Covid-19 outbreak and stocks return on the West African Economic and Monetary Union’s stock market: An empirical analysis of the relationship through the event study approach

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Abstract
This study uses the Wilcoxon's signed ranks test to identify the effect of the Covid-19 outbreak on the stocks returns of companies listed on the West African Economic and Monetary Union’s (WAEMU) stock market by considering two event dates (January 23, 2020 and March 2, 2020). To account for the temporal volatility in the event approach, the study resort to a GARCH model. Empirical findings suggest that January 23, 2020 event (first case of death due to Covid-19 in China) have had a minor impact on the WAEMU stock market while the event on March 2, 2020 (first case of Covid-19 in the WAEMU) strongly affected the financial market. This negative impact is much more pronounced for the distribution sectors (−34.16%). Robustness analysis reveals that the main information leading to disruption on the market is the weekly death cases and not the confirmed cases. In addition, government anti-Covid-19 measures such as social distancing and governance positively affect the stock return whereas lockdown, public health measures and movement restrictions contribute to a decline in the stock’s price.

KEYWORDS
BRVM, Covid-19, stocks, WAEMU, Wilcoxon signed ranks test

JEL CLASSIFICATION
G1l; G12; G14; G15; I10; I18

1 | INTRODUCTION

The history of humankind has witnessed several epidemic diseases that have had a devastating social impact (death of several million people), but also enormous economic and financial consequences. Indeed, between 1,347 and 1,351, the famous black plague caused the death of a hundred million people worldwide. The cholera epidemic in Mexico between 1899 and 1923, the AIDS virus that appeared in Cameroon in 1908, as well as the SARS between 2002 and 2003 in Asia and Canada and the Ebola hemorrhagic virus infection are among others, some of the epidemics that have destabilized socio-economic equilibrium worldwide (Zeren & Hizarci, 2020). Although empirical investigation on the effect of those epidemics on stock value did not reach the same conclusion, most of them show that the two variables are strongly related (Bash, 2020; Chen, Jang, & Kim, 2007; Pendell & Cho, 2013). Chen et al. (2007) have shown that the SARS epidemic led to a positive financial...
performance of biotechnology companies whereas Brounen and Derwall (2010) found that prices decline following terror attacks. For Kim and Tang (2020), the epidemic disease outbreaks have a negative influence on the restaurant industry. Today, with a highly connected and integrated world, the consequences of viral epidemic diseases beyond mortality and morbidity are enormous, because if the health risks are high, the economic and financial damages are even greater.

Appeared in China in Hubei Province in December 2019, the Corona Virus Disease (Covid-19) was quickly declared as a pandemic by the World Health Organization (WHO) due to the number of deaths that had already reached the 20,000 milestone, but also because of a potential contagion effect in other parts of the world. The WHO’s appeals led States to make a painful trade-off between the economic and social aspects. Thus, measures such as the cancellation of international flights, the suspension of trade, the interruption of educational and recreational activities in several countries, the postponement of the Olympic Games in Rio and the confinement and quarantine are decisions aimed at containing the spread of Covid-19 (Gilbert, Pullano, & Pinotti, 2020; Hellewell et al., 2020; Hoehl, Rabenau, & Berger, 2020; WHO, 2020). All of these decisions are not without economic consequences. Although it is tempting to correlate the current Covid-19 outbreak, caused by the SARS-CoV-2 coronavirus, and the SARS outbreak of 2003, the two situations are different in more than one point. While the shock of SARS was essentially regional, the Covid-19 affects practically every country in the world. In addition, according to the IMF and the WTO (2019), the Chinese economy represented only 4% of world GDP in 2003 against 17% in 2019, and China occupies 40% of international trade against only 4% in 2003. As the size of the Chinese stock market has increased considerably, it is logical to conclude that the economic impact on the rest of the world will be significant.

The coronavirus outbreak has shocked the financial markets and, in general, the global economy. Financial markets in Asia have had very hard weekends, with the prospect of devastating consequences for the global economy. Stocks markets recorded losses leading to their worst drop since the 2008–2009 financial crisis when the global economy had experienced a recession. In addition, there are signs that make fear the worst, such as the highest level of the VIX index since 2011, when the public debt crisis was raging. The American rating agency Standard & Poors has lowered China’s growth forecasts for 2020. The Covid-19 crisis, which was first a supply shock linked to the difficulties of companies’ supply from China, led to the fall of financial markets, including long-term interest rates. Growth and inflation expectations are revised down in the long-run not because markets anticipate a permanent crisis linked to the virus but because the response of monetary authorities and governments is not judged to be up to the challenges.

European financial centres also suffered from the Covid-19. The outbreak costs the tourism sector alone a billion euros per month. Concerning the financial markets, they practically lost in few days all the gains of 2019. European indices plunged from 7 to 8% causing the market to topple into a chaotic situation with declines of more than 20% since peaks in late February 2020. During the second week of March 2020, the Euro STOXX 50 index plunged by 8.45%, the DAX in Frankfurt by 12.24% and the FTE 100 in London by 9.81%. The Italian stock market has lost 17% since the beginning of the health crisis while the Milanese MIB finally ended the session at −16.92%. Similar observations have been made on the American financial markets. The Dow Jones closed with a decline of −7.83%, the NASDAQ by −7.29% and the S&P 500 by −7.64%.

If Africa is the least contaminated region of the world for the moment (203,899 confirmed cases over 7,000,000 cases worldwide), WHO apprehensions and the outbreak management strategies led by different governments will have collateral effects on its financial markets. Monday, March 9, 2020 and Thursday, March 12, 2020 were two particularly dark days for African stock markets. Indeed, the Johannesburg stock market fell by 9.72%. The Namibian Stock Exchange collapsed by 8.81% while the Casablanca Stock Exchange recorded the largest decline in its history (−6.70%). After a fall of more than 15%, the Nairobi Stock Exchange suspended its trading session after the announcement of the first case of Covid-19. The Nigerian stock market ended at −3.72% with losses of nearly $2 billion for investors. The panic in the financial markets has led the West African Economic and Monetary Union (WAEMU) stocks market authorities to rearrange their trading hours by advancing the opening fixing by 15 min (9:30 a.m. instead of 9:45 a.m.), and the market closing at 2 p.m. instead of 3 p.m.

Regarding the rapid spread of the pandemic, studies have attempted to analyse the possible effects of Covid-19 on the economy (Ayittey, Ayittey, Chiwero, Kamasah, & Dzuvor, 2020; Estrada, Park, Koutronas, Khan, & Tahir, 2020; Luo & Tsang, 2020) as well as the factors responsible for its transmission (Priyadarsini & Suresh, 2020; Qiu, Chen, & Shi, 2020; Wu & McGoogan, 2020). There is also a growing literature on the relationship between Covid-19 and financial markets (Albulescu, 2020; Baig, Butt, Haroon, & Rizvi, 2020; Gormsen & Koijen, 2020; He, Sun, Zhang, & Li, 2020; Mazur, Dang, & Vega, 2020; Phan & Narayan, 2020;
Ramelli & Wagner, 2020; Singh, Dhall, Narang, & Rawat, 2020; Zaremba, Kidys, Aharon, & Demir, 2020; Zeren & Hizarci, 2020). However, in the West African context, to the best of our knowledge, the Covid-19/financial market relationship has not yet been subject to empirical investigations. In this sense, the purpose of this research is to analyse the effect of the Covid-19 outbreak on the WAEMU Stock Exchange to fill this gap. Thus, the objective of this article is to analyse the effects of the Covid-19 outbreak on the BRVM market.

The remainder of the article is organized around three sections. The first section presents a review of the literature on the relationship between the epidemic and economic and stock market variables. The second section develops the material (econometric model) and the method used. The third section presents the main findings and policy implications.

2 | LITERATURE REVIEW

The concept of the informational efficiency of financial markets, according to which the observed price of financial securities reflects all available information at all times, is undoubtedly the essential pillar of modern financial theory (Fama, 1965). However, according to behavioural finance, investors’ sentiments affect their investment decisions and can therefore affect stock prices on financial markets (Ritter, 2003). Indeed, most studies indicate that disasters such as the 1991 Gulf War (Foster, 1996), the 2001 terrorist attacks (Chang, 2005; Hergert, 2004) and SARS (Overby, Rayburn, Hammond, & Wyld, 2004) have had negative impacts on investors’ portfolios and even on the global economy. This clearly shows that some information leads to the observation of anomalies in the financial markets, thus calling into question the market efficiency. According to Viscusi (1990), society’s responses to health risks tend to be extreme and inconsistent. As such, several investigations show that individuals’ behaviour facing the SARS outbreak was not only observed in the pharmaceutical industry (Bennett, Chiang, & Malani, 2015) but also in the financial markets.

On the link between epidemics and economic development, Bloom and Mahal (1997) show that HIV and economic growth have a long-term cointegration structure. However, there is no evidence of causality between these two variables. In a similar study, Barnetta, Whitesideb, Khodakevichc, Kruglovd, and Steshenko (2000) found a negative relationship between these variables in the Ukrainian context. As for Vijayakumar et al. (2013), they examined the relationship between the chikungunya epidemic in India and monthly per capita income. The authors conclude that there is no link between the two variables.

Chen et al. (2007) show that in the face of the SARS epidemic, the tourism sector has been the most affected in terms of falling stock prices on the Taiwan Stock Exchange. In addition, there has been a drop in the stock prices of companies operating in the wholesale sector and retailers. However, there is a positive effect for the biotechnology field (Chen, Chen, Tang, & Huang, 2009). Ali, Md Nassir, Hassan, and Abidin (2010) showed a strong investor reaction to the SARS outbreak on the Malaysian stock market leading to a decline in stock prices. In the same vein, Hsieh (2013) shows that the daily volatility of the markets is higher in times of crisis than in a situation of stability (or the absence of shock). Nippani and Washer (2004) used the non-parametric Mann–Whitney test to examine the impact of SARS on the financial markets in some countries: Canada, China, Hong Kong, Indonesia, Philippines, Singapore, Thailand and Vietnam. The authors found that except China and Vietnam, the epidemic had no negative impact on the financial markets of the affected countries. Longin and Solnik (2001) showed that using the theory of extreme values, the correlation between epidemic and securities price is increasing in a bear market. However, there is no correlation between bull markets and high volatility markets. Onay and Ünal (2012) explored long-run financial integration and the extreme dependence between two financial markets and found the existence of an episodic cointegration for the sample studied.

According to an estimation made by Fan, Jamison, and Summers (2018), the projected annual cost of an influenza pandemic would be around $ 500 billion or 0.6% of world income, including both the miss to win and the intrinsic cost of rising mortality. Previously, Marinč and Ichev’s (2016) analysis on the impact of the Ebola virus outbreak on US financial markets revealed a negative widespread effect and more pronounced for smaller and more volatile markets. Companies belonging to less stable sectors also feel this negative effect.

More recently, Zeren and Hizarci (2020) have analysed the effect of Covid-19 on the financial markets of the most affected countries by this epidemic. The authors used the Maki (2012) cointegration test taking into account the total number of daily deaths and the total number of daily confirmed cases. The results show that in all the financial markets analysed, there was a long-run cointegration relationship between the total number of confirmed cases and the SSE, KOSPI and IBEX35 indices. However, there appears to be no cointegration with the FTSE, MIB, CAC40 and the DAX30. Ramelli and Wagner (2020) also analysed the effect of the Covid-19 pandemic on stock prices.
The study found that the telecommunications and pharmaceutical sectors performed well while the transportation and energy sectors saw their performance deteriorate. It also emerges that American companies, dependent on Chinese inputs and those that are very export-oriented in China suffered due to the fall in their stock prices on the market. Mazur et al. (2020) investigate the US stock market performance during the crash of March 2020 triggered by Covid-19. The authors find that natural gas, food, healthcare and software stocks earn high positive returns, whereas equity values in petroleum, real estate, entertainment and hospitality sectors fall dramatically. In addition, they pointed out that loser stocks exhibit extreme asymmetric volatility that correlates negatively with stock returns. Singh et al. (2020) examine the impact of the Covid-19 outbreak on the stock markets of G 20 countries. For this purpose, they use an event study methodology to measure abnormal returns (ARs) and panel data regression to explain the causes of ARs. Findings reveal that cumulative average abnormal return (CAAR) from day 0 to day 43, ranging from −0.70 to −42.69%, is a consequence of increased panic in the stock markets resulting from an increased number of Covid–19 confirmed cases in the G-20 countries. Additionally, the results of panel data analysis indicate a recovery of stock markets from the negative impact of Covid-19 as time goes by. Albulescu (2020) documented that new confirmed cases of Covid-19 and death reported positively influence market volatility index (VIX) both within and outside of China. Additionally, the author supports that the higher the spread of the deadly virus in the country, the higher would be the financial volatility in the stock market. Phan and Narayan (2020) investigate how the stock price reacted in real-time to different stages in Covid-19’s evolution. Finding suggests that markets overreact and as more information becomes available and people understand the ramifications more broadly, the market corrects itself. He et al. (2020) use an event study approach to empirically study the market performance and response trends of Chinese industries to the Covid-19 pandemic. They conclude that transportation, mining, electricity and heating and environment industries have been adversely impacted by the pandemic. However, manufacturing, information technology, education and healthcare industries have been resilient to the pandemic. Bash (2020) study the effect of the first registered case of Covid-19 on stock market returns using event study analysis. Mean-adjusted returns and market model methods are used to estimate cumulative ARs (CARs) for 30 countries. The results show that stock market returns experience a downwards trend as well as significant negative returns following the Covid-19 outbreak. Baig et al. (2020) suggest that increases in confirmed cases and deaths due to coronavirus are associated with a significant increase in market illiquidity and volatility.

According to Phan and Narayan (2020), the scale of the Covid-19 has been matched by government policies to cushion its negative repercussions. Many governments responded with multiple policy approaches (travel bans, lockdowns and stimulus packages) to minimize the repercussions of the pandemic. Some researchers have attempted to examine the impact of these measures on the stock market. Baker et al. (2020) investigations suggest that government restrictions on commercial activity and voluntary social distancing, operating with powerful effects in a service-oriented economy, are the main reasons the US stock market reacted so much more forcefully to Covid-19 than to previous pandemics. For Baig et al. (2020), the implementations of restrictions and lockdowns contribute to the deterioration of liquidity and stability of markets. Gormsen and Koijen (2020) use aggregate stock and dividend futures markets data to quantify how investors’ expectations about economic growth evolved across horizons following Covid-19 and subsequent policy responses until July 2020. Their forecasting shows a decline of 8% in the annual growth of dividends in both the United States and Japan and a 14% decline in the European Union. In addition, news about US monetary policy and the fiscal stimulus bill around March 24 boosted the stock market and long-term growth but did little to increase short-term growth expectations.

Although researches linking epidemic diseases and the functioning of the WAEMU stock market are not documented, some studies have shown that this market takes the weak form of efficiency (N'Dri, 2007) and not the semi-strong form (Dadem Kemgou, Manetsa, Djoutsa Wamba, & Kamdem, 2017). These findings imply that it is not possible to obtain positive ARs on the basis of past information, but current information could lead to taking advantage of the market. Otherwise, the Covid-19 epidemic could lead to some disruptions on the BRVM market.

From this review, it emerges that a pandemic such as the Covid-19 can have differentiated effects depending on the structure of the stock market on the one hand and the measures taken by companies themselves and States to counter the effects of the pandemic on the other hand.

3 | PRESENTATION OF WAEMU’S STOCK MARKET AND SITUATION OF THE COVID-19

The WAEMU, which brings together eight countries, provides in its constituent treaty of November 14, 1973, the
establishment of an organized financial market. In 1991, the idea of a single financial market, common to all the countries of the Union was developed to promote trade and strengthen regional integration. The decision to create the Regional Financial Market was taken in December 1993 and the implementation of this operation was entrusted to the Central Bank of West African States (BCEAO). The Regional Stock Exchange constitutes, with the Regional Council for Public Savings and Financial Markets (CREPMF), one of the two structures of this Regional Financial Market.

It is a specialized financial institution created on December 18, 1996 in accordance with a decision of the WAEMU Council of Ministers taken in December 1993. This stock exchange is common to eight countries in West Africa: Benin, Burkina Faso, Guinea-Bissau, Ivory Coast, Mali, Niger, Senegal and Togo. In 2020, almost 65 companies are listed on this stock market. The BRVM is based in Abidjan and has national stock exchange offices (ANB) in each country. Each ANB is linked to the head office by a satellite relay, which ensures the routing of orders and information to all investors on the Stock Exchange in an equitable manner.

As shown in Table 1, the eight WAEMU member countries did not record Covid-19 cases at the same moment. However, the majority of countries experienced their first cases in March. Paradoxically, Guinea-Bissau, a country that was belatedly contaminated by the pandemic (April 16, 2020), recorded the highest number of cumulated cases on May 4 (1,650). The cumulative total of death cases is the highest for Niger. Benin has recorded the fewest confirmed and deaths cases. The average number of new cases in the union is about 179 with an average of eight daily deaths.

On the WAEMU stock market, there are two main indices, representing the activity of equity market securities. These are BRVM 10 and BRVM Composite. The BRVM Composite is a general index that takes into account all the companies listed on the stock market. The BRVM Composite is adjusted each time a new company is listed (but also in the event of an increase or reduction in the capital), to be adapted to the evolution of the Regional Financial Market.

The BRVM 10 index is composed of the 10 most active and liquid companies on the market. The notion of liquidity occupying a fundamental place in the selection of the securities making up the BRVM 10 index, each year. This index is updated four times, meaning every quarter (the first Monday of January, April, July and October). The criteria for choosing companies is rigorous and comply with international standards. Thus, the BRVM 10 companies obey the following criteria: the average amount of transactions during the 3 months preceding the quarterly review must not be less than the median of the average daily amounts of transactions of all securities; the frequency of transactions should always be more than 50%, meaning the securities should trade at least once in two, during the 3-month study period.

Since the advent of Covid-19 in the WAEMU, the two benchmark indices have been declining with a similar evolution as illustrated in Figure 1. Indeed, there is a general deterioration in return by 20% between the beginning of March and the first half of April 2020. A slight recovery is observed during the first half of May,

| Countries            | Date of first confirmed cases | Cumulative number of confirmed cases | Cumulative number of death cases | Average daily confirmed cases | Average daily death cases |
|----------------------|------------------------------|-------------------------------------|---------------------------------|-----------------------------|--------------------------|
| Benin                | 17-March-2020                | 90                                  | 2                               | 2                           | 1                        |
| Burkina Faso         | 09-March-2020                | 662                                 | 46                              | 12                          | 1                        |
| Ivory Coast          | 12-March-2020                | 1,398                               | 17                              | 26                          | 1                        |
| Guinea-Bissau        | 16-April-2020                | 1,650                               | 7                               | 87                          | 1                        |
| Mali                 | 26-March-2020                | 563                                 | 29                              | 14                          | 1                        |
| Niger                | 19-March-2020                | 750                                 | 36                              | 16                          | 1                        |
| Senegal              | 02-March-2020                | 1,271                               | 9                               | 20                          | 1                        |
| Togo                 | 07-March-2020                | 124                                 | 9                               | 2                           | 1                        |
| Total                | 6,508                        | 155                                 | 179                             | 8                           | 1                        |
| Minimum              | 90                           | 2                                   | 2                               | 1                           | 1                        |
| Maximum              | 1,650                        | 46                                  | 87                              | 1                           | 1                        |

*Source: By authors from WHO Covid-19 database (2020).*
were not taken into account because they do not have complete data essential for the analysis. Four econometric estimates were carried out. An estimate for the total sample is composed of 42 companies regardless of the sector, then an estimate for each sectoral index (10 companies for industry, 14 for finance and 7 for distribution). The study period takes into account two periods. The first seeks to understand the impact of the first case of death due to Covid-19 observed in China on January 23, 2020 on the BRVM stock market. To do so, a period from November 21, 2019 to March 26, 2020 is used. The choice of this time horizon for estimates is because China was the first country to experience Covid-19 cases before it spread globally. Moreover, China has become Africa's largest trade partner and has greatly expanded its economic ties to the continent. Therefore, the research is interested in seeing the market behaviour 45 exchange days before and 45 exchange days after this date. In a second step, by considering the date of March 2, 2020 as the event date in the WAEMU, an estimation period going from December 30, 2019 to May 4, 2020 is retained. The objective, in this case, is to identify the effect of Covid-19 on the BRVM stock market following the first confirmed case in one of the member countries.

Studies related to the impact of events on shareholder wealth generally use the Sharpe (1963) model. Dyckman, Philbrick, and Stephan (1984) have shown that the adjusted average return model, the adjusted market return model, and the market model have the same power to correctly detect the presence of AR. To take into account the temporal volatility and obtain ARs as well as CAR during the outbreak period of Covid-19, we followed Chen et al. (2009) using a GARCH model. The return $R_i$ is calculated as follows:

\begin{equation}
R_{it} = \ln\left(\frac{P_{it}}{P_{it-1}}\right).
\end{equation}

With $P_{it}$ and $P_{it-1}$, respectively, the stock closing prices of firm $i$ on dates $t$ and $t - 1$. The AR of stock $i$ on day $t$ is subsequently defined as below:

\begin{equation}
AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) = \varepsilon_{it}.
\end{equation}

With $\varepsilon_{it}$, $\varepsilon_{it} \sim (0,h_{it})$

\begin{equation}
E(R_{it}) = \hat{\alpha}_i + \hat{\beta}_i R_{mt}.
\end{equation}

$AR_{it}$ represents the AR of the company $i$ on day $t$; $E(R_{it})$ the expected return of firm $i$ on date $t$ and $\Psi_{i-1}$ represents all the information available on date $t - 1$. $R_{it}$ and $R_{mt}$ are, respectively, the return of

**FIGURE 1** Evolution of the BRVM benchmarks indices during the Covid-19 outbreak.

Source: WAEMU Regional Securities Market (May 2020) [Colour figure can be viewed at wileyonlinelibrary.com]
The conditional variance in the GARCH (1, 1) is estimated to test their statistical significance. The calculation of the cross-sectional CAAR is calculated and estimated in Tables 2 and 3. Secondly, Tables 4 and 5 provide the results of the effect of Covid-19 on the stock return of WAEMU’s listed companies, considering the date of March 2, 2020 as the event date. Finally, some robustness analysis is carried out.

5 | MAIN FINDINGS AND DISCUSSION

This section is devoted to the presentation of the empirical findings. Firstly, considering the date of January 23, 2020 (the date on which the first case of death due to Covid-19 was reported in China), the results are presented in Tables 2 and 3. Secondly, Tables 4 and 5 provide the results of the effect of Covid-19 on the stock return of WAEMU’s listed companies, considering the date of March 2, 2020 as the event date. Finally, some robustness analysis is carried out.

5.1 | Average abnormal and cumulative returns around the date of January 23, 2020

In Table 2 are reported the AARs and the CAARs from the event study for all companies in the sample as well as the three selected sectoral indices (BRVM Industry, BRVM Finance and BRVM Distribution). The results show a decline in the stock returns 8 days before the Covid-19 outbreak. In addition, the ARs are negative for the total sample and especially for the sub-samples of BRVM industry and BRVM Finance. There are four more significant ARs in the BRVM industry and two in the BRVM Finance compared to the total sample. This is explained by the fact that although the first case of death was only observed on January 23 in China, the WAEMU regional stock market had already anticipated the harmful effects that the epidemic of Covid-19 could have.

The days following the appearance of the outbreak were characterized by the presence of five ARs significantly different from zero, three of which are positive. This reflects the fact that in the 20 days since the appearance of the Covid-19 in China, companies in the WAEMU have not been negatively affected. However, sectors such as industry and finance have been slightly affected. Table 2 shows that the AARs of the BRVM Industry are all negative and significant at the 0.1% threshold and that no CAAR is statistically significant. This is explained by the fact that West Africa is a major importer of production tools and industrial raw materials from China. China, the epicentre of the outbreak on day 0, had to take measures to contain the disease. This attitude combined with the psychosis of countries faced with the rapid transmission of the virus and the progressive
TABLE 2  Average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) of the BRVM market 20 days before and 20 days after the appearance of Covid-19 in China (January 23, 2020)

| Days | Total sample (N = 42) | BRVM industry (N = 10) | BRVM finance (N = 14) | BRVM distribution (N = 7) |
|------|-----------------------|------------------------|-----------------------|---------------------------|
|      | AAR (%)    | CAAR (%)   | AAR (%)    | CAAR (%)   | AAR (%)    | CAAR (%)   | AAR (%)    | CAAR (%)   |
| −10  | 0.87 (2.56) | 0.72 (1.84) | 0.19 (2.92) | 0.14 (1.90) | 0.13 (2.55) | 0.52 (0.83) |
| −9   | 0.81 (2.53) | 0.29 (1.54) | 0.24 (2.66) | 0.21 (1.77) | 0.00 (0.00) | 0.00 (0.00) |
| −8   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −7   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −6   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −5   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −4   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −3   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −2   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| −1   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 0    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 1    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 2    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 3    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 4    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 5    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 6    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 7    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 8    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 9    | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 10   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 11   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 12   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 13   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 14   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 15   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 16   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 17   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 18   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 19   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |
| 20   | 0.17 (2.87) | 0.13 (1.86) | 0.13 (2.52) | 0.13 (1.90) | 0.00 (0.00) | 0.00 (0.00) |

Note: This table presents the average abnormal returns and the cumulative average abnormal returns surrounding the date \( t = \) January 23, 2020 of the Covid-19 outbreak. The abnormal return is obtained from the difference between the observed return and that expected. The expected return is determined from the regression of the standard market model. The \( W \) statistics of Wilcoxon’s signed-rank allow us to test the null hypothesis that the average abnormal returns or the cumulative average abnormal returns are equal to zero. The numbers in parentheses represent the SD. ***, ** and * are the statistical significance level at 0.1, 1 and 5%, respectively.
The implementation of barrier measures have had consequences on international trade, particularly with the countries of the WAEMU. The impact on the finance sector is not clear, as there are both positive and negative AARs after date 0. This is due to a difference of opinion between investors. Indeed, if some anticipate a future contagion of the market due to the interconnection between financial systems, others perceive this sector as the solution to the post-Covid-19 economic recovery. As for the distribution sector, the results show that until the 15th day after the outbreak, this sector was doing well with positive AARs. Then the negative effect was only felt to the 16th and 19th days. The close relationship between the industry and distribution sectors explains this result. The AARs and CAARs are summarized in the table below.

Analysis of the Average ARs (AARs) by event windows in Table 3 reveals that 10 days before the first case of death in China, companies listed on the WAEMU stock market felt the negative effects of Covid-19. Indeed, the negative and significant AR in the window [−10; 0] is −0.08%. This negative effect was much more pronounced in the window [−5; 0] with an AR of −0.37%. While the distribution sector was not affected, the industrial and financial sectors experienced a sharp deterioration compared to the total number of companies (−3.78 and −4.39%, respectively). In addition, these sectors soon felt the effects of Covid-19 because the AARs fall within the event window [−20; 0]. However, over the period covering 20 days after the first confirmed death in China due to Covid-19, the two indices (BRVM Industry and BRVM Finance) and the total sample (42 companies) have positive and significant ARs, but these ARs are low. Indeed, the returns were, respectively, 0.09% for the total sample, 0.25% for the industrial sector and roughly close to zero for the finance sector.

Throughout the event, only the total sample without distinction of sectors have a positive AR of 0.17% in the window [−10; 10]. The industrial, financial and distribution sectors all exhibit very low ARs. However, these returns are not significant.

Overall, this first level of analysis shows that the appearance of the Covid-19 outbreak in China on January 23, 2020, did not have significant effects on companies listed on the Regional Stock Exchange market. This is due to the late contamination of WAEMU countries because the first case in the Union was recorded 38 days after the outbreak raged in China. Another explanation lies in the fact that there is no correlation between the WAEMU stock market and the Asian financial markets in general and the Chinese in particular.

### Table 3

| Event windows | Total sample (N = 42) AAR (%) | BRVM industry (N = 10) AAR (%) | BRVM finance (N = 14) AAR (%) | BRVM distribution (N = 7) AAR (%) |
|---------------|------------------------------|-------------------------------|-------------------------------|----------------------------------|
| Before event  |                              |                               |                               |                                  |
| [−20; 0]      | 0.27 (0.72)                  | −3.78 (1.43)*                 | −4.39 (1.07)**                | 0.26 (2.01)                      |
| [−10; 0]      | −0.08 (0.77)*                | 0.1 (1.33)                    | −0.08 (1.23)                  | −0.14 (1.66)                     |
| [−5; 0]       | −0.37 (0.53)*                | 0.09 (1.71)                   | 0.29 (1.26)                   | −0.74 (0.52)                     |
| Across event  |                              |                               |                               |                                  |
| [−20; 20]     | 0.18 (0.77)                  | 0.03 (1.23)                   | −0.1(0.86)                    | 0.16 (1.13)                      |
| [−10; 10]     | 0.17 (0.85)**                | 0.002 (1.16)                  | −0.07(0.99)                   | 0.05 (1.42)                      |
| [−5; 5]       | −0.17 (0.48)                 | −0.09 (0.95)                  | 0.07 (1.16)                   | −0.36 (1.15)                     |
| After event   |                              |                               |                               |                                  |
| [0; 20]       | 0.09 (0.81)**                | 0.25 (0.95)*                  | 0.00 (0.56)**                 | 0.24 (1.11)                      |
| [0; 10]       | 0.43 (0.84)                  | 0.29 (0.95)                   | −0.06 (0.67)                  | 0.13 (1.19)                      |
| [0; 5]        | 0.08 (0.29)                  | −0.06 (0.72)                  | −0.16(0.64)                   | 1.21(1.51)                       |

Note: This table presents the average abnormal returns surrounding the date \( t = \) January 23, 2020 of the Covid-19 outbreak. The abnormal return is obtained from the difference between the observed return and that expected. The expected return is determined from the regression of the standard market model. The \( W \) statistics of Wilcoxon’s signed-rank allow us to test the null hypothesis that the average abnormal returns are equal to zero. The numbers in parentheses represent the SD. ***, ** and * are the statistical significance level at 0.1, 1 and 5%, respectively.

### 5.2 Average abnormal and cumulative returns around the date of March 2, 2020

The analysis in Table 4 indicates the presence of several negative ARs 20 days before the outbreak of the Covid-19 in the WAEMU. There are six negative AARs going from
the 16th day to the second day before the date of March 2 significantly different from zero. This result implies that well before the advent of Covid-19 in the WAEMU, all companies in the union had already felt the negative consequences of the pandemic. This result is explained by the lightning spread of the outbreak in Asia and Europe on the one hand and on the other hand by the appearance of cases in Africa since February 2020 coupled with the interdependence of economies. The measures adopted in highly contaminated countries and regarding the dependency relationship that exists between these countries and the Union, the volume of activity has been reduced, thus causing the WAEMU stocks market to plummet. However, the industrial and distribution sectors were not negatively affected. Despite the presence of predominantly negative ARs, only the positive AR on date −1 for the industry sector is statistically different from zero. The distribution sector presents ARs, which are mainly positive, however, only the AARs of dates −8 and −1 are significant. These results are in line with those found by Chen et al. (2009) who showed that a few days before the SARS outbreak in Taiwan, the financial market in Taiwan had experienced a downturn due to the collapse of China's financial markets where the disease was already raging. For the finance sector, practically all the ARs are negative with 5 which are highly significant (t = −16; −15; −14; −13 and −5) as illustrated in Table 4.

The pandemic reached the first African country (Egypt) on February 14, 2020 which corresponds to day −11 in our event study (see Table 4). Even though it led to the presence of three ARs on day −7; −5 and −2, it should be emphasized that the arrival of covid in Africa did not disrupt

| TABLE 4 | Average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) of the BRVM market 20 days before the appearance of the first case of Covid-19 in the WAEMU (March 2, 2020) |
| Days | Total sample (N = 42) | BRVM industry (N = 10) | BRVM finance (N = 14) | BRVM distribution (N = 7) |
| | AAR (%) | CAAR (%) | AAR (%) | CAAR (%) | AAR (%) | CAAR (%) | AAR (%) | CAAR (%) |
| −20 | −0.19 (2.85)*** | −0.19 (2.85)*** | 0.94 (2.82) | 0.94 (2.82) | −0.07 (2.63) | −0.19 (11.29) | −1.96 (2.98) | −1.96 (2.98) |
| −19 | −0.49 (2.48)*** | −0.68 (4.22)*** | −1.28 (2.03) | −0.32 (1.72) | −0.77 (3.02) | −0.97 (9.62) | 0.56 (1.36) | −1.39 (3.55) |
| −18 | −0.28 (2.51)*** | −0.97 (2.66)*** | −0.88 (3.31) | −1.16 (3.62) | −0.16 (2.35) | −1.13 (10.54) | 0.73 (1.46) | −0.65 (2.66) |
| −17 | −0.58 (2.26)*** | −1.49 (3.90)*** | −0.56 (2.16) | −1.66 (4.22) | −1.13 (2.17) | −2.27 (11.92) | 0.71 (3.34) | 0.06 (4.48) |
| −16 | −0.71 (2.49)** | −2.20 (4.92)*** | 0.26 (4.07) | −1.31 (6.32) | −0.99 (1.42)** | −3.26 (12.20) | −1.86 (2.32) | −1.79 (5.82) |
| −15 | −1.61 (5.30)** | −3.82 (6.20)*** | −1.08 (2.01) | −2.30 (6.82) | −0.73 (1.74)** | −4.00 (13.01) | −6.15 (1.19) | −7.95 (9.69)** |
| −14 | −0.78 (2.14)*** | −4.61 (6.80)*** | −0.08 (2.01) | −2.27 (7.29) | −1.68 (2.20)** | −5.68 (13.98) | 0.25 (1.06) | −7.69 (9.25)*** |
| −13 | 0.23 (6.65) | −4.38 (6.82)*** | −0.66 (1.94) | −2.79 (7.01) | −0.03 (0.86) | −5.72 (13.76) | 5.21 (15.53) | −2.48 (10.60) |
| −12 | −0.63 (2.32) | −5.01 (7.58)*** | −0.25 (3.11) | −2.88 (9.11) | −0.31 (1.22) | −6.04 (14.42) | −1.52 (2.67) | −4.01 (11.39) |
| −11 | −0.37 (2.78) | −5.38 (8.19)*** | 0.21 (3.02) | −2.49 (10.22) | −0.5 (2.87) | −6.54 (15.30) | 0.34 (1.08) | −3.66 (11.66) |
| −10 | −0.42 (2.77) | −5.81 (9.14)*** | −0.55 (2.01) | −2.84 (11.33) | −0.39 (2.80) | −6.94 (16.41) | −0.26 (1.84) | −3.93 (11.30) |
| −9 | −0.59 (2.17) | −6.41 (9.69)*** | 0.42 (1.31) | −2.19 (12.18) | −0.18 (0.95) | −7.12 (16.35) | −0.03 (0.60) | −3.97 (11.38) |
| −8 | −0.32 (2.08) | −6.73 (9.82)*** | −0.74 (2.23) | −2.68 (13.47) | −0.1 (1.53) | −7.23 (16.17) | 0.23 (1.83)** | −3.73 (12.44) |
| −7 | −0.51 (2.45)* | −7.25 (10.43)*** | −0.67 (1.77) | −3.09 (14.27) | −0.14 (2.98) | −7.38 (17.06) | −0.76 (1.10) | −4.49 (12.52) |
| −6 | −0.14 (1.95) | −7.40 (10.51)*** | −0.28 (0.74) | −3.09 (14.85) | −0.19 (2.32) | −7.57 (16.31) | 0.1 (0.72) | −4.39 (12.30) |
| −5 | −0.39 (1.84)* | −7.79 (10.38)*** | −0.38 (1.36) | −3.16 (15.02) | −0.81 (1.36)** | −8.38 (16.60) | 0.06 (1.59) | −4.32 (11.54) |
| −4 | −0.3 (2.94) | −8.10 (11.64)*** | −1.01 (2.48) | −3.84 (16.50) | 0.53 (3.33) | −7.85 (18.38) | −0.13 (0.84) | −4.45 (12.13) |
| −3 | −0.01 (1.97) | −8.11 (11.89)*** | −0.2 (1.27) | −3.69 (17.47) | −0.5 (1.65) | −8.35 (18.15) | 1.04 (2.44) | −3.41 (12.08) |
| −2 | −0.49 (2.30)* | −8.53 (11.49)*** | −0.24 (2.78) | −3.56 (16.91) | −0.2 (2.55) | −8.56 (17.74) | 0.07 (0.90) | −3.34 (11.28) |
| −1 | 1.35 (2.49)*** | −7.18 (11.06)*** | 1.53 (2.85)** | −1.62 (17.79) | 0.87 (1.82) | −7.69 (16.93) | 2.52 (2.62)** | −0.82 (10.44) |
| 0 | 0.28 (3.02) | −6.89 (11.74)*** | −0.5 (2.69) | −1.69 (19.57) | 0.63 (1.60) | −7.05 (17.90) | 0.47 (5.08) | −0.34 (8.82) |

Note: This table presents the average normal returns and the cumulative average abnormal returns surrounding the date t = March 2, 2020 of the Covid-19 outbreak. The abnormal return is obtained from the difference between the observed return and that expected. The expected return is determined from the regression of the standard market model. The W statistics of Wilcoxon’s signed-rank allow us to test the null hypothesis that the average abnormal returns or the cumulative average abnormal returns are equal to zero. The numbers in parentheses represent the SD. ***, ** and * are the statistical significance level at 0.1, 1 and 5%, respectively.
fundamentally the BRVM market because these negatives ARs are all lower than days before day −11. Moreover, the market volatility after these days was stable compared to previous days. A positive AR is reported on day −1 for the total sample and for the two indices (BRVM Industry and BRVM Distribution). These findings could be explained on the one hand by the fact that there is a weak connection between the African financial market and in the second hand, it might be due to the very low daily confirmed and death cases in the continent compared to Asia, Europe and America which let investors believe that Africa will be spared by the spread of the pandemic. The BRVM finance index also did not overreact to the arrival of covid in Africa as witnessed by one negative AR on day −5 compared to three before day −11.

In a nutshell, 20 days before the appearance of covid in the WAEMU, the stock market did fell the negative effect of the pandemic, however, as time goes by, and given the very low contamination in Africa, there is a market correction effect.

Investment and funding have always been a major concern for African companies in general and the WAEMU’s companies in particular. Even though the BRVM is not a very active stock market, some companies depend on it for their funding and investment. Our empirical findings suggest that the advent of Covid-19 might foster these problems. Indeed, during these times of Covid-19, business closures and measures adopted by different governments created a serious problem of fundraising for companies to meet their commitment and keep their operations until recovery. However, given the shock experienced by these companies, and with respect to the falling of stock prices due to massive selling, the BRVM stock market can no longer be the solution of fundraising for these companies. Analysis of the AARs and the daily effect shows that overall, the appearance of the outbreak provokes a negative and significant reaction of the prices on the WAEMU stock market. Indeed, the 20 days following the appearance of Covid-19 in the WAEMU were characterized by a deterioration in the stock market performance.
for all companies in the sample, as shown in Table 5. This negative gap between the real returns and expected ones reflects the deterioration in investors’ wealth following the advent of the outbreak.

This decline is observed between the 13th and the 20th day with abnormal negative returns up to 6% and statistically significant at 0.1% threshold. The adoption of quarantine and confinement measures and the cessation of several economic activities in member countries are at the origin of this observed decline. This analysis is supported by the CAARs, which are all negative and very significant, thus reflecting the fact that the deterioration observed lasted until the 20th day. The sectoral indices (finance and distribution) show similar results. Indeed, the 14th, 17th and 20th days display negative ARs varying between 0.76 and 2.45%. This negative effect is not surprising since the economies of the region are highly dependent on the financial system for financing investments. The slowdown in economic activity, which has resulted in the inability of economic agents to meet their commitments to banks explains this underperformance. The distribution sector was the most affected on the fourth day after the outbreak in the WAEMU. The ARs for this sector alone go up to 34.16% and are statistically significant. The strong sensitivity of this sector might be mainly explained by government measures taken very soon to slow down the spread of the virus (lockdown, movement restrictions, etc.). Even though in some countries such as Ivory Coast which is the largest economy of WAEMU, some distribution companies have seen an important increase in their turnover, this is only due to the general panic of consumers who have used their savings to buy a large variety of goods and services to prevent uncertainties about Covid-19. However, investors do not only look at current performance but, also take into account the outlook of companies. When government anti-Covid-19 measures have been implemented, there was a big uncertainty about when companies will reopen again. Since the distribution companies usually have many perishable goods, the fact they remain close for a long time did have a negative repercussion because, not only they will have to face fixed charges but also many stocks could lose value or be valueless. All these anticipations by investors lead to a decline in the distribution companies’ values on the stock market. On the other hand, the distribution sector seems to

| Panel regression with fixed effect $R_t = \delta_0 + \sum_{i=1}^{6} \delta_i Anticovid_{it} + \delta_6 Confcases_{it} + \delta_7 Deathcases_{it} + \epsilon_t$ |
|----------------------------------------|-------------------------------|-------------------------------|-------------------------------|
| Variables                        | Total sample                  | BRVM industry                | BRVM finance                 | BRVM distribution            |
| Intercept                        | -0.003846***                  | -0.000453***                 | -0.000609***                 | -0.008633***                 |
|                                 | (-1.62E+14)                  | (-9.59E+13)                  | (-8.39E+13)                  | (-5.36E+13)                  |
| Covid-19 cases                  |                               |                               |                               |                               |
| Confirmed cases                 | -3.11E-21                     | -1.15E-21                    | -6.12E-22                    | -1.85E-20                    |
|                                 | (0.612400)                    | (1.138399)                   | (-0.394387)                  | (-0.536395)                  |
| Death cases                     | -8.06E19***                   | -4.90E-20                    | -2.65E-20                    | -1.86E-18                    |
|                                 | (-2.621173)                   | (0.799555)                   | (0.281484)                   | (0.889872)                   |
| Government anti-Covid-19 measures|                               |                               |                               |                               |
| Social distancing               | 2.03E-17***                   | 8.86E-18***                  | 9.97E-18***                  | 3.77E-16***                  |
|                                 | (5.485661)                    | (12.04800)                   | (8.820045)                   | (15.03151)                   |
| Public health measures          | -8.79E18***                   | 1.62E-18***                  | 3.44E-18***                  | 6.23E-17***                  |
|                                 | (-7.490950)                   | (6.947968)                   | (9.582102)                   | (7.815651)                   |
| Movement restrictions           | -1.49E17***                   | -5.78E-19                    | -4.80E18***                  | -4.10E-17***                 |
|                                 | (-7.128716)                   | (1.385085)                   | (-7.490679)                  | (2.886014)                   |
| Lockdown                        | -2.63E-18                     | -8.89E-19***                 | 1.56E-18*                    | 2.10E-17                     |
|                                 | (-0.996580)                   | (1.691536)                   | (1.934971)                   | (1.174628)                   |
| Governance measures             | 1.68E17***                    | 6.29E-18***                  | 0.000000                     | 1.34E-16***                  |
|                                 | (-2.613075)                   | (4.920829)                   | (0.000000)                   | (3.079926)                   |
| $R^2$                           | 0.97                          | 0.91                         | 0.99                         | 0.92                         |
| Adjusted $R^2$                  | 0.94                          | 0.89                         | 0.94                         | 0.90                         |
| $F$ statistic                   | 8.58E+30                      | 1.93E+32                     | 4.04E+31                     | 3.87E+29                     |
| Prob ($F$ statistic)            | 0.000000                      | 0.000000                     | 0.000000                     | 0.000000                     |

Note: This table shows the effect of weekly confirmed and death cases and government anti-Covid-19 measures on the stock return for the overall market and the industry, finance and distribution indices. Value in parentheses are the t statistics and *** indicates 1, 5 and 10% significance level, respectively.
have been positively affected by the event on the 3rd and 11th days regarding the abnormal positive and significant returns (1.16 and 1.04%, respectively). The most significant negative effect only occurred on the 16th day (−2.31%). In accordance with the general acceptance which tends to associate a fall in the financial markets with a shock, the results obtained are in line with the conclusions of Al-Awadhi, Khaled, Al-Awadhi, and Alhammadi (2020) who highlighted the negative and significant effect of Covid-19 on the stocks’ returns regardless of the company’s sector. The author also pointed out that this effect tends to be greater as the total number of confirmed cases and the number of deaths increase. However, our results are contradictory with those found by Chen et al. (2009) who showed that the SARS epidemic has not only had negative effects on the Taiwanese stock market. Indeed, biotechnology companies in this country have enjoyed positive returns. Similarly, Yan, Tu, Stuart, and Zhang (2020) have shown that travelling, entertainment and tech companies are most likely to benefit from the covid outbreak due to the effect of short-run panic.

The BRVM market is a stable market with very low volatility. However, the advent of Covid-19 shows an overreaction of the market. In just 3 days the first confirmed case was reported, the volatility of this market was about 32.48% and reached a peak of 36.43% in day 15. The distribution index has been the most volatile (79.93% in day 3 to 89.09% in day 15). However, the industry and finance indices did not overact to the Covid-19 pandemic. For these indices, the volatility ranged from 1 to 3%. Since our estimation in Table 6 support that more than 90% of the stock return is explained by the covid and anti-government measures, we then conclude that the high variability observed is mainly due to Covid-19. These findings are consistent with Yang, Chen, and Zhang (2020) who documented that different industries are affected by the pandemic to varying degrees, and their responsiveness also varies.

### 5.3 Robustness check

To check the robustness of our findings, two types of tests have carried out. In the first robustness analysis, aggregate weekly data are used to run a fixed effect regression. The idea behind this test is to see how the evolution of confirmed cases and deaths cases affect the stock value. Government anti-Covid-19 measures have been included as a control variable and social distancing, public health measures, movement restrictions, lockdown and governance measures obtained from the ACAPS dataset are used as proxy. The description of these variables is shown in Table 7. The estimation model is written as follows:

\[
R_t = \delta_0 + \sum_{i=1}^{5} \delta_i \text{Anticovid}_i + \delta_6 \text{Confcases}_i + \delta_7 \text{Deathcases}_i + \epsilon_t, \tag{7}
\]

where Confcases and Deathcases are, respectively, the weekly confirmed cases and death cases for the country i in time t. Anticovid represents the government anti-Covid-19 measures taken by each country of the WAEMU. \(\epsilon_t\) is a random error term. \(\delta_0\) to \(\delta_7\) are parameters to be estimated. The estimation results are reported in Table 6.

For each estimation, the \(R^2\) square values are almost closed to 1, which means that the stock return in the time
of Covid-19 in the WAEMU is essentially explained by weekly covid cases and the measures adopted by each country to deal with the pandemic. Moreover, the probability values of the F statistic are all equal to zero, implying that overall, the estimation model is significant. The analysis of the impact of covid cases on the stock return shows that weekly confirmed cases do not have any significant effect on the market. However, the death cases negatively and significantly affect the overall market at 1% threshold. Since Chen, Liu, and Zhao (2020) and Narayan (2019) support that investors’ sentiment influences stock returns, it appears that in the case of the WAEMU, the main information degrading investors infatuation towards the stock market is not the evolution of confirmed cases, but the weekly death cases. This finding is partly consistent with those found by Albulescu (2020) who reported that new confirmed cases of Covid-19 and death positively influence market VIX both within and outside of China.

Given the spread of the virus, like many other countries, the WAEMU member countries’ governments have taken actions to properly fight against the pandemic. These actions are sometimes a painful trade-off between economic and social aspects. If these measures work in some developed countries, it might not work in Africa because lockdown and market closures are difficult in a region where preventing people from going to work could jeopardize their survival. Social distancing is also complex on a continent experiencing the fastest urban growth in the world, where two to three generations often live under the same roof. Our estimation on the impact of these anti-covid-19 measures reveals differential effects on the stock’s return. The adoption of social distancing by the WAEMU member countries seems to enhance investors’ sentiment because it contributes to increasing the stock price for the market as a whole and for the selected indices. This positive reaction of the market can be explained by the fact that social distancing measured in the framework of this study by the closure of businesses and public services, the limited public gathering and school closures are actions that contribute to slow down the spread of the virus which is an imperative for economic recovery. This finding is in line with Singh et al. (2020) who indicate a recovery of stock markets from the negative impact of Covid-19. Even though public health measures do have a positive impact on the sectoral indices, their effect on the BRVM composite is negative and significant. The movement restrictions also contribute to deteriorating the stock value. Estimation shows that these measures have a negative and significant effect on the BRVM market. The movement restrictions which include border closures and domestic travel restrictions make it difficult for companies to export their goods and services overseas and even in the domestic markets. As consequence, a bad outlook for companies is expected by investors. This finding is similar to those found by Blau, Brough, and Thomas (2014) and Zaremba et al. (2020) who report that restrictive government policies can cause uncertainty, stimulate abnormal trading activity and destabilize markets.

Lockdown measures negatively impact the overall market and positively impact the distribution sector, although, they are not significant. However, these measures do have a significant impact on the BRVM Industry and BRVM Finance indices. The BRVM Industry recorded a negative and significant return. This finding contrast with Phan and Narayan (2020) who found that for the United States, Germany, Russia, India, Israel, Peru and Chile lockdown measures had the most positive response on the stocks market. However, it is in line with Baig et al. (2020) who indicate that declining sentiment and the implementations of restrictions and lockdowns contribute to the deterioration of liquidity and stability of markets. Finally, governance measures positively and significantly impact the market. Since this variable seeks to identify whether the country has declared the state of emergency or not, it turns out that when the state of emergency is declared by a given country, investors seem more confident because that means the government takes the pandemic seriously and will certainly be engaged in fighting against it.

To take into account a possible overvaluation due to lockdown and movement restriction, we estimate again the AARs and the CAARs on the weekly basis 39 weeks following the detection of Covid-19 in the WAEMU. Analysis of Table 8 shows that for the total sample, and all the selected sectoral indices, more negative and significant ARs are observed during the first 10 weeks following Covid-19 in the WAEMU. The negative effect lasted until the 20th week. The 30 and 40 weeks exhibit both negative and positive significant ARs. Such evolution might be explained by the anti-Covid-19 measures adopted by each member states very soon. Social distancing, lockdown and movement restrictions have been implemented very early in the WAEMU and contributed to slow down the spread of the pandemic. More positive ARs are observed for the financial sector. This is due to the comprehensive responses of the central bank very early. With respect to the difficulties experienced by companies in the WAEMU, the regional central bank (BCEAO) for the WAEMU has taken preemptive steps to better satisfy banks’ demand for liquidity and mitigate the negative impact of the pandemic on economic activity. The BCEAO first raised the liquidity made available to banks at its weekly and monthly auctions of March 23, allowing average refinancing rates to remain
**TABLE 8**  Average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) of the BRVM market 39 weeks following the first case of Covid-19 in the WAEMU (March 2, 2020)

| Days       | Total sample     | BRVM industry | BRVM finance | BRVM distribution |
|------------|------------------|---------------|--------------|-------------------|
|            | AAR (%)          | CAAR (%)      | AAR (%)      | CAAR (%)          |
| Week 1     | −1.96 (3.12)**   | −1.96 (2.59)**| 2.45 (1.39)  | 2.45 (3.08)       |
| Week 2     | −1.23 (0.51)**   | −3.19 (0.87)**| −0.21 (1.88)**| 2.25 (0.14)       |
| Week 3     | −4.03 (1.98)**   | −7.21 (2.84)**| 0.61 (0.58)  | 2.86 (0.43)       |
| Week 4     | −2.65 (0.97)**   | −9.86 (1.87)**| −2.11 (1.92)**| 0.75 (1.49)       |
| Week 5     | −1.10 (1.10)**   | −10.96 (0.78)**| −0.83 (0.91)*| −0.07 (0.58)      |
| Week 6     | 0.21 (0.78)      | −10.75 (0.15)**| 0.96 (1.27)  | 0.89 (0.68)       |
| Week 7     | 0.01 (0.16)      | −10.74 (0.01) | −0.54 (1.06)**| 0.35 (0.38)*      |
| Week 8     | 3.63 (2.41)      | −7.10 (2.57)  | −2.78 (1.58)*| −2.43 (1.97)*     |
| Week 9     | −1.19 (3.41)     | −8.30 (0.85)  | 0.65 (2.43)  | −1.77 (0.47)*     |
| Week 10    | 0.07 (0.89)*     | −8.22 (0.06)  | 0.48 (0.12)  | −1.29 (0.34)*     |
| Week 11    | −4.21 (3.03)     | −12.43 (2.98) | 1.12 (0.45)  | −0.17 (0.79)      |
| Week 12    | 0.88 (3.60)      | −11.55 (0.62) | −1.34 (1.74)*| −1.51 (0.95)      |
| Week 13    | 1.97 (0.62)      | −9.58 (1.39)  | 0.54 (1.33)  | −0.97 (0.38)      |
| Week 14    | 2.70 (3.30)      | −6.88 (1.91)  | −0.37 (0.64)*| −1.34 (0.26)      |
| Week 15    | −2.08 (4.78)*    | −8.96 (1.47)  | 1.27 (1.16)*| −0.07 (0.90)      |
| Week 16    | −0.01 (1.46)*    | −8.98 (0.91)  | 1.83 (0.40)  | 1.76 (1.29)       |
| Week 17    | −0.42 (0.29)*    | −9.40 (0.30)  | −0.04 (1.32)**| 1.72 (0.03)       |
| Week 18    | −0.91 (0.35)*    | −10.31 (0.64)*| 0.27 (0.22)*| 1.99 (0.19)       |
| Week 19    | −2.02 (0.78)     | −12.33 (1.43)*| 0.22 (0.04)  | 2.21 (0.16)       |
| Week 20    | −1.26 (0.53)     | −13.59 (0.89)*| −0.91 (0.80)*| 1.30 (0.64)       |
| Week 21    | −1.53 (0.19)     | −15.13 (1.09)*| 0.76 (1.18)  | 2.06 (0.54)       |
| Week 22    | −0.67 (0.61)     | −15.79 (0.47)*| −0.56 (0.93) | 1.50 (0.40)       |
| Week 23    | 1.35 (1.43)      | −14.44 (0.95)*| −2.09 (1.08) | −0.59 (1.48)      |
| Week 24    | 0.50 (0.61)      | −13.94 (0.35)*| −2.29 (0.14) | −2.87 (1.61)      |
| Week 25    | −0.78 (0.90)     | −14.72 (0.55)*| 1.50 (2.68)*| −1.37 (1.06)      |
| Week 26    | 1.78 (1.81)      | −12.94 (1.26)*| 1.82 (0.23)*| 0.45 (1.29)       |
| Week 27    | −1.68 (2.44)     | −14.62 (1.19)*| −2.48 (3.04)*| −2.03 (1.75)      |
| Week 28    | 0.03 (1.21)**    | −14.59 (0.02)*| −0.26 (1.57) | −2.29 (0.18)      |
| Week 29    | −2.20 (1.57)     | −16.78 (1.55)*| 4.76 (3.55)  | 2.47 (3.37)       |
| Week 30    | −0.06 (1.51)     | −16.85 (0.05)*| 1.01 (2.65)  | 3.48 (0.71)       |
| Week 31    | −1.11 (0.74)     | −17.96 (0.78)*| −0.69 (1.20) | 2.79 (0.49)       |
| Week 32    | −0.52 (0.42)     | −18.48 (0.37)*| −4.43 (2.64) | −1.64 (3.13)      |
| Week 33    | −0.15 (0.26)     | −18.62 (0.10)*| −1.72 (1.92) | −3.36 (1.22)      |
| Week 34    | −0.95 (0.57)     | −19.57 (0.67)*| 4.23 (4.21)**| 0.87 (2.99)       |
| Week 35    | 6.06 (4.96)*     | −13.52 (4.28)*| 2.06 (1.53)**| 2.93 (1.46)       |
| Week 36    | −0.71 (4.79)*    | −14.23 (0.50)*| 1.03 (0.73)**| 3.96 (0.73)       |
| Week 37    | −0.46 (0.18)     | −14.69 (0.33)*| −3.99 (3.55) | −0.03 (2.82)      |
| Week 38    | 1.55 (1.42)**    | −13.14 (1.10) | 6.40 (7.35)**| 6.36 (4.52)       |
| Week 39    | 0.42 (0.80)      | −12.72 (0.30) | −1.30 (5.44) | 5.06 (0.92)       |

**Note:** ***,**, ** and * are the statistical significance level at 0.1%, 1% and 5% respectively.
relatively close to the floor of the monetary policy corridor of 2.5%. This was followed, starting with the weekly refinancing auction of March 30, 2020, by the adoption of a full allotment strategy at a fixed rate of 2.5% thereby allowing banks to satisfy their liquidity needs fully at a lower rate. For the distribution sector, our findings are consistent with those found in Table 5. This sector suffered from the Covid-19 despite the fact that lockdown and movement restriction measures have been removed or relaxed. This might be due to the fact that unlike European countries where companies did benefit from government stimulus packages, in the WAEMU, it has not been the case. It could also be explained by investors’ fears about a second wave of Covid-19.

***, ** and * are the statistical significance level at 0.1%, 1% and 5% respectively.

Since the prevailing concern about traditional GARCH models of stock index returns was among other things their unsatisfactory accommodation of the leverage effect and volatility persistence, as a robustness check, the EGARCH model is proposed to accommodate these characteristics. The parameters estimation for the EGARCH (1, 1) model are reported in Table 9. The results show that except for the financial sector, the leverage effects \( C(4) \) are negative and significant at 1% (for the total sample and Industry sector) and 5% (for the Distribution sector) the 39 weeks following the arrival of covid in the WAEMU. This result implies that good news in the time of covid generates less volatility than bad news on the stock market. In times of crisis, shareholders feel scarier for bad news, because the bad investment will go bankrupt. Thus, some government anti-Covid-19 measures which are considered to be good news by the market contribute to reducing the market volatility.

The symmetric effect \( C(3) \) is positive and significant for the total sample which means the volatility is sensitive to market events in the whole period (39 weeks after March 2, 2020). On the other hand, the largest significant value of \( C(3) \) during the crisis is observed on week 20, implying that volatility was very sensitive 20 weeks after Covid-19.

### Table 9

EGARCH (1, 1) model parameters estimates for stock return 39 weeks following Covid-19

| Variables          | Total sample | BRVM industry | BRVM finance | BRVM distribution |
|--------------------|--------------|---------------|--------------|------------------|
|                    | Coeff.       | SE            | Coeff.       | SE              | Coeff.       | SE            | Coeff.       | SE              |
| **Total weeks**    |              |               |              |                 |               |               |               |                 |
| \( C(1) \)         | 0.582134***  | 0.052753      | -0.029391    | 0.366137        | 0.754492      | 0.485604      | -1.728550***  | 0.575135        |
| \( C(2) \)         | 0.547999***  | 0.000417      | 0.039094     | 0.524986        | -1.012278     | 0.652626      | 0.9310528*    | 0.512251        |
| \( C(3) \)         | -0.084533*   | 0.253101      | -0.135516    | 0.237961        | 0.577758      | 0.376185      | -0.064892     | 0.189360        |
| \( C(4) \)         | 0.880233***  | 4.19E-07      | 1.081491***  | 0.140308        | 0.365469      | 0.326110      | -0.583213*    | 0.320625        |
| **10 weeks after Covid-19** |          |               |              |                 |               |               |               |                 |
| \( C(1) \)         | 1.584857     | 1.089326      | 1.076459     | 0.729131        | -1.958170***  | 0.283317      | 0.539000      | 2.036024        |
| \( C(2) \)         | -1.716718    | 1.662982      | -1.148625    | 2.510134        | -1.790524     | 2.348178      | 0.127522      | 3.605436        |
| \( C(3) \)         | 1.067669     | 3.074848      | 3.667409     | 7.255984        | 2.796452*     | 1.549183      | -1.097522     | 1.276933        |
| \( C(4) \)         | 0.724551     | 1.316721      | 1.303045     | 2.132875        | -0.850971     | 1.052823      | 1.943782      | 1.557269        |
| **20 weeks after Covid-19** |          |               |              |                 |               |               |               |                 |
| \( C(1) \)         | 1.018626***  | 0.141489      | 0.277069     | 0.744397        | 0.905415      | 0.642135      | -2.153057     | 1.595016        |
| \( C(2) \)         | -0.893976*** | 0.120032      | -0.389001    | 0.844896        | -1.782506**   | 0.799987      | 0.963756      | 1.678386        |
| \( C(3) \)         | -0.327842*** | 0.302296      | -0.078654    | 0.627338        | 0.790609      | 0.521809      | -0.065251     | 0.952338        |
| \( C(4) \)         | 0.783365***  | 0.016545      | 1.045650     | 1.038501        | 0.357140      | 0.377263      | -0.996515     | 0.880475        |
| **30 weeks after Covid-19** |          |               |              |                 |               |               |               |                 |
| \( C(1) \)         | 0.730311     | 0.538515      | 2.132177**   | 0.972125        | 0.636036      | 0.554628      | -1.390737     | 1.398717        |
| \( C(2) \)         | -0.275589    | 0.547441      | -0.859442    | 0.632028        | -1.400978     | 0.911754      | 0.504858     | 0.799193        |
| \( C(3) \)         | 0.366924     | 0.314974      | -0.077876    | 0.452632        | 0.799853      | 0.612341      | -0.050825     | 0.666192        |
| \( C(4) \)         | 0.534045     | 0.511968      | -1.073566*** | 0.293119        | -0.098403     | 0.516221      | -1.022527     | 1.481120        |

Abbreviations: ABS, absolute value; RESID, residual; SQRT, square root. ***, ** and * are the statistical significance level at 0.1%, 1% and 5% respectively.
after covid than in the earlier stage. This might be explained by the fact that when relaxing anti-Covid-19 measures, economic activities start to recover and investors are more confident in the outlook of companies. It could also be explained by the December effect. Institutional investors may sell their bad investments to benefit from corporate tax reduction.

Concerning parameter $C(2)$ which measures the persistence in conditional volatility irrespective of anything happening in the market, our results show that for the total sample regardless of the analysis period, all the coefficients are statistically significant at the 1% threshold. The positive coefficient for the whole period (0.547999) implies that volatility takes a long time to die out following the health crisis in the WAEMU stock market.

6 CONCLUSION AND POLICY IMPLICATION

The main motivation for this empirical investigation was to measure the link between the advent of Covid-19 and the stock returns of companies listed on the WAEMU stock market. This study uses an event approach based on a GARCH process and considers two event dates. The findings reveal that the appearance of the outbreak on January 23, 2020 had only a minimal effect on the WAEMU stock market. Even the arrival of the pandemic in Africa did not cause profound disruption in the market. On the other hand, the union’s stock market in general as well as the sectoral indices of industry, finance and distribution have been sensitive to Covid-19 since the appearance of the first case on March 2, 2020 in the WAEMU. This negative effect was felt much more by the distribution companies. These findings are consistent with previous research on the effect of epidemics/pandemics on the stock market return. Previous studies have shown that shocks (SARS, Ebola, etc.) are generally associated with a negative effect on individual portfolios and even on the global economy. The study also reveals that the market volatility was stable before the first case of covid occurred in the WAEMU. However, high volatility of the market is seen just 3 days the first confirmed cases were recorded. Moreover, our robustness analysis reveals that the main information that led to disruption on the market is not the weekly confirmed cases but the death cases. The investigations also support that government anti-covid measures have a differential effect on the BRVM stock market. While social distancing and governance measures are associated with a positive reaction of the market, movement restrictions, lockdown and public health measures contribute to a decline in the stock value.

This research comes out with practical implications for decision-makers. Since the study has shown that governance and social distancing lead to a positive reaction of the stock market, the WAEMU member countries governments should continue to enforce social distancing particularly the limit public gathering because this measure is effective in slowing down the spread of the virus and hence help in economic activities recovery. More stimulus packages and/or the postponement of some corporation taxes could be envisaged. However, lockdown, movement restrictions need to be removed to allow the free circulation of goods and people, specifically for companies which turnover is generated through exports. The WAEMU central bank should think about lowering the key interest rate to make it much easier for businesses to borrow money which might contribute to boost their activities and boost confidence among investors. Finally, the findings suggest that investors should be very careful in their portfolio selection. More specifically, it militates in investing in the financial sector instead of the distribution sector because the latter has been the most affected by the pandemic.

Some biotech companies found a new vaccine against Covid-19 which is more than 90% effective. Even though these vaccines are not available yet in Africa, future research could investigate how the stock market reacts to this new.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data available in a reasonable request.

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ENDNOTES

1 According to Thierry Breton, European Commissioner.
2 The first case of Covid 19 appeared for the first time in a WAEMU member countries on March 2, 2020 where an individual in Senegal have been tested positive for Covid-19.
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