



International Journal of Business and Emerging Markets

ISSN online: 1753-6227 - ISSN print: 1753-6219

<https://www.inderscience.com/ijbem>

**COVID-19 outbreak and performance of financial markets:
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DOI: [10.1504/IJBEM.2022.10050206](https://doi.org/10.1504/IJBEM.2022.10050206)

Article History:

Received:	28 May 2020
Accepted:	23 July 2022
Published online:	09 January 2023

COVID-19 outbreak and performance of financial markets: evidence from the stock market, the foreign exchange market and cryptocurrencies market in Nigeria

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Abstract: The study investigated performance of the stock market, foreign exchange market and the cryptocurrencies market as a result of COVID-19 outbreak. Event studies methodology was employed to determine the abnormal return (AR) and corresponding cumulative abnormal return (CAR) following the first confirmed case of the pandemic and the first recorded case of fatality, after controlling for the concurrent effect of crude price fluctuations. Consistent with previous studies, the paper documented evidence of negative reaction of -0.34% and -1.01% for the Nigerian stock market and the cryptocurrency market respectively at the announcement of first case of the pandemic's outbreak. The study also documented negative and statistically significant effects of -1.71% and -0.78% for Nigerian stock market and the cryptocurrency market respectively when the first case of death was announced. Adverse effect of the pandemic was found to be stronger when the first case of death was announced compared to first reported case of the outbreak. However, negative but insignificant effect was recorded for the foreign exchange market. The paper concluded that negative reaction for the stock market is consistent with market panic and policy uncertainty during the pandemic. Furthermore, adverse effect of the pandemic on the cryptocurrency market was due to increased co-movement of the market with regulated financial markets such as the stock market as well as correlation of returns between the markets.

Keywords: event study methodology; emerging market; financial market efficiency; pandemics; Nigeria.

JEL codes: G12, N27, G14, I18.

Reference to this paper should be made as follows: Mohammed, I. (2023) 'COVID-19 outbreak and performance of financial markets: evidence from the stock market, the foreign exchange market and cryptocurrencies market in Nigeria', *Int. J. Business and Emerging Markets*, Vol. 15, No. 1, pp.1–33.

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This paper is a revised and expanded version of a paper entitled 'Reflections of COVID-19 in Nigerian Stock Market, Forex Market and Cryptocurrency Market presented at International Conference on COVID 19 and the World, Centre for Integrated Development Studies, Tribhuvan University, Kathmandu, Nepal, 13–14 July 2020.

1 Introduction

The outbreak of COVID-19 first manifested as a unique class as coronavirus which later came to be known as novel coronavirus. According to the World Health Organization (WHO, 2020a), the virus was isolated out of a group of pneumonia-like cases first reported in China. The virus was reported to have been first found on the 7th of January 2020 in Wuhan, a Chinese city in Hubei Province. The COVID-19 is believed to be caused by a new strain of the coronavirus family known as SARS-CoV-2 which previously had not been linked to human beings, but has now been confirmed to transmit the disease from human to human (WHO, 2020a). Since emergence of the first confirmed case of the virus in January 2020 by the WHO, spread of the virus across the world has been rapid and unprecedented with several fatalities recorded from the virus over short periods of time. According to Ali et al. (2020) and Haq and Shirwani (2021), China was unanimously designated as the global epicentre of physical contagion as well as financial contagion for spillovers to other global financial markets. Given the rapid rate of spread of the virus globally, Egypt had experienced its first reported case in Africa on the 14th of February 2020 (WHO, 2020b). According to the Nigerian National Center for Disease Control (NCDC, 2020a) and WHO (2020c), Nigeria was the second African country to report outbreak of the pandemic on the 27th February 2020 barely some weeks after Egypt's first African case, and the first case of fatality for Nigeria occurred on 23rd of March 2020.

Nigeria became first in the West Africa sub-region and the second country in Sub-Saharan Africa to report COVID-19 cases, and the number of new cases and recorded deaths from the pandemic rose astronomically over time (NCDC, 2020b). Within a span of just about two months, a total of 238 cases, made up of 198 active cases of infections, 35 cases of recovery and five cases of fatality were recorded as at 6th of April 2020 (NCDC, 2020c). By end-December 2020, the number of confirmed cases grew geometrically to 5,733 while the number of cases of fatalities rose to 1,311 with an annual case fatality rate of 1.5% for the year (NCDC, 2020d). Rapid spread of the virus in Nigeria has created serious cause for concern among other African countries and even beyond the continent. Health experts and analysts have argued that in addition to the problem of weak health systems and the dearth of critical health infrastructure across Africa, Nigeria's explosive population density and growth creates increased risks for the rapid spread of the pandemic across the continent. The Nigerian National Population Commission (NPC, 2020) and the UN (2020) put the country's population at 206.1 million, representing 2.64% of the world population. The figures make Nigeria the most populous African country and the 7th globally with an annual population growth rate of 2.58%. To compound issues, experts have also expressed scepticism with respect to the efficacy of Nigerian government's policy response to the pandemic as they expressed dissatisfaction with the pace of managing the crisis.

The unprecedented growth in social and economic integration between Nigeria and West African countries in particular, and all African countries in general is arguably a major factor that amplifies the risk of financial spillovers and contagion in the continent as a result of the pandemic (Akhtaruzzaman et al., 2021; Harjoto et al., 2021; Okorie and Lin, 2021; Udejaja and Isah, 2022). Thus, the concerns and fears that a poorly managed response to the pandemic by Nigeria could precipitate a full-blown regional social and economic crisis across the entire African continent are not misplaced. Experts and analysts have voiced their concerns and fears that absence of effective management of the pandemic in Nigeria could have so severe and far reaching consequences, with the likelihood of Nigeria becoming an epicentre for the pandemic in Africa or even globally by surpassing China (Tih, 2020). The case of Nigeria becomes particularly important because of these sorts of concerns. Aside the fact that Nigeria plays a strategically important role in the African social, political and economic landscape, the country is one of the most vibrant economies in terms of attracting foreign capital. According to International Institute of Finance (IIF, 2020), the country is arguably one of the strongest African commercial hubs and also a choice destination for foreign investors in terms of capital flows, particularly foreign portfolio investment. Prior to the pandemic, financial markets in Nigeria have enjoyed relatively stable growth due to the continuous inflow of foreign capital, which earned the country the rating of the biggest economy on the African continent (IIF, 2020).

Since the first case of the pandemic was reported, effect of the pandemic on the Nigerian financial system has become increasingly visible and apparent in a number of ways. As a mono-economy that relies substantially and heavily on revenues from crude oil sales, the crash in crude oil prices on the global scale adversely manifested on the economic and fiscal strategies of the country. The simultaneous adverse fallouts of crude price fluctuations and the pandemic became immediately visible on financial markets (Sharif et al., 2020). Effect of the pandemic was visible on commercial activities as firms rapidly lost their markets and liquidity positions (De Vito and Gomez, 2020). Lockdowns, employee absenteeism, entrenchment of social distancing culture, prohibition of large gatherings and self-isolation of suspected cases, adopted as strategies for combating spread of the virus (Ahmar and del Val, 2020; Ahmed and Memish, 2020; Saadat et al., 2020) resulted in far reaching socio-economic effects that affected the lives of the global population (Nicola et al., 2020; Roy et al., 2020). However, financial markets appeared to be the worst visibly hit by the pandemic as the non-pharmaceutical measures of lockdowns, employee absenteeism, prohibition of mass gatherings and entrenchment of social distancing significantly heightened stock market volatility, especially in the equity markets (Deng et al., 2022; Scherf et al., 2022; Zaremba et al., 2020). According to Ali et al. (2020), 30% of global equity market values were eroded within just the first 100 days of the virus outbreak. Since the outbreak was first reported, financial markets' risks have arguably increased substantially (Zhang et al., 2020), resulting in declined performance and increased volatility as a result of market panic globally (Ali et al., 2020).

Abiodun (2020) reported that within just six hours of announcing the first Nigerian case of the pandemic, market capitalisation and all-share index (ASI) of the Nigerian Stock Exchange (NSE) each shaded approximately 2.2% of their initial values. On the other hand, the apex regulator of banking institutions, the Central Bank of Nigeria (CBN) had to devalue the Nigerian naira-US dollar exchange rate by a whopping 15% as a result

of the outbreak in Nigeria on 20th. According to Onu and Soto (2020), the devaluation was a compelling strategy to mitigate the mounting pressure of demand for more US dollars by foreign investors seeking to withdraw their capital invested in Nigeria. To further corroborate the evidence of capital flight, the NSE (2020) report showed that while the inflow of foreign portfolio funds into Nigeria decreased by approximately 22% by end-February, which was the month in which the country's first case of infection was reported; outflow of portfolio funds on the other hand increased by 12.62% month-on-month when compared to their respective values at the end of January. Furthermore, even unconventional financial markets such as the cryptocurrency markets which are not subject to formal financial regulatory frameworks reacted to the outbreak of COVID-19 in Nigeria because the Bitcoin/Luno prices for Nigerian Bitcoin holders decreased by 0.71% at the announcement of the first outbreak case of the pandemic in Nigeria.

The extant empirical evidence has documented that financial markets generally respond adversely to announcement of outbreak of pandemics. This evidence is especially true and consistent for stock markets which are often the first financial markets to swiftly respond to such events. In addition, a study by Lahmiri and Bekiros (2020) provided novel evidence that the COVID-19 pandemic increased volatility and instability in cryptocurrency markets. Conventionally, important macroeconomic events such as the outbreak of pandemics which effects cover the entire financial system are best examined using the methodology of event studies which was first introduced by Fama et al. (1969) and popularised by Brown and Warner (1985) and Mackinlay (1997). The methodology is based on the efficient markets theory introduced by Fama (1965) and further enhanced in his subsequent works in 1970, 1991 and 1998. According to the theory, financial markets have the in-built mechanism to instantly and accurately absorb and reflect corporate and macroeconomic information, like the outbreak of pandemics, in financial asset prices. Even though the earlier version of the theory was based on stock markets only, subsequent improvements on the theory by Fama (1965) have extended its application to all financial markets (Sorokina et al., 2013).

Previous empirical evidence on pandemics appears to have mostly dwelt on the SARS outbreak of 2003 because, according to Lee and McKibbin (2012), the SARS virus of 2003 was adjudged as the worst pandemic with the most pervasive and severe economic impact since the 1918 outbreak of the Spanish flu. At the moment, the empirical evidence on effect of COVID-19 on financial markets is still evolving (Goodell, 2020). However, most of the existing studies such as Al-Awadhi et al. (2020), Ashraf (2020), Avalos and Zakrajsek (2020), Conlon and McGee (2020), Harjoto et al. (2021), Lahmiri and Bekiros (2020), Takyi and Bentum-Ennin (2021), Al-Qudah and Houcine (2022), Babshetti et al. (2022) and Scherf et al. (2022), among others, have concentrated mainly on stock markets, ignoring cryptocurrency markets and foreign exchange markets. Another characteristic of these studies is that most of them have limited their analysis to either China or the US stock markets which operate within developed market architecture. These studies have also not taken into cognisance the simultaneous effect of global fluctuations in crude oil prices that was equally affecting financial markets alongside the pandemic.

In addition, most of the studies on previous pandemics have reported findings based on limited scope of coverage for the effect of the pandemic. For instance, Chen and Huang (2009) limited their scope to biotechnology and hospitality sectors, Chen et al. (2007) covered only the hotel and hospitality industry, Loh (2006) focused on the airline

sector, Tai-Leung et al. (2010) examined only pharmaceutical and tourism sectors, Wang et al. (2013) restricted their study to biotechnology sector, and Wong (2008) focused on only the real estate industry. Thus, these previous studies concentrated on investigating the effects of pandemics in selected individual sectors without exploring the economy-wide effects. In addition, most these previous studies on past pandemics focused on economies in Asia (where the epidemics were severe) which operate under financial and institutional architectures that are substantially different from what is obtainable in emerging economies in Africa such as Nigeria. This makes it difficult, if not wholly impossible, to generalise such findings to countries such as Nigeria.

The imperatives of investigating the reaction of Nigerian financial markets to the pandemic are justified by the fact that the country was the third in the whole of Africa and the first in the West African sub-region to record cases of the outbreak. The early manifestation of the pandemic in Nigeria thus gives ample time and data to investigate effects of the pandemic in Africa. Furthermore, important socio-economic characteristics of Nigeria such as a rapidly growing population, poor health system and low level of health awareness, which are features common to most African countries, have been feared by health experts to worsen the outbreak. According to WHO (2020c), Nigeria in particular and Africa in general may drift into being the epicentre of the COVID-19 pandemic. In addition, Nigeria is adjudged as the biggest economy in Africa, the third largest cryptocurrency market in the world and a preferred destination for foreign capital, especially portfolio inflows that are invested in various financial markets. Nigeria's economic and financial position in Africa can be a catalyst for contagion and spillover effects of the pandemic to other African and emerging financial markets. Foreign investors have historically trooped to Nigerian financial markets to create hedge portfolios and with the pandemic outbreak, the need to examine effect of the pandemic on such markets becomes obvious.

Therefore, this study aims at investigating market effects of COVID-19 on the three important financial markets in Nigeria; the stock market, the foreign exchange market and the cryptocurrencies market. The paper covered only the Nigerian economy because of the country's indispensability to the continent of Africa in terms social, political and economic coordination. The similarity and compatibility of Nigeria's economy with that of many African nations means that, in terms of generalisations, the findings on Nigeria can easily and conveniently be extended to cover other African countries. Specifically, the country's ever-growing population is another justification for investigating effects of the pandemic on financial markets in Nigeria.

Subsequent sections of the paper are arranged in the following order: the empirical literature and theoretical postulations are expounded under Section 2, the materials and methods employed in the paper are outlined in Section 3, the results and corresponding discussion of the findings can be found in Section 4, the policy implications of the findings are in Section 5, The conclusions drawn are enunciated in Section 6; and Section 7 identifies suggestions for further studies.

2 Empirical and theoretical literature

Throughout the century, the periodic outbreaks of pandemics have been a somewhat familiar phenomenon. Barro and Ursua (2009) have argued that in this century, the

Spanish flu (also called the flu) outbreak of 1918 is considered the pandemic with the most devastating effect economically and socially. According to the study, at least six epidemics of endemic proportions have been recorded within the century after the flu of 1918. The six major outbreaks after the flu are the Avian flu outbreak in 1997, the SARS-H1N1 outbreak in 2003, the outbreak of SARS H5N1 in 2005, the outbreak of swine flu in 2009, the Middle East respiratory syndrome (MERS) epidemic in 2012 and the 2014 African Ebola epidemic. Despite the fact that the flu is considered the most devastating, there is dearth of empirical studies on the epidemic, and the reasons for this development is not far-fetched. According to Karlsson et al. (2014), the low level of advancement in terms of data collection and the biting effects of the First World War with its attendant distractions arguably contributed to the little research attention received by the flu. However, the H1N1 SARS epidemic of 2003 received the highest attention of researchers as majority of the extant empirical literature on the financial and economic effects of the outbreak of epidemics are based on the epidemic of 2003. Until the emergence of COVID-19, the 2003 epidemic is considered only second to the flu in this century in terms of its severe effects. In contrast however, only a few studies concentrated on the effects of the SARS H5N1 epidemic of 2005.

While empirical works on the SARS H1N1 outbreak of 2003 like Bennett et al. (2015) and Lee and McKibbin (2004) examined the overall social and economic effect of the epidemic, most empirical studies have focused on addressing its impact on financial markets, particularly the stock market. Considering the fact that stock markets are usually the quickest to react to macroeconomic events like outbreaks because of their level of global integration, it thus becomes expedient to examine the reaction of stock markets to the outbreak of epidemics (Akhtaruzzaman et al., 2021; Avalos and Zakrajsek, 2020; Feng et al., 2021; Okorie and Lin, 2021). As would be expected, a large number of these SARS outbreak studies focused mainly on Asian financial markets which were then the most affected by the epidemics.

Nippani and Washer (2004) was one of the early known studies that employed a sample of eight emerging stock markets to assess impact of the 2003 outbreak of SARS. Findings revealed that only the stock markets of China and Vietnam were negatively affected by the outbreak while no evidence of any form of effect was recorded for the remaining six emerging stock markets. In a closely related study, Loh (2006) evaluated reaction of the airlines sector in Canada, China, Hong Kong, Singapore, Taiwan and Thailand to the 2005 H5N1 outbreak of avian flu. The adverse impact of the outbreak was found to have manifested in the form of increase in volatilities for the airlines stocks. Furthermore, Chen et al. (2007) relied on data from the Taiwanese hotel industry to examine the sector's reaction to the outbreak of SARS. It was found that the pandemic's effect on the earnings and share prices of hotel stocks was significantly negative. In the same vein, Wong (2008) examined reaction of housing and real estate industry to the announcement of SARS outbreak in Hong Kong. As was the case in previous studies, findings of this study confirmed adverse impact of the epidemic on housing prices of listed Hong Kong real estate firms. In a yet another study, Chen and Huang (2009) examined effect of the H1N1-SARS outbreak of 2003 on the biotechnology and hospitality sectors in Taiwan. Supporting the findings of Chen et al. (2007), the study documented adverse and favourable impacts of the epidemic on the hospitality and biotechnology industry respectively. Furthermore, a study by Tai-Leung et al. (2010) which considered effect of the 2003 outbreak on the pharmaceutical sector in China found evidence consistent with that of the previous literature. Specifically, the study

reported adverse effect of the epidemic on the tourism sector in China and positive effect for the pharmaceutical sector. Similarly, Wang et al. (2013) focused on the response of biotechnology industry in Taiwan to outbreak of diseases of infectious nature including the SARS epidemic outbreak of 2003. Consistent with the evidence established by the previous studies on epidemics outbreak, the study documented significant adverse reaction of Taiwanese biotechnology firms to the outbreak.

Since its emergence, evidence on the financial markets' effects of COVID-19 has been steadily on the rise, and the debate is still ongoing. Even within the financial markets, studies have largely concentrated on the pandemic's effect on stock markets from a global viewpoint. As an early study, Al-Awadhi et al. (2020) investigated reaction of the Chinese stock markets to the outbreak of COVID-19 pandemic. The study established that the stock markets in China reacted negatively and significantly to announced daily increases in confirmed cases of the pandemic and recorded deaths. Albulescu (2020) assessed response of the US volatility index (VIX) for financial markets to the announcement of new confirmed cases and death arising from COVID-19 infections in China 40 days after international monitoring of the pandemic had commenced. The study revealed the positive impact of Chinese death ratios on volatility in the US financial markets. The volatility in the USA was more pronounced when new cases of death as a result of the pandemic in China were announced. With respect to new confirmed cases of the virus however, the effect on volatility within Chinese and the US stock markets was found to be mixed. Ali et al. (2020) investigated volatilities and decline in financial markets' performance following emergence of COVID-19 in China using the Chinese, Italian, Spanish, German, French, South Korean, US, Switzerland and the UK stock markets as sample. Results based on EGARCH models revealed that Chinese financial markets were the first to stabilise after spilling over the crisis to other global financial markets. Ashraf (2020) relied on cross-country panel data involving 64 countries to assess the responses of their stock markets to announcements of the outbreak of COVID-19. Evidence documented by the study suggests that confirmed number of the cases of the outbreak across the world gave rise to negative and adverse reactions by stock markets. It was thus concluded that response of stock markets globally to the outbreak was swift and instantaneous, varying over time and across economic jurisdictions. Avalos and Zakrajsek (2020) in a comparative study between the outbreak of COVID-19 and that of SARS 2003 analysed effects of the two epidemics on China and other stock markets of Asia. The study found that COVID-19's impact was more severe and devastating for the Chinese and the other stock markets in Asia covered by the study when compared with the impact of the SARS epidemic. It was thus concluded that effects of COVID-19 were deeper relative to those of the 2003 outbreak of SARS. The revelation by this study has unsettled the general narrative that the 2003 SARS outbreak is the most severe for this century after the flu. Baker et al. (2020) employed time-varying jumps of stock markets over two centuries to examine how COVID-19 has altered the recent behaviour of stock markets in the USA. The study found that, when compared to other past outbreaks of infectious diseases, the outbreak of COVID-19 had the most elaborate effect on volatilities among US stock markets. Hence, the study arrived at the conclusion that the response of the US stock markets to announcement of the outbreak of the COVID-19 pandemic is surprisingly unprecedented. Haroon and Rizvi (2020) assessed effect of COVID-19 news sentiment on volatilities of stock markets. Results showed that panic generated by the uncertainty surrounding financial

markets gave rise to swift and unprecedented volatility in equity markets. Sharif et al. (2020) investigated the impact of COVID-19 on global prices of crude oil, stock markets returns, uncertainty in policies and geo-political risks in the US economy following the pandemic. Analysis based on coherence wavelet and wavelet-based causality approaches revealed pronounced effects of the pandemic and oil prices on volatility in US stock markets, geopolitical risk levels and uncertainty in economic policy levels. Zaremba et al. (2020) assessed effect of the sudden outbreak of COVID-19 on stock markets volatilities in 67 countries amidst government interventions using a multi-factor regression model based on the CAPM. The study documented significant effect of interventions that are non-pharmaceutical in nature on volatilities of stock markets in the countries considered. Specifically, cancellation of events relating to public gatherings and early information campaigns were found to be significant drivers of volatility. Furthermore, Akhtaruzzaman et al. (2021) examined cross-country contagion of financial and non-financial nature among China and the G7 economies amidst COVID-19 using VARMA DCC-GARCH family models. The study established evidence of increased conditional correlations among the returns of financial and non-financial firms, with such degree of correlation being higher for financial firms. It was concluded that the higher correlation among financial firms makes them veritable channels for the transmission of financial contagion amidst the pandemic. Haq and Shirwani (2021) investigated the transmission of shocks from Chinese stock markets to global stock markets and vice versa in the wake of COVID-19 using conventional long run models of Johansen cointegration test, vector error correction and autoregressive models and Granger's test for causality to analyse the shock transmission. While short run results depict relationship between China's previous prices and those of the USA and Hong Kong, long run results reveal unidirectional causality from the UK, Hong Kong and Japan. Harjoto et al. (2021) utilised a sample of 76 countries made up of 23 developed economies' stock markets and 53 emerging economies' stock markets to examine evidence of performance of the stock markets during the pandemic's outbreak. Results from the study revealed evidence that the pandemic adversely affected global stock markets, increased volatility and trading volumes. The effects were found to vary from developed economies' stock markets to emerging economies' stock markets. While cases of infections and those of deaths significantly impacted on returns, volatility and trading volumes of emerging economies' stock markets, only cases of infections as a result of the pandemic affected returns, volatility and trading volumes in developed economies' stock markets. The study concluded that in line with institutional theory, emerging and developed markets react differently to the pandemic's outbreak announcement. Okorie and Lin (2021) employed data from 32 global stock markets profoundly affected by COVID-19 to evaluate the fractal nature of contagion effects of the pandemic on global stock markets. Findings revealed that the pandemic had fractal contagion effect on global stock markets examined, and such effects tend to diminish and fizzle out over time. Takyi and Bentum-Ennin (2021) investigated the effect of COVID-19 on stock market reaction of 13 emerging countries of Africa. The study documented an average reduction in stock market performance of between -2.7% to -21% during and after occurrence of the pandemic. It was also found that the observed negative effect on the emerging African stock markets was pervasive in 10 out of the 13 economies. Abouelfaraq and Qutb (2022) evaluated effect of COVID-19 on the volatility and return of the Egyptian stock market. The study utilised the heteroskedasticity consistent variant of the GARCH model for its analysis and established that the pandemic had a pervasive effect on the volatility and

daily returns of the EGX100 but no such effect was recorded for the EGX30. The study also found that response of Egyptian stock market reacted to the pandemic's first two waves but not to the third wave. Also, the reaction was found to be more incisive for the first wave relative to the second wave. Al-Qudah and Houcine (2022) employed the standard methodology of event studies with a view to evaluating COVID-19's effect on returns of the six major regions of Europe, Africa, South-Eastern Asia, the Western Pacific, the Eastern Mediterranean and Americas. The study established evidence that increased incidence of the pandemic negatively affected stock market returns, and the speed of reaction was swift and immediate. It was also documented by the study that the pandemic's adverse effect appeared to be pronounced at the early stage of the pandemic and more severe for the Pacific region. The study further documented that feeling of fear was a major mediator in terms of the adverse effect on stock markets. Similarly, Babshetti et al. (2022) looked at the effect of COVID-19 from the perspectives of stock markets and exchange rates in India, Vietnam, China, Russia, Singapore and Japan. Results and analysis from the study revealed that the pandemic's recorded effects on both the stock and foreign exchange markets in the six sampled Asian countries were adverse. However, the effect was found to be more pronounced for India. It was concluded that India suffered more effects socially and economically as a consequence of the pandemic compared to other Asian countries within the sample. Deng et al. (2022) employed a sample of 12 countries to evaluate reaction of stock markets to the twin policy responses of lockdown and interest rate cuts. Using the difference in difference (DID) approach, it was found that lockdown and interest rate cuts positively impacted on the stock markets, with the magnitude of reaction being larger for interest rate cuts relative to lockdown. Pandey et al. (2022) investigated the impact of 90 corporate events' announcements by Indian firms during COVID-19. Results based on the methodology of event studies found that the resulting documented impact of the various corporate events did not follow similar pattern. Thus, while bonus issues and stock splits generated positive market effect, rights issues and stock splits did not result in any market effect. Scherf et al. (2022) utilised a sample of 42 countries consisting of OECD and BRICS stock markets in order to analyse effect of COVID-19 lockdowns with respect to stock market. Relying on event study methodology, the study established a general negative reaction to increase in lockdown restrictions. On the other hand, the study found that relaxation of the lockdown resulted in positive stock market reactions. Udejaja and Isah (2022) utilised a daily panel dataset of 20 African stock markets to assess extent of reaction to COVID-19's sudden outbreak. Using a PMG-based panel – autoregressive distributed lag (ARDL) model, the study revealed that South Africa is the country with highest incidence with respect to cases and deaths. It was also established that Morocco was the country with highest number of confirmed cases from the outbreak, followed by Tunisia as the second most infected country based on the number of confirmed cases. Egypt on the other hand ranked second in terms of deaths. The study concluded that what tends to account for the declining performance of African stock markets during the pandemic is not the deaths recorded from the pandemic but confirmed of cases infection.

In contrast, there are fewer empirical works on the pandemic's effects on the global markets for foreign exchange. This is notwithstanding the existence of early evidence in the empirical literature suggesting the pandemic's contagion effect on markets for foreign exchange (Aslam et al., 2020; Li et al., 2021). One of these early works is that of Aslam et al. (2020) which examined foreign exchange markets' efficiencies in the light of

COVID-19's outbreak for six markets. The study employed five-minutes intra-day values for the Swiss franc, the euro, the pound sterling, Canadian dollar, Japanese yen and Australian dollar. Based on a detrended variant of multifractal fluctuation approach, the study found evidence of declining efficiency associated with the six foreign exchange markets, with the largest effect recorded for Australian dollars. Conversely, the duo of the Swiss franc and the Canadian dollar recorded the highest level of efficiency relative to the other brand of currencies under consideration amidst outbreak of the epidemic. In the same vein, Feng et al. (2021) investigated COVID-19's effect by focusing on volatility behaviour of exchange rates in 20 countries. Using the system GMM estimation as method of analysis, the study found evidence of increased exchange rate volatility as a result of increase in confirmed cases while government policy responses to the pandemic inhibited volatility. Similarly, Li et al. (2021) assessed COVID-19 pandemic's effects on US and Chinese exchange rates' dynamics. ARDL model was used to analyse confirmed cases of the infection and consequent fatalities therefrom on foreign exchange markets' fluctuations within the two countries. A negative impact of the pandemic was recorded for the US and Chinese foreign exchange markets respectively, and this effect were observed for COVID-19 cases and deaths over short run and long run periods. Furthermore, Beckmann and Czudaj (2022) investigated COVID-19's effect from the angle of returns on exchange rates by utilising a database from a large survey and computed abnormal exchange rate returns as a consequence of emergence of the pandemic. Analysis from the study established the presence of excess returns as a result of the pandemic, and the excess returns were found to be partly explained by macroeconomic fundamentals, chief among which was the individual country policy response to the pandemic. It was thus concluded that policy response to the pandemic is an important determinant for future currency behaviour.

Even though debate on the importance of cryptocurrencies is still yet to be exhausted, evidence had been established that this class of financial assets react to macroeconomic events, and initial empirical evidence on their relationship with COVID-19 have found that the crypto markets are contagious to the pandemic (Corbet et al., 2020a; Iqbal et al., 2021; Montasser et al., 2022). Conlon et al. (2020) was among the first batch of empirical works that investigated whether cryptocurrencies are good or even better candidates for diversification or as safe havens for investors in relation to equities markets in the wake of COVID-19. The study utilised the conditional variant of value at risk models as well the conventional variant of the model for its analysis and found that Bitcoin and Ethereum are, based on the majority cases examined, lacked good safe haven and diversification properties for many international equities markets during period of the pandemic's outbreak. Corbet et al. (2020b) established further evidence by evaluating the contagion and spillover impacts arising from COVID-19's outbreak from Chinese stock markets to the cryptocurrency market using GARCH and DCC-GARCH models. The study found significant spikes in volatility and correlations between returns of Shanghai and Shenzhen stock markets and those of Bitcoin market return, which is induced by the pandemic. The finding suggests spillovers of effect of the pandemic from stock markets to cryptocurrencies markets. Similarly, Lahmiri and Bekiros (2020) assessed the outbreak of COVID-19's impact on performance of 45 selected cryptocurrencies markets and a combination 16 carefully selected stock markets. The study found increased evidence of instability and volatility in cryptocurrency markets relative to stock markets. It was concluded that crypto assets tend to be more volatile and riskier during periods of pandemics and may not be suitable alternatives for hedging and portfolio diversification.

Furthermore, the work of Iqbal et al. (2021) employed returns obtained on daily basis from the ten adjudged top cryptocurrencies to determine the pandemic's extent of influence on the markets for cryptocurrencies. The study employed the quantile-in-quantile regression (QQR) for its analysis, and found that COVID-19's effects on cryptocurrencies markets were pronounced and significant. The impact varied for bearish and bullish markets as the small cryptos absorbed the pandemic's impact and still yielded small positive returns. In addition, Montasser et al. (2022) employed the return on 18 cryptocurrencies to test their efficiency during COVID-19 and compared the results with pre-pandemic bubbles of 2017–2018. The study utilised dynamic version of clustering based on time warping as its approach for analysis and found that the pandemic period has the most pronounced effect on the efficiency of cryptocurrencies markets. Sarkodie et al. (2022) attempted an assessment of the pandemic's effects based on returns of from four popular cryptocurrencies: Litecoin, Bitcoin, Ethereum and Bitcoin Cash. Relying on the novel multiple hypotheses developed by Romano and Wolf, the study documented that the pandemic induced positive shocks towards the returns of the crypto assets. Specifically, Litecoin recorded the highest positive return of between 3.20% to 3.84%, Bitcoin 2.71% to 3.27%, Ethereum 1.43% to 1.75%; and Bitcoin Cash 1.34% to 1.62% in the wake of the pandemic's outbreak. It was concluded that the market for cryptocurrencies recorded positive shocks as a result of the pandemic.

The foregoing exploration of the existing literature points to the fact that stock markets have traditionally always responded to announced pandemics and epidemics outbreaks. Majority of such existing studies clearly uphold the cliché that the nature of reaction by stock markets has largely been negative and significant. It is also evident that the foreign exchange and cryptocurrencies markets reacted adversely to the pandemic. However, only a few of the studies employed the event study methodology that has been proven by torrents of studies as highly effective when the objective is to capture the effects of macroeconomic and corporate events (Al-Qudah and Houcine, 2022; Pandey et al., 2022).

The procedure for examining reactions of the stock market in particular and financial markets in general has its roots in the popular and widely acclaimed theory of market efficiency developed by Eugene Fama through a plethora of publications spanning over four decades. The argument by Fama (1965) that stock markets, and by extension all financial markets, possess in-built mechanism that instantly reflects new relevant information systematically and instantaneously into the prices of stocks, and by extension, financial assets prices, is the mainstay of this theory. Thereafter, the line-up of subsequent works by Fama (1970, 1991, 1998) extended the initial proposition on stock markets to hold for all financial markets. In addition, these subsequent studies have extended the reaction from corporate value-relevant corporate events to even macroeconomic events. In Fama's (1965, 1970) works, three tiers of stock market efficiency have been identified in a graduating fashion as the weak, semi-strong and strong form, respectively. The ability of financial markets to react to macroeconomic events, announcements like the outbreak of COVID-19 pandemic is captured by the semi-strong form tier of financial markets' efficiency. The semi-strong form type of efficient markets presupposes the ability of financial markets to impound rapidly and instantly all information of public nature into the market prices of financial assets. Based on this explored suitability, the theory of efficient financial markets is adopted as the underpinning theoretical postulation upon which this paper is structured.

3 Methodology

The current study seeks to evaluate reaction of the Nigerian stock market, the foreign exchange market and the cryptocurrency market to COVID-19's announcement by employing the methodology of events studies. This study utilises the events studies procedure because of its established suitability for handling issues relating to reactions of financial markets to announcements of events. According to Brown and Warner (1985), Kothari and Warner (2006), Mackinlay (1997), McWilliams and Siegel (1997) and Sorokina et al. (2013), several tests of the methodology using real and simulated data have shown that it is robust with respect to its accuracy in capturing the precise effects of announced value-relevant corporate and macroeconomic events. As proof of the method's suitability in examining financial markets' responses to announcements of pandemics' outbreaks, it has been employed in recent times by Al-Qudah and Houcine (2022), Pandey et al. (2020) and Scherf et al. (2022) to investigate COVID-19's impact. Therefore, this paper investigates the dual macroeconomic events of announcement of the first confirmed Nigerian case of COVID-19 outbreak and the first recorded case of fatality as a result of the pandemic. Precisely, the former was recorded in Nigeria on 27th of February 2020 while the latter occurred on 23rd of March 2020. Similarly, the paper considered the foreign exchange market due to its centrality to strengthening the liquidity of stock markets and facilitating foreign portfolio inflows. This is in addition to the long established empirical evidence of cross-correlation, contagion and financial spillovers between stock and foreign exchange markets (Aslam et al., 2020; Babshetti et al., 2022; Beckmann and Czudaj, 2022). Furthermore, considering the fact that cryptocurrencies are assuming rapid global importance over the years as argued by Auer and Claessens (2018), Conlon et al. (2020), Corbet et al. (2020b) and Giudici et al. (2020); this paper extends its scope and analysis to cover cryptocurrency markets as unregulated markets. According to Chainalysis (2020), adoption of crypto assets on the global scale skyrocketed by a whopping 2,300% from the first quarter of 2019 to end-2020 alone. Furthermore, some of the recent works have established links of comovement between the pandemic and returns recorded by cryptocurrencies markets (Goodell and Goutte, 2021). Notwithstanding the findings by some of the recent studies (Conlon et al., 2020; Conlon and McGee, 2020; Corbet et al., 2020b; Iqbal et al., 2021; Montasser et al., 2022) that cryptocurrencies serve as conduits for contagion in times of economic turmoil and financial crises, it is considered expedient by this paper to investigate the cryptocurrency market. This is because several studies including Corbet et al. (2018), Conlon et al. (2020), Iqbal et al. (2021), Corbet et al. (2018), Gil-Alana et al. (2020), Ji et al. (2020), Liu and Tsyvinski (2018) and Sarkodie et al. (2022) all provided evidence supporting the notion that the unregulated nature of cryptocurrency markets enhances their suitability as the right alternative candidates for diversification of investment portfolios in times of economic and financial uncertainties. Moreover, Montasser et al. (2022) and Sarkodie et al. (2022) have found evidence in support of the fact that the pandemic significantly affected the efficiency of cryptocurrency markets and induced pronounced volatility. According to Binance (2021), Nigeria ranked first based on a comprehensive global survey of cryptocurrency usage and adoption conducted in 2020. The report revealed that the country's adoption rate is 32%, with every one out of three Nigerians having used crypto assets. In addition, Chainalysis (2020) reported that Nigeria ranked the sixth country on the global index for adoption of cryptocurrency in 2020. Bearing these evidences that reinforce the soaring importance of cryptocurrencies

in mind, the paper deemed it necessary to include cryptocurrency markets in its investigations.

For the purpose of this study, daily market values for the financial markets under consideration were collected. For the NSE, daily closing values of the market's ASI were collected over the relevant periods from NSE and investing.com. Similarly, daily parallel market rates of the Nigerian naira to the US dollar were collected as foreign exchange market data covering the same period from database of CBN. In addition, the Bitcoin Nigerian-denominated values from Luno collected from investing.com were utilised as the surrogates for the cryptocurrency market operations. Daily closing prices for the crude oil basket of OPEC collected from OPEC website were also employed to measure fluctuations in prices of crude. The choice of the parallel exchange rate was favoured relative to the official government rate as the former is a product of realistic market forces of demand and supply for the currencies. In addition, the relative popularity, transparency and higher market share and value of Bitcoin within the entire cryptocurrency ecosystem as confirmed by the works of D'Alfonso et al. (2016), Giudici et al. (2020), Iqbal et al. (2021) and Sarkodie et al. (2022) was the reason why it was considered an ideal proxy. Furthermore, given that Nigeria is an active member of the OPEC, it makes economic sense to employ the cartel's basket price as a measure of crude oil prices in Nigeria. The values for these financial markets were subsequently converted to returns using the continuous compounding approach. For the NSE return, it was obtained using the following specification:

$$R(NSM)_t = \ln \left[\frac{ASI_t - ASI_{t-1}}{ASI_{t-1}} \right] \tag{1}$$

where

$R(NSM)_t$ the return on the Nigerian stock market in the current period

ASI_t current value of the Nigerian stock market ASI

ASI_{t-1} preceding value of the Nigerian stock market ASI

\ln the natural logarithmic function.

In similar fashion, daily return on the Nigerian foreign exchange market was determined based on the continuously compounded return method. The model is specified as follows:

$$R(NFM)_t = \ln \left[\frac{PXR_t - PXR_{t-1}}{PXR_{t-1}} \right] \tag{2}$$

where

$R(NFM)_t$ the return on the Nigerian foreign exchange market in the current period

PXR_t current value of the Nigerian naira-US dollar exchange rate

PXR_{t-1} preceding value of the Nigerian naira-US dollar exchange rate

\ln as earlier defined.

For the cryptocurrency market, the return was also generated on the same continuously compounded basis. The model employed is as follows:

$$R(NCM)_t = \ln \left[\frac{BCR_t - BCR_{t-1}}{BCR_{t-1}} \right] \quad (3)$$

where

$R(NCM)_t$ the return on the Nigerian cryptocurrency market in the current period

PXR_t current value of the Nigerian Bitcoin-Luno rate

PXR_{t-1} preceding value of the Nigerian Bitcoin-Luno rate

\ln as defined previously.

The return on crude oil prices was also computed with the aid of continuously compounded approaches similar to those used for the previous financial assets. The model is as follows:

$$R(COP)_t = \ln \left[\frac{OBP_t - OBP_{t-1}}{OBP_{t-1}} \right] \quad (4)$$

where

$R(COP)_t$ the return on OPEC crude oil price in the current period

OBP_t current price of the OPEC crude oil basket

OBP_{t-1} preceding price of the OPEC crude oil basket

\ln as defined earlier.

The values were converted using natural logarithmic transformations so as to keep the likely effects of outliers under check. Considering the fact that the return variables are time series by their very nature, the necessity of conducting unit root tests to confirm their stationarity becomes inevitable. The tests were carried out using the augmented version of the Dickey-Fuller test (ADF), the test developed by Phillips and Perron (PP) and the version developed by Kwiatkowski, Phillips, Schmidt and Shin (KPSS) (Kwiatkowski et al., 1992). According to Agung (2009), Brooks (2014) and Greene (2003), it is common knowledge in finance theory that time series variables that are not stationary in behaviour give rise to misleading and spurious results.

A fundamental requirement of event studies is that the length of the event and parameter estimation windows must be clearly, adequately and unambiguously specified ab initio. Consequently, an event window spanning 21 trading days and an estimation window comprising 120 trading days were selected by this study. Kothari and Warner (2006), Mackinlay (1997), McWilliams and Siegel (1997) and Sorokina et al. (2013) have variously argued that a time frame of 120 days is considered sufficiently adequate for formulating benchmark returns as far as event studies are concerned. While early studies such as Panayides and Gong (2002) posited that the use of just 11 trading days' data event window can adequately account for the full effects of a given value-relevant event, a more elaborate event window was chosen by this study in order to account for the sluggish adjustment of emerging financial markets like Nigeria to publicly available information as was established previously by Afego (2010) and Mohammed (2012). The event window of 21 trading days consists of ten-day pre-announcement sub-period, the announcement day itself, and another ten-day post announcement sub-period. While the

pre-announcement sub-period starts from Day -10 to Day -1 , the post announcement sub-period starts from Day $+1$ and ends at Day $+10$. The announcement day is accordingly labelled as Day 0 . On the other hand, the 120-day estimation window for normal period parameters commences at Day -130 and ends at Day -11 .

In this study, the computation of abnormal returns (ARs) was based on the mean-adjusted model approach, and the ARs were calculated for COVID-19's first announced case of infection in Nigeria as well as for the first recorded case of fatality as a result of the virus outbreak. Al-Qudah and Houcine (2022), Angelovska (2011), Koenraadt and Leung (2019) and Scherf et al. (2022) have contended that where the events under investigation are of macroeconomic nature capable of affecting entirety of the financial and economic systems at the same time such as the current COVID-19 outbreak; the most suitable approach is the determination of ARs through the use of mean-adjusted benchmark models. Mean-adjusted returns were calculated by subtracting a constant from the returns over a period of interest (estimation or event window). The constant was obtained by taking the mean or average of the returns spanning the parameter estimation window. The model is based on the assumption of average returns over the N periods covered by the estimation window. This is summarised as follows in the model below:

$$\bar{R} = \left(\frac{1}{N} \right) \sum_{t=1}^N R_t \quad (5)$$

where

\bar{R} the mean or average return over a given window of interest

N the length of period over the parameter estimation window

R_j the return at time t or the current period.

An important consideration in designing the methodology for this paper is the subsisting trade war between the China and the USA which preceded the pandemic's outbreak. Global crude oil markets were experiencing marked volatilities and fluctuations as aftermath of such trade war when COVID-19 broke out. The volatilities were in crude market prices were sustained throughout the period of this study. Thus, global economies were yet to fully deal with the effects of crude oil price volatilities induced by the trade war when the pandemic broke out. Considering the ample and long established evidence that stock markets and even foreign exchange markets are affected by instabilities and volatilities in crude prices, the current study opted for controlling these effects on the returns of the three financial markets under investigation. Degiannakis et al. (2018) provided an example of global evidence of the effect of crude oil price fluctuations on stock markets while Ikechukwu and Omotayo (2019) and Ogiri et al. (2013) established the Nigerian evidence on the stock market effects of such volatilities. In the same vein, Bhattacharya et al. (2019) documented global evidence on the effect of crude volatilities on the foreign exchange markets while Henry (2019) and Ogundipe et al. (2014) established the Nigerian evidence. In addition, Sharif et al. (2020) have found interconnectedness among the trio of COVID-19, crude oil price shocks and stock market volatility in recent times.

Notwithstanding that existing studies on the pandemic's effects have ignored how crude fluctuations concomitantly contributed to the response by cryptocurrency markets, the effect of crude prices was controlled for by the study where model (6) revealed

statistically significant results. In order to put the effects of crude oil fluctuations under control, a linear regression model expressing the relationship between Nigerian stock markets returns and crude returns was estimated as follows:

$$R(NSM)_t = \alpha_0 + \beta_1 COILR_t + \mu_t \quad (6)$$

where

$R(NSM)_t$ the return on the Nigerian stock market in the current period

$COILR_t$ the crude oil return on OPEC basket in the current period

α_0 and β_1 the model parameters to be estimated

μ_t stochastic population error term.

A similar control process for the effect of crude oil on exchange rate returns in Nigeria was also controlled for. The relationship in this case was estimated based on the model below:

$$R(NFM)_t = \alpha_0 + \beta_1 COILR_t + \mu_t \quad (7)$$

where

$R(NFM)_t$ the return on the Nigerian foreign exchange market in the current period

$COILR_t$, α_0 , β_1 and μ_t as defined earlier.

The procedure was also extended to control for the same effect for the cryptocurrency market. The relationship was estimated based on the specified function in model (8) below:

$$R(NCM)_t = \alpha_0 + \beta_1 COILR_t + \mu_t \quad (8)$$

where

$R(NCM)_t$ the return on the Nigerian cryptocurrency market in the current period

$COILR_t$, α_0 , β_1 and μ_t as earlier defined.

The estimations of models (6), (7) and (8) were conducted over the period spanning the parameter estimation window up to the event window based on the pandemic's confirmed first case of infection and case of fatality respectively. In order to ensure that these linear models satisfy the classical assumptions, the models were estimated based on the Newey-West (Newey and West, 1987) specification for heteroskedasticity and autocorrelation consistent (HAC) errors approach. In the same vein, the Jarque-Bera normality statistic was employed to examine the series' distributional characteristics in terms of normality. In order to arrive at the event's ARs from the various financial markets under investigation, the expected or predicted mean-adjusted return was subtracted from computed or actual AR associated with the pandemic as the event of interest. This procedure is depicted in the model below:

$$AR_t = R_t - \bar{R} \quad (9)$$

where

AR_t the current period AR for the Nigerian stock market, the foreign exchange market or the cryptocurrency market

R_t the current period return for the Nigerian stock market, the foreign exchange market or the cryptocurrency market

\bar{R} the average or mean return for the Nigerian stock market, the foreign exchange market or the cryptocurrency market.

In addition, the paper arrived at the cumulative abnormal return (CAR) by summing up the AR over a selected time interval. This is demonstrated in the model below:

$$CAR_t(t_0, t_n) = \sum_{t=0}^n AR_t \tag{10}$$

where

$CAR_t(t_0, t_n)$ the AR cumulated over the period t_0 to t_n

AR_t the AR at the current period.

To test the statistical significance of the daily CAR and the AR computed, the t-test for AR, which is a non-parametric statistic, was employed. The test statistic is computed based on the following specified model:

$$t = \frac{AR_t}{\sigma} \tag{11}$$

where

AR_t the abnormal return at a current point in time

σ the population standard deviation for the parameter estimation window returns.

The standard deviation is indispensable to the test for statistical significance for both the CARs and the ARs for all the three class of financial assets under consideration by this paper. It was thus computed based on the procedure suggested by Angelovska (2011) and Koentraadt and Leung (2019) presented below:

$$\sigma = \sqrt{\frac{\sum_{t=-11}^{-130} (R_t - \bar{R})^2}{120}} \tag{12}$$

where

σ the population standard deviation for the parameter estimation window returns

R_t and \bar{R} are defined previously.

4 Result and discussion

As detailed out under the methodology section of this paper, the three return series of the Nigerian stock market, the foreign exchange market and the cryptocurrency market were tested to ascertain their level of stationarity. Results based on the three different variants of stationarity tests are presented in Table 1

Table 1 Results for tests of return stationarity

<i>First panel: confirmed first case of infection test for stationarity of returns</i>				
	<i>Return on NSM</i>	<i>Return on NFM</i>	<i>Return on NCM</i>	<i>Return on OPEC crude</i>
KPSS	0.41	0.50	0.17	0.59
ADF test	-5.54*	-11.82*	-7.34*	-10.33*
PP test	-5.52*	-34.58	-7.11*	-10.32*
<i>Second panel: confirmed first case of fatality test for stationarity of returns</i>				
	<i>Return on NSM</i>	<i>Return on NFM</i>	<i>Return on NCM</i>	<i>Return on OPEC crude</i>
KPSS	0.43	0.42	0.09	0.50
ADF test	-3.28*	-10.32*	-12.14*	-1.46
PP test	-7.94*	-22.74*	-12.14*	-13.71*

Note: *Indicates significance at the 1% level.

Source: E-Views 10 extractions from output (2020)

The first panel in Table 1 depicts strong evidence of failure to reject null hypothesis that the series of returns based on first confirmed case of infection are stationary at any of conventional levels of 1%, 5% and 10% levels of significance using KPSS tests. It can also be seen from the same panel that the null hypotheses of existence of unit root in the return series for the confirmed first case of infection based on the ADF test and PP test have been rejected at all the conventional levels. Similar results could also be observed for the return series based on the confirmed first case of fatality using all the different tests for stationarity. However, the only exception was OPEC return series which could not reject the null hypothesis of unit root. On the whole, it is clear from the results that the return series are stationary at levels or in their original form and therefore follow $I(0)$ order of integration. The evidence of stationarity lends further credence to existing financial theory which postulates that asset prices are based on their very nature known to be non-stationary but asset returns on the other hand exhibit stationary properties.

The study, in line with its methodological framework, also controlled for the volatility effects of crude prices on the three classes of financial markets being examined using linear models specified in equations (6), (7) and (8). Essential elements of the linear results are presented in Table 2.

From the first panel of Table 2, it can be seen that for the confirmed first case of infection, the effect of crude price fluctuations on the Nigerian stock market were positive and statistically significant at the 1% level. The same positive and significant effect was also recorded for the cryptocurrency market. However, the effect was negative and insignificant for the Nigerian foreign exchange market. Based on the models' explained variation coefficient, 4.4% and 9.6% variations in the stock market and cryptocurrency returns respectively were accounted for by crude prices instability. For the second panel which results are based on first confirmed case of fatality, the results

were strikingly similar in terms of significance and direction of effects. The stock and cryptocurrency markets had 4.3% and 3.4% respectively of their performance being explained by crude price changes. Results from Table 2 support the earlier premonition that crude price instability was significantly distorting financial markets returns in Nigeria even before the advent of COVID-19. Such effects continued to concurrently affect the financial markets albeit the effects of the pandemic. This interesting revelation further underscores the importance of controlling for these crude effects by studies during the pandemic period in Nigeria.

Table 2 Results of linear model regressions for controlling crude oil effects

<i>First panel: confirmed first case of infection regressions</i>				
	<i>Slope (%)</i>	<i>t-values</i>	<i>R² (%)</i>	<i>F-values</i>
Return on OPEC crude » return on NSM	2.30 (0.090)	2.556**	4.40	6.360**
Return on OPEC crude » return on NFM	-6.00 (2.00)	-0.300	0.01	0.450
Return on OPEC crude » return on NCM	11.30 (2.90)	3.897*	9.60	14.812*
<i>Second panel: confirmed first case of fatality regressions</i>				
	<i>Slope (%)</i>	<i>t-values</i>	<i>R² (%)</i>	<i>F-values</i>
Return on OPEC crude » return on NSM	1.40 (0.060)	2.333**	4.30	6.264**
Return on OPEC crude » return on NFM	1.00 (12.00)	0.083	0.00	0.060
Return on OPEC crude » return on NCM	4.10 (1.90)	2.158**	3.40	4.886**

Notes: *Indicates significance at the 1% level and **indicates at the 5% level.

The standard error for each slope is presented in parenthesis.

Source: E-Views 10 extractions from output (2020)

To accurately reflect these crude prices fluctuations effects, residuals derived from the estimated models accounting for the effects became the adjusted returns that accounted for such crude oil prices volatilities. The CARs and ARs were then recomputed respectively based on the mean-adjusted approach highlighted earlier under methodology section. The procedure was used to arrive at adjusted abnormal and CARs for first confirmed case of infection and first case of fatality. Table 3 depicts the summary statistics of ARs and CARs.

The first panel of Table 3 indicates that for the first confirmed case of infection, the dispersion around the mean abnormal and CARs for the Nigerian stock, foreign exchange and cryptocurrency markets respectively is pronounced. The observed high level of dispersion is further supported by the large range and variability for the maximum and minimum values of ARs and CARs for the three categories of financial markets. It can further be observed that skewness for the abnormal and CAR is negative, suggesting preponderance of market losses than gains during the pandemic. The panel also shows that the kurtosis was mostly excess in nature, resulting in fat tails and peakedness at the mean of the distribution. The evidence of leptokurtic distribution of returns for the three categories of financial markets is in line with the theoretical literature in finance (see Agung, 2009; Brooks, 2014; Gujarati, 2003). In terms of normality, the Jarque-Bera statistics is highly significant for all the categories of markets, implying absence of normality. The evidence from second panel of Table 3 is not quite different from the first as the same evidence of high dispersion, negative skewness and leptokurtic distribution

of returns for the three categories of markets as a result of announcement of first confirmed case of fatality.

Table 3 Descriptives for event window abnormal and CARs

<i>First panel: confirmed first case of infection statistics</i>						
	<i>AR for NSM</i>	<i>CAR for NSM</i>	<i>AR for NFM</i>	<i>CAR for NFM</i>	<i>AR for NCM</i>	<i>CAR for NCM</i>
Average	-0.0008	-0.0047	-0.0006	-0.0044	-0.0014	-0.0078
Standard deviation	0.0015	0.0043	0.0031	0.0057	0.0058	0.0059
Minimum values	-0.0051	-0.0171	-0.0097	-0.0154	-0.0252	-0.0294
Maximum values	0.0016	-0.0001	0.0031	0.0022	0.0027	-0.0009
Skewness of distribution	-1.31	-1.54	-1.39	-0.76	-3.57	-2.36
Kurtosis of distribution	4.47	4.79	4.73	2.40	15.44	9.92
Jarque-Bera statistic	7.92**	11.10*	9.33*	2.34	179.97*	61.42*
<i>Second panel: confirmed first case of fatality statistics</i>						
	<i>AR for NSM</i>	<i>CAR for NSM</i>	<i>AR for NFM</i>	<i>CAR for NFM</i>	<i>AR for NCM</i>	<i>CAR for NCM</i>
Average	-0.0011	-0.0152	-0.0014	-0.0224	-0.00	-0.0108
Standard deviation	0.0016	0.0049	0.0173	0.0241	0.0070	0.0097
Minimum values	-0.0051	-0.0226	-0.0385	-0.0639	-0.0264	-0.0293
Maximum values	0.0014	-0.0013	0.0457	0.0065	0.0114	-0.0001
Skewness of distribution	-0.84	1.22	0.64	-0.50	-2.41	-0.97
Kurtosis of distribution	3.01	4.53	4.64	1.63	10.76	2.32
Jarque-Bera statistic	2.46	7.26**	3.80	2.50	73.11*	3.67

Note: *indicates significance at the 1% level and **indicates at the 5% level.

Source: E-Views 10 extractions from output (2020)

The AR and CAR was calculated separately for the first confirmed case of infection and first reported case of fatality. This was done for all the three categories of financial markets. The ARs and CARs for the Nigerian stock market are presented in Table 4.

From Table 4, it can be observed that AR of -0.04% and corresponding CAR of -0.34% for the Nigerian stock market on the day the first confirmed case of infection was announced suggest negative effect. This indicates that the reaction of the Nigerian stock market to the announcement of the outbreak was adverse. However, only the CAR is significant statistically at the 1% level. In the same vein, the average AR of -0.08% and CAR of -0.47% when the first confirmed case of infection was reported is also negative, with only the CAR being significant statistically. Table 4 further reveals that most of the pre and post-announcement ARs and CARs are negative values, pointing to the persistence of decline in stock market performance during the pandemic. In terms of the first reported case of fatality on the other hand, negative and statistically significant announcement day abnormal and CARs of -0.17% and -1.71% respectively, at the 1% level, were recorded. Similarly, the average AR and CAR values of 0.11% and -1.52% were documented. However, only the value of CAR was found to be significant statistically. Similar to what was found under the first confirmed case of infection, the pre and post-announcement windows were dominated by negative returns as well. The

general evidence supports adverse response of the Nigerian stock market to outbreak of the pandemic in terms of the confirmed first case of infection and the first case of fatality. This implies that death from the pandemic affected the market more adversely than increase in reported cases. In specific terms, investors in Nigeria lost 0.17% of their investment value on the day the first case of death was announced alone, and cumulatively lost 1.71% of their investment due to the reported case of death as a result of the pandemic. On the average however, each investor in Nigeria lost 1.52% due to the pandemic. For reported new cases, the finding suggests that investors in Nigeria cumulatively lost 0.34% of the value of their investments when the first case of the pandemic was announced. All these portend shrinkage in investment and capital formation in Nigeria as a result of the pandemic.

Table 4 Announcements effects of COVID-19 on stock market within event window

Day	Confirmed first case of infection				Confirmed first case of fatality			
	AR _t	T (AR _t)	CAR _t	T (CAR _t)	AR _t	T (AR _t)	CAR _t	T (CAR _t)
-10	-0.0001	-0.11	-0.0001	-0.11	-0.0013	-1.83*	-0.0013	-1.83*
-9	-0.0005	-0.66	-0.0005	-0.77	-0.0051	-7.33*	-0.0064	-9.16*
-8	-0.0007	-1.00	-0.0012	-1.77	-0.0034	-4.88*	-0.0098	-14.04*
-7	0.0000	-0.03	-0.0013	-1.80	-0.0036	-5.10*	-0.0134	-19.14*
-6	-0.0002	-0.35	-0.0015	-2.15**	0.0000	0.00	-0.0134	-19.14*
-5	0.0001	0.16	-0.0014	-1.99	0.0002	0.33	-0.0132	-18.81*
-4	-0.0006	-0.80	-0.0020	-2.79**	-0.0007	-1.06	-0.0139	-19.87*
-3	-0.0010	-1.49	-0.0030	-4.28*	0.0014	2.07**	-0.0125	-17.80*
-2	0.0000	0.00	-0.0030	-4.28*	-0.0030	-4.22*	-0.0154	-22.02*
-1	0.0000	-0.02	-0.0030	-4.30*	0.0000	0.02	-0.0154	-22.00*
0	-0.0004	-0.53	-0.0034	-4.83*	-0.0017	-2.48**	-0.0171	-24.48*
+1	-0.0020	-2.84*	-0.0054	-7.67*	-0.0002	-0.26	-0.0173	-24.74*
+2	-0.0017	-2.39**	-0.0070	-10.06*	-0.0002	-0.26	-0.0175	-25.00*
+3	0.0016	2.22**	-0.0055	-7.84*	0.0002	0.29	-0.0173	-24.71*
+4	0.0007	0.97	-0.0048	-6.88*	0.0007	1.02	-0.0166	-23.69*
+5	0.0001	0.11	-0.0047	-6.77*	-0.0020	-2.91*	-0.0186	-26.59*
+6	-0.0001	-0.21	-0.0049	-6.98*	-0.0004	-0.57	-0.0190	-27.17*
+7	-0.0004	-0.63	-0.0053	-7.61*	0.0003	0.42	-0.0187	-26.75*
+8	-0.0051	-7.34	-1.0005	-14.95*	-0.0005	-0.76	-0.0193	-27.51*
+9	-0.0033	-4.76*	-1.0038	-19.71*	-0.0011	-1.59	-0.0204	-29.10*
+10	-0.0033	-4.76*	-1.0071	-24.47*	-0.0022	-3.14*	-0.0226	-32.24*
<i>Average</i>	<i>-0.0008</i>	<i>-1.14</i>	<i>-0.0047</i>	<i>-6.71*</i>	<i>-0.0011</i>	<i>-1.57</i>	<i>-0.0152</i>	<i>-21.71*</i>

Note: *indicates significance at the 1% level and **indicates at the 5% level.

Source: E-Views 10 extractions from output (2020)

The AR and CAR associated with the cryptocurrency market as a result of the pandemic is also analysed. The AR and CAR is presented in Table 5.

Table 5 COVID-19 effects on foreign exchange market within event window

Day	Confirmed first case of infection				Confirmed first case of fatality			
	AR _t	T (AR _t)	CAR _t	T (CAR _t)	AR _t	T (AR _t)	CAR _t	T (CAR _t)
-10	0.0001	0.00	0.0001	0.00	-0.0029	-0.13	-0.0029	-0.13
-9	0.0022	0.10	0.0022	0.10	-0.0001	0.00	-0.0030	-0.13
-8	-0.0016	-0.07	0.0007	0.03	0.0005	0.02	-0.0025	-0.11
-7	-0.0014	-0.06	-0.0007	-0.03	0.0040	0.18	0.0015	0.07
-6	0.0005	0.02	-0.0002	-0.01	-0.0014	-0.06	0.0001	0.00
-5	0.0002	0.01	0.0000	0.00	-0.0036	-0.16	-0.0035	-0.16
-4	0.0023	0.10	0.0022	0.10	-0.0039	-0.18	-0.0074	-0.34
-3	-0.0007	-0.03	0.0016	0.07	0.0031	0.14	-0.0043	-0.20
-2	-0.0043	-0.19	-0.0027	-0.12	0.0028	0.13	-0.0015	-0.07
-1	0.0019	0.09	-0.0008	-0.04	-0.0084	-0.38	-0.0099	-0.45
0	-0.0056	-0.26	-0.0064	-0.29	-0.0217	-0.99	-0.0316	-1.44
+1	0.0004	0.02	-0.0060	-0.28	-0.0076	-0.35	-0.0392	-1.79
+2	0.0031	0.14	-0.0029	-0.13	0.0457	2.09	0.0065	0.30
+3	-0.0029	-0.13	-0.0058	-0.26	-0.0204	-0.93	-0.0139	-0.63
+4	0.0015	0.07	-0.0043	-0.20	-0.0385	-1.76	-0.0524	-2.39**
+5	-0.0027	-0.12	-0.0070	-0.32	-0.0043	-0.20	-0.0567	-2.59**
+6	0.0013	0.06	-0.0057	-0.26	-0.0072	-0.33	-0.0639	-2.92*
+7	-0.0097	-0.44	-0.0154	-0.70	0.0078	0.36	-0.0561	-2.56**
+8	0.0004	0.02	-0.0150	-0.68	0.0145	0.66	-0.0415	-1.90*
+9	0.0002	0.01	-0.0147	-0.67	-0.0166	-0.76	-0.0581	-2.65**
+10	0.0024	0.11	-0.0123	-0.56	0.0280	1.28	-0.0301	-1.37
<i>Average</i>	<i>-0.0006</i>	<i>-0.03</i>	<i>-0.0044</i>	<i>-0.20</i>	<i>-0.0014</i>	<i>-0.06</i>	<i>-0.0224</i>	<i>-1.02</i>

Note: *indicates significance at the 1% level and **indicates at the 5% level.

Source: E-Views 10 Extractions from Output (2020)

The first panel of Table 5 depicts that the negative but statistically insignificant AR of -0.56% and -0.64% respectively were documented for the foreign exchange market on the announcement of confirmed first case of infection. While the negative values suggest that the market reacted negatively, insignificance nature of the values implies that they do not carry any statistical weight. On the contrary however, the most of the abnormal and CAR values across the pre-announcement and post-announcement sub-periods were predominated by positive values. This indicates that the Nigerian foreign exchange market recorded more of gains for the periodic around announcement of the first confirmed case of infection for the pandemic. The average abnormal and CARs of 0.06% and -0.44% respectively over the entire event window for the first case of infections portray mixed results. In the same vein, the second panel shows that reactions to announcement of first fatality case was adverse of -0.14% AR and positive CAR of 2.24% both of which are insignificant statistically. This shows that the results for this panel are not any different from those of new reported cases as they are also negative and insignificant statistically, indicating that the market's perception of the announcement of

first confirmed case of infection as unfavourable but did not reasonably affect the market. The insignificant negative values of CAR and AR further reinforce the evidence such effects. Furthermore, the pre-announcement and post-announcement period ARs are predominantly negative but insignificant. These findings imply that the effect of the pandemic on new cases and cases of death on the foreign exchange market in Nigeria was not pronounced. This further depicts that the pandemic did not induce much fluctuations in Nigerian naira to US dollar rates.

Furthermore, the study calculated the values of AR and CAR arising from the first confirmed case of infection and the case of fatality. Table 6 summarises the results.

Table 6 Recorded COVID-19 effects on crypto market within event window

Day	Confirmed first case of infection				Confirmed first case of fatality			
	AR _t	T (AR _t)	CAR _t	T (CAR _t)	AR _t	T (AR _t)	CAR _t	T (CAR _t)
-10	-0.0009	-0.39	-0.0009	-0.39	-0.0051	-2.42**	-0.0051	-2.42**
-9	-0.0004	-0.19	-0.0013	-0.58	0.0005	0.24	-0.0046	-2.18**
-8	-0.0038	-1.74	-0.0051	-2.32**	0.0017	0.81	-0.0029	-1.36
-7	0.0027	1.25	-0.0024	-1.07	-0.0264	-12.59*	-0.0293	-13.95*
-6	-0.0021	-0.95	-0.0044	-2.02*	0.0036	1.73	-0.0257	-12.22*
-5	-0.0021	-0.96	-0.0066	-2.98*	-0.0034	-1.64	-0.0291	-13.86*
-4	-0.0001	-0.06	-0.0067	-3.04	0.0038	1.81	-0.0253	-12.06*
-3	0.0013	0.58	-0.0054	-2.46**	0.0009	0.43	-0.0244	-11.63*
-2	-0.0015	-0.70	-0.0070	-3.16*	0.0114	5.45	-0.0130	-6.18*
-1	-0.0036	-1.65	-0.0106	-4.81*	-0.0011	-0.54	-0.0141	-6.72*
0	0.0005	0.23	-0.0101	-4.58*	0.0063	3.02*	-0.0078	-3.70*
+1	-0.0008	-0.37	-0.0109	-4.95*	0.0015	0.71	-0.0063	-2.99*
+2	0.0012	0.56	-0.0096	-4.39*	-0.0003	-0.16	-0.0066	-3.15*
+3	-0.0016	-0.73	-0.0113	-5.12*	0.0011	0.55	-0.0055	-2.60*
+4	0.0001	0.03	-0.0112	-5.09*	0.0005	0.25	-0.0049	-2.35**
+5	0.0023	1.07	-0.0089	-4.02*	0.0001	0.03	-0.0049	-2.32**
+6	0.0023	1.04	-0.0066	-2.98*	-0.0010	-0.47	-0.0059	-2.79*
+7	0.0009	0.40	-0.0057	-2.58**	0.0038	1.79	-0.0021	-1.00
+8	-0.0002	-0.08	-0.0059	-2.67**	-0.0016	-0.75	-0.0037	-1.76
+9	0.0017	0.77	-0.0042	-1.90*	-0.0020	-0.96	-0.0057	-2.72*
+10	-0.0252	-11.47*	-0.0294	-13.37*	0.0056	2.67*	-0.0001	-0.05
<i>Average</i>	<i>-0.0014</i>	<i>-0.63</i>	<i>-0.0078</i>	<i>-3.55*</i>	<i>0.0000</i>	<i>0.00</i>	<i>-1.0008</i>	<i>-5.14*</i>

Note: *indicates significance at the 1% level and **indicates at the 5% level.

Source: E-Views 10 extractions from output (2020)

It can be seen from Table 6 that the AR of 0.05% following announcement of confirmed first reported case of infection was positive while the corresponding CAR of -1.01% experienced by the cryptocurrency market was negative, suggesting that while the crypto market perceived the announcement of the outbreak as a positive signal, the announcement was perceived as negative news on the cumulative basis. However, the AR

was statistically insignificant, but the corresponding CAR was found to be significant statistically at the 1% level. Table 6 further reveals that the average values of AR and CAR for the entire event window were negative but only the latter was found to be statistically significant. In addition, most of the values AR and cumulative abnormal within the pre and post-announcement periods were negative, indicating that the reaction around period of the pandemic was profoundly adverse. On the other hand, positive and significant AR of 0.63% (at the 1% level) was associated with the day the first case of fatality from the pandemic was announced in Nigeria. However, the -0.78% corresponding CAR for the announcement day of fatality was negative and also significant. While the average AR associated with the announcement of first case of infection was approximately and insignificantly close to zero, the negative average CAR of -1.08% was significant. Like in the case of the stock market, the effect was stronger when cases of deaths were announced compared to new cases of the pandemic. The initial positive AR is explained by noise and the slower pace of impounding information in cryptocurrency markets in relation to stock markets. The market subsequently adjusted to reflect the negative effect on crypto asset prices. The co-movement of reaction to the pandemic among the stock market and the cryptocurrency market in Nigeria is a pointer to the positive nature of cross-correlations between their returns and the high possibility of diversification by investors between these markets. It also suggests the contagion effect between the two markets.

In the final analysis, it can be argued that evidence of negative effect of COVID-19's outbreak on the Nigerian stock market is in tandem with findings of Al-Qudah and Houcine (2022), Avalos and Zakrajsek (2020), Harjoto et al. (2021), Scherf et al. (2022), Sharif et al. (2020), Takyi and Bentum-Ennin (2021), Zaremba et al. (2020), and such other earlier works that documented findings of strongly significant adverse impacts of previous epidemics on various stock markets like Chen et al. (2007), Chen and Huang (2009), Loh (2006), Tai-Leung et al. (2010), Wang et al. (2013) and Wong (2008). Like the evidence on the stock market, this paper also found adverse impact of the pandemic on the market for cryptocurrency in Nigeria. The findings of negative and strongly significant effect of the pandemic on cryptocurrency market in Nigeria is consistent with Iqbal et al. (2021) and Montasser et al. (2022), and suggests that cryptocurrency returns are positively correlated with the returns of the Nigerian stock market during the pandemic as was established previously by Corbet et al. (2020b) and Sarkodie et al. (2022). However, the pandemic had negative but insignificant effect on the foreign exchange market in Nigeria. This finding is slightly incongruent with the previous studies of Babshetti et al. (2022) and Li et al. (2021) who also found negative but statistically significant effect of the pandemic on the foreign exchange market.

5 Policy implications

The findings of this paper bring to the fore some far reaching policy implications. The withdrawal of foreign capital from the Nigerian stock market by investors in panic mood and the concomitant excessive pressures mounted on the demand for US dollars to repatriate foreign portfolio capital during the pandemic no doubt created consequences in terms of Nigeria's foreign debt servicing and management, stock market liquidity, management of the country's foreign reserves, balance of payment position and economic growth and development over the long-term. In addition to distorting Nigeria's ongoing

efforts to attract more foreign capital especially portfolio funds, continuous mounting of pressure of the foreign exchange could result in depletion of Nigeria's foreign exchange reserves and further plunge the country into crises. As a consequence of the foreign exchange crisis induced by the pandemic, Nigeria's ability to service its international debts become seriously impaired. All these will culminate in an exceedingly unfavourable balance of payment for Nigeria, no thanks to the pandemic. Similarly, the obvious inability of policy makers in Nigeria to promptly and aptly design and put in place a robust policy framework in form of a pandemic response to facilitate growth of the learning curve from previous epidemics (like the Ebola outbreak of 2014) facilitated foreign investors' sudden panic and unprecedented withdrawal of funds from Nigeria. The absence of such a policy response framework is believed to be the main factor that exacerbated risks of uncertainty in terms of response policies in Nigeria when the pandemic broke out.

In addition, some incisive implications in terms of policy framework can also be implied based on the finding on cryptocurrencies. These policy implications become particularly for designing and promoting acceptance of cryptocurrencies regulation framework by the CBN in Nigeria. It can be implied from the findings that the market co-moves with conventional financial markets in Nigeria. This means that the cryptocurrency market in Nigeria will react in similar fashion and perhaps even direction and magnitude, to macroeconomic events as would do other conventional financial markets in Nigeria such as the foreign exchange market and the stock market. This point to the imperatives of embracing cryptocurrencies and designing a financial regulatory framework that will ensure their safe usage and exchange as critical financial assets within the Nigerian financial systems. This is necessary especially considering the astronomically increasing number of Nigerians accepting and trading in cryptocurrencies.

6 Conclusions

In this paper, the methodology of events studies was relied upon to investigate COVID-19's effects on three financial markets in Nigeria namely the stock market, the foreign exchange market and the cryptocurrency market. On the overall, the study established adverse evidence of response of by the Nigerian stock market to announcement of the confirmed first case of infection and the first reported case of fatality arising from the pandemic respectively. The pandemic's negative effect is arguably attributable to panic by investors and other market participants when the outbreak's news suddenly hit financial markets. In addition, the resultant uncertainty in terms of definite policies to combat the unanticipated effects of the outbreak further exacerbated the negative impact on Nigerian stock market. Similarly, evidence of dominant and persistent negative AR and CAR throughout the event window is a pointer to the market's sustained decline around periods the pandemic was anticipated and when its outbreak was eventually announced.

In contradistinction however, the study revealed that the pandemic recorded negative but statistically insignificant overall effect on Nigeria's foreign exchange market for the announcement of the pandemic's confirmed first case of infection and confirmed first reported case of fatality, respectively. The statistically insignificant is explained by the Nigerian Government's continuous intervention in the foreign exchange market through

interbank activities with a view to achieving stability in exchange rate. The CBN's sustained supply to the interbank market downplayed the actual variability in exchange rates arising from announcement of the pandemic's outbreak.

Furthermore, the study also documented the outbreak's adverse impact on the cryptocurrency market the day news of the confirmed first case of infection and first case of fatality broke out, respectively. This observed negative effect on cryptocurrency market is as a result of the fact that notwithstanding the unregulated nature of these markets which operates outside the formal financial system, the market's integration with other formal financial markets like the stock and foreign exchange markets gives rise to instantaneous contagion and spillover effects of important macroeconomic events like COVID-19's unanticipated outbreak.

The paper therefore recommends that SEC as the policy maker for the Nigerian capital market should establish print and electronic real-time information dissemination channels through which investors and other capital market stakeholders would be continuously informed and kept abreast with the slightest developments during pandemic outbreaks so as to curb market panic and overreaction to pandemics outbreak. The SEC, in conjunction with the CBN and NSE should collaborate to put in place robust policy framework to help cushion the negative effects of the pandemic. The framework should be built on the principle of entrenching stimulus aimed at supporting market infrastructure and enhancing financial markets liquidity, and promoting safety-compliant market intermediation. Furthermore, it is recommended that the CBN should withdraw its participation in the Nigerian foreign exchange market through the interbank window so as to promote the efficiency of the foreign exchange market and conserve Nigeria's foreign reserve. In addition, the SEC and the CBN should develop a policy framework that will recognise cryptocurrencies as alternative legal tender in Nigeria in view of the fact that cryptocurrencies markets correlate with the Nigerian stock market. Such framework should emphasise strict regulations and controls for owning and investing in crypto assets in Nigeria. At the very least, the aforementioned regulators should develop a framework to regulate cryptocurrency trading if it is not economically expedient to legalise and recognise cryptocurrencies as alternative legal tender in Nigeria especially considering the teeming number of Nigerian citizens trading in cryptocurrencies.

This study has contributed to knowledge in a number of ways. From the perspective of empirical contribution to the literature, the study established the nature of the effect of the pandemic not only on the conventional financial markets (the stock and foreign exchange markets) but also the cryptocurrency market which is not regulated and controlled through the formal financial system. In terms of methodological contributions, the study controlled for, and isolated the effect of crude oil price fluctuations which occurred concurrently with the pandemic. Failure to control for the effect of crude fluctuations on the financial markets could contaminate the AR computed and render the results spurious as it appears to be the case with many current studies on the effect of COVID-19 on financial markets. The study has also contributed to practice in that persistence of the pandemic can create foreign exchange crises for the CBN, foreign investors, and ultimately result in depletion of Nigeria's foreign reserves. The finding also demonstrated that investors in Nigeria who attempt to hedge against the risk of the pandemic by diversifying to crypto assets will record negative returns because the cryptocurrency market positively correlates with the Nigerian stock market and offers negative returns as well. Theoretically, the study has contributed to knowledge by establishing that efficient markets theory is not only applicable to financial markets

operating within the formal financial system but can as well be applied to informal financial markets such as the cryptocurrency market once there is correlation of returns between the markets.

7 Limitations and suggestions for further studies

This paper examined the initial response of financial markets to COVID-19 pandemic using daily data over a short-term period to establish immediate response of financial markets in line with the market efficiency theory. Given that the pandemic was still ravaging economies and financial markets as at the time of completing this paper, the time frame from inception of the pandemic was too short to conduct a long run effects study. The study also did not focus on investigating the factors that may explain the reaction of these financial markets to the outbreak because of the short time interval from the outbreak of the pandemic to the writing of this paper. The study was also not able to undertake a sectorial analysis of the effects of the pandemic as such approach can provide interesting insights to the disaggregated nature of investor sentiments within the same financial market. Lastly, the study did not also conduct a comparative analysis of the reaction with other emerging financial markets in Africa or elsewhere as the Nigerian financial market was considered as a reasonable representation of the behaviour of African financial markets given their many similarities in institutional structure.

Future studies need to examine the long run effects to ascertain how long it takes financial markets to efficiently reflect and impound the news of the pandemic into prices of assets in financial markets. Such study will be necessary to establish the effect of the pandemic on the value of buy-and-hold investors in Nigeria who hold portfolios over a long period of time. Future studies can also investigate the determinants of such market reaction to the pandemic. It is important to investigate these cross-sectional factors that may have accounted for differences or variations in reactions to the pandemic especially across different financial markets. Identifying the most important factors that drive the effects of the pandemic can be veritable inputs for policy making during pandemics outbreak. Furthermore, the imperatives of conducting sectorial analysis of the effect of the pandemic within financial markets by future studies can help reveal which sectors are relatively more resilient and insulated from the adverse effects of the pandemic because such knowledge will have far reaching implications for portfolio diversification during periods of pandemics. In addition, the need to conduct comparative analysis between or among countries lies in the fact that it is expedient to account for institutional differences, market regulations, policy responses, as well as other factors that can account for variation of the effects of the pandemic across countries.

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