Impact of Coronavirus Pandemic on the Global Economy: Demand and Supply Shocks

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Abstract

This paper examines the dynamic effects of coronavirus pandemic on the global economy by pitching its searchlights on the demand and supply shocks. The study employed Vector Autoregression (VAR) technique and Granger causality test; the Granger causality test revealed that COVID-19 pandemic does not trigger change in regional stock markets and commodity prices within these regions; except for the price of natural gas which changed as a result of the COVID-19 pandemic in Europe. Besides the EURONEXT market in Eastern Mediterranean region, the impulse response shows that other regional stock markets responded positively to shocks in daily report of COVID-19 confirmed cases. The study concludes that within the study period, the HSBC's stock index was the worst-hit. Economies must embrace aggressive efforts at developing COVID-19 vaccine as well as coordinated policy measures at increasing the stock market pause above 15 minutes whenever stock prices fall below the lower bound threshold.

Key words: Coronavirus Pandemic; Global Economic; Demand and Supply Shock
J.E.L. classification: G01, G02, E30

1. Introduction

The alarming rate at which the novel COVID-19 disease is spreading and ravaging lives all over the globe has continued to send panic and anxiety to the government in different nations of the world, especially at this point when the permanent cure of the virus remains a pipe dream. The virus has spread to over 200 countries with well over 3.7million confirmed cases and 259,380 fatalities globally as at 6th of May, 2020 (Scooper, 2020). The outbreak of the virus was a sudden hit as the global economy is battling financial fragilities since the 2008/09 global financial crisis. Few years before the COVID-19 outbreak, the economy world outlook has been fragile as most countries are recovering from the recent global economic crisis. World Bank due to the sluggish recovering of the global economy, estimated global GDP growth to be 2.5% in 2020 a little upshot from 2.4% in the previous year. Unfortunately, the global lockdown measure as a result of the public health emergency caused by COVID-19 has brought about significant economic shock, which cuts across all sectors of the economy. The consequential effect of this will result in a global recession that will further repress the world economy to below 2.5%, being the global recessionary threshold (United Nations Conference on Trade and Development, (UNCTAD), 2020). This drop-in global growth will be witnessed through a noticeable fall in tourism, manufacturing output and services as a result of the tightening effects of lockdown across the globe (IMF, 2020). Unfortunately, Maital & Barzani (2020, p.12) emphasize that the major flaws in tackling the impending global shock dwell in the misapplication of interventions. For instance, the major effects

of the pandemic are on the supply-side, while the support and assistance are largely targeted on the demand side. Thus, global instruments and strategies aimed at revamping the supply-side deficiencies or shocks are limited. The international monetary fund (IMF) also envisages the pandemic will trigger a global recession which may be as bad as the global financial crisis of 2018-19 (Georgieva, 2020).

In a well-integrated world, the huge impact of COVID-19 beyond mortality and morbidity has become evident since the outbreak. As the reaction of the government, media, companies and individuals to the pandemic has resulted in a simultaneous shock in global demand and supply chain. This has eventually led to a decline in consumption (which damped demand globally), disrupted the supply chain and interrupted total production level globally. Consequently, this shock in global economic activities, though can be separated into the demand and supply-side; its combined effects include fall in GDP growth rate, exchange rate depreciation, rise in the inflation rate, rise in unemployment, wage slash, economic and social palliative measures, fall in interest rate (Ataguba, 2020, p.4). This has affected companies across the globe as they have shut down operations and this, in turn, is affecting so many people who are laid off due to the effect of the pandemic. Even though some developed nations have begun to ease the shutdown measures which has brought a ray of hope after weeks of rancorous gloom (El-Erian, 2020, p.27), the effect of the pandemic has practically changed both the consumers' pattern of consumption and the supply chain. The decline in consumption is as a result of panic of loss of jobs and low expectation of future income by the individual. Hence, the movement restriction did not only affect an individual's consumption level but also affected their income-generating capacity which in turn hampered their expenditure on consumption. The investors are not left out as the uncertainty that follows the pandemic and the negative profit outlook has made investors have held off from investment. More so, the most hit countries at this point, are the oil-exporting countries whose commodity prices have remained below 15 dollars per barrel due to a fall in the global demand of oil and limited market. This has exerted an excruciating effect on fiscal spending. The monies mapped out for development and poverty reduction in most developing nations are expended on health care facilities and building of isolation centers.

On the other hand, the impact of the supply chain disruptions has a ripple effect on the economy as countries will not be able to stimulate their economy due to a drop in the share price. A supply shock is an event that triggers a drastic fall in the supply of some essential raw materials or production input(s), hence, causing increased cost of production and sky-rocketing price of finished products. Also, reduce the supply of labor from unwell workers affects the global supply chain. The shutdown of companies and production activities has brought about a decline in the supply of goods and services and hence, triggered the increase in the price of goods. This has also resulted in disruption in the supply of components used for production to firms and this will result in higher cost of production for industries. Due to the shutdown as a result of COVID-19, companies cannot get their products to the market, hence, the major cause of inflation because the shortage in the supply of goods will bring about scarcity.

In light of the above, it is pertinent to note that the pandemic is likely going to result in the global recession and emerging countries will be hit more. Hence, policy measures should be put in place to ameliorate the global effect of the pandemic. This becomes expedient as copious studies within the same period have carefully highlighted the global impact of the pandemic with extensive evidence (Andayi *et al,* 2019, p.91; Hintzen, 2019,p. 1624; Olaniyi, 2020,p.5) as far as we know, studies have not examined the global economic shock of COVID-19 virus with particular reference to the demand and supply shock. Studies like Fornaro and Wolf, 2020; Faria e Castro (2020; have also dived into the macroeconomic issues around COVID-19 but have focused on the impact of COVID-19 on productivity and the effect of the pandemic on the utility of consumer respectively.

It is therefore expedient to note that studies on the global shock of COVID-19 pandemic is still budding, this avails us the opportunity to fill the most recent gap in the literature. Hence, the study aims to examine the impact of coronavirus pandemic on the global economy shock. Beyond the introduction, the next section of our paper is conceptual review which is followed by critical review of literature, methodology, presentation and discussion of results while the subsequent section contains conclusion and relevant policy prescriptions.

2. Literature review

The recent unwavering challenges posed by COVID-19 on the global economy have received copious of empirical studies directed towards expanding the understanding of the features, causes and impacts of the novel virus. The preponderance of these studies underlined certain preeminent factors like; socio-economic impacts (Olaniyi, 2020; Tang et al, 2020), transmission of infections and diffusion of shocks (Peckham, 2013), demand and supply of medical resources (Lal, 2020), systemic risks within the financial markets (Zhang, et al, 2020), climate factor (Altamimi & Ahmed, 2019; Tosepu et al., 2020), prevalence and control measures (Ceylan, 2020, Zhao et al, 2020), respiratory syndrome (Al-Raddadi et al, 2020), temperature (Briz-Redón & Serrano-Aroca, 2020), and mortality rates (Ferdinand & Nasser, 2020; Wang et al, 2020), among others.

The rhetoric and empirics surrounding the novel COVID-19 is awash in the literature but notwithstanding the foregoing, critical review of the extant literature revealed certain limitations of which three are outstanding. First, no existing intellectual exposition to the best of our knowledge that empirically examines the relation between COVID-19 pandemic and global economic shocks. Hence, empirical literature on this issue of context is still budding. Second, the research conducts a robust analysis and discourse on both the demand and supply-side shocks Third, as a result of the a-theoretical nature of the COVID-19 pandemic and global economic shock relation; the study is at the frontline of attempts at exploring beyond the utilization of simple descriptive analysis which most literature employed Hence, a Vector Autoregression (VAR) model, correlation test and a granger causality test were employed to examined the nexus between the COVID-19 pandemic and the global shock.

3. Research methodology

For us to examine the objectives stated earlier in our previous section, we identified the various measures of our global demand and supply variables. We proxied our measure of global economic activities using the stock index of major stock markets in each region. In Africa, we used the stock index of South Africa (SASI) and Nigeria stock exchange (NSESI) to proxy economic activities in Africa; we used the stock index of EURONEXT (EUSI) and the HSBC (HSBCSI) to proxy economic activities in Europe and the Eastern Mediterranean. We further used the stock index of NASDAQ (NADQSI) and New York stock exchange (NYSI) to proxy economic activities in Americas; we used the stock index of Hongkong (HGKSI) and Shanghai stock market (SHGSI) to proxy economic activities in Asia and then the stock index of Australia stock exchange (AUSI) was used to proxy economic activities in the West Pacific region.

The extent of COVID-19 pandemic outbreak for each region was measured using the daily Word Health Organisation report on COVID-19 confirmed cases for Africa (AFCC), Americas (AMCC), Asia (ASCC), East Mediterranean (EMCC), Europe (EUCC) and the West Pacific (WPCC). Then, the world prices were measured using the Brent crude oil price (COP), the gold prices (GOP) and natural gas prices (NGP).

To achieve our objective, we first conducted a descriptive statistic of the variables in concern; then we examined the correlation between the region's daily reported COVID-19 confirmed cases and their respective stock index of the top stock markets in the region. We also conducted a correlation test to examined the relationship between the region's daily reported COVID-19 confirmed cases and the world prices (crude oil price, gold price and natural gas price).

To further deepen our analysis, a granger causality test was conducted between the region's daily reported COVID-19 confirmed cases and their respective stock index of the top stock markets in the region and also amongst the world prices; this is to ascertain if the COVID-19 influenced global economic activities or otherwise.

Then, an impulse-response is graphed from a Vector Autoregression (VAR) model in order to understand the response of the region's stock market activities to shocks from COVID-19 cases as well as how the world prices responded to each region's daily COVID-19 cases. We thus specify a Vector Autoregression for each block in the region as:

$$AFCC_t = \beta_0 + \beta_1 \sum_{i=1}^{p} SASI_{t-i} + \beta_2 \sum_{i=1}^{p} NSESI_{t-i} + \beta_3 \sum_{i=1}^{p} COP_{t-i} + \beta_4 \sum_{i=1}^{p} GOP_{t-i} + \beta_5 \sum_{i=1}^{p} NGP_{t-i} + \mu_{1t} \quad (1)$$

$$AMCC_t = \chi_0 + \chi_1 \sum_{i=1}^{p} NADQSI_{t-i} + \chi_2 \sum_{i=1}^{p} NYSI_{t-i} + \chi_3 \sum_{i=1}^{p} COP_{t-i} + \chi_4 \sum_{i=1}^{p} GOP_{t-i} + \chi_5 \sum_{i=1}^{p} NGP_{t-i} + \mu_{2t} \quad (2)$$

$$ASCC_t = \psi_0 + \psi_1 \sum_{i=1}^{p} HGKSI_{t-i} + \psi_2 \sum_{i=1}^{p} SHGSI_{t-i} + \psi_3 \sum_{i=1}^{p} COP_{t-i} + \psi_4 \sum_{i=1}^{p} GOP_{t-i} + \psi_5 \sum_{i=1}^{p} NGP_{t-i} + \mu_{3t} \quad (3)$$

$$EMCC_t = \lambda_0 + \lambda_1 \sum_{i=1}^{p} HSBCSI_{t-i} + \lambda_2 \sum_{i=1}^{p} EUSI_{t-i} + \lambda_3 \sum_{i=1}^{p} COP_{t-i} + \lambda_4 \sum_{i=1}^{p} GOP_{t-i} + \lambda_5 \sum_{i=1}^{p} NGP_{t-i} + \mu_{4t} \quad (4)$$

$$EUCC_t = \gamma_0 + \gamma_1 \sum_{i=1}^{p} HSBCSI_{t-i} + \gamma_2 \sum_{i=1}^{p} EUSI_{t-i} + \gamma_3 \sum_{i=1}^{p} COP_{t-i} + \gamma_4 \sum_{i=1}^{p} GOP_{t-i} + \gamma_5 \sum_{i=1}^{p} NGP_{t-i} + \mu_{5t} \quad (5)$$

$$WPCC_t = \zeta_0 + \zeta_1 \sum_{i=1}^{p} AUSSI_{t-i} + \zeta_2 \sum_{i=1}^{p} COP_{t-i} + \zeta_3 \sum_{i=1}^{p} GOP_{t-i} + \zeta_4 \sum_{i=1}^{p} NGP_{t-i} + \mu_{6t} \quad (6)$$

We employed daily data spanning from January 1st 2020 till April 30th 2020 as all data were retrieved from the World Health Organisation, Macrotrends, Yahoo Finance, Investing.com, Nigeria stock exchange and Organization of the Petroleum Exporting Countries (OPEC). The measures of the data are presented below.

Table no. 1: Description of Variables

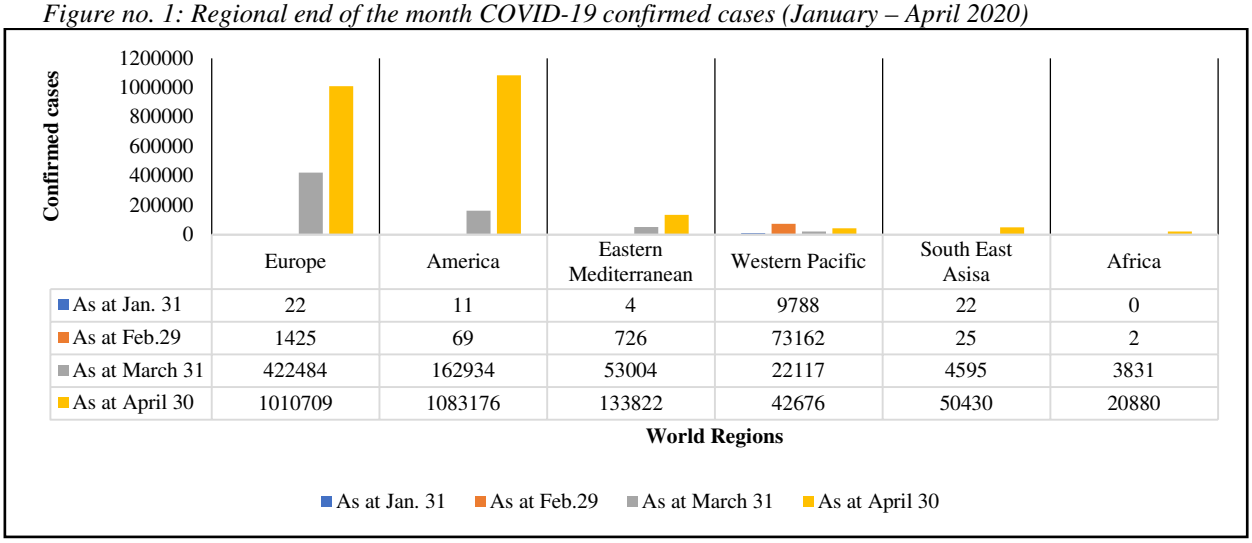
Variable	Description	Measures	Source
AFCC	Africa's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)
AMCC	America's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)
ASCC	Asia's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)
AUSSI	Stock index of Australia stock market	Australian dollar	Yahoo Finance
COP	Brent Crude oil Prices	US Dollars	OPEC (2020)
EMCC	East Mediterranean's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)
EUCC	Europe's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)
EUSI	Stock index of EURONEX stock market, Paris	Euro	Yahoo Finance
GOP	Gold prices	US Dollars	Macrotrends
HGKSI	Stock index of Hongkong stock market	Hong Kong dollar	Yahoo Finance
HSBCSI	Stock index of HSBC stock market	Chinese yuan	Yahoo Finance
NADQSI	Stock index of US NASDAQ stock market	US dollars	Yahoo Finance
NGP	Natural gas price	US Dollars	Macrotrends
NSESI	Stock index of Nigeria stock market	Naira	Investing.com
NYSI	Stock index of New York stock market	US dollars	Yahoo Finance
SASI	Stock index of South Africa stock market	South African rand	Investing.com
SHGSI	Stock index of Shanghai stock market	Chinese yuan	Yahoo Finance
WPCC	Africa's COVID-19 daily confirmed cases	No. of people infected	WHO (2020)

Source: Authors' contribution

4. Presentation and discussion of results

This section presents the results estimated based on the methods specified in the previous section. It then follows the discussion of the results in a bid to achieve the result objective stated in section one of this paper. We first conduct a trend analysis to understand the behaviour of the number of confirmed cases and selected global demand and supply economic indicators.

Figure no. 1: Regional end of the month COVID-19 confirmed cases (January – April 2020)



Source: World Health Organisation (2020)

Figure 1 shows the end of the month statistics of the regions' COVID-19 confirmed cases. From the figure, the western pacific region had the highest number of confirmed cases as at the end of January 2020, having a number 9788 cases while Africa had no cases as at then. The western pacific continued to remain the epicenter of COVID-19 even at the end of February 2020 with a total number of 73,162 cases (647.5% increase). As at the end of February 2020, Africa has officially reported only 2 cases while Europe cases have increased from 22 as at the end of January 2020 to 1425 cases as at the end of February 2020. In March ending, confirmed cases across the regions have increased and America's number of COVID-19 cases increased exponentially with a massive number of 162,934 cases. As at the end of March, the Western Pacific cases had slowed down and declined from 73162 cases to 22,117; however, Europe became the epicenter of COVID-19 cases having recorded 422,484 cases with Italy, United Kingdom and France been the worst hit of the health crisis. During April, there was total lockdown in most of the worst-hit regions with United Kingdom, France, Italy, United States, Brazil, South Africa and Nigeria leading several regions and as at the end of April 2020, Americas had become the epicenter with a total number of 1,083,176 cases while Europe was slightly 6.69% lower than that Americas confirmed cases.

Table no. 2: Descriptive statistics of global demand and supply economic indicators

Major market	Mean	Median	Maximum	Minimum	Std. Dev.	J.B.	Prob.	Obs
Australian SI	5143.26	5521.20	5935.500	3782.800	722.2713	13.67	0.0011	109
EURONEXT S.I.	1017.110	1099.270	1182.100	733.9300	151.0628	13.55	0.0011	109
Hongkong S.I.	25939.82	26312.63	29056.42	21696.13	2095.417	8.54	0.0140	109
HSBC S.I.	581.1363	621.1200	683.5900	4.851800	112.7321	562.66	0.0000	111
NASDAQ S.I.	8683.775	8958.890	9817.180	6860.670	815.5354	10.38	0.0056	108
NSE S.I.	25681.69	26838.02	29710.56	20669.38	3091.759	12.04	0.0024	110
South African S.I.	46970.73	49282.53	52735.75	34239.30	5146.284	12.22	0.0022	109
NYE S.I.	12361.40	12918.98	14183.20	8777.380	1713.492	11.68	0.0029	108
Shanghai S.I.	2909.580	2883.865	3115.570	2660.170	126.4524	8.22	0.0164	102

Source: Investing (2020a); Yahoo Finance (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g)

Table 2 shows the descriptive statistics of the stock index of major markets around the world during the COVID-19 era. The average stock index of the Australian stock exchange was 5143.26 and it went as low as 3782.8 within four months of the crisis (26.5% fall in stock index); however, the stock index managed to climb to 5935.5 above the average (meagre 7.3% increase). The average stock index of the EURONEXT was 1017.11 and it went as low as 733.93 within four months of the crisis (27.84% fall in stock index); however, the stock index managed to climb to 1182.1 above the average (meagre 16.22% increase). The average stock index of the Hongkong stock exchange was 25939.82 and it went as low as 21696.13 within four months of the crisis

(16.36% fall in stock index); however, the stock index managed to climb to 29056.42 above the average (12.01% increase). HSBS stock index was the worst hit as it went down from an average of 581.14 to 4.852, a massive decline of 99.17%. Table 1 clearly shows that the decline in the stock index for the 9 identified markets were higher than the increased experience above their averages. The implication of this is that the stock markets experienced high negative shocks in their stock index than a possible increase; this made the global economy to be volatile as economic agents were possibly responding to the shocks in the health pandemic (COVID-19).

Table no. 3: Descriptive statistics of the region's COVID-19 daily confirmed cases (January – April 2020)

Statistics	Africa Confirmed COVID-19 cases	America Confirmed COVID-19 cases	Asia Confirmed COVID-19 cases	Eastern Medit. Confirmed COVID-19 cases	Europe Confirmed COVID-19 cases	West Pacific Confirmed COVID-19 cases
Mean	392.26	15577.38	688.40	2374.13	16681.86	1367.99
Median	359	3,174	235	1,656	11,653	1099
Max.	1,460	52,138	2,858	6,437	41,333	15,166
Min.	0	0	0	0	0	0
Std. Dev.	375.41	17307.69	899.44	1957.47	15,939.46	1612.39
J.B.	8.98	9.87	16.39	6.59	10.73	10976.4
Prob.	0.011	0.007	0.000	0.037	0.005	0
Total cases	24,713	1,246,190	55,072	187,556	1,434,640	147,743
Obs.	63	80	80	79	86	108

Source: World Health Organisation (2020)

From table 3, it can be seen that an average of 392 cases was reported daily in Africa between the periods January 2020 till April 2020 and a maximum of 1460 cases were the highest cases reported daily; in Americas, an average of 15,577 cases were reported daily and a maximum of 52,138 cases was reported in a single day. On average, 688 cases were reported daily in Asia and a single maximum of 2858 cases was reported in a day. Eastern Mediterranean and the West Pacific reported an average of 2374 and 1367 cases respectively while their peak was 6437 and 15166 respectively. Europe topped the average daily cases of 16,682 while the had a maximum of 41,333 cases reported in a single day.

Table no. 4: Descriptive statistics of Brent crude oil prices, gold prices and Natural gas prices

Statistics	Brent Crude oil price	Gold price	Natural gas price
Mean	43.63464	1616.379	1.861930
Median	52.95500	1592.950	1.890000
Maximum	70.25000	1769.400	2.170000
Minimum	9.120000	1477.900	1.500000
Std. Dev.	19.23114	71.19842	0.144338
Jarque-Bera	12.86571	5.137461	2.050425
Probability	0.001608	0.076633	0.358720
Observations	110	118	114

Source: Macrotrends (2020a, 2020b); Investing (2020a); Yahoo Finance (2020a, 2020b, 2020c, 2020d, 2020e, 2020f, 2020g)

From the table 4 as reported above, Brent crude oil prices average 43.63 US dollars and went as high as 70.25 dollars; however, it crashed to 9.12 US dollars; this is as a result of the dispute between Saudi Arabia and leaders of Non-OPEC members especially Russia. The decline in crude oil prices worsened when there was much decline in demand due to countries shutting down with industries and firms not opening. Gold price although relatively stable still experienced shocks within the four months of the studied COVID-19 era as it managed to peak 1769.4 and declined up till 1477.9. Also, the natural gas price hovered around 1.5 to 2.17 but maintained an average of 1.86 between the period of study.

Granger causality result between each region's daily COVID-19 confirmed cases and global demand and supply economic indicators

We applied the Granger causality test to examine and determine whether the reported daily COVID-19 confirmed cases causes a change in selected global demand and supply economic indicators. From the result, Africa's daily COVID-19 confirmed cases does not cause a change in the stock index of South African stock exchange, stock index of the Nigerian stock exchange, global crude oil prices, gold prices and natural gas prices; this is because their f-statistics is not statistically significant as their probabilities are greater than 5%. However, the result revealed that the stock index of the Nigerian stock exchange was able to cause a change in the natural gas price; crude oil prices was able to cause a change in the gold price and the natural gas prices. The implication of this is that Africa's daily COVID-19 confirmed cases did not influence the macroeconomic fundamentals within the African economy.

The granger causality test was employed to examine whether the reported daily COVID-19 confirmed cases causes a change in selected global demand and supply economic indicators. The result shows that America's daily COVID-19 confirmed cases does not cause a change in the stock index of NASDAQ stock exchange, stock index of the New York stock exchange, global crude oil prices, gold prices and natural gas prices; this is because their f-statistics is not statistically significant as their probabilities are greater than 5%. However, the result revealed that the stock index of the NASDAQ stock exchange caused a change in the stock index of New York stock exchange and the natural gas prices while the stock index of the New York stock exchange was able to cause a change in the natural gas price.

We applied the Granger causality test to examine and determine whether Asia's reported daily COVID-19 confirmed cases causes a change in selected global demand and supply economic indicators. From the result, we can see that Asia's daily COVID-19 confirmed cases does not cause a change in the stock index of Hongkong's stock exchange, stock index of the Shanghai stock exchange, global crude oil prices, gold prices and natural gas prices; this is because their f-statistics is not statistically significant as their probabilities are greater than 5%. However, the result revealed that the stock index of the Hongkong stock exchange was able to cause a change in the stock index of Shanghai stock exchange and the natural gas price; also, the stock index of the Shanghai stock exchange was able to cause a change in the natural gas price.

The granger causality test was employed to examine whether the Eastern Mediterranean daily reported COVID-19 confirmed cases causes a change in selected global demand and supply economic indicators. From the result, the Eastern Mediterranean's daily COVID-19 confirmed cases does not cause a change in the stock index of HSBC stock exchange, stock index of the EURONEXT, global crude oil prices, gold prices and natural gas prices; this is because their f-statistics is not statistically significant as their probabilities are greater than 5%. However, the result revealed that the stock index of the EURONEXT caused a change the stock index of HSBC stock exchange and the natural gas prices while the stock index of HSBC was able to cause a change in the crude oil prices and the natural gas price. Also, the result revealed that the gold price and the natural gas price was also able to cause a change in the stock index the HSBC stock exchange.

We further tried to examine the causal relationship between Europe's daily reported COVID-19 confirmed cases and the selected global demand and supply economic indicators. We found out that the European's daily COVID-19 confirmed cases do not cause a change in the stock index of HSBC stock exchange, stock index of the EURONEXT, global crude oil prices and gold prices. However, Europe's daily COVID-19 confirmed cases cause a change in the natural gas price while the stock index of the EURONEXT causes a change in the European's daily COVID-19 confirmed cases and the stock index of HSBC. The stock index of the HSBC has a bi-directional relationship between crude oil prices.

We also found that the daily reported COVID-19 confirmed cases do not cause a change in the stock index of the Australian stock exchange, the crude oil price, gold prices and the natural gas prices.

Response of selected global demand and supply economic indicators to Impulse from each region's daily COVID-19 confirmed cases

The impulse response function plotted graphically reveals that the stock index of the South Africa stock exchange responded positively to shocks in the daily report of COVID-19 confirmed cases and this is relatively mild with the largest effect felt after the 5th period; this is also the same with the stock index of the Nigerian stock exchange; and gold prices. However, the crude oil price responded negatively to daily reports of Africa's COVID-19 confirmed cases and this was felt great after the 3rd period. However, natural gas price first responded negatively to Africa's daily report of COVID-19 confirmed cases and subsequently was positive but insignificant.

The impulse response function plotted graphically shows that the stock index of NASDAQ responded positively to shocks in America's daily report of COVID-19 confirmed cases and the effect was felt greatly as the periods expanded; this is the same for the stock index of New York stock exchange and gold price. However, crude oil prices did not respond to shocks in America's daily report of COVID-19 confirmed cases in the first 5 periods while it responded positively in subsequent periods. The graph shows that only natural gas prices responded negatively to shocks in America's daily report of COVID-19 confirmed cases and this was greatly felt immediately after the first period; the negative response remained but declined significantly after the 5th period.

The impulse response function plotted graphically reveals that the stock index of Hongkong's stock exchange responded negatively to shocks in Asia's daily report of COVID-19 confirmed cases and the effect was felt great after the 5th period; also, the stock index of the Shanghai stock exchange responded negatively to shocks in Asia's daily report of COVID-19 confirmed cases and the effect was felt greatly as the periods continued to increase. The result of the I-R function also shows that crude oil prices responded negatively to shocks in Asia's daily report of COVID-19 confirmed cases and the effect was felt great after the second period and it remained steady afterward. Gold prices also responded negatively to shocks in Asia's daily report of COVID-19 confirmed cases and the effect was felt great after the second period; although it rebounded after the 6th period this positive response was mild. It was only the natural gas price that responded positively to shocks in Asia's daily report of COVID-19 confirmed cases and the effect was felt greatly in the first period; it declined massively but remained relatively faint subsequently.

From the impulse response function, graphically, the stock index of the HSBC market responded positively to shocks in Eastern Mediterranean's daily report of COVID-19 confirmed cases immediately after the first period, but this became negative subsequently and the negative effect faded out immediately after the 6th period. Also, the stock index of EURONEXT market responded negatively to shocks in Eastern Mediterranean's daily report of COVID-19 confirmed cases at the start of the period and it faded away after the 8th period; gold prices responded positively to shocks in Eastern Mediterranean's daily report of COVID-19 confirmed cases and this effect was greatly felt after the first year, but there was a sharp decline and then remained relatively positive at large. Crude oil prices greatly responded negatively to shocks in Eastern Mediterranean's daily report of COVID-19 confirmed cases and this was greatly felt after the 2nd period; also, natural gas prices responded negatively to shocks in Eastern Mediterranean's daily report of COVID-19 confirmed cases but the response was mild after the 3rd period.

From the impulse response function, graphically, the stock index of the HSBC market responded negatively to shocks in Europe's daily report of COVID-19 confirmed cases and this was felt greatly in the first period, however, it diminished after the 4th year; the stock index of EURONEXT responded negatively to shocks in Europe's daily report of COVID-19 confirmed cases but this was mild throughout the study. the graph, however, revealed that crude oil prices slightly responded negatively to shocks in Europe's daily report of COVID-19 confirmed cases and after the first period, there was no response and there was subsequently a negative response after the 6th period. Also, gold prices responded negatively to shocks in Europe's daily report of COVID-19 confirmed cases but the effect became positive after the 4th period. However, natural gas prices responded negatively to shocks in Europe's daily report of COVID-19 confirmed cases throughout the period but this was felt greatly immediately after the 3rd period.

From the impulse response function, graphically, the stock index of the Australian stock exchange responded positively to shocks in West Pacific's daily report of COVID-19 confirmed cases and this was felt greatly immediately after the 3rd period; this same pattern was felt by crude

oil prices but this was felt great after the 4th period. Also, natural gas prices responded positively to shocks in West Pacific's daily report of COVID-19 confirmed cases and the effect declined significantly immediately after the 5th period. The result from the graph only revealed that gold prices responded negatively to shocks in West Pacific's daily report of COVID-19 confirmed cases and this was felt great after the 3rd period.

5. Conclusions and policy recommendation

This study examined how the global economy has responded to the coronavirus pandemic and specific variables are used to measure the various activities that define the global economy. From the study, the coronavirus outbreak first started in the West Pacific region with many cases reported; and Europe and America followed suit in COVID-19 confirmed cases. While Africa had only 2 cases in February, West Pacific already had 73,162 cases. In sundry, Europe had the highest number of reported cases within the period of study.

Also, the study revealed that amongst the major stock markets investigated, HSBC's stock index was the worst hit during the period examined, however, all the stock markets investigated showed that there were great changes in their stock index and this was skewed largely to reductions than increases in the stock index. We can also conclude from the study; Europe had the highest daily occurrence of coronavirus cases while America reported the highest cases in a single day. Gold prices throughout the study remain relatively stable during the period of the investigation while the Brent crude oil prices were highly volatile during the period.

Further, African, Americas, Asians, Eastern Mediterranean, West Pacific and Europe's daily COVID-19 confirmed cases did not granger cause the respective stock index of top stock markets within the regions (South Africa stock exchange, Nigeria stock exchange, NASDAQ, New York stock exchange, Hongkong stock exchange, Shanghai stock exchange, HSBC, EURONEXT and Australia stock exchange respectively). Also, we can conclude that the African, Americas, Asians, Eastern Mediterranean and West Pacific's daily COVID-19 confirmed cases did not granger cause Brent crude oil price, gold prices and the natural gas prices; only the Europe's daily COVID-19 confirmed cases influenced the natural gas price. However, the study concludes that one of the top region's stock market causes a change in another's top stock market; this is evident as NASAQ's activity influences the New York stock exchange, the Hongkong market influences the Shanghai stock market and EURONEXT influences HSBC's activities. Also, we conclude that the HSBC's stock market activities influenced the crude oil prices and vice-versa while the crude oil prices further influenced the natural gas prices and gold prices. Also, the New York stock exchange, NASDAQ, HSBC, EURONEXT, Hongkong and Shanghai's stock market activities influenced natural gas prices. We thus infer from the study that the HSBC market is a major determinant of global economic activities while crude oil prices determine other world prices of supply goods.

Concerning shock phenomenon, crude oil prices responded negatively to shocks in Asia, Europe, East Mediterranean and Africa's daily reported COVI-19 confirmed cases while natural gas prices responded negatively to shocks in Africa's daily reported COVI-19 confirmed cases. Also, the stock index of Hongkong and Shanghai's stock market responded negatively to shocks in Asia's daily reported COVI-19 confirmed cases while the stock index of HSBC and EURONEXT's stock market responded negatively to shocks in Europe and East Mediterranean's daily reported COVI-19 confirmed cases. We further conclude that natural gas prices responded negatively to shocks in Europe's daily reported COVI-19 confirmed cases while gold prices responded negatively to shocks in West Pacific's daily reported CVID-19 confirmed cases.

While aggressive effort is made medically to develop vaccines in curbing the outbreak, a more coordinated policy measure is greatly needed by the management of the stock markets around the globe such as an increase in putting on hold trading activities when the stock prices fall below a lower bound from the 15minutes issued earlier by U.S. Securities and Exchange Commission.

6. References

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