

# COVID-19 PANDEMIC AND SECTORAL STOCK PERFORMANCE IN NIGERIA: A QUANTILE REGRESSION APPROACH

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## ABSTRACT

*This study examines the effects of COVID-19 pandemic (cases and deaths) and government policy responses on the sectoral stock returns in Nigerian using daily data from January 2nd, 2020 to November 24th, 2020. The stock returns of five sectors are considered which include consumer goods, banking, oil and gas, food/beverages and insurance. Employing OLS and quantile regression methods, our results establish that COVID-19 cases, deaths, and government stringency, and containment and health policy have strong impacts on sectoral stock returns. However, the impact appears to be stronger from COVID-19 confirmed cases, and containment and health policy than from its deaths and government stringency policy. Structure of dependence is predominantly stronger in the bearish markets and is significantly negative at the extreme lower and intermediate quantiles. COVID-19 cases and stringency and containment and health policies move in opposite direction to these sectors' stock returns. As Coronavirus cases surge, stock prices decline.*

**Keywords:** Coronavirus, Stock Market, Quantile Regression, Sectoral Stock Returns, Government Policies.

**JEL:** C13; C21; D53; G18; P34.

## INTRODUCTION

This study is primarily carried out to examine the impact of COVID-19 pandemic (cases and deaths) and the measures taking by the government to curb the spread of COVID-19, especially lockdown and containment and health policy measures on sectorial stock market performance in Nigeria. The world has been thrown into not only health crisis but also socioeconomic crises as a result of COVID-19 pandemic. Historically, the COVID-19 pandemic began in the city of Wuhan in the province of Hubei, China in December 31st, 2019. As it spreads sporadically to other countries, the World Health Organisation (hereafter WHO) declared the COVID-19 a global pandemic in March 11th, 2020. As at August 7th, 2020, the world had recorded about 19,076,745 cases and 714,618 deaths globally (ECDC, 2020). Like other countries, Nigeria has been having its fair share of COVID-19 pandemic. The country recorded the first cases of COVID-19 in February 17th, 2020, allegedly to bring to the country by an Italian man who came for business activity. As of August 7th, 2020, the total number cases and deaths recorded in the country stood at 45,244 and 930 respectively (NCDC, 2020). As the COVID-19 pandemic reached its critical point, the WHO announced a number of measures to be adopted by countries in order to curb or stem the tide of spreading of COVID-19 pandemic.

These measures among others include hand washing with detergent, sanitisation of hands after washing, wearing of mask in public places, social distancing, lockdown of the economies, travelling ban, banning of gathering in public places such as eateries, tourism centres and religion centres. These measures were adopted by many countries, including Nigeria.

These measures, especially the social distancing and total lockdown, have had a great impact on all aspects of the economy, including financial sector where the prices of assets drastically fell across the globe. In specific term, between January and March, 2020, the prices of major precious commodities such as gold, palladium, copper, platinum, iron and aluminium declined by 3.5%, 31.8%, 22.3%, 41.1%, 5.5% and 12.8% respectively (Schmidhuber, Pound and Qiao, 2020). Within the same period, the crude oil price, especially the WTI fell sporadically by 61.6%. The capital market where the stocks and shares are being bought and sold is not spared. The US Congressional Research Service report (2020) shows that between Dow Jones Industrial Index lost about one-third of its valued price which represent about 56.76% between February 14th and March 23rd, 2020. Similar trend was observed in the share price of S&P 500 as it fell by 33.81% within the same period. Since the COVID-19 pandemic is a global phenomenon, financial market in developing countries are also affected by some magnitudes. For instance, between February and March also, all share price index in Nigeria fell by 21.81% while South Africa's Top 40 index dropped by 33.34% (Authors' computation).

Given the general behaviour of the price of financial assets during the on-going COVID-19 pandemic, a lot of researchers have devoted a great deal of effort to examine the impact of the COVID-19 confirmed cases and deaths as well as government policy actions on the stock market performance (returns) (Al-Awadhi et al., 2020; Ali Alan & Rizvi, 2020; Ashraf, 2020a & b; Erdem, 2020; Huo & Qui, 2020; Liu et al., 2020; Mazur et al., 2020; Topcu & Gulal, 2020). Evidence from these studies agrees that the COVID-19 pandemic related cases and deaths as well as the measures taking by government to contain the spread of the virus, especially total lockdown of the economy has a negative effect on stock market returns, however it is submitted that the impacts are not ditto across the sectors in the financial market (Huo & Qui, 2020; Mazur et al., 2020). Given this, our study complements the extant studies on the COVID-19 pandemic and stock market return by verifying the veracity of the second empirical findings. Specifically, we examine the impact of COVID-19 pandemic confirmed cases and deaths as well as government policy actions on the stock market returns across sectors in Nigeria. We assemble 201 firms listed in Nigerian Stock Exchange Market and classify them into nine sectors which include agricultural sector, conglomerate sector, construction and real estate sector, consumer goods sector, financial services sector, health services sector, ICT sector, industrial goods sector, natural resources sector, oil and gas sector and general service sector.

The implementation of the objectives of our study is conducted as follows. We compute the growth in the number of infectious cases and deaths related to the COVID-19 pandemic and examine their impacts on each of the sectorial stock market performance. We believe that the effect of the infectious cases might not be the same as the effect of deaths on stock market returns. We are also of the opinion that the effect of either infectious cases or deaths might vary across the sectors. Hence, it is crucial to investigate these effects to know the sector(s) that is (are) actually affected. Knowing this would be a guide to policymakers in their efforts to bring economic back to life after the pandemic. Across the world, several measures were taken to stem the tide of spreading of COVID-19a pandemic. The most important of these measures that brought the world economy to its knees are social distancing and total lockdown. Almost all the affected countries implemented these measures, although compliance varied across the countries.

Hence, it is important to investigate how these measures affected financial sector, especially stock market returns in every country instead of lumping the countries together in panel form.

Lumping countries together in panel estimation also suffers from the problem of generalisation which can result in formulation and implementation of spurious policy. Hence, we examine the effects of social distancing and total lockdown on the stock market returns of each of the sectors mentioned above. To capture the social distancing and total lockdown, we use the data on government intervention policy actions compiled by the Oxford University in conjunction with the Blavatnik School of Government. The data were collected for the series of measures taken by the governments across the world (Hale et al., 2020a,b). Although three cogent indices were computed from the series of data (stringency index, economic support index and containment and health index), we make use of stringency index and containment and health index. The stringency index captures social distancing and total lockdown while the containment and health also stringency index variables and provision of health services for the infected persons. The two indices range from 0 to 100 with 0 representing low level of government intervention policy actions and 100 fully implementation of government intervention policy actions. It has been submitted that the stringency index has a negative effect on stock market returns, while containment and health policy response is expected to have positive effect on stock returns because containment and health policy restores the investor's confidence (Ashraf, 2020b). We examine the veracity of this claim by investigate the impact of the stock market returns of the sectors of the firms listed in Nigerian Stock Exchange market. The purpose is to know the sector that is actually affected by the government policy actions of social distancing and total lockdown and health policy response. We also investigate the indirect effect of social distancing and lockdown as well as containment and health policies on stock returns. Ashraf (2020b) had argued that government intervention policies such as social distancing measures, testing and quarantining policy and government income support programmes tend to reduce the intensity of the spread of COVID-19 pandemic. The indirect effect of COVID-19 pandemic on sectoral stock returns by interacting COVID-19 confirmed cases and deaths with the government intervention policies and then examines the effects of their resulting multiplicative variables on sectoral stock returns.

Since we are not only interested in conditional mean effect of COVID-19 confirmed cases and deaths and government policy response on sectoral stock returns but also conditional median distributional effect, we employ two estimation methods, namely Robust Standard Ordinary Least Squares (RSOLS) and Quantile Regression (QR). The RSOLS is used to evaluate conditional mean effect while the QR is employed to verify the conditional median distributional effect. The QR is deployed specifically because its advantages over the RSOLS.

While the use of RSOLS is prone to the violation of some basic assumptions of Classical Regression such homoscedasticity, normality, no serial correlation, absence of outliers in the data generation process and right specification, the use of the QR overcomes some of the assumptions. For instance, in the empirical study, the QR is resilience or robust to the presence of outliers in the data generating process. Also, the QR is not subject to the conditionality of the assumptions of classical regression, particularly the assumption of normality which states that the error terms are independently and identically distributed with zero mean and constant variance (Allen et al., 2013).

The rest of the study is structured as follows. Section presents methodology. Section 3 focuses on data description and preliminary findings. In section 4, the empirical results are presented while section 5 concludes with policy recommendations.

## METHODOLOGY

To evaluate the dependence between sectoral stock market returns and COVID-19 pandemic and government policies, we employ the RSOLS and QR estimation method. We begin the methodology by specifying the standard multivariate OLS regression model as follows:

$$ssr_t = \alpha_0 + \alpha_1 \text{COV}_{19t} + \alpha_2 \text{extrt}_t + \varepsilon_t \quad (1)$$

Where  $ssr_t$  denotes sectoral stock returns computed as  $ssr_t = 100 * \ln\left(\frac{P_t}{P_{t-1}}\right)$  where  $P_t$  is the stock price at current period,  $t$  and  $P_{t-1}$  is the stock price in the previous period.  $\text{COV}_{19t}$  represents COVID-19 confirmed cases and deaths and government policy response,  $\text{extrt}$  is the exchange rate used as a control variable.  $\alpha_0$  captures sectoral stock returns without any reference to COVID-19 confirmed cases and deaths, government intervention policies and exchange rate effect.  $\alpha_1$  and  $\alpha_2$  capture the effects of COVID-19 confirmed cases and deaths and government intervention policies and exchange rate. On a priori, COVID-19 confirmed cases and deaths are expected to have a negative effect on sectoral stock returns. Following the hypothesis developed by Ashraf (2020b), it is expected that social distance and lockdown should have a negative effect on sectoral stock returns while the containment and health policy response should have a positive influence on sectoral stock returns. In the case of exchange rate, theoretical nexus between stock returns and exchange rate appear to remain mixed. Therefore, we can expect the effect of exchange rate on sectoral stock returns to be negative or positive.

We now present the QR technique model. This method is an improvement of the OLS regression, and provides a broad representation of a conditional distribution (Zhu, Guo, You and Xu, 2016). Besides, concentrating only on the mean effects can generate erroneous outcome of the significant coefficients or misrepresentation of the right linkages (Binder and Coad, 2011). As stated in Koenker and Hallock (2001), the estimator in QR is insensitive when there are issues of skewness, outlier observations and heterogeneity on the endogenous variable. The technique was developed by Koenker and Bassett (1978), which considers the value of the disturbance term conditional on the explanatory variables in  $\tau$ th quantile, is 0. Thus, the specification of the conditional quantile technique ( $y_i | x_i$ ) is shown below:

$$Q_{y_i}(\tau | V) = \sigma(\tau) + V_i' \delta(\tau) \quad (2)$$

From Eqn. (2), the parameter to be estimated is represented by  $\delta(\tau)$ , the conditional  $\tau$ th quantile of  $y_i$  is symbolized by  $Q_{y_i}(\tau | x_i', \sigma)$ ,  $0 < \tau < 1$ ,  $\sigma$  denotes the unobserved impact, while  $V$  stands for a vector of explanatory variables. We estimate the measures of the  $\tau$ th quantile conditional distribution as follows:

$$\hat{\delta}(\tau) = \arg \min_{\delta \in R^p} \sum_{i=1}^n g_{\tau}(y_i - V_i' \delta(\tau) - \sigma(\tau)) \quad (3)$$

The check function is represented as  $\mathcal{G}_\tau(u) = u(\tau - I(u < 0))$  and  $I(\cdot)$  is the standard indicator function (for this present study,  $u = y_i - V_i'\delta(\tau) - \sigma(\tau)$ ). The robustness of the QR is observed given that the idiosyncratic term split between negatives and positives, and provides weights of  $\tau$  and  $1-\tau$ . Koenker and D'Orey (1987) recommended a direct linear programming algorithm to solve the above problem. Buchinsky (1995) proposed a pair bootstrap process to generate the computed coefficients' standard errors. This also produces standard errors which are valid asymptotically when the quantile regression function suffers from misspecification and heteroskedasticity (Mensi, 2014).

Finally, seven  $\tau$ th quantiles were considered in our analysis (5<sup>th</sup>, 10<sup>th</sup>, 25<sup>th</sup>, 50<sup>th</sup>, 75<sup>th</sup>, 90<sup>th</sup>, 95<sup>th</sup>), which were distributed into bearish market/extreme lower quantile (0.05), harshly decline (0.10), intermediate market (0.25, 0.50, 0.75) and bullish market/extreme upper quantile (0.90, 0.95).

## Data Sources and Preliminary Findings

### Data

This study empirically investigates the dependence structure between the growth in COVID-19 reported cases and deaths, and government policies (government stringency and containment policies) and sectoral stock returns on a daily basis. The study covers the period from 2 January 2020 to 24 November 2020. COVID-19 related variables include – domestic reported cases and deaths; government policies include – stringency policy; containment & health policy. Stock returns were obtained from industrial indices of five sectors on the Nigerian Stock Exchange (NSE). The five sectors examined are: consumer goods; banking; oil & gas; food/beverages and tobacco, and insurance. The choice of these sectors was informed by the availability of data. Also, data were sourced from the following sources: *investing.com* and *ourworldindata.com*. The stock prices and exchange rate data are sourced from *investing.com*. COVID-19 confirmed cases and deaths and government policy interventions are obtained from *ourworldindata.com*. However, it must be stated that data on COVID-19 confirmed cases and deaths has its origin from the European Centre for Disease Prevention and Control (<https://www.ecdc.europa.eu/en/covid-19-pandemic>) while data on government policy interventions comes from the Oxford COVID-19 Government Response Tracker (<https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker>). The stock returns were computed by taking the log-differences of the sectoral stock indices among two successive prices. Equally, we computed the growth rates of the other independent variables.

### Descriptive Statistics and Graphical Analysis

The summary statistics of all the variables at their levels and returns/growth rates are reported in Table 1. At level, the average values for all the sectors are positive, with consumer goods sector having the highest mean value (924), whereas the insurance sector has the lowest mean value (129). In terms of their returns, consumer goods, banking and insurance sectors, all have positive returns, with the largest returns from insurance at 0.87, while the oil & gas and food/beverages and tobacco sectors have negative returns each. Moreover, the standard deviation was used to evaluate the unconditional volatility, and as indicated in Table 1, this value is the

same across the sectors' stock returns, with the exception of the banking sector, which is also highest among the five sectors. The stock market in Nigeria, similar to other stock markets undergoes enormous uncertainty for the period of the global COVID-19 pandemic. The distributions of our variables are all not normal as indicated by the results of the kurtosis, which are all leptokurtic – denoting “*sharp-topped*” distribution with more and larger outliers than the normal distribution. In terms of skewness, consumer goods, banking, oil & gas and insurance sectors are negatively skewed, which indicate longer left tail than the right tail, while food/beverages and tobacco sector is positively skewed, indicating longer right tail relative to the left tail.

<b>Variables</b>	<b>Obs</b>	<b>Mean</b>	<b>Std. Dev</b>	<b>Min</b>	<b>Max</b>	<b>p1</b>	<b>p99</b>	<b>Skew.</b>	<b>Kurt.</b>
Consumer goods	224	923.658	145.876	656.67	1301.32	668.610	1235.6	0.441	2.334
Banking	224	313.201	50.239	219.94	460.03	226.10	429.84	0.565	2.523
Oil & Gas	224	212.566	21.095	162.88	254.45	170.340	254.44	0.241	2.258
Food/beverages	224	450.22	72.806	314.16	611.54	315.450	592.67	0.495	2.482
Insurance	224	129.046	9.407	108.33	159.27	111.800	154.18	0.583	3.486
CONSMAR	223	0.033	1.926	-9.083	6.365	-5.973	4.892	-0.610	6.909
BANKSR	223	0.040	2.771	-13.39	7.685	-9.378	7.210	-0.866	6.745
OANDGR	223	-0.073	1.323	-5.866	5.109	-5.104	4.266	-0.917	9.631
FBR	223	-0.015	1.656	-5.542	5.648	-4.857	5.510	0.082	6.310
INSR	223	0.087	1.440	-5.837	4.665	-3.248	3.227	-0.441	4.668
COVID-19 cases	224	25675.63	25855.9	0.000	66439	0.000	65839	0.323	1.372
COVID-19 deaths	224	509.348	479.875	0.000	11680	0.000	1165	0.165	1.272
Stringency index	224	53.564	28.791	0.000	85.650	0.000	85.650	-0.694	2.051
Containment & Health Index	224	53.777	27.03	0.000	80.560	0.000	80.560	-0.908	2.305
Exchange rate	224	354.841	29.628	306.38	381.300	306.400	381.25	-0.844	2.058

**Note:** CONSMAR, BANKSR, OANDGR, FBR and INSR denote the stock market returns in the consumer goods, banking, oil & gas, food/beverages and insurance sectors respectively.

Next, we conducted trend analysis for the five sectors, COVID-19 indicators and government policy response to the Corona virus pandemic, as displayed in Figures 1 – 7. All series are presented in levels and returns. It can be seen that stock prices of all sampled sectors considerably tumbled and displayed more volatile behaviour around the month of March 2020 (i.e. the post-COVID-19 declaration period) when the virus was declared a global pandemic (see Figures 1–5). The advent of Corona virus raised investors' apprehension, foreign and local, leading to panic markets activities. The Nigerian All Share Index dropped by more than 26% during March 2020 (NSE, 2020). In terms of COVID-19 cases and deaths, we observed that they were steadily low from January 2020 to around mid-April 2020 and thereafter exploded and progressively continued on that trend Figure 6. Lastly, the trend for government policy response to COVID-19 pandemic (proxy by stringency policy, and containment and health policy responses to COVID-19) is presented in (Figure 7).

It is observed that these policies were very low during the first three months of 2020; however, following the declaration of COVID-19, government policies to contain the virus jumped from an index of around 20 to the neighbourhood of around 80 – 90. This jump is not surprising following the partial lockdown of major parts of the economy and the ban on social gathering. In addition, to ensure that collinearity and multicollinearity do not pose any problem for our estimation, we analysed pairwise correlations results as displayed in (Table 2). As shown

by the correlation matrix, all the correlation values are low for all the sectors examined. Given these low correlation values, it can be submitted that collinearity and multicollinearity do not present any issue of worry.

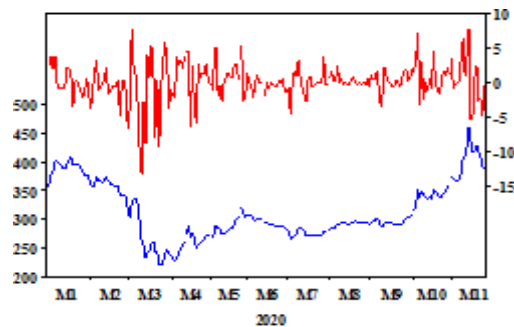
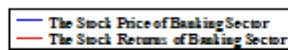


Figure 1: The Stock Price and Returns of Banking Sector



**Figure 1**  
**THE STOCK PRICE AND RETURNS OF BANKING SECTOR**

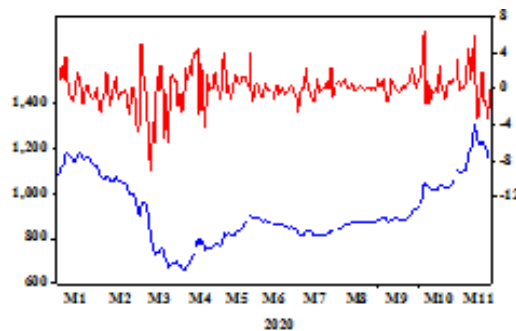
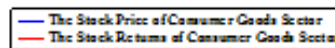


Figure 2: The Stock Price and Returns of Consumer Goods Sector



**Figure 2**  
**THE STOCK PRICE AND RETURNS OF CONSUMER GOODS SECTOR**

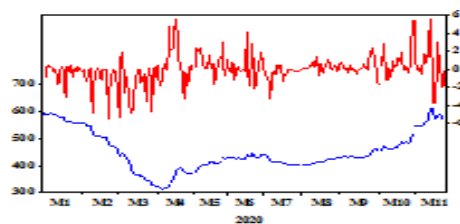
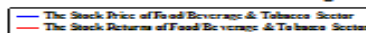


Figure 3: The Stock Price and Returns of Food/Beverage & Tobacco Sector



**Figure 3**  
**THE STOCK PRICE AND RETURNS OF FOOD/BEVERAGE & TOBACCO SECTOR**

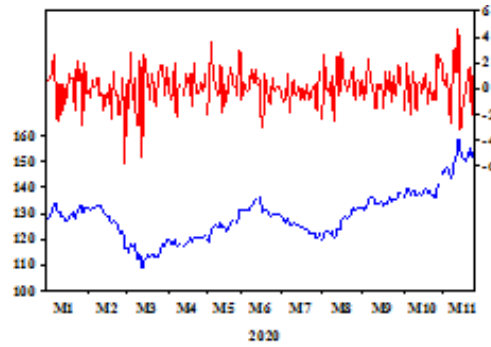


Figure 4: The Stock Price and Returns of Insurance Sector

— The Stock Price of Insurance Sector  
 — The Stock Returns of Insurance Sector

**Figure 4**  
**THE STOCK AND RETURNS OF INSURANCE SECTOR**

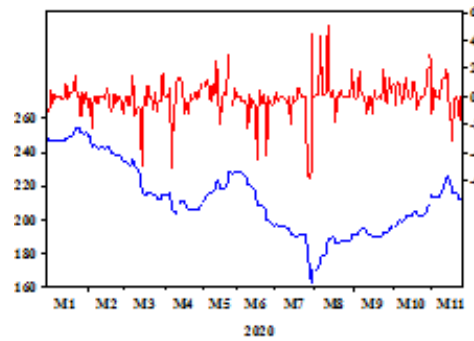


Figure 5: The Stock Price and Returns of Oil and Gas Sector

— The Stock Price of Oil and Gas Sector  
 — The Stock Returns of Oil and Gas Sector

**Figure 5**  
**THE STOCK PRICE AND RETURNS OF OIL AND GAS SECTOR**

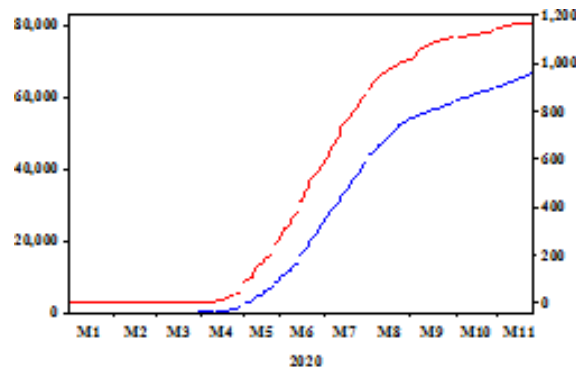
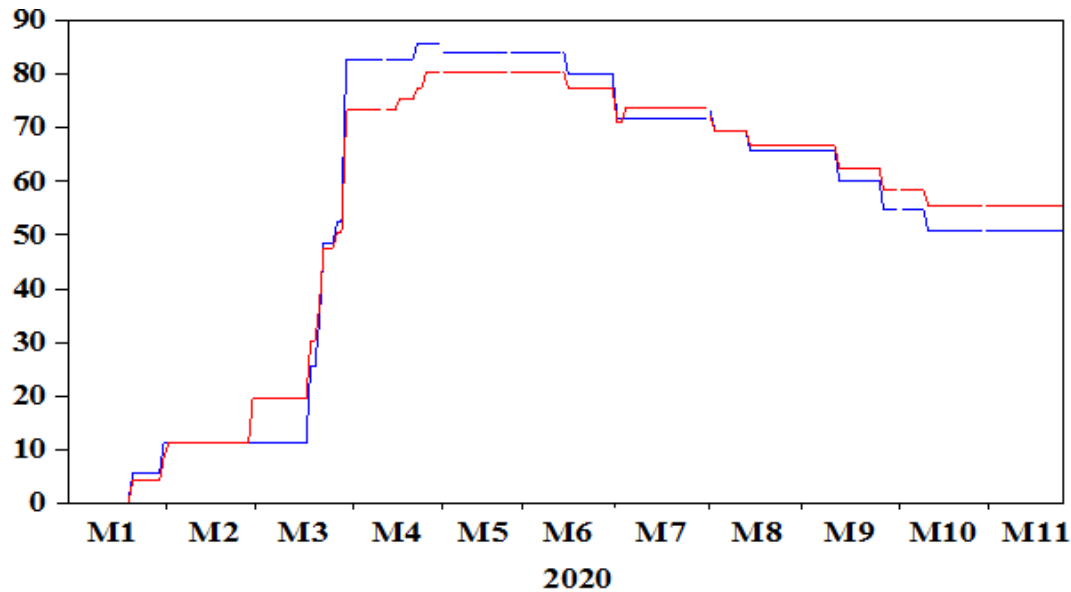


Figure 6: Total COVID-19 Confirmed Cases and Deaths

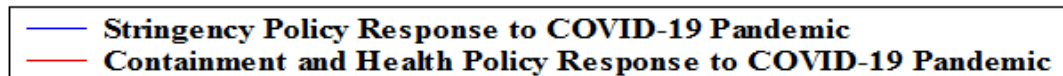
— Total COVID-19 Confirmed Cases  
 — Total COVID-19 Confirmed Deaths

**Figure 6**  
**TOTAL COVID-19 CONFIRMED CASES AND DEATHS**





**Figure 7: Government Policy Response to COVID-19 Pandemic**



**Figure 7**  
**GOVERNMENT POLICY RESPONSE TO COVID-19 PANDEMIC**

Variables	CONSMAR	BANKSR	OANDGR	FBR	INSR	TCR	TDR	SIR	CHIR	Exchange rate
CONSMAR	1.000									
BANKSR	0.948*	1.000								
OANDGR	0.186*	0.103	1.000							
FBR	0.564*	0.364*	0.203*	1.000						
INSR	0.327*	0.345*	0.166*	0.190*	1.000					
TCR	-0.347*	-0.365*	-0.034	-0.192*	-0.094	1.000				
TDR	0.011	0.005	-0.138	0.075	0.052	0.737*	1.000			
SIR	-0.116	-0.076	0.061	-0.125	-0.058	0.426*	-0.016	1.000		
CHIR	-0.214*	-0.180*	0.014	-0.134	-0.185*	0.466*	0.008	0.806*	1.000	
Exchange rate	-0.207*	-0.223*	-0.025	-0.145*	-0.087	0.578*	-0.021	0.264*	0.209*	1.000

Note: CONSMAR, BANKSR, OANDGR, FBR and INSR denote the stock market returns in the consumer goods, banking, oil & gas, food/beverages and insurance sectors respectively. TCR, TDR, represent growth in COVID-19 cases and deaths, while SIR, CHIR, denote stringency index and containment & health index. \* shows significance at the 0.05 level.

Further, to avoid spurious regressions and for purposes of robustness, we investigate the stationarity of the dependent and explanatory variables by applying two conventional unit root tests – Phillips-Perron (PP) and the Augmented Dickey-Fuller (ADF) tests. The ADF and PP tests for unit root results are displayed in (Table 3). As evident in Table 3, both conventional unit root test (ADF & PP) results show a rejection of the null hypothesis of unit root at the 1% level

of significant. Thus, either with constant, with constant & trend or without constant & trend, all our series are integrated of order zero (i.e. I(0)).

<b>Table 3</b>											
<b>UNIT ROOT TEST RESULTS</b>											
<b>Phillip-Perron at Level</b>											
		CONSMAR	BANKSR	OANDGR	FBR	INSR	TCR	TD R	SIR	CHIR	Exchange rate
With Constant	t-Statistic	-10.534	-11.762	-12.526	10.243	-17.768	-12.083	-14.052	-14.059	-12.146	-17.449
		***	***	***	***	***	***	***	***	***	***
With Constant & Trend	t-Statistic	-10.756	-11.734	-12.548	10.551	-18.086	-12.891	-14.870	-14.305	-12.732	-17.469
		***	***	***	***	***	***	***	***	***	***
Without Constant & Trend	t-Statistic	-10.557	-11.790	-12.530	10.265	-17.734	-11.107	-13.336	-13.969	-11.993	-17.354
		***	***	***	***	***	***	***	***	***	***
<b>At First Difference</b>											
		D(CONSMAR)	D(BANKSR)	D(OANDGR)	D(FBR)	D(INSR)	D(TCR)	D(TDR)	D(SIR)	D(CHIR)	D(Exchange rate)
With Constant	t-Statistic	-57.508	-68.453	-62.851	65.916	-219.597	-140.623	-57.655	-147.566	-100.403	-269.169
		***	***	***	***	***	***	***	***	***	***
With Constant & Trend	t-Statistic	-57.543	-68.491	-62.618	65.768	-236.637	-145.900	-57.130	-145.442	-98.568	-270.748
		***	***	***	***	***	***	***	***	***	***
Without Constant & Trend	t-Statistic	-57.883	-68.884	-63.041	66.569	-225.877	-141.630	-57.880	-148.026	-100.742	-269.855
		***	***	***	***	***	***	***	***	***	***
<b>Augment Dickey-Fuller at Level</b>											
		CONSMAR	BANKSR	OANDGR	FBR	INSR	TCR	TD R	SIR	CHIR	Exchange rate
With Constant	t-Statistic	-10.585	-11.876	-12.496	10.094	-17.823	-2.985	-3.394	-6.051	-12.142	-17.416
		***	***	***	***	***	**	**	***	***	***
With Constant & Trend	t-Statistic	-10.807	-11.975	-12.558	10.567	-17.970	-2.925	-2.358	-6.444	-12.775	-17.407
		***	***	***	***	***	n0	n0	***	***	***
Without Constant & Trend	t-Statistic	-10.608	-11.903	-12.497	10.116	-17.790	-3.312	-4.068	-5.935	-11.923	-17.350
		***	***	***	***	***	***	***	***	***	***
<b>At First Difference</b>											
		D(CONSMAR)	D(BANKSR)	D(OANDGR)	D(FBR)	D(INSR)	D(TCR)	D(TDR)	D(SIR)	D(CHIR)	D(Exchange rate)
With Constant	t-Statistic	-10.647	-11.396	-10.485	-	-	-	-	-	-	-11.652

	Statistic				10.762	11.628	8.796	18.018	10.824	11.687	
		***	***	***	***	***	***	***	***	***	***
With Constant & Trend	t-Statistic	-10.625	-11.372	-10.464	-10.737	-11.600	-8.788	-10.939	-10.838	-11.758	-11.624
		***	***	***	***	***	***	***	***	***	***
Without Constant & Trend	t-Statistic	-10.671	-11.419	-10.509	-10.787	-11.657	-8.697	-18.040	-10.832	-11.671	-11.679
		***	***	***	***	***	***	***	***	***	***

Notes: CONSMAR, BANKSR, OANDGR, FBR and INSR denote the stock market returns in the consumer goods, banking, oil & gas, food/beverages and insurance sectors respectively. TCR, TDR, represent growth in COVID-19 cases and deaths, while SIR, CHIR, denote stringency index and containment & health index. (\*) Significant at the 10%; (\*\*) Significant at the 5%; (\*\*\*) Significant at the 1%, and (no) Not Significant. \*MacKinnon (1996) one-sided *p-values*.

## Empirical Analysis and Discussions

**OLS regression results:** The OLS results are presented in Table 4. The results are presented in five models for the five sampled stock market sectors. Beginning with the COVID-19 indicators, our results show that the growth in COVID-19 cases has negative impact on all the sectors, but statistically significant only in the banking and consumer goods sectors at 5% respectively. In terms of magnitude, the effect appears to be stronger on the banking sector, followed by the consumer goods sector. On the other hand, the growth in COVID-19 deaths has positive and insignificant impact on all sectors, except for the Oil & Gas sector. Further, in the cases of government policy responses, we find that the increase in stringency policy exerts negative impact on all sectors with the exception of the Oil & Gas sector. This impact is statistically significant at 1% for the food/beverages sector, 5% for the oil & gas sector and 10% for the insurance sector. Similarly, the rise in government containment and health policy also has negative impact on all the sectors except for the oil & gas sector. However, the effect is significant at 1% for the consumer goods sector, 5% for the food/beverages sector and 10% for the banking sector.

	Consumer goods	Banking	Oil & Gas	Food/beverages	Insurance
Growth in COVID-19 cases	-0.044** (0.018)	-0.066** (0.026)	-0.003 (0.007)	-0.017 (0.010)	-0.005 (0.010)
Growth in COVID-19 deaths	0.001 (0.011)	0.001 (0.018)	-0.017 (0.016)	0.010 (0.006)	0.006 (0.009)
Stringency index	-0.014 (0.011)	-0.006 (0.018)	0.011** (0.005)	-0.018*** (0.006)	-0.006* (0.004)
Containment and health index	-0.043*** (0.016)	-0.049* (0.027)	0.003 (0.008)	-0.023** (0.009)	-0.032 (0.021)
TCSIR	-0.027* (0.015)	-0.038 (0.024)	0.001 (0.005)	-0.015** (0.006)	-0.004 (0.006)
TDSIR	-0.003 (0.011)	-0.005 (0.018)	-0.012 (0.016)	0.005 (0.006)	0.005 (0.008)
TCCHIR	-0.034** (0.016)	-0.048* (0.025)	0.001 (0.006)	-0.016** (0.008)	-0.004 (0.007)

TDCHIR	-0.002	-0.004	-0.013	0.006	0.005
	(0.011)	(0.018)	(0.016)	(0.006)	(0.008)
Exchange rate	-0.140***	-0.204***	0.165**	-0.150***	-0.256***
	(0.033)	(0.040)	(0.070)	(0.024)	(0.073)

Note: TCSIR, TDSIR denote interaction terms between COVID-19 cases and stringency index and COVID-19 deaths and stringency index, while TCCHIR, TDCHIR represent the interaction terms between COVID-19 cases and containment & health and COVID-19 deaths and containment & health policy. Standard errors are in parenthesis. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Furthermore, we introduced interaction terms between COVID-19 indicators and government policy responses. Our results show that the interaction between COVID-19 cases and stringency policy has negative impact on all sectors except the oil & gas sector, and it is statistically significant at 5% and 10% only for the food/beverages and consumer goods sectors respectively. On the other hand, the interaction between COVID-19 deaths and stringency policy shows negative impact for the consumer goods, banking and oil & gas sectors respectively, and positive effect on the food/beverages and insurance sectors. The effect is however insignificant in all the sectors. In addition, the effect of the interaction term between COVID-19 cases and containment & health policy on stock markets is qualitatively the same to its impact without interaction, which is negative and significant for the consumer goods sector, banking sector and food/beverages sector, whereas it is positive and insignificant for the oil & gas sector. Finally, we examined the effect of exchange rate on stock market returns and our results show that exchange rate has high significant impact on these sectors. The impact is negative and significant at 1% for the consumer goods, banking, food/beverages and insurance sectors, but it is positive and significant at 5% for the oil & gas sectors.

## The Quantile Regression

The quantile regression estimates for the Nigerian stock market returns for five sectors are displayed in Table 5. Based on extant studies on quantile regression, we reported the estimated results for seven quantiles from 0.05 to 0.95 with consideration of the domestic and global COVID-19 pandemic, and government stringency, containment and health policies. To ascertain the channel through which government policies impact stock market returns, we introduced interaction terms between COVID-19 cases and stringency policy; COVID-19 deaths and stringency policy; COVID-19 cases and containment policy; and COVID-19 deaths and containment policy. Further, we generated the standard errors by using a set of Buchinsky (1995) bootstrap technique, reported in Table 5. Also, the results of all the quantiles and conditioning series for the five sectors are graphically illustrated in Figure 8.

	<b>Consumer goods</b>	<b>Banking</b>	<b>Oil &amp; Gas</b>	<b>Food/beverages</b>	<b>Insurance</b>
<b>COVID-19 CASES</b>					
q5:tr	-0.093**	-0.139**	0.020	-0.027	-0.012
	(0.044)	(0.059)	(0.056)	(0.050)	(0.019)
q10:tr	-0.043	-0.060	0.004	-0.046	-0.008
	(0.039)	(0.055)	(0.040)	(0.028)	(0.021)
q25:tr	-0.045**	-0.077**	-0.005	-0.018	0.000
	(0.022)	(0.035)	(0.007)	(0.020)	(0.018)
q50:tr	-0.027	-0.045	-0.000	-0.011	-0.009
	(0.022)	(0.034)	(0.006)	(0.011)	(0.016)
q75:tr	-0.012	-0.017	0.005	-0.002	0.000

	(0.019)	(0.048)	(0.009)	(0.015)	(0.017)
q90:tcr	-0.022	0.013	-0.012	0.009	-0.009
	(0.059)	(0.048)	(0.012)	(0.038)	(0.012)
q95:tcr	0.024	0.003	-0.005	-0.012	-0.016
	(0.063)	(0.068)	(0.014)	(0.059)	(0.013)
<b>COVID-19 DEATHS</b>					
q5:tdr	0.005	-0.013	-0.034	-0.000	0.002
	(0.046)	(0.071)	(0.052)	(0.046)	(0.021)
q10:tdr	0.001	-0.023	-0.044	0.019	-0.006
	(0.017)	(0.029)	(0.046)	(0.041)	(0.022)
q25:tdr	-0.015	-0.014	-0.016	0.009	0.007
	(0.016)	(0.034)	(0.025)	(0.015)	(0.016)
q50:tdr	-0.009	0.028	0.000	0.006	-0.007
	(0.018)	(0.032)	(0.016)	(0.009)	(0.017)
q75:tdr	-0.000	0.013	0.006	0.023	0.010
	(0.031)	(0.037)	(0.012)	(0.035)	(0.011)
q90:tdr	0.033	0.022	0.000	0.043	0.003
	(0.044)	(0.039)	(0.011)	(0.058)	(0.008)
q95:tdr	0.019	0.009	-0.013	0.006	-0.007
	(0.046)	(0.046)	(0.025)	(0.097)	(0.010)
<b>STRINGENCY POLICY</b>					
5q. sir	0.019	0.022	0.034	-0.173	0.018
	(0.076)	(0.125)	(0.032)	(0.121)	(0.022)
q10:sir	-0.006	-0.019	0.022	0.002	0.012
	(0.041)	(0.082)	(0.014)	(0.077)	(0.021)
q25:sir	-0.015	-0.006	0.011**	-0.014	-0.002
	(0.016)	(0.042)	(0.006)	(0.021)	(0.034)
q50:sir	-0.024	-0.017	0.005	-0.019	-0.013
	(0.020)	(0.032)	(0.008)	(0.025)	(0.019)
q75:sir	-0.004	0.009	0.007	-0.011	-0.019
	(0.021)	(0.026)	(0.011)	(0.024)	(0.028)
q90:sir	-0.020	-0.014	0.011	-0.029	-0.031
	(0.036)	(0.086)	(0.011)	(0.032)	(0.030)
q95:sir	-0.030	-0.028	-0.001	-0.044	-0.038
	(0.064)	(0.117)	(0.014)	(0.051)	(0.031)
<b>CONTAINMENT AND HEALTH POLICY</b>					
q5:chir	-0.034	-0.040	0.015	0.015	-0.063
	(0.038)	(0.051)	(0.028)	(0.133)	(0.048)
q10:chir	-0.058**	-0.072**	0.000	-0.005	-0.072
	(0.025)	(0.034)	(0.016)	(0.073)	(0.048)
q25:chir	-0.071***	-0.107***	-0.012	-0.026*	-0.004
	(0.024)	(0.041)	(0.013)	(0.014)	(0.044)
q50:chir	-0.041	-0.017	0.005	-0.025*	-0.020
	(0.026)	(0.058)	(0.014)	(0.013)	(0.025)
q75:chir	-0.037	-0.037	0.012	-0.011	-0.019
	(0.026)	(0.047)	(0.018)	(0.013)	(0.028)
q90:chir	-0.038	-0.027	0.013	-0.029	-0.031
	(0.035)	(0.097)	(0.016)	(0.019)	(0.025)
q95:chir	-0.057	-0.052	-0.001	-0.044	-0.039
	(0.044)	(0.150)	(0.019)	(0.077)	(0.030)
<b>COVID-19 CASES*STRINGENCY POLICY</b>					
q5:tcsir	-0.093**	-0.139**	0.020	-0.027	-0.011
	(0.041)	(0.059)	(0.051)	(0.039)	(0.012)
q10:tcsir	-0.043	-0.057	0.004	-0.046*	-0.007
	(0.039)	(0.055)	(0.026)	(0.025)	(0.014)
q25:tcsir	-0.030*	-0.048*	0.004	-0.010	-0.002
	(0.016)	(0.028)	(0.006)	(0.010)	(0.012)
q50:tcsir	-0.021	-0.037	-0.000	-0.011*	-0.009
	(0.016)	(0.028)	(0.005)	(0.005)	(0.008)

q75:tcsir	-0.004	0.004	0.004	-0.015	0.000
	(0.016)	(0.030)	(0.007)	(0.012)	(0.011)
q90:tcsir	-0.016	-0.010	0.001	-0.026	-0.009
	(0.035)	(0.040)	(0.007)	(0.025)	(0.011)
q95:tcsir	0.024	0.003	-0.002	-0.012	-0.015*
	(0.038)	(0.052)	(0.009)	(0.043)	(0.008)
<b>COVID-19 DEATHS*STRINGENCY POLICY</b>					
q5:tdsir	-0.006	-0.016	-0.034	-0.000	0.002
	(0.023)	(0.080)	(0.038)	(0.060)	(0.020)
q10:tdsir	-0.014	-0.036*	-0.044	0.007	0.024
	(0.012)	(0.020)	(0.030)	(0.028)	(0.019)
q25:tdsir	-0.016	-0.026	-0.003	0.008	0.007
	(0.014)	(0.032)	(0.025)	(0.009)	(0.012)
q50:tdsir	-0.010	0.005	0.000	0.006	-0.011
	(0.017)	(0.028)	(0.014)	(0.007)	(0.016)
q75:tdsir	-0.000	0.013	0.020*	0.012	0.010
	(0.029)	(0.034)	(0.012)	(0.013)	(0.011)
q90:tdsir	0.030	0.022	0.000	0.002	0.003
	(0.033)	(0.046)	(0.011)	(0.044)	(0.010)
q95:tdsir	0.019	0.041	-0.005	0.006	-0.007
	(0.039)	(0.064)	(0.017)	(0.069)	(0.012)
<b>COVID-19 CASES*CONTAINMENT AND HEALTH POLICY</b>					
q5. tcchir	-0.093**	-0.139**	0.020	-0.027	-0.011
	(0.039)	(0.063)	(0.054)	(0.040)	(0.015)
q10:tcchir	-0.043	-0.060	0.004	-0.046**	-0.007
	(0.042)	(0.057)	(0.030)	(0.023)	(0.016)
q25:tcchir	-0.032	-0.077***	-0.001	-0.015	0.000
	(0.022)	(0.030)	(0.006)	(0.014)	(0.013)
q50:tcchir	-0.023	-0.039	-0.000	-0.011	-0.011
	(0.016)	(0.029)	(0.005)	(0.007)	(0.011)
q75:tcchir	-0.009	0.006	0.006	-0.009	0.000
	(0.012)	(0.036)	(0.007)	(0.014)	(0.013)
q90:tcchir	-0.023	-0.010	0.001	-0.025	-0.009
	(0.040)	(0.043)	(0.009)	(0.031)	(0.012)
q95:tcchir	0.024	0.003	-0.003	-0.012	-0.016
	(0.046)	(0.056)	(0.010)	(0.046)	(0.010)
<b>COVID-19 DEATHS*CONTAINMENT POLICY</b>					
q5:tdchir	-0.008	-0.016	-0.034	-0.000	0.002
	(0.037)	(0.083)	(0.041)	(0.057)	(0.019)
q10:tdchir	-0.014	-0.043*	-0.044	0.008	0.027
	(0.013)	(0.025)	(0.027)	(0.033)	(0.018)
q25:tdchir	-0.015	-0.015	-0.003	0.007	0.008
	(0.013)	(0.035)	(0.026)	(0.010)	(0.012)
q50:tdchir	-0.010	0.018	0.000	0.006	-0.011
	(0.015)	(0.030)	(0.014)	(0.008)	(0.016)
q75:tdchir	-0.000	0.013	0.013	0.012	0.010
	(0.031)	(0.030)	(0.012)	(0.018)	(0.011)
q90:tdchir	0.030	0.022	0.000	0.002	0.003
	(0.040)	(0.052)	(0.014)	(0.047)	(0.009)
q95:tdchir	0.019	0.041	-0.006	0.006	-0.007
	(0.045)	(0.059)	(0.023)	(0.075)	(0.010)

Note: Standard errors are in parenthesis; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

### Arrangement and scale of dependence between the sectors and COVID-19 reported cases and deaths

Panel A, Table 5 provides the results between COVID-19 related cases and stock market

returns for the five sectors. The impact of the current global pandemic as denoted by the COVID-19 confirmed cases is negative and significant for the lower quantile (0.05) and around the middle quantile (0.25), while it has no effect in the upper quantiles, for both the consumer goods and banking sectors. The correlation between the consumer goods and banking and COVID-19 cases diminishes as we progress from the 0.05 quantile to the 0.25 quantile, which denotes that the dependence decreases as one moves from the bearish market to the normal market and vice versa. Thus, the consumer goods sector, banking sector and COVID-19 cases show nonlinear co-movement as the strength of dependence increases when the markets are bearish (0.05), however, the strength of dependence diminishes as the markets become normal (0.25). Further, it is worthy to note that the growth in COVID-19 cases does not affect the consumer goods and banking sectors' stock market returns during periods of severely deteriorating conditions (i.e. 0.10 quantile) and from the 50<sup>th</sup> quantile to the 0.95 quantile and above (i.e. the bullish markets). Conversely, considering the other remaining sectors (oil & gas, food/beverages and tobacco and insurance), growth in COVID-19 related cases does not have any significant effect on their stock returns, whether at the extreme bearish markets (5<sup>th</sup> quantile and lower), harshly decline markets (10<sup>th</sup> quantile), normal market activities (25<sup>th</sup> to 75<sup>th</sup>) or during the extreme upper quantile or bullish markets (90<sup>th</sup> to 95<sup>th</sup> and higher).

Further, Panel B, Table 5 displays the results for the growth in COVID-19 reported deaths. The structure of dependence is insignificant in all the sectors with the growth in COVID-19 deaths for all quantiles – from the 5<sup>th</sup> to the 95<sup>th</sup>. Generally, this result portends is the lack of signal of co-movement between the Nigerian sectoral stock market returns and the growth in COVID-19 related deaths. In spite of the fact that the COVID-19 pandemic decreased stock return co-movement through the financial markets, the co-movement of the sectoral stock market with the growth in COVID-19 deaths is still unchanged from the time when the Coronavirus was discovered and declared a global pandemic.

### **Arrangement and scale of dependence between the sectors and stringency policy**

The estimation results for the government stringency policy and the sectoral stock returns are displayed in Panel C Table 5. As indicated, the estimated results show the same outcomes as for the case of the growth in COVID-19 related fatalities in all sectors, with the exception of the oil & gas sector. Our results reveal a non-significant dependence structure with the government stringency for all quantiles from 0.05 to 0.95 for the consumer goods sector, banking sector, food/beverages and tobacco sector, and insurance sector. This indicates that these sectors and COVID-19 related fatalities do not exhibit evidence of having either lower tail dependence, normal market dependence or upper tail dependence. However, in the case of the oil & gas sector, we found a positive and significant dependence structure with the government stringency policy around the intermediate market activities (i.e. about the 25<sup>th</sup> quantile). This confirms that the effect of the activities in the government gains strengths in the transitional quantile (0.25). Though, the dependence structure is still unchanged at the lower extreme and upper extremes. A possible reason for this positive outcome could be as a result of increased investments in the upstream and downstream sectors of the oil & gas industry. For example, the China National Offshore Oil Corporation added a \$3 billion US dollar to the available \$14 billion US dollar invested in the oil and gas operations in Nigeria, which is projected that the oil field will peak at about 200,000 bbls/day (Research and Markets, 2020).

### **Structure of dependence between sectors and containment & health policy**

The results for the dependence structure between the sectoral stock returns and containment and health policy are presented in Panel D, Table 5. The effect of containment and health policy on the Nigerian sectoral stock returns is negative and significant only for the severely decline quantile and intermediate quantile in the cases of both the consumer goods sector and the banking sector, but insignificant in the lower extreme quantile (0.05 and below), higher-middle quantiles (50<sup>th</sup> and 75<sup>th</sup>) and upper extreme quantiles (90<sup>th</sup>, 95<sup>th</sup> and greater). In both the cases of consumer goods and banking sectors, the impact appears to intensify as we move from the 10<sup>th</sup> quantile to the 25<sup>th</sup> quantile. Therefore, the dependence structures are nonlinear, with dependence in the harshly decline quantile (0.10) and intermediate quantile (0.25), but independent in the extreme upper tail and extreme lower tail. In the same vein, when we consider the food/beverages and tobacco sector, the impact of the containment and health policy is negative and significant for the intermediate quantile (25<sup>th</sup> and 50<sup>th</sup> quantiles) only, and the strength of the co-movement being the same. Hence, it is evident that the results for the food/beverages and tobacco sector exhibit an intermediate dependence; however, it is independence at the extreme lower tail and upper tail. That is, the dependence structure fluctuates with the advent of the COVID-19 pandemic, but remain almost monotonic in their sizes in the two quantiles (25<sup>th</sup> and 50<sup>th</sup>). Government containment policy has no effect on the fluctuations of the oil & gas sector and the insurance sector. The results show that there are extreme lower tail independence, intermediate independence and extreme greater tail independence.

### **Structure of dependence between sectors and interaction terms (COVID-19 cases, deaths & stringency policy)**

The dependence structure results for the sectors' stock returns and the interaction term between COVID-19 cases and government stringency policy are displayed in Panel E, Table 5. The impact of the interaction term on the consumer goods stock returns and banking stock returns is insignificant for every quantiles, with the exclusion of the 5<sup>th</sup> and 25<sup>th</sup> quantiles for both sectors, which are negative and significant. Therefore, we conclude that the interaction term of COVID-19 cases and stringency has extreme lower tail and intermediate dependence in the consumer goods and banking sectors, but the impact has independence in the harshly decline period (0.1) and from the 50<sup>th</sup> quantile to the extreme upper tail quantile (0.95). In addition, similar to the COVID-19 cases in Panel A, the effect of the interaction term loses its intensity as we move from the 5<sup>th</sup> quantile to the 25<sup>th</sup> quantile in both sectors. Further, when we consider the food/beverages and tobacco, and insurance sectors, the results show a negligible impact of the interaction term between COVID-19 cases and stringency on their stock returns for all quantiles, with the exception of the 10<sup>th</sup> and 50<sup>th</sup> quantiles for food/beverages and tobacco, and the 95<sup>th</sup> quantile for the insurance sector, with negative relationship. Therefore, this exhibits independence at the tails, indicating that the bearish and bullish markets activities in terms of the interaction term between COVID-19 cases and stringency have no effect on the food/beverages and tobacco sector's stock returns, whereas the bearish to the normal market activities of the interaction term have no impact on the insurance sector's stock returns. Hence, higher correlation between the interaction term and the consumer goods, banking, food/beverages and tobacco, and insurance sectors is detected at the lower and intermediate, severely decline and intermediate, and upper quantiles in those four sectors. Conversely, the interaction term between COVID-19



cases and government stringency have no effect on the distribution of the oil & gas sector's stock returns. In addition, Panel F, Table 5 reveals that results for the sectors' stock returns and the interaction term between COVID-19 deaths and government stringency. Our results show that the impact of this interaction term is only negative and significant for the 10<sup>th</sup> quantile in the case of the banking sector, and positive and significant for the 75<sup>th</sup> quantile in the case of oil & gas sector. This underlines the fact that government stringency through COVID-19 deaths does not have general impact across the sectors' stock returns. It does not show any significant effect on the stock returns of these sectors, except for the banking sector at the harshly decline quantile (0.1) and for the oil & gas sector at the intermediate quantile (0.75).

### **Structure of dependence between sectors and interaction terms (cases and deaths & containment and health policy)**

Panel G shows the results for the interaction term between COVID-19 cases and containment and health policy. The results exhibit heterogeneous effect of the interaction term on these sectors. It has a negative and significant effect on the consumer goods sector at the lower quartile (0.05); lower and intermediate (0.05, 0.25) quantiles for the banking sector, and the severely decline quantile (0.10) for the food/beverages and tobacco sector. Hence, these results underscore the significance of apprehension and panic when the market is bearish. Nevertheless, the impact is irrelevant for the intermediate and greater quantiles for the consumer goods and food/beverages and tobacco sectors, and insignificant for the upper quantile in the case of the banking sector. However, our results do not show evidence of significant impact of the interaction term on the stock returns of the oil & gas and insurance sectors, suggesting that panic and uncertainty do not get spread to those sectors in the bearish, normal and bullish periods. Further, the impact of the interaction term between COVID-19 deaths, and containment and health policy is exhibited in Panel H. Similar to the results of the COVID-19 reported deaths, the interaction term between COVID-19 deaths, and containment and health policy has no significant dependence across the different quantiles for each of the sectors, except for the banking sector where the effect of the interaction term is negative and significant for harshly decline quantile (0.1). This means that government containment and health policy through COVID-19 related deaths does not have strong impact on the stock markets in Nigeria.

Overall, our results establish the dependence between the Nigerian sectors' stock returns and COVID-19 related cases, deaths, and government stringency, and containment and health policy. This dependence exists; it is nonlinear and left-tailed. However, the impact appears to be stronger from COVID-19 confirmed cases, and containment & health policy than from its deaths and government stringency policy. Structure of dependence is predominantly stronger in the bear markets or in recessions and is significantly negative at the extreme lower and intermediate quantiles. COVID-19 cases and stringency and containment and health policies move in opposite direction to these sectors' stock returns. As Coronavirus cases surge, stock prices decline. Our findings are consistent with prior findings documented in Baur, Dimpfl and Jung (2012), who reported the reaction of stock markets to macroeconomic events when in a bearish period. Also, recently in Corbet, Hou, Hu, Lucey and Oxley (2020), Corbet, Larkin & Lucey (2020) and Cepoi (2020), which recommends the thorough utilization of the appropriate channels of communication to curtail the economic crisis caused by COVID-19. Moreover, structure of dependence fluctuates in a nonlinear fashion and is dissimilar across sectors and quantiles. Finally, we summarized the empirical results for the five sectors in Table 6. Overall and relative to the proxies for COVID-19 pandemic and government stringency, and containment and health

policies, the oil & gas, the food/beverages and tobacco, and insurance sectors are not affected by the COVID-19 pandemic, with the exception of the interaction term between the growth in COVID-19 cases and government stringency in the case of the insurance sector. Only stringency and the interaction term between the growth in COVID-19 deaths and stringency affected the oil & gas sector's stock returns. Lastly, the food/beverages and tobacco sector is only impacted by government containment and health policy, the interaction terms between COVID-19 cases and stringency, and containment and health policies. In comparison, the OLS results displayed in Table 4 and the quantile regression results presented in Table 5 are qualitatively similar with the relevant estimates retaining their statistical significance and directions.

	Consumer			Banking			Oil & Gas			Food/beverages			insurance		
	L	I	U	L	I	U	L	I	U	L	I	U	L	I	U
COVID-19 cases	-		NS			NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
COVID-19 deaths	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS	INS
Stringency policy	INS	INS	INS	INS	INS	INS	INS	+	INS	INS	INS	INS	INS	INS	INS
Containment and health policy	-		NS			NS	NS	NS	NS	NS	-	NS	NS	NS	NS
Case*Stringency policy	-		INS			INS	INS	INS	INS	-		INS	INS	INS	-
Deaths*Stringency policy	INS	INS	INS		INS	INS	INS		INS	INS	INS	INS	INS	INS	INS
Case*Containment & health policy	-	INS	INS			INS	INS	INS	INS	-	INS	INS	INS	INS	INS
Deaths*Containment & health policy	NS	NS	NS		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

*Notes:* 1. low quantile, intermediate quantile and upper quantile are denoted by L, I and U, respectively. 2. INS stands for insignificant dependence and + and - signs designates when the effect has a significant positive and negative statistical co-movement. 3. Variables are COVID-19 reported cases and deaths, government stringency policy and containment & health policy. 4. Others are the interaction terms between COVID-19 cases, deaths and stringency policy and containment and health policy.

*Source:* authors' compilation.

The coefficients of the dynamic trace of quantile regression for the key variables and sectors. The vertical axes indicate coefficient estimates of variables over the stock returns distribution, whereas the horizontal axes depict the quantiles of the dependent variable. Finally, quantile regression error bars correspond to bootstrapped 95% confidence intervals (200 bootstrap replications).

## CONCLUDING REMARKS

It is of enormous significance for investors in the financial markets to model the dependence between the COVID-19 pandemic and stock markets in developing economies, especially the sectors of the Nigerian stock exchange, because the findings from such an exercise will provide informed investment choices. As documented in prior studies, the performance of

the stock market can be influenced considerably by the fundamental adjustments of the aggregate macroeconomic changes, the business cycles and the risk elements. For instance, conclude that there is a tenure premium in the expectation of proceeds from long term investments such as ordinary shares and bonds, which are linked to business circumstances. Hence, every financier operating globally in the stock markets pay keen attention to the events occurring in the entire economy. Eventually, it has become imperative to appreciate the structure of dependence of the capital markets on the outbreak of the COVID-19 pandemic.

Recently, research interest has progressively examined the effect of the novel Coronavirus on stock markets in different regions. Nonetheless, much has not been done on underdeveloped and emerging economies, particularly in Africa. Emerging markets are becoming key players in international development. Also, there is dearth of studies examining the effect of the global COVID-19 pandemic, government policy on the Nigerian stock market.

Therefore, this study adds to the growing literature by evaluating the dependence structure between COVID-19, government policies and the Nigerian stock market across different sectors and diverse quantiles. We employed a quantile regression approach for five sectors on the Nigerian stock exchange, including consumer goods, banking, oil & gas, food/beverages and tobacco, and insurance, spanning from 2 January 2020 to 24 November 2020.

Our results indicate differing outcomes from sector to sector of the degree and structure of dependence, suggesting that investors and policy makers need to respond uniquely, depending on the sector of interest. The quantile regression helps to distinguish the structure and degree of dependence, and the dependence between the COVID-19 pandemic and the Nigerian sectoral stock market returns all over the response variable's conditional distribution.

We found that the structure of dependence is significantly negative and occurs majorly at the extreme lower and intermediate quantiles for each sector and are stronger when the growth in COVID-19 reported cases and government containment policy indicators are considered. Hence, sectoral stock returns decrease as the COVID-19 cases surge and as government introduces containment and health policies. However, the impact is prone to occur only in a recession across sectors. Dependence in the course of bearish markets is an indication of decreased prospects in the diversification of investments. The existence of extreme lower tail and intermediate dependence is important for decision makers to minimize variations in the stock market. It is important to evaluate the dependence of the sectors' stock market policy needs sector by sector. Finally, we recommend hedging as an essential tool during financial tumult.

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