the graph, Nigeria ~~has~~ recorded highest monthly infection in the month of January, 2021. During the month there were about 44,000 infection cases (Central Bank of Nigeria, 2022).

Fig. 3: Line graph of Covid-19 Infections in Nigeria



Source: Author's plot based on data from NCDC.

Unit Root Results

To determine the stationarity of the variables, unit root test was performed using Augmented Dickey Fuller (ADF) technique and the result is presented in table 3. The result indicates that: COVD and EXCHR are stationary at level (I (0)), while CPI, and INTR are stationary at first difference (I(1)). This indicates that the variables are stationary at difference levels at level and first difference. Therefore, ARDL is therefore suitable for estimating the relationship equations in this study.

Table 2: Unit Root Result

Variables	Test statistics	0.05 (5%) critical values	Order of integration
CPI	-8.8648	-2.9077	I(1)
COVD	-3.4536	-2.9100	I(0)
EXCHR	-3.0344	-2.9069	I(0)
INTR	-7.8781	-2.9077	I(1)

Source: Author computation (2023) using E-view 10

Lag Length Selection

In order to determine the appropriate lag to be considered in the study, VAR Lag Order Selection Criteria was estimated. The result of the lag selection criteria in table 3 showed that both Akaike information criteria (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) unanimously indicated one lag as the appropriate lag length.

Table 3: Summary of VAR Lag Length Selection Criteria Result

Lag	AIC	SC	HQ
0	39.72584	39.86546	39.78046
1	31.58053*	32.27865*	31.85360*

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2	31.99915	33.25575	32.49068
3	32.32716	34.14226	33.03715
4	32.30170	34.67529	33.23014
5	31.68575	34.61784	32.83265
6	31.90691	35.39749	33.27227

Source: Author computation (2023) using E-view 10

Bound Test for Co-Integration

The Auto-Regressive Distributed Lag (ARDL) bound test is carried to determine the presence of long-run relationship among variables of the model. The Null hypothesis is that no long run relationship exist among variables. The decision rule is that: if the F- Statistic computed is greater than the I(0) and I(1) the null hypothesis will be rejected and we conclude that there is co-integration (relationship); and when the F-Statistic Computed is less than the I(0) and I(1) we accept the null hypothesis.

Table 4: Bound Test Result

Test Statistic	**Value**	**K**
F- Statistic	1.569	3
Critical Values Bounds		
Significant Level	**I(0) Bound**	**I(1) Bound**
10%	2.72	3.77
5%	3.23	4.35
1%	4.29	5.61

Source: Author computation (2023) using E-view 10

From the ARDL bound test result in table 4, the computed F-statistic value of 1.569 is less than the bounds values of both the lower I(0) and upper I(1) bounds at all significant levels of 10%, 5% and 1%, thus the null hypothesis for the absence of cointegration among the variables of study cannot be rejected. Consequently, the short-run ARDL model was estimated and the result presented in table 5.

Autoregressive Distributed Lag (ARDL) Model

The coefficients of the independent variable, covid-19 (COVD) at time t carried negative signs which indicate an inverse relationship with the dependent variable (CPI_t) and thus implies that an increase in covid-19 did not increase inflation. However, the covid-19 has the weakest coefficient of less than 0.05% effect, Exchange rate has less than 0.5% effect and interest rate has 0.5% effect. The value of R-square and adjusted R-square of 0.98 indicate that 98% of the dependent variable is explained by the independents variables. The probability of F-statistic is 0.0000 indicates the general result of the regression is statistically significant.

Table 5: ARDL Regression Result

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LOG CPI(-1))	0.9944	0.0245	40.5815	0.0000

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LOG COVD	-0.000017	-0.0000063	-2.7528	0.0079
D(LOG COVD(-1))	0.000020	0.000062	3.2416	0.0020
EXCR	0.00728	0.00456	1.5960	0.1159
D(EXCR (1))	-0.0060	0.004337	-1.3864	0.1709
INTR	-0.00507	0.00560	-0.9065	0.3684
β_0	-0.4179	0.5871	-0.7117	0.4795
R-Square	0.9889		Adjusted R-Square	0.9877
F-Statistic	860.1108		Prob. (F-statistic)	0.0000

Source: Author computation (2023) using E-view 10

Granger causality Test

Granger causality test was carried out to determine the causal relationship between Covid-19 pandemic (COVD) and inflation (CPI) in Nigeria. The result as contained in table 6 indicates that the null hypothesis COVD does not Granger Causes CPI is rejected at 5% level of statistical significance. Similarly, the null hypothesis that CPI does not Granger Cause COVD cannot be rejected considering the F-statistics probability (0.4288) greater than 0.05 critical value.

Table 6: Granger Causality Test Result

Null Hypothesis:	Obs.	F-statistic	Probability
COVD does not Granger Cause CPI	60	4.54463	0.0010
CPI does not Granger Cause COVD	60	1.01242	0.4288

Source: Author computation (2023) using E-view 10

4.7. Post Estimation Diagnostic Tests

To verify the robustness of the estimated model, various post-estimation diagnostics were performed. The results as presented in table 7 shows that, the model is homoscedastic, correctly specified and free from serial correlation. However, the model suffer the problem of non-normality as indicated by Jarque-Bera test.

Table 7: Post-estimation Diagnostic Tests Results

Diagnostic test	Technique	Null Hypothesis	Probability (5%)
Serial Correlation Test	Breusch-Godfrey Serial Correlation LM Test	No Serial Correlation	0.1101
Heteroskedasticity Test	Breusch-Pagan-Godfrey	Homoskedasticity	0.7342
Normality Test	Jarque-Bera	Residuals Normally Distributed	0.0000
Specification Test	Ramsey Reset Test	Correctly Specified	0.1587

Source Author's Computation (2023) using Eviews 10

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2. Discussion of findings

This study examined the relationship between covid-19 infection and inflation rate. The empirical analysis were mainly carried out using Autoregressive Distributed Lag (ARDL) and Granger causality techniques. The ARDL bound testing result reported the absence of cointegration among the variables of study, therefore, a short-run ARDL model was estimated and diagnosed. Findings of the short-run ARDL revealed that one percent increase in covid-19 infections reduces inflation by (0.000073%). This is weak but significant negative relationship between Covid-19 infections and inflation. This suggests that there is no statistical evidence to claim that Covd-19 pandemic rises inflation over the period of study. Hence, the large infection cases of the pandemic led to little reduction in inflation rate. This can be attributed to low demand effect of nationwide lockdown. However, the Granger causality test result indicated a unidirectional causality running from that Covid-19 to inflation. More precisely, Covid-19 granger causes inflation but inflation does not granger-cause Covd-19 at five percent (5%) level of statistical significance. The quantity theory of money, demand pull and cost push theories appeared to have explained the inflationary pressures experienced during the Covid 19 period. For instance, in Nigeria interest rate was cut down which led to increase in money supply, oil price crashed which led to higher exchange rate. So also, the lock down measures imposed during the period, affected economic activities of individuals and firms and subsequently the demand and supply of many products. However, despite the empirical study revealed what is contrary to the actual situation in the economy, previous studies such Ozili, 2020, Armantier, at el (2020), Adeyemi (2020), Banerjee, Medhrotra, & Zampolli (2020), etc., have the opinion that covid-19 caused inflation through transitional process. These included stay-home, lock down; moratorium extension, interest rate reduction, devaluation etc., and most of these measures are taken by the Federal Government of Nigeria.

Conclusion and Recommendation

This study assessed the relationship between covid-19 infections and inflation in Nigeria. Moreover, it has examined the causality of the relationship between Covid-19 infections and inflation. The study found negative weak relationship between covid-19 infections and inflation, and it also found that covid-19 granger cause inflation. Though, the finding appears to have contradicted the common sense, because as a matter of fact, inflation rate and Covid-19 simultaneously increased during the period. However, the literature indicated that some economic measures taken by government to curb the spread of the pandemic may be responsible for the increase in the prices. In view of this, it is recommended that further studies maybe carried out in order re-examine the relationship. Government should implement preventive measures with all necessary senses. Government should be careful when taking measures to curb a disease or can cause production bottleneck in the economy. Businesses and individuals should be encouraged and be supported to survive economic challenges arising from public health challenges like Covid 19 pandemic.

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