CBN Journal of Applied Statistics Vol. 13 No. 1 (June 2022) *209-239*

Impact of COVID-19 Pandemic on the Nigeria Stock Market: A Sectoral Stock Prices Analysis

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This study examines the impact of the COVID-19 pandemic on sectoral stock prices in Nigeria stock market using daily data covering from February 28, 2020 to June 26, 2020. Applying the autoregressive distributed lag (ARDL) bounds test, the study finds that COVID-19 pandemic had adverse impact on the stock market indices in the short run. Furthermore, the study documents negative response of sectoral stock prices to the pandemic while the stock prices of the banking sub-sector are the worst hit. Compared to the consumer goods, and industrial subsector indices, the speed of adjustment to long run equilibrium is faster for the banking, subsector. Results from sensitivity analysis also indicate that the stock market responds negatively to the pandemic when the number of confirmed COVID-19 deaths is used. However, the stock market performance is more sensitive to the total number of confirmed cases than the total number of confirmed deaths. This implies that the market responds quickly to the pandemic. This paper, therefore, concludes that the COVID-19 pandemic had negative and heterogenous impacts on sectoral stock prices in Nigeria during the first wave of the pandemic.

Keywords: COVID-19, stock market, Nigeria, bounds test, sectoral stock prices
JEL Classification: C22, F32, I15, O55
DOI: 10.33429/Cjas.13122.7/9

1. Introduction

The need for a viable stock market in any economy cannot be overemphasized because of its roles. Due to its liquidity, Pandel (2005) argued that investors obtain the required financial supports without hitches, thereby promoting capital allocation, increased investment, and economic progress. The stock market is considered as one

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The views expressed in this paper are those of the authors and do not in any way represent the position of the Central Bank of Nigeria.
The authors are grateful to Idris Adamu, Ogbuehi Francisca, Bituk P. Zivoshiya, Etim E. Samuel and Oloyede M. Betsy for research assistance.

of the economic tools for measuring the growth of an economy because it reflects the financial strength and potential viability of corporate organizations listed on the stock exchange.

No doubt, the financial market which the stock market falls under its umbrella plays a part in promoting economic growth. This is achieved by attracting investors through the supply of financial products to individuals and firms (Caporale *et. al*, 2004). According to Oladapo, *et al.* (2017), the Nigerian stock market has advanced over time through trading volumes, turnover, number of stock exchanges and other financial intermediaries, the number of listed stocks, investor population, market capitalization, and stock price indices. Valev (2003) opined that the Nigerian stock market provides relevant instruments for investors, individual and government which result to growth and development in the country. However, Habiba and Waliu (2020) observed that in spite the committed efforts to propel the Nigerian economy through long-term capital market instruments, global shocks such as the subprime mortgage global financial crisis posed a threat to the market. Another global challenge to the stock market which has brought about the 'new normal' in almost every facet of the economy is the emergence of novel coronavirus pandemic (HaiYue, *et al.*, 2020).

The coronavirus, which was first reported in December 2019, in Wuhan China, quickly escalated into a public health emergency and was declared a pandemic by the World Health Organisation (WHO) on March 11, 2020 (Zhu, *et al*., 2020; WHO, 2020). Virtually all the sectors of the world economy have been affected by the outbreak of the disease while countries have used various measures including lockdowns to contain the spread of the virus. Several sectors, such as oil and gas, aviation, education, health, manufacturing, and financial markets have been hit by this outbreak. International Monetary Fund (IMF) noted that the economy of the world was witnessing its worst economic downturn since the great depression with emerging markets in Africa and others at high risk (Eric, 2020; Ozili & Arun, 2020).

The index case of coronavirus infection was recorded in Nigeria on February 27, 2020. However, it was publicly announced on February 28, 2020 (Nigeria Centre for Disease Control, 2020). This led to social distancing policies and eventually lockdown measures to curb the spread of the disease. As it is the case with many other

countries that recorded COVID-19 cases, the Nigerian economy faced severe economic impacts following the implementation of the lockdown measures. According to the National Bureau of Statistics (NBS, 2020), the real gross domestic product (GDP) declined by 6.10 per cent in the second quarter of 2020 owing to the impacts of the COVID-19 pandemic as well as the consequent decline in oil price.

The Nigerian Stock Exchange (NSE) All Share Index (ASI) which stood at 29,710.56 on the 20th of January 2020 declined by 13.1 per cent to 25,816.57 on the 2nd of March 2020. The index further declined to 24,930.88 by the 26th of June 2020 (Nigerian Stock Exchange (NSE), 2020). Almost all the sectoral indices declined at early days of the pandemic. Among the NSE sectoral indices, Banking, Industrial and Oil & Gas market indices were 409.23, 1,228.22 and 248.99 points respectively as of January 20, 2020. On March 2, 2020, these indices stood at 303.94, 1,199.75 and 234.101 points respectively for the sectors. Comparatively, these revealed declined in the mentioned sectors. More so, the indices stood at 289.31 for Banking, 1,194.99 for Industry and 198.55 points for Oil & Gas on June 26, 2020 (NSE, 2020). No doubt, stock market investors would like to know the series of numbers which reveal the changing mean value of companies' share prices on a stock exchange for investment decision making. This goes on to show how important the ASI and stock prices are to investors, while policymakers use the ASI as a barometer to measure and compare the stock market performance with policies made in that regard.

The attitude of investors in the stock market activities may rely on many factors such as the level of information around the pandemic, reported cases of infected persons with COVID-19, and deaths arising from COVID-19 virus, lockdown policy, attitudes towards vaccination and government palliative measures. These factors combined to shape investors' decision that strongly influence their investment strategies and sentiments. Peng *et al*., (2015) noted that when there is high market volatility, the envisaged risk of investors is likely to rise. Hence, investors tend to wait for normalcy to return in the market. This may not be farfetched, as investors have confidence about the economy, the demand for stock rises, thereby increasing the market indices. However, there tend to be less demand over increasing supply of stock due to investors feeling of uncertainty or potential threat in the economy (Gusni, 2016).

The study examines the impact of the COVID-19 pandemic on sectoral stock prices in Nigeria stock market, focusing on the dominant sectoral indices of banking, consumer goods, industrial, insurance and oil and gas. There are theoretical and empirical evidence supporting the economic impacts of the COVID-19 pandemic (Fernandes, 2020; Ozili & Arun, 2020; McKibbin & Fernando, 2020; Kanu, 2020; Adenomon *et al.,* 2020; Ozili, 2020; Baker *et al.,* 2020). The existing studies for Nigeria include Adenomon *et al.* (2020), Ozili (2020), Muyiwa *et. al* (2020) and Raifu *et al* (2021). While Ozili (2020) employed descriptive statistics to provide preliminary analysis of the impact of the pandemic on selected macroeconomic variables, Adenomon *et al.* (2020) investigated the response of stock market volatility to the crisis. The Nigerian studies focused on stock market returns of listed firms (Raifu *et al.,* 2021) and market capitalization (Muyiwa *et al.,* 2020). Therefore, the novelty of this paper lies on the sectoral stock prices of Nigeria stock market in relation to the first wave of the COVID-19 pandemic in the country.

As observed previously on the declining trend of most of the sectoral indices and ASI in the year 2020, notably on the 20th of January, 2nd of March, and 26th of June within the pandemic period, it becomes imperative to examine the impact of the pandemic on the sectoral stock market indices. No doubt, the need for capital formation from the stock exchange presents opportunities for emerging industries and listed companies to attract funding. However, the process could become challenging should COVID-19 pandemic change the market sentiments. Consequently, this study is predicated on investment decisions and policy sustainability. The stock exchange is an important economic institution that helps both the investors and the companies for mutual benefits. From the investors view, the study will motivate individuals in the event of related pandemic, to diversify their portfolio among the sectors of the market without possibly pulling out their fund through the secondary market. Sequel to this, investors' confidence is renewed, thereby providing the required funds for the industries. The study provides the policymakers with the opportunity of acquiring knowledge on the sectors which are mostly hit by the pandemic and possibly come up with result-based policies that will provide succour to the sectors.

The rest of the paper is organised as follows: Section 2 reviews related literature

while Section 3 outlines the study methodology; the empirical results are presented and discussed in Section 4; and Section 5 concludes the paper and provides policy recommendations.

2. Literature Review

2.1 Theoretical Literature

There are many theories which may fit in the study of sectoral stock market prices and COVID-19 pandemic. The study reviews the theory of black-swan and capital asset pricing model (CAPM) due to their relevance associated with the study. However, the underpinning theory for this study is CAPM.

The theory of black swan and its usage in economics was advanced by Taleb (2007). Using the discovery of black swan, Taleb explained unanticipated events that influence the activities of stock market and commerce either negatively or positively. According to Taleb, a "black swan is not only the occurrence of an unexpected event; it is also the absence of an expected event." Ngwakwe (2020) opined that the theory refers to "events that are highly unpredictable of which the attendant effects on stock markets, money markets and general economy is severe." Therefore, unpredictability is one of the criteria for black swan event. The characteristics of events in relation to black swan could be known by their utmost rarity, intense impact, and the global assertion that they are clear in hindsight. As noted by Taleb (2007) and stated in Estrada (2009), black swan could be regarded as an event with three attributes: (i) it is an outlier, lying outside the purview of regular expectations (ii) it carries a severe impact. The event itself and its consequences can be either positive or negative; and (iii) despite being an outlier, plausible explanations for its occurrence can be found after the fact. This implies that black swan events possess ex post explanation. In order words, efforts are made to obtain the cause(s) for its occurrence after the event itself has taken place. In a nutshell, a black swan has three characteristics: rarity, extreme impact, and retrospective predictability. Brunåker and Nordqvist (2013) noted that a black swan is an event which could not be predicted in advance by (all but a very few of) the observers.

The theory is linked to unexpected events that affect commercial activities and stock market (Taleb, 2001; Taleb, 2007). The theory could be related to coronavirus emer-

gence in China that overwhelmed the world. It is used as a reference point to relate events that are highly unpredictable and severe in nature.

The characteristics of COVID-19 pandemic in relation to black swan event can be adduced from Mishra (2020) who discussed black swan events to be rare events which have outsized impact, so difficult to anticipate and model. The characteristics of the pandemic could be vividly seen from the black swan events of global implications. Mishra (2020) likened the crash of the United States housing market to a black swan event due to its catastrophic and global impact. More so, only a few observers were able to predict its occurrence. In the same vein, the COVID-19 pandemic which has same features could be described as a black swan event. The emergence of the COVID-19 pandemic revealed the inability to predict and prepare for black swan events despite the idea of pandemic readiness which has been on the global public health community's watch.

The Capital Asset Pricing Model (CAPM)

The CAPM developed by Sharpe (1964) and Lintner (1965), marks the birth of asset pricing theory. It is understandable that no matter the investors effort in investment diversification, there is always possibility of risk which needs to be mitigated. Thus, investors seek for rate of returns that will off-set the risk. Sharpe (1964) classified two types of risk that will always exist as systematic risk and unsystematic risk. While the latter in more technical terms, captures the part of stock return that is not in correlation with general market performance, the former represents the market risks which captures the overall dangers or uncertainty of investing. Some of the examples of systematic risks are recessions, interest rate and wars. Thus, COVID-19 pandemic could be situated in this regard because CAPM captures a parameter which reveals the quantity changes in the price of a particular stock compared with quantity change of the entire stock market.

2.2 Empirical Literature

This subsection provides empirical literature on the link between some macroeconomic variables and stock market prices. Most importantly, review of the empirical literature focuses on stock market reactions to the COVID-19 pandemic, and macroeconomic effects of the pandemic on stock market volatility.

Like any other market, the stock market has prices. These prices drift from time to time and this drift is referred to as volatility. In existing literature, the relationship between stock market volatility and macroeconomic variables has been evaluated. Using GARCH model, Adeyeye *et al*., (2017) studied the effect of financial liberalisation on the volatility of an emerging stock market in Africa with a focus on the Nigerian stock market and found a positive link between financial liberalisation and return volatility which indicated increase in stock market volatility.

Using the non-linear autoregressive distributed lag (NARDL), Obi *et al*., (2018) examined the impact of oil shocks on stock market prices in Nigeria and affirmed that there is a non-linear relationship between oil price shocks and stock prices volatility. The study indicated that there is a difference in the manner that both negative and positive oil price shocks affect stock price volatility. Fasanya and Akinde (2019) also examined the volatility transmission in the Nigeria financial market. The study revealed that the Nigerian stock market is the largest net receiver and sender of return spillover to other markets. The finding suggests that the Nigerian financial market was susceptible to shocks.

Okonkwo (2019) explored the connection between stock return volatility and selected macroeconomic variables in an emerging stock market using Johansen cointegration. The findings indicated that in the long run there is a casual nexus between stock return volatility and macroeconomic variables in an emerging stock market. As noted by Phan and Narayan (2020), COVID-19 is inflicting unprecedented universal economic damage. In the same vein, Goodell (2020) argued that COVID-19 has wide ranging influence on financial sectors, and stock markets are not in exemption.

Ashraf (2020) observed that stock markets negatively react to the COVID-19 pandemic and the stock markets' reaction change over time with the stages of the outbreak. Similarly, Topcu and Gulal (2020) reinforced the position that the pandemic impacts negatively on the global stock markets. They further noted that emerging markets will not have adequate resources to cope with the challenges of COVID-19 pandemic due to lack of capital inflows.

Jarrow and Rosenfeld (1984) noted that stock markets sometimes display sudden,

market-wide price changes that can also spread to other markets. Nevertheless, the means through which such shocks emerge and spillover across markets are not vividly comprehended. Levine (1991) opined that developed stock market lowers both liquidity and business productivity shocks. In his view, this helps investors to increase their access to investment funds and possibly promotes production capacity. Shen, *et al.* (2020) observed that covid-19 pandemic has not only caused infections to human lives and deaths but has inflicted shock to the world financial markets. As noted by Adnan and Hasan (2021), ever since the pronouncement of covid-19 as a pandemic, the stock markets have plummeted around the world. This may not be unconnected to the fear and panic trading which has caused volatility in the domestic and foreign stock markets. Baker *et al.* (2020) reported that COVID-19 pandemic has affected the stock market more than the previous infectious disease like Spanish flu and SARS.

There is a gradual build-up of literature regarding COVID-19 and the volatility of the stock market. Studies such as Liu *et al*., (2020) evaluated the short-term impact of COVID-19 on stock market indices in 21 countries. The results derived from using an event study method revealed that the stock markets fell quickly after the outbreak of the virus, also the panel fixed effect regressions also support the evidence that confirmed cases of COVID-19 have adverse effect on stock indices. Al-Awadhi *et al*., (2020) investigated the impact of infectious diseases on stock market outcomes. The study adopted the use of panel data regression analysis to measure the effect of COVID- 19 on the Chinese stock market. The results indicated that there is significant negative effect of the contagious diseases on stock returns by the daily increase in the confirmed cases and deaths of COVID-19. Papadamou *et al.*, (2020) investigated the direct and indirect effects of COVID-19 pandemic on implied stock market volatility by examining the effects of pandemic related search on Google trend capturing major international stock markets. The results of the panel data analysis technique used show that search queries for COVID-19 have both direct and indirect effect on implied stock volatility. However, the findings suggest that Google search-based anxiety about COVID-19 contagion leads to elevated risk aversion in stock market.

While highlighting the importance of impact assessment of the COVID-19 pandemic, Baker, *et al.* (2020) considered the short and medium macroeconomic effects of COVID-19 induced uncertainties. These uncertainties were characterized using the stock market volatility measures, newspaper-based measures, and business expectations survey responses. The paper estimated an empirical model to examine these uncertainties. The results revealed that a year-on-year contraction in the real gross domestic product (GDP) of the United States of America would be about 11% in the last quarter of 2020. This implies a negative effect of COVID 19 induced uncertainty on the economy.

Fernandes (2020) discussed the impact of the COVID-19 crisis on industries and countries with further discussion on the channels through which economic activities would be impacted by the pandemic. The stock markets around the world were negatively affected and countries such as Brazil, Colombia, South Africa among others were the worst performing stock markets. The oil, gas and coal sector led the negative returns in the stock market. Overall, the results suggested a decline in global GDP and the economic cost of the recession would be equally distributed. Di Chen, *et al.* (2021) examined COVID-19 shocks on the stock markets of oil exploration and production enterprises. With the application of panel data analysis, the results revealed that both the government response stringency index and the number of confirmed cases have adverse effect on stock prices. It was also found that the unfavourable reaction of the stock market to government response stringency index is greater than that from confirmed cases.

McKibbin and Fernando (2020) used a hybrid of the DSGE and CGE models to examine the impact of different scenarios of COVID-19 on macroeconomic outcomes and financial markets. In the seven scenarios, the first six assumed that shocks temporarily affect the economy while scenario seven suggests that a pandemic may resurface year on year, indefinitely. The study therefore found a decline in global GDP and predicted that the economic cost of the pandemic would aggravate quickly and further suggested that monetary, fiscal and health policy responses would help to cushion the effect of the pandemic.

Adenomon, *et al.* (2020) examined the effect of the COVID-19 on the performance

of the Nigerian Stock Exchange using historical data, Quadratic GARCH and Exponential GARCH models with the inclusion of dummy variables. The results revealed a loss in stock returns and high stock volatility in Nigeria which translates into a negative effect of COVID-19 on the economy. David and Aharon (2021) used an event study methodology and multivariate regressions approach to examine COVID-19, government interventions and emerging capital markets performance. The study found that interventions are associated with a negative market response while closures such as stay-at-home restrictions on gatherings have the most negative effect on emerging capital markets. The market response to economic measures is dependent on the type of support given. Furthermore, the study found that the market responded to direct income aid positively, and negatively to debt or contract relief.

In the analysis of the COVID-19 situation in Africa, Ozili (2020a) discussed the socioeconomic impact of the pandemic, policy responses and opportunities for reforms that could present itself in a COVID-19 world. The study found that there is an uncertainty in the duration of the pandemic and suggested that fiscal and monetary tools be utilized to stimulate growth by the authorities in Africa. Furthermore, Ozili (2020b) also examined the COVID-19 situation in Nigeria. The study found a negative impact of COVID-19 which was driven by declining oil prices and spill overs from the pandemic. The study confirmed the existence of the spill over of COVID-19. The study also found social distancing policies to have a negative impact on the stock market and the economy at large. Yanshuang *et al.* (2021) analysed the impact of the COVID-19 pandemic on G20 stock markets from multiple perspectives. The study measured total, net, and pairwise volatility connectedness among G20 stock markets. The results indicated that the total volatility connectedness among G20 stock markets increased significantly during the COVID-19 pandemic. Furthermore, the spatial econometrics methods were used to analyse the effects of COVID-19 on the stock markets' volatility spillovers. The empirical results suggested that stock markets react more significantly to the COVID-19 confirmed cases and cured cases than the death cases.

There are few studies such as Liu *et al*., (2020), Al-Awadhi *et al*., (2020), Papadamou *et al*., (2020), Baker, *et al.* (2020), and Adenomon, *et al.* (2020) available regarding

COVID-19 and its impacts on the Nigerian stock market prices. Previous studies considered the reactions of stock market to COVID-19 pandemic and stability of stock markets in the face of the pandemic outbreak. By focusing on the impact of COVID-19 pandemic on the sectoral indices, this paper differs from previous studies. The paper, therefore, provides potential investors with information to diversify their investment portfolios.

3. Data and Methodology

3.1 Data

The choice of sectoral indices employed in the study was guided by the NSE suite or class of indices which were deployed to expand and cater for market performance evaluation. There are four classes of NSE indices. Each index has subsectors/classes. The first is co-branded indices which are NSE Lotus Islamic index, NSE Afrinvest banking value index, NSE Afrinvest dividend yield index, NSE Meristem growth index and NSE Meristem value index. The second are the NSE pension, and NSE corporate governance indices which fall under the thematic indices group. The third is the NSE benchmark indices which include NSE all-share, NSE premium board, NSE 30, NSE 50, and ASeM indices, and the fourth class is the sectoral indices which includes NSE banking, NSE consumer goods, NSE industrial, NSE insurance and NSE oil and gas. The dominant indices are found under the sectoral index class. Hence, the use of these sectoral indices as variables of interest in the model specification.

We use daily data starting from February 28, 2020, when the COVID-19 index case was reported in Nigeria to June 26, 2020, when the stock market started trending up. The essence of this scope is to capture the first wave impact of COVID-19 pandemic on the sectoral stock market prices. The dependent variables considered in our model include the Nigerian Stock Exchange All Share Index (NSEASI) as well as its Nigerian Exchange (NSE) dominant sectoral components, such as banking (NSEBKG), consumer goods (NSECOG), industrial (NSEIND), insurance (NSEINS) and oil and gas (NSEOG). The All-Share Index and the dominant sectoral indices were sourced from Nigerian Stock Exchange (2020). The impact of the COVID-19 pandemic on each of the above-mentioned stock market indices is studied by including the total

number of confirmed cases of the infection (CCTN) in Nigeria among the explanatory variables of our regression. The data for COVID-19 pandemic were obtained from Nigeria Centre for Disease Control Situation Report (2020).

As observed by Ogbulu (2018), crude oil price has significant impact on stock market prices as changes in oil price could transmit to the stock market. Also, trading on the NSE is influenced by foreign portfolio investors hence, the introduction of exchange rate (ER) and oil price (OP) as control variables. These control variables were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin (2020).

3.2 Model Specification

Using the CAPM theory, Sharpe (1964) revealed that systematic risk represents the market risks which captures the overall dangers or uncertainty of investing.

The formula is presented as follows:

$$R_a = R_{r,f} + \beta_a * (R_m - R_{r,f}) \tag{1}$$

where R_a is expected return on a security, $R_{r,f}$ stands for risk-free rate, R_m is the expected return of the market, β_a is the slope of the model and $(R_m - R_{r,f})$ represents the equity market premium. Due to the peculiarity of this study in terms of its focus, equation (1) is adapted. Thus, the sectoral stock indices replace R_a while on the right-hand side of the equation, COVID-19 pandemic indicators and other explanatory variables were used to replace the existing variables. The functional form of the relationship between the stock market and the COVID-19 pandemic for this study is specified as follows:

$$NSEASI_t = f(CCTN_t,\ ER_t, OP_t) \tag{2}$$

where, the variables in equation (2) are as previously described. It is expected that a negative relationship exists between the NSEASI and the total number of confirmed cases (CCTN). The study model was examined for sensitivity to alternative measure of the incidence of COVID-19 pandemic by replacing CCTN in the model with the total number of confirmed deaths (CDTN). Following Abraham (2016), we assume a positive relationship between oil price and the stock market in line with the expec-

tation for oil-exporting countries while the impact of exchange rate is negative.

Based on the autoregressive distributed lag (ARDL) bounds testing approach proposed by Pesaran and Shin (1999), the following model is specified:

$$\Delta NSEASI_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEASI_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSEASI_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (3)$$

where: *t-i* is the lag length, the parameter α is the intercept, the short run components are $\beta_{1i} - \beta_{4i}$, and the long run coefficients are $\beta_5 - \beta_7$. Equivalently, the ARDL representation for the sectoral models are as follow:

$$\Delta NSEBKG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEBKG_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSEBKG_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (4)$$

$$\Delta NSECOG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSECOG_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSECOG_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (5)$$

$$\Delta NSEIND_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEIND_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSEIND_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (6)$$

$$\Delta NSEINS_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEINS_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSEINS_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (7)$$

$$\Delta NSEOG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEOG_{t-i} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} - \rho(NSEOG_{t-1} - \beta_5 CCTN_{t-1} - \beta_6 ER_{t-1} - \beta_7 OP_{t-1}) + \varepsilon_t \quad (8)$$

The test for long run relationships in equations (3) – (8) is based on a computed F-statistic, which tests for the joint significance of the long run coefficients in each of

the equations. The hypothesis being tested is of the form:

$$H_0: \ \beta_5 = \beta_6 = \beta_7 = 0$$

$$H_1: \ \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$$

Rejecting the null hypothesis (H_0) implies the existence of a cointegrating relationship; thus, permitting the estimation of an analogous error correction model. For any of the equations in (3) – (8) where cointegration is established, an appropriate error correction model is estimated.

For instance, in the case of the *NSEASI*, the error correction model can be specified as follows:

$$\Delta NSEASI_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEASI_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (9)$$

where: $\sum_{i=1}^{n} \beta_{ji}, \ \ for \ j = 1,..4$ is the short-run impact of the explanatory variables on the dependent variable; the coefficient of the error correction term, ρ, represents the speed at which the system adjusts to the long run equilibrium.

Equivalently, the ARDL error correction model for the sub-sectors is as follow:

$$\Delta NSEBKG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEBKG_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (10)$$

$$\Delta NSECOG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSECOG_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (11)$$

$$\Delta NSEIND_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEIND_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (12)$$

$$\Delta NSEINS_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEINS_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (13)$$

$$\Delta NSEOG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} \Delta NSEOG_{t-1} + \sum_{i=0}^{n} \beta_{2i} \Delta CCTN_{t-i} + \sum_{i=0}^{n} \beta_{3i} \Delta ER_{t-i} + \sum_{i=0}^{n} \beta_{4i} \Delta OP_{t-i} + \rho ECM_{t-1} + \mu_t \quad (14)$$

3.3 Estimation Procedure

We employed the ARDL bounds testing approach proposed by Pesaran & Shin (1999) and Pesaran, Shin & Smith (2001). Apart from being used to disentangle long run relationship from short run dynamics, we find the ARDL technique appropriate for the study since it does not require that the variables in our regression are all integrated of the same order. In other words, the ARDL approach allows us to estimate the relationship between the incidence of COVID-19 pandemic and the Nigerian stock market even when the order of integration of the variables are a mix of $I(0)$ and $I(1)$.

To ascertain the different level of integration, the series were subjected to stationarity test using augmented Dickey-Fuller and Phillips-Perron unit root tests (Dickey & Fuller, 1979; Phillips & Perron, 1988). The next step is to test for the existence of a long run relationship among the variables. After the bounds testing, the next stage is estimation of the long-run and short-run models.

4. Results and Discussion

4.1 Descriptive statistics

Using daily data starting from February 28 to June 26, 2020, Table 1 presented the summary statistics for the model variables. The mean and standard deviation of NSEASI were 23,681.1 and 1,572.1, with minimum and maximum values of 20,669.4 and 26,669.4 respectively. Among the sectors, the industrial index assumed the highest mean of 1,090.3 and standard deviation of 84 with minimum and maximum values of 953.9 and 1,226.4 respectively. The sector with the lowest mean value is the insurance index, revealing average value of 122.2, standard deviation of 6.9 with minimum and maximum values of 108.3 and 137 respectively.

Within the study period, the minimum exchange rate (ER) stood at ₦365.5 while the maximum was ₦392.2. On the average, ER stood at ₦382.1 with standard deviation of 7.4. Oil price (OP) stood at $7.2 and $55.0 for minimum and maximum values respectively with a standard deviation of 12.3. However, OP stood at $29.2 on the

average.

Table 1: Descriptive Statistics

	Mean	Min	Max	Std. Dev	No. Obs
CCTN	5,132.7	1.0	22,614.0	6,721.8	80
CDTN	141.3	0.0	549.0	174.7	80
NSEASI	23,681.1	20,669.4	26,426.2	1,572.1	80
NSEBKG	276.3	219.9	337.4	28.2	80
NSECOG	391.2	314.2	458.0	39.9	80
NSEIND	1,090.3	953.9	1,226.4	84.0	80
NSEINS	122.2	108.3	137.0	6.9	80
NSEOG	216.7	198.6	235.9	9.3	80
ER	382.1	365.3	392.2	7.4	80
OP	29.2	7.2	55.0	12.3	80

CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEAI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG, exchange rate is ER and oil price is OP.

4.2 Graphical Presentation

A graphical presentation of the series is shown using a line graph to trace the trends for the study period. As revealed by the graphs, while CCTN and CDTN were constantly trending upwards, it is evident that on the average, NSEASI, NSEBKG, NSECOG, NSEIND, NSEOG, and OP witnessed a downward trend till 8^{th} May 2020. Afterwards, they were characterized by fluctuating trends. Distinctively, NSEINS showed a rising trend with associated fluctuations within the period. Also, ER maintained a rising trend on the average, with fluctuations within the period.

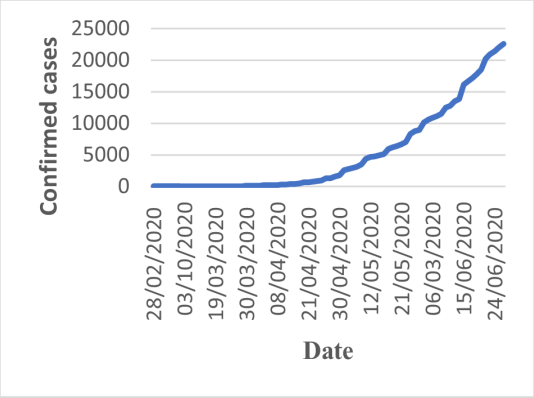

Figure 1: Total number of confirmed cases (cctn)

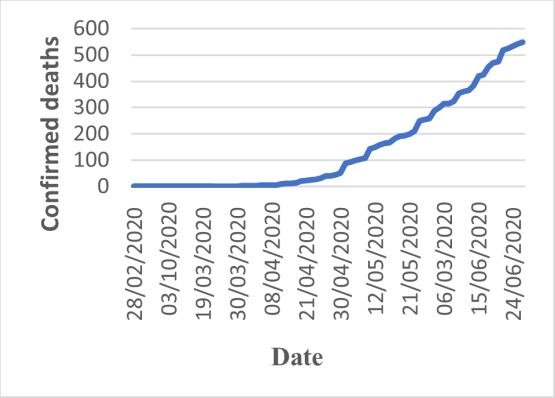

Figure 2: Total number of confirmed death (cdtn)

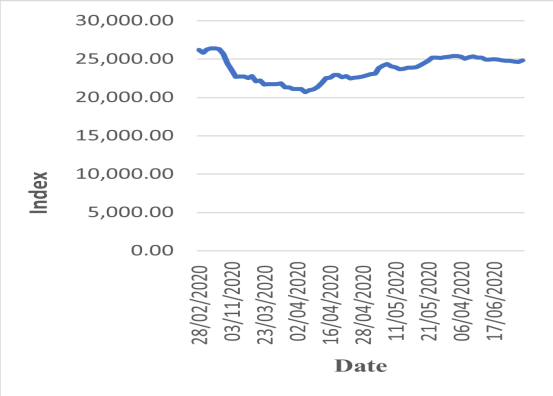

Figure 3: All share index (nseasi)

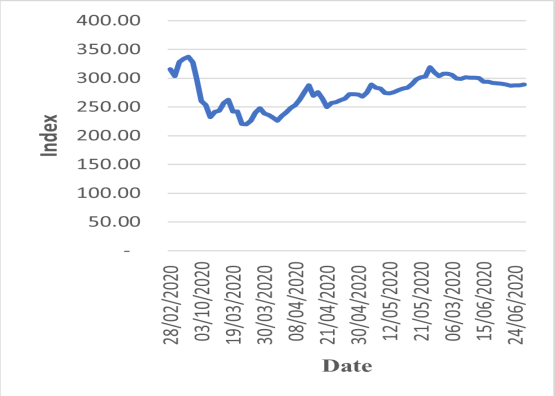

Figure 4: NSE Banking (nsebkg)

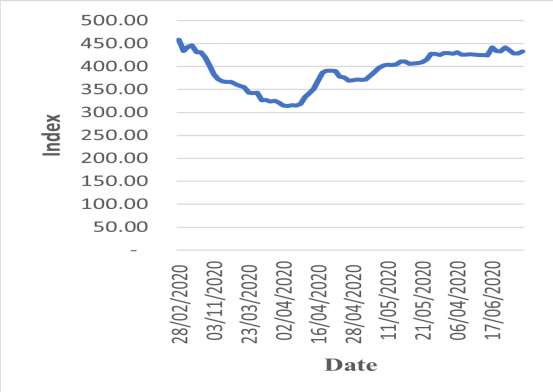

Figure 5: NSE Consumer goods (nsecog)

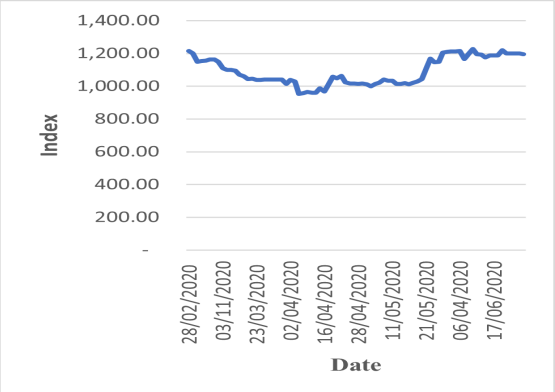

Figure 6: NSE Industrial (nseind)

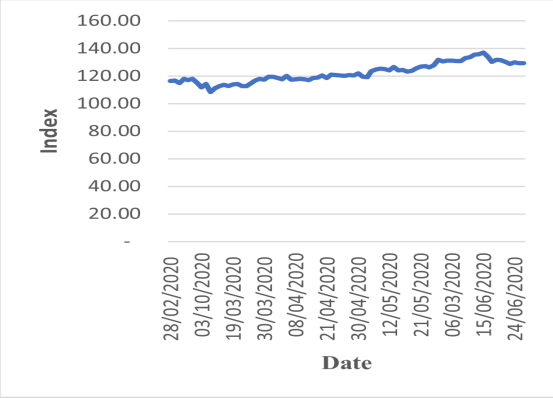

Figure 7: NSE Insurance (nseins)

Figure 8: NSE Oil and Gas (nseog)

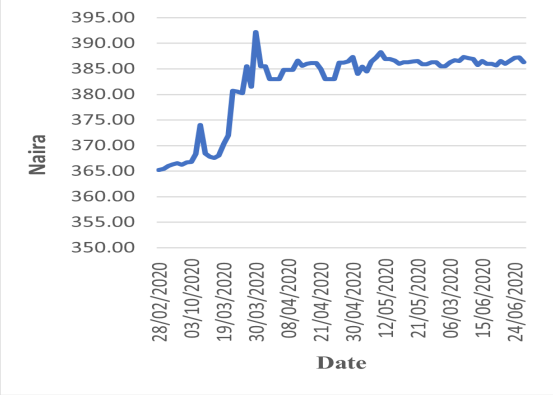

Figure 9: Exchange Rate (er)

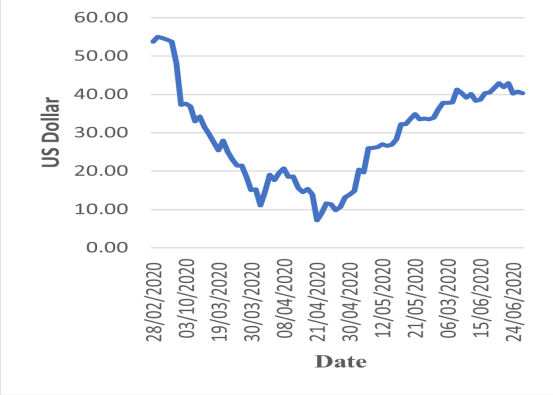

Figure 10: Oil Price (op)

4.3 Collinearity Diagnostics

Oil price and exchange rate in Nigeria are likely to be correlated. Therefore, using the two as explanatory variables in the same model may lead to collinearity. Hence, the correlation matrix in Table 2 provides collinearity diagnostics from the reference model in equation 2. It revealed that there is no collinearity problem between OP and ER. This is evident from the correlation coefficient of -0.35 approximately. Thus, the correlation of such magnitude does not have the potential to adversely affect the regression estimates.

Table 2: Correlation Matrix

	NSEASI	CCTN	ER	OP
NSEASI	1.000000	0.217963	-0.148720	0.757268
CCTN	0.217963	1.000000	0.889761	-0.033122
ER	-0.148720	0.889761	1.000000	-0.349530
OP	0.757268	-0.033122	-0.349530	1.000000

CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEASI is All Share Index (NSEASI), ER is the exchange rate and OP is oil price.

4.4 Unit root tests

The general assumption regarding time series data is that they are non-stationary and stochastic. It is important to test for non-stationarity of the series to avoid spurious regression (Gujarati, 2004). Therefore, the variables were subjected to the augmented Dickey-Fuller and Phillips-Perron unit root tests. As shown in Table 3, the results revealed that the series are integrated at order zero (I(0)) or one (I(1)). Particularly, the augmented Dickey-Fuller test results show that the stock market variables used in the model, oil price and exchange rate are I(1) while the COVID-19 variable relating to total confirmed cases (CCTN) is I(0).

Table 3: Unit Root Test Results

Variable	Augmented Dickey-Fuller (ADF)				Philips-Perron (PP)			
	Level	1st Diff.	Model	∼I(d)	Level	1st Diff.	Model	∼I(d)
CCTN	-3.9423***		C	I(0)	-4.0235***		C	I(0)
CDTN	-1.9713	-2.2191	C & T	-	-0.5093	-9.1171***	C & T	I(1)
OP	-2.1060	-8.9170***	C & T	I(1)	-2.0695	-8.9529***	C & T	I(1)
ER	-2.2608	-12.7261***	C & T	I(1)	-2.5774	-12.6306***	C & T	I(1)
NSEASI	-1.8779	-3.4169**	C	I(1)	-1.5675	-5.6851***	C	I(1)
NSEBKG	-1.9761	-5.9047***	C	I(1)	-1.7427	-6.9930***	C	I(1)
NSEINS	-1.1437	-10.5480***	C	I(1)	-0.9159	-10.7975	C	I(1)
NSECOG	-1.1085	-5.1626***	C	I(1)	-1.1540	-5.1940***	C	I(1)
NSEOG	-1.5384	-5.3354***	C & T	I(1)	-1.6976	-7.9996***	C & T	I(1)
NSEIND	-2.6231	-8.1619***	C & T	I(1)	-2.6259	-8.1578***	C & T	I(1)

Note: CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEASI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG, exchange rate is ER and oil price is OP. C and C & T indicate model with constant and constant & trend, respectively; *** (**) * indicates significance at 1% (5%) 10% critical level.

The results further showed that the time series for the total number of COVID-19 deaths (CDTN) is neither integrated of order zero nor one using ADF test. However, the Phillips-Perron unit root test indicates that all the variables are integrated of either order I(0) or I(1). Therefore, we conclude that none of the variables is I(2) using

Phillips-Perron test results, thus justifying the use of an ARDL model.

4.5 Cointegration test results

The study tests for cointegration among the independent variables (CCTN, ER, OP) and the dependent variables (NSEASI, NSEBKG, NSECOG, NSEIND, NSEINS and NSEOG). The results of the bounds test are presented in Table 4. The results provided evidence in support of a cointegrating relationship for the NSEASI model. In terms of the sectoral indices, the study finds evidence of cointegration for the banking sector (NSEBKG) and consumer goods (NSECOG). The results also show the absence of long run relationship among the explanatory variables and the stock price indices for the industrial (NSEIND), insurance (NSEINS), and oil and gas (NSEOG) sectors.

Table 4: Bounds Test for Cointegration

Model	F-statistic	Critical values		Conclusion
		I(0)	I(1)	
NSEASI	7.8663	2.79	3.67	Cointegration
NSEBKG	10.2064	2.79	3.67	Cointegration
NSECOG	4.1331	2.79	3.67	Cointegration
NSEIND	3.1968	2.79	3.67	Inconclusive
NSEINS	3.3374	2.79	3.67	Inconclusive
NSEOG	1.3916	2.79	3.67	No Cointegration

Note: CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEASI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG. Critical values at 5% significance level.

Hence, for the models where cointegration is established, we proceed to study the dynamic relationship between COVID-19 pandemic and the respective stock prices.

4.6 Results and Discussion

The results of the short run model estimated to understand the impact of COVID-19 pandemic on the Nigerian stock prices is presented in Table 5. In the short-run, a significant and negative relationship exists between the confirmed cases of COVID-19 and NSEASI. This implies that an increase in the number of COVID-19 cases brings about a bearish performance in the stock market. This finding is not surprising as the emergence of COVID-19-induced panic and uncertainty in the global economy

led to massive selloffs of stocks as investors opted for liquidity, thereby dragging stock prices downward. The finding is in line with that of Fernandes (2020).

Similarly, the coefficients of the COVID-19 variable in the model for the banking sub-sector of the stock market are negative and significant. The coefficient of the COVID-19 variable is negative for the consumer goods sub-sector (see column 4 in Table 5) but not statistically significant. The highest adverse impact is recorded in the banking sub-sector (0.0657).

Table 5: Short-run model: Stock market response to reported cases of Covid-19 cases

Variable	NSEASI	NSEBKG	NSECOG
D(AR(-1))	0.2341***	0.2517***	0.3772***
	(0.0823)	*(0.0770)*	*(0.0909)*
D(AR(-2))	0.2616***	0.2422***	
	(0.0828)	*(0.0778)*	
D(CCTN)	-0.0171***	-0.0657***	-0.0089
	(0.0041)	*(0.0107)*	*(0.0069)*
ECM(-1)	-0.1995***	-0.3281***	-0.1411***
	(0.0308)	*(0.0445)*	*(0.0301)*
R-squared	0.5766	0.5652	0.4143
Model diagnostics			
Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.2949	1.3710	0.2847
P-value	0.7456	0.2613	0.7532
Heteroskedasticity Test: ARCH			
F-statistic	0.0025	2.8214	1.3339
P-value	0.9602	0.0975	0.2520

*Numbers in parenthesis are standard errors. CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEASI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG,. *,**, and *** indicate significance at 10%, 5% and 1% levels respectively. In the short run estimates of the model, ER and OP are uncaptured because they are not statistically significant in the model estimates across board. However, they are captured in the long run model estimate.*

The coefficients of the error correction term in Table 5 are negative and significant across the four models. However, following a disequilibrium, the fastest speed of

adjustment is the banking sub-sector. The Breusch-Godfrey serial correlation LM test results indicate the absence of serial correlation in the models. Also, the autoregressive conditional heteroscedasticity test results showed that the residual variances are constant over time.

From the long-run coefficients in Table 6, the COVID-19 pandemic as captured by CCTN is found to be positive in the NSEASI model. The positive coefficient of the pandemic is also observed to be the same with sectoral indices of banking, and consumer goods. Ordinarily, the pandemic is expected to exert negative impact on the sectoral stock prices, at least in the short run, however, the reverse is the case in the long run. During the pandemic, government interventions such as stimulus packages and targeted credit facility were issued to enhance the productivity of the real sector of the economy. As normalcy is restored in the long run, coupled with sustained interventions, the effect on the various stock markets indices is likely to fizzle out. This finding aligns with Topcu and Gulal (2020) who found that official response time and size of the stimulus package provided by the government count in offsetting the effects of the pandemic. Furthermore, the implication of the positive sign borne by the pandemic parameter could be deduced from Dinh and Paresh (2020) who argued that "as with any unexpected news, markets over-react and as more information becomes available, and people understand the ramifications more broadly the market corrects itself".

In terms of the control variables, as expected, oil price has a positive significant impact on the Nigerian stock market. On the other hand, exchange rate depreciation generates a negative and significant impact on the Nigeria stock market with the highest impact recorded by the consumer goods sub-sector.

Table 6: Long run analysis

Variable	NSEASI	NSEBKG	NSECOG
CCTN	0.023916***	0.032421***	0.053708***
	(0.004778)	(0.007780)	(0.009977)
OP	0.031295*	0.018574	0.015853
	(0.016631)	(0.026406)	(0.034135)
ER	-2.57825***	-3.361893**	-5.535893***
	(0.817610)	(1.375737)	(1.752931)
C	25.15207***	25.35896***	38.48876***
	(4.867143)	(8.188480)	(10.43254)

Numbers in parenthesis are standard errors. **,**, and *** indicate significance at 10%, 5% and 1% levels respectively. CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEAI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG, exchange rate is ER and oil price is OP.*

4.7 Sensitivity analysis

In this section, we analyse the sensitivity of the model using an alternative representation of the COVID-19 pandemic variable. In other words, instead of the total number of confirmed cases, we analyse the response of the Nigerian stock market to the total number of confirmed COVID-19 deaths in the country.

As found in the previous section, Table 7 showed that cointegration exists for the models relating to all share index (NSEASI), the NSEBKG, and the NSECOG. In addition, we establish co-integration for the industrial sub-sector.

Table 7: Bounds test results for the alternative model

Model	F-statistic	Critical values		Conclusion
		$I(0)$	$I(1)$	
NSEASI	9.7614	2.79	3.67	Cointegration
NSEBKG	7.3205	2.79	3.67	Cointegration
NSECOG	7.4764	2.79	3.67	Cointegration
NSEIND	3.8539	2.79	3.67	Cointegration
NSEINS	2.7743	2.79	3.67	No Cointegration
NSEOG	1.6081	2.79	3.67	No Cointegration

Critical values at 5% significance level. CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEASI is All Share Index , NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG.

Consequently, in this section, we estimate four error correction models corresponding to the models for which long run relationship were established. The results presented in Table 8 showed that the coefficients of the error correction term for the models are significant and negative, in line with expectation. As found in sub-section 4.6, the speed of adjustment is the fastest under the model for the banking sub-sector (-0.4267).

On the other hand, the lowest adjustment speed (-0.1518) is recorded for the industrial sub-sector. The COVID-19 pandemic as represented by the total number of confirmed deaths impacts negatively on NSEASI as well as the NSEIND. In other words, the all share index responds negatively to both the total number of confirmed cases and the total number of confirmed COVID-19 deaths. The Breusch-Godfrey Serial Correlation LM and ARCH test results show that the models are free from serial correlation and heteroscedasticity.

Table 8: Error correction model

Variable	NSEASI	NSEBKG	NSECOG	NSEIND
D(AR(-1))	0.1554*	0.2522***	0.3080***	
	(0.0826)	*(0.0866)*	*(0.0872)*	
D(AR(-2))	0.2728***	0.2551***		
	(0.0808)	*(0.0884)*		
D(CDTN)	-0.0129**			-0.0280**
	(0.0056)			*(0.0118)*
D(OP)			-0.0221*	0.0115
			(0.0125)	*(0.0159)*
D(OP(-1))			-0.0228*	-0.0405**
			(0.0126)	*(0.0162)*
D(ER)	-0.6650***	-1.5619***		
	(0.1664)	*(0.4924)*		
CointEq(-1)*	-0.2743***	-0.4267***	-0.2597***	-0.1518***
	(0.0381)	*(0.0684)*	*(0.0412)*	*(0.0335)*
R-squared	0.6015	0.4645	0.485288	0.2435
Model diagnostics				
Breusch-Godfrey Serial Correlation LM Test:				
F-statistic	2.0060	1.3934	0.5686	1.0927
P-value	0.1432	0.2558	0.5692	0.3416
Heteroskedasticity Test: ARCH				
F-statistic	0.1117	0.0000	1.9351	2.5838
P-value	0.7392	0.9983	0.0802	0.1125

Note: Numbers in parenthesis are standard errors. CCTN is the total number of confirmed cases (CCTN), CDTN is the total number of confirmed deaths, NSEAI is All Share Index (NSEASI), NSEBKG is banking, NSECOG is consumer goods, NSEIND is industrial, NSEINS is the insurance, oil and gas stand for NSEOG, exchange rate is ER and oil price is OP. *,**, and *** indicate significance at 10%, 5% and 1% levels respectively.

5. Conclusion and Policy Recommendations

This paper reports empirical evidence on the impacts of the COVID-19 pandemic on stock prices in Nigeria using daily data on both aggregate and sectoral stock prices. The bounds test provided evidence of co-integration between the total number of confirmed cases and the NSEASI, NSEBKD, and NSECOG. On the other hand, the study did not find evidence of co-integrating relationship for three sub-sectors, namely, the NSEIND, NSEINS, and the NSEOG. The results showed that the COVID-19 pandemic has a negative impact on the NSEASI. The response of the NSEASI to the total number of confirmed cases is higher than its response to the total number of

confirmed deaths. In other words, the performance of the stock market is more sensitive to the total number of confirmed cases than the total number of confirmed deaths.

COVID-19 pandemic has adverse impact on the stock market indices in Nigeria. It is undoubtedly a turning point in the activities of many sectors, as well as for the directions of development of the entire market. Results for the sectoral indices further revealed that the banking sub-sector of the stock market is most affected in the short run. While the NSE consumer goods index responds negatively to the total number of confirmed COVID-19 cases, the response is not statistically significant. The NSEBKG recorded a relatively high speed of adjustment to long run equilibrium following a shock to the system, compared to the NSEASI. The study found bearish performances in the banking, and consumer goods sub sectors arising from the decline in their stock prices due to the COVID-19 pandemic. Of the sub-sectors considered, the NSECOG has the lowest adjustment process. On the other hand, with sustained government interventions in the form of COVID-19 pandemic stimulus packages, the effect of the pandemics on the stock market and its sub sectors, is expected to disappear in the long run.

As found from the emergence of COVID-19 pandemic, the banking sub-sector was found to adjust to long run equilibrium speedily, followed by consumer goods. These are indications that banking and consumer goods sub-sectors were sensitive to the pandemic in their adjustment processes.

It is recommended that further studies relating to impact of COVID-19 post-first wave on Nigeria sectoral stock prices should be carried out. Other estimation measures with impulse response function; sectoral stock index price volatility, could be applied. We suggest for further studies which should go beyond the scope covered in this paper as it captures the early exposure to the pandemic in Nigeria.

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