Acta Univ. Sapientiae, Economics and Business, **9**, (2021) 86–101

DOI 10.2478/auseb-2021-0005

Does Stock Market Respond to Disease Pandemic? A Case of COVID-19 in Nigeria

Terver Theophilus KUMEKA, Olabusuyi Rufus FALAYI, Adeniyi Jimmy ADEDOKUN*
Department of Economics, Dominican University, Ibadan
terverkumeka@yahoo.com; busuyifalayi@gmail.com
* Corresponding author: jimmyades2005@yahoo.com

Abstract. This paper investigates whether stock markets respond to disease pandemic referencing the case of COVID-19 in Nigeria. The paper employs three cointegrating regression models: Fully Modified Ordinary Least Squares, Dynamic Ordinary Least Squares, and Canonical Cointegrating Regression to analyse the effect of growth in total COVID-19 confirmed cases and related deaths in Nigeria and across the globe from 27 February 2020 to 4 September 2020 on the stock market performance. Key findings support the presence of long-run association between stock market returns and COVID-19 in Nigeria. The stock market is found to respond negatively to both domestic and global growths in total confirmed cases and deaths of COVID-19. Consequently, affected businesses in Nigeria should be assisted and bailed out by the government through practices such as tax filing, subsidies, targeted spending, and credit.

Keywords: COVID-19, pandemic, stock market returns, cointegrating regressions
JEL classification: I1, G2

1. Introduction

The effects of disease pandemic on countries' economies and the stock market in particular has attracted the attention of scholars and policy makers in recent time because a healthy population has been regarded as the engine of economic growth. Studies have shown that improvement in health boosts the economy of developing countries. Thus, in this case, health is viewed as education, which is an integral component of human capital (Meer et al., 2003; Bloom and Canning, 2000). Moreover, it is gaining global attraction because stock and economic growth are susceptible to diverse risks such as Ebola virus, Middle East respiratory syndrome (MERS), severe acute respiratory syndrome (SARS), and the economic meltdown of 2008 that culminated into devastating effects on the stock markets and other financial markets (Dang and Nguyen, 2020).

Thus, the outbreak of COVID-19 has become a source of concern because it poses several challenges to personal lives such as extreme occurrences of death and disease and subsequent economic lockdown for the purposes of curtailing the spread of the disease. This unexpected shock may have a negative impact on economic trends and investors' risk perception. For instance, havoc caused by COVID-19 may have negative effects on investment decisions and returns on assets because stock market performance is usually influenced by the behaviour of investors in such a way that when the market is bullish and risk perception is low, investors behave more optimistically, but when the market is bearish and risk perception is high, then investors become relatively pessimistic, and this can lead to short-term fluctuations in stock performance. This has, therefore, offered an opportunity to scholars and policy makers to assess the effect of pandemic on the stock markets. As a result, this paper examines the effects of COVID-19 on stock market performance in Nigeria by investigating its impact on stock market indices. Different from extant studies, the study contributes to existing literature on COVID-19 and stock market performance by quantitatively investigating the economic effect of lockdown.

Thus, the fundamental questions of this research based on the aforementioned are: What is the effect of the total reported cases of COVID-19 (both locally and globally) on stock market returns? What is the effect of COVID-19-related deaths on stock market returns? Does lockdown associated with COVID-19 affects the stock market? Consequently, the findings show that stock market in Nigeria responds more to the growth in domestic COVID-19 confirmed cases and global reported deaths caused by the pandemic than to the domestic reported deaths and global COVID-19 confirmed cases. Also, lockdown significantly affects stock returns in Nigeria.

The structure of the rest of the paper is as follows. Section 2 presents literature review. Section 3 discusses data and methodology. Section 4 presents results and discussion. Finally, section 5 provides the conclusion and recommendations.

2. Literature Review

Several research on the economic impact of pandemics, such as Ebola virus, Middle East respiratory MERS, and SARS, have been carried out. For example, an event study approach was used by Chen, Jang, and Kim (2007) to show a relatively negative impact of the SARS epidemic on the price movements of hotel stock in Taiwan. Their findings showed that the tourism industry felt the hit mostly, suffering the highest fall in stock price (about 29 percent) due to the epidemic. This finding was supported by other studies, such as Chen, Chen, Tang, and Huang (2009), which used the GARCH process event analysis method to confirm that the SARS crisis had a negative effect on Taiwan's tourism and wholesale as well as retail sectors in Taiwan. However, using Mann–Whitney non-parametric tests to examine the impact of the SARS epidemic on the stock markets in a study on Canada, China, Singapore, Hong Kong, the Philippines, Indonesia, Thailand, and Vietnam, Nippani and Washer (2004) found rather mixed results. Their findings showed that, except for China and Vietnam, the SARS epidemic had no negative impact on the stock markets of the affected countries.

Recently, the sudden outbreak of COVID-19 confounded world health experts that no immediate medical respite was found for the pandemic. According to Fitzgerald (2020), "The accompanying effect of the Coronavirus pandemic has spiralled into different swings in the global stock and money markets, thus causing jitters amongst investors." Studies have shown that the COVID-19 pandemic infection and fatality rates revealed that no infectious disease epidemic had affected the stock market as strongly as the pandemic. From the current perspective, past pandemics have left only mild traces on the U.S. stock exchange. For instance, Baker et al. (2020) gave account of stock market response to COVID-19, and their findings suggested that the major factors for why the US stock market reacted to COVID-19 was the excessive control of government to restrict commercial activity and social activities. However, a surprising finding by other researchers, such as Onali (2020), who analysed COVID-19 and stock market fluctuations using the GARCH(1,1) model in the US and six additional countries, showed that variations in the number of cases and deaths did not affect the US stock market returns. A related research (Ngwakwe, 2020) on the early effects of the COVID-19 pandemic on three major regional stock indices worldwide supported a similar finding, that is: some stock markets, such as the Shanghai Composite Index, were immune to the COVID-19 pandemic.

The general opinion among academics, however, is that COVID-19 has a negative impact on the stock markets of the countries affected. This was supported by researchers such as Manzoor, Wang, Zhang, and Manzoor, (2020), who used a method of event analysis to demonstrate that stock markets in major Asian countries experienced more negative abnormal returns compared to other nations. Using an event study approach to examine the impact of COVID-19 on the stock markets of the six worst COVID-19 pandemic countries, Alber (2020) found that stock market returns were more susceptible to Coronavirus cases than deaths and more to new ones than to Coronavirus cumulative measures. In addition, research by Elsayed and Elrhim (2020) on the effects of COVID-19 spread on the Egyptian stock market showed evidence that the return of stock market sectors was more susceptible to cumulative mortality indicators on a regular basis than to deaths from corona viruses and to new cases more than to cumulative mortality indicators.

In the same vein, panel data regression analysis was used by Al-Awadhi, Al-Saifi, Al-Awadhi, and Alhamadi (2020) to demonstrate that regular growth in both total reported cases and cases of death induced by COVID-19 had major negative effects on stock market returns in all Chinese stock market companies. Ashraf (2020), who used panel data techniques to investigate regular COVID-19 reported cases and deaths and stock market returns data from 64 countries between 22 January and 17 April 2020, also confirmed this finding. He found that stock markets reacted negatively to the growth confirmed in COVID-19 cases. That is, as the number of reported cases rose, stock market returns declined. The result also showed, however, that financial markets were more proactive in responding to growth in the number of reported cases relative to growth in the number of deaths. Similarly, Baiga, Buttb, Haroona, and Rizvia (2020) in their study on deaths, panic, lockdowns, and US equity markets during COVID-19 crisis confirmed that market illiquidity and volatility are highly related to the rise in the number of confirmed COVID-19 cases and deaths. In addition, the illiquidity and instability of the markets are also linked to the decline in investor sentiments, government policies of economic shutdown, and the lockdown of public places.

Despite many evidence of the negative impact of COVID-19 on stock markets, some scholars went further to show that the effect quickly fizzled out shortly after the outbreak (see: Liu, Manzoor, Wang, Zhang, and Manzoor, 2020; He, Liu, Wang, and Yu, 2020; Okorie and Lin, 2020; Salisu, Ebuh, and Usman, 2020). Many scholars have also looked into the impact of the disease pandemic on other macroeconomic variables such as diesel consumption (Ertuğrul, Güngör, and Soytaş, 2020), currency depreciation, and stock market (Narayan, Devpura, and Wang, 2020), and oil prices and COVID-19 (Gil-Alana and Monge, 2020).

The above indicate that, considering their numerous results and concentrations in America, Asia, and other developed countries, with very few in Africa, the few studies on the stock market's reaction to the COVID-19 pandemic are inconclusive. Most of these studies showed that stock market returns respond negatively to new COVID-19 cases and cumulative cases of death, but they did not consider the influence of the lockdown on the performance of the stock market, which could lead to inaccurate model estimates and skewed results. This study, therefore, explores the stock market's reaction to the COVID-19 pandemic in Nigeria in general, and it specifically examines the effects of the lockdown on the economy.

3. Data, Model, Methodology, and Preliminary Analysis

3.1. Data Description

The datasets used in this study are stock market index (All Share Index) sourced from *www.investing.com* and the number of COVID-19 reported cases and deaths at the daily level sourced from *Our World in Data*. The datasets cover a period from

27 February to 4 September 2020. To capture the overall effects of lockdown on stock market, we introduced a dummy variable, which takes value 1 in the period of the lockdown, i.e. from 30 March to 4 May 2020, and 0 otherwise.

We apply certain filters to refine the data. Observations with missing values are not accounted for because, while COVID-19 data is available every day, stock market data are not reported on the weekends or on national holidays. In the case of Nigeria, the stock market is open from Monday to Friday. After the adjustment, our final dataset has 129 data points over the period from 27 February to 4 September 2020.

Furthermore, from the daily closing index, we computed the daily returns as follows: $r_{i,t} = 100 * \log\left(p_t / p_{t-1}\right)$, where $r_{i,t}$ is the daily stock returns of a firm i at time t, p_t is the current daily closing price of the stock index of a firm i at time t, and p_{t-1} is the preceding day closing price $(t-1)$ for a firm i.

The growths in the COVID-19-related cases and deaths are computed using the following: $cg_t = \left(c_t / c_{t-1}\right) - 1$ and $dg_t = \left(d_t / d_{t-1}\right) - 1$, where cg_t and dg_t are the growths in the cases and deaths of COVID-19 pandemic at time t, c_t and d_t are the number of cases and deaths reported at time t, and c_{t-1} and d_{t-1} are the cases and deaths of the preceding day, that is, $(t-1)$.

3.2. Model and Methodology

This study adopts the approach used by Narayan and Narayan (2005), Lee and Wang (2018), and Saboori et al. (2014). To enable us analyse the relationship between stock market index, total COVID-19 cases, and COVID-19-related deaths and growth of daily confirmed cases, the model below is proposed:

$$SMR_t = \sigma_0 + \sigma_1 CoV_t + D_t + \mu_t \quad (1),$$

where μ_t is the idiosyncratic error term, SMR_t is the dependent variable (here it is the stock market returns for Nigeria), σ_0 is the constant, σ_1 is the coefficient of the model, CoV_t is a vector of independent variables (which are total COVID-19 reported cases and deaths at the domestic and global level), and D_t is a time dummy, which captures the impact of lockdown on the stock market. The dummy variable takes the value 1 for the period from 30 March to 4 May 2020 and 0 otherwise.

We employed three cointegrating regression models for analyses – Fully Modified Ordinary Least Squares (FMOLS), Dynamic Ordinary Least Squares (DOLS), and Canonical Cointegrating Regression (CCR). Further, we provide explanations for the FMOLS method only (see Park, 1992; Saikkonen, 1992; Stock and Watson, 1993 – for more details on CCR and DOLS methods). The FMOLS regression method was first employed by Phillips and Hansen (1990) to present the best estimation of cointegrating regressions. This method transforms OLS in order to eliminate the endogeneity challenges in the explanatory variables, which are due to the presence of cointegration relationship. The FMOLS approach likewise reduces the challenges resulting from the long-run association between the cointegrating equation and changes in the random regressor. According to Hansen (2002), "the FMOLS estimator is asymptotically unbiased and has fully efficient mixture normal asymptotics allowing for standard Wald tests using asymptotic Chi-square statistical inference".

The linear regression model is specified as follows:

$$SMR_t = \sigma_0 + \sigma_1 CoV_t + D_t + \mu_t \qquad t = 1, 2, ..., n \qquad (2),$$

where the K x 1 vector of I(1) explanatory variables are not cointegrated themselves. Thus, CoV_t is a process with stationarity at first differences, which is stated as:

$$\Delta CoV_t = \eta + \upsilon_t, \qquad t = 2, 3, ..., n \qquad (3),$$

in which η is a K x 1 vector of drift parameters, and υ_t is a K x 1 vector of I(0), or stationary variables. It is assumed that $\zeta_t = (\mu_t, \upsilon_t')'$ is stationary with zero mean and a finite positive-definite covariance matrix, Σ.

Two stages are involved in carrying out the calculation of the FMOLS evaluation of σ. In stage one, the *SMRt* long-run interdependence of μ_t and υ_t is corrected. As a result, $\widehat{\mu}_t$ is the OLS residual vector in equation (1), and:

$$\zeta_t = \begin{pmatrix} \widehat{\mu}_t \\ \widehat{\upsilon}_t \end{pmatrix}, \qquad t = 2, 3, ..., n \qquad (4),$$

where $\widehat{\upsilon}_t = \Delta CoV_t - \widehat{\eta}$ for $t = 2, 3, ..., n$ and $\widehat{\eta} = (n-1)^{-1} \sum_{t=2}^{n} \Delta CoV_t$.

A consistent estimator of the long-run variance of ζ_t is given by:

$$\widehat{\varpi} = \widehat{\Sigma} + \widehat{\lambda} + \widehat{\lambda}' = \begin{bmatrix} \overset{\varpi\widehat{11}}{1 \times 1^{\widehat{\varpi}_{11}}} & \overset{\varpi\widehat{21}}{1 \times k^{\widehat{\varpi}_{21}}} \\ \overset{\varpi\widehat{21}}{k \times 1^{\widehat{\varpi}_{21}}} & \overset{\varpi\widehat{22}}{k \times k^{\widehat{\varpi}_{22}}} \end{bmatrix},$$

where $\widehat{\Sigma} = \frac{1}{n-1} \sum_{t=2}^{n} \widehat{\zeta}_t \widehat{\zeta}_t$, $\widehat{\lambda} = \sum_{s=1}^{m} w(s,m) \widehat{\Upsilon}_s$, $\widehat{\Upsilon}_s = n^{-1} \sum_{t=1}^{n-s} \widehat{\zeta}_t \widehat{\zeta}'_{t+s}$, and *w(s,m)* is the lag of window with horizon *m*.

In stage two, the FMOLS estimator of σ is given by:

$$\hat{\sigma}_* = (W'W)^{-1}\left(W'S\hat{M}R^* - nD\hat{Z}\right),$$

where $S\hat{M}R^* = (S\hat{M}R^*, S\hat{M}R^*, ..., S\hat{M}R_n^*)'$, $W = (\tau_n, CoV)$, and $\tau_n = (1,1,...,1)'$.

Therefore, the FMOLS estimator utilizes preliminary evaluations of the equality and the residuals of the one-sided long-run covariance matrices.

3.3. *Preliminary Analysis*

3.3.1. Descriptive Statistics

Summary statistics, such as maximum, minimum, average, standard deviation, skewness, kurtosis, and Jarque–Bera test, are displayed in *Table 1*. It can be observed in *Table 1* that, on the average, the stock market in Nigeria has a negative average return of about -0.02% for the period from 27 March to 4 September 2020, with a maximum return of about 1.33% and a standard deviation of approximately 0.49%. COVID-19 cases in Nigeria have an average growth rate of about 0.07%, with a maximum growth rate at 1.67%, and a variation rate of 0.18%, while COVID-19-deaths related cases grew by approximately 0.03%, with a maximum growth rate of 1.00% and a standard deviation of 0.09% within the period of study.

Moreover, on the global level, we observed that global COVID-19 cases have a growth rate of about 0.03%, with a maximum growth rate of about 0.14% and a rate of variation of about 0.03%. However, in terms of global fatalities, *Table 1* revealed that global COVID-19-related deaths have a growth rate of 0.03%, with a maximum growth of approximately 0.14% and a standard deviation of about 0.04%. Overall, we observed negative skewness for the stock market returns, while all COVID-19-related indicators, both domestic and global, are positively skewed.

Table 1. *Descriptive statistics*

	Smr	Gtc	Gtd	Gtwc	Gtwd
Mean	-0.018	0.068	0.034	0.031	0.031
Maximum	1.333	1.667	1.000	0.138	0.140
Minimum	-2.186	0.000	0.000	0.009	0.004
Std. Dev.	0.489	0.182	0.095	0.028	0.038
Skewness	-1.116	6.595	8.329	2.053	1.647
Kurtosis	7.062	53.092	83.253	6.340	4.332

	Smr	Gtc	Gtd	Gtwc	Gtwd
Jarque–Bera	115.481	14422.150	36109.790	150.592	67.852
Probability	0.000	0.000	0.000	0.000	0.000
Observations	129	129	129	129	129

Source: authors' calculation

Note: Smr represents stock market returns. Gtc and Gtd stand for growth in domestic COVID-19 cases and deaths. Gtwc and Gtwd represent growth in global COVID-19 cases and deaths respectively.

3.3.2. Correlation Analysis

Table 2 contains Pearson correlation coefficients between the series. As expected, there is negative correlation between the total growth of COVID-19 cases and the stock market returns in Nigeria, while the growth in fatalities is positively related to stock market returns. However, expectedly, the growths in both global COVID-19 cases and deaths have negative correlations with stock market returns in Nigeria. Also, lockdown represented by a dummy appears to positively relate to the stock market.

Table 2. *Correlation*

	Smr	Gtc	Gtd	Gtwc	Gtwd	Du1
Smr	1.000					
Gtc	-0.332	1.000				
Gtd	0.047	0.133	1.000			
Gtwc	-0.166	0.427	0.135	1.000		
Gtwd	-0.180	0.429	0.183	0.967	1.000	
Du1	0.115	0.089	0.400	0.281	0.381	1.000

Source: authors' calculation

Note: Smr represents stock market returns. Gtc and Gtd stand for growth in domestic COVID-19 cases and deaths. Gtwc, Gtwd, and Du1 represent growth in global COVID-19 cases, deaths, and dummy variable respectively.

3.3.3. Unit Root Tests

First of all, it is conventional and also required to ascertain the order of integration for each series as the FMOLS approach is only applicable for series that are I(0) or I(1) or fractionally integrated. However, according to the literature, the processes of data generation for various economic series are described by random movements leading to incorrect conclusion if the features of the data are not examined with great caution. A variable is considered stationary over time if its autocovariances and the mean are time-independent, and the reverse is true for a non-stationary series, which means it has a unit root. In the literature, the conventional techniques to test for a series stationarity is the unit root test, and the common tests available for individual time series are the Augmented Dickey–Fuller (ADF) test (Dickey and Fuller, 1979, 1981), the Phillips–Perron (PP) test (Phillips and Perron, 1988), and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) test (Kwiatkowski, Phillips, Schmidt, and Shin, 1992).

Table 3 contains the results of ADF, PP, and KPSS. This is carried out on the natural logarithms of the levels and first differences of the series. The outcomes indicate that all the variables are stationary at first difference, which signifies I(1) order of integration. For the KPSS, it tests the null hypothesis that the series has no unit root – indicating stationarity of the series, whereas the alternative hypothesis states that the variable non-stationary has a unit root.[1] Therefore, from the unit root results, there is no evidence of I(2) for all the series, thus confirming the suitability of FMOLS, DOLS, and CCR approaches for the long-run association between stock market and COVID-19.

Table 3. *Unit root*

Tests	ADF(*l*)	ADF(*d*)	PP(*l*)	PP(*d*)	KPSS(*l*)	KPSS(*d*)
Smr	-5.037***	-	-7.904***	-	0.361*	0.106
Gtc	-2.143	-10.325***	-9.628***	-80.694***	0.927***	0.500
Gtd	-11.194***	-	-11.336***	-	0.485**	0.009
Gtwc	-2.688*	-2.680*	-1.738	-14.058***	0.704**	0.129
Gtwd	-3.012**	-5.993***	-1.506	-13.544***	0.776***	0.164
Du1	-1.852	-11.180***	-1.917	-11.180***	0.389*	0.090

Source: authors' calculation

*Notes: Smr represents stock market returns. Gtc and Gtd stand for growth in domestic COVID-19 cases and deaths. Gtwc, Gtwd, and Du1 represent growth in global COVID-19 cases, deaths, and dummy variable respectively. Level and first differences are denoted by l and d. ADF and PP report t-statistics, while KPSS reports LM – statistic. *, **, and *** represent statistical significance at 10%, 5%, and 1% levels respectively. The null hypothesis is rejected at p-values set at 10% level of significance.*

1 The decision to reject or accept the null hypothesis in the case of KPSS unit root test is based on the LM statistic probability values as specified in Kwiatkowski, Phillips, Schmidt, and Shin (1992).

3.3.4. Cointegration Test

The non-stationarity of two or more variables may be made stationary in a linear combination (Engle and Granger, 1987). The existence of stationary linear combination is an indication that there is cointegration among the non-stationary time series, resulting in long-run equilibrium among the series. For our current study, we employ the Johansen cointegration test (Johansen, 1988). The rationale for our choice is that the Johansen approach produces better results than other cointegration tests, e.g. the Engle–Granger single equation test method, since the maximum likelihood procedure has useful large and finite sample features (Cheung and Lai, 1993). Also, it employs two ratio tests – a trace test and a maximum eigenvalue test – to investigate the number of cointegrated relationships. However, in the event of disparity in results between the trace statistics and maximum eigenvalue statistics, the latter is preferred because of the advantage of performing separate tests on each eigenvalue. The Johansen cointegration test results are recorded in *Table 4*. We observed that both the trace test and the maximum Eigen statistic test confirm the existence of at least five cointegrating equations at the 5% level. Hence, we conclude that the null hypothesis of no cointegration among the series is rejected. Therefore, based on the Johansen cointegration test results in *Table 4*, we inferred the existence of a long-run equilibrium association between stock market returns and COVID-19 (proxied by the growth in total number of confirmed cases and number of deaths – domestic and global) in Nigeria.

Table 4. *Cointegration test*

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	p-value
None *	0.594	272.823	95.754	0.000
At most 1 *	0.379	162.864	69.819	0.000
At most 2 *	0.298	104.755	47.856	0.000
At most 3 *	0.242	61.620	29.797	0.000
At most 4 *	0.171	27.787	15.495	0.000
At most 5 *	0.039	4.873	3.841	0.027
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	
None *	0.594	109.959	40.078	0.000
At most 1 *	0.379	58.108	33.877	0.000
At most 2 *	0.298	43.135	27.584	0.000

At most 3 *	0.242	33.833	21.132	0.000
At most 4 *	0.171	22.914	14.265	0.002
At most 5 *	0.039	4.873	3.841	0.027

*Note: Trace and Max-eigenvalue tests show 6 cointegrating equations at the 5% level. * represents rejection of the hypothesis at the 5% level.*

4. Results and Discussion

Results for the three methods (FMOLS, DOLS, and CCR) are reported in *Table 5*. For domestic COVID-19 cases, our results indicate that the growth in total reported cases of COVID-19 have negative impact on stock market returns for all the three methods. An increase in the cumulative cases of COVID-19 led to decrease in the stock market returns by -0.76%, -1.42%, and 0.70% for the FMOLS, DOLS, and CCR models respectively. This shows that as the total COVID-19 cases in Nigeria increase, stock returns will decrease. In terms of level of significance, the results showed that all the coefficients on the total COVID-19 cases are statistically significant at the one percent level. Conversely, growth in cases of fatalities (deaths from COVID-19 in Nigeria) has a positive but insignificant impact on the stock market returns for all the models except DOLS.

Table 5. *Empirical results*

Estimation methods	FMOLS	DOLS	CCR
Gtc	-0.758*** (0.168)	-1.423*** (0.458)	-0.696*** (0.260)
Gtd	0.228 (0.314)	-0.946 (0.894)	0.293 (0.507)
Gtwc	9.236** (4.083)	20.266* (10.828)	9.385* (5.465)
Gtwd	-7.541** (3.268)	-13.792 (8.509)	-7.648* (4.585)
Du1	0.283*** (0.090)	0.637*** (0.207)	0.270** (0.117)
Intercept	-0.159 (0.104)	-0.386** (0.192)	-0.169** (0.074)
Cointegrating equation deterministics	0.001 (0.001)	0.003 (0.002)	0.001 (0.001)
R^2	0.172	0.35	0.171
Adj-R^2	0.131	0.28	0.130
Long-run variance	0.095	0.299	0.095

Cointegration Coefficient Diagnostic[1]	46.118 *df* = 121	21.642 *df* = 116	34.698 *df* = 121
Cointegration Test[2]	40.853***	0.034	2.898***

Source: authors' calculation

*Notes: the dependent variable for the three models is Smr, which represents stock market returns. Gtc and Gtd stand for growth in domestic COVID-19 cases and deaths. Gtwc, Gtwd, and Du1 represent growth in global COVID-19 cases, deaths, and dummy variable respectively. The values in parenthesis represent standard errors. *, **, and *** represent statistical significance at 10%, 5%, and 1% levels respectively.*

Furthermore, in the case of global COVID-19 cases and deaths, the results are contrary to *a priori* expectations. We found a positive relationship between the stock market returns and the growth in total global COVID-19 confirmed cases for all three models (FMOLS, DOLS, and CCR). This means that a rise in global COVID-19 cases improves the stock market returns in Nigeria for all three models. Statistically, the coefficients of the FMOLS are significant at 5% conventional level, while they are significant at 10% for the DOLS and CCR models. On the contrary, when we consider the growth in the number of fatalities, the results show that as the growth in global COVID-19-related deaths increases, the stock market returns in Nigeria decline. This indicates that as the number of global COVID-19-related deaths increases, stock returns in Nigeria decrease. For the FMOLS model, COVID-19-related death cases cause the stock market returns to decrease from a rise in the number deaths, and this is statistically significant at 5% level. For the DOLS model, increase in COVID-19-related deaths will give rise to a decrease in the stock returns, but it appears to be statistically insignificant. In the CCR model, an increase in the global COVID-19-death related cases causes the stock market in Nigeria to decrease statistically significant at 10%. The results show that increase in the growth of reported cases will cause the stock market to deteriorate.

Our results are consistent with other scholars' findings in the literature. For example, Alber (2020) found similar outcomes in a study on the top six countries hit by the COVID-19 pandemic. He reported that stock market returns appear to be more responsive to COVID-19 cases than deaths and COVID-19 cumulative cases than new ones. Al-Awadhi, Al-Saifi, Al-Awadhi, and Alhamadi (2020) investigated the effect of Coronavirus-infected cases and fatalities on stock market returns in two stock exchanges in China (Hang Seng Index and Shanghai Stock Exchange Composite Index); they documented that daily growth in total reported cases and total deaths as a result of Coronavirus have a significantly inverse effect on the stock returns of all companies.[2] Also, Elsayed and Abd Elrhim (2020) found that at the sectoral level, sectors' stock market returns are more sensitive to cumulative deaths than daily reported deaths from COVID-19, and there is greater responsiveness

2 Similar studies include Ashraf (2020), Baker, Bloom, Davies, Kost, Sammon, and Viratyosin (2020), Okorie and Lin (2020), Onali (2020), and Ramelli and Wagner (2020), among others.

to new COVID-19 cases than the cumulative cases. Further, Ru, Yang, and Zou (2020), who studied the different responses of stock markets to the 2003 SARS and Coronavirus, reported that countries that did not experience the 2003 SARS do not have timely and effective reactions to the current pandemic (COVID-19).

5. Conclusions

Following the data evaluation above, our study provided certain key findings. The baseline and subsequent results established the existence of long-run association between stock market returns and COVID-19 in Nigeria. Moreover, we found that the stock market in Nigeria responds negatively and significantly to both domestic and global growths in total COVID-19 cases and deaths. However, the effects of the growth in total domestic COVID-19 cases and the growth in global COVID-19-related deaths appear to exert greater negative and significant impact on stock returns in Nigeria. This signified that as the number of confirmed cases and deaths continued to grow, there would be a decrease in stock market returns in the country. On the other hand, the results indicated that domestic growth in COVID-19-related deaths had insignificant positive impact on stock returns, while the growth in global confirmed cases had positive and significant impact on stock returns in Nigeria. Also, as expected, the results supported the significant effect of government lockdown on stock returns. In sum, our results implied that the financial market of Nigeria responded more to the growth in domestic confirmed cases and global reported deaths than to the domestic reported deaths and global confirmed cases. This was not surprising since the number of fatalities in Nigeria was not as much compared to other countries in Europe and the United States. In general, the study indicated that the stock market in Nigeria reacted promptly to the Coronavirus deadly disease, but the reaction was dependent on the event measured.

Given our findings that stock market returns responded negatively to COVID-19 to the detriment of businesses, it is recommended that affected businesses in Nigeria should be assisted and bailed out by the government through practices such as tax filing and subsidies. The government should increase budget allocation to businesses and employees in order to enhance market and business confidence and should redirect the totality of debt, equity, and credit guarantees to affected businesses.

References

Al-Awadhi, A. M.; Al-Saifi, K.; Al-Awadhi, A.; Alhamadi, S. (2020). Death and contagious infectious diseases: Impact of the COVID-19 virus on stock market returns. *Journal of Behavioral and Experimental Finance.* 100326.

Alber, N. (2020). The effect of Coronavirus spread on stock markets: The case of the worst 6 countries. Available at: SSRN 3578080.

Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: Cases or fatalities? *Research in International Business and Finance* 54, 101249.

Baiga, A. S.; Buttb, H. A.; Haroona, O.; Rizvia, S. A. R. (2020). Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. *Finance Research Letters* 38.

Baker, S. R.; Bloom, N.; Davis, S. J.; Kost, K.; Sammon, M.; Viratyosin, T. (2020). The unprecedented stock market reaction to COVID-19. *The Review of Asset Pricing Studies* 10(4): 742–758.

Bloom, D. E.; Canning, D. (2000). The health and wealth of nations. *Science* 287(5456): 1207–1209.

Chen, C. D.; Chen, C. C.; Tang, W. W.; Huang, B. Y. (2009). The positive and negative impacts of the S.A.R.S. outbreak: A case of the Taiwan industries. *The Journal of Developing Areas* 43(1): 281–293.

Chen, M. H.; Jang, S. S.; Kim, W. G. (2007). The impact of the SARS outbreak on Taiwanese hotel stock performance: An event-study approach. *International Journal of Hospitality Management* 26(1): 200–212.

Cheung, Y. W.; Lai, K. S. (1993). Finite-sample sizes of Johansen's likelihood ratio tests for cointegration. *Oxford Bulletin of Economics and Statistics* 55: 313–328.

Dang, T. L.; Nguyen, T. M. H. (2020). Liquidity risk and stock performance during the financial crisis. *Research in International Business and Finance* 52. 101165.

Dickey, D. A.; Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association* 74: 427–431.

(1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica* 49: 1057–1071.

Elsayed, A.; Elrhim, Abd. (2020). The effect of COVID-19 spread on Egyptian stock market sectors. Available at: SSRN 3608734.

Engle, R. F.; Granger, C. W. J. (1987). Cointegration and error correction: Representation, estimation and testing. *Econometrica* 55: 251–276.

Ertuğrul, H. M.; Güngör, B. O.; Soytaş, U. (2020). The effect of the COVID-19 outbreak on the Turkish diesel consumption volatility dynamics. *Energy Research Letters* 1(3). 17496.

Fitzgerald, M. (2020). Coronavirus and market volatility shuts down the IPO market for potential listings like Airbnb. Retrieved from: https://www.cnbc.

com/2020/03/14/coronavirus-and-marketvolatility-shuts-down-the-ipo-market-for-potential-listings-like-airbnb.html; downloaded on: 02.18.2020.

Gil-Alana, L. A.; Monge, M. (2020). Crude oil prices and COVID-19: Persistence of the shock, *Energy Research Letters* 1(1). 13200.

Hansen, B. E. (2002). Tests for parameter instability in regressions with I(1) processes. *Journal of Business and Economic Statistics* 20(1): 45–59.

He, Q.; Liu, J.; Wang, Z.; Yu, J. (2020). The impact of COVID-19 on stock markets. *Economic and Political Studies* 8(3): 275–288.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control* 12: 231–254.

Kwiatkowski, D.; Phillips, P. C.; Schmidt, P.; Shin, Y. (1992). Testing the null hypothesis of stationary against the alternative of a unit root. *Journal of Econometrics* 54: 159–178.

Lee, J. W.; Wang, Z. (2018). Spillover effects of foreign direct investment inflows and exchange rates on the banking industry in China. *Journal of Asian Finance, Economics and Business* 5(2): 15–24.

Liu, H.; Manzoor, A.; Wang, C.; Zhang, L.; Manzoor, Z. (2020). The COVID-19 outbreak and affected countries' stock markets response. *International Journal of Environmental Research and Public Health* 17(8). 2800.

Meer, J.; Miller, D. L.; Rosen, H. S. (2003). Exploring the health–wealth nexus. *Journal of Health Economics* 22(5): 713–730.

Narayan P. K.; Devpura, N.; Wang, H. (2020): Japanese currency and stock market: What happened during the COVID-19 pandemic? *Economic Analysis and Policy* 68: 191–198.

Narayan, P. K.; Narayan, S. (2005). Estimating income and price elasticities of imports for Fiji in a cointegration framework. *Economic Modelling* 22: 423–438.

Ngwakwe, C. C. (2020). Effect of COVID-19 pandemic on global stock market values: A differential analysis. *Economica* 16(2): 255–269.

Nippani, S.; Washer, K. M. (2004). SARS: A non-event for affected countries' stock markets? *Applied Financial Economics* 14(5): 1105–1110.

Okorie, D. I.; Lin, B. (2020). Stock markets and the COVID-19 fractal contagion effects. *Finance Research Letters* 101640.

Onali, E. (2020). Covid-19 and stock market volatility. Available at: SSRN 3571453.

Park, J. Y. (1992). Canonical cointegrating regressions. *Econometrica: Journal of the Econometric Society* 60: 119–143.

Phillips, P. C.; Hansen, B. E. (1990). Statistical inference in instrumental variable regression with I (1) processes. *Review of Economic Studies* 57(1): 99–125.

Phillips, P. C.; Perron, P. (1988). Testing for a unit root in time series regression. *Biometrica* 75(2): 335–346.

Ramelli, S.; Wagner, A. F. (2020). Feverish stock price reactions to COVID-19. *CEPR Discussion Paper* 14511.

Ru, H.; Yang, E.; Zou, K. (2020). What do we learn from SARS-CoV-1 to SARS-CoV-2: Evidence from global stock markets. Available at: SSRN 3569330.

Saboori, B.; Sapri, M.; bin Baba, M. (2014). Economic growth, energy consumption and CO2 emissions in OECD's transport sector: A fully modified bi-directional relationship approach. *Energy* 66: 150–161.

Saikkonen, P. (1992). Estimation and testing of cointegrated systems by an autoregressive approximation. *Econometric Theory* 8(1): 1–27.

Salisu, A. A.; Ebuh, G. U.; Usman, N. (2020). Revisiting oil-stock nexus during COVID-19 pandemic: Some preliminary results (2020). *International Review of Economics and Finance* 69: 280–294.

Stock, J. H.; Watson, M. W. (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica* 61: 783–820.