DECISIONS REGARDING THE ROLE OF BAD NEWS AND ASYMMETRIC EFFECTS IN THE MIDDLE EAST STOCK MARKETS

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Abstract

This paper aims to study the impact of the COVID-19 pandemic, the Russian invasion of Ukraine, and the Turkey-Syria earthquake on the Middle East's developed, emerging, and frontier markets. For this purpose, panel data of nine Middle East financial markets listed in Morgan Stanley from January 2, 2018, to July 27, 2023, were analyzed using multi-criteria. In the event study, two approaches were deducted to analyze the price impact: 1) a standard event study and 2) an independent sample, following Brown and Warner (1985). The generalized autoregressive conditional heteroskedasticity (GARCH) group captures asymmetric and leverage effects. The results show volatility in financial market index returns and the impact of bad news and leverage in all markets. However, this effect is asymmetric across markets, indicating a low integration. Moreover, the negative impact of COVID-19 was more pronounced than that of both the Russian invasion of Ukraine and the Turkey-Syria earthquake. This study's findings can help investors make informed investment decisions and select optimal portfolios. It will also add to the existing body of knowledge by shedding new light on the factors that influence stock price volatility and risk management in Middle Eastern international fiscal issues.

Keywords: Financial Risk, COVID-19, Russian Invasion of Ukraine, Turkey-Syria Earthquake, Event Studies, GARCH Group

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1. INTRODUCTION

Pandemics, wars, and conditions of instability have occurred in countries around the world since 2019. Starting with COVID-19, economic and social losses remained. Companies operating in the Middle East have been severely affected by the shock of COVID-19, similar to their counterparts worldwide. More than two years after the outbreak of this pandemic, it seems that the recovery of companies in the Middle East, Arab Gulf countries, and North Africa is surrounded by many doubts. However, compared to other regions, the impact on these companies differs in some unique ways (Zhao et al., 2023). Changes have occurred in business dealings and social interactions. A survey conducted by the World Bank on 50 countries in the Middle East and North Africa (MENA) reported companies' exposure to financial hardship, loss of revenue, job losses, and business closures. The decline in revenue led to financial hardships for most companies. For example, 93% of companies in Jordan faced a decline in cash flow, which led to delays in fulfilling their financial obligations. It was also found that the average decrease in sales was recorded at 50% in the first and second rounds of the pandemic; service sector companies were the most affected, and 17% of companies liquidated their businesses during the second wave of the pandemic (World Bank, 2021).

After COVID-19 receded to some extent, the Russian invasion of Ukraine began in late February 2022. As a result, global stock markets faced additional uncertainty regarding those related to the COVID-19 pandemic. The ongoing war in Ukraine has weakened the prospects for post-pandemic economic recovery for emerging and developing market economies in Europe and Central Asia. The World Bank (2022) report confirmed that the global economy continues to suffer from weakness due to the war through major disruptions in trade and food and fuel price shocks, all of which contribute to high inflation rates and the subsequent tightening of global financing conditions (World Bank, 2022). The macroeconomic impact is primarily seen by J. P. Morgan (2022) research through commodity markets, while the financial ties between Russia and the rest of the world are relatively smaller. Boungou and Yatié (2022a) concluded a negative impact on global financial markets.

Another major event occurred on February 6, 2023, and the media called it the earthquake of the century, as it caused large human and material losses in both Turkey and Syria. The outcome of these losses is huge in terms of lives and properties. To the best of our knowledge, no empirical studies are exploring the impact of the earthquake on Middle East stock markets. This study attempted to bridge this gap.

According to financial and behavioral finance theories, share prices are a good measure of a company's performance and shareholders' returns. Hence, the movement of stock prices is a function of the determinants of the company and the capital market (Kumar et al., 2021). Any financial or incidental occurrence affects investors' perceptions, which, in proper sequence, influences stock prices. It is concluded that optimistic perceptions reduce return volatility, while pessimism amplifies earnings volatility (Lee et al., 2002).

At least two factors contributed to the significance of this study's findings. First, they aid in understanding the financial consequences of the ongoing pandemic and conflict, allowing investors, portfolio managers, and policymakers to devise effective financial strategies. Second, by considering three distinct crises — the COVID-19 pandemic, the Russian invasion of Ukraine, and the Turkey-Syria earthquake — this research expands previous studies on the relationship between health pandemics, wars, natural disasters, and stock markets, which primarily focused on one type of crisis, such as World War II (Goel et al., 2017) or focused on developed, developing, and global financial markets (Kumar et al., 2021; Lento & Gradojevic, 2021; Pagnottoni et al., 2021), or study climate geophysical disasters (Franco et al., 2019; Rayamajhee & Bohara, 2019; Jha et al., 2021; Pagnottoni et al., 2022).

COVID-19 as a surprise health crisis, the Russian invasion of Ukraine as a geopolitical crisis, and the Turkey-Syria earthquake in 2023 are significant systematic risks for financial markets. The Middle East stock markets provide a unique financial market context in which to analyze the linkage between different types of systematic risks (COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake) and the performance of the financial markets. MENA stock markets are characterized by dominant state ownership, low regional and international integration, moderate competition for listings, young markets dominated by a few sectors, high levels of retail investment, and diversification of financial products (Amico (Koldertsova) & Celik, 2012). Some of these characteristics may be considered challenges facing regulators in improving corporate governance. For example, concentrated and complex ownership of listed firms (50% of the total market is state ownership). Therefore, regulators varied between stock exchanges and securities regulators (e.g., Oman and the Kingdom of Saudi Arabia (KSA)). In light of the systematic risk confronting financial markets, this adds a burden on regulators. The Middle Eastern financial markets are in a strategic region. The financial markets in the Middle East refer to either rich countries, such as the Arab Gulf states, or poor ones, such as Yemen. It is a politically unstable region, and this is what makes studying the performance of financial markets remarkable, as the performance of these markets may differ from others. Some of these markets are emerging (e.g., Egypt, Kuwait, Qatar, the KSA, Turkey, and the UAE), and some are frontiers (e.g., Jordan, Bahrain, and Oman) (Morgan Stanley Capital International [MSCI], n.d.)

Therefore, this study aims to investigate the volatility of the stock markets of Middle Eastern countries at the same time, with results that help policymakers and provide decision-makers with information to help companies adapt, recover, and sustain. In addition, it helps investors build and modify their portfolios regarding the financial markets' impacts on different crises. To achieve this study's aim, the author uses market indices. The author conducts two approaches a standard event study following Brown and Warner (1985) to analyze the price impact and the generalized autoregressive conditional heteroskedasticity (GARCH) group. In addition, the author compares the volatility results for the three crises.

To the best of the author's knowledge, no empirical research has been conducted on the impact of COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake on Middle East stock markets. This study attempts to bridge this gap.

The remainder of this paper is organized as follows. Section 2 reviews the relevant literature. Section 3 analyzes the methodology used to conduct empirical research on the impact of the COVID-19 pandemic, war, and earthquake on the indices of the Middle East stock markets. Section 4 presents the results of the study. Section 5 proposes the discussion. Finally, Section 6 concludes the paper.

2. LITERATURE REVIEW

Stock market volatility has been subject to many empirical studies in developed and emerging markets. Due to the tendency of stock prices to change unexpectedly (Bhowmik & Wang, 2020), so volatility is a feature of financial markets (Khan et al., 2023). The variance of the rate of return, or its square root, is commonly computed as market uncertainty. Volatility is associated with market uncertainty and influences the behavior of individual and institutional investors (Bhowmik & Wang, 2020). Studying the volatility of asset returns in the capital market is a central concern of contemporary financial research. On the other hand, forecasting perfect market volatility is a difficult process, and although numerous theories and approaches exist, few perform well in all stock markets. This explains why forecasting market returns and volatility presents a challenge for academics and financial analysts.

The relationship between volatility and uncertainty is the result of two assumptions: 1) the effect of leverage and 2) volatility feedback. The leverage effect is related to the news spread in the market; when it is unfavorable, it causes a decrease in the stock price, which in turn leads to an increase in the leverage factor, thus increasing stock volatility. At the same time, volatility feedback can be defined as unpredictable stock price volatility that would eventually result in elevated risk in the future (Bhowmik & Wang, 2020).

Different situations usually affect capital markets by confusing investors' judgments and affecting stock prices. Therefore, the author hypothesizes that the stock market responds to major events. Examples include manufacturing accidents (Akyildirim et al., 2021), sports (Buhagiar et al., 2018), environmental issues (Alsaifi et al., 2020; Guo et al., 2020; Worthington & Valadkhani, 2004; Seetharam, 2017) and political events (Boungou & Yatié, 2022a; Bash & Alsaifi, 2019).

2.1. The response of the financial markets to different events

Examining different pandemics, disasters, and wars as uncertain conditions is the focus of this research. Although various studies have been conducted previously, no one, according to the researcher's knowledge, has studied three different types of disasters simultaneously and in the same region, especially in the Middle East region. According to published research, most of the global markets witnessed negative stock returns, increased volatility, and cumulative abnormal returns (Alajlani et al., 2024; Barakat et al., 2022; Rakshit & Neog, 2022). The COVID-19 outbreak had a negative cumulative average abnormal return (CAAR) during various event windows for sample firms. According to Farooq et al. (2021), various markets and investors in developed nations offer notable long-term abnormal returns in the first 101 days. Businesses in developing nations were able to identify notable negative abnormal returns. Tuna and Tuna (2022) found permanent causality between stock markets and the number of COVID-19 cases. However, a CAAR temporary causality was not found in the short term. Ullah (2022) concluded that new COVID-19 daily cases and deaths adversely impacted daily market returns worldwide. The positive rate of new COVID-19 cases and the number of new COVID-19 daily tests positively impacted market returns. Insaidoo et al. (2021) studied the COVID-19 pandemic in Ghana's stock returns and found a negligible negative relationship. These findings support the hypothesis that the pandemic caused an 8.23% increase in market volatility. According to Othman et al. (2022), volatility persists in stock markets across developed, Asian, and Gulf Cooperation Council (GCC) countries. However, in several stock markets, it is below unity, indicating that volatility typically persists in the short term. According to Zhao et al. (2023), the effects of the COVID-19 pandemic on financial markets vary between developed and developing countries. It has a greater impact on the financial markets of developed nations owing to economic instability, decreased demand, and decreased supply. The three biggest effects in developing countries are changes in consumption patterns, confidence, and expectations, and the bandwagon effect. However, few studies have been conducted on natural disasters. Tay (2023) concluded in his review of climate change and stock markets that most studies focus on developed economies, and there is currently little information available regarding how investors evaluate climate threats. Pagnottoni et al. (2022) discovered that stock markets' reactions to natural hazard shocks varied based on the type of event occurring and its geographical location. The disaster categories that appeared to cause the most severe reactions in global financial markets were those related to climate change and biological disasters. Moreover, the examined stock indices react more strongly to shocks in European countries. Boungou and Yatié (2022b) documented a significantly negative impact of climate change on the performance of global stock indices. Jha et al. (2021) observed the heterogeneous effects of different disasters; finance responded differently to insured and uninsured risks and varied between countries.

One study, by Boungou and Yatié (2022a), examined the Russian invasion of Ukraine and found a negative relationship between the Russian invasion of Ukraine and world stock market returns (a sample of 94 countries). Therefore, we hypothesize the following:

H1: The Middle East stock markets respond to the major events of COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake.

2.2. The asymmetry role of bad news

Stock market volatility has been studied extensively in GARCH and autoregressive-moving-average (ARMA) models. Neokosmidis (2009) found that the exponential generalized autoregressive conditional heteroscedastic (EGARCH) model is the best predictor among other asymmetric models. Liu and Hung (2010) support the superiority of the EGARCH model, as they study the volatility asymmetry role in the S&P 100 stock index using GARCH models. Their study proved that the EGARCH model produced the most precise daily volatility forecasts. Negative shocks increase volatility more than positive shocks, as evidenced by (Okičić (2014) for Central and Eastern Europe, and good news affects the future stock market more than bad news, as proposed by Kumar and Biswal (2019) for Brazil, India, Indonesia, and Pakistan. Li and Wang (2013) tested the information symmetry and leverage effect in China's stock indices using ARMA, threshold GARCH (TGARCH), and EGARCH. All estimation models succeeded in clarifying volatility clustering. Hou (2013) studied the asymmetrical effect of bad news on Chinese stock indices. The results revealed an overestimation of volatility and returns in the high-volatility periods. In the Indian stock market, the leverage effect and volatility clustering were found from 2003 to 2015 (Varughese & Mathew, 2017). Volatility was determined by Gupta et al. (2014) using Indian Currency Market. Bhunia and Ganguly (2020) concluded the impact of bad news pre and during of COVID-19 on international stock markets. Therefore, this study hypothesizes the following.

H2: There is an asymmetric role for bad news resulting from COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake in the Middle East stock markets.

2.3. The leverage effects of the events

Other research has studied the leverage effect and/or volatility and concluded the existence of leverage effect pre and during COVID-19 on selected international stock markets (Bhunia & Ganguly, 2020). Zhou (2023) found a significant leverage effect in the American and Chinese markets and determined investors' "herd behavior". Ghorbel and Attafi (2014) studied the volatility in MENA stock markets from 2007 to 2012 using GARCH family models based on daily observations. The researchers noticed ordinary observations during the normal period. Simultaneously, the volatile period increases dependency between markets. Therefore, this study hypothesizes the following.

H3: There is a leverage effect of the three events in the Middle Eastern financial markets.

Based on its capacity to represent asymmetric volatility in the Middle East stock market, the GARCH group model was selected for this study (Neokosmidis, 2009; Liu & Hung, 2010; Varughese & Mathew, 2017; Kumar & Biswal, 2019). In this study, we adopted a multi-criteria approach. The event study for COVID-19, the Russian invasion of Ukraine, and the natural disaster of the recent earthquake that occurred in Turkey and Syria. The GARCH group, including EGARCH, was built to model the volatility of the Middle Eastern stock markets.

By employing the event study and GARCH group models and contrasting their results with those from other methods, such as the regression approach, this study seeks to add to the existing literature. The author hopes to obtain a more accurate assessment of the relationship between the World Index and Middle Eastern stock market indices by carrying out this in-depth analysis. Policymakers, investors, and market participants will benefit greatly from this study's findings, which will help them make wise decisions regarding risk management and investment strategies.

3. RESEARCH METHODOLOGY

This study adopts empirical research to examine the response of the Middle East stock markets to the major events of COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake, and to investigate the role of volatility asymmetry and capture the leverage effect of the incidents and events in the given financial market indices. An event study following Brown and Warner (1985) to analyze the price impact and the GARCH group (ARCH (GARCH) model, GARCH (1, 1), GARCH-M (1, 1), TGARCH, and exponential generalized ARCH (EGARCH) model) to capture the asymmetric role and effect of bad news on the Middle East stock markets. Other models can investigate market volatility (e.g., "stochastic volatility models" are used to capture volatility in options and risk management, "exponential moving average" is useful to make inferences in time-varying volatility; when using intraday data, "realized volatility" is the key; fractional integrated models used with long time-series for dynamic volatility), but when modeling time-varying volatility, the GARCH group becomes the standard methodology. Khan et al. (2023) concluded the suitability of the GARCH group to model the volatility evenly during COVID-19, whereas, EGARCH showed its superiority before the COVID-19 pandemic.

3.1. Data collection

This analysis was conducted at the country-day level. The panel data spans from January 2, 2018, to July 27, 2023, covering periods of major market turbulence, including COVID-19, the Russian invasion of Ukraine, and the Turkey-Syria earthquake. The data were collected from different secondary data to capture the integration impact of the three events. Daily Middle East stock index data were obtained from Investing.com ("MSCI all-country world equity index", n.d.) and the COVID-19 parameters were obtained from MSCI (n.d.)

This study uses two quantitative methods: 1) event study and 2) GARCH group. For the event study, the data was divided into three windows; 25 trading days pre-event day, the event day, and 25 days after the event (excluding weekends), and an estimation period of 250 days, following Boungou and Yatié (2022a) and Kamal et al. (2023). For the Russian invasion of Ukraine, Pretorius (2023) considered the event day two days earlier than February 24, 2022, as there were signs that an invasion was imminent. The same criteria were followed for the Turkey-Syria earthquake, the event day was February 6, 2023. For COVID-19, the date of the first confirmed positive case for each country was used as an event day, as in Table 1.

This study examines the impact of the COVID-19 pandemic and two other events using Global Indices of the Middle East capital market listed by MSCI: 1) MSCI Egypt (*E*), 2) MSCI Israel (*D*), 3) MSCI Jordan (*F*), 4) MSCI Oman (*F*), 5) MSCI Qatar (*E*), 6) MSCI United Arab Emirates (*E*), 7) MSCI Saudi Arabia Tadawul shares (*E*), 8) MSCI Kuwait (*E*), and 9) MSCI Bahrain (*F*). The MSCI All Country World Index (ACWI) is included to represent the world market index since the pandemic can affect the world and is used as a benchmark. The MSCI ACWI incorporates both developed and emerging countries. Table 1 displays the participating countries of the Middle East in the MSCI ACWI Developed, Emerging, and Frontier Markets Index, in addition to the date of the first confirmed COVID-19 cases. The daily closing prices of these indices were employed.

Table 1. MSCI ACWI and Frontier Markets Index

Country	*First COVID confirmed case*	*Developed market (D)*	*Emerging markets (E)*	*Frontier markets (F)*
Egypt	14/2/2020		*	
Israel	21/2/2020	*		
Jordan	3/3/2020			*
Oman	24/2/2020			*
Qatar	29/2/2020		*	
United Arab Emirates (UAE)	29/1/2020		*	
KSA	2/3/2020		*	
Kuwait	24/2/2020		*	
Bahrain	24/2/2020			*

Source: MSCI (n.d.).

3.2. Research methods

Following the natural log difference technique (Chaudhary et al., 2020), the returns on all market indices were calculated using the following formula:

$$R_{j,t} = ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

where $R_{j,t}$ is the daily return of index j in period t; P_t is the daily price of index j in period t and P_{t-1} is the daily price of index j in period t - 1. If a movement in a period does not alter the mean, variance, or autocorrelation structure, the time series is stationary (Golder et al., 2020). Therefore, the panel unit root test in Table 2 revealed no stationary effect because the probability of all tests was less than 0.05.

Table 2. Panel unit root test

Method	*Levin-Lin-Chu test**		*Im, Pesaran and Shin W-stat*		*Augmented Dickey–Fuller-Fisher Chi-square*		*Phillips–Perron-Fisher Chi-square*	
	Stat.	*Prob.*	*Stat.*	*Prob.*	*Stat.*	*Prob.*	*Stat.*	*Prob.*
Egypt	-15.9578	0.000	-14.9757	0.000	119.415	0.000	119.539	0.000
Israel	-18.4769	0.000	-17.1395	0.000	113.983	0.000	113.901	0.000
Jordan	-21.2111	0.000	-17.2222	0.000	132.365	0.000	132.396	0.000
Oman	-22.4426	0.000	-18.9996	0.000	138.761	0.000	138.796	0.000
Qatar	-13.1300	0.000	-14.8778	0.000	118.738	0.000	118.805	0.000
UAE	-16.6042	0.000	-14.9850	0.000	119.479	0.000	119.033	0.000
KSA	-19.0586	0.000	-16.4046	0.000	128.248	0.000	128.261	0.000
Kuwait	-37.1440	0.000	-30.6842	0.000	91.6575	0.000	18.4207	0.000
Bahrain	-19.047	0.000	-15.8560	0.000	125.093	0.000	124.433	0.000
World	-18.3178	0.000	-15.8957	0.000	125.332	0.000	124.458	0.000

Source: Output of EViews software.

Considering the volatility asymmetry role and capturing the leverage effect of the incidents and events in the financial markets indices, the EGARCH model was used, considering Eq. (2).

$$Log(h_t) = \varphi + \sum_{i=1}^{q} \eta_i \left|\frac{u_{t-i}}{\sqrt{h_{t-i}}}\right| + \sum_{i=1}^{q} \lambda \frac{u_{t-i}}{\sqrt{h_{t-i}}} + \sum_{k=1}^{p} \theta_k \, log(h_{t-k}) \tag{2}$$

Instead of being quadratic, the leverage effect is exponential because the $Log(h_t)$ is the log of the variance series (h_t). This guarantees that no negative estimate exists, where φ is a constant, η is the ARCH effect, λ is the asymmetric effect and θ is the GARCH effect. An asymmetric model was indicated if $\lambda_1 = \lambda_2 = \ldots = 0$. Nonetheless, $\lambda_i < 0$ suggests that negative shocks or bad news cause more volatility than positive shocks or good news.

Because the GARCH-M model permits the conditional mean to rely on its conditional variance, ARCH-M (1, 1) can be estimated using the variance. To explain the index return, we model the time-varying risk premium. Conditional variance may enter the conditional mean function of Y_t if the risk is captured by either volatility or conditional variance. That is:

$$Y_t = c + \varepsilon h_t + u_t \tag{3}$$

Standard ARCH and GARCH models treat bad news (negative $u_{t-1} < 0$) and good news (positive $u_{t-1} > 0$) symmetrically. That is, their impact on asset volatility, h_t is the same ($b_1 u_{t-1}^2$). Therefore, the absolute value of the news, and not its sign, is the matter (the residual term is squared). Therefore, in ARCH/GARCH models, a large positive (negative) shock has the same magnitude as the volatility of the signs. However, the impact of good and bad news on financial assets and the market may be asymmetric. When good (bad) news hits a financial market, assets tend to enter a state of tranquility (turbulence) and volatility decreases (increases). To capture these asymmetries in the financial market, the threshold GARCH (T-GARCH) was devised by Zakoian (1994). By adding a multiplicative dummy variable to the variance equation, we simply check for a statistically significant difference when the shocks are negative. The conditional variance for the TGARCH (1, 1) model is expressed as:

$$h_t = \varphi + \theta_1 \, h_{t-1} + b_1 u_{t-1}^2 + \boldsymbol{\gamma_1 u_{t-1}^2 D_{t-1}} \tag{4}$$

where, D_{t-1} takes the value of 1 (bad news) fo $u_t < 0$ and 0 otherwise. Hence, good and bad news have different effects. Good news has an impact on b_1, whereas bad news has an impact on $b_1 + \gamma_1$. The term γ indicates asymmetry or leverage; when $\gamma > 0$, when $\gamma = 0$, it indicates symmetry (the model collapses to the standard GARCH). If γ is significant and positive, it implies that bad news has a larger effect on ht than good news.

Nelson (1991) developed the exponential GARCH model (EGARCH) to capture the leverage effect of events on financial markets (Asteriou & Hall, 2016). TGARCH allows asymmetries to be tested. When good (bad) news hits a financial market, assets tend to enter a state of tranquility (turbulence) and volatility decreases (increases). EGARCH uses the log of the variance of the series as a dependent variable, not the level of conditional variance. The conditional variance for the EGARCH (*p, q*) model is specified as:

$$log(h_t) = \varphi + \sum_{i=1}^{q} \eta_i \left| \frac{u_{t-1}}{\sqrt{h_{t-1}}} \right| + \sum_{i}^{q} \lambda_i \frac{u_{t-1}}{\sqrt{h_{t-1}}} + \sum_{k}^{p} \theta_k \ log\,(h_{t-k}) \quad (5)$$

The leverage effect is made exponential rather than quadric by the log of the variance series (h_t), ensuring that the estimates are non-negative. The constant is denoted by φ, ARCH effects by η, asymmetric effects by λ, and GARCH effects by θ. The model was symmetric if $\lambda_1 = \lambda_2 = \ldots = 0$. The bad news causes more volatility than good news does when $\lambda_1 < 0$. To calculate the leverage effect, if $u_{t-1} < 0$, the total effect of u_{t-1} on 1 $log\,(h_t)$ is $(1 - \lambda_1)\,|u_{t-1}|$, whereas, if $u_{t-1} > 0$, the total effect of u_{t-1} on 1 $log\,(h_t)$ was $(1 + \lambda_1)\,|u_{t-1}|$ (Asteriou & Hall, 2016).

4. RESULTS

The expected return of R_i is extracted by regressing the country index return (*i*) on the World Index return R_m as a benchmark, according to the single-index market model. The daily predicted value was used as the expected value and the daily residuals were used as the abnormal return (AR). An event study was conducted to answer the first question of this study. The total duration of each event was 301 days. The estimated period was 250 days, and the window included 51 days, the event day, and 25 days before and after the event.

4.1. Testing the markets' responses using event study (*H1*)

Testing the differences between the AR before and after each event of COVID-19, the Russian invasion of Ukraine and the Turkey-Syria earthquake natural disaster events (Tables 3a–3c) shows negative insignificant differences in the mean AR of 7/9 countries for the COVID-19 pandemic and 6/9 for the Turkey-Syria earthquake events. Eight out of nine countries exhibited positive mean AR in the Russian invasion of Ukraine with a significant negative difference only in the Jordan index. Compared with the World Index, Israel, and Qatar in the COVID-19 event, all countries except Egypt in the Russian invasion of Ukraine event, and Egypt, Israel, and the KSA in the Turkey-Syria earthquake event have positive average AR.

Testing the Russian invasion of Ukraine event, Table 3. b shows a significant negative difference only for Jordan's index.

Table 3a. Independent sample t-test of AR: COVID-19 event

Country	*Event window*	*Mean*	*Std.*	*F*	*Sig.*	*t*	*Sig.*	*Mean diff.*
Egypt	Before	0.000135	0.015786	33.492	0.000	0.230	0.820	0.001941
	After	-0.001806	0.044454					
Israel	Before	-0.000698	0.011457	82.352	0.000	-0.210	0.835	-0.001687
	After	0.000989	0.042315					
Jordan	Before	-0.000141	0.008474	10.315	0.000	1.858	0.074	0.006211
	After	-0.006352	0.017486					
Oman	Before	-0.000301	0.0119997	35.348	0.000	0.876	0.388	0.003679
	After	-0.003981	0.021941					
Qatar	Before	-0.000544	0.013797	25.505	0.000	-0.177	0.861	-0.000838
	After	0.000295	0.024651					
UAE	Before	-0.000668	0.012921	80.528	0.000	0.296	0.769	0.002558
	After	-0.003226	0.045504					
KSA	Before	-0.000792	0.012334	19.820	0.000	-0.139	0.890	-0.0005577
	After	-0.000234	0.020802					
Kuwait	Before	-0.000112	0.014001	26.733	0.000	0.071	0.944	0.000365
	After	-0.000477	0.026982					
Bahrain	Before	0.0003755	0.006550	17.283	0.000	2.027	0.052	0.004696
	After	-0.004320	0.012081					
World	Before	0.0000516	0.008865	178.756	0.000	-0.031	0.976	-0.000250
	After	0.0003020	0.043074					

*Note: * significant p < 0.05.*

Table 3b. Independent sample t-test of AR: Russian invasion of Ukraine event

Country	Event window	Mean	Std.	F	Sig.	t	Sig.	Mean diff.
Egypt	Before	-0.001704	0.010269	8.432	0.006	-0.009	0.993	-0.000058
	After	-0.001646	0.032276					
Israel	Before	-0.000038	0.011065	0.093	0.762	-0.115	0.909	-0.000360
	After	0.000322	0.011051					
Jordan	Before	-0.000938	0.009511	3.525	0.067	-2.656	0.011*	-0.00783
	After	0.006997	0.011518					
Oman	Before	-0.000903	0.004916	14.309	0.000	-1.139	0.264	-0.003226
	After	0.002322	0.013280					
Qatar	Before	0.000721	0.006546	8.69	0.005	-1.528	0.136	-0.004639
	After	0.005360	0.013692					
UAE	Before	-0.000004	0.006555	5.905	0.019	-0.897	0.376	-0.002550
	After	0.002546	0.012609					
KSA	Before	-0.000132	0.007554	0.014	0.905	-0.632	0.530	-0.001308
	After	0.001176	0.007075					
Kuwait	Before	0.000322	0.004670	4.722	0.035	-0.767	0.448	-0.001376
	After	0.001698	0.007661					
Bahrain	Before	0.001961	0.006273	2.553	0.117	0.194	0.847	0.000484
	After	0.001481	0.010779					
World	Before	-0.002454	0.011492	1.246	0.270	-1.231	0.224	-0.004531
	After	0.002076	0.014367					

*Note: * significant p < 0.05.*

Table 3c reveals no statistically significant effect of the natural disaster on the Middle East stock markets and the World Index. The author noticed a positive return for most of the countries except Egypt (mean diff. = -0.001946), the KSA (mean diff. = -0.002165), and the World Index (mean diff. = -0.001332).

Table 3c. Independent sample t-test of AR: Turkey-Syria earthquake event

Country	Event window	Mean	Std.	F	Sig.	t	Sig.	Mean diff.
Egypt	Before	0.0017405	0.021807	0.897	0.344	-0.419	0.676	-0.001946
	After	0.0036869	0.030431					
Israel	Before	-0.000733	0.014913	2.664	0.104	0.297	0.767	0.000896
	After	0.0016290	0.012285					
Jordan	Before	0.0009414	0.012628	2.627	0.106	1.440	0.151	0.003800
	After	-0.002859	0.015268					
Oman	Before	0.0009361	0.010164	1.912	0.168	0.864	0.388	0.001763
	After	-0.000827	0.007108					
Qatar	Before	-0.000350	0.013273	0.157	0.692	1.015	0.311	0.0027328
	After	-0.003083	0.011408					
UAE	Before	-0.000172	0.012473	0.180	0.671	0.190	0.849	0.000486
	After	-0.000958	0.012310					
KSA	Before	-0.000469	0.010478	0.527	0.468	-1.022	0.308	-0.002165
	After	0.0015967	0.008524					
Kuwait	Before	0.0000803	0.008597	0.010	0.919	1.193	0.234	0.002102
	After	-0.002022	0.008497					
Bahrain	Before	0.0002047	0.005977	2.824	0.094	0.684	0.494	0.000813
	After	-0.000609	0.003148					
World	Before	-0.000314	0.012794	4.212	0.041	9.747	0.460	-0.001332
	After	0.0010179	0.008216					

*Note: * significant p < 0.05.*

Tables 4a–4c display the daily differences in the three events. Table 4a reveals that a significant difference in AR appeared to two-three days before the World Health Organization (WHO) announced the COVID-19 pandemic on March 11, 2020. On the day of the announcement, only the KSA index had a significant negative AR. However, one day after the event, 8/9 countries had a significant negative difference in AR, except for Israel's index. This indicates that information about the virus was announced after closing the markets and reflected the next day. Interestingly, Israel's index returns as a developed market reacted positively to the WHO announcement and a significant negative effect (-2.0%, $t = -3.032$) appeared starting from the fourth day post the COVID-19 event. According to Bannigidadmath et al. (2022), Israel had a statistically significant positive effect from the lockdown announcement on returns and a cumulative effect over the five days following the lockdown event.

Table 4a. Daily differences: Pandemic event

Day	*AR and t-value*	*t-Egypt*	*t-Israel*	*t-Jordan*	*t-Oman*	*t-Qatar*	*t-UAE*	*t-KSA*	*t-Kuwait*	*t-Bahrain*
-5	AR	0.008	-0.028	-0.014	0.009	0.000	-0.033	-0.007	-0.013	-0.007
	t	0.581	-4.293*	-1.668	0.962	-0.003	-3.828*	-0.743	-1.562	-1.498
-4	AR	-0.030	-0.007	-0.001	0.002	0.013	0.002	-0.005	-0.009	-0.007
	t	-2.137*	-1.003	-0.120	0.237	1.211	0.257	-0.576	-1.152	-1.641
-3	AR	0.009	0.002	-0.001	0.008	0.016	0.005	-0.081	-0.100	-0.034
	t	0.657	0.276	-0.114	0.919	1.425	0.556	-8.889*	-12.501*	-7.703*
-2	AR	-0.127	-0.041	0.011	-0.123	-0.118	-0.126	-0.071	-0.100	-0.057
	t	-9.048*	-6.355*	1.322	-13.662*	-10.632*	-14.486*	-7.736*	-12.455*	-12.820*
-1	AR	0.034	-0.015	0.029	0.018	0.038	0.057	0.068	0.000	0.013
	t	2.413*	-2.287*	3.418*	1.980*	3.474*	6.526*	7.475*	0.042	2.971*
0	AR	-0.006	0.004	-0.015	0.016	0.020	-0.001	-0.027	0.015	-0.002
	t	-0.432	0.643	-1.746	1.757	1.786	-0.068	-2.973*	1.888	-0.532
+1	AR	-0.181	0.010	-0.020	-0.028	-0.029	-0.057	-0.020	-0.060	-0.034
	t	-12.88*	1.496	-2.388*	-3.172*	-2.617*	-6.618*	-2.227*	-7.532*	-7.553*
+2	AR	0.013	-0.011	-0.080	-0.010	0.012	-0.014	-0.016	-0.054	-0.017
	t	0.900	-1.677	-9.438*	-1.151	1.060	-1.572	-1.788	-6.762*	-3.920*
+3	AR	-0.062	0.017	-0.034	-0.010	0.033	-0.082	-0.043	0.014	-0.012
	t	-4.410*	2.681*	-4.054*	-1.061	3.001*	-9.396*	-4.711*	1.801	-2.659*
+4	AR	0.075	-0.020	-0.014	-0.028	0.023	-0.075	0.021	-0.013	-0.013
	t	5.319*	-3.032*	-1.674	-3.119*	2.099*	-8.647*	2.307*	-1.562	-2.951*
+5	AR	0.071	-0.028	-0.016	-0.015	0.012	0.040	0.013	0.053	-0.003
	t	5.071*	-4.365*	-1.948*	-1.628	1.117	4.624*	1.404	6.607*	-0.608

*Note: * significant p < 0.05.*

How the invasion affects stock markets is reported in Table 4b. A window of five days of AR was computed before and after the event day. On the event day, there were statistically significant negative returns of the 3/9 countries under the study. The AR of Egypt's index was the most affected, with a return of 5.03% (t = -3.732), followed by the KSA (-1.97%, t = -2.642), and Bahrain (-1.124%, t = -2.92). Three countries were impacted positively; Qatar had a statistically significant positive return in the first three days after the invasion by 2.85%, 3.74%, and 1.46% respectively. The UAE had a statistically significant positive return for three days starting on the second day after the invasion, and Israel had a positive return of 3.01% only on the second day after the event. The event occurred after the market closed and the reaction appeared on the next trading day. The impact of Egypt, the KSA, and Bahrain on the same day that the war was declared could be due to the connection of these markets to bilateral trade with Russia. Egypt's imports from Russia include grain, wood, iron, and steel (State Information Service, 2023). The influence of the KSA is because Russia is the largest supplier of refined fuels in the KSA and other Middle Eastern countries. Following Russia's invasion of Ukraine in 2022, Saudi Arabia has increased its investments in Russian energy companies. Additionally, the OPEC+ group is led by the KSA and Russia (World Trade Organization [WTO], n.d.). Bahrain is heavily reliant on migrant labor; oil and gas are major sources of government revenue, and the service sector, particularly financial services, accounts for the majority (58%) of economic output. This means that changes in oil prices have a significant impact on government programs and revenues (Loft & Garraway, 2023).

Table 4b. Daily differences: Invasion event

Day	*AR and t-value*	*t-Egypt*	*t-Israel*	*t-Jordan*	*t-Oman*	*t-Qatar*	*t-UAE*	*t-KSA*	*t-Kuwait*	*t-Bahrain*
-5	AR	-0.00149	-0.00302	-0.01213	-0.00084	0.0015	-0.00207	0.00975	0.01163	0.01431
	t	-0.1108	-0.397-	-0.451	-0.101	0.159	-0.272	1.307	0.530	3.721*
-4	AR	-0.00904	-0.00170	0.0067	0.00586	-0.0033	-0.00998	-0.00313	-0.00610	0.00186
	t	-0.6715	-0.224	0.251	0.710	-0.456	-1.311	-0.419	-0.278	0.485
-3	AR	0.00704	-0.00821	0.0006	0.00110	-0.0075	0.01589	-0.00248	0.00746	0.00106
	t	0.5229	-1.079	0.0240	0.134	-1.030	-2.088*	-0.332	0.340	0.275
-2	AR	-0.0236	0.00958	-0.00049	0.00049	0.0026	0.00389	0.00625	-0.00106	-0.00270
	t	-1.755	1.260	-0.0181	0.060	0.360	0.511	0.838	-0.048	-0.702
-1	AR	-0.0053	0.00972	0.0093	-0.00096	0.0043	0.00039	-0.00454	0.00812	0.01870
	t	-0.3963	1.278	0.347	-0.116	0.589	0.051	-0.609	0.370	4.862*
0	AR	-0.0503	-0.00518	-0.00865	-0.00410	-0.0074	-0.00524	-0.01971	-0.00116	-0.01124
	t	-3.732*	-0.680	-0.322	-0.497	-1.019	-0.689	-2.642*	-0.053	-2.92*
+1	AR	0.02525	-0.00387	0.0284	-0.00265	0.0285	0.00579	0.00943	0.01830	0.00578
	t	1.875	-0.509	1.058	-0.321	3.919*	0.761	1.265	0.834	1.502
+2	AR	0.00802	0.03015	0.0117	0.00681	0.0374	0.02967	0.01257	0.00743	0.00101
	t	0.5953	3.963*	0.435	0.826	5.145*	3.900*	1.685	0.338	0.261
+3	AR	-0.0166	-0.01335	-0.00734	0.01571	0.0146	0.01957	0.00476	0.00004	0.00270
	t	-1.234	-1.755	-0.273	1.905	2.007*	2.572*	0.638	0.002	0.702
+4	AR	0.01047	-0.00257	0.0038	0.02520	-0.0023	0.02386	-0.00242	-0.00024	-0.00125
	t	0.7775	-0.337	0.141	3.056*	-0.309	3.137*	-0.324	-0.012	-0.324
+5	AR	-0.089	-0.01446	0.0204	-0.00009	0.0017	0.00453	0.00644	0.01173	0.00308
	t	-6.609*	-1.90	0.758	-0.0103	0.242	0.595	0.863	0.534	0.801

*Note: * significant p < 0.05.*

The Turkey-Syria earthquake occurred in the early morning of the sixth of March 2023. Some countries experienced tremors that struck Turkey and Syria, including Egypt and Israel. Jordan and Israel are also adjacent to the collapse crater, which is an earthquake zone. The data on the day of the event are presented in Table 4c shows a significant positive return of 2.45% for Israel only. It is known that the Israeli stock market is ranked as a developed market, and the news is reflected quickly in the market as an efficient market, but this event does not affect the investors' decisions.

Table 4c. Daily differences: Earthquake event

Day	*AR and t-value*	*t-Egypt*	*t-Israel*	*t-Jordan*	*t-Oman*	*t-Qatar*	*t-UAE*	*t-KSA*	*t-Kuwait*	*t-Bahrain*
-5	AR	0.0220	-0.0106	-0.0039	-0.0035	-0.0231	0.0031	-0.0054	-0.0073	-0.0007
	t	1.04	-1.07	-0.306	-0.340	-1.727	-0.237	-0.501	-0.814	0.119
-4	AR	-0.004	0.0073	-0.010	0.0094	0.0100	0.0094	0.112	-0.0044	-0.0040
	t	-0.185	0.742	-0.790	0.916	0.748	0.724	1.043	-0.498	-0.648
-3	AR	-0.016	0.0148	0.0079	0.115	0.0072	-0.0002	0.0093	0.0220	-0.0003
	t	-0.787	1.501	0.615	1.118	0.537	-0.016	0.864	0.242	-0.043
-2	AR	0.0165	-0.0050	-0.0044	-0.0015	-0.0034	0.0014	0.0087	0.0042	-0.0013
	t	0.779	-0.513	-0.342	-0.146	-0.254	0.111	0.806	0.474	-0.203
-1	AR	-0.025	-0.0080	0.0094	0.0086	-0.0020	-0.0027	0.0131	0.0055	-0.0100
	t	-1.18	-0.811	0.727	0.838	-0.151	-0.210	1.215	0.612	-1.605
0	AR	0.0012	0.0245	-0.0009	-0.000	0.0070	0.0100	0.0039	-0.00008	0.0006
	t	0.059	2.497*	-0.070	-0.001	0.520	0.776	0.359	-0.084	0.095
+1	AR	-0.027	0.0009	-0.0045	0.0074	0.0077	-0.0104	0.0031	0.0032	-0.0011
	t	-1.29	0.096	-0.352	0.718	0.575	-0.803	0.288	0.355	-0.176
+2	AR	0.0018	0.0078	0.0018	0.0034	0.0059	0.0048	-0.0056	-0.0036	-0.000
	t	0.086	0.791	0.142	0.328	0.444	0.371	-0.524	-0.405	-0.006
+3	AR	-0.001	0.0119	0.0152	-0.0088	-0.0016	-0.0088	0.0057	-0.0027	-0.0003
	t	-0.056	1.210	1.181	-0.853	-0.121	-0.682	0.532	-0.297	-0.054
+4	AR	-0.004	0.0026	-0.0228	0.0041	-0.0324	-0.0027	-0.0069	-0.0070	-0.0012
	t	-0.190	0.263	-1.775	0.395	-2.042*	-0.206	-0.645	-0.783	-0.178
+5	AR	-0.065	-0.0332	0.0092	0.0016	-0.0173	-0.0159	-0.0071	-0.0025	-0.0009
	t	-3.08*	-3.37*	0.717	0.153	-1.296	-1.227	-0.658	-0.275	-0.144

*Note: * significant $p < 0.05$.*

In summary, COVID-19 and political events had a statistically significant negative effect on returns in 88.89% and 33.3% of the markets, respectively. Political and natural disaster events significantly positively affected returns in 33.3% (other markets) and 11.1% of the markets. COVID-19, by comparison, had more cases of significantly negative effects on returns than positive effects. According to the WTO (n.d.), the growth of merchandise trade slowed in the first half of 2022 and was predicted to slow even more in the second half of the year due to the Ukrainian crisis, high inflation, and the aftereffects of the pandemic. These results are accepting the *H1*.

Therefore, it is necessary to study the volatility asymmetry role and capture the leverage effect of the incidents and events in the given financial markets' indices. The EGARCH model was used to answer the second question of this study considering Eq. (2).

4.2. Testing the suitability for using EGARCH

Tables 5a–5c present the terms to ensure the presence of the ARCH effect to proceed with finding EGARCH. Table 5a shows the results of the GARCH (1, 1) model for the COVID-19 pandemic. The coefficient of the past value was positive and statistically significant for 6/9 of the nine counties. From the mean equation, the average index returns for Egypt, Jordan, the UAE, the KSA, Kuwait, and Bahrain are 0.137, 0.342, 0.132, 0.078, 0.090, and 0.050, respectively, and their past values significantly predict the series by 0.194, 0.064, 0.128, 0.143, 0.188, and 0.174, respectively. From the variance equation, the coefficients of the constant variance term (*C*), ARCH (*b*), and GARCH (θ) are positive and statistically significant at the < 0.001 level for 8/9 countries, except for Jordan. This provides the results for the GARCH model. The time-varying volatility includes a constant (e.g., Egypt) 0.000035 plus the past conditional variance ($0.668\hat{h}_{t-1}$) and a component that depends on past error ($0.196\hat{u}^2_{t-1}$). All coefficients of the conditional variance specification meet the stability conditions $0 < b_1 < 1$, $0 < \theta_1 < 1$ and $b_1 + \theta_1 < 1$. In Jordan, IGARCH occurs, where $b_1 + \theta_1 \geq 1$, which equals 1.0043.

Table 5a. Results of GARCH (1, 1): COVID-19 pandemic

Equations		*Egypt*	*Israel*	*Jordan*	*Oman*	*Qatar*	*UAE*	*KSA*	*Kuwait*	*Bahrain*
Kurtosis		21.165	18.2827	248.564	28.903	28.001	27.398	17.590	32.224	22.0287
Mean	*C*	0.137382 (0.0000)	0.122256 (0.0000)	0.342176 (0.0000)	0.121587 (0.0000)	0.13515 (0.0000)	0.131605 (0.0000)	0.077922 (0.0000)	0.090123 (0.0000)	0.050133 (0.0000)*
	Ret(-1)	0.193755 (0.0000)	-0.01229 (0.8024)	0.064303 (0.0000)	-0.02101 (0.7091)	-0.0343 (0.5620)	0.127739 (0.0061)	0.142824 (0.0009)	0.187921 (0.0002)	0.173699 (0.0001)*
Variance	*C*	0.000035 (0.0000)	0.000007 (0.0004)	0.0000004 (0.0000)	0.000029 (0.0000)	0.000008 (0.0000)	0.000008 (0.0000)	0.000004 (0.0005)	0.000006 (0.0000)	0.000005* (0.0000)*
	b	0.195630 (0.0000)	0.101298 (0.0000)	-0.006186 (0.0000)	0.556219 (0.0000)	0265947 (0.0000)	0.217252 (0.0000)	0.157635 (0.0000)	0.324646 (0.0000)	0.181248 (0.0000)*
	θ	0.6684 (0.000)	0.6852 (0.000)	1.01048 (0.0000)	0.369986 (0.000)	0.72390 (0.000)	0.778118 (0.0000)	0.814779 (0.0000)	0.663916 (0.0000)	0.612362 (0.0000)*

*Note: * significant $p < 0.05$.*
Source: Output of EViews software.

The Russian invasion of Ukraine results are shown in Table 5b, in the mean equation, the coefficient of the past value is positive and statistically significant in 2/9 out of the nine countries. The average index returns for Egypt and the UAE are 0.078 and 0.037, respectively, and their past values significantly predict the series by 0.128 and 0.29, respectively. From the variance equation, the coefficients of the constant variance term (*C*), the ARCH (*b*), and the GARCH (θ) are positive and statistically significant at less than 0.05 level for 6/9 of the countries. This provides the result of the GARCH model, which improves the ARCH model results. The time-varying volatilities of Egypt, Israel, Qatar, the UAE, the KSA, and Bahrain include constants 0.0000193, 0.000003, 0.00041, 0.000009, 0.00048, and 0.0000014 plus GARCH's past ($0.868\hat{h}_{t-1}$, $0.914\hat{h}_{t-1}$, $0.094\hat{h}_{t-1}$, $0.742\hat{h}_{t-1}$, $0.786\hat{h}_{t-1}$, and $0.779\hat{h}_{t-1}$, and components that depend on past error ($0.0561\hat{u}^2_{t-1}$, $0.064\hat{u}^2_{t-1}$, $0.207\hat{u}^2_{t-1}$, $0.208\hat{u}^2_{t-1}$, $0.133\hat{u}^2_{t-1}$, and $0.193\hat{u}^2_{t-1}$, respectively. The six coefficients of the conditional variance specification meet the stability conditions $0 < b_1 < 1$, $0 < \theta_1 < 1$, and $b_1 + \theta_1 < 1$.

Table 5b. Results of GARCH (1, 1): Russian invasion of Ukraine

Equations		***Egypt***	***Israel***	***Jordan***	***Oman***	***Qatar***	***UAE***	***KSA***	***Kuwait***	***Bahrain***
Kurtosis		9.096	4.225	157.07	8.011	7.682	12.785	8.674	136.5	12.23
Mean	*C*	0.0779 (0.0000)	0.0479 (0.000)	0.3649 (0.000)	0.0532 (0.0000)	0.0366 (0.000)	0.0368 (0.000)	0.0448 (0.000)	0.2252 (0.001)	0.01910 (0.0000)
	Ret(-1)	0.1278 (0.0415)	0.0495 (0.431)	0.0151 (0.779)	-0.03553 (0.5461)	0.1055 (0.203)	0.2895 (0.000)	0.1274 (0.059)	-0.0669 (0.841)	0.083963 (0.1812)
Variance	*C*	0.000019 (0.0213)	0.0000 (0.254)	0.0003 (0.447)	0.000009 (0.2852)	0.00041 0.0000	0.0000 (0.001)	0.00048 (0.065)	0.0002 (0.000)	0.00000 (0.0000)
	b	0.056139 (0.0063)	0.0643 (0.027)	-0.0065 (0.486)	0.038412 (0.1935)	0.20665 (0.000)	0.2080 (0.000)	0.13252 (0.0009)	0.2173 0.1786	0.1932 (0.0000)
	θ	0.868597 (0.0000)	0.9136 (0.000)	0.6237 (0.207)	0.836801 (0.0000)	0.09456 (0.615)	0.7415 (0.000)	0.78563 (0.000)	-0.017 (0.854)	0.7794 (0.0000)

Source: Output of EViews software.

Table 5c clarifies the results of GARCH (1, 1) of the Turkey-Syria earthquake, from the mean equation, the coefficient of the past value is positive and statistically significant in 5/9 of the countries at a significant level less than 0.05. The average index returns for Jordan, Qatar, the KSA, Kuwait, and Bahrain are 0.026, 0.040, 0.39, 0.031, and 0.025, respectively. Their past values predicted the series significantly by 0.147, 0.180, 0.225, 0.218, and 0.172, respectively. From the variance equation, the coefficients of the constant variance term (C), ARCH (b), and GARCH (θ) are positive and statistically significant at the < 0.001 level for six out of the nine countries. This provides the result of the GARCH model, which improves the ARCH model results. The time-varying volatilities of Egypt, Jordan, the UAE, the KSA, Kuwait, and Bahrain include constants 0.0000126, 0.0000215, 0.00041, 0.000023, 0.0000036, 0.00001, and 0.000002 plus GARCH's past ($0.904\hat{h}_{t-1}$, $0.608\hat{h}_{t-1}$, $0.600\hat{h}_{t-1}$, $0.777\hat{h}_{t-1}$, $0.728\hat{h}_{t-1}$, and $0.927\hat{h}_{t-1}$ and components that depend on past error ($0.070\hat{u}^2_{t-1}$, $0.327\hat{u}^2_{t-1}$, $0.240\hat{u}^2_{t-1}$, $0.196\hat{u}^2_{t-1}$, $0.115\hat{u}^2_{t-1}$, and $0.049\hat{u}^2_{t-1}$, respectively. The six coefficients of the conditional variance specification meet the stability conditions $0 < b_1 < 1$, $0 < \theta_1 < 1$, and $b_1 + \theta_1 < 1$.

Table 5c. Results of GARCH (1, 1): Turkey-Syria earthquake

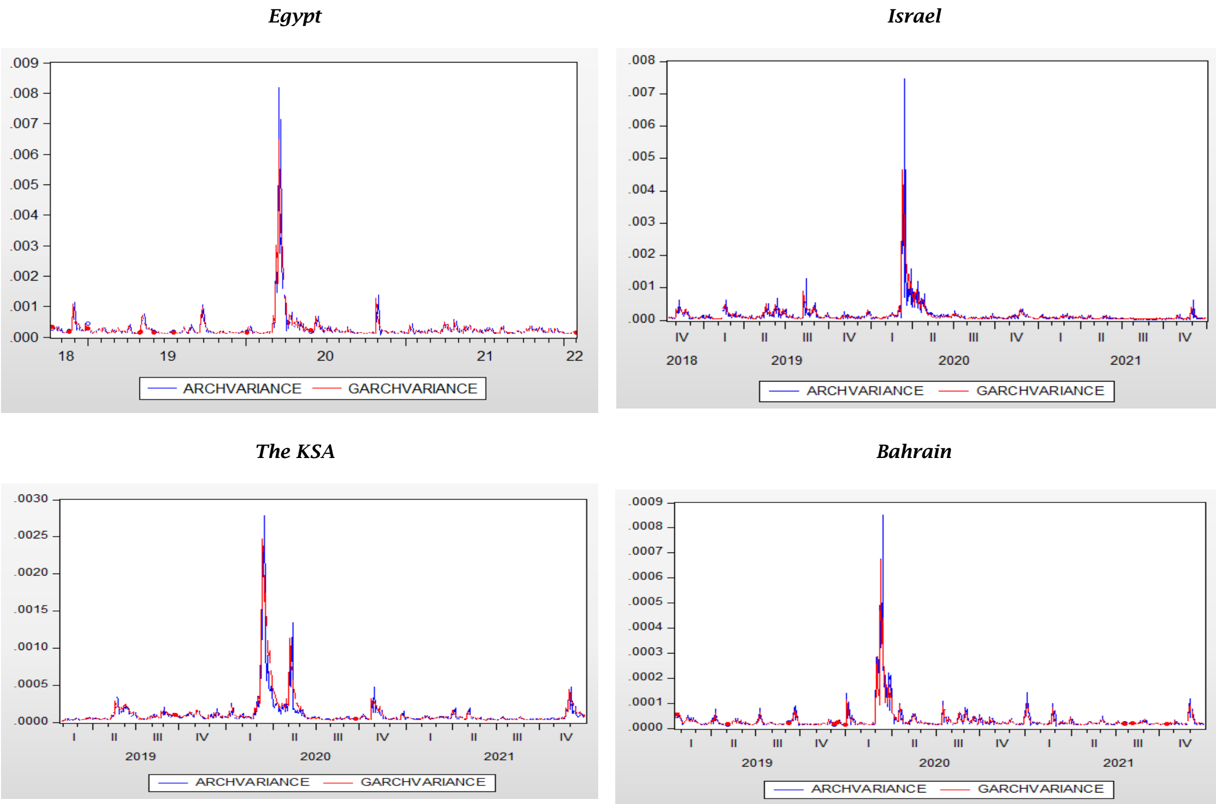
Equations		***Egypt***	***Israel***	***Jordan***	***Oman***	***Qatar***	***UAE***	***KSA***	***Kuwait***	***Bahrain***
Kurtosis		8.127	4.589	10.790	12.097	3.814	7.054	4.970	5.581	13.13
Mean	*C*	0.087198 (0.0000)	0.06711 (0.000)	0.025824 (0.000)	0.03999 (0.000)	0.0403 (0.000)	0.00028 (0.000)	0.039394 (0.0000)	0.03145 (0.0000)	0.024968 (0.0000)
	Ret(-1)	0.037925 (0.631)	0.03672 (0.536)	0.1474 (0.0488)	0.00931 (0.694)	0.1797 (0.005)	0.09222 (0.135)	0.224823 (0.0002)	0.217935 (0.0007)	0.171896 (0.0008)
Variance	*C*	0.00001 (0.058)	2.96E-05 (0.2675)	0.00002 (0.0013)	1.15E-07 (0.6733)	0.00009 (0.0826)	0.00002 (0.0012)	0.000004 (0.0546)	0.00001 (0.0053)	0.00000 (0.0000)
	b	0.07025 (0.0001)	0.0471 (0.207)	0.32684 (0.0009)	-0.0135 (0.000)	0.11381 (0.048)	0.24049 (0.000)	0.19584 (0.0002)	0.11542 (0.0050)	0.04934 (0.0000)
	θ	0.90415 (0.0000)	0.80127 (0.000)	0.60752 (0.0000)	1.00502 (0.000)	0.39846 (0.183)	0.59953 (0.000)	0.77726 (0.0000)	0.72887 (0.0000)	0.9271 (0.0000)

Source: Output of EViews software.

These findings establish the presence of time-varying conditional volatility in the returns of indices. These results also indicate that the persistence of volatility, as represented by the sum of the ARCH and GARCH parameters ($b_1 + \theta_1$), is high. This indicates that the effect of today's shock remains in the forecast of variance for many future periods.

To determine the parsimony of the GARCH (1, 1) model relative to the ARCH (6, 1) model, the ARCH and GARCH variances were plotted together. Figure 1 revealed that the GARCH (1, 1) model explains as much as the ARCH model with three parameters, rather than six. Therefore, the use of GARCH (1, 1) is better because its behavior and explanation are stronger.

Figure 1. Variance of GARCH (1, 1) and ARCH (6, 1) for Egypt, Israel, the KSA, and Bahrain



4.3. Testing the asymmetries of good (bad) news (*H2*)

To answer the second hypothesis, threshold GARCH (T-GARCH) was used to capture the asymmetries of good (bad) news in the financial market, as stated in Eq. (4). In Table 6a, the mean equation of index returns for 5/9 countries is significant. In the variance equation, the coefficient of the asymmetric term (the difference between good and bad news = γ) is positive for all countries except Jordan and Oman and statistically significant at the 0.1% level, indicating that for Egypt, Israel, Qatar, the UAE, the KSA, Kuwait, and Bahrain, there are asymmetries in the news of COVID-19. Bad news of COVID-19 has a larger effect on the volatility of the indices than good news, since $b_1 + \gamma > b_1$; γ is negative and statistically significant for the Jordan and Oman indices, indicating that good news has a larger effect than bad news on these indices.

Table 6a. TGARCH for COVID-19 pandemic

Equations	*Egypt*	*Israel*	*Jordan*	*Oman*	*Qatar*	*UAE*	*KSA*	*Kuwait*	*Bahrain*
Mean equation									
C	0.133146 (0.0000)	0.11711 (0.0000)	0.336845 (0.0000)	0.121262 (0.0000)	0.131057 (0.0000)	0.128832 (0.0000)	0.078464 (0.0000)	0.088417 (0.0000)	0.050245 (0.0000)
Ret(-1)	0.187723 (0.0000)	0.025656 (0.5614)	0.085913 (0.3799)	-0.01209 (0.7511)	-0.00675 (0.8975)	0.143535 (0.0042)	0.134278 (0.0059)	0.199473 (0.0000)	0.170137 (0.0000)
Variance equation									
C	3.26E-05 (0.0000)	8.94E-06 (0.0000)	0.000222 (0.4478)	0.09E-05 (0.0000)	5.79E-06 (0.0000)	8.16E-06 (0.0000)	3.38E-06 (0.0000)	9.65E-06 (0.0000)	5.72E-06 (0.0000)
b_1	0.05178 (0.0856)	-0.03665 (0.0166)	0.026416 (0.0005)	0.979867 (0.0000)	0.026773 (0.2557)	0.087122 (0.0000)	0.050452 (0.0290)	0.110613 (0.0016)	0.059680 (0.0320)
γ	0.215277 (0.0000)	0.220784 (0.0000)	-0.02994 (0.0000)	-0.84751 (0.0000)	0.353262 (0.0000)	0.263481 (0.0000)	0.147617 (0.0000)	0.469573 (0.0000)	0.201789 (0.0002)
GARCH(-1)	0.709011 (0.0000)	0.864623 (0.0000)	0.584668 (0.2844)	0.452613 (0.0000)	0.784577 (0.0000)	0.787372 (0.0000)	0.845077 (0.0000)	0.623437 (0.0000)	0.621136 (0.0000)

Source: Output of EViews software.

Table 6b indicates a significant mean equation for the UAE at a significance level of 0.1%, and less than 5% for Egypt; the other indices are insignificant. After introducing the dummy variable, the coefficient of the γ is positive for Egypt, Israel, the KSA, and Kuwait and significant at the 0.1% level, except for the Kuwait index return, indicating that there are asymmetries in the news of the Russian invasion of Ukraine. The bad news of the Russian invasion of Ukraine has larger effects on the volatility of the indices than the good news since $b_1 + \gamma > b_1$; γ is negative and statistically significant for the Oman, the UAE, and Bahrain indices, indicating that good news has a larger effect than bad news on these indices, while it is insignificant for Jordan and Qatar.

Table 6b. TGARCH for Russian invasion of Ukraine

Equations	Egypt	Israel	Jordan	Oman	Qatar	UAE	KSA	Kuwait	Bahrain
Mean equation									
C	0.078900 (0.0000)	0.047691 (0.0000)	0.365654 (0.0000)	0.056224 (0.0000)	0.037516 (0.0000)	0.038510 (0.0000)	0.045567 (0.0000)	0.260446 (0.0000)	0.19075 (0.0000)
Ret(-1)	0.113946 (0.0458)	0.037839 (0.5561)	0.012344 (0.2657)	-0.09526 (0.1248)	0.085995 (0.3305)	0.262173 (0.0001)	0.109870 (0.0706)	-0.23875 (0.2079)	0.093084 (0.1740)
Variance equation									
C	1.90E-05 (0.0036)	5.73E-06 (0.0002)	0.000108 (0.1613)	7.23E-06 (0.0447)	4.39E-05 (0.0000)	1.09E-05 (0.0021)	4.20E-06 (0.0599)	0.000107 (0.2082)	1.54E-06 (0.0030)
b_1	-0.01785 (0.3967)	-0.05862 (0.0175)	-0.00027 (0.9965)	0.162514 (0.0260)	0.325503 (0.0000)	0.381719 (0.0000)	0.017955 (0.5417)	-0.22780 (0.1238)	0.368856 (0.0025)
γ	0.126655 (0.0017)	0.221337 (0.0000)	-0.00606 (0.9231)	-0.17207 (0.0225)	-0.16389 (0.2272)	-0.33009 (0.0008)	0.146839 (0.0019)	0.724313 (0.1834)	-0.248045 (0.0426)
GARCH(-1)	0.878658 (0.0000)	0.917095 (0.0000)	0.876616 (0.0000)	0.839332 (0.0000)	0.056784 (0.7451)	0.722027 (0.0000)	0.830804 (0.0000)	0.551090 (0.1287)	0.700547 (0.0000)

Source: Output of EViews software.

Coefficients of γ in Table 6c are positive for Egypt, Israel, Jordan, the UAE, the KSA, and Kuwait and significant at the 0.1% level, except for Israel and Jordan, indicating asymmetries in the news of the Turkey-Syria earthquake. The bad news of the Turkey-Syria earthquake has larger effects on the volatility of the indices than the good news since $b_1 + \gamma >;$. γ is negative and statistically significant for Oman and insignificant for the Qatar and Bahrain indices, while it is insignificant for Jordan and Qatar.

The results in Table 6a–6c showed that the Middle East markets' indices varied in their responses to the bad news included in the studying events. Hence, it accepts the *H2* that there is an asymmetry in the news of the three events, and the responses varied between the Middle East markets' indices.

Table 6.c. TGARCH for Turkey-Syria earthquake

Equations	Egypt	Israel	Jordan	Oman	Qatar	UAE	KSA	Kuwait	Bahrain
Mean equation									
C	0.138023 (0.0000)	0.066738 (0.0000)	0.025629 (0.0000)	0.043353 (0.0000)	0.040710 (0.0000)	0.072673 (0.0000)	0.037536 (0.0000)	0.031829 (0.0000)	0.024797 (0.0000)
Ret(-1)	0.187708 (0.0000)	0.041371 (0.4911)	0.151542 (0.0477)	-0.08239 (0.2649)	0.173308 (0.0083)	0.087725 (0.1526)	0.250942 (0.0000)	0.200093 (0.0001)	0.177958 (0.0004)
Variance equation									
C	3.26E-05 (0.0000)	4.57E-05 (0.1613)	2.07E-05 (0.0017)	2.15E-05 (0.0044)	8.78E-05 (0.1091)	2.36E-05 (0.0003)	4.97E-06 (0.0030)	6.02E06 (0.0000)	1.68E-07 (0.0000)
b_1	0.0151785 (0.0855)	0.031045 (0.5004)	0.295527 (0.0047)	0.348200 (0.0024)	0.137252 (0.0815)	0.051320 (0.1769)	-0.05394 (0.1666)	-0.06908 (0.0030)	0.058378 (0.0002)
γ	0.215275 (0.0000)	0.078849 (0.1692)	0.067738 (0.7127)	-0.38436 (0.0010)	-0.06220 (0.5576)	0.328004 (0.0001)	0.295322 (0.0000)	0.232011 (0.0000)	-0.027035 (0.1917)
GARCH(-1)	0.708989 (0.0000)	0.697886 (0.0003)	0.876616 (0.0000)	0.625643 (0.0000)	0.403066 (0.2131)	0.615762 (0.0000)	0.839087 (0.0000)	0.854429 (0.0000)	0.934247 (0.0000)

Source: Output of EViews software.

4.4. Testing the leverage effect (*H3*)

The EGARCH is used to capture the leverage effect of studied events on the named financial markets considering Eq. (5), for answering the third hypothesis. Table 7a revealed that the indices of Egypt, Israel, Qatar, the UAE, the KSA, Kuwait, and Bahrain have negative and statistically significant coefficients of asymmetric terms (λ), which indicates that for these countries, bad news has a larger effect on the volatility of the index returns during the COVID-19 pandemic. The returns of the Jordan and Oman indices are positive, greater than zero, and statistically significant.

Table 7a. EGARCH for the effect of the COVID-19 pandemic

Equations	Egypt	Israel	Jordan	Oman	Qatar	UAE	KSA	Kuwait	Bahrain
Mean equation									
C	0.132531 (0.0000)	0.118959 (0.0000)	0.363870 (0.0000)	0.11754 (0.0000)	0.132973 (0.0000)	0.139335 (0.0000)	0.077751 (0.0000)	0.091986 (0.0000)	0.049858 (0.0000)
Ret(-1)	0.191719 (0.0000)	0.009684 (0.8250)	0.015709 (0.0328)	0.02076 (0.6385)	-0.022442 (0.5833)	0.075589 (0.1109)	0.141749 (0.0012)	0.165761 (0.0009)	0.173280 (0.0001)
Variance equation									
φ	-1.32041 (0.0000)	0.462491 (0.0000)	-0.510955 (0.0000)	-1.84612 (0.0000)	-0.525762 (0.0000)	-0.628164 (0.0000)	-0.147813 (0.0000)	-1.29748 (0.0000)	-2.41007 (0.0000)
η	0.298279 (0.0000)	0.122955 (0.0000)	-0.083749 (0.0000)	0.422936 (0.0000)	0.181401 (0.0000)	0.293207 (0.0000)	0.195097 (0.0000)	0.314025 (0.0000)	0.277237 (0.0000)
λ	-0.14056 (0.0000)	-0.144687 (0.0000)	0.118427 (0.0000)	0.239809 (0.0000)	-0.171372 (0.0000)	-0.110678 (0.0000)	-0.100020 (0.0000)	-0.161633 (0.0000)	-0.138379 (0.0000)
θ	0.869165 (0.0000)	0.958213 (0.0000)	0.932933 (0.0000)	0.832540 (0.0000)	0.956989 (0.0000)	0.951422 (0.0000)	0.970768 (0.0000)	0.885365 (0.0000)	0.790236 (0.0000)

Source: Output of EViews software.

Table 7b revealed that the λ of the indices' returns of Egypt, Israel, Jordan, Qatar, the KSA, and Kuwait are negative and all statistically significant except Jordan and Qatar, which implies that bad news has a larger effect on the volatility of the indices' returns during the Russian invasion of Ukraine. The returns of the indices of Oman and the UAE are positive, greater than zero, and statistically significant, which implies that good news has a larger effect than bad news for these indices.

Table 7b. EGARCH for the effect of the Russian invasion of Ukraine

Equations	*Egypt*	*Israel*	*Jordan*	*Oman*	*Qatar*	*UAE*	*KSA*	*Kuwait*	*Bahrain*
Mean equation									
C	0.080238 (0.0000)	0.045883 (0.0000)	0.349199 (0.0000)	0.05629 (0.0000)	0.037731 (0.0000)	0.043874 (0.0000)	0.045253 (0.0000)	0.205434 (0.0000)	0.019965 (0.0000)
Ret(-1)	0.098898 (0.0692)	0.066997 (0.2714)	0.056463 (0.3265)	-0.096280 (0.1066)	0.086590 (0.3131)	0.147852 (0.118)	0.113937 (0.0435)	0.022373 (0.8671)	0.047958 (0.4734)
Variance equation									
φ	-0.420967 (0.0036)	-0.373635 (0.0061)	-7.38579 (0.1092)	-1.21881 (0.0029)	-3.66051 (0.0110)	-10.3376 (0.0000)	-0.477440 (0.0947)	-8.04122 (0.0039)	-1.00731 (0.0004)
η	0.063485 (0.0101)	0.004961 (0.9141)	-0.122496 (0.2513)	0.125161 (0.0333)	0.425966 (0.0000)	0.419856 (0.0009)	0.142698 (0.0071)	-0.038885 (0.4511)	0.381854 (0.0000)
λ	-0.101729 (0.0000)	-0.202300 (0.0000)	-0.001245 (0.9931)	0.173183 (0.0001)	-0.011655 (0.8526)	0.332285 (0.0000)	-0.105131 (0.0000)	-0.146143 (0.0000)	0.139204 (0.0081)
θ	0.954872 (0.0000)	0.958049 (0.0000)	0.009865 (0.9872)	0.881964 (0.0000)	0.655090 (0.0000)	-0.084837 (0.6832)	0.962358 (0.0000)	0.017212 (0.9584)	0.931717 (0.0000)

Source: Output of EViews software.

A significant negative effect of the Turkey-Syria earthquake appeared in Egypt, the UAE, the KSA, and Kuwait. In addition, an insignificant effect appears in Israel and Bahrain, as shown in Table 7c.

Table 7c. EGARCH for the effect of Turkey-Syria earthquake

Equations	*Egypt*	*Israel*	*Jordan*	*Oman*	*Qatar*	*UAE*	*KSA*	*Kuwait*	*Bahrain*
Mean equation									
C	0.137385 (0.0000)	0.067037 (0.0000)	0.028282 (0.0000)	0.043910 (0.0000)	0.040924 (0.0000)	0.070465 (0.0000)	0.039163 (0.0000)	0.032279 (0.0000)	0.025015 (0.0000)
Ret(-1)	0.191948 (0.0000)	0.038374 (0.5163)	0.059251 (0.2517)	-.088132 (0.2036)	0.176888 (0.0054)	0.110265 (0.0394)	0.217137 (0.0001)	0.194338 (0.0001)	0.171036 (0.0032)
Variance equation									
φ	-1.32079 (0.0000)	-1.9169 (0.1209)	-16.1998 (0.0000)	-2.31319 (0.0004)	-3.89818 (0.1141)	-0.768427 (0.0002)	-0.837361 (0.0007)	-1.00256 (0.0000)	-0.551660 (0.0000)
η	0.304743 (0.0000)	0.156539 (0.0544)	0.202340 (0.0131)	0.065101 (0.3812)	0.202540 (0.0468)	0.105157 (0.0705)	0.210657 (0.0022)	0.056083 (0.1388)	0.270624 (0.0000)
λ	-0.137017 (0.0000)	-0.070501 (0.0814)	0.231488 (0.0000)	0.306515 (0.0000)	0.029028 (0.6660)	-0.168040 (0.0000)	-0.184178 (0.0000)	-0.204056 (0.0000)	-0.035593 (0.2066)
θ	0.869913 (0.0000)	0.790038 (0.0000)	-0.81424 (0.0000)	0.759814 (0.0000)	0.566518 (0.0461)	0.924108 (0.0000)	0.930078 (0.0000)	0.902188 (0.0000)	0.967299 (0.0000)

Source: Output of EViews software.

The greatest total effect of leverage is on COVID-19. Egypt, Israel, and Jordan were affected more by the earthquake than by the invasion, while Qatar, the UAE, and Oman were affected more by the invasion. The financial market in Bahrain was affected approximately equally by the three events, as shown in Table 8. Therefore, these results accepted the *H3* that there is a leverage effect on the Middle East financial markets caused by the three events. The effect of the invasion and earthquake varied between the indices.

Table 8. The leverage effect

Event	*Egypt*	*Israel*	*Jordan*	*Oman*	*Qatar*	*UAE*	*KSA*	*Kuwait*	*Bahrain*
COVID-19	5.19601	4.80491	7.87001	11.0339	4.11334	9.76339	6.03677	8.00337	6.16446
Invasion	2.30993	0.08602	1.14861	2.49659	5.30104	4.41318	2.40983	0.86479	5.65334
Earthquake	5.28773	1.78826	3.05482	1.14402	2.04606	1.50491	2.49953	1.17812	6.61594

Source: Output of EViews software.

In summary, the aforementioned data indicate a range of volatility and leverage across Middle Eastern stock markets, although these fluctuations may be insignificant or barely noticeable in certain markets. These fluctuations were evident during the COVID-19 crisis, and fluctuations in index returns varied between countries in the two events of the Russian invasion of Ukraine and the Turkey-Syria earthquake, according to political and economic relations or geographical proximity.

5. DISCUSSION

This study analyzes the volatility of the Middle East stock markets in response to major health, political, and natural events using two methodologies. In the event study methodology, the integration between the Middle East indices and the World Index was investigated. Considering a window of 51 trading days, 25 pre-event days, the event day, 25 days post-event, and the estimated period is 250 days. This study considered the indices of the Middle Eastern countries as a dependent variable and the World Index as an independent variable to estimate the expected return based on a single index model.

Previous research has employed traditional models, such as event study, regression, and GARCH models, to study the effect of unanticipated events and to find the relationship between them. In this study, event studies, in addition to the GARCH group, are applied not only to find the volatility of these indices but also to combine it with the asymmetric role, the effect of positive and negative shocks, the relationship between indices, and the leverage effect of the different types of events. Moreover, financial markets are widely affected by COVID-19: (Alajlani et al., 2024; Zhao et al., 2023; Farooq et al., 2021; Jindal & Gupta, 2022; Tuna & Tuna, 2022; Ullah, 2022; Kumar et al., 2021; Insaidoo et al., 2021). However, there is still a need to investigate Middle Eastern markets. In addition, we integrate and investigate the impact of the recent events of the Russian invasion of Ukraine and Turkey-Syria earthquakes that encountered the Middle East markets, which have not been well studied.

The EGARCH model is a powerful tool for determining whether positive (negative) news has a more noticeable effect on volatility than adverse (positive) news of equal size. Therefore, this approach is applied to examine the extent to which the indices' returns and volatility to Middle East markets have been impacted by the three major events that hit the Middle East.

This study used nine major indices of the Middle East capital market listed by the MSCI. These are classified as developed, emerging, and frontier markets, as shown in Table 1.

The results of this study showed that the COVID-19 event had the greatest impact on financial market returns in the Middle East, followed by the Russian invasion of Ukraine, while the Turkey-Syria earthquake had the least impact, according to the daily differences method, one day after the event day. Using the independent differences method, the results showed negative, insignificant abnormal returns for a long period of 250 days post-event. The COVID-19 event had the greatest impact, as it produced negative returns for seven countries, followed by the Turkey-Syria earthquake for six countries. However, the Russian invasion of Ukraine event had positive returns for eight countries, except for Egypt. Only the Jordanian market index showed a significant positive difference during this event. Apart from Egypt in the political event, the results of the financial market indices in the Middle East under study are consistent with the global index.

In the COVID-19 event, there were two country indices, one developed and the other emerging, while three market indices — one developed and two emerging — were in line with the World Index during the natural crisis event. According to Topcu and Gulal (2020), Asia's emerging markets are most affected by COVID-19, followed by South America and the Middle East. The emerging and frontier markets in this study were negatively and insignificantly affected by COVID-19 because of the necessary measures and larger stimulus packages that governments immediately implemented.

In addition, most of the financial markets in the Middle East responded negatively on the event day and disappeared in the post-event period, and there were positive and insignificant differences between the pre-and post-event periods of the Russian invasion of Ukraine in this study, which is consistent with the study of Kamal et al. (2023) conducted on the Australian stock market and the study of Insaidoo et al. (2021), which found an insignificant negative relationship between the COVID-19 pandemic and Ghana stock returns. Nonetheless, Boungou and Yatié (2022a) found a negative correlation between world stock market returns and the Russian invasion of Ukraine. While 27 European Union countries were negatively affected in both crises (COVID-19 and the Russian invasion of Ukraine), the tourism sector was more affected in the case of COVID-19, while Hungary, the Czech Republic, and Ireland were most affected in the Russian invasion of Ukraine (Misini & Tosuni, 2023).

Considering the asymmetric volatility and leverage effect, the finding of this study indicates the presence of leverage over the study period in all studied financial markets in Middle East. This result is consistent with Othman et al. (2022) and Golder et al. (2022) in a study conducted on the GCC markets investigating COVID-19. Using EGARCH on the Ghana stock market, the market return was volatile by 8.23% in response to the COVID-19 pandemic (Insaidoo et al., 2021). In addition, in all markets (Brazil, China, Italy, India, Germany, Russia, Spain, the United Kingdom, and the United States [U.S.]), the indices exhibit increases in conditional volatilities and bad state probabilities. However, this effect varies, depending on the market. Additionally, they discovered that the negative impact of deaths is greater than the positive impact of recovery (Basuony et al., 2022). According to Jindal and Gupta (2022), during the pandemic, negative shocks affected Thailand and Indian stock markets more than positive ones did. Nonetheless, most parameter estimates are found to be statistically significant across all models, indicating the existence of a leverage effect in both stock market returns. However, Padungsaksawasdi and Treepongkaruna (2023) reported that an increase in COVID-19 cases confirmed corresponds favorably with all market volatility measures. More vigilant investors also reduce market volatility as the number of confirmed cases increases. Moreover, COVID-19 is the primary cause of significant volatility in the U.S. stock market (Gao et al., 2022). In contrast to China, the U.S. stock market has become less sensitive to COVID-19 due to the significant increase in daily new cases that have persisted for months. Furthermore, an exceptionally lenient policy regarding interest rates successfully reduced the volatility of the American stock market.

The findings of this study related to the Russian invasion of Ukraine showed significant heterogeneous fluctuations in index returns as they were affected by bad news, especially in developed markets (Israel) and emerging markets (Egypt, the KSA, and Kuwait). The largest impact of the increase appeared in the returns of the Bahrain market index (frontier), Qatar, and the UAE (emerging). Mu et al. (2022) found a consistent volatility spillover over time, and the Russian stock market is the source of risk, which may generate long-run volatility spillovers in the international stock market.

Regarding the Turkey-Syria earthquake, bad news had a larger effect on the volatility of the Middle East market indices. The effect differs from one country to another due to geographical proximity and the political-economic relationships for Egypt, Israel, and Jordan, or the contagion effect for the Bahrain index. Despite the lack of studies conducted on natural risks, a study by Di Tommaso et al. (2023), which dealt with 17 European countries and 92 natural risks on the sovereign credit default swap market, concluded a heterogeneous response of European sovereign credit default swap to a natural disaster, with the response varying from one region to another. Seetharam (2017), who studied the responses of listed firms in the U.S. market between 1980–2014 and 122 natural disasters, found that stock market valuations for exposed companies were 0.3%–0.7% lower than those of non-exposed companies. The market value of the exposed firms is expected to be negatively impacted by an estimated US$9 million to US$22 million, with the largest losses occurring later in the timeline of the disaster. In contrast to severe storms and floods, Worthington and Valadkhani (2004) showed that bushfires, cyclones, and earthquakes have a significant impact on market returns. The overall impact may be favorable or unfavorable, with the majority of effects occurring on the day of the event and some adjustments in the days that follow.

Valuable insights are gained by analyzing event studies and the volatility effects of the Middle East stock market indices and the World Index. These consistent volatility effects may be caused by the growing integration and interdependence of global financial markets, especially in the Middle Eastern markets. Today's interconnected world allows market players, institutional investors, and trading systems to operate across borders, which leads to increased interlinkage between various stock markets. Shocks and information can be transmitted easily because of this interconnectedness. According to Sainath et al. (2023), volatility across markets may be affected by factors, such as global economic trends, geopolitical events, and investor sentiment.

Some Middle East market indices' volatility is insignificant for GARCH models, suggesting that these effects may not have a significant economic impact. This phenomenon may be the result of two factors. First, there is little evidence to suggest that Middle Eastern markets have become more integrated with international markets (Chau et al., 2014). Second, it may refer to the nature of these markets (i.e., emerging and frontier), where rumors take place in the absence of market transparency and efficiency. Some indices show a significant asymmetric effect of volatility, which may explain why the change is a result of a specific event, investor behavior, or market conditions.

6. CONCLUSION

The results shed light on the presence of volatility in the Middle Eastern financial markets. These events play a large part in shaping the asymmetry of market volatility. Bad news has a greater effect on the volatility of index returns. The leverage effect appears clearly during the COVID-19 crisis, and fluctuations in index returns varied between countries in the two events of the Russian invasion of Ukraine and the Turkey-Syria earthquake. The emerging and frontier markets have the highest leverage effect, and the effect varies between markets. This suggests a linkage between them, and the difference may be attributed to market conditions, investor behavior, and market regulators. While the significance of this volatility is limited, asymmetry highlights the need for a comprehensive understanding of the market dynamics and risk management practices.

Practically, institutions and market players can reduce the spread of volatility by implementing risk management plans and regulatory measures. Hedging techniques, portfolio diversification, and the use of derivative instruments are examples of risk management techniques that can assist institutions and investors in controlling and containing volatility risk. By taking these steps, the impact of volatility shocks can be lessened, and the economic importance of the effects can be diminished. Furthermore, in the case of COVID-19, as a global pandemic, regulatory persons may implement a loose monetary policy to achieve market stability. Furthermore, the policymakers in the financial markets that have no leverage effects may benefit from the findings of this study by making sufficient regulations preventing investors from making abnormal returns based on past news.

This study is limited to the Middle Eastern financial markets. Therefore, future research should consider these other markets neighboring the events' countries such as Poland, Belarus, Hungary, Romania, and Slovakia. Future studies may investigate the macroeconomic variables (e.g., inflation, government intervention) or microeconomic variables like market capitalization, and liquidity in addition to the market rank.

It is crucial to consider the limitations of the present study. This study used the World Index as a benchmark, which may have affected the results. Thus, it may be more accurate to find another benchmark for emerging and frontier markets. It also focused on the latest three events in a specific period. It may be more beneficial to extend this to other types and events. Additionally, this study used different types of analytical techniques; using other types, such as difference in difference, may introduce different results. Researchers may use other methodologies (e.g., fractional integrated models to gauge dynamic volatility) to gain more information on the drivers of volatility and their implications for market participants and policymakers.

In conclusion, this study contributes to the existing literature by offering more understanding of the effect of crisis types on different financial markets and the linkage between these markets. It opens a door for future studies and has important implications in elaborating new strategies for managing financial market risk.

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