

Stock Markets and COVID-19 Outbreak Spillover Effects: Evidence from the MENA Region

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Abstract: This paper examines the short and long impact of covid-19 and its spillover effects on MENA region stock markets by using the t-tests and Mann – Whitney non-parametric tests to examine the mean and median daily returns from June 25, 2019, to November 22, 2020. Using a sample of ten selected MENA countries and nine most affected world countries by the covid-19 on November 22, 2020, we find that all stock markets are negatively and significantly affected by the covid-19 outbreak in the short term but not in the long term and that this impact has bidirectional spillover effects between MENA countries and Asian, European, and American countries. However, there is no evidence that these countries' stock markets were affected by the covid-19 more negatively than it does the global average.

Keywords: Covid-19; stock markets; spillover effects; MENA.

1. INTRODUCTION

In December 2019, the world economy ended the year with an average growth of 3.3% and a prospect of growth of 0.3% for 2020 according to the International Monetary Fund (IMF). However, the announcement at the end of December of the outbreak of a coronavirus in Wuhan would shake economists' forecasts and undermine the entire world economy. Since the start of 2020, the coronavirus epidemic, after hitting China, has spread to the rest of the world: measures to contain this health crisis have had serious consequences for the functioning of our economies.

The impact of this economic crisis, as a sudden turnaround in the economic cycle, results from both a negative supply shock (fall in industrial production, closure of factories, stoppage of construction projects, serious disruptions in the supply chains of firms, etc.) and a negative demand shock (slowdown in household consumption due to containment measures, postponement of investment plans) which cause a violent economic recession, resulting in a sharp slowdown in the rate of production growth. Regardless of the uncertainty associated with the health crisis itself and its dramatic human consequences, the global economy was, however, already weakened. Among the factors of mistrust, there is the Sino-American trade conflict, as well as the geopolitical tensions, in particular, around the oil market (especially between Russia and Saudi Arabia).

While the coronavirus pandemic first impacted the "real" economy (industrial production, household consumption, etc.), with the slowdown in global economic activity, it then quickly affected the financial sphere. The outbreak of the

disease around the world plunged financial markets into turmoil at the end of March, with stock markets falling and extreme price volatility not seen since the great financial crisis of 2007-2008: the panic has affected all classes of financial assets, from equity markets to bonds, including gold, crypto-assets like bitcoin, and raw materials, highlighting the expectations of operators on the very harsh consequences of this crisis for the global economy.

Several articles in the popular press have discussed the magnitude of this crisis compared to the two other major events: the financial crisis of 2008 and the great depression of 1929. An important difference with the Covid-19 crisis could however arise¹. Both the crisis of 1929 and the crisis of 2008 correspond to financial crises and were not followed by a rapid recovery in growth². Even if the exit trajectory of the covid-related crisis has yet to be defined, the monetary and budgetary policies implemented to limit the destruction of human and physical capital could result in a faster rebound than during the two previous crises.³ This makes a study of the impact of covid-19 on the stock markets necessary.

The covid-19 pandemic and related containment measures have caused an unprecedented global contraction in economic activity and a drop in global demand for petroleum products. In 2020, global oil demand has fallen for the first time since the global recession of 2009. At the same time, the decision of some key producers to increase their production in early March worsened the impact on a market already oversupplied, which increased the imbalances. The result was one of the most serious price shocks in the history of the

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³<https://www.imf.org/en/Publications/WEO/Issues/2019/03/28/world-economic-outlook-april-2019>

energy market. In April, Brent oil prices fell below the US \$20 per barrel, a loss of almost 70% of its value. As storage capacities approached their limits, oil prices set by West Texas Intermediate contracts expiring in May turned negative for the first time in their history.

The steep fall in oil prices was a major factor in the collapse of global stock markets. The spillover effect and the close relationship between the oil market and the stock markets have been widely discussed, especially after the current health crisis. Sakurai and Kurosaki (2020) investigated how the relationship between oil and the US stock market changed after the onset of the Covid-19 crisis. To do so, they computed upside and downside correlations between the two markets. First, they documented the correlation asymmetry: the downside correlation is higher than the upside correlation. Second, they found that both upside and downside correlations increased after the crisis. This indicates that after the start of the Covid-19 crisis, a positive (negative) oil shock is even better (worse) news for the stock market than an equivalent shock before the crisis. Similarly, Akbar et al (2020) examined the impacts of return spillovers and dynamic time-frequency linkages between crude oil prices and five primary stock markets in Europe (the United Kingdom, Spain, Italy, Germany, and France). The sampling period is from 2018 to 2020. Overall, the current results shed light on that in comparison with the pre-Covid-19 period and showed that the return transmission is more apparent during the Covid-19 crisis. More importantly, there exist significant dependent patterns about the information spillovers, and time-frequency linkages between crude oil and five major stock markets might provide urgent prominent implications for portfolio managers, investors, and government agencies.

Due to their dependence on oil and gas exports, it is mainly the countries of the Gulf Cooperation Council (GCC) that have been most affected by the decline in hydrocarbon prices. Thus, they faced a double shock: the Covid-19 pandemic and the collapse in oil prices. It should be noted that the impact of the outbreak of covid-19 on the stock markets of the GCC countries, was studied by (Alber and Saleh, 2020) and it appeared interesting to us to widen the research to cover all the MENA region countries. This led us to study, in a first step, the separate impacts that covid-19 has had on the stock markets of the Mena region and the most foreign affected countries by covid-19 on November 22, 2020, according to The World Health Organization (WHO). This date was chosen because our research was conducted around November 22, so that is the most recent date then. And to examine, in a second step, whether this impact had a bidirectional spillover effect between Mena stock markets and Asian, European, and American stock markets.

We chose the United Arab Emirates (UAE) as the reference country in the MENA region because it was the first country in the MENA to report a confirmed case on 29 January 2020 according to The World Health Organization (WHO). Then, the coronavirus spread throughout the Mena region to reach Turkey which was the last country in the Mena region to be affected by the epidemic on March 11, 2020, according to Turkey's Health Minister. The appearance of the virus directly influenced the UAE stock market. Then, it is likely that fluctuations in the UAE stock market can have spillover

effects on other markets,⁴ whether in the MENA region or the rest of the world, due to the depth of the interdependence among economies in the context of globalization⁵.

To accomplish our empirical study, we established three covid-19 outbreak timelines namely UAE, MENA, and world timelines based on the timeline of the Covid-19 pandemic. Then, we examined the separate impacts that covid-19 has had on the stock markets of the UAE, selected MENA countries, and selected World countries as represented by their stock market indices. After that, we studied the covid-19 outbreak spillover effects on these stock indices by examining the mean and median returns of the indices during the different periods of the three timelines using the t-tests and Mann – Whitney non-parametric tests. Finally, to determine if the affected stock markets' performance is significantly below the global average, we compared the returns of the UAE and the selected MENA market indices to the returns of the S&P Pan Arab Composite index and the returns of the selected world market indices to the S&P 1200 Global Index returns.

According to the results of our empirical study in the UAE and MENA timelines, the outbreak of the covid-19 in the MENA region had a negative but limited and short-term impact on the MENA stock markets including the UAE, especially during the pre and short periods. Furthermore, it appears that such an impact has spill-over effects on American, Asian, and European stock markets only in the short term. Then, we conclude that the impact of the outbreak of the covid-19 in the MENA region whether on the selected world or the selected MENA stock market is limited and is not long-term persistent. Add to that, there is no evidence that covid-19 has a negative impact on the major stock indices in these countries compared with the S&P Pan Arab Composite index and the S&P 1200 Global Index.

Results of our empirical study in the world timeline show that both the MENA and the selected world stock markets are negatively and significantly affected by the appearance of Covid-19 in the world and this negative impact worsened during the short period following the outbreak of the epidemic in the world. This negative impact disappears during the mid and long period. So, we can admit that the impact of covid-19 on world stock markets has a backflow effect on the MENA stock markets. Then, results show that the impact of covid-19 on stock markets has bidirectional spill-over effects between Mena countries and Asian, European, and American countries. Finally, we conclude that the negative impact of covid-19 on the selected world stock markets, as well as its spillover effects on the MENA stock markets including the UAE only, persist in the short term.

Considering the importance of the covid-19 outbreak on global financial markets, our paper makes contributions to the modest but growing literature on covid-19 and international investment in three aspects. First, it documents the separate impacts that covid-19 has had on the stock markets

⁴ <https://reliefweb.int/report/united-arab-emirates/who-confirms-first-cases-novel-coronavirus-2019-ncov-eastern>

⁵ <https://www.garda.com/fr/crisis24/alertes-de-securite/321446/turkey-first-case-of-coronavirus-confirmed-march-11-update-4>

of the Mena region and the most affected countries by covid-19 on November 22, 2020, all over the world. It should be noted that our work represents the first research that studies the impact of the outbreak of covid-19 on the MENA region stock markets. Second, it is also the only research that examines the spillover effects of UAE's stock market on those countries and the spillover effects of their stock markets back on UAE's stock market by defining three timelines. Finally, it presents a reference work for future research to evaluate international stock market trends after the disappearance of the pandemic to make the best decisions in this new and highly uncertain financial and economic environment.

The remainder of the paper proceeds as follows: The second section reviews the literature on the impact of crises on the stock markets and the spillover effect between them. The third section provides an overview of the main data as well as the methodology used, specifying the different hypotheses of our study. The fourth section presents and discusses detailed findings from our data analysis. The final section summarizes our key conclusions.

2. LITERATURE REVIEW

2.1. The Impact of Crises on Stock Markets Performance

Researchers believe that covid-19 and SARS belong to the same family, but these two epidemics differ significantly. Many previous studies related to the effects of the infectious virus epidemic could be referred to as we discuss the impact of covid-19. For example, (deLisle, 2003) proposed that the cost of the 2003 SARS outbreak resulted in losses as high as in the financial crisis of Asia, estimated at \$3 trillion value in GDP and \$2 trillion value in financial markets equity. Similarly, Nippani and Washer (2004) examined the effect of SARS in Canada, China, the particular administrative region of Hong Kong, China, Indonesia, the Philippines, Singapore, Thailand, and Vietnam and concluded that only the stock markets of China and Vietnam were affected by SARS. In their paper, (Chen et al., 2007) studied the impact of the SARS outbreak on the performance of hotel stocks in exchanges in the Chinese mainland and Taiwan and found a significant negative impact. According to (Bai, 2014; Baker et al., 2012), investors may feel pessimistic about investment prospects in a given market, selling off that market's stocks under communicable disease outbreaks. In a recent study, (Chen et al., 2018) analyzed the effect of the SARS epidemic on China's long-term relationship with four Asian stock markets. Their findings supported the existence of a time-varying co-integration relationship in aggregate stock price indices, and they also found that the SARS epidemic has weakened China's long-term relationship with the four markets.

Despite the recent appearance of the coronavirus, many researchers have studied the impact of the outbreak of the covid-19 on the stock markets. For instance, (Ahundjanov et al., 2020) explored the relationship between Google search queries related to covid-19 and the performance of major financial indices. The empirical analysis based on the Bayesian inference of a structural vector autoregressive model showed that one unit increase in the popularity of covid-19-related global search queries, after controlling for covid-19

cases, results in 0.038 – 0.069 % of a cumulative decline in global financial indices after one day and 0.054 – 0.150 % of a cumulative decline after one week. And, (Baker et al., 2020) examined and evaluated the potential explanations for the unprecedented stock market reaction to the covid-19 pandemic by using text-based methods. They concluded that the earliest stock market jumps attributed to covid-19 developments in late February and early March mostly involved reactions to news about the course of the pandemic in the United States. Jumps later in March and through the end of April 2020 also reflected policy responses to the pandemic, including news about actual or prospective fiscal and monetary policy actions.

Using daily covid-19 confirmed cases and deaths and stock market returns data from 64 countries over the period January 22, 2020, to April 17, 2020, (Ashraf, 2020) examined the stock markets' response to the covid-19 pandemic. He found that stock markets responded negatively to the growth in covid-19 confirmed cases and the number of deaths. His analysis also suggested negative market reaction was strong during the early days of confirmed cases and then between 40 and 60 days after the initial confirmed cases. Overall, his results proved that stock markets quickly respond to the covid-19 pandemic and this response varies over time depending on the stage of the outbreak. Besides, (He et al., 2020) studied the direct effect of covid-19 on stock markets in the People's Republic of China, Italy, South Korea, France, Spain, Germany, Japan, and the United States of America (USA). Their results suggested that covid-19 has a negative but short-term impact on the stock markets of the eight affected countries. Moreover, except for China, there is no evidence that covid-19 has a negative impact on the major stock indices in these countries compared to the S&P 1200 Global Index in the short term. Furthermore, (Phan and Narayan, 2020) provided a commentary on how the most active financial indicator (namely, the stock price) reacted in real-time to different stages in covid-19's evolution. They argued that, as with any unexpected news, markets over-react and as more information becomes available, and people understand the ramifications more broadly the market corrects itself. This was their hypothesis which needs robust empirical verification. The data signal possible overreaction and market correction. When they observed how each of the 25 countries' stock markets reacted to cases of covid-19 infections and deaths, they concluded that during the early stages stock prices in the vast majority of the countries negatively reacted but with time as countries reached 100,000 infections and 100 deaths, for example, the reaction in 50% of the markets was positive suggesting a possible market correction.

To analyze the covid-19 potential effects on the stock markets, (Yan et al., 2020) looked at past outbreaks and concluded that often markets will react adversely to these such incidents in the short term but that in the long-term, markets eventually correct themselves and increase. Using an event study method, (Liu et al., 2020) studied the short-term impact of the coronavirus outbreak on 21 leading stock market indices in major affected countries including Japan, Korea, Singapore, the USA, Germany, Italy, and the UK, etc. They confirmed that the stock markets in major affected countries are significantly affected by the coronavirus outbreak. Countries in Asia experienced more negative abnormal returns as

compared to other countries. And, they concluded that investors' fear sentiment is proved to be a complete mediator and transmission channel for the covid-19 outbreak's effect on stock markets. To isolate the different effects of covid-19 on the stock market returns and identify the channels through which each of the effects influences the returns, (Aggarwal et al., 2020) used a sample of twelve countries with the most liquid stock markets (Australia, Canada, China, Germany, Hong Kong, India, Japan, South Korea, Switzerland, Taiwan, UK, and the US) from December 2019 to May 2020. They found that the panic caused by the pandemic affects the stock return negatively through the updation of the market risk premium channel. The stringency of the lockdown has a two-way effect on the stock market returns, whereas it affects the return negatively through the updation of growth forecasts, it also affects the return positively through the updation of market risk premium.

Also, (Adenomou et al., 2020) studied the covid-19 effect on Nigeria's stock exchange performance by employing Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models. They consider the historical data of the daily All Share Price (ASP) of the Nigerian Stock Exchange (NSE) from March 2, 2015, to April 16, 2020. They found that covid-19 has negative effects on the stock market returns in Nigeria. (Takyi and Bentum-Ennin, 2020) studied and quantified the short-term impact of the covid-19 on the stock performance of thirteen African countries namely: Ghana, Nigeria, South Africa, Kenya, Tanzania, Tunisia, Mauritius, Morocco, Zambia, Namibia, Botswana, Cote D'Ivoire, Uganda, using daily time series of stock markets data from October 1, 2019, to June 30, 2020. They found that the stock markets of 10 African countries are significantly and negatively affected by covid-19, while the other 3 countries have no significant short-term impact of the covid-19 pandemic on their stock markets, so they concluded that during their study period, covid-19 had no positive effect on stock market performance in Africa. They provided evidence that the covid-19 pandemic has restrictive effects on stock market performance in African economies.

Studying the performance of the US stock market during the crash of March 2020, (Mazur and al., 2020) show that equity values in petroleum, real estate, entertainment and hospitality sectors decrease dramatically.

(Alzyadat and Asfoura, 2021) studied the impact of covid-19 on the stock market of Saudi Arabia. Using daily closing stock market price index of el Tadawul all share index for the period March 15 to August 10, 2020 with ARCH model, the returns of the stock market are negatively affected by the Covid-19 pandemic. So that, the response of the Saudi Arabia stock market is quickly.

Using the Autoregressive Distributed Lag (ARDL) Bound cointegration test, (Hatmanu, M and Cautisanu, C., 2021) analyzed the effect of the pandemic on the Romanian stock market (measured by the BET index) using three variables: the number of new cases and the number of new deaths caused by covid-19, measures taken by authorities, and the international economic context for the period from 11 March 2020 to 30 April 2021. Results show a negative and significant impact of the pandemic on the BET index for Romania.

Recently, (Ganie, NR and al. 2022.) analyzed the effect of covid-19 outbreak on stock markets in the top six affected countries based on the total number of cases confirmed. They use the event study methodology to test the most volatile event period, revealing that Brazilian stock indices declined of more than 50% during the pandemic and Mexican indices had the lowest fall in the same period.

Using event study methodology, (Attari, UF and al., 2022) studied the abnormal returns of firms from USA, UK, France, China, India, Mexico, Turkey, and Thailand in response to Coronavirus Disease 2019 (COVID-19). Results show that for the first 101 days investors provide significant long term abnormal returns.

Using time varying dependence approach under Covid-19, (Gazi S U and al., 2022) studied the connected dynamics of the affected Asian financial markets and global financial market. They show a strong and positive dependence among the investigated markets and an increase tendency of co movements over the higher horizon.

2.2. Spillover Effect between Stock Markets During Crisis

Stocks markets are interlinked and interdependent. Researchers have discovered the close cross-market correlations during the crisis. For example, (Wang et al., 2003) examined the degree of global and regional integration of the emerging African stock markets, whether it was affected, and how it was affected by the 1997–1998 global emerging market crisis. Results on both long-run relationships and short-run causal linkages showed that regional integration between most of the African stock markets was weakened after the 1997–1998 crisis. The USA exerted noticeable influence on very few African markets and such influence is probably only evident in the South African market. The USA was significantly affected only by the South African market but not by other African markets. Hence, the degree of global integration of African stock markets was very limited except for South Africa. Finally, the findings of this study carry an important implication that the degree of integration between emerging markets tends to change over time, especially around periods marked by financial crises.

Also, (Chiang et al., 2007) examined the daily stock return for nine Asian markets namely Thailand, Malaysia, Indonesia, Japan, the Philippines, South Korea, Taiwan, Hong Kong, and Singapore for the period 1996 to 2003 and found that there was a high correlation among sample Asian countries during the period of crises. (Wang and Nguyen Thi, 2007) examined whether an external shock could change the relationship between markets in one country (or one region). Results proved the existence of contagion. The significant increase in the correlation coefficient shows the same trend between markets. Their study proved the existence of contagion between Taiwan and US stock markets. Also, Royfaizal et al. (2009) examined the interrelationship between the Asian stock markets namely, Malaysia, Singapore, the Philippines, Thailand, Indonesia, China, Japan, Korea, and the US stock markets. They concluded that the linkages between the Asian and the US stock markets are stronger in the post-crisis period. Their empirical results showed that the long-run relationships between Asian stock markets occur only

during- and post-crisis periods. During the pre-crisis period, there are no significant cointegrating vectors among the Asian stock markets. This result showed that the Asian stock markets are more independent before the crisis. Using trivariate VAR-GARCH models to investigate the volatility transmission from the regional and global markets to 41 emerging markets in Asia, Europe, Latin America, and the Middle East and North Africa, Beirne et al. (2010) found evidence of spillover effects for most sample markets. According to them, the effect of investor sentiment on stock markets is more pronounced in countries that are culturally more susceptible to herd-like actions and overreaction or countries with low institutional participation.

Furthermore, Suliman (2011) examined contagion and crisis propagation (spillovers) in the Gulf Cooperation Council (GCC) economies over the period 1960 to 2002. He also examined whether contagion occurred in Saudi Arabia after the 1987 US stock market crash and the 1997 Thai exchange rate devaluation and whether these contagion shocks spillover to smaller countries of the region. Spillovers are likely to occur among interdependent countries within the same geographical region. The results indicated that contagion from the US stock market crash and the Thai devaluation occurred in Saudi Arabia, and these external shocks were propagated to smaller GCC countries. This suggests that GCC countries are likely to mitigate such propagations through economic integration.

To examine the interrelationships between the United States and some selected European stock markets at different development levels during the recent financial crisis, Evrim-Mandaci and Çağlı (2012) used impulse response functions to determine the response of stock market prices of these European countries to a shock in the US market. They found that the United States has permanent effects on the European countries in their sample for the period between 2005 and 2012 covering the recent financial crisis. Also, their findings are invariant to the development levels of the European stock markets. In other words, a shock in the US market is not only influencing the European developed markets but also the emerging and frontier markets. Morales and Andreosso-O'Callaghan (2012) concluded that the global stock markets were becoming more interdependent and crises in one country would soon spread to another. Stock market movements become increasingly correlated. Events like infectious disease outbreaks can induce negative changes in investors' sentiment that strongly affect their investment decisions and, consequently, stock market prices. By examining the dynamic linkages of the BRICS markets with the US and European markets, Hammoudeh et al. (2016) showed evidence of the presence of leverage effects and fractional integration in conditional volatility for all markets. The market linkages at the group level, after the onset of the global financial crisis 2008–09,⁶ confirms a certain degree of contagious effects across markets.

Moreover, Sun and Hou (2019) found that Southeast Asia, Malaysia, Vietnam, and Thailand were most financially inte-

grated with China. For the East European area, Poland and Croatia show the best potential in terms of monetary and financial cooperation; with the Czech Republic. Habiba et al. (2020) investigated the cointegration and volatility spillover dynamics between the USA and South Asian stock markets, namely, India, Pakistan, and Sri Lanka. They found that the USA stock market has a causal relationship with emerging stock markets in the short term. The findings of the EGARCH model revealed that asymmetric volatility spillover effects are significant in all selected stock markets in pre, during, and post-crisis periods. Then, they concluded that returns and volatility spillover effects are higher in the financial crisis period as compared to the non-financial crisis period.

Lastly, Okorie and Lin (2020) investigated the fractal contagion effect of the covid-19 pandemic on the stock markets of the top 32 coronavirus-affected economies (as of March 31, 2020). The results confirmed a fractal contagion effect of the covid-19 pandemic on the stock markets. Furthermore, this fractal contagion effect fizzles out over time (in the middle and long run) for both the stock market's return and volatility. They concluded that the covid-19 pandemic has resulted in panic as well as the temporary closure of businesses in most economies with confirmed positive coronavirus cases. These reactions are bound to affect the performance of the businesses in these economies as well as their stock market dynamics.

3. DATA AND METHODOLOGY

To examine the impact of covid-19 on stock market returns, we used the t-tests and Mann – Whitney non-parametric tests of daily returns and we compared the returns of the most representative indices of selected MENA and world stock markets (presented next) in the period of our study to the returns of the S&P Pan Arabia composite index and the returns of the stock indices of the selected world countries to the S&P 1200 Global Index returns respectively.

We started our sample construction by collecting the data on the daily closing value of stock market indices from the investing.com website over our period of study. Data starts on January 25, 2019, and ends on November 22, 2020. Then, we applied several filters to the collected data.

For the first part of our data, we use the stock indices of selected MENA countries considered as the representative cases in our study: First of all, we dropped Yemen from the data because there is no stock market in Yemen. Second, from the remaining data, we drop the countries for which the data of daily stock market returns were not available as Libye, Algeria, Lebanon, Iraq, Jordan, Palestine, and Syria. So, the final list of selected MENA countries studied in this paper is UAE, Bahrain, Kuwait, Saudi Arabia, Tunisia, Morocco, Oman, Qatar, Egypt, and Turkey.

For the second part of our data, we use the stock indices of selected world countries considered the most affected countries with a large number of confirmed cases in the world on November 22, 2020, according to WHO. We drop from the data Iran because there is no stock index there and we add Argentine, which ranks ninth in the number of confirmed cases according to the same source. Then, our final list of

⁶BRICS is the acronym coined to associate five major emerging national economies: Brazil, Russia, India, China, and South Africa. The BRICS members are known for their significant influence on regional affairs.

selected world countries studied in this paper consists of Brazil, India, France, Russia, the USA, Espagne, Italy, the United Kingdom, and Argentine.

Table 1. Sample Information.

In this paper, we set three covid-19 outbreak timelines namely: UAE, MENA, and world timeline. Then, we examined the separate impacts that covid-19 has had on the UAE, selected MENA, and selected World stock markets. After that, we test the covid-19 outbreak spillover effects on those stock markets. Finally, we compare the returns of selected MENA stock indices to the return of the S&P Pan Arab Composite index⁷ and the returns of the selected world stock indices to the S&P 1200 Global Index⁸ returns.

For the UAE timeline, the period is divided into several sub-periods. The UAE timeline is related to important events related to Covid-19 in UAE. We have chosen UAE because, according to the World Health Organization (WHO), it is the first country in the MENA region to be affected by Covid-19 on January 29, 2020. The daily returns are grouped into the comparison, pre-, short, mid, and long event windows. The comparison period starts from June 25, 2019, to January 26, 2020. The pre-event period is from January 27, 2020, to March 30, 2020. It presents the period that precedes the appearance of the pandemic. We suppose as our first hypothesis that there is a negative impact of Covid-19 on the stock indices of the UAE. The second sub-period presents the short event, which lasts 10 days, from March 31, 2020, to April 11, 2020. The situation has deteriorated in the UAE in the subsequent weeks with the announcement of the government Dubai's Supreme Committee of Crisis and Disaster Management increased restrictions on movement in the Al Ras area of Dubai and starts to evacuate its citizens from several countries on March 31, 2020, which represents the first day of this sub period. The third sub-period presents the mid-event which lasts 90 days from March 31, 2020, to June 29, 2020, and the fourth sub-period is from March 31, 2020, to November 22, 2020, and it presents the long event. The long event extends to the date of our study, as the pandemic did not finish yet. Our hypothesis for the short, mid, and long event windows is that Covid-19 has a negative impact on the UAE stock market and spill-over effects on other selected stock markets.

The performance of these indices during the prevent, short event, mid-event, and long event window are also compared with the performance of the S&P 1200 Global Index for selected world countries and with the S&P Pan Arab Composite for selected MENA countries. Our hypothesis for the short, mid and long event window is that Covid-19 has a negative impact on the stock market index of selected countries compared with the S&P Pan Arab Composite index and the S&P 1200 Global Index.

For the MENA timelines, the same proceeding is applied. This timeline is also divided into several sub-periods and the dates are related to major events of the epidemic in the MENA region. The comparison period lasts 60 days from June 25, 2020, to February 14, 2020. The pre-event period is from February 15, 2020, to March 11, 2020, and this represents the period from the first case of Covid-19 outside UAE in the MENA region precisely in Egypt and extends to reach all MENA countries and Turkey was the last country in the MENA region to be touched by the pandemic according to Turkey's Health Minister. The short event starts when all MENA countries are affected by Covid-19, on March 12, 2020, and lasts for 10 days. The mid-period lasts 90 days from March 12, 2020, to June 11, 2020, and finally, the long event extends from March 12, 2020, to November 22, 2020, the date of our study, as the pandemic did not finish yet. Our hypothesis for short, mid, and long event windows is that Covid-19 has a negative impact on the stock market index of selected MENA countries and spillover effects on other stock markets.

Then, we compare the performance of these indices during the pre-, short, mid, and long event windows with the performance of the S&P 1200 Global Index for selected world stock markets and with the S&P Pan Arab Composite for selected MENA stock markets. We hypothesize that Covid-19 has a negative impact on the major selected countries' stock indices compared with the S&P Pan Arab Composite index and the S&P 1200 Global Index.

The world timeline is divided into several sub-periods and the main dates are related to major events of the epidemic in the world and thus the outbreak outside UAE and MENA region.

The comparison period lasts 60 days from June 25, 2019, to January 29, 2020. The period from January 30, 2020, to March 10, 2020, is called the pre-event period knowing that January 30, 2020, represents the date of the announcement of the Public Health Emergency of International Concern by the WHO. The short period lasts 10 days from March 11, 2020, the date the Covid-19 epidemic is declared a pandemic by the WHO⁹, to March 22, 2020. The mid-period lasts 90 days from March 11, 2020, to June 9, 2020, and finally, the long period extends from March 11, 2020, to November 22, 2020. Our hypothesis for the short, mid, and long event windows is that the Covid-19 outbreak in the world has a negative impact on the UAE, the selected world, and MENA stock market indices and that the negative impact on the selected world stock markets has spillover effects on UAE and selected MENA stock markets.

Finally, we compare the performance of these indices during the pre-, short, mid, and long event windows with the performance of the S&P 1200 Global Index for selected world countries and with the S&P Pan Arab Composite for selected MENA countries. We hypothesize that Covid-19 has a negative impact on the major stock indices in selected countries compared with the S&P 1200 Global Index and the S&P Pan Arab Composite index.

⁷Includes stocks from 11 Pan Arab markets. The index reflects the float available to GCC residents, which is typically larger than that available to investors based outside the region.

⁸Is a free-float weighted stock market index of global equities from Standard & Poor's. The index covers 31 countries and approximately 70 percent of global stock market capitalization.

⁹<https://edition.cnn.com/2020/03/11/health/coronavirus-pandemic-world-health-organization/index.html>

4. RESULTS

4.1. UAE Timeline

In the first part of this section, we start with the analysis of the results of the UAE timeline to provide answers to our research questions: Does the outbreak of covid-19 in the UAE significantly affect the selected stock markets? Does the impact of covid-19 on UAE stock markets have a spill-over effect on other stock markets?

Table 2. Differences in Mean Returns of UAE Timeline.

Panel A shows that all selected MENA stock market indices present negative returns except for EGX 70 EWI. However, the returns of the selected world stock market indices are positive during this same period. So that, the selected world stock markets are performing well before the appearance of the covid-19 in the UAE.

Panel B compares the returns of the pre-event period with the comparison period. The results obtained show that all the selected MENA and world stock market indices significantly underperformed their comparison period except for BIST 100 which significantly outperformed its comparison period at the 1% level of significance. The negative impact of the appearance of covid-19 in the UAE on the stock markets is statistically significant at the 1% level of significance for Jordan, Bahrain, Kuwait, Morocco, and Oman stock markets. It is statistically significant at the 5% level of significance for UAE, SA, Iraq, Qatar, Brazil, India, France, Russia, Espagne, Italy, and the UK stock markets. And, it is statistically significant at the 10% level of significance for the Egyptian stock market. This leads us to note that the appearance of covid-19 in the UAE has affected the world stock markets.

Based on our results during the comparison, pre and short periods, we find that the selected MENA countries are not performing well before the appearance of corona-19 in the MENA region and in particular in the UAE. This can be explained by the fact that the public revenues of the six nations of the Gulf Cooperation Council (GCC - Saudi Arabia, Bahrain, United Arab UAE, Oman, Qatar, and Kuwait) are highly dependent on oil, the demand for which has fallen since the start of the epidemic's outbreak in China since November 16, 2019, which usually absorbs a fifth of the region's production.

The second blow for these countries: was the lack of agreement between the *Organization of Petroleum Exporting Countries* (OPEC) and Russia on an additional reduction in oil production to support prices whose trend was already downward. This triggered a price war between Ryad and Moscow. Saudi Arabia has drastically lowered its prices, flooding the market with low-cost barrels. Prices have since plunged, reaching their lowest level in 18 years, with a barrel of Brent at around \$ 25, which equates to tens of billions of dollars in losses for the Gulf.

In addition to the drop in oil prices, the appearance of Covid-19 in the UAE had a remarkable negative impact on all stock markets reflected in a significant drop in the average daily returns during the pre-event period compared to the comparison period (Panel B).

Then, we conclude that the impact of covid-19 in the stock markets of GCC countries and in particular the UAE stock market has spill-over effects either on other selected MENA or world stock markets. On the one hand, these spill-over effects may be linked to the outbreak of covid-19 and the shock, and panic among international investors¹⁰ as explained by Aggarwal et al. (2020). In recent years, stock markets have become more and more interdependent. This interdependence can be explained in particular by the interactions of economic fundamentals and the behavior of investors. Also, this interdependence of stock exchanges is not linear and its intensity increases in times of high volatility (Wang and Nguyen Thi, 2007). On the other hand, these spill-over effects may be explained by the return spillovers and dynamic time-frequency linkages between crude oil prices and stock markets, especially during the covid-19 period as proven by Akbar et al. (2020).

Panel C compares the returns of the short period with the comparison period. The results obtained show that only 4 market indices significantly underperformed their comparison periods during the short period, namely Bahrain All Share (at the 1% level), BIST 100 (at the 5% level), Tunindex (at the 1% level), and Moroccan All Shares (at the 1% level). As a result, the outbreak of the covid-19 epidemic affects negatively and significantly only 4 selected MENA stock markets and it has no negative impact on the selected world stock markets. This leads us to conclude that the stock markets have been affected much more by the appearance of the epidemic than by its outbreak in the UAE.

Panels D and E compare the returns of the mid-period and the long period respectively with the comparison period. The results obtained show that only the Bahrain stock market, among the selected MENA stock markets, was statistically and negatively affected during the mid-period at the 5% level. On the other hand, all selected world stock market indices outperform their period of comparison, although this outperformance is not statistically significant. The appearance and outbreak of the covid-19 in UAE as the first country affected by the virus in the MENA region have no lasting effect on other stock markets, either the selected MENA or the selected world stock markets.

Interestingly, the UAE stock market was not seriously affected by the corona-19 outbreak. Indeed, during the short period, ADX General significantly outperformed its comparison period at the 1% level. This outperformance persists for medium and long periods, but it is not statistically significant. This high degree of resilience may be explained by the fact that the UAE announced a \$ 35 billion economic recovery plan that includes injections into the stock market and support for various sectors, long before the corona-19 outbreak in the region.

Table 3. Differences in median returns of UAE timeline

¹⁰ By presenting 15 major stock market corrections and panics that have occurred over the past 200 years, (Grable, 2021) showed that the initial market reaction to the covid-19 pandemic was neither unique nor unexpected. (Grable, 2021) highlighted the importance of helping clients maintain perspective as they try to make sense of ongoing market volatility associated with covid-19.

The results of the non-parametric Mann–Whitney test largely confirm the findings obtained from the results of the t-test. Indeed, according to the results appearing in panel B, the majority of stock market indices underperformed their period of comparison during the pre-event period. Among the selected Mena stock market indices, this underperformance was statistically significant for ADX General (at the 5% level), Bahrain All Share (at the 1% level), BIST 100(at the 10% level), Moroccan All Shares (at the 1% level), and QE General (at the 5% level). Although this underperformance was observed for 7 indices out of 9 indices of the selected world stock markets, it was only statistically significant for BYMA Argentina General (IBG) at the 10% level of significance. So, we can conclude that the negative impact of the outbreak of covid-19 in the UAE is limited.

Panel C compares the median returns of the short period with those of the comparison period. The results obtained show that only the Bahrain All Share significantly underperformed the comparison period during the short period at the 1% level of significance. As a result, the outbreak of the covid-19 epidemic affects negatively and significantly only one selected MENA stock market and it has no negative impact on the selected world stock markets. This leads us to confirm our finding that the stock markets have been affected much more by the appearance of the epidemic than by its outbreak in the UAE and that the impact of the Covid-19 outbreak in the UAE on other stock markets is negligible during the short period.

Panels D and E compare the returns of the mid-period and the long period respectively with those of the comparison period. The results obtained show that only the Bahrain stock market, among the stock markets of all selected countries, was statistically and negatively affected during the mid-period at the 5% level of significance.

Based on the results of the non-parametric Mann – Whitney test, we conclude that the negative impact of the appearance of covid-19 in the UAE, whether on the UAE or other stock markets, is limited and is not long-term persistent.

Table 4. Returns relative to the S&P Pan Arab Composite index and the S&P 1200 Global Index of UAE timeline

The results obtained in panel A show that there is no statistically significant difference between the indices of the selected MENA stock markets and the S&P Pan Arab Composite index except for the BIST 100 index which significantly outperforms the S&P Pan Arab Composite index at the 5% level of significance.

The results obtained in Panel B show that Bahrain All Share, BIST 100, FTSE Coast Kuwait 40, Tunindex, and Moroccan All Shares indices underperformed significantly the S&P Pan Arab Composite index during the short period. The statistical significance of this underperformance remains only for Bahrain All Share at the 10% level of significance during the mid-period (Panel C) and it disappears during the long period for all selected MENA stock markets (Panel D). Our findings confirm that the negative impact of the outbreak of covid-19 in the UAE on the selected Mena stock markets is limited and is not long-term persistent compared with the S&P Pan Arab Composite index.

The results obtained in table 4 show that there is no statistically significant difference between the performance of the selected world market indices and the performance of the S&P 1200 Global Index for the pre-, short, mid, and long event windows of the UAE timeline. We conclude that the negative impact of covid-19 on the selected world stock markets compared with the S&P 1200 Global Index is insignificant.

According to the results of our empirical study in the UAE timeline in the first part of this section, the outbreak of the covid -19 in the UAE had a negative but limited direct impact on the MENA region stock markets, especially during the pre and short periods. Furthermore, it appears that such an impact has spill-over effects on American, Asian, and European stock markets only during the pre-event period. Then, we conclude that the impact of the outbreak of the covid-19 in the UAE whether on the selected world stock market or the selected MENA stock market is limited and is not long-term persistent. Finally, there is no evidence that covid-19 has a negative impact on the major stock indices in these countries compared with The S&P Pan Arab Composite index and the S&P 1200 Global Index.

4.2. MENA Timeline

The second part of our empirical evidence focuses on the results of the MENA timeline to provide answers to our research questions: Does the outbreak of covid-19 in MENA countries significantly affect the selected stock markets? Does the impact of covid-19 on MENA stock markets have a spill-over effect on the UAE and selected world stock markets?

Table 5. Differences in mean returns of MENA timeline

According to the results obtained in Panel A, all selected MENA stock market indices show negative returns except for FTSE coast Kuwait40, MSM 30 Moroccan all shares and EGX 70 EWI. However, the returns of the selected world stock market indices are positive during this same period. That is, the selected world stock markets are performing well before the appearance of covid-19 in the MENA.

Compared to the comparison period, the mean return in the pre-event period (panel B), almost all stock indices except for BIST 100, have been significantly negatively affected. The ADX general, BAHRAIN all shares, ASE general, BIST 100, FTSE coast Kuwait, MSM30, Moroccan all shares (at 1% level), and TADAWUL all shares, Tunindex, QE general, EGX 70 EWI (at 5% level) underperformed the comparison period. And, all selected world stock market indices underperformed the comparison period at the level of 1% of significance. Based on our results of the comparison and pre-event period, we can conclude that the covid-19 outbreak in Mena countries has a negative impact on the selected MENA stock markets and this impact has spillover effects on UAE and the selected world stock markets.

The fast spread of the covid-19 around the world can affect negatively economic trends as well as investment decisions and consequently the stock market trends. Such unexpected shocks make investors pessimistic and do not take risks (Bai (2014), Baker et al. (2012)). In fact, during crisis periods, the

stock market linkages, as well as the spillover effects, become pronounced. And this was explained by the sentimental factors (Gormsen and Koijen, 2020) and the social media that stimulate trade activities (Broadstock and Zhang (2019)).

The GCC is the most economically stable in the Middle East and North Africa (MENA) region, whose economy depends on the oil production industries, characterized by developing their economic structures and high living standards (Alber and Saleh (2020)). Global stock markets witnessed more impact from the covid-19 pandemic than any previous pandemic, even the Spanish flu (Baker et al. (2020)). However, in the GCC, the unprecedented outbreak of COVID-19 has led to instability in the region (Ben Amar et al. (2020)). The cause was not marked by the increase in the number of infected cases (Y.H. Saif-Alyousfi (2022), (Sadiq et al. (2021); Rubbaniy et al. (2020)). However, instead, actions are taken to prevent the pandemic's spread. Governments were quick to take preventive actions, negatively affecting various sectors, namely service, tourism, and financial. In turn, this caused panic in the public and increased their concern over the ability of the leadership response to deal with the crisis appropriately. However, the GCC countries have the strongest economies in the Arab world and are the most affected. Furthermore, the actions taken to prevent the COVID-19 spread resulted in a decline in the stock markets' profit gains.

The impact on the stock market depends entirely on the extent of Covid-19 spread and how governments respond to take preventive actions that protect their economies (Szczygielski et al. (2021); Okorie and Lin (2021); Y.H. Saif-Alyousfi (2022)).

The results of the short event window (Panel C), show that only four stock indices namely Bahrain All Share, Tunindex, MSM 30, and EGX 70 EWJ significantly under performed their comparison periods at the 1% level. However, the negative effect is not as important for selected world stock market indices. It is significantly negative at the level of 1% of significance only for; BSE Sensex 30. So, we can conclude that the negative effect of the covid-19 outbreak is limited for the selected MENA stock markets and insignificant for the selected world stock markets. So, the spillover effect on the selected MENA stock markets during the pre-event period is limited and it does not exist for the selected world stock markets.

The absence of the spillover effects remains during the mid and long periods. The results of the mid-event window presented in Panel D show that only two selected MENA stock market indices are significantly negative namely, Bahrain all shares (at the level of 5%) and MSM 30(at the level of 10%). And, in the long event window (Panel E), the negative effect has disappeared most for all stock market indices (selected MENA countries and world countries). This leads us to conclude that the stock markets indices have been affected much more by the appearance of the epidemic than by its outbreak in MENA so the negative effect is not long-term persistent.

Table 6. Differences in median returns of MENA timeline.

The results of non-parametric Mann–Whitney tests during the pre, short, mid, and long event windows for the MENA timeline, are presented in table 6. It contains the number of

trading days for each window, the median returns, Z-statistics, and statistical significance levels.

The non-parametric Mann–Whitney test can confirm the findings obtained from the results of the t-test in the comparison period (table 5 panel B).

According to the results of the pre-event window shown in Panel B, most selected MENA stock market indices are negatively and significantly affected: Bahrain all shares, BIST100 and Moroccan all shares(at 5% level), and FTSE coast Kuwait 40 and Tadawul all shares (at 10% level). So, they under performed in their comparison period. However, the selected world stock market indices are significantly and negatively affected at different levels of significance.

The negative effect remains significant, in the short period (panel C), only for Bahrain all shares at the 1% level of significance, and it remains significant in the mid-period (panel D), only for Bahrain all shares at the 1% level and BIST100 at the 10% level for the selected MENA stock market indices. Hence, none of the selected world stock market indices present a significant sign. In the long event window (Panel E), the negative effect, as well as the spillover effects, disappear totally for stock market indices. None of the selected stock market indices presents a significant negative effect.

Based on the results of the non-parametric Mann – Whitney test, we conclude that the negative impact of the appearance of covid-19 in the MENA region on the selected stock markets is limited to a short period and this can be explained by the work of Andersen (2020) who shows, that in the most severe scenario, there is a short economic impact of the covid-19 and not a significant long-run impact which results in the non-persistence of the impact of the covid-19 on the stock markets during the mid and long periods.

Table 7. Returns relative to the S&P Pan Arab Composite index and the S&P 1200 Global Index of MENA timeline

According to table 7, there is strong evidence that the stock markets indices do not present any difference compared to the S&P Pan Arabia and S&P 1200 for selected MENA stock markets and selected world stock markets respectively. Although the effect is negative for certain indices, it is significant only for BIST 100 during the short, mid, and long events. So, the impact of COVID 19 is limited on the selected MENA stock markets and insignificant for all the selected world stock markets.

According to the results of our empirical study in the MENA timeline in the second part of this section, the outbreak of the covid -19 in the MENA region had a negative but limited direct impact on the stock markets of MENA region countries including the UAE, especially during the pre and short periods. Furthermore, it appears that such an impact has spill-over effects on Americans, Asians, and Europeans only during the pre-event period. Then, we conclude that the impact of the outbreak of the covid-19 in the MENA region whether on the UAE or the selected world stock market is limited and is not long-term persistent. Finally, there is no evidence that covid-19 has a negative impact on the major stock indices in these countries compared with the S&P Pan Arab Composite index and the S&P 1200 Global Index.

4.3. World Timeline

The third part of our empirical evidence focuses on the results of the world timeline to provide answers to our research questions: Does the outbreak of covid-19 in the American, Asian, and European countries significantly affect the selected stock markets? Does the impact of covid-19 on American, Asian, and European stock markets have a spill-over effect on the UAE and the selected MENA stock markets?

Table 8. Differences in mean returns of the world timeline.

Panel A shows that the returns of the selected world market indices are positive during the comparison period. That is, the selected world stock markets are performing well before the appearance of covid-19.

Panel B compares the returns of the pre-event period with the comparison period. The results obtained show that all the selected world market indices significantly underperformed their comparison period. Except for the S&P 500 which underperformed its comparison period at the 5% level and BYMA Argentina General (IBG) which underperformed its comparison period not significantly, all the other indices underperformed their comparison periods at the 1% level. This leads us to conclude that all selected world stock markets are negatively and significantly affected by the appearance of covid-19 in the world and that this negative impact worsened during the short period following the outbreak of the epidemic in the world. Indeed, the difference in means between the short period and the comparison period (Panel C) is greater than the difference in means between the pre-event period and the comparison period.

The outbreak of the coronavirus has increasingly affected the real economy and created a stir in the stock markets all over the world. The fall of the markets of our selected countries was particularly spectacular during the pre-and short period. This stock market debacle may be explained by the combined effect of ever-growing fears linked to the consequences of the coronavirus and the fall in oil prices. The covid-19 virus is indeed not the only concern of investors. According to Agence France-Presse (AFP), Oil prices have fallen by more than 30% in Asia on March 9, 2020, their biggest drop since the Gulf War in 1991. Indeed, according to APERC (2007); (Ang et al., 2015); (Erahman et al., 2016), oil price shocks significantly affect stock returns and volatility, regardless of whether a region is an oil-importing and exporting economy. (Mugableh, 2017) proved that the overall effect of the price of oil on the financial markets is decided by that of the nation's net oil market job due to its variability.

Our results are confirmed by Sadiq et al. (2021). The authors looked into the effect of COVID-19 on emerging stock markets in seven of the Association of Southeast Asian Nations' (ASEAN-7) member countries from March 21, 2020, to April 31, 2020. They found that there is almost no chance that the COVID-19 pandemic would positively affect the stock market performance in all the countries, mainly Indonesia and Singapore were the countries most affected. And they showed that COVID-19 fear causes an eventual reason for public attention towards stock market volatility.

This confirms the conclusion that the outbreak of covid -19 significantly affected the stock markets, whether directly or indirectly.

The same results are obtained for the UAE and the selected MENA countries. In the pre-event window (Panel B), the UAE and all the selected MENA stock indices excepting the Tunindex significantly underperformed their comparison period: FTSE coast Kuwait 40 underperformed its comparison periods at the 1% level of significance and ADX general, Bahrain all shares, Tadawul all shares, Moroccan all shares, MSM30, BIST100 and QE general underperformed their comparison periods at the 5% level.

The covid-19 outbreak in the world had a remarkable negative impact on the UAE and selected MENA stock market indices reflected in a significant drop in the average daily return during the pre-event period (Panel C) compared to the comparison period (Panel B). So, we conclude that the impact of covid-19 on the selected world stock markets has a spill-over effect on the UAE and the selected MENA stock markets during the pre and short periods.

We can rely on the work of Adekoya and Oliyide (2020) to explain our findings. Adekoya and Oliyide (2020) examine the pandemic impact on the connectedness among the markets. According to them, many reasons suggest that in addition to its negative impact on the performances of the markets, the pandemic can also be a driver of their connectedness, coming from the perspective of the global financial cycle channel. Their findings prove *“that the covid-19 outbreak has been largely responsible for risk transmission across various commodity and financial markets. This is because it has significantly raised investors' and policy uncertainties and immensely altered global financial cycle which in turn results in global flows of capital, and movements in the prices of assets across different financial markets”*.

Panels D and E compare the returns of the mid-period and the long period respectively with the comparison period. The results obtained show that the selected world stock markets recovered rapidly after the short event window. Indeed, no significant negative impact was observed during the mid or the long period. This leads us to say that the negative impact of covid-19 on the selected world stock markets is not long-term persistent. Our findings are supported by some recent findings. According to Yan et al. (2020), markets often react adversely to the covid-19 potential effects in the short term but in the long term, markets eventually correct themselves and increase. This has also been proven by Phan and Narayan (2020). They argue that, as with any unexpected news, markets over-react and as more information becomes available and people understand the ramifications more broadly the market corrects itself.

Results also revealed that the significant impact of covid-19 on stock markets of MENA countries during the pre and short periods disappear in the mid and long periods (Panel D and E) except for Bahrain all shares present a negative and significant impact at the level of 5%. Then, we conclude that the covid-19 outbreak spillover effects disappear during the mid and long periods.

Table 1. Lists the Countries and Their Stock Market Index as Follows.

Indices	Countries
ADX GENERAL	United Arab Emirates
Selected MENA countries indices	
Bahrain all shares	Bahrain
Bist 100	Turkey
FTSE Coast Kuwait 40	Kuwait
Tadawul all shares	Saudi Arabia
Tunindex	Tunisia
Maroccan all shares	Morocco
MSM 30	Oman
GE GENERAL	Qatar
EGX 70 EWJ	Egypt
Selected world countries indices	
Bovespa	Brasil
BSE SENSEX 30	India
CAC40	France
MOEX Russia	Russia
S&P500	USA
SMSI	Espagne
FTSE MIB	Italy
FTSE 100	United Kingdom
BYMA Argentine General	Argentina

Table 2. Contains the results of the mean comparison test during the pre, short, mid, and long event windows for the UAE timeline. It presents the number of trading days for each window, the mean returns, standard deviations, t-statistics, and statistical significance levels.

	Panel A: Comparison period From June 25, 2019 to January 26, 2020			Panel B: Pre-event window From January 27, 2020 to March 30, 2020				Panel C: Short event window From 31 March 2020 to April 11, 2020				Panel D: Mid event window From March 31, 2020 to June 29, 2020				Panel E: Long event window From March 31, 2020 to November 22, 2020			
	Number of trading days	Event group's mean	Event group's std. dev.	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value
ADX General	147	0,00%	1,78%	46	-0,70%	1,78%	-2,3425**	8	1,19%	0,99%	3,4505***	62	0,20%	1,14%	1,1538	162	0,15%	0,99%	1,3022
Bahrain All Share	143	-0,05%	0,76%	46	-0,50%	0,84%	3,6329***	8	-0,61%	0,47%	-3,6787***	60	-0,19%	0,49%	-2,5125**	155	-0,04%	0,51%	-0,6671
BIST 100	147	-0,47%	1,11%	46	1,24%	2,24%	3,3656***	9	-0,82%	1,16%	-2,0766**	60	0,93%	1,18%	5,5202***	160	0,73%	1,30%	5,1082***
FTSE Coast Kuwait 40	119	-0,05%	2,03%	35	-1,08%	2,18%	-2,6282***	7	-0,53%	1,01%	-1,3647	51	0,03%	1,34%	0,1422	138	0,01%	1,27%	0,0452
Tadawul All Share	148	-0,01%	1,45%	46	-0,53%	1,48%	-2,1427**	8	1,21%	0,94%	3,7078***	60	0,25%	1,11%	1,4888	158	0,21%	1,03%	1,8157*
Tunindex	148	-0,04%	0,60%	45	-0,18%	0,60%	-1,7151*	7	-0,40%	0,40%	-2,6712***	61	0,06%	0,42%	0,948	160	0,04%	0,45%	0,7926
Moroccan All Shares	143	-0,06%	1,21%	47	-0,66%	1,33%	-3,0119***	9	-0,58%	0,52%	-3,3501***	63	-0,01%	0,65%	-0,1053	158	0,01%	0,61%	0,0181
MSM 30	124	-0,04%	0,70%	45	-0,38%	0,71%	-3,1205***	8	0,00%	4,70%	-0,0049	62	0,05%	0,54%	0,0543	157	0,05%	0,51%	0,086
QE General	131	-0,01%	1,21%	44	-0,53%	1,24%	-2,4815**	8	1,04%	0,86%	3,4829***	60	0,16%	0,89%	1,1395	160	0,14%	0,81%	1,4424
EGX 70 EWI	127	0,24%	1,51%	45	-0,52%	1,74%	-1,7457*	8	0,76%	1,28%	1,6311	58	0,65%	1,40%	3,0058***	153	0,49%	1,48%	2,7759***
Bovespa	147	0,11%	1,09%	44	-1,00%	2,85%	-2,0661**	8	0,46%	1,36%	0,9314	61	0,33%	1,59%	1,3787	162	0,13%	1,58%	0,7476
BSE Sensex 30	144	0,05%	0,92%	45	-0,83%	1,91%	-2,5792**	6	1,58%	1,30%	2,9921***	59	0,33%	1,44%	1,4782	162	0,23%	1,31%	1,5554
CAC 40	148	0,07%	0,83%	46	-0,70%	1,83%	-2,2838**	8	0,33%	0,98%	0,9157	62	0,16%	1,33%	0,7847	166	0,09%	1,36%	0,5897
MOEX Russia	149	0,09%	0,71%	44	-0,63%	1,56%	-2,3815**	9	0,99%	0,80%	3,7165***	61	0,13%	1,01%	0,8679	163	0,06%	1,01%	0,4923
S&P 500	148	0,08%	0,75%	45	-0,49%	2,13%	-1,37	8	0,73%	1,06%	1,914*	64	0,20%	1,27%	1,0581	165	0,12%	1,22%	0,8433
SMSI	148	0,03%	0,78%	46	-0,76%	1,85%	-2,453**	8	0,67%	0,89%	2,0998**	62	0,14%	1,28%	0,7107	166	0,10%	1,38%	0,6557
FTSE MIB	148	0,08%	0,93%	46	-0,76%	2,10%	-2,1739**	8	0,49%	1,04%	1,2809	62	0,17%	1,35%	0,8066	166	0,08%	1,38%	0,5212
FTSE 100	148	0,03%	0,72%	46	-0,68%	1,63%	-2,5206**	8	0,75%	0,90%	2,3302**	61	0,19%	1,19%	1,0353	164	0,08%	1,19%	0,589
FTSE Argentina General	145	0,12%	4,35%	42	-1,24%	4,48%	-1,5802	6	2,30%	4,30%	1,2869	59	0,80%	4,16%	1,2393	159	0,40%	3,71%	0,9423

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 3 contains results of non-parametric Mann–Whitney tests during the pre, short, mid, and long event windows for the UAE timeline. It presents the number of trading days for each window, the median returns, Z-statistics, and statistical significance levels.

	Panel A: Comparison period From June 25, 2019 to January 26, 2020		Panel B: Pre-event window From January 27, 2020 to March 30, 2020			Panel C: Short event window From March 31, 2020 to April 11, 2020			Panel D: Mid event window From March 31, 2020 to June 29, 2020			Panel E: Long event window From March 31, 2020 to November 22, 2020		
	Number of trading days	median return	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value
ADX General	147	-0,03%	46	-0,31%	-2.383**	8	0,34%	0.873	62	0,21%	0.721	162	0,16%	1.521
Bahrain All Share	143	0,06%	46	-0,14%	-2.910***	8	-0,68%	-3.472***	60	-0,13%	-2.498**	155	-0,03%	-0.835
BIST 100	147	0,25%	46	0,70%	1.872*	9	-1,18%	-1.638	60	0,95%	5.972***	160	0,88%	6.289***
FTSE Coast Kuwait 40	119	0,10%	35	-0,16%	-1.481	7	-0,52%	-1.113	51	-0,05%	0.151	138	-0,08%	0.135
Tadawul All Share	148	0,09%	46	-0,46%	-1.639	8	1,21%	2.804***	60	0,08%	2.039**	158	0,09%	2.456**
Tunindex	148	-0,04%	45	0,11%	0.454	7	-0,20%	-0.819	61	0,10%	1.484	160	0,10%	1.587
Moroccan All Shares	143	0,04%	47	-0,30%	-3.307***	9	-0,79%	-1.581	63	0,04%	-0.128	158	0,01%	0.057
MSM 30	124	0,01%	45	-0,01%	-1.188	8	-0,02%	-0.143	62	-0,04%	-0.37	157	-0,03%	-0.354
QE General	131	-0,04%	44	-0,48%	-2.04**	8	0,49%	1.474	60	0,14%	0.448	160	0,15%	1.368
EGX 70 EWI	127	0,05%	45	-0,05%	-0.524	8	1,06%	1.314	58	0,76%	3.939***	153	0,60%	3.912***
Bovespa	147	0,02%	44	-0,88%	-1.231	8	0,67%	0.178	61	0,06%	1.051	162	-0,02%	0.641
BSE Sensex 30	144	0,09%	45	-0,49%	-1.989**	6	1,43%	0.269	59	0,46%	1.768*	162	0,29%	2.626***
CAC 40	148	0,09%	46	-0,26%	-0.869	8	0,27%	0.980	62	0,30%	1.136	166	0,00%	0.137
MOEX Russia	149	0,06%	44	-0,40%	-1.418	9	1,13%	2.341**	61	0,08%	0.787	163	0,09%	0.438
S&P 500	148	0,09%	45	-0,21%	-1.250	8	0,56%	0.418	64	0,34%	1.517	165	0,27%	1.590
SMSI	151	-0,04%	46	0,03%	-0.58	8	0,78%	1.35	62	0,28%	0.854	166	0,04%	0.144
FTSE MIB	148	0,06%	46	0,21%	-0.541	8	1,22%	1.366	62	0,40%	1.434	166	0,20%	0.639
FTSE 100	150	0,05%	46	-0,14%	-0.827	8	1,21%	1.342	61	0,28%	1.597	164	0,10%	0.622
FTSE Argentina General	145	0,21%	42	-0,64%	-1,8*	6	2,53%	2.029**	59	0,78%	1.144	159	0,56%	0,545

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 4 contains the results of the comparison of the performance of the selected MENA stock market indices with the performance of the S&P Pan Arab Composite index and the performance of the selected world stock market indices with the performance of the S&P 1200 Global Index for the pre- (Panel A), short (Panel B), mid (Panel C), and long (Panel D) event windows of the UAE timeline using t-tests.

	Panel A: Pre-event window From January 27, 2020 to March 30, 2020			Panel B: Short event window From 31 March 2020 to April 11, 2020			Panel C: Mid event window From March 31, 2020 to June 29, 2020			Panel D: Long event window From March 31, 2020 to November 22, 2020		
	Mean	Std. Dev	t	Mean	Std. dev	t	Mean	Std. dev	t	Mean	Std. dev	t
ADX General	-0,15%	2,74%	-0,2759	0,52%	2,12%	0,5041	0,07%	1,41%	0,2887	0,05%	0,97%	0,5099
Bahrain All Share	0,10%	1,79%	0,2791	-1,22%	0,93%	-3,6239***	-0,26%	0,85%	-1,7869*	-0,08%	0,67%	-1,0756
BIST 100	1,29%	3,15%	2,0754**	-1,99%	1,67%	-3,1981***	0,30%	1,05%	1,6932*	0,14%	1,07%	1,2325
FTSE Coast Kuwait 40	-0,45%	3,03%	-0,6892	-1,13%	1,36%	-1,7951*	-0,02%	1,47%	-0,0575	-0,01%	1,11%	-0,0429
Tadawul All Share	-0,03%	2,28%	-0,0696	0,49%	0,95%	1,0865	0,07%	1,25%	0,3463	0,07%	0,93%	0,7051
Tunindex	0,33%	1,69%	0,9733	-1,12%	1,10%	-2,3335**	-0,11%	0,85%	-0,7598	-0,09%	0,66%	-1,3647
Moroccan All Shares	-0,07%	2,27%	-0,1598	-1,21%	1,19%	-2,5153**	-0,10%	1,00%	-0,5714	-0,05%	0,74%	-0,6484
MSM 30	0,16%	1,69%	0,4684	-0,68%	0,93%	-1,6289	-0,13%	0,89%	-0,8819	-0,10%	0,67%	-1,3768
QE General	-0,02%	2,05%	-0,0428	0,33%	1,27%	0,5459	-0,01%	1,06%	-0,0327	0,01%	0,79%	0,0999
EGX 70 EWI	-0,01%	2,32%	-0,0194	0,05%	1,14%	0,0864	0,49%	1,31%	2,1975**	0,36%	1,21%	2,8205***
Bovespa	-0,59%	4,13%	-0,728	-0,05%	3,21%	-0,03	0,20%	2,06%	0,5398	0,05%	1,62%	0,3073
BSE Sensex 30	-0,47%	3,11%	-0,7791	1,02%	3,57%	0,5258	0,14%	1,97%	0,3803	0,10%	1,43%	0,6049
CAC 40	-0,32%	3,07%	-0,5416	-0,22%	2,56%	-0,1725	-0,02%	1,91%	-0,0619	-0,03%	1,51%	-0,2009
MOEX Russia	-0,23%	2,87%	-0,4056	0,47%	2,12%	0,456	-0,02%	1,60%	-0,0596	-0,04%	1,26%	-0,2788
S&P 500	-0,10%	3,43%	-0,1566	0,20%	3,00%	0,1308	0,04%	1,85%	0,1205	0,01%	1,41%	0,0698
SMSI	-0,12%	1,80%	-0,6339	-0,04%	0,86%	-0,4093	-0,06%	1,17%	-0,4906	-0,05%	1,21%	-0,5508
FTSE MIB	-0,06%	1,95%	-0,3006	0,01%	0,94%	0,1412	0,02%	1,21%	0,1455	0,00%	1,21%	0,0019
FTSE 100	-0,10%	1,69%	-0,596	-0,03%	0,87%	-0,2898	-0,03%	1,12%	-0,3123	-0,06%	1,11%	-0,653
FTSE Argentina General	-0,13%	3,44%	-0,3493	0,11%	3,04%	0,3269	0,23%	2,99%	0,7876	0,20%	2,69%	0,9234

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 5 contains the results of the mean comparison test during the pre, short, mid, and long event windows for the MENA timeline. It presents the number of trading days for each window, the mean returns, standard deviations, t-statistics, and statistical significance levels.

	Panel A: Comparison period From June 25, 2019 to February 14, 2020			Panel B: Pre-event window From February 15, 2020 to March 11, 2020				Panel C: Short event window From March 12, 2020 to March 24, 2020				Panel D: Mid event window From March 12, 2020 to June 11, 2020				Panel E: Long event window From March 12, 2020 to November 22, 2020			
	Number of trading days	Event group's mean	Event group's std. dev.	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value
ADX General	161	0,01%	0,68%	20	-1,20%	1,25%	-4,2437***	8	-0,74%	1,37%	-1,5156	63	0,06%	1,71%	0,2469	174	0,14%	1,38%	0,9471
Bahrain All Share	157	0,09%	0,44%	20	-0,80%	0,79%	-4,4752***	8	-0,75%	0,54%	-4,016***	60	-0,27%	0,58%	-3,1781**	167	-0,07%	0,57%	-1,1810
BIST 100	162	-0,43%	1,17%	19	2,60%	2,03%	5,7372***	8	1,03%	1,54%	1,8735*	94	-0,16%	1,57%	-0,7907	172	0,65%	1,44%	4,1858
FTSE Coast Kuwait 40	131	0,07%	0,95%	14	-1,87%	1,90%	-3,6529**	6	-0,44%	1,45%	-0,7362	51	0,06%	1,61%	0,2147	146	0,03%	1,31%	0,1777
Tadawul All Share	162	-0,05%	0,09%	20	-0,96%	1,40%	2,9515**	8	-0,24%	1,05%	-0,6197	62	0,19%	1,25%	1,0431	171	0,22%	1,11%	1,7911
Tunindex	163	-0,02%	0,32%	19	-0,23%	0,37%	-2,5502**	7	-1,04%	0,60%	-4,8143***	61	-0,06%	0,61%	-0,6168	171	0,00%	0,57%	-0,0509
Moroccan All Shares	158	0,05%	0,49%	20	-0,88%	0,99%	-3,8933***	8	-0,64%	1,08%	-1,6529	61	-0,16%	1,02%	-1,055	170	-0,08%	0,91%	-0,2825
MSM 30	138	0,03%	0,43%	20	-0,52%	0,70%	-3,2009**	8	-0,73%	0,47%	-4,1789**	50	-1,42%	4,60%	-1,8812*	157	-0,45%	3,68%	-1,0543
QE General	144	-0,05%	0,75%	19	-0,85%	1,20%	-2,971**	8	0,11%	8,20%	0,3657	48	0,30%	1,01%	1,7933*	160	0,19%	0,89%	1,8738
EGX 70 EWI	139	0,01%	1,22%	19	-0,74%	1,40%	2,2008**	8	-2,27%	1,64%	-4,0031**	58	3,27%	1,96%	0,9683	153	0,40%	1,84%	1,8084
Bovespa	162	0,08%	1,14%	17	-2,59%	2,12%	-5,1243***	8	-0,20%	2,25%	-0,2411	61	0,45%	2,40%	1,2505	174	0,19%	2,15%	0,7895
BSE Sensex 30	160	0,04%	0,93%	17	-1,35%	1,21%	-4,6475***	8	-2,39%	1,68%	-4,1151**	59	0,06%	1,98%	0,2095	174	0,15%	1,71%	0,8255
CAC 40	166	0,06%	0,85%	19	-2,12%	1,49%	-6,5080***	8	0,66%	1,34%	1,3592	62	0,26%	1,64%	1,0703	178	0,13%	1,57%	0,7808
MOEX Russia	164	0,07%	0,72%	17	-1,80%	1,25%	-6,1870***	8	0,72%	1,21%	1,6508	63	0,24%	1,33%	1,2311	175	0,10%	1,23%	0,7828
S&P 500	163	0,09%	0,77%	18	-1,72%	1,48%	-4,9737***	8	0,00%	1,72%	0,0008	63	0,27%	1,88%	0,9731	177	0,14%	1,67%	0,7740
SMSI	163	0,04%	0,81%	19	-2,26%	1,54%	-6,7162***	8	0,60%	1,32%	1,2553	62	0,12%	1,27%	0,6241	166	0,08%	1,37%	0,5488
FTSE MIB	163	0,10%	0,98%	19	-2,65%	1,90%	-6,3654***	8	1,62%	1,40%	3,2879**	62	0,15%	1,35%	0,7389	166	0,07%	1,37%	0,4317
FTSE 100	163	0,02%	0,75%	19	-1,76%	1,32%	-6,0486*	8	0,25%	1,18%	0,5953	61	0,19%	1,18%	1,0862	164	0,08%	1,19%	0,6450
FTSE Argentina General	160	0,08%	4,18%	17	-1,88%	4,29%	-1,7279	6	-2,71%	4,36%	0,1343	59	0,83%	4,04%	1,3465	159	0,43%	3,64%	1,0637

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 6. Contains results of non-Parametric Mann–Whitney tests during the pre, short, mid, and long event windows for the MENA timeline. It presents the number of trading days for each window, the median returns, Z-statistics, and statistical significance levels.

	Panel A: Comparison period From June 25, 2019 to February 14, 2020		Panel B: Pre-event window From February 15, 2020 to March 11, 2020			Panel C: Short event window From March 12, 2020 to March 24, 2020			Panel D: Mid event window From March 12, 2020 to June 11, 2020			Panel E: Long event window From March 12, 2020 to November 22, 2020		
	Number of trading days	Median return	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value	Number of trading days	Median return	Event group's z-value
ADX General	147	-0,03%	20	-0,55%	-1,580	8	-2,49%	-1,199	63	0,17%	0,508	161	0,13%	1,621
Bahrain All Share	143	0,063%	20	-0,14%	-2,480**	8	-1,05%	-3,300**	60	-0,21%	-3,285*	167	0,01%	-1,329
BIST 100	147	-0,48%	19	0,87%	2,536**	8	0,72%	0,942**	94	-0,78%	-1,709**	172	0,36%	5,860
FTSE Coast Kuwait 40	119	0,09%	14	-0,38%	-1,874	6	0,74%	0,936	51	0,25%	0,910*	146	0,05%	0,569***
Tadawul All Share	148	0,05%	20	-0,45%	-1,804*	8	-0,16%	0,015	62	0,32%	2,175	171	0,19%	2,795
Tunindex	148	-0,03%	19	-0,01%	-0,950	7	-0,33%	-0,545	61	0,09%	1,435**	171	0,06%	1,433**
Moroccan All Shares	143	0,00%	20	-0,51%	-3,482**	8	0,79%	0,090*	61	0,04%	-0,278	170	0,01%	-0,026
MSM 30	124	0,01%	20	0,12%	-0,152	8	-0,58%	-2,500*	50	-0,20%	-2,199**	157	-0,04%	-1,210
QE General	131	-0,05%	19	-0,41%	-1,200	8	0,98%	1,310	48	0,43%	2,015**	160	0,13%	2,253**
EGX 70 EWI	127	0,07%	19	-0,09%	-1,077	8	-3,01%	-1,417	58	0,92%	3,341**	149	0,65%	3,984**
Bovespa	162	0,02%	17	-0,97%	-1,860*	8	0,70%	0,103	61	1,08%	1,381	174	-0,01%	0,925
BSE Sensex 30	160	0,07%	17	-0,47%	-2,609**	8	-2,37%	-1,199	59	0,30%	0,998	174	0,30%	2,475
CAC 40	166	0,09%	19	-0,89%	-3,161**	8	2,16%	1,193	62	0,42%	1,537	178	0,02%	0,425
MOEX Russia	164	0,04%	17	-0,65%	-2,393*	8	-0,32%	-0,015	63	0,24%	1,207	175	0,12%	0,723
S&P 500	163	0,12%	18	-1,50%	-3,446**	8	-1,35%	-0,336	63	0,30%	1,179	177	0,24%	1,575
SMSI	166	0,035%	19	-1,41%	-2,929**	8	1,24%	0,929	62	0,28%	0,784	166	0,03%	0,013
FTSE MIB	163	0,09%	19	-1,49%	-2,938**	8	1,97%	1,309	62	0,40%	1,362	166	0,19%	0,502
FTSE 100	165	0,05%	19	-0,68%	-2,441**	8	1,25%	1,053	61	0,28%	1,604	164	0,10%	0,622
FTSE Argentina General	160	0,15%	17	-1,40%	-1,842*	6	0,06%	-0,225	59	0,77%	1,288	159	0,55%	0,835

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 7 contains the results of the comparison of the performance of the selected MENA stock market indices with the performance of the S&P Pan Arab Composite Index and the performance of the selected world countries' market indices with the performance of the S&P 1200 Global Index for the pre-, short, mid, and long event windows of the MENA timeline using t-tests.

	Panel A: Pre-event window From February 15, 2020 to March 11, 2020			Panel B: Short event window From March 12, 2020 to March 24,,2020			Panel C: Mid event window From March 12, 2020 to June 11, 2020			Panel D: Long event window From March 12, 2020 to November 22, 2020		
	Mean	Std. dev	t	Mean	Std. dev	t	Mean	Std. dev	t	Mean	Std. Dev	t
ADX General	-0,16%	1,14%	-0,1366	0,00%	1,04%	0,0427	-0 05%	1,29%	-0,0044	0,03%	1,06%	0,4305
Bahrain All Share	0,11%	0,94%	1,1500	0,09%	0,63%	1,2995	-0,01%	0,72%	-0,2011	0,00%	0,65%	0,0366
BIST 100	-0,05%	1,56%	-0,2969	-0,34%	1,16%	-2,9512**	-0,51%	1,26%	-4,8277***	-0,14%	1,10%	-1,7951
FTSE Coast Kuwait 40	0,00%	1,44%	0,0264	0,09%	1,05%	0,7680	0,07%	1,19%	0,5802	0,04%	1,00%	0,5443
Tadawul All Share	-0,04%	1,21%	-0,3607	-0,03%	0,87%	-0,2977	-0,02%	1,02%	-0,2174	0,02%	0,91%	0,2278
Tunindex	0,09%	0,81%	1,0932	-0,01%	0,65%	-0,1209	-0,04%	0,72%	-0,5963	-0,05%	0,66%	-0,9886
Moroccan All Shares	0,07%	1,02%	0,6480	0,06%	0,88%	0,6271	-0,02%	0,91%	-0,1894	-0,01%	0,81%	-0,1257
MSM 30	0,08%	0,91%	0,7940	0,03%	0,61%	0,4326	-0,37%	2,98%	-1,3243	-0,26%	2,43%	-1,4007
QE General	-0,39%	1,11%	-0,3428	-0,01%	7,46%	-0,1506	-0,03%	0,90%	-0,0041	0,00%	0,79%	0,0379
EGX 70 EWI	0,03%	1,20%	0,2617	-0,08%	1,17%	-0,6304	0,07%	1,39%	0,5027	0,17%	1,30%	1,6725
Bovespa	-0,97%	4,37%	-0,6558	0,01%	7,72%	0,0021	0,21%	3,48%	0,3360	0,05%	2,31%	0,2199
BSE Sensex 30	0,23%	2,77%	0,2479	-2,22%	6,11%	-0,7163	-0,22%	3,09%	-0,3865	-0,01%	1,99%	-0,0663
CAC 40	-0,51%	3,24%	-0,4762	0,85%	5,43%	0,3032	0,01%	2,73%	0,0107	-0,01%	1,90%	-0,0684
MOEX Russia	-0,18%	3,04%	-0,1709	0,92%	5,24%	0,3403	0,00%	2,46%	-0,0037	-0,03%	1,67%	-0,1651
S&P 500	-0,08%	3,45%	-0,0736	0,22%	6,62%	0,0636	0,04%	3,01%	0,0802	0,02%	0,01%	0,1028
SMSI	-0,09%	1,39%	-0,6279	0,01%	1,32%	0,1018	0,06%	1,39%	-0,4690	-0,06%	1,35%	-0,5309
FTSE MIB	-0,08%	1,59%	-0,476	0,12%	1,37%	0,8086	0,01%	1,43%	0,0413	-0,01%	1,36%	-0,0530
FTSE 100	-0,07%	1,27%	-0,5242	-0,03%	1,26%	-0,2268	-0,07%	1,35%	-0,5323	-0,08%	1,27%	-0,7968
FTSE Argentina General	0,00%	3,12%	0,0014	-0,07%	3,18%	-0,2094	0,17%	3,01%	0,6016	0,16%	2,70%	0,7696

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 8 contains the results of the mean comparison test during the pre, short, mid, and long event windows for the world timeline. It presents the number of trading days for each window, the mean returns, standard deviations, t-statistics, and statistical significance levels.

	Panel A: Comparison period			Panel B: Pre-event window				Panel C: Short event window				Panel D: Mid event window				Panel E: Long event window			
	From June 25, 2019 to January 29, 2020			From January 30, 2020 to March 10, 2020				From March 11, 2020 to March 22, 2020				From March 11, 2020 to June 9, 2020				From March 11, 2020 to November 22, 2020			
	Number of trading days	Event group's mean	Event group's std. dev.	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value	Number of trading days	Event group's mean	Event group's std. dev.	Event group's t-value
ADX General	150	0,02%	0,70%	29	-0,66%	1,13%	-2,9207***	8	-2,14%	1,43%	-4,3620***	62	0,05%	1,76%	0,1908	176	0,08%	1,46%	0,4854
Bahrain All Share	147	0,09%	0,45%	29	-0,44%	0,74%	-2,9819***	8	-0,93%	0,60%	-4,4753***	60	-0,34%	0,64%	-3,5599***	169	-0,10%	0,61%	-1,4750
BIST 100	150	0,16%	1,23%	29	-0,72%	1,40%	-2,5948**	8	-2,12%	1,50%	-4,0857***	60	-0,01%	1,52%	-0,0372	174	0,01%	1,49%	0,0562
FTSE Coast Kuwait 40	122	0,10%	0,96%	21	-1,49%	1,91%	-3,4089***	7	-3,68%	0,79%	-4,6301***	50	0,09%	1,65%	0,3279	148	0,03%	1,48%	0,1404
Tadawul All Share	151	-0,03%	0,90%	29	-0,59%	1,38%	-2,1413**	8	-1,07%	1,06%	-2,8439***	60	0,18%	1,27%	0,9337	172	0,18%	1,13%	1,3990
Tunindex	151	-0,01%	0,33%	29	-0,09%	0,35%	-1,1844	7	-1,56%	0,60%	-7,8924***	60	-0,05%	0,63%	-0,4898	173	0,00%	0,58%	-0,0229
Moroccan All Shares	148	0,07%	0,48%	29	-0,38%	0,90%	-2,1447**	8	-2,14%	1,28%	-5,2353***	64	-0,25%	1,23%	-1,3383	173	-0,08%	1,08%	-0,6717
MSM 30	146	0,03%	0,45%	29	-0,26%	0,65%	-2,0365**	7	-0,91%	0,54%	-4,6940***	61	-0,15%	6,10%	-1,6064	170	-0,06%	0,55%	-0,9132
QE General	121	0,01%	1,01%	22	-0,82%	1,55%	-2,3250**	6	0,67%	1,13%	1,4182	48	0,15%	1,34%	0,6405	139	0,08%	1,18%	0,5340
EGX 70 EWI	147	0,00%	1,14%	29	-0,68%	1,35%	-2,5451	7	-1,81%	1,65%	-2,904***	57	0,01%	1,69%	0,0448	166	-0,01%	1,48%	0,0297
Bovespa	150	0,09%	1,13%	26	-0,88%	1,71%	-2,4586**	8	-3,52%	2,52%	-4,0261***	62	0,10%	2,71%	0,2320	176	0,04%	2,37%	0,1560
BSE Sensex 30	147	0,04%	0,91%	28	-0,54%	1,05%	-2,5657**	8	-2,08%	1,49%	-4,0285***	59	-0,05%	2,09%	-0,1660	176	0,11%	1,79%	0,5267
CAC 40	154	0,05%	0,84%	29	-0,89%	1,19%	-3,8228***	8	-1,57%	1,52%	-2,9176***	62	0,15%	1,84%	0,5424	180	0,07%	1,72%	0,3516
MOEX Russia	152	0,08%	0,72%	27	-0,89%	1,10%	-4,0500***	8	-0,84%	1,25%	-1,8718*	63	0,12%	1,47%	0,5640	177	0,04%	1,33%	0,2886
S&P 500	151	0,07%	0,76%	28	-0,49%	1,26%	-1,9144*	8	-2,59%	1,80%	-4,1634***	63	0,16%	2,02%	0,5255	179	0,07%	1,79%	0,3639
SMSI	154	0,02%	0,80%	29	-0,84%	1,16%	-3,7142***	8	-1,70%	1,61%	-2,9864***	62	0,08%	1,82%	0,2946	180	0,04%	1,76%	0,2014
FTSE MIB	151	0,09%	0,97%	29	-1,09%	1,44%	-3,8753***	8	-1,42%	1,83%	-2,1552**	62	0,15%	1,97%	0,4874	180	0,05%	1,82%	0,2326
FTSE 100	153	0,02%	0,75%	29	-0,77%	1,06%	-3,6885***	8	-1,8814	1,25	-4,3785***	61	0,11%	1,64%	0,4319	178	0,04%	1,52%	0,2376
FTSE Argentina General	148	0,01%	4,32%	27	-0,88%	4,24%	-0,9886	8	-3,91%	4,56%	-2,3987**	58	0,56%	4,39%	0,8248	171	0,20%	3,89%	0,4560

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 9 contains results of non-parametric Mann–Whitney tests during the pre, short, mid, and long event windows for the world timeline. It presents the number of trading days for each window, the median returns, Z-statistics, and statistical significance levels.

	Panel A: Comparison period		Panel B: Pre-event window			Panel C: Short event window			Panel D: Mid event window			Panel E: Long event window		
	From June 25, 2019 to January 29, 2020		From January 30, 2020 to March 10, 2020			From March 11, 2020 to March 22, 2020			From March 11, 2020 to June 9, 2020			From March 11, 2020 to November 22, 2020		
	Number of trading days	median return	Number of trading days	median return	Event group's z-value	Number of trading days	Event group's mean	Event group's z-value	Number of trading days	Event group's mean	Event group's z-value	Number of trading days	Event group's mean	Event group's z-value
ADX General	150	-0,03%	29	-0,14%	-1.707*	8	-2,71%	-2.228**	62	0,21%	0.428	176	0,15%	1.193
Bahrain All Share	147	0,06%	29	-0,05%	-1.537	8	-1,11%	-3.276***	60	-0,31%	-3.550***	169	-0,06%	-1.487
BIST 100	150	0,20%	29	-0,51%	-1.777*	8	-1,05%	-1.784*	60	0,18%	0.623	174	0,15%	0.790
FTSE Coast Kuwait 40	122	0,11%	21	-0,51%	-2.755***	7	-0,05%	-0.634	50	0,24%	1.187	148	-0,05%	0.521
Tadawul All Share	151	0,08%	29	-0,54%	-1.745*	8	-1,39%	-1.182	60	0,35%	2.127**	172	0,11%	2.378**
Tunindex	151	-0,04%	29	0,09%	-0.064	7	-1,45%	-1.821*	60	0,12%	1.475	173	0,10%	1.522
Moroccan All Shares	121	0,09%	29	-0,33%	-2.322**	8	-2,22%	-2.001**	64	0,11%	-0.128	173	0,05%	-0.160
MSM 30	140	0,00%	29	0,09%	0.317	7	-1,10%	-2.061**	61	-0,12%	-1.570	170	-0,04%	-0.993
QE General	148	0,04%	22	-0,33%	-1.371	6	1,54%	2.17**	48	0,38%	1.426	139	0,22%	0.961
EGX 70 EWI	147	-0,05%	29	-0,08%	-1.262	7	-2,41%	-1.245	57	0,34%	0.411	166	0,02%	-0.039
Bovespa	150	0,02%	26	-0,88%	-1.359	8	-4,58%	-1.094	62	1,05%	1.125	176	-0,02%	0.657
BSE Sensex 30	147	0,09%	28	-0,47%	-1.673*	8	-2,39%	-1.707*	59	0,15%	0.870	176	0,28%	2.330**
CAC 40	154	0,09%	29	-0,33%	-1.762*	8	0,54%	0.170	62	0,42%	1.559	180	0,01%	0.304
MOEX Russia	152	0,07%	27	-0,46%	-2.104**	8	-1,12%	-0.775	63	0,22%	1.139	177	0,08%	0.474
S&P 500	151	0,09%	28	-0,31%	-1.334	8	-4,70%	-1.521	63	0,34%	1.159	179	0,27%	1.473
SMSI	154	-0,03%	29	0,01%	-1.016	8	0,20%	0.138	62	0,53%	1.312	180	0,04%	0.144
FTSE MIB	151	0,06%	29	-0,05%	-1.430	8	1,02%	0.701	62	0,61%	1.907*	180	0,23%	0.733
FTSE 100	153	0,05%	29	-0,22%	-1.470	8	-0,20%	-0.093	61	0,65%	1.784*	178	0,15%	0.755
FTSE Argentina General	148	0,19%	27	-0,51%	-1.454	8	-2,38%	-1.334	58	1,04%	1.312	171	0,54%	0.293

Note: *, **, *** indicates statistical significance at 1, 5 and 10% , respectively.

Table 10 contains the results of the comparison of the performance of the selected world market indices with the performance of the S&P Pan Arab Composite index and the performance of the selected world market indices with the performance of the S&P 1200 Global Index for the pre-, short, mid, and long event windows of the world timeline using t-tests.

	Panel A: Pre-event window			Panel B: Short event window			Panel C: Mid event window			Panel D: Long event window		
	From January 30, 2020 to March 10, 2020			From March 11, 2020 to March 22, 2020			From March 11, 2020 to June 9, 2020			From March 11, 2020 to November 22, 2020		
	Mean	Std. Dev	t	Mean	Std. dev	t	Mean	Std. dev	t	Mean	Std. dev	t
ADX General	-0,30%	1,91%	-0,6947	-1,21%	3,91%	-0,6438	-0,01%	2,28%	-0,0134	0,02%	1,42%	0,1280
Bahrain All Share	-0,02%	1,65%	-0,0450	0,07%	1,87%	0,0751	-0,33%	1,19%	-1,6164	-0,09%	0,82%	-1,1153
BIST 100	-0,23%	1,80%	-0,5595	-1,06%	2,88%	-0,7672	0,07%	1,71%	0,2505	0,09%	1,31%	0,6589
FTSE Coast Kuwait 40	-1,05%	2,63%	-1,5953	-0,12%	3,53%	-0,0663	0,11%	1,97%	0,3188	0,04%	1,34%	0,3120
Tadawul All Share	-0,29%	2,09%	-0,6041	-0,20%	2,30%	-0,1773	0,07%	1,62%	0,2684	0,07%	1,09%	0,5876
Tunindex	0,24%	1,45%	0,7431	-0,66%	2,03%	-0,6481	-0,13%	1,23%	-0,6190	-0,09%	0,83%	-1,0688
Moroccan All Shares	0,01%	1,79%	0,0329	-1,17%	3,49%	-0,6941	-0,26%	1,73%	-0,8751	-0,10%	1,15%	-0,8311
MSM 30	0,10%	1,59%	0,2677	0,02%	1,75%	0,0233	-0,20%	1,17%	-0,9858	-0,11%	0,79%	-1,3598
QE General	-0,48%	2,18%	-0,8845	1,58%	2,39%	1,1333	0,08%	1,60%	0,2675	0,06%	1,07%	0,0531
EGX 70 EWI	-0,35%	1,83%	-0,8529	-0,91%	3,94%	-0,4553	-0,06%	1,99%	-0,1857	-0,86%	1,32%	-0,6339
Bovespa	-0,32%	2,80%	-0,4138	-0,94%	7,90%	-0,2305	-0,02%	3,88%	-0,0227	0,00%	2,54%	-0,0164
BSE Sensex 30	-0,03%	1,78%	-0,0543	0,45%	5,21%	0,1669	-0,21%	3,27%	-0,3590	0,01%	2,10%	0,0569
CAC 40	-0,36%	2,09%	-0,6472	0,97%	5,58%	0,3383	0,01%	3,03%	0,0105	-0,01%	2,07%	-0,0592
MOEX Russia	-0,33%	2,07%	-0,5874	1,73%	5,13%	0,6630	0,01%	2,69%	0,0236	-0,01%	1,81%	-0,0269
S&P 500	0,06%	2,34%	0,0967	-0,03%	6,29%	-0,0078	0,03%	3,22%	0,0610	0,01%	2,13%	0,0579
SMSI	-0,52%	2,38%	-0,8296	1,17%	6,32%	0,3582	0,04%	3,11%	0,0659	0,00%	2,12%	0,0156
FTSE MIB	-0,34%	2,09%	-0,6200	0,81%	5,90%	0,2650	-0,10%	3,02%	-0,1776	-0,07%	2,11%	-0,3272
FTSE 100	-0,27%	1,98%	-0,5133	0,63%	4,89%	0,2501	-0,07%	2,87%	-0,1362	-0,07%	1,94%	-0,3560
FTSE Argentina General	-0,28%	2,95%	-0,3479	-1,30%	6,28%	-0,4023	0,48%	3,77%	0,7090	0,19%	2,79%	0,6318

Table 9. Differences in median returns of the world timeline.

These results partially confirm the findings obtained in table 8. We notice that the selected world market indices underperformed their comparison periods during the pre-event period (Panel B) except for SMSI. However, the negative impact is statistically significant only for BSE Sensex 30 and CAC 40 (at the 10% level), and MOEX Russia (at the 5% level). And, 50% of the selected MENA market indices significantly underperformed the comparison period: the negative impact is statistically significant for ADX general, BIST100, Tadawul all shares and FTSE coast Kuwait 40 at 10% level and Moroccan all shares at 5% level.

The results of the panel (C) show that during the short period, some indices underperformed their comparison period, namely, Bovespa, BSE Sensex 30, MOEX Russia, S&P 500, and BYMA Argentina General (IBG), and the FTSE 100. But, only the BSE Sensex 30 shows a significant underperformance at the 10% level of significance. However, most of the MENA stock markets indices significantly underperformed their comparison period, namely Bahrain all share (at 1% level), ADX general, Moroccan all shares, MSM30 and QE general, Tunindex, and BIST100 (at 10% level).

Results obtained in Panels B et C confirm the existence of a limited negative impact of the covid-19 outbreak on the selected world stock markets. And in turn, this impact has spillover effects on half of the selected MENA stock markets including the UAE. So, we conclude that the impact of covid-19 on stock markets has bidirectional spill-over effects between Mena countries and Asian, European, and American countries.

Panels D and E compare the returns of the mid-period and the long period respectively with the comparison period. The results obtained show that no significant negative impact was observed during the mid or long period for both selected world and Mena stock markets excepting Bahrain all share which underperformed its comparison period during the mid-period at 1% level.

We conclude that the results of non-parametric Mann-Whitney tests during the pre, short, mid, and long event windows for the world timeline show that the negative impact of covid-19 on the selected world stock markets as well as its spillover effect on the selected MENA stock markets including the UAE are limited and is not long-term persistent.

Table 10. Returns relative to the S&P Pan Arab Composite index and the S&P 1200 Global Index of the world timeline

The results obtained in table 10 show that there is no statistically significant difference between the performance of the selected world market indices and the performance of the S&P 1200 Global Index and between the performance of the Mena market indices and the performance of the S&P Pan Arab Composite index for the pre-, short, mid, and long event windows of the world timeline. This is consistent with the results obtained from Tables 4 and 7. There is no evidence that covid-19 has a negative impact on the major stock indices in selected countries compared with the S&P 1200 Global Index and the S&P Pan Arab Composite index. So, we confirm the limited impact of covid-19 on the stock markets.

According to the results of our empirical study in the world timeline in the third part of this section, all stock markets are negatively and significantly affected by the appearance of Covid-19 in the world, and this negative impact worsened during the short period following the outbreak of the epidemic in the world. This negative impact disappears during the mid and long period. So, we can conclude that the negative impact of covid-19 on the stock markets of selected world countries as well as its spillover effects on the MENA stock markets including the UAE are not long-term persistent.

5. CONCLUSION

As Covid-19 spreads quickly, the government has taken some measures to prevent the propagation of the pandemic, which has as a consequence a global supply shock in the manufacturing sector. Loss of more than 10 trillion dollars in the global economy. This is the principal cause of panic in the financial markets worldwide.

This paper tends to investigate empirically the direct and spillover effects of Covid-19 on the stock markets using daily returns on data of selected MENA and world stock markets. To this end, we established three covid-19 outbreak timelines namely: UAE, MENA, and world timelines. The main timelines are related to important events related to the outbreak of Covid-19 in the UAE, the MENA region, and the world. Then, by examining the mean and median returns of the indices during the different periods of the three timelines using the t-tests and Mann – Whitney non-parametric tests, we examined the covid-19 separate impacts on the stock markets of the UAE, selected MENA countries, and selected World countries as represented by their stock market indices and we studied the covid-19 outbreak bidirectional spillover effect on these stock indices. Finally, we compared the returns of the UAE and the selected MENA market indices to the returns of the S&P Pan Arab Composite index and the returns of the selected world market indices to the S&P 1200 Global Index returns, to determine if the affected stock markets' performance is significantly below the global average.

The UAE and MENA timelines results show that the outbreak of Covid-19 in the UAE and MENA, during the pre and short periods, had a negative but limited direct impact on the MENA region stock market and this negative impact has spill-over effects on American, Asian, and European stock markets only during the pre-event period. Then, we conclude that the impact of the outbreak of Covid-19 in the UAE whether on the selected world or MENA stock markets is limited and is not long-term persistent. Finally, there is no evidence that Covid-19 has a negative impact on the major stock indices in these countries compared with The S&P Pan Arab Composite index and the S&P 1200 Global Index.

The world timeline results show that all stock markets are negatively and significantly affected by the appearance of Covid-19 in the world, and the negative impact became most important during the short period following the outbreak of the epidemic in the world. This negative impact disappears during the mid and long period. Then, we concluded that the impact of Covid-19 on stock markets has bidirectional spill-over effects between MENA countries and Asian, European, and American countries only during the pre-event and short

periods. So that, the covid-19 outbreak spillover effects on stock markets are not long-term persistent.

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