Mixed reactions of Africa regional stock markets to COVID-19 pandemic: events study analysis

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C H R O N I C L E	A B S T R A C T
	COVID-19 has caused severe disruptions in global economic activities, and its impacts on stock markets cannot be overemphasized. The study employs market model and event study approach with four events (WHO announcement of COVID-19 as a global health emergency, confirmed infections, confirmed deaths, and vaccination) to examine the reactions of four African regional blocs' markets to the pandemic from September 1, 2019, to August 31, 2021, to estimate the average abnormal returns of each regional bloc. On the day of the WHO announcement, we document insignificant negative average abnormal returns in the Northern bloc. We also document significant negative average abnormal returns for infections in all but the Northern bloc on the event day. The Western bloc generated the highest significant negative average abnormal return (-43 per cent) on the day COVID-19 death was confirmed on the continent. We finally document insignificant average abnormal returns from weeks 1 to 20 after the first vaccination in the Northern and Eastern blocs. The study recommends that investors, portfolio managers, and speculators not panic during similar pandemics since they can generate significant abnormal returns and diversify their investment holdings across the four regional blocs in Africa, as demonstrated by the COVID-19 pandemic.

1. Introduction

The World Health Organization (WHO) on January 30, 2020, announced the novel coronavirus disease (COVID-19) as a global public health emergency and declared it a global pandemic on March 11, 2020 (WHO, 2020). COVID-19 is documented to have started in Hubei, China, and has spread globally, affecting every facet of human endeavour (Verma et al., 2021). As of September 15, 2021, the total number of worldwide infections and deaths across 221 countries stood at 227,340,730 and 4,675,493 respectively. The US has the highest number of infections and deaths, followed by India in infections and Brazil in deaths (Worldometer, 2021). In the world of globalization, it is anticipated that the impact of COVID-19 would be experienced in all markets. Ozili & Arun (2020) argue that global stock markets lost US$6 trillion from February 24-28, 2020. Takyi & Bentum-Ennin (2021) suggest that the impact of COVID-19 on developing economies would be more severe, while Verma et al. (2021) posit that the impact of the crisis on world economies would be colossal devastation if not curtailed in the short term.

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COVID-19 has subjected the world economic situation to severe disruption (Rehman et al., 2021). The impact of the COVID-19 outbreak on global markets began to increase rapidly as there was no hope to prevent it from spreading despite strict quarantine measures in China (Zeren & Hizarci, 2020). The World Bank Group Flagship report of June 2021 predicts a 5.6 per cent global economic growth for 2021 compared with the 3.5per cent contraction witnessed in 2020 due to the COVID-19 pandemic. The World Bank avers that emerging markets and developing economies' increasing COVID-19 cases, limited vaccinations, and lack of substantive macroeconomic support hinder the rebound of external demand and high commodity prices. Financial-related insecurity can be an exceptionally stressful factor for society since a financial crisis or a stock market crash can directly or indirectly influence peoples economic well-being (Dias & Pereira, 2021). Distinctive events of diverse degrees usually affect stock market predictivity. There is a broadly acknowledged concept in behavioral finance that events instigating widespread panic such as elections, wars, fear, shocks, pandemics, political, financial, and economic related emergencies regularly lead to a breakdown of the proficient market speculation by causing asset prices to deviate from their essential values (Ozkan, 2021).

Despite the growing literature on the impact of COVID-19 pandemic on stock markets performance [for example, (Adu-Gyamfi et al., 2021; Chowdhury et al., 2021; Seven & Yılmaz, 2021)], its effect is not fully known. One branch of extant literature suggests that the pandemic has occasioned a significant dip in stock prices with widening price fluctuations, while others hold a contrary view. However, the majority of these studies are from the developed and emerging markets of the Americas, Europe, and Asia (Açikgöz & Günay, 2020; Amin et al., 2021; Ozili & Arun, 2020; Sadiq et al., 2021; Seven & Yılmaz, 2021; Wahyuni, 2020), with a handful from individual countries in Africa (Anyanwu & Salami, 2021; Bisson & Hambleton, 2020; Raifu et al., 2021; Shipalana & O'riordan, 2020) which exclude vaccination event. Takyi & Bentum-Ennin (2021) posit that the effects of the COVID-19 pandemic on the welfare of households, financial and non-financial markets performance, and economic growth and development of national economies are likely to be greater in developing countries. COVID-19 stock markets nexus, to the best of our knowledge, is yet to be addressed in the context of regional blocs in Africa. Furthermore, the authors are motivated to include vaccination and three other events to examine the impact of COVID-19 on the four regional blocs of Africa.

As the COVID-19 situation in Africa continues to soar (see Table 1), our study's objective is to analyze the reaction of the four regional blocs' stock markets to the COVID-19 pandemic. We use the Africa union demarcation of the continent (i.e., Northern, Southern, Eastern, and Western blocs), improved daily historical stock market data from September 1, 2019, to August 31, 2021, and market model in an event study methodology. We find significant positive average abnormal returns in Southern, Eastern, and Western blocs and insignificant negative average abnormal return in the Northern bloc. We also document significant negative average abnormal returns on infections in all but the Northern bloc on the event day. The Western bloc generated the highest significant negative average abnormal return (-43 per cent) on the day COVID-19 death was confirmed on the continent. We finally document significant positive average abnormal return in the Western bloc on vaccination day and insignificant average abnormal returns 20 weeks after the first inoculation in the Northern bloc.

Table 1
Situation of COVID-19 in the four regional blocs of Africa

Africa Regional Blocs	Date of 1st Infection	Total Confirmed Cases	Average Daily Confirmed Cases	Total Active Cases	Total Recovered	Total Death	Total Test Conducted	Date of 1st Vaccination
NORTHERN	Feb,14 2020	1,808,245	5,633	115,003	1,640,524	52,718	14,593,396	Jan 24, 2021
Egypt	Feb 14,2020	288,162	898	32,855	238,580	16,727	3,068,679	Jan 24, 2021
Morocco	Mar 2, 2020	856,049	2,816	55,715	787,794	12,540	8,933,140	Jan 28, 2021
Tunisia	Mar 2, 2020	664,034	2,184	26,433	614,150	23,451	2,591,577	Mar 3, 2021
SOUTHERN	Mar 5, 2020	3,319,261	11,027	175,888	3,050,137	93,236	21,391,734	Jan 17, 2021
Malawi	Apr 2,2020	60,386	221	10,578	47,640	2,168	385,309	Mar 11, 2021
Botswana	Mar 30, 2020	156,927	569	6,147	148,519	2,261	1,645,029	Mar 10, 2021
Namibia	Mar14, 2020	125,046	429	2,773	118,898	3,375	660,118	Mar 19, 2021
South Africa	Mar 5, 2020	2,770,575	9205	154,789	2,533,956	81,830	16,426,011	Jan 17, 2021
Zambia	Mar 18, 2020	206,327	716	1,601	201,124	3,602	2,275,267	Apr 14, 2021
EASTERN	Mar 12, 2020	365,409	1,243	41,429	319,789	7,851	4,305,390	Jan 25, 2021
Kenya	Mar 12, 2020	235,298	800	8,221	222,357	4,720	2,367,077	Mar 5, 2021
Mauritius	Mar 18, 2020	10,196	35	11,883	1,854	29	358,675	Jan 25, 2021
Uganda	Mar 20, 2020	119,915	419	21,325	95,578	3,102	1,579,638	Mar 10, 2021
WESTERN	Feb 27, 2020	368,428	1196	17,377	352734	4,018	5,215,317	Mar 1, 2021
Cote d'Ivoire	Mar 11, 2020	58,357	197	1,635	56,350	546	888,751	Mar 1, 2021
Nigeria	Feb 27, 2020	191,805	622	10,858	178,492	2,455	2,727,834	Mar 5, 2021
Ghana	Mar 12, 2020	118,266	402	4,884	117,892	1017	1,598,732	Mar 1, 2021
Total		5,861,343	19,513	349,697	5,363,184	157,823	45,505,732	

Source: Authors' compilation from Worldometer (2021) and (https://virusncov.com/)
Note: As of August 31, 2021, the overall infections, and deaths due to coronavirus (COVID-19) in the four regional blocs of Africa reached 5, 861, 343 and 157,823 respectively.

The study contributes to the literature on analyzing pandemics, specifically COVID-19 on financial markets in Africa. Also, unlike other studies which are country-specific [for example, (Alzyadat & Asfoura, 2021; Insaidoo et al., 2021; Smales, 2021; Susilawati et al., 2020; Ziemba, 2020)], this study focuses on the regional blocs in Africa. To the best of our knowledge, no study has been concurrently done in the four regional blocs of Africa. Another contribution of this study is that it touches all sectors of the economy of the various regional blocs in Africa as opposed to single industries such as

energy (Shaikh, 2021), tourism (Wu et al., 2021), and sports and transport (Ozili & Arun, 2020). Moreover, to the best of the authors' knowledge, the study is the earliest to incorporate the event of vaccination in assessing the impact of COVID-19 in the regional blocs' markets in Africa. Furthermore, the study contributes to decomposing the effect of COVID-19 in Africa via the regional blocs. This is essential for investors and fund managers for portfolio re-balancing decisions during pandemics.

The remainder of the study is arranged as follows. A brief literature review is in section 2, followed by material and method in section 3. Empirical results at section 4, while we conclude and make recommendations to policymakers and investors in section 5.

2. Literature Review

There have been numerous epidemic diseases that have caused many deaths, for example, the Black Death (Plague Outbreak), which led to the deaths of about 75-100 million people between 1347 and 1351, the Bleeding Fever of 1899 to 1923, the Cholera epidemic in Mexico in 1908, the AIDS virus that first appeared in Cameroon in 1980, and the Ebola EVD from 2014 to 2016 (Zeren & Hizarci, 2020). Since 2003, human coronaviruses such as SARS-CoV and MERS-CoV have also threatened global public health. In February 2003, SARS-CoV was identified in Guangdong Province, Peoples Republic of China, and transmitted to humans from infected civets such as bats (Dyall et al., 2017). A few years later, in 2012, MERS emerged in Saudi Arabia as a severe respiratory disease with frequent gastrointestinal and renal difficulties. As if the world was over with such pandemics, but in 2019 the world woke up again with the emergence of virus disease from Wuhan, China. The causative agent was later identified as coronavirus. COVID-19 was declared by the WHO as a global emergency in January 2020 due to the number of deaths (74,816) it had already taken and the 1,349,660 infected cases as of April 7, 2020 (Ekwunife & Ukeje, 2020). The declaration by WHO and the fear of the unknown made nations react by minifying financial transactions, enforcing travel bans, strict isolation approaches, and utilizing stimulus packages to pad the unprecedented slowdown in loss of jobs and economic activity (Alzyadat & Asfoura, 2021). International flights between several countries were cancelled, and border crossings with unsafe countries were likewise closed due to COVID-19. The Covid-19 pandemic negatively affected global trade and cultural and social life, especially trade-in commodities, production, tourism, and transportation sectors. Many countries halted merchandised trade with China. In line with all these negative effects developing from the COVID-19 pandemic, it seems unavoidable that economic growth, stock markets, and exchange rates will also have their share in these situations (Zeren & Hizarci, 2020). Also, many questions keep arising among academia and practitioners, such as, "why the spread of coronavirus can bring the world economy to its knees, how health crisis translates to an economic crisis, and the impact of COVID-19 on stock markets performance" (Ozili & Arun, 2020).

Many institutions have examined the impact and complications of COVID-19 on the global economy. For instance, the International Monetary Fund (IMF) lowered its growth projection for the global economy. As travel opportunities for tourists who spend billions annually were curtailed, the tourism industry was affected by the increased flight cancellations, hotel bookings, and local and international events cancellations worth over $200 billion. Equally, the International Air Transportation Association (IATA) revealed that the air travel industry might lose about US$113 billion. Ozili & Arun (2020) studied the impact of the lockdown days on the stock market performance and the economy. They found that the increasing number of lockdown days, international travel restrictions, and monetary policy decisions cruelly affected the economic activities, the opening, closing, lowest and highest stock price of major stock market indices. However, restriction on internal movement and higher fiscal policy spending positively impacted economic activities, even though the increasing number of confirmed coronavirus cases did not significantly affect the level of economic activities. Bisson & Hambleton (2020) argue that the economic impact of the COVID-19 pandemic on the hotel industry has been more severe than the 9/11 and 2008 recessions combined. Also, owing to uncertainty, fear, and rational assessment that firms' profits are likely to be lower due to the impact of COVID-19, global stock markets lost about US$6 trillion from February 24-28, 2020.

Moreover, the impact of COVID-19 on various continents and blocs differs across sectors and regions around the globe (Jamaani, 2021). For instance, Takyi & Bentum-Ennin (2021) studied the impact of COVID-19 on stock market performance in Africa using the Bayesian structural time series approach. Their results show that, within the sample period, there is almost no chance that the COVID-19 pandemic would positively affect stock market performance in Africa. Also, the United Nations Economic Commission for Africa projects Africa's economic growth in 2020 to slow to 1.8 per cent in the best-case scenario or to see a contraction of 2.6 per cent in the worst case, which has the potential to push 29 million people into extreme poverty (Takyi & Bentum-Ennin, 2021). Orhun (2021) studied the impact of the COVID-19 global health crisis on stock markets using 13 cross-country effects. Their findings show that stock markets of countries that have larger foreign direct investment exposure to China, higher democracy index, a higher number of confirmed COVID-19 cases, and accept a higher percentage of Chinese tourists are more prone to getting negatively affected by such a global health crisis. However, stock markets of countries with higher health expenditure, higher level of preparedness for pandemics, and higher gross domestic product per capita are likely to have less negative abnormal returns. Insaidoo et al. (2021) also studied Stock market performance and COVID-19 pandemic using evidence from a developing economy. The study findings show a statistically insignificant negative relationship between the COVID-19 pandemic and the Ghana stock returns. The results confirm that the COVID-19 pandemic has increased the Ghana stock exchange returns volatility by 8.23

per cent. Anh & Gan (2020) also studied the impact of COVID-19 lockdown on the performance of stock markets in Vietnam and disclose that the Vietnam stock market before and during the nationwide lockdown performed in an opposing way.

Regarding Africa, Bisson & Hambleton (2020) studied the impact of COVID-19 on value chains and posit that curfews, market closures, border closures, and limited internal movement impacted the key value chains and threatened livelihood. Shipalana & O'riordan (2020) also revealed that African countries have the cumulative effects of the pandemic and projected a recession amid widening falling government revenues, fiscal deficits, and soaring debt servicing costs. The extant literature such as Bisson & Hambleton (2020); Orhun (2021); Raifu et al. (2021); Takyi & Bentum-Ennin (2021) investigated the impact of COVID-19 on Africa and stock markets. Still, they examined individual countries and focused on discussing the African continent in one scope. In this study, we add to the literature on the impact of COVID-19 on stock market performance by uniquely examining the regional blocs' stock markets in Africa, namely, Eastern, Western, Southern, and Northern. The study is also unique as it considers the effect of vaccine administration on the performance of the regional blocs' markets.

3. Materials and Method

3.1 Materials

We collected historical data on daily stock market returns (US$) and the Dow Jones Global Index (DJGI)[1] for the four African Regional blocs from Databank Research (www.databankgroup.com) and investing.com respectively, for the period from September 1, 2019, to August 31, 2021. The essence of using the US$ returns for the regional blocs is to have uniformity in our analysis since the individual countries making up the four regional blocs on the continent use different currencies. The COVID-19 data spanning from January 30, 2020, to August 31, 2021, was obtained from the official website of the WHO (https://covid19.who.in/). Events used for analysis in this paper include the WHO announcement of COVID-19 as a global public health emergency on January 30, 2020, confirmed COVID-19 infections, confirmed COVID-19 deaths, and vaccinations in each regional bloc. Each regional bloc consists of three countries except the Southern bloc, which has five countries. We grouped the 14 African countries into four regional blocs as follows: Northern bloc (Egypt, Morocco, & Tunisia); Southern bloc (Botswana, Malawi, Namibia, South Africa & Zambia); Eastern bloc (Kenya, Mauritius & Uganda); and Western bloc (Cote d'Ivoire, Ghana & Nigeria). The regional bloc grouping is based on the African Continent's African Union demarcation (https://au.int/en/member_states/countryprofiles2). Countries making up the regional blocs were selected on the following criteria: highest GDP[2] values for 2019; and availability of stock markets and COVID-19 data. The 2019 GDP data was obtained from the World Bank. Countries with high GDP but unavailable stock market or COVID-19 data were substituted for the next one, which satisfied all the above criteria. For example, Algeria, with the fourth-highest GDP in Africa in 2019, was substituted for lack of stock market data. Similarly, Tanzania, with a higher GDP, was also substituted for the non-availability of COVID-19 data. We further excluded all countries from the Central bloc due to the non-availability of stock market data.

3.2 Method

The study applied the event study approach to analyse the impact of COVID-19 on Africa's regional stock markets. The selection of the event study approach is based on its theoretical foundation, which has proved to be a useful instrument for studying the impact of events in stock markets, and the efficient market hypothesis, which assumes the full reflection of all available public information in security prices in the market. The event study approach provides a simple yet effective way to explicitly describe and establish the relationship between events and stock market returns (Dyckman et al., 1984). We follow Brown & Warner (1985); Campbell et al. (1997) and use 120 days prior estimation window and 21-day event window in the study. We utilized the 2-sided t-statistic from the Standard Normal Distribution to test the significance of our results. Fig. 1 presents our event study timelines.
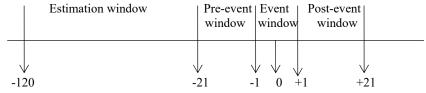

Fig. 1. Event study timeline
Note: The prior estimation window is from -120 to 0. From -21 to -1 is the pre-event window, 0 is the event window (such as COVID-19 announcement, COVID-19 infection, COVID-19 death, and vaccination), and +1 to +21 is the post-event period.

To calculate the abnormal return for each bloc in our dataset, we used the market model which has high predictive power and widely used in such studies (Brenner, 1979). We used OLS regression first to estimate each bloc's stock market returns.

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[1] Dow Jones Global Index (DJGI) is a global index which measures the overall performance of stock markets around the world. See, (Al-Qudah & Houcine, 2021)

[2] World Bank website (2019 GDP of African countries): https://databank.worldbank.org/source/world-development-indicators

$$R_{i,t} = \alpha_i + \beta_i R_{mt} + \varepsilon_{i,t} \tag{1}$$

where, $R_{i,t}$ is the return for bloc i at time t, R_{mt} is DJGI, which is a proxy for the market return on day t, $\varepsilon_{i,t}$ is the residuals. α_i and β_i are the parameters to be estimated. Using the initially estimated regression parameters, the following equations are employed to estimate the Expected Returns (ER) and the Average Abnormal Return (AAR) for each bloc at time t.

$$E(R_{i,t}) = \alpha_i + \beta_i R_{mt} \tag{2}$$
$$AAR_{i,t} = R_{i,t} - E(R_{i,t}) \tag{3}$$

where, $E(R_{i,t})$ is the Expected Return for bloc i at time t, α_i and β_i are the parameters estimated from equation (1), $R_{i,t}$ is the return for bloc i at time t, R_{mt} is the market return, and $AAR_{i,t}$ is the Average Abnormal Return for bloc i at time t. We aggregate the AARs to form the Cumulative Average Abnormal Returns (CAARs) and test their significance in our dataset. The CAAR is specified as:

$$CAAR_{(t_0,t_1)} = \sum_{t=t_0}^{t1} AAR_{i,t} \tag{5}$$

4. Empirical Results

4.1 WHO announcement

The WHO announcement of COVID-19 as a global emergency did not generate any significant AAR in the stock market in the Northern bloc of Africa on the event day. Significant AARs were recorded from pre-event day -17 to day -10 (excluding day -16), and post-event days 8 to 10 and 13 & 14 (see, Table 2).

Table 2
AARs and CAARs 21 days before and 21 days after the event of WHO announcement

	Northern bloc		Southern bloc		Eastern bloc		Western bloc	
Days	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-21	0.011	0.011	0.01	0.01	0.027	0.027	0.014	0.014
-20	0.014	0.025	0.012	0.022	0.03	0.057	0.019	0.034
-19	0.015	0.04	0.016	0.038	0.033	0.09	0.029	0.063
-18	0.019	0.059	0.014	0.052	0.017	0.107	0.045**	0.108
-17	0.026**	0.085	0.021	0.073	0.019	0.125	0.007	0.115
-16	-0.075	0.009	0.099***	0.172	0.132***	0.258	0.144***	0.258
-15	-0.097**	-0.087	0.082***	0.254	0.137***	0.395	0.138***	0.396
-14	-0.092**	-0.179	0.082***	0.336	0.134***	0.529	0.140***	0.536
-13	-0.081**	-0.26	0.087***	0.423	0.140***	0.668***	0.154***	0.691
-12	-0.086***	-0.346	0.081***	0.504	0.145***	0.814***	0.158***	0.849
-11	-0.082**	-0.427**	0.077***	0.581	0.144***	0.958***	0.154***	1.002
-10	-0.079**	-0.507***	0.079***	0.66	0.127***	1.085***	0.153***	1.156**
-9	-0.074	-0.581***	0.072***	0.732**	0.121***	1.206***	0.159***	1.315**
-8	-0.073	-0.654***	0.074***	0.806**	0.119***	1.325***	0.165***	1.480***
-7	-0.072	-0.726***	0.071***	0.876***	0.121***	1.446***	0.168***	1.648***
-6	-0.068	-0.793***	0.066***	0.942***	0.122***	1.567***	0.162***	1.810***
-5	-0.07	-0.863***	0.068***	1.010***	0.125***	1.693***	0.167***	1.977***
-4	-0.068	-0.931***	0.064***	1.074***	0.126***	1.818***	0.165***	2.142***
-3	-0.069	-1.000***	0.056***	1.130***	0.134***	1.953***	0.159***	2.301***
-2	-0.07	-1.071***	0.050***	1.180***	0.125***	2.078***	0.159***	2.460***
-1	-0.069	-1.140***	0.051***	1.231***	0.124***	2.201***	0.153***	2.613***
0	-0.066	-1.206***	0.050***	1.281***	0.128***	2.329***	0.147***	2.760***
1	-0.063	-1.269***	0.042***	1.322***	0.135***	2.464***	0.142***	2.902***
2	-0.069	-1.338***	0.036***	1.358***	0.136***	2.600***	0.142***	3.044***
3	-0.067	-1.405***	0.045***	1.403***	0.126***	2.726***	0.147***	3.191***
4	-0.068	-1.473***	0.042***	1.445***	0.120***	2.847***	0.151***	3.342***
5	-0.068	-1.540***	0.050***	1.496***	0.135***	2.982***	0.151***	3.493***
6	-0.068	-1.609***	0.046***	1.542***	0.139***	3.121***	0.133***	3.627***
7	-0.071	-1.680***	0.035***	1.577***	0.131***	3.251***	0.139***	3.765***
8	-0.076**	-1.756***	0.037***	1.614***	0.124***	3.376***	0.133***	3.899***
9	-0.081**	-1.836***	0.041***	1.655***	0.119***	3.495***	0.136***	4.034***
10	-0.075**	-1.911***	0.042***	1.698***	0.113***	3.608***	0.135***	4.169***
11	-0.072	-1.984***	0.042***	1.740***	0.109***	3.717***	0.132***	4.302***
12	-0.072	-2.056***	0.043***	1.783***	0.083***	3.799***	0.131***	4.433***
13	-0.078**	-2.134***	0.040***	1.823***	0.104***	3.903***	0.131***	4.564***
14	-0.076**	-2.211***	0.039***	1.862***	0.096***	4.000***	0.131***	4.696***
15	-0.075	-2.285***	0.039***	1.901***	0.093***	4.093***	0.128***	4.824***
16	-0.069	-2.355***	0.034***	1.935***	0.095***	4.188***	0.120***	4.944***
17	-0.078	-2.433***	0.037***	1.972***	0.113***	4.301***	0.108***	5.052***
18	-0.081	-2.514***	0.032***	2.005***	0.123***	4.424***	0.098***	5.151***
19	-0.084	-2.598***	0.032***	2.037***	0.110***	4.534***	0.094***	5.245***
20	-0.088	-2.686***	0.029***	2.065***	0.127***	4.661***	0.084***	5.329***
21	-0.088	-2.774***	0.006***	2.072***	0.130***	4.792***	0.082***	5.411***

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. Day -21 to day -1 constitute the pre-event period, while day 1 to day 21 is the post-event period. Day 0 is the event day. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. ***, ** denote 1% & 5% significance level respectively.

The possible reason for the negative AARs in the Northern bloc could be its proximity to Europe. Market participants may have anticipated the spread of COVID-19 to the bloc and so decided to offload their equity interest which may have occasioned the negative but largely insignificant AARs. However, significant negative CAARs were observed from pre-

event day -11 to post-event day 21. In Table 3, Across event [-21, +21] window showed significant negative AAR in the Northern bloc of Africa. This result reinforces our observation of the deteriorating negative AARs in the bloc across the period. Significant positive AARs were observed in Southern Africa from pre-event day -16 to post-event day 25. There was significant positive AAR on the day the WHO announced COVID-19 as a global emergency in the Southern bloc. Similarly, significant positive CAARs were observed from pre-event day -9 to post-event day 21 (see Table 2). Except for Across event [-21, +21] window, all the event windows generated significant positive AARs. CAARs for Before event [-21, 0], and Across event [-21, +21] & [-10, +10] windows were significantly positive (Table 3). Strong investor belief and certainty in the market could have spurred the significant positive AARs in the Southern bloc. However, the significant positive AARs in the bloc were the least positive on the continent.

The Eastern bloc generated significant AAR on the day COVID-19 was announced as a global emergency by the WHO. Pre-event day -16 to post-event day 21 showed significant positive AARs. CAARs were significant from pre-event day -13 to post-event day 21 (see Table 2). The positive AARs in the Eastern bloc were higher than that of the Southern bloc. For example, on event day 0, the AAR for the Eastern bloc was 12.8 per cent, while that of the Southern bloc was 5 per cent (at 1 per cent significance level). Investor optimism of the non-devastating impact of the virus on the bloc could also be a reason for the significant positive AARs. AARs (except Across event [-21, +21] window) and CAARs were positive and significant in all the event windows (Table 3).

Pre-event day -18 to post-event day 21 (except pre-event day -17) produced significant AARs in the Western bloc of Africa. There was a significant positive AAR on the day COVID-19 was declared a global emergency. Similarly, CAARs were positive and significant from pre-event day -10 to post-event day 21 (see Table 2). The Western bloc produced the highest AARs on the continent. For example, the AAR on event day 0 in the Western bloc was 14.7 compared to -6.5, 5 & 12.8 per cent for Northern, Southern, and Eastern blocs respectively. Higher significant positive AARs & CAARs were observed in all the event windows in the Western bloc (Table 3).

Table 3
AARs and CAARs around the day (Before, Across, After) COVID-19 was announced by the WHO

Event windows		Northern bloc		Southern bloc		Eastern bloc		Western bloc	
		AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
Before event	[-21, 0]	-0.055	-1.206***	0.058***	1.281***	0.106***	2.329***	0.126***	2.760***
		(0.0005)	(0.073)	(0.0005)	(0.2193)	(0.0001)	(0.1023)	(0.0003)	(0.2331)
	[-10, 0]	-0.071	-0.778***	0.064***	0.700	0.125***	1.371***	0.160***	1.758***
		(0.0002)	(0.476)	(0.0007)	(0.1032)	(0.0003)	(0.4712)	(0.0009)	(0.3587)
	[-5, 0]	-0.069	-0.412***	0.056***	0.339	0.127***	0.762***	0.158***	0.950**
		(0.0003)	(2.065)	(0.0004)	(0.5997)	(0.0003)	(1.7244)	(0.0008)	(1.9870)
Across event	[-21, +21]	-0.094***	-2.774***	-0.017	2.072***	0.012	4.792***	0.077***	5.411***
		(0.0025)	(11.322)	(0.0091)	(3.2838)	(0.0145)	(8.5009)	(0.0084)	(9.9391)
	[-10, +10]	-0.071	-1.484***	0.053***	1.117***	0.126***	2.650***	0.151***	3.167***
		(3.1E-05)	(0.463)	(0.0002)	(0.1733)	(0.0003)	(0.4396)	(0.0003)	(0.7499)
	[-5, +5]	-0.068	-0.747***	0.050***	0.553	0.129***	1.414***	0.153***	1.683***
		(0.0001)	(0.529)	(0.0002)	(0.1738)	(0.0004)	(0.3910)	(0.0004)	(0.4522)
After event	[0, +21]	-0.074	-1.634***	0.038***	0.841	0.118***	2.590***	0.127***	2.797***
		(0.0001)	(0.800)	(0.0001)	(0.1621)	(0.0002)	(0.4499)	(0.0004)	(0.4445)
	[0, +10]	-0.070	-0.772***	0.042***	0.467	0.128***	1.406***	0.142***	1.556***
		(9.0E-06)	(0.718)	(3.4E-05)	(0.2492)	(0.0004)	(0.3908)	(0.0001)	(0.6237)
	[0, +5]	-0.067	-0.401***	0.044***	0.265	0.130***	0.781***	0.147***	0.880**
		(4.5E-05)	(2.256)	(0.0001)	(0.7230)	(0.0005)	(1.6384)	(0.0001)	(2.2115)

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. The numbers in parenthesis denote standard deviation while ***, ** denote 1% & 5% significance level respectively.

4.2 Confirmed infections

Table 4, the Northern bloc of Africa showed insignificant reactions to the news of 1st confirmed COVID-19 infection in the markets from pre-event day -21 to post-event day 3, including the event day. We observed significant negative reactions from post-event day 4 to post-event day 21, excluding post-event days 5 & 6. The market's early daily insignificant negative AARs were due to fears that the virus could not (have) be contained. Also, the early insignificant positive CAARs may be due to weakening early negative AARs over that period. The later significant negative AARs & CAARs may have been caused by the continuous increase in cases, which might have instilled fear in investors and led to increasing selling out decisions. In Table 5, Across event [-21, +21] & [-5, +5], and After event [0, +21] windows recorded significant negative AARs in the market. In the Southern bloc, the market reaction to the news of 1st confirmed COVID-19 infection was significant negative AAR on event day 0 even though insignificant AARs preceded from pre-events day -21 to day -12. From pre-event day -11 to post-event day 21, the market recorded significant negative AARs (see Table 4). Deteriorating significant AARs (from event day value of -18.7 per cent to post-event day 21 value of -23.5 per cent) may have been occasioned by panic, increasing daily infections, mandatory lockdowns, and closure of businesses in the bloc. In Table 5,

we observed significant negative AAR across all three (Before, Across, and After) event windows, indicating that the significant negative AARs were worsening by the day.

We observed that the market in the Eastern bloc produced the highest negative significant AAR (-23 per cent) on the continent on the day of the 1ˢᵗ confirmed COVID-19 infection, see Table 4. Pre-event days -21 to -11 produced no significant AARs. However, the bloc generated significant negative AARs from pre-event day -10 to post-event day 21, excluding pre-event day -9. We observed significant negative AARs & CAARs in all three event windows (Table 5). The overall negative reaction in the market could be attributed to an increase in new cases, lock downs, ban on social and public gatherings, closure of businesses, misinformation, disinformation, and fear that the virus could overwhelm the region, leading to increasing investor decision to exit the market. The Western bloc displayed insignificant positive AARs from pre-event days -21 to -13 and showed insignificant negative AARs from pre-event days -12 to -4. The region registered significant negative AARs from pre-event day -3 to post-event day 21, including the day COVID-19 was 1ˢᵗ confirmed in the bloc. The significant negative AAR (-19.9 per cent) on event day 0 is the second-highest on the continent after the Eastern bloc. However, the Western bloc generated the highest post-event significant AARs, see Table 4. Apart from Before event [-21, 0] window, all the other events windows produced significant negative AARs (Table 5). This indicates that uncertainties in the Western bloc market increased a few days (Before event [-10, 0] & [-5, 0] windows) to the first confirmed COVID-19 case.

Table 4
AARs and CAARs 21 days before and 21 days after the event of confirmed COVID-19 infections

Days	Northern bloc		Southern bloc		Eastern bloc		Western bloc	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-21	-0.017	0.573	-0.002	-0.002	-0.013	-0.013	0.015	0.015
-20	-0.021	0.552	-0.003	-0.005	0.006	-0.007	0.013	0.028
-19	-0.021	0.532	-0.01	-0.015	-0.001	-0.008	0.011	0.039
-18	-0.022	0.509	-0.004	-0.019	-0.009	-0.017	0.013	0.052
-17	-0.027	0.483	-0.007	-0.025	-0.012	-0.029	0.018	0.069
-16	-0.027	0.455	0.001	-0.025	-0.026	-0.056	0.016	0.085
-15	-0.027	0.428	-0.015	-0.039	-0.041	-0.096	0.013	0.098
-14	-0.03	0.398	-0.027	-0.066	-0.047	-0.143	0.007	0.105
-13	-0.033	0.365	-0.025	-0.092	-0.063	-0.206	0.002	0.106
-12	-0.025	0.34	-0.051	-0.143	-0.059	-0.265	-0.009	0.097
-11	-0.018	0.322	-0.063**	-0.206	-0.048	-0.313	-0.03	0.067
-10	-0.015	0.308	-0.056**	-0.261	-0.060**	-0.373	-0.04	0.027
-9	-0.019	0.289	-0.061**	-0.322	-0.04	-0.413	-0.056	-0.029
-8	-0.021	0.268	-0.064***	-0.386	-0.065**	-0.478	-0.063	-0.093
-7	-0.023	0.245	-0.089***	-0.476	-0.113***	-0.591**	-0.056	-0.149
-6	-0.014	0.231	-0.109***	-0.585	-0.097***	-0.687***	-0.043	-0.192
-5	-0.015	0.216	-0.111***	-0.696**	-0.105***	-0.793***	-0.05	-0.242
-4	-0.018	0.199	-0.138***	-0.834***	-0.142***	-0.935***	-0.064	-0.306
-3	-0.018	0.181	-0.163***	-0.997***	-0.183***	-1.118***	-0.115***	-0.42
-2	-0.023	0.158	-0.180***	-1.177***	-0.194***	-1.311***	-0.120***	-0.540**
-1	-0.021	0.137	-0.174***	-1.352***	-0.188***	-1.500***	-0.140***	-0.680***
0	-0.021	0.116	-0.187***	-1.539***	-0.230***	-1.730***	-0.199***	-0.879***
1	-0.027	0.089	-0.224***	-1.763***	-0.262***	-1.992***	-0.232***	-1.111***
2	-0.031	0.058	-0.231***	-1.994***	-0.282***	-2.274***	-0.235***	-1.345***
3	-0.033	0.025	-0.244***	-2.239***	-0.260***	-2.534***	-0.239***	-1.584***
4	-0.060**	-0.035	-0.239***	-2.478***	-0.255***	-2.790***	-0.258***	-1.842***
5	-0.043	-0.078	-0.231***	-2.709***	-0.247***	-3.037***	-0.313***	-2.156***
6	-0.043	-0.121	-0.225***	-2.934***	-0.258***	-3.295***	-0.337***	-2.492***
7	-0.069***	-0.19	-0.243***	-3.177***	-0.271***	-3.566***	-0.346***	-2.838***
8	-0.124***	-0.314	-0.240***	-3.417***	-0.277***	-3.843***	-0.366***	-3.204***
9	-0.144***	-0.458**	-0.210***	-3.627***	-0.286***	-4.129***	-0.367***	-3.571***
10	-0.148***	-0.606***	-0.240***	-3.867***	-0.280***	-4.410***	-0.359***	-3.930***
11	-0.170***	-0.776***	-0.249***	-4.115***	-0.276***	-4.685***	-0.367***	-4.298***
12	-0.158***	-0.935***	-0.254***	-4.370***	-0.267***	-4.952***	-0.381***	-4.678***
13	-0.160***	-1.095***	-0.234***	-4.604***	-0.264***	-5.216***	-0.395***	-5.073***
14	-0.140***	-1.234***	-0.238***	-4.842***	-0.128***	-5.344***	-0.458***	-5.531***
15	-0.160***	-1.394***	-0.238***	-5.080***	-0.154***	-5.498***	-0.440***	-5.972***
16	-0.160***	-1.554***	-0.148***	-5.228***	-0.135***	-5.633***	-0.421***	-6.393***
17	-0.151***	-1.705***	-0.162***	-5.391***	-0.214***	-5.847***	-0.397***	-6.789***
18	-0.135***	-1.840***	-0.208***	-5.599***	-0.245***	-6.091***	-0.399***	-7.188***
19	-0.171***	-2.011***	-0.230***	-5.829***	-0.249***	-6.340***	-0.385***	-7.573***
20	-0.187***	-2.198***	-0.244***	-6.073***	-0.164***	-6.504***	-0.367***	-7.940***
21	-0.198***	-2.396***	-0.235***	-6.307***	-0.235***	-6.739***	-0.343***	-8.283***

Note: Each bloc comprises three countries, except the Southern bloc, which consists of five. Day -21 to day -1 constitutes the pre-event period, while day 1 to day 21 is the post-event period. Day 0 is the event day. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return, while ***, ** denote 1% & 5% significance level, respectively.

Table 5

AARs and CAARs around the day (Before, Across, After) of confirmed COVID-19 infections

Event windows		Northern bloc		Southern bloc		Eastern bloc		Western bloc	
		AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
Before event	[-21, 0]	-0.022	-0.474	-0.070***	-1.539**	-0.079***	-1.730***	-0.04	-0.879
		-0.001	-0.4959	-0.0176	-2.3031	-0.019	-2.358	-0.0232	-6.1048
	[-10, 0]	-0.019	-0.206	-0.121***	-1.334***	-0.129***	-1.417***	-0.086**	-0.946
		-0.0011	-0.6212	-0.0042	-3.2802	-0.005	-3.5526	-0.011	-5.5821
	[-5, 0]	-0.019	-0.115	-0.159***	-0.954***	-0.174***	-1.042***	-0.114***	-0.686
		-0.0012	-0.7614	-0.0004	-5.3731	-0.0003	-5.4767	-0.0055	-6.7001
Across	[-21, +21]	-0.069***	-2.986***	-0.147***	-6.307***	-0.157***	-6.739***	-0.193***	-8.283***
		-0.0006	-4.4925	-0.0018	-20.9326	-0.0023	-19.7133	-0.0017	-27.8014
	[-10, +10]	-0.044	-0.928**	-0.174***	-3.661***	-0.195***	-4.097***	-0.190***	-4.144***
		-3.60E-05	-0.0005	-1.60E-05	-1.5466	-4.30E-05	-1.8021	-0.0001	-1.0624
	[-5, +5]	-0.028	-0.31	-0.193***	-2.124***	-0.214***	-2.349***	-0.178***	-1.963***
		-0.0005	-0.4456	(0.0013))	-0.609	-0.0015	-0.5068	-0.0011	-2.0173
After event	[0, +21]	-0.115***	-2.533***	-0.225***	-4.956***	-0.238***	-5.239***	-0.346***	-7.603***
		-0.0059	-2.9996	-0.004	-7.372	-0.0027	-6.7234	-0.0324	-21.9893
	[0, +10]	-0.068***	-0.743***	-0.229***	-2.515***	-0.265***	-2.91***	-0.295***	-3.250***
		-0.001	-0.1112	-0.0056	-0.1611	-0.0073	-0.0329	-0.0119	-0.0786
	[0, +5]	-0.036	-0.215	-0.226***	-1.357***	-0.256***	-1.537***	-0.246***	-1.476***
		-0.0002	-0.5659	-0.0063	-3.2808	-0.0082	-3.0441	-0.0063	-3.4778

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. The numbers in parenthesis denote standard deviation while ***, ** denote 1% & 5% significance level respectively.

4.3 Confirmed COVID-19 deaths

Significant negative AARs were observed from pre-event day -2 to post-event day 21 in the Northern bloc of Africa.

Table 6

AARs and CAARs 21 days before and 21 days after the event of confirmed COVID-19 deaths

Days	Northern bloc		Southern bloc		Eastern bloc		Western bloc	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-21	-0.009	-0.009	-0.049	-0.049	-0.035	-0.035	-0.006	-0.006
-20	-0.007	-0.016	-0.047	-0.096	-0.032	-0.066	-0.012	-0.018
-19	-0.015	-0.031	-0.052	-0.148	-0.044	-0.11	-0.023	-0.041
-18	-0.015	-0.046	-0.052	-0.2	-0.041	-0.151	-0.037	-0.078
-17	-0.017	-0.063	-0.07	-0.27	-0.051	-0.202	-0.065	-0.143
-16	-0.011	-0.074	-0.064**	-0.334	-0.059	-0.261	-0.064	-0.207
-15	-0.012	-0.086	-0.080**	-0.414	-0.056	-0.317	-0.099***	-0.307
-14	-0.014	-0.1	-0.116***	-0.53	-0.063	-0.381	-0.123***	-0.43
-13	-0.014	-0.115	-0.133***	-0.663	-0.059	-0.439	-0.107***	-0.536
-12	-0.011	-0.126	-0.132***	-0.795	-0.062	-0.501	-0.116***	-0.652
-11	-0.001	-0.127	-0.153***	-0.948	-0.067	-0.568	-0.118***	-0.77
-10	0.001	-0.127	-0.171***	-1.119**	-0.064	-0.632	-0.145***	-0.915
-9	0.004	-0.123	-0.181***	-1.300***	-0.105***	-0.737	-0.221***	-1.136**
-8	0.008	-0.115	-0.191***	-1.491***	-0.110***	-0.847**	-0.231***	-1.367***
-7	0.007	-0.108	-0.189***	-1.680***	-0.112***	-0.959***	-0.272***	-1.639***
-6	0.009	-0.099	-0.172***	-1.852***	-0.125***	-1.084***	-0.356***	-1.995***
-5	0.017	-0.082	-0.243***	-2.095***	-0.161***	-1.246***	-0.399***	-2.394***
-4	-0.017	-0.098	-0.172***	-2.267***	-0.166***	-1.412***	-0.367***	-2.761***
-3	-0.036	-0.134	-0.166***	-2.433***	-0.179***	-1.591***	-0.396***	-3.157***
-2	-0.063***	-0.198	-0.143***	-2.576***	-0.232***	-1.823***	-0.396***	-3.554***
-1	-0.072***	-0.270***	-0.177***	-2.753***	-0.242***	-2.065***	-0.405***	-3.959***
0	-0.069***	-0.339***	-0.189***	-2.943***	-0.253***	-2.317***	-0.430***	-4.389***
1	-0.071***	-0.410***	-0.192***	-3.135***	-0.236***	-2.553***	-0.388***	-4.777***
2	-0.079***	-0.489***	-0.184***	-3.318***	-0.223***	-2.777***	-0.378***	-5.155***
3	-0.080***	-0.569***	-0.174***	-3.492***	-0.217***	-2.993***	-0.354***	-5.509***
4	-0.120***	-0.689***	-0.177***	-3.669***	-0.206***	-3.200***	-0.374***	-5.883***
5	-0.140***	-0.830***	-0.175***	-3.843***	-0.201***	-3.401***	-0.360***	-6.242***
6	-0.130***	-0.959***	-0.110***	-3.953***	-0.199***	-3.600***	-0.368***	-6.610***
7	-0.112***	-1.071***	-0.116***	-4.068***	-0.215***	-3.815***	-0.387***	-6.997***
8	-0.096***	-1.167***	-0.146***	-4.214***	-0.228***	-4.043***	-0.380***	-7.377***
9	-0.062***	-1.229***	-0.097***	-4.311***	-0.239***	-4.283***	-0.352***	-7.729***
10	-0.104***	-1.333***	-0.164***	-4.475***	-0.233***	-4.516***	-0.325***	-8.054***
11	-0.112***	-1.445***	-0.165***	-4.640***	-0.147***	-4.663***	-0.349***	-8.403***
12	-0.129***	-1.574***	-0.167***	-4.807***	-0.195***	-4.858***	-0.340***	-8.743***
13	-0.130***	-1.704***	-0.176***	-4.982***	-0.201***	-5.059***	-0.321***	-9.064***
14	-0.149***	-1.853***	-0.171***	-5.153***	-0.100***	-5.159***	-0.204***	-9.268***
15	-0.149***	-2.002***	-0.172***	-5.325***	-0.166***	-5.325***	-0.290***	-9.558***
16	-0.109***	-2.111***	-0.178***	-5.503***	-0.192***	-5.517***	-0.313***	-9.871***
17	-0.124***	-2.235***	-0.181***	-5.684***	-0.190***	-5.707***	-0.314***	-10.185***
18	-0.147***	-2.381***	-0.178***	-5.862***	-0.188***	-5.895***	-0.306***	-10.491***
19	-0.171***	-2.552***	-0.175***	-6.037***	-0.216***	-6.111***	-0.286***	-10.777***
20	-0.160***	-2.712***	-0.176***	-6.212***	-0.217***	-6.328***	-0.284***	-11.060***
21	-0.160***	-2.873***	-0.177***	-6.389***	-0.213***	-6.541***	-0.308***	-11.368***

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. Day -21 to day -1 constitute the pre-event period, while day 1 to day 21 is the post-event period. Day 0 is the event day. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. ***, ** denote 1% & 5% significance level respectively.

There was significant negative AAR (-6.9 per cent) on the day the 1st COVID-19 death occurred in the Northern bloc. The smaller significant negative AARs in the Northern bloc compared to others could be attributed to the fact that the Northern bloc confirmed its first death on February 14, 2020, almost a month before the WHO declared COVID-19 a global pandemic on March 11, 2020. Similarly, CAARs were significantly negative from pre-death day -1 to post-death day 21 (Table 6). Across event [-21, +21], [-10, +10], [-5, +5], and After event [0, +21], [0, +10], [0, +5] windows produced significant negative AARs & CAARs respectively (Table 7).

The 1st confirmed COVID-19 death in the Southern bloc of Africa produced a significant AAR of -18.9 per cent in the stock market. Significant negative AARs (CAARs) were recorded from pre-event day -16 (day -10) to post-event day 21, see, Table 6. Negative significant AARs in the Southern bloc were not as high as those of the Eastern and Western blocs, an indication that increasing death cases, lockdowns, ban on social and public gatherings, and closure of business in most of the bloc produced lower negative AARs on the continent except against the Northern bloc. Significant AARs & CAARs were generated for all the Before, Across, and After events windows (Table 7).

The Eastern bloc generated a significant AAR of -25.3 per cent on the 1st confirmation of COVID-19 death. Significant AARs were observed from pre-event day -9 to post-event day 21. Similarly, CAARs were significantly negative from pre-event day -8 to post-event day 21 (Table 6). The effect of lockdowns, increasing deaths, bans, and closure of businesses in the Eastern bloc did not heavily impact the market as observed in the Western bloc. In all the event windows, AARs & CAARs were significantly negative (Table 7).

Akin to all the blocs, see Table 6, the AAR for the Western bloc on account of the 1st confirmed COVID-19 death was negative and significant. Significant negative AARs were observed from pre-event day -15 to post-event day 21, while CAARs were significantly negative from pre-event day -9 to post-event day 21. The Western bloc had the highest negative AARs on the event of deaths on the continent. For example, the AAR on event day 0 was -43 per cent in the Western bloc while the Northern, Southern, and Eastern blocs were -6.9, -18.9 & -25.3 per cent respectively. This result concurs with Verma et al. (2021), who posit that COVID-19 devastations would be colossal if not curtailed in the short term. The result could also be attributed to high investor uncertainties, weaker health care systems, lockdowns, bans on social and public gatherings, and closure of businesses which exerted enormous selling pressure on the bloc's stock market. AARs & CAARs in all the event windows were similarly negative and significant (Table 7).

Table 7
AARs and CAARs around the day (Before, Across, After) of confirmed COVID-19 deaths

Event windows		Northern bloc		Southern bloc		Eastern bloc		Western bloc	
		AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
Before event	[-21, 0]	-0.015	-0.339	-0.134***	-2.943***	-0.105***	-2.317***	-0.200***	-4.389***
		(0.0031)	(0.8380)	(0.0017)	(0.3174)	(0.0107)	(0.4586)	(0.0202)	(0.6501)
	[-10, 0]	-0.019	-0.212	-0.181***	-1.995***	-0.159***	-1.749***	-0.329***	-3.619***
		(0.0028)	(1.0188)	(0.0006)	(1.0023)	(0.0005)	(1.0437)	(0.0002)	(2.5425)
	[-5, 0]	-0.040	-0.241	-0.182***	-1.091***	-0.206***	-1.233***	-0.399***	-2.394***
		(0.0014)	(0.9501)	(0.0007)	(5.3761)	(0.0019)	(2.8109)	(0.0056)	(8.0239)
Across event	[-21, +21]	-0.067***	-2.873***	-0.149***	-6.412***	-0.152***	-5.565***	-0.266***	-10.416***
		(0.0001)	(3.9261)	(0.0006)	(27.1771)	(0.0017)	(10.9137)	(0.0050)	(35.0887)
	[-10, +10]	-0.057***	-1.206***	-0.168***	-3.527***	-0.130***	-2.724***	-0.305***	-6.408***
		(4.2E-05)	(0.0209)	(2.5E-05)	(1.4062)	(0.0068)	(0.2239)	(0.0036)	(3.4660)
	[-5, +5]	-0.066***	-0.731***	-0.181***	-1.991***	-0.211***	-2.316***	-0.386***	-4.247***
		(6.3E-05)	(0.1983)	(0.0004)	(1.0960)	(0.0026)	(0.1700)	(0.0035)	(0.8730)
After event	[0, +21]	-0.118***	-2.603***	-0.165***	-3.636***	-0.203***	-4.476***	-0.337***	-7.409***
		(0.0045)	(3.1229)	(0.0003)	(1.3969)	(0.0008)	(5.2642)	(0.0002)	(6.4737)
	[0, +10]	-0.097***	-1.063***	-0.157***	-1.722***	-0.223***	-2.451***	-0.372***	-4.095***
		(0.0018)	(0.0191)	(0.0003)	(1.9172)	(0.0040)	(0.1299)	(0.0027)	(1.1080)
	[0, +5]	-0.093***	-0.559***	-0.182***	-1.090***	-0.223***	-1.034***	-0.381***	-2.283***
		(0.0011)	(0.3352)	(0.0007)	(5.2613)	(0.0041)	(3.4896)	(0.0028)	(8.6526)

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. The numbers in parenthesis denote standard deviation while ***, ** denote 1% & 5% significance level respectively.

4.4 Vaccination

The Northern bloc generated insignificant negative AARs from pre-event days -21 to -14 and insignificant positive AARs from pre-event day -13 to post-event day 21. There was no significant AAR on the day vaccination commenced in the bloc, see Table 8. All the event windows (Before event, Across event, and After event) generated positive but insignificant AARs & CAARs (Table 9). The market reaction immediately before and after the vaccination day may be a sign of confidence that a cure had finally arrived, resulting in excess demand oversupply, thus causing price appreciations and the generation of positive but insignificant AARs. The Southern bloc market reacted positively to the vaccination but did not generate significant AARs from pre-event day -21 to post-event day 21. However, CAARs were significant from pre-event day -11 to post-event day 21 (see Table 8). The events windows (Table 9) produced similar results. This reaction in the bloc's market

is a sign of market recovery and investors' confidence that the vaccination rollout would minimize the devastating effect of the pandemic to the barest minimum.

The market reaction in the Eastern bloc was similar to the Northern bloc. Whereas there were insignificant negative AARs from pre-event days -21 to -18, positive insignificant AARs were observed from pre-event day -17 to post-event day 21. No significant AAR was observed on vaccination day in the Eastern bloc. CAARs were positive and significant from pre-event day -8 to post-event day 21 (Table 8). All events windows AARs (CAARs) were insignificant (significant). This reaction indicates soaring investor confidence and market recovery leading to stability and optimism in the bloc. The Western bloc reacted differently to the COVID-19 vaccination. From pre-event day -21 to day -1, we observed insignificant positive AARs. Interestingly, on event day 0 and post-event day 1, the market recorded significant positive AARs (15.3 and 15.2 per cent respectively). Significant positive AARs were observed at post-event days 13, 14 & 21, while an insignificant negative AAR was at post-event day 10 (see Table 8). Overall, there were no significant AARs in all the event windows (Table 9). The probable cause of the market reaction on the event day in the Western bloc could be associated with the actual inoculation of citizens despite initial fears that vaccination on the continent could delay, thus bolstering investor confidence of a swift market recovery. We further analyse the reaction of the four regional blocs 20 weeks after the first administration of COVID-19 vaccines, see Table 10. Contrary to Takyi & Bentum-Ennin (2021), we observe no significant AAR in the Northern & Eastern blocs, confirming that they may have recovered early from the impact of the pandemic. Significant positive AARs are observed in the Southern & Western blocs from weeks 8, 10, 12, 14-20, and weeks 5-20 respectively. We attribute the significant positive AARs in the Southern & Western blocs to rising investor confidence, a general slowdown in infections and deaths, improved sensitization, earlier than anticipated market recovery, and easing of restrictions after the blocs were able to receive and or procure additional vaccines to continue their inoculations.

Table 8
AARs and CAARs 21 days before and 21 days after the event of COVID-19 vaccination

Days	Northern bloc		Southern bloc		Eastern bloc		Western bloc	
	AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
-21	-0.085	-0.085	0.105	0.105	-0.014	-0.014	0.122	0.122
-20	-0.079	-0.165	0.108	0.213	-0.007	-0.022	0.124	0.246
-19	-0.083	-0.248	0.113	0.326	-0.004	-0.025	0.124	0.37
-18	-0.078	-0.326	0.113	0.44	-0.003	-0.028	0.127	0.497
-17	-0.074	-0.4	0.104	0.544	0	-0.028	0.131	0.628
-16	-0.074	-0.474	0.106	0.65	0.003	-0.025	0.124	0.752
-15	-0.073	-0.547	0.106	0.756	0.003	-0.021	0.128	0.880**
-14	-0.077	-0.624	0.11	0.866	0.014	-0.007	0.128	1.007***
-13	0.046	-0.578	0.118	0.984	0.136	0.129	0.13	1.137***
-12	0.047	-0.531	0.114	1.097	0.143	0.272	0.131	1.269***
-11	0.047	-0.484	0.098	1.195**	0.144	0.416	0.14	1.409***
-10	0.05	-0.434	0.102	1.298**	0.145	0.561	0.141	1.550***
-9	0.053	-0.382	0.11	1.407***	0.142	0.703	0.141	1.691***
-8	0.054	-0.328	0.115	1.522***	0.145	0.848**	0.138	1.828***
-7	0.049	-0.279	0.114	1.636***	0.144	0.992**	0.136	1.965***
-6	0.052	-0.228	0.116	1.752***	0.146	1.138***	0.137	2.102***
-5	0.049	-0.178	0.115	1.867***	0.141	1.279***	0.137	2.239***
-4	0.051	-0.127	0.122	1.989***	0.144	1.423***	0.136	2.375***
-3	0.051	-0.076	0.123	2.112***	0.138	1.561***	0.138	2.513***
-2	0.048	-0.029	0.119	2.230***	0.143	1.704***	0.137	2.650***
-1	0.053	0.025	0.124	2.354***	0.142	1.846***	0.139	2.789***
0	0.049	0.074	0.123	2.477***	0.139	1.985***	0.153**	2.942***
1	0.048	0.122	0.119	2.596***	0.137	2.123***	0.152**	3.094***
2	0.052	0.174	0.112	2.708***	0.13	2.253***	0.145	3.239***
3	0.047	0.221	0.11	2.818***	0.131	2.384***	0.143	3.382***
4	0.064	0.285	0.112	2.930***	0.142	2.526***	0.141	3.523***
5	0.058	0.344	0.105	3.035***	0.139	2.665***	0.137	3.660***
6	0.054	0.397	0.117	3.153***	0.138	2.802***	0.139	3.798***
7	0.058	0.455	0.122	3.275***	0.138	2.940***	0.144	3.943***
8	0.064	0.519	0.116	3.390***	0.142	3.083***	0.143	4.086***
9	0.063	0.582	0.114	3.504***	0.147	3.230***	0.142	4.228***
10	0.052	0.634	0.123	3.627***	0.15	3.380***	-0.1	4.128***
11	0.042	0.676	0.122	3.749***	0.152	3.533***	0.139	4.267***
12	0.047	0.723	0.123	3.872***	0.151	3.684***	0.144	4.411***
13	0.049	0.772	0.118	3.991***	0.133	3.817***	0.154**	4.565***
14	0.048	0.82	0.118	4.108***	0.113	3.930***	0.151**	4.716***
15	0.047	0.867	0.122	4.230***	0.114	4.044***	0.145	4.861***
16	0.046	0.913	0.122	4.353***	0.102	4.146***	0.143	5.003***
17	0.048	0.961	0.125	4.478***	0.101	4.247***	0.139	5.142***
18	0.044	1.005	0.127	4.605***	0.105	4.352***	0.138	5.280***
19	0.042	1.048	0.128	4.732***	0.103	4.454***	0.141	5.421***
20	0.05	1.097	0.125	4.857***	0.111	4.565***	0.146	5.567***
21	0.045	1.143	0.125	4.983***	0.111	4.676***	0.153**	5.720***

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. Day -21 to day -1 constitutes the pre-event period, while day 1 to day 21 is the post-event period. Day 0 is the event day. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return, while ***, ** denote 1% & 5% significance level, respectively.

Table 9
AARs and CAARs around the day (Before, Across, After) of confirmed COVID-19 vaccination

Event windows		Northern bloc		Southern bloc		Eastern bloc		Western bloc	
		AAR	CAAR	AAR	CAAR	AAR	CAAR	AAR	CAAR
Before event	[-21, 0]	0.003	0.074	0.113	2.496***	0.090	1.985***	0.134	2.942***
		(0.0055)	(1.6908)	(0.0002)	(0.4070)	(0.0033)	(0.6506)	(0.0004)	(0.5970)
	[-10, 0]	0.051	0.558	0.117	1.286**	0.143	1.569***	0.139	1.532***
		(0.0002)	(0.0937)	(0.0001)	(0.8034)	(0.0004)	(0.3828)	(0.0002)	(0.6730)
	[-5, 0]	0.050	0.292	0.123	0.737	0.144	0.847**	0.140	0.840***
		(0.0002)	(0.2650)	(0.0001)	(2.5488)	(0.0003)	(1.6498)	(0.0001)	(2.6634)
Across event	[-21, +21]	0.027	1.143	0.117	5.017***	0.109	4.676***	0.133	5.720***
		(0.0012)	(1.5639)	(2.0E-05)	(14.5995)	(0.0009)	(7.6050)	(3.5E-05)	(15.4525)
	[-10, +10]	0.053	1.118	0.117	2.450***	0.141	2.964***	0.129	2.719***
		(0.0002)	(0.4533)	(2.0E-06)	(0.3722)	(0.0002)	(0.8709)	(5.3E-05)	(0.2717)
	[-5, +5]	0.052	0.571	0.119	1.309**	0.139	1.567***	0.142	1.558***
		(0.0004)	(0.1406)	(1.3E-05)	(0.7512)	(0.0002)	(0.3596)	(0.0001)	(0.6231)
After event	[0, +21]	0.051	1.118	0.120	2.648***	0.129	2.830***	0.133	2.931***
		(0.0002)	(0.3172)	(0.0001)	(0.7977)	(3.0E-05)	(0.6136)	(0.0001)	(0.7288)
	[0, +10]	0.055	0.610	0.117	1.292**	0.139	1.534***	0.122	1.339***
		(0.0003)	(0.1386)	(0.0001)	(0.7788)	(0.0002)	(0.3461)	(0.0006)	(1.2550)
	[0, +5]	0.053	0.387	0.116	0.683	0.135	0.819**	0.145	0.862***
		(0.0005)	(0.1580)	(8.1E-05)	(2.7437)	(0.0002)	(1.6871)	(0.0003)	(2.5734)

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. The numbers in parenthesis denote standard deviation while ***, ** denote 1% & 5% significance level respectively.

Table 10
AARs for the regional blocs 20 weeks after the event of 1st COVID-19 vaccination

weeks	Northern bloc	Southern bloc	Eastern bloc	Western bloc
	AAR	AAR	AAR	AAR
week 1	0.054	0.112	0.136	0.144
	(0.0035)	(0.0003)	(0.00203)	(0.0006)
week 2	0.058	0.118	0.143	0.094
	(0.0025)	(0.0004)	(0.00172)	(0.0315)
week 3	0.047	0.121	0.133	0.147
	(0.0014)	(0.0004)	(0.001377)	(0.0007)
week 4	0.046	0.125	0.104	0.141
	(0.001)	(0.0003)	(0.0006)	(0.001)
week 5	0.646	1.567	1.238	2.151**
	(0.0017)	(0.0002)	(0.00066)	(0.0034)
week 6	0.05	0.13	0.124	0.175**
	(0.0019)	(0.0004	0.000385	(0.0051
week 7	0.046	0.147	0.119	0.193***
	(0.001)	(0.0021)	(0.00026)	(0.0075)
week 8	0.043	0.153**	0.141	0.239***
	(0.0015)	(0.002)	(0.00139)	(0.0241)
week 9	0.043	0.149	0.142	0.266***
	(0.0024)	(0.0016)	(0.001385)	(0.0351)
week 10	0.03	0.163**	0.133	0.221***
	(0.0041)	(0.0042)	(0.000883)	(0.0239)
week 11	0.031	0.143	0.149	0.195***
	(0.005)	(0.0266)	(0.00199)	(0.0216)
week 12	0.05	0.170**	0.149	0.211***
	(0.0104)	(0.0057)	(0.002127)	(0.0257)
week 13	0.024	0.151	0.165	0.252***
	(0.0029)	(0.0056)	(0.004702)	(0.0447)
week 14	0.031	0.163**	0.171	0.253***
	(0.0022)	(0.0097)	(0.004469)	(0.0457)
week 15	0.032	0.179**	0.172	0.235***
	(0.0018)	(0.0172)	(0.004696)	(0.0417)
week 16	0.022	0.192**	0.165	0.239***
	(0.0034)	(0.0239)	(0.003798)	(0.0431)
week 17	0.01	0.178**	0.174	0.239***
	(0.0061)	(0.0269)	(0.005356)	(0.0441)
week 18	(0.01	0.217***	0.186	0.239***
	(0.007)	(0.0525)	(0.006978)	(0.0449)
week 19	(0.016	0.236***	0.183	0.247***
	(0.0081)	(0.0748)	(0.006286)	(0.0429)
week 20	(0.006	0.121**	0.158	0.276***
	(0.0054)	(0.0032)	(0.0075)	(0.0538)

Note: Each bloc is composed of three countries except the Southern bloc, which consists of five. The AAR is generated from the difference between actual return and expected return. The market model is used to generate the expected return. The numbers in parenthesis denote standard deviation while ***, ** denote 1% & 5% significance level respectively.

5. Conclusion and Recommendation

The motivation for this study is to examine the impact of the novel COVID-19 pandemic on the four regional blocs in Africa. We use regional bloc classification by the African Union and employ the market model in an event study approach with four events (WHO announcement of COVID-19 as a global health emergency, confirmed infections, confirmed deaths, and vaccinations) to analyse the reactions of the four regional blocs' stock markets to the COVID-19 pandemic. We use daily stock markets data from September 1, 2019, to August 31, 2021, and COVID-19 data in our analysis. To the best of the authors' knowledge, this is the first study to use four regional blocs in Africa and four events, including vaccination, to analyse the reaction of stock markets to the COVID-19 pandemic. We conclude that markets in the four regional blocs of Africa react differently to different phases of the COVID-19 pandemic, which provides opportunities for investors, portfolio managers, and speculators. First, we document that, on the day the WHO announced COVID-19 as a global health emergency on January 30, 2020, the Southern, Eastern, and Western blocs generated significant positive AARs while the Northern bloc did not produce significant AAR. While the AARs in the Southern, Eastern, and Western blocs were positive from pre-event day -16 to post-event day 21, the AARs of the Northern bloc were negative from pre-event day -16 to post-event day 21. Second, on the day of the 1st confirmed infections, all but the Northern bloc generated significant AAR. In the event of infections, all the regional blocs generated negative AARs, with the Northern (Western) bloc generating the least (highest). Third, the 1st confirmed COVID-19 death caused significant negative AARs in all the four regional blocs on event day, with the Western (Northern) bloc producing the highest (lowest) AAR. In tandem with Raifu et al. (2021), rising infections and deaths occasioned negative AARs in all the four regional blocs of Africa. Fourth, we document early recovery for all the four regional blocs in Africa from the devastating effect of the COVID-19 pandemic premised on the fact that each of the blocs generated positive AARs on the event of vaccination even though only the Western bloc generated significant AAR (15.3 per cent, at 5 per cent significance level) on the event day. Fifth, we conclude that when vaccines are discovered and inoculations begin during pandemics, investors and portfolio managers should maintain their equity positions in each of the four regional blocs of Africa since our results indicate positive abnormal returns. A justification that regional blocs stock markets recover early during pandemics. Finally, we conclude that during pandemics, investors, portfolio managers, and speculators could maximize their returns while minimizing their losses by selling and purchasing stocks in the various regional blocs to re-balance their equity positions.

Based on the above conclusions, we recommend as follows: 1) Our results show that the WHO announcement of COVID-19 as a global health emergency generated significant abnormal returns in the Southern, Eastern, and Western blocs of Africa. We recommend to governments and stakeholders in the regional blocs to intensify education and minimize the spread of misinformation and disinformation during pandemics since they have the potential of causing abnormal price movements in their respective stock markets. 2) Governments should have clear and well-communicated monetary and fiscal plans in the regional blocs. Our results show that investor uncertainties also accounted for the abnormal returns experienced in the market during the COVID-19 pandemic. 3) When the WHO announces a pandemic, investors, fund managers, and speculators could dispose-off their equity holdings in the Southern, Eastern, and Western blocs at an abnormal profit and then purchase shares in the Northern bloc at a discount. Similarly, in the case of increasing infections and deaths, investors, speculators, and portfolio managers could exit the Northern, Eastern, and Southern bloc markets to minimize their losses while purchasing stocks in the Western bloc at relatively lower prices. Thus, we recommend that investors, portfolio managers and speculators not panic during pandemics since they can generate significant abnormal returns and diversify their investment holdings across the four regional blocs in Africa, as demonstrated by the COVID-19 pandemic.

The study is limited to four out of five regional blocs in Africa. We urge future researchers to explore the central bloc, and how the various sectors in the regional blocs react to COVID-19 and compare their results.

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