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Stock market response to COVID-19 pandemic: A comparative evidence from two emerging markets

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**A B S T R A C T**

This paper presents the first comparative study of emerging stock markets' response to the COVID-19 pandemic with evidence from Ghana and Botswana. Using daily time-series data from March 1, 2020, to September 30, 2021, the study estimates parametric, semi-parametric and non-parametric models, and provides evidence to support the negative effects of the COVID-19 pandemic (i.e., the total number of reported COVID-19 cases and deaths) on the stock market performances of Ghana and Botswana. Interestingly, the study shows that the impact of the pandemic on Ghana's stock market is quantitatively greater than the stock market of Botswana. The study calls for fiscal and monetary policies to help firms on the stock market to survive the shock. Going forward, measures aimed at building a robust stock market to withstand such external shocks are critical.

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**Introduction**

In 1989, both stock exchanges of Ghana and Botswana were established and have remained the sole stock exchanges in their respective countries. Both exchanges have performed creditably since their inception even though they have also encountered periods of shortfalls. Globally, the Ghana Stock Exchange (GSE) has been described as one of the high performing exchanges. For instance, the GSE was adjudged the sixth highest performing emerging stock market in 1993, with a capital appreciation of 116% [14]. Again, in 1994, as cited by Quaidoo [43], Birinyi Associates, a research company based in the USA, judged the GSE as the stock market with the highest performing index of all emerging markets, gaining 124.3 percent at

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**Abbreviations:** GSE, Ghana Stock Exchange; BSE, Botswana Stock Exchange; GSE CI, Ghana Stock Exchange Composite Index; ASEA, African Securities Exchanges Association; SARS, Severe Acute Respiratory Syndrome; WHO, World Health Organisation; UN, United Nations; IMF, International Monetary Fund; ILO, International Labour Organisation; GDP, Gross Domestic Product; WTO, World Trade Organisation; COVID-19, Corona Virus Disease 2019.

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its index level. Periods after 1995 were, however, characterized by a mix of high and low performances mainly as results of internal shocks from macroeconomic instability. Additionally, as indicated in Yarkey and Adjasi [52], the GSE was adjudged by Morgan Stanley Capital International Global Index as the world’s highest-performing market for 2003 with an annual return of about 154.7% in Ghana cedi terms or 144% in US dollar terms, compared to 30% return for the global average. Even though the exchange is considerably younger than most African stock exchanges, it has attracted a great deal of publicity and interest from researchers and investors.

Similarly, the Botswana Stock Exchange (BSE) has equally chalked up some remarkable successes. The BSE has been one of Africa’s best-performing stock markets, with a 10-year average return of 24%. Regarding Southern Africa, the BSE is considered the third-largest stock market in terms of market capitalization, thus being one of the most active stock markets in SSA with comparatively high capitalization [14].

The two stock markets and other African stock markets have been found susceptible to external financial shocks. For instance, the GSE Composite Index (GSE CI) fell more than 46.58% from end of year figure of 10,431.64 by the end of 2008 to 5572.34 as at the end of 2009. A closer look at the GSE CI depicts that the growth began to fall marginally in the latter part (October) of 2008 showing signs of susceptibility to global financial crisis. The BSE Domestic Company Index (BSE DCI) increased from 3559.10 in 2005 to 6195.40 in 2006 and 8421.60 in 2007. The index, however, decreased to 7035.50 (i.e., 16.46 and 33% in US dollar terms in 2008) mainly due to a fall in stock demand as a result of global financial crisis. The fall in index was experienced more in the latter part of 2008. The index, however, began improving in 2009.

So far, the discussion shows that the two stock markets, to a larger extent, responded susceptibility to external shocks. Against this background, a key question that needs to be addressed is - to what extent are these two emerging markets responsive to natural disasters and other pandemics?

It is worthy to state that the Severe Acute Respiratory Syndrome (SARS) that occurred in 2000–2003 from Guangdong in the southern part of China did not have any significant effect on SSA markets in general, even though it affected 8000 people across twenty six countries including China, Canada, Hong Kong, Singapore and Vietnam. In addition, the disease did not have any significant adverse effect globally with the exception of China and Vietnam [40].

The novel corona virus disease 2019 (2019-nCOV or COVID-19) which was reported for the first time by the World Health Organization (WHO) to have occurred in Wuhan, China close to the end of 2019 spread rapidly and widely to almost every country of the world. To halt the spread of the disease, several countries including Ghana and Botswana, introduced stringent measures such as lockdowns, wearing of face masks, regular use of hand sanitisers, travel restrictions, enforcement of social distancing, and closure of schools, drinking bars and restaurants among others. The global spread of the pandemic in the first two quarters of 2020 witnessed a drastic reduction in demand for certain goods and services as the uncertainty about the future increases. The other important concerns relate to production capacity reductions, closure of businesses, reduction in employee welfare conditions, payment of half salaries and employee layoffs.

It is imperative to state that some amount of panic among consumers and firms created distortions in demand, consumption, investment patterns and market anomalies. Global financial markets have also exhibited some degree of responsiveness to the COVID-19 impact. Indeed, the pandemic has led to global contraction in real economic activity growth and worldwide decline in stock prices [31,53]. The global financial market is among the worst hit industries by the pandemic. Inevitably, stock markets of the world have not been spared. Towards halting the spread of the pandemic, governments across the world implemented preventive measures such as social distancing, lockdowns, etc. Ironically, such measures have stifled economic activities in several sectors especially tourism, clothing and textiles, education and so on. The contagion effect of the pandemic on global financial markets has been observed in almost every stock market. Again, horrific news from the media has also contributed to investment pattern within the first two quarters of the year [55,56]. The measures of the stock market are trending downward, and investors have become more pessimistic and prefer to wait for market certainty before reviving their investment activities [18,35]. Owing to the rapid spread of the highly infectious disease and death cases, many individuals, including investors across the globe, are uncertain. Such uncertainties are expected to negatively affect the performance of the stock market. Uncertainty produces anxiety that can have a depressive effect on investment decisions, stock prices, and the stock market performance, eventually. Al-Awadhi et al. [3] and Li [33] have noted that returns on the stock market respond to major events such as disasters [32], news [34] and weather [47] and political events [28].

The COVID-19 pandemic is expected to impact negatively on many capital markets in Africa and around the world. However, do we expect the well-performing markets in Africa to be susceptible to the shock as a result of the pandemic? To this end, we identify Ghana and Botswana’s stock markets as two emerging yet well-performing markets in Africa and investigate the extent to which they have individually responded to COVID-19. Specifically, we examine how the total number of reported cases and deaths of COVID-19 have affected the performance of both Exchanges.

The remainder of the paper is structured as follows: section two discusses previous literature on the subject, and section three explains the methodology (data and empirical strategy) used for the study. The fourth section presents and discusses the results. In the last section, the conclusion and relevant policy prescriptions are discussed.

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1 ASEA, African Securities Exchanges Association Report, ASEA, 2009 mfw4a.org/publication/2009-african-securities-exchanges-association-year-book [Accessed on the 25-06-2022].
**Literature review**

**Review of COVID-19 pandemic and firms’ performance**

This study is founded on the theory of institutional resilience. According to Aligica and Tarko [4], this theory focuses on the relationship between the human and the environment. The theory acknowledges that natural shocks can affect humans’ existence, their behavior and decision making. The theory extends the concept to include all sources of instability. Examples of such sources of instability include political, health, economic, cultural, and social shocks. By implication, COVID-19 presents a source of instability to emerging and fragile markets. The pandemic has affected social interaction and well-being and economic activities globally through the imposed lockdowns, work from home policies and social distancing policies [8]. The pandemic has not only claimed millions of lives but has also adversely affected private and business lives. Almost all industries have been affected by the pandemic in one way or another, but the effect in some industries such as transportation and international trade, hospitality, tourism and education have been gargantuan. One of the stringent measures taken by governments after the WHO declaration of the pandemic was border controls resulting in ban of international travels since it was estimated that massive movement of people through the use of airplanes is to a great extent responsible for the human-to-human transmission of the disease. These restrictions affected businesses worldwide because most of these businesses are interconnected through international trade. One important channel that brings the enormous impact of COVID-19 on Ghana’s stock exchange to bear is international trade, which hence demands critical attention. There is a strong expectation of a decline in trade as lockdowns have been implemented, resulting in a decrease in trade between African countries and their trade partners, leading to immense economic losses for the countries involved [11].

Admittedly, COVID-19 has seriously affected the real economy even in its pre-pandemic period, with a negative effect on trade, tourism, and the transport industry, causing local food shortages [48]. With this background, the decline in oil prices due to the global slowdown associated with COVID-19 necessitates an inquiry into the oil-stock dynamics from the net oil-importing country perspective. A myriad of studies on the COVID-19 pandemic and oil markets or prices have shown some impact on various socioeconomic and political factors (e.g., [7,25,39]).

The tourism sector is among the hardest affected globally by the pandemic. The United Nations World Tourism Organization [50] predicted a decline in foreign tourist arrivals of 20–30% and that millions of industry workers were likely to lose their jobs. In its report, the International Labor Organization [22] identifies the coronavirus pandemic as “the worst global crisis since the Second world war” (p.2). In both the formal and informal sectors of the economy, over several million people are at risk of slipping deeper into poverty due to the devastating effects of the virus. Strict measures taken by governments, such as lockdowns and travel restrictions, will result in the loss of 195 million full-time jobs, or 6.7% of global working hours. Many are in low-paid, low-skilled jobs where sudden loss of income is catastrophic [22].

COVID-19 and mitigating measures taken by governments have compelled business owners and managers to mobilize the available resources to make short term decisions which could have long term implications such as reduction in production capacity/output, layoffs and temporarily shutting down operations. Companies of all sizes have adapted their business models and strategies to changing external or environmental factors within a short period of time. This certainly would have an impact on financial performance of businesses as indicated by empirical studies [30]. This has compelled companies of all sizes to adapt their business models to changing conditions brought about by the pandemic to avoid collapse [55].

**Impact of the pandemic on economic growth**

COVID-19 has negatively impacted countries worldwide in terms of economic growth. Before the outbreak was declared a pandemic by the WHO, there were already strong signs of a decline in the global economy. Some countries have been thrown into recession. The UN has warned that the pandemic is likely to have a major adverse impact on the global economy and cause countries worldwide to lower GDP growth (United Nations, [49]).

A variety of channels, such as labor markets, global supply chains and consumption behaviors, can be triggered by the pandemic, all of which can adversely affect the global economy. The International Monetary Fund (IMF) predicted in the Global Economic Outlook Report in April 2020 that the global gross domestic product (GDP) would fall by 3% during the year [23], while the World Trade Organization (WTO) predicted that global trade could decline by as much as 32% in 2020 [51].

**COVID-19 and the non-African financial sector**

Numerous empirical studies have been done in the past on effects of epidemics on economic activities such as stock market performance. Analyzing forty-three (43) countries, Barro et al. [12] found evidence that the Great Influenza Pandemic (Spanish Flu) of 1918–2020 triggered stock price declines worldwide. Currently, much of the studies on epidemics in recent times focused on specific countries. For instance, Gupta et al. [20] documented negative economic effects of SARS in Canada, Chen et al. [15] in Taiwan, and Beutels et al. [13] in China.

Studies on the novel COVID-19 pandemic, however, seem to have drawn more interest from researchers and financial market practitioners. Studies such as Goodell [19] have confirmed that the COVID-19 pandemic is causing unprecedented global economic harm that is devastating. He asserts that the pandemic may have a wide-ranging effect on the financial
sector, including capital markets. Al-Awadhi et al. [3] analyzed the early effects of the COVID-19 outbreak on share prices in China with employed firm-level data from China. Furthermore, Zhang et al. [53] found that COVID-19 has contributed to a surge in global financial market risk.

Using panel-data regression models to assess the effect on stock market return of the daily increase in the number of COVID-19, Anh and Gan [6] found that from January 30 to May 30, 2020, the daily stock returns of 723 listed companies in Vietnam decreased during the pre-lockdown and lockdown periods. The research leads to the assertion that pandemics such as COVID-19 have negative effects on stock returns. The study also found that the Vietnam stock market before and during the nationwide lockdown performed in opposing ways. Although the COVID-19 pre-lockdown had a significant negative effect on stock returns in Vietnam, the lockdown period had a significant positive impact on the stock performance of the whole market and the various business sectors in Vietnam.

The results on the dependency of companies on trade linkages and the value of a strong financial position as a matter of preparedness for future pandemics still remain important.

COVID-19 and the financial sector in Africa

The impact of COVID-19 has led to a slowdown in all economic sectors worldwide [45]. Indeed, the International Monetary (IMF) Fund Report in 2020 observed that in the face of COVID-19, Africa, like all the global economy, faces its worst downturn since the Great Depression. Specific to the financial sector, uncertainty, volatility and risk in the financial markets have been the major concerns. This claim is justified by the abrupt decline in the equity markets and the loss in market value of approximately 30% within a few weeks of the pandemic, coupled with a sell-off speed more than the 2008–09 global financial crises [45]. These disturbances continued into credit markets making it tough for firms and governments to make borrowing of funds for any duration. It is expected that the economic slowdown will continue to create new problems in the financial system and may eventually result in a financial crisis. Roy [45] further argues that although the Equity markets in Africa have recovered to a certain extent (since their March 2020 lows), the recovery does not properly display the possible downside situations. Market participants stated that the instability in price of equity demonstrates movement between optimistic and pessimistic macroeconomic outlook of the stakeholders. The continuous lack of liquidity in financial markets led to forced selloffs by owners or managers of assets due to a fall in credit rating.

Empirically, the impact of COVID-19 on especially the stock market has been investigated by several studies. With thirteen African countries, Takyi and Bentum-Ennin [46] have investigated the short-term impact of COVID-19 on stock market performance/index. Applying the Bayesian structural model, the study finds mixed results. While the study showed that for 10 African countries, there is evidence of a statistically significant impact of COVID-19 on the stock market performance, and that the impact ranges from −2.7% to −20%, no evidence is found for the remaining three African countries. Takyi and Bentum-Ennin’s study relates to the present study to a certain extent. The point of departure is that they used a non-parametric approach for thirteen countries and focused on the short-term effects while we focused on parametric, non-parametric and semi-parametric models for only two emerging markets.

Similarly, Iyke and Ho [26] with a relatively larger number (14) of African countries relied on daily investor attention index and stock market index and revealed that a key determinant of stock market performance is investors’ attention. Using the EGARCH framework, the authors also found mixed results. While negative results were obtained for countries such as Nigeria, Zambia and Botswana, positive results were obtained for Tanzania and Ghana.

Raifu [44] combined both time series and panel frameworks to examine the effects of COVID-19 on Stock Market performance in 14 African countries. The author relied on three econometric methods, namely ordinary least squares with robust standard errors, pooled ordinary least squares and the panel vector autoregressive. As expected, the authors found a negative and statistically significant effect of COVID-19 confirmed cases and stock market performance for Tunisia (North Africa), Uganda, Kenya and Tanzania (Eastern Africa), and Botswana (Southern Africa). However, the study failed to establish any evidence for COVID-19 death cases and stock market performance. This study highlighted the need to investigate the impact of the pandemic and compare at country-level rather than lumping all together in a panel framework as such results can be misleading. Again, focusing on the volatility of African stock markets, Del Lo et al. [16] in a parametric panel data framework estimated the impact of COVID-19 on the volatility of major African stock markets. In their evidence, they argued that panic and fear associated with COVID-19 drives African stock volatility of about 7%. In addition, Zougrana et al. [54] focused on the West African Economic and Monetary Union’s stock market. The authors used the GARCH processes and found that the negative effect of COVID-19 pandemic is more noticeable for the distribution sectors. Here, the market was more sensitive to death cases and not confirmed cases.

For country specific studies, Insaidoo et al. [24] investigated stock market performance and COVID-19 with focus on Ghana. Just like Iyke and Ho [26], the authors relied on an EGARCH framework and found that the pandemic has increased the volatility of the Ghana stock market by 8.23%. The case of Nigeria is not that different from Ghana. Adenomon et al. [1] used QGARCH and EGARCH processes and argued that COVID-19 has a negative effect on Nigeria’s stock market. The authors added that the stock market in Nigeria is also characterised by high volatility. This negative COVID-19 stock market performance is also established by Jellilov et al. [27].

So far, the studies have indicated that recovery rates of stock markets in Africa have generally been relatively slow. Agbloyor and Abor [2] asserts that whilst stock markets in developed markets have largely recovered from COVID-19, stock markets in Africa remain in negative territory.
It is important to mention that apart from the financial sector, other sectors affected by the pandemic include but are not limited to the aviation, tourism, petroleum and the health sectors of most African countries [5,36,45].

Methodology

Data

The study relies on near real-time daily time-series data spanning the period March 1, 2020, to September 30, 2021, of COVID-19 cases and deaths as well as the stock market indices of two emerging stock market, namely Ghana and Botswana. These two markets are chosen mainly because they are comparable based on their period of establishment, data consistency, middle income status, and position of having almost the same number of listed companies as of September 2021. In Table SM1 (see supplementary Tables in Appendix), we present the variables used for the regression estimation, the definitions and associated verifiable sources. It must be acknowledged that given the available data used with its associated constraints, annual macroeconomic controls are not included. Similarly, heterogeneous analysis is also limited. Against the aforementioned data limitations, we focus on associations rather than causal effects.

Justification of variables

The dependent variable is chosen because in empirical literature (see [21,35,47]) stock market performance has been measured using the stock market index. Similarly, in this study we used stock market index as a measure of stock market performance as our dependent variable. The variable is transformed into a natural logarithm form in order to interpret the regression results as elasticity.

Several measures have been used as evidence of the presence of COVID-19 in specific countries. These include the total number of both active and reported cases as well as the number of deaths recording as a result of COVID-19. In this study, we used the number of reported cases and the number of COVID-19 related deaths to facilitate initial-level analysis and end-level analysis. It is worth mentioning that because the unresolved initially reported cases led to deaths, intuitively, we expect a strong correlation between these measures. In Table SM2 (see supplementary Tables in Appendix), we present evidence of a statistically significant correlation amongst the variables. In effect, we estimate a bivariate model to avoid the problem of multi-collinearity.

Econometric estimation: the autoregressive distributed lags (ARDL) cointegration technique

The econometric technique employed in estimating the long-run relationship between COVID-19 cases and deaths and the stock market performance is the ARDL bounds test cointegration technique. This technique was first developed by Pesaran and Shin [42]. Later, an extended version was developed by Pesaran et al. [41]. Since then, the technique has been widely accepted and used by applied economists [10,37]. The technique’s acceptance is contingent on its strengths over already existing standard estimators such as the Engle and Granger [17] and Johansen and Juselius [29] approaches. A key factor that motivated the use of the ARDL model is its performance in small samples [38]. Given that COVID-19 has not existed over several years and that the sample size may not be very large, the ARDL model becomes an ideal choice for the study. Again, being a dynamic model, it also accounts for possible serial correlation and endogeneity concerns. The standard ARDL model is specified as:

$$\Delta \ln SM_t = \beta + \sum_{i=1}^{c} \gamma_{1i} \Delta \ln TC_{t-i} + \sum_{i=1}^{c} \gamma_{2i} \Delta \ln DC_{t-i} + \alpha_1 \ln TC_{t-1} + \alpha_2 \ln DC_{t-1} + u_t$$

(1)

where $\gamma_{ni}$ (i.e. $n = 1, 2$) and $\alpha_m$ (i.e., $m = 1, 2$) are measures of short-run and long-run dynamics. However, for the purpose of investigating the long-run relationships to inform policy decisions, we focus on only the long-run estimates for our analysis.

Based on Eq. (1), the hypothesis to test is specified as:

$$H_0 : \alpha_1 = \alpha_2 = 0$$

Under the null hypothesis of no cointegration, we used the calculated F-statistic from the F-test and compare it with the lower and upper bound thresholds provided by Pesaran et al. [41]. The decision rule is that, if the calculated F-statistic is greater than the upper bounds, we reject the no cointegration in favor of the alternative and conclude that there is evidence of cointegration. Likewise, if the calculated F-statistic is less than the lower bound, we accept the no cointegration and fail to reject the alternative and conclude that there is no evidence of cointegration. Again, if the calculated F-statistic falls within the lower and upper bounds threshold, then the test results are inconclusive and a similar test may be required to validate the conclusion.

Diagnostic tests

To validate the results that will be churned out from the data, we subject our data to key statistical tests. First, in Table SM3 (see supplementary Tables in Appendix) we used the Breusch-Godfrey Serial Correlation LM Test to investigate whether
there is any evidence of autocorrelation in the errors of the regression model. The results for both Ghana and Botswana accept the null hypothesis of no autocorrelation of any order for both regressions.

Next, unlike the serial correlation test, the heteroscedasticity test for both countries are found to be highly statistically significant, thus rejecting the null hypothesis of no heteroscedasticity. To address this problem, we used the autoregressive distributed lag (ARDL) model as our preferred estimator while the other models are estimated with robust standard errors for robustness checks.

Using the Jarque-Bera test (Table SM3), with the exception of the total cases model which shows some degree of normality, all the other models for both countries failed to show evidence of normality. One way of dealing with such problems is to transform the variables. So, we transformed all the variables into natural logarithm form and estimated their respective elasticities.

Moreover, one would expect the pandemic period to be characterized by a breakpoint. To this end, we use the Quandt-Andrew breakpoint test to identify the unknown breakpoint days in the dataset. As per the results reported in Table SM6 (see supplementary tables), no such evidence is found. This is plausible given the fact that it is only the period of the shock that is being investigated with no reference to the pre-COVID-19 period. This is purely based on the absence of data.

Another key time-series identification problem that can easily drive our results is the problem of endogeneity. We argue that we do not expect endogeneity that may arise as a result of reverse causality. However, we cannot rule out endogeneity stemming from misspecification and missing variable bias (refer to the constant terms in Tables 1 and 2). So, we estimated three dynamic models that inherently address issues of serial correlation and endogeneity concerns. These estimators are the fully modified ordinary least squares (FMOLS), the dynamic ordinary least squares (DOLS) and the ARDL models. To a large extent, we do not expect any of the afore-discussed identification issues to invalidate the signs of our results. That notwithstanding, our results are interpreted as association and not causal.
Results

Given that the primary aim of this study is to investigate the extent to which the number of reported cases and deaths have impacted stock market performance, we model the relationship using a time-series design. A key requirement to avoid spurious regression is to examine the stationarity properties of the series. The Philip Peron and the Dickey Fuller tests are used for both Ghana and Botswana. In Table SM4 (see supplementary Tables in Appendix), results for both countries reveal that the series are stationary in levels, and that they are integrated of order zero [I(0)].

Following from the unit root results, we proceed to investigate the long-run cointegration relationship between stock market performance and total number of cases on one hand and stock market performance and total number of death cases for each country using the bounds test. In Table SM5 (see supplementary Tables in Appendix), we show evidence that the computed F-statistic for both models exceed the upper bounds at even 1% level of significance. That is, a long-run relationship exists between the variables irrespective of the country. This implies that we can proceed to estimate the long-run elasticities for the two countries using the two models.

Results and analysis

In Table 1, we present the ARDL results for Ghana. We show evidence of a negative and statistically significant relationship between the total number of COVID-19 cases and stock market performance in Ghana. That is, a 1% increase in total COVID-19 cases leads to a 0.023% decrease in stock market performance, all else held constant. Relative to the other estimators, we observe that the signs are consistent while the magnitudes are almost the same – suggesting that the ARDL result is robust across the different estimators. This result is plausible in that, developing countries such as Ghana with relatively weaker institutions that reflect in poor healthcare delivery have a higher probability to heighten country specific uncertainty and risk associated with Ghana’s investment opportunities. Consequently, investors’ confidence is expected to decline, with a corresponding negative market reaction. In line with our findings, Ashraf [9] argues that “stock market returns decline as the number of confirmed cases increase in a country” (p.10).

Given that the total number of cases correlates with the total number of deaths, we estimated them independently to ascertain a possible convergence in the evidence. As expected, we find evidence of a negative and statistically highly significant relationship between the total death cases and the stock market performance. Statistically, a 1% increase in the total death cases is associated with a 0.0407% reduction in stock market performance. In comparison with the other estimators, we observe consistency in the signs and significance while the magnitudes are approximately the same. This also suggests that the ARDL result is robust across the different estimators. The plausibility of our results hinges on the fact that the incessant real-time reports or news of the rising number of death cases caused by the pandemic heightens fear and panic in firms and investors’ behavioral response. The temporary shutting down of firms by reducing activities and production capacity, ultimately affects profitability of firms negatively. In consequence, investors become risk averse in their investment decisions, with an associated negative stock market reaction. Again, our evidence to a large extent corroborates with Ashraf [9], who observes in his panel study that stock market response to the growth in number of deaths due to the pandemic is negative, albeit weak. Thus, both studies report negative and statistically significant results; however, while the present study reports relatively stronger evidence, Ashraf [9] shows weak evidence. The marginal difference in the significance could be attributed to the data-span and structure.

The findings of this study contribute to the research on the link between epidemics and financial market performance. It provides empirical evidence on the effect outbreak of epidemics has on stock market performance.

In Table 2, we present the ARDL results for Botswana. Akin to the results for Ghana, we have evidence of a negative and statistically highly significant relationship between the total number of COVID-19 cases and stock market performance in Botswana. That is, a 100% increase in total COVID-19 cases is associated with a 1% decrease in stock market performance, all other factors held constant. We observe from the other estimators that the signs are consistent while the magnitudes are approximately the same. This provides evidence to some degree of robustness across the different estimators used in the regression analysis. Again, the results for Botswana also corroborate with the results by Ashraf [9].

Again, analogous to the results from Ghana, we show evidence of a negative and statistically significant relationship between the total death cases and stock market performance in Botswana. Thus, all else being constant, a 100% increase in total death cases is associated with a 1.55% reduction in stock market performance at 5% level of significance. By way of estimator comparison, we find evidence that the signs are the same while the magnitudes are approximately the same. Also, this stands to reason that the ARDL result is robust across the different estimators. Again, the evidence here confirms the results by Ashraf [9].

The justification of the findings for Ghana is similar to that of Botswana. However, what is striking and interesting is that the impact of the total number of COVID-19 cases on stock market performance in Ghana is 0.0230% while that of Botswana is 0.0100%, yielding a difference of 0.013 percentage points. That is, the reported total number of COVID-19 cases impacts the stock market in Ghana more than it impacts the stock market in Botswana. On the other hand, the total number of death cases as a result of COVID-19 and its impact on the stock market in Ghana is 0.0407% while that of Botswana is 0.0155%, yielding a difference of 0.0252 percentage points. This suggests that the total number of COVID-19 death cases impacts the stock market in Ghana more than it impacts the stock market in Botswana. Overall, we argue that COVID-19 has had a more
severe impact on Ghana’s stock market than Botswana’s stock market. The findings imply that the Ghanaian stock market is more susceptible to COVID-19 external shocks than Botswana’s stock market.

It can be inferred from the results that investors in both stock markets exhibit swift response to external shocks. Such risk averse investors will adopt the wait-and-see strategy before committing themselves to any purchases of stocks. The influence of COVID-19 spread and its resulting death cases on stock market performance can be partly psychological. This can be explained by the fact that investors can be behaviorally responsive [47].

The non-parametric evidence

Consequent to our parametric results, we further provide robust non-parametric evidence of the relationship between stock market performance and the total number of COVID-19 cases and deaths independently for Ghana and Botswana (see Tables 3 and 4).

Similar to our parametric results, all the kernel type non-parametric estimators confirm the negative relationship between the COVID-19 measures (total number of cases and total number of deaths) and stock market performance for Ghana and Botswana. In addition, the impact of the relationship is found to be severe with higher magnitude in Ghana than Botswana.

Again, we used the lowess smoother which provides non-parametric graphical evidence of the relationship between the COVID-19 measures and stock market performance for both countries. The results for both Ghana (Fig. 1) and Botswana (Fig. 2) illustrate an inverse relationship between both measures of COVID-19 and stock market performance. That is, the parametric and non-parametric evidence attest to the fact that COVID-19 has not spared the stock market with its devastating effects on developing countries, especially, Ghana and Botswana.

This study further examines the differences or similarities between the GSE and the BSE. The Wilcoxon Signed-Rank Test, which is a non-parametric test, is used to investigate the differences and similarities between the markets, and the results are presented in Table 5. First, we examine the full sample of both markets and find evidence of a statistically significant difference between both markets. This implies that although the two markets may have some similarities in terms of year of establishment and number of listed companies being almost the same, in terms of the stock market index, both markets are statistically different. Second, we triangulate the data and investigate the period before the pandemic (Pre-COVID Sample) and during COVID-19 Sample. The results corroborate with the full sample period. However, what is striking is the differences in the z-statistic for both periods. It is obvious that the z-statistic is quantitatively greater for the COVID-19 period than the pre-COVID period reflecting the impact of the pandemic. Similarly, because the severity of the impact of the pandemic on one market is quantitatively greater than the other, it is observed to be driving the results of the full sample. This result validates our earlier claim that the impact of the pandemic has been quantitatively greater on Ghana.

### Table 3
Non-parametric estimates for number of reported cases.

| Country | Ghana | Botswana | Ghana | Botswana | Ghana | Botswana |
|---------|-------|----------|-------|----------|-------|----------|
| Kernel Type | Bartlett | Bartlett | Parzen | Parzen | Quadratic Spectral | Quadratic Spectral |
| D.InTC | D.InSM | D.InSM | D.InSM | D.InSM | D.InSM | D.InSM |
| Bandwidth (Newey-West/Andrews) | −0.0404 | −0.0013 | −0.2709 | −0.0140 | −0.0530 | −0.0001 |
| DoF Adjustment | 48.239 | 36.728 | 0.3012 | 2.2034 | 22.199 | 17.545 |
| VAR Pre-whitening (Var Lag) | No | No | 1 | 1 | No | No |

*Dependent Variable: The log difference of Total Number of COVID-19 Reported Cases.

### Table 4
Non-parametric estimates for number of reported deaths.

| Country | Ghana | Botswana | Ghana | Botswana | Ghana | Botswana |
|---------|-------|----------|-------|----------|-------|----------|
| Kernel Type | Bartlett | Bartlett | Parzen | Parzen | Quadratic Spectral | Quadratic Spectral |
| D.InDC | D.InSM | D.InSM | D.InSM | D.InSM | D.InSM | D.InSM |
| Bandwidth (Newey-West/Andrews) | −0.0404 | −0.0013 | −0.2709 | −0.0140 | −0.0530 | −0.0001 |
| DoF Adjustment | 48.239 | 36.728 | 0.3012 | 2.2034 | 22.199 | 17.545 |
| VAR Pre-whitening (Var Lag) | No | No | 1 | 1 | No | No |

*Dependent Variable: The log difference of Total Number of COVID-19 Reported Deaths.

### Table 5
Wilcoxon rank test of stock market performance for Ghana and Botswana.

| Test | Full Sample | Pre-COVID Sample | During COVID-19 Sample |
|------|-------------|------------------|------------------------|
| Z    | 29.273      | 20.704           | 24.349                 |
| p-value | 0.0000      | 0.0000           | 0.0000                 |
than on Botswana because of the latter's degree of resilience to shocks. Similarly, Takyi and Bentum-Ennin [46] have used the Bayesian structural time series approach to also show that, quantitatively, the negative impact of the pandemic on the performance of the Ghanaian stock market is greater than that of Botswana.

**Conclusion**

This paper studies the effect of COVID-19 cases and death figures on the stock market performance of Ghana and Botswana which are emerging markets established in the same year. This research adds to existing literature as it explores the effects of the unexpected outbreak of COVID-19 on the stock markets. The spread of the pandemic has been reported to have affected sectors of almost every country of the world. Using daily data of stock market performance, we estimate parametric, semi-parametric and non-parametric models and find that the stock markets in Ghana and Botswana have not been spared in the devastating effect of the pandemic. Our results suggest that COVID-19 outbreak has a negative and statistically significant effect on stock market performance for both countries. The effect of the pandemic in Ghana was, however, found to be greater than that of Botswana, albeit marginal. In the present circumstances, policy makers as a matter of urgency
need to strategically put in measures to halt the spread of the impact of COVID-19 on businesses. Tax reliefs and flexible statutory payments should be arranged by governments. Again, financial institutions must roll out packages that will help the survival of sectors which include but are not limited to manufacturing, transportation, education, hospitality and tourism which are believed to be the hardest hit. Going forward, we call for measures for both markets to assume a robust structural form that is resilient and not susceptible to such external shocks.

Limitations of the study

The authors acknowledge that this study is not without the usual challenges associated with empirical studies. First, due to data constraints, the problem of endogeneity could not be wholly addressed, hence our results have been interpreted as association and not causal impact. We recommend that future studies with valid instruments to estimate a causal relationship of COVID-19 measures and stock market performance. Second, the daily aggregated data presented a limitation to triangulation and further disaggregation into private and public sector performance. Again, the authors do not subscribe to rescaling macroeconomic annual data into daily data, hence the authors included time fixed effects (where applicable) and interpreted the results as association and not causation. We recommend further studies to also consider such disaggregation. Thirdly, the authors admit that in Ghana and Botswana, due to high levels of illiteracy, use of traditional medicine and low access to health facilities, it is likely that the number of cases and deaths reported are understated, hence the results should be treated as lower bound estimates.

Despite the limitations associated with this study, we are confident that the conclusion from this study is valid, and the total number of cases and deaths as a result of COVID-19 are negatively associated with the performance of the stock markets in Ghana and Botswana, albeit in different magnitudes.

Declaration of Competing Interest

We wish to state that there are no conflicts of interest associated with this paper. In addition, we have not received any financial support from any sources for this work.

CRediT authorship contribution statement

Joseph Emmanuel Tetteh: Conceptualization, Methodology, Software, Data curation, Writing – original draft, Writing – review & editing. Anthony Amoah: Conceptualization, Methodology, Software, Data curation, Writing – original draft, Writing – review & editing. Kenneth Ofori-Boateng: Methodology, Writing – original draft, Writing – review & editing. George Hughes: Methodology, Writing – original draft, Writing – review & editing.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.sciaf.2022.e01300.

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