14th International Scientific Conference "Business and Management 2024"
May 16–17, 2024, Vilnius, Lithuania

NEW TRENDS IN CONTEMPORARY ECONOMICS, BUSINESS AND MANAGEMENT

ISSN 2029-4441 / eISSN 2029-929X
eISBN 978-609-476-363-2
Article Number: bm.2024.1274
https://doi.org/10.3846/bm.2024.1274

INFLUENCE OF GEOPOLITICAL RISK ON STOCK VOLATILITY IN THE MIDDLE EAST AND NORTH AFRICA STATES

Oana PANAZAN [1*], Catalin GHEORGHE [2]

[1,2]*Department of Engineering and Industrial Management, Transilvania University of Brasov, 29 Eroilor Bvd., 500036 Brasov, Romania*

Received 29 February 2024; accepted 15 April 2024

Abstract. The paper aims to explore the impact of geopolitical risk (GPR) on volatility dynamics in the Middle East and North Africa (MENA) states following the conflict between Ukraine and Russia (started in February 2022) and Israel and Hamas (started in October 2023). Fourteen states were analyzed between 01 January 2022 and 31 December 2023 using exponential general autoregressive conditional heteroskedastic (EGARCH) and vector autoregression (VAR). We find that GPR influenced the MENA markets slightly, and only Iraq reacted significantly to the Ukraine conflict. We also observed a clustering tendency of stock markets in the analyzed area and a slight influence in a few MENA states during the Israel–Hamas conflict. The MENA countries' regulators and politicians, tasked with oversee-ing macro and micro rules based on a holistic approach that leaves no one behind, will find valuable information in this study. Because it demonstrates how quickly the stock markets respond to ongoing conflicts, this study also provides important insights to investors, managers, policymakers, and society at large.

Keywords: MENA, Israel–Hamas war, Russia–Ukraine war, volatility, GPR, EGARCH, VAR.

JEL Classification: D53, E32, G32, M20, O16.

1. Introduction

Volatility is a fundamental concept in the capital markets because it is a signaling role for all participants. Volatility dynamics affect portfolio management, asset prices, contracts, and strategies. The link between volatility and geopolitical events has been studied over the years, but it has received increased attention after the war in Ukraine. Volatility is transmitted through the flow of capital on the market, credit risk, corporate-level stocks, economic stimulus, telecommunication services, utility sectors, geopolitical risks, and the price of oil (Jiao et al., 2023; Zhao, 2023; Wu & Xie, 2023). Increasing volatility reduces the predictability of returns (Liu et al., 2023), issues pertaining to corporations, states, governments, and individual investors (Xu et al., 2023), and increases stock price crash risk (Ren et al., 2023).

In the GPR category, according to Caldara and Iacoviello (2022), the following activities that impact the typical peace process of worldwide connections are included: terrorism, tensions between states or regions, nuclear threats, elections, political uprisings, and war. Recent studies suggest a negative effect of GPR on stock returns (Pham & Nguyen, 2022; Yang & Yang, 2021), commodities (Aloui et al., 2023; Micallef et al., 2023; Mo et al., 2024), gold, and cryptocurrencies (Hasan et al., 2022; Rao et al., 2022; Singh et al., 2022; Yang et al., 2024).

The states of the Middle East and North Africa are frequently identified with the acronym MENA. Beyond cultural and historical similarities, such a grouping is used in climate, military, and academic discussions (https://www.worldbank.org/en/region/mena). MENA is not among the regional groups of the United Nations or other international organizations. Existing definitions of MENA in different studies and reports show differences regarding the inclusion of states under this acronym. Beyond such framings, we have used this group of states to establish the volatility of capital markets following the conflict between Russia and Ukraine, (started in February 2022) and that between Israel and Hamas (started in October 2023).

* Corresponding author. E-mail: *oana.panazan@unitbv.ro*

Throughout the past ten years, a number of regional and global economic and financial crises have had an impact on the MENA region's countries, both directly and indirectly, (Adekoya et al., 2022; Aloui et al., 2023; Gharaibeh & Kharabsheh, 2023). Furthermore, the region has experienced poor macroeconomic indicators at home and abroad, particularly after the Arab Spring. As a result, the current study examines how the GPR Index affects the volatility of the stock market index for the chosen MENA countries.

In the MENA region, the impact of the GPR on capital markets is an important topic due to the history of the region. The influence of GPR in such a region, characterized by GPR events, can provide an accurate depiction of these events on stock index returns and volatility. MENA states are characterized by demographic growth, similar economic structures, and different political systems comparable to developed countries (Elsayed & Helmi, 2021). Elsayed and Helmi (2021) did not include the Russian-Ukrainian conflict, and Gharaibeh and Kharabsheh (2023) did not include the full period of the conflict in Ukraine. Such aspects may lead to novel findings results.

Based on gaps identified previously, the paper aims to discuss the main characteristics of stock market volatility in the Middle East North Africa (MENA) region.

The selection of the EGARCH model was founded on the subsequent advantages, as it allows the capture of the imbalance in volatility (Tiwari et al., 2019) and volatility persistence shocks (Khan et al., 2023) incorporates the leverage impact, which represents the asymmetric impact of adverse and advantageous effects (Kim & Won, 2018; Xia et al., 2023).

We add to the body of literature in multiple ways. First, we provide information related to two ongoing military conflicts and the MENA financial markets. Our study presents evidence that GPR influences the MENA markets to a small extent during the period under review. Second, we found that the Iraqi market was the only one that reacted significantly to the onset of the conflict in Ukraine. Third, we delve into understanding the clustering trend of stock markets in the area. We found a small influence in a few states after the start of the conflict between Israel and Hamas. However, we did not observe any relationship between geopolitical risks and the volatility of some financial markets. Finally, our study applies robustness tests such as the Granger and Augmented Dickey-Fuller (ADF) tests to test the stationarity of time series. Our outcomes are central to recognizing the effects of GPR on volatility spillovers in MENA states and are especially significant to policymakers, market regulators, portfolio managers, and investors.

The paper is organized as follows. Section 2 presents a synthesis of the literature on GPR events in the analyzed states. Section 3 explains the methodology and dataset used to evaluate the link between GPR and volatility. Section 4 displays the results for the entire sample period. Section 5 makes a connection with the results of other studies. Finally, Section 6 concludes the paper with a few takeaways, restrictions, and areas that need further exploration.

2. Synthesis of literature

The impact of geopolitical risk on stock markets has been discussed often by scientists and specialists. After the outbreak of hostilities in Ukraine, the global GPR recorded unprecedented values (Zhang et al., 2023). The emergence of political risks increases volatility (Salisu et al., 2022), reduces investments (Christou et al., 2017), increases the systematic risk (Zhao, 2023), decreases investor confidence and capital migration to developed countries or safe haven assets, which can offer options for hedging and effectively diversify risk (Bouri et al., 2024). Gupta et al. (2019) demonstrated that the GPR index is the main force behind international trade flows.

Balli et al. (2019) demonstrated clustering of persistence of spillovers but without a predominance of Gulf Cooperation Council countries (CCG). The authors investigated the spread of volatility in 15 Islamic financial markets using the VAR-based generalized spread index from 2007 to 2017.

Throughout the COVID-19 epidemic, Islamic markets proved greater resilience compared to traditional markets (Adekoya et al., 2022). Oad Rajput et al. (2023) studied the spread of volatility in the Islamic financial markets of Saudi Arabia, Malaysia, Indonesia, and Turkey as an effect of the GPR spread using exponential GARCH models. The authors concluded that the propagation effects were manifested from Turkey to the other states. Abu-Alkheil et al. (2017) showed that the majority of Islamic indices can provide an excellent opportunity for diversification to attract worldwide portfolios, which are more important in difficult financial periods. The authors considered 32 traditional and 32 Islamic stock indices during the period 2002–2014. An extension of these conclusions was given by Yarovaya et al. (2021), according to whom, Islamic stocks and bonds (Sukuk) exhibited safe-haven characteristics amid the COVID-19 outbreak. Although Islamic indices are characterized by higher risks, they can contribute to diversification when combined with other assets (Raza et al., 2019).

Yilmaz et al. (2015) hypothesized a link involving Islamic stock markets and the traditional financial system. Given the role of oil in fueling world economies, most studies focus on oil costs and global stock returns (Ftiti & Hadhri, 2019; Lin & Su, 2020; Shahzad et al., 2018). The overall conclusion is that the major returns of the Islamic stock market are interlinked, not just under normal circumstances, but especially during tumultuous times in the financial and economic spheres, and oil demonstrates a net spillover status. According to Bouri et al. (2024), during GPR events, Islamic stocks are available investment options, as they offer useful diversification advantages. Of the studies on Islamic states, most are based on spillover indices of the US or other developed countries' stock, oil, and gold sectors (Kang et al., 2023; Sherif, 2020; Yousaf et al., 2022).

The conflict between Israel and Hamas began on October 7, 2023. Since it is a recent and ongoing event, as expected, no studies demonstrating the induced impact on financial markets could be identified in the literature. Therefore, the literature search was extended to find other GPR events that affected the national financial markets considered. For this, all GPR events from the last decade that had their epicenter in the analyzed area were considered. We selected studies that had as their object GPR events located in the studied area, such as the Gulf War (Iglesias & Rivera-Alonso, 2022; Larsson & Nossman, 2011; Zavadska et al., 2020) and Syrian war (Naimy et al., 2020). No research was found on other local geopolitical events such as the Afghanistan war, the Iraq war, the Lebanon–Israel war, and the Libya war and their impact on the MENA financial markets.

We found the existence of a much smaller number of studies covering the MENA states compared to the Islamic area even though one of the ways of transmission of contagion is geographical proximity. Using GARCH models and a sample period between February 1999 and June 2014, Arfaoui and Rejeb (2015) argued that markets are interconnected and hedge ratios are typically low. Elsayed and Helmi (2021) examined the impact of GPR on returns and volatility in MENA states using an ADCC-GARCH model. The authors showed that GPR does not increase the return spread in the studied financial markets, and Qatar, the United Arab Emirates, and the Kingdom of Saudi Arabia are the primary return transmitters spread to the other states. Another gap identified in the literature is that the effects of GPR in the MENA states seem contradictory, at least compared to the GCC states. Based on these aspects, we study here the volatility generated by two GPR events, one outside MENA and another generated inside this group of countries.

3. Data and methodology

The time frame for analysis is from 01 January 2022 to 31 December 2023 and covers the major geopolitical events during this period. The MENA member states, as they appear on the World Bank platform, were selected, (https://www.worldbank.org/en/region/mena). A single representative index was chosen for each state. Table 1 shows the selected states and the associated index. For each index, the daily closing prices were obtained from (https://www.investing.com) and the daily values of the GPR index from (https://www.matteoiacoviello.com/gpr.htm). Time series of equal length were constructed. The daily performance of the indices $R_{i,t}$ was computed as the natural logarithm of the ratio of the indices to the following relation:

$$R_{i,t} = \ln\left(\frac{Index_t}{Index_{t-1}}\right). \tag{1}$$

The EGARCH method was applied to calculate the volatility of the temporal sequence. The model allows relaxing the positive constraints between parameters, has the best results in terms of volatility forecasts (Chen et al., 2023), and accounts for measurement biases (Wu & Xie, 2023). By giving the most current data higher weights and the older data exponentially lower weights, the model becomes more adaptable to changes (Kim & Won, 2018).

Table 1. Analysis index

Country	Index
Bahrain	BAX
Egypt	EGX30
Iraq	ISX60
Israel	TA125
Jordan	AMGNRLX
Kuwait	BKM50
Lebanon	BLSI
Morocco	MASI
Oman	MSM30
Palestina	PLE
Qatar	QSI
Saudi Arabia	MSCI TAWADUL 30
Tunisia	TUNINDEX
UAE	DFMGI

Nelson (1991) proposed the EGARCH model, which captures the asymmetric consequences of positive and negative impacts of the same magnitude and leads to a positive value of the conditional variance, even if the calculated parameter is negative. The model is defined by the following relations:

$$y_t = x_t\varphi + \varepsilon_t; \tag{2}$$

$$\ln\sigma_t^2 = \alpha_0 + \beta\ln\sigma_{t-1}^2 + \gamma\left(\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right) + \mu\left|\frac{\varepsilon_{t-1}}{\sigma_{t-1}}\right|, \tag{3}$$

where y_t, the time sequence in Relation 2, is formulated of explanatory variances x, φ is the parameter, and ε_t the error term.

The VAR model introduced by Sims (1980) is frequently used for time series forecasting and the analysis of dynamic impacts of disturbances to a framework of variables. It is described using the following equation:

$$y_t = \delta_1 y_{t-1} + \cdots + \delta_n y_{t-n} + \varepsilon_t,\ t = 1, 2, ..., T. \tag{4}$$

The unit root of the series was checked to avoid pseudo-regression. The time series is stationary if there is no periodic change and no regular variation in its mean and variance. The ADF was applied, where the null premise (H_0) is the sequence that has a unit root and is non-stationary:

$$y_t = \omega_1 y_{t-1} + \omega_2 y_{t-2} + \cdots + \omega_p y_{t-p} + \varepsilon_t, t = 1,2, ..., T, \quad (5)$$

where y_t is the time sequence of the stock indices, t is the time lag of the variable y, p is the order of the autoregressive prototype, $\omega_i\left(i=1,2,3,\ldots,p\right)$ is the coefficient of the autoregressive prototype, ε_t is the white noise of the zero-mean series. Relation 5 is an autoregressive model with no trend and a steady mean that can be pronounced as follows:

$$\lambda^p - \omega_1 \lambda^{p-1} - \omega_p = 0, \quad (6)$$

where $\lambda^i\left(i=1,2,\ldots,p\right)$ is the characteristic root. The sequence is continuous if all the characteristics of the formula lie on the circle of units $\left|\lambda^i\right| < 1$.

The Granger causality was estimated. Rejection of the null hypothesis is interpreted as rejection of non-causality. The Granger causality test based on VAR for this investigation was implemented as follows:

$$\begin{pmatrix} y_{1t} \\ y_{2t} \\ X_t \end{pmatrix} = A_0 + A_1 \begin{pmatrix} y_{1t-1} \\ y_{2t-1} \\ X_{t-1} \end{pmatrix} + A_2 \begin{pmatrix} y_{1t-2} \\ y_{2t-2} \\ X_{t-2} \end{pmatrix} + A_3 \begin{pmatrix} y_{1t-3} \\ y_{2t-3} \\ X_{t-3} \end{pmatrix} + \begin{pmatrix} \eta_{1t} \\ \eta_{2t} \\ \eta_{3t} \end{pmatrix}, \quad (7)$$

where y_{it} represents the volatility of stock indices, X_t is the GPR, and η_{it} are the error terms.

4. Results

4.1. Descriptive statistics

From Appendix 1, it can be seen that in general the indices show a similar trend, that is, volatility followed by stabilisation with two exceptions. Thus, ISX60 has the largest amplitude at the beginning of the conflict between Russia and Ukraine. The dynamic can be justified due to Iraq's initial non-alignment in the Ukraine War, (https://gulfif.org/iraqs). Another exception is the BLSI index, which registered an appreciable volatility amplitude in May 2022, the period in which the legislative elections were scheduled. After a course characterised by a low amplitude of volatility, the index of Saudi Arabia, MSCI TADAWUL 30, recorded at the end of the period a considerable increase in volatility following the Israel-Hamas conflict.

Table 2 displays the descriptive statistics for the all-time series. Based on the information provided, it can be concluded that the analyzed time sequence does not adhere to a normal distribution, because they are leptokurtic, with a kurtosis value greater than 3. The highest indicator value is the ISX60 index (312.18) followed by BLSI (139.96) and PLE (59.29).

On the opposite side, the series with the lowest value of the indicator is as follows: QSI (4.84), EGX30 (5.30), and TUNINDEX (5.87). All series have a degree of eccentricity specific to financial phenomena dominated by risks and uncertainty.

For a perfectly symmetrical or normal distribution, the skewness indicator is always 0. The data series are

Table 2. Descriptive statistics

Index	Mean	Maximum	Minimum	Standard Deviation	Skewness	Kurtosis	Probability
BAX	0.00014	0.0342	–0.0261	0.0042	0.4178	16.3620	0.00
EGX30	0.00117	0.0540	–0.0424	0.0127	0.3320	5.3087	0.00
ISX60	0.00072	6.6502	–6.6553	0.3767	–0.0260	312.1834	0.00
TA125	–0.00013	0.0279	–0.0692	0.0103	–0.8259	7.0056	0.00
AMGNRLX	0.00022	0.0239	–0.0227	0.0048	0.4167	6.6024	0.00
BKM50	–0.00017	0.0277	–0.0399	0.0068	–0.8685	8.8249	0.00
BLSI	0.00112	0.3151	–0.0744	0.0183	8.1008	139.9683	0.00
MASI	–0.00015	0.0495	–0.0419	0.0068	–0.4181	13.2263	0.00
MSM30	0.00014	0.0276	–0.0258	0.0047	0.3972	8.16232	0.00
PLE	–5.29E-05	0.0224	–0.0654	0.0050	–4.5994	59.2930	0.00
QSI	–0.00011	0.0341	–0.0358	0.0088	0.1080	4.8445	0.00
MSCI TADAWUL 30	–1.42E-05	0.1260	–0.0521	0.0097	2.5628	51.7457	0.00
TUNINDEX	0.00034	0.0148	–0.0144	0.0030	0.2666	5.8750	0.00
DFMGI	0.00038	0.0272	–0.0589	0.0073	–0.9048	11.1306	0.00

slightly or moderately asymmetric. The negative value of the skewness indicator indicates an asymmetry to the left. Series that have a negative skew are BKM50, DFMGI, ISX60, MASI, PLE, and TA125. A zero-probability value indicates instability in financial markets.

4.2. ADF results

Since the choice of the right model depends on the variable stationarity, we utilise the ADF to investigate the unit root. The outcomes of the ADF examination display that the variables do not have a unit root (Table 3).

Time series are stationary if there are no changes in the structure of the distribution. There is a unit root in the variable studied when the probability of the ADF test has a p-value > 5%, and it does not exist when the p-value is less than 5%. All series are stationary at a level, according to the findings.

4.3. EGARCH results

The β term shows the degree to which the GPR impacts the future volatility of the index return. For most series, a number greater than 0 denotes a positive correlation between the past and present return variance. The series that has a negative value of this coefficient are the following: BLSI, MSCI TADAWUL 30, PLE, and TA125. The term provides insight into the signal of the GPR-induced shock and the impact of volatility on the future of index returns. A negative value indicates leverage effect (AMGNRLX, BKM50, DFMGI, MASI, MSCI TADAWUL 30, PLE, QSI, TA125, and TUNINDEX) and decreasing returns, which leads to higher volatility compared to an increase in returns of the same magnitude (Table 4).

The μ coefficient provides information related to the extent to which GPR impacts the future volatility of the analyzed indices. It provides an understanding of the durability of historical volatility and how historical volatility influences future volatility projections.

The Akaike Information Criterion (AIC) was utilized to determine the number of lags. It comprises the following criteria: the Final Prediction Error (FPE), the Akaike Information Criterion (AIC), the Schwarz Information Criterion (SC), the Hannan-Quinn Information Criterion (HQ), and the Sequential Modified LR Test Statistic (LR), where LR is involved in the calculation of FPE, AIC, SC, and HQ. There are two regulations for selecting the ideal delay order. If there is a maximum * for a specific lag order, that is chosen to construct the VAR model. If there are several criteria with an identical number of *, then the criterion with the lowest value is chosen (Appendix 2).

Table 3. ADF test results

ADF	t-Statistic	Prob.*	ADF	t-Statistic	Prob.*	ADF	t-Statistic	Prob.*
BAX	−14.154	0.00	EGX30	−22.927	0.00	ISX60	−43.184	0.00
1%	−3.440		1%	−3.440		1%	−3.440	
5%	−2.865		5%	−2.865		5%	−2.865	
10%	−2.569		10%	−2.569		10%	−2.569	
TA125	−25.099	0.00	AMGNRLX	−22.645	0.00	BKM50	−23.859	0.00
1%	−3.440		1%	−3.440		1%	−3.440	
5%	−2.865		5%	−2.865		5%	−2.865	
10%	−2.569		10%	−2.569		10%	−2.569	
BLSI	−23.796	0.00	MASI	−21.979	0.00	MSM30	−14.69	0.00
1%	−3.440		1%	−3.440		1%	−3.440	
5%	−2.865		5%	−2.865		5%	−2.865	
10%	−2.569		10%	−2.569		10%	−2.569	
PLE	−22.086	0.00	QSI	−20.247	0.00	MSCI TADAWUL 30	−23.720	0.00
1%	−3.440		1%	−3.440		1%	−3.440	
5%	−2.865		5%	−2.865		5%	−2.865	
10%	−2.569		10%	−2.56917		10%	−2.569	
TUNINDEX	−21.007	0.00	DFMGI	−23.718	0.00			
1%	−3.440		1%	−3.440				
5%	−2.865		5%	−2.865				
10%	−2.569		10%	−2.569				

Table 4. Coefficients of the EGARCH model

	α_0	β	γ	μ
BAX	–0.303	0.196	0.018	0.984
EGX30	–0.418	0.103	0.012	0.960
ISX60	–10.263	1.757	0.254	0.002
TA125	–3.578	–0.055	–0.224	0.606
AMGNRLX	–1.217	0.261	–0.006	0.903
BKM50	–0.737	0.155	–0.081	0.936
BLSI	–0.184	–0.129	0.085	0.969
MASI	–1.579	0.424	–0.284	0.874
MSM30	–0.680	0.067	0.070	0.941
PLE	–9.250	–0.055	–0.056	0.125
QSI	–1.792	0.111	–0.069	0.819
MSCI TADAWUL 30	–18.327	–0.087	–0.051	–0.973
TUNINDEX	–1.731	0.109	–0.030	0.857
DFMGI	–0.973	0.167	–0.150	0.915

4.4. Robustness test

Following the application of the Granger examination, a unidirectional causality connection was identified among GPR, AMGNRLX, and BAX and between EGX30 and GPR (Table 5). The results show that the series exceeds the stationarity condition.

The Granger causality test has been extensively used in research to examine the direction of causality between the two variables, (Shahbaz et al., 2012). The result of causality test shows one-way causal relationship running from GPR to Jordan and Bahrain indices, and from Egypt indice to GPR.

5. Discussion

Until the beginning of the conflict in Ukraine, the MENA stock exchange operated normally, with specific volatility for the area. The beginning of the war in Ukraine on February 24, 2022, determined the differentiated reaction of the analyzed states. Thus, the highest volatility value was recorded in Iraq, immediately after the beginning of the conflict. Low volatility was recorded in Israel, Bahrain, Lebanon, Egypt, Morocco, the United Arab Emirates, Qatar, Oman, and Saudi Arabia. A lack of reaction from the markets in Tunisia, Palestine, Jordan, and Kuwait during the same period was observed.

Table 5. Granger result

Null Hypothesis:	F-Statistic	Null Hypothesis:	F-Statistic
GPR BAX	1.999	GPR MASI	0.782
BAX GPR	1.821	MASI GPR	0.385
GPR EGX30	0.875	GPR MSM30	0.375
EGX30 GPR	3.439	MSM30 GPR	0.342
GPR ISX60	0.257	GPR PLE	1.063
ISX60 GPR	0.749	PLE GPR	0.680
GPR TA125	1.425	GPR QSI	0.918
TA125 GPR	1.257	QSI GPR	0.619
GPR AMGNRLX	2.753	GPR MSCI TADAWUL 30	0.459
AMGNRLX GPR	0.964	MSCI TADAWUL 30 GPR	0.977
GPR BKM50	0.967	GPR TUNINDEX	0.600
BKM50 GPR	1.116	TUNINDEX GPR	0.587
GPR BLSI	0.574	GPR DFMGI	1.157
BLSI GPR	0.370	DFMGI GPR	1.542

The conflict between Israel and Hamas generated low volatility in Egypt, Israel, Kuwait, Lebanon, Morocco, Palestine, and the United Arab Emirates. The stability of the markets in the belligerent states (Israel and Palestine) after the start of the conflict until the end of the analysis period is remarkable. Other markets such as Tunisia, Iraq, Bahrain, Jordan, Oman, Qatar, and Saudi Arabia did not register an increase in volatility.

The negative β coefficient in Relation 3 indicates a decrease in returns and implicitly significant volatility compared to an increase in returns of the same size. Such negative values were recorded in the indices of Israel, Lebanon, Palestine, and Saudi Arabia. For the rest of the indices, the coefficient β was positive, indicating a positive connection between past and current variances.

A negative value of the coefficient γ shows the presence of the leverage effect of negative news on the increase in volatility compared to positive news of equal intensity. As seen in Table 4, even if there were nine negative values of the γ coefficient related to the markets of Israel, the United Arab Emirates, Jordan, Kuwait, Morocco, Palestine, Qatar, Saudi Arabia, and Tunisia, the values are small. The results for Morocco and Israel can be considered significant. The outcomes offer proof of a leverage effect, denoting that negative news will cause volatility to rise more than similar-sized positive news.

The weak reaction to the war in Ukraine can be justified by the great geographical distance from the belligerent states, an aspect pointed out both by our previous research and other authors such as Elsayed and Helmi (2021). Our results highlight that, in the presence of GPR, the MENA financial markets have a similar reaction, thus validating the conclusions drawn by Arfaoui and Rejeb (2015). Moreover, the clustering tendency of the GCC states demonstrated by Balli et al. (2019) can be extended to the GPR events studied by us. We have expanded the results obtained by Adekoya et al. (2022) to the period analyzed, as our results confirm a certain immunity of the MENA markets.

The link analysis shows that the Tunisian Stock Index is not linked to the stock market and the stock indices for Islamic stocks. Our findings are in line with the conclusions drawn by Abu-Alkheil et al. (2017) and Yarovaya et al. (2021) regarding not only Islamic markets but also the remaining MENA states. We emphasize the diversification potential of MENA countries for global portfolios, especially in periods characterized by the presence of GPR. Such results provide an important risk perspective needed by decision-makers, government, and investors; without understanding the behavior of the stocks studied, the emergence of GPR portfolio diversification can become useless, as demonstrated by Shahzad et al. (2018).

6. Conclusions

Taking into account the indicated aspects, we have covered certain wide gaps in the literature. MENA states have similar economic structures and rely on natural resources. We studied the impact of the confrontation between Russia and Ukraine (since February 2022) and Israel and Hamas (since October 2023) on 14 MENA states. Our results can help portfolio managers, investors, decision-makers, and market regulators understand the spread of volatility and the effect of geopolitical risk.

All series have a degree of eccentricity specific to financial phenomena dominated by risks and uncertainty. There are series with negative asymmetry, an aspect that reconfirms the instability of the financial markets. The outcomes indicate that the variable impacts of shocks on index returns are significant and evident for Morocco and Israel, indicating the leverage effect for these states. The impacts of GPR shocks on stock index volatility shift from negative to positive, having a different effect on stock indices.

Our work is limited by the fact that we did not include the states of Algeria, Djibouti, Iran, Libya, Syria, and Yemen. Overall, our results can help investors, portfolio managers, market regulators, and legislators to understand more about how geopolitical risks affect MENA countries. Future research should also focus on determining how war affects oil prices and financial market impacts.

Funding

This research received no external funding.

Contribution

The authors state that they contributed equally to the article.

Disclosure statement

The authors declare no conflict of interest.

References

Abu-Alkheil, A., Khan, W. A., Parikh, B., & Mohanty, S. K. (2017). Dynamic co-integration and portfolio diversification of Islamic and conventional indices: Global evidence. *The Quarterly Review of Economics and Finance*, *66*, 212–224. https://doi.org/10.1016/j.qref.2017.02.005

Adekoya, O. B., Oliyide, J. A., & Tiwari, A. K. (2022). Risk transmissions between sectoral Islamic and conventional stock markets during COVID-19 pandemic: What matters more between actual COVID-19 occurrence and speculative and sentiment factors? *Borsa Istanbul Review*, *22*(2), 363–376. https://doi.org/10.1016/j.bir.2021.06.002

Aloui, R., Jabeur, S. B., Rezgui, H., & Arfi, W. B. (2023). Geopolitical risk and commodity future returns: Fresh insights from dynamic copula conditional value-at-risk approach. *Resources Policy*, *85*, Article 103873. https://doi.org/10.1016/j.resourpol.2023.103873

Arfaoui, M., & Rejeb, A. B. (2015). Return dynamics and volatility spillovers between FOREX and stock markets in MENA countries: What to remember for portfolio choice?

International Journal of Management and Economics, *46*, 72–100. https://doi.org/10.1515/ijme-2015-0022

Balli, F., De Bruin, A., & Chowdhury, I. H. (2019). Spillovers and the determinants in Islamic equity markets. *The North American Journal of Economics and Finance*, *50*, Article 101040. https://doi.org/10.1016/j.najef.2019.101040

Bouri, E., Gök, R., Gemi̇ci̇, E., & Kara, E. (2024). Do geopolitical risk, economic policy uncertainty, and oil implied volatility drive assets across quantiles and time-horizons? *The Quarterly Review of Economics and Finance*, *93*, 137–154. https://doi.org/10.1016/j.qref.2023.12.004

Caldara, D., & Iacoviello, M. (2022). Measuring geopolitical risk. *American Economic Review*, *112*(4), 1194–1225. https://doi.org/10.1257/aer.20191823

Chen, C. W. S., Watanabe, T., & Lin, E. M. H. (2023). Bayesian estimation of realized GARCH-type models with application to financial tail risk management. *Econometrics and Statistics*, *28*, 30–46. https://doi.org/10.1016/j.ecosta.2021.03.006

Christou, C., Cunado, J., Gupta, R., & Hassapis, C. (2017). Economic policy uncertainty and stock market returns in PacificRim countries: Evidence based on a Bayesian panel VAR model. *Journal of Multinational Financial Management*, *40*, 92–102. http://doi.org/10.1016/j.mulfin.2017.03.001

Elsayed, A. H., & Helmi, M. H. (2021). Volatility transmission and spillover dynamics across financial markets: The role of geopolitical risk. *Annals of Operations Research*, *305*, 1–22. https://doi.org/10.1007/s10479-021-04081-5

Ftiti, Z., & Hadhri, S. (2019). Can economic policy uncertainty, oil prices, and investor sentiment predict Islamic stock returns? A multi-scale perspective. *Pacific-Basin Finance Journal*, *53*, 40–55. https://doi.org/10.1016/j.pacfin.2018.09.005

Gharaibeh, O., & Kharabsheh, B. (2023). Geopolitical risks, returns, and volatility in the MENA financial markets: Evidence from GARCH and EGARCH models. *ELIT–Economic Laboratory for Transition Research*, *19*(3), 21–36. https://doi.org/10.14254/1800-5845/2023.19-3.2

Gulf International Forum. (2022). *Iraq's $27 bln TotalEnergies deal stuck over contract wrangling.* https://gulfif.org/iraqs

Gupta, R., Gozgor, G., Kaya, H., & Demir, E. (2019). Effects of geopolitical risks on trade flows: Evidence from the gravity model. *Eurasian Economic Review*, *9*, 515–530. https://doi.org/10.1007/s40822-018-0118-0

Hasan, M. B., Hossain, M. N., Junttila, J., Uddin, G. S., & Rabbani, M. R. (2022). Do commodity assets hedge uncertainties? What we learn from the recent turbulence period? *Annals of Operations Research.* https://doi.org/10.1007/s10479-022-04876-0

Investing.com. (2024) *Stock market quotes & financial news.* https://www.investing.com/

Iglesias, E. M., & Rivera-Alonso, D. (2022). Brent and WTI oil prices volatility during major crises and Covid-19. *Journal of Petroleum Science and Engineering*, *211*, Article 110182. https://doi.org/10.1016/j.petrol.2022.110182

Jiao, J.-W., Yin, J.-P., Xu, P.-F., Zhang, J., & Liu, Y. (2023). Transmission mechanisms of geopolitical risks to the crude oil market – A pioneering two-stage geopolitical risk analysis approach. *Energy*, *283*, Article 128449. https://doi.org/10.1016/j.energy.2023.128449

Kang, S. H., Hernandez, J. A., Rehman, M. U., Shahzad, S. J. H., & Yoon, S.-M. (2023). Spillovers and hedging between US equity sectors and gold, oil, Islamic stocks and implied volatilities. *Resources Policy*, *81*, Article 103286. https://doi.org/10.1016/j.resourpol.2022.103286

Khan, M., Kayani, U. N., Khan, M., Mughal, K. S., & Haseeb, M. (2023). COVID-19 pandemic & financial market volatility: Evidence from GARCH models. *Journal of Risk and Financial Management*, *16*(1), Article 50. https://doi.org/10.3390/jrfm16010050

Kim, H. Y., & Won, C. H. (2018). Forecasting the volatility of stock price index: A hybrid model integrating LSTM with multiple GARCH-type models. *Expert Systems with Applications*, *103*, 25–37. https://doi.org/10.1016/j.eswa.2018.03.002

Larsson, K., & Nossman, M. (2011). Jumps and stochastic volatility in oil prices: Time series evidence. *Energy Economics*, *33*(3), 504–514. https://doi.org/10.1016/j.eneco.2010.12.016

Lin, B., & Su, T. (2020). The linkages between oil market uncertainty and Islamic stock markets: Evidence from quantile-on-quantile approach. *Energy Economics*, *88*, Article 104759. https://doi.org/10.1016/j.eneco.2020.104759

Liu, F., Umair, M., & Gao, J. (2023). Assessing oil price volatility co-movement with stock market volatility through quantile regression approach. *Resources Policy*, *81*, Article 103375. https://doi.org/10.1016/j.resourpol.2023.103375

Matteo Iacoviello's homepage. (n.d.). *Geopolital Risk (GPR) Index*. https://www.matteoiacoviello.com/gpr.htm

Micallef, J., Grima, S., Spiteri, J., & Rupeika-Apoga, R. (2023). Assessing the causality relationship between the Geopolitical Risk Index and the agricultural commodity markets. *Risks*, *11*(5), Article 84. https://doi.org/10.3390/risks11050084

Mo, B., Nie, H., & Zhao, R. (2024). Dynamic nonlinear effects of geopolitical risks on commodities: Fresh evidence from quantile methods. *Energy, 288*, Article 129759. https://doi.org/10.1016/j.energy.2023.129759

Naimy, V., Montero, J.-M., El Khoury, R., & Maalouf, N. (2020). Market volatility of the three most powerful military countries during their intervention in the Syrian War. *Mathematics*, *8*(5), Article 834. https://doi.org/10.3390/math8050834

Nelson, D. B. (1991). Conditional heteroskedasticity in asset returns: A new approach. *Econometrica*, *59*(2), 347–370. https://doi.org/10.2307/2938260

Oad Rajput, S. K., Memon, A. A., Siyal, T. A., & Bajaj, N. K. (2023). Volatility spillovers among Islamic countries and geopolitical risk. *Journal of Islamic Accounting and Business Research*, *15*(5), 729–745. https://doi.org/10.1108/jiabr-07-2022-0173

Pham, L., & Nguyen, C. P. (2022). How do stock, oil, and economic policy uncertainty influence the green bond market? *Finance Research Letters*, *45*, Article 102128. https://doi.org/10.1016/j.frl.2021.102128

Rao, A., Gupta, M., Sharma, G. D., Mahendru, M., & Agrawal, A. (2022). Revisiting the financial market interdependence during COVID-19 times: A study of green bonds, cryptocurrency, commodities and other financial markets. *International Journal of Managerial Finance*, *18*(4), 725–755. https://doi.org/10.1108/IJMF-04-2022-0165

Raza, N., Ali, S., Shahzad, S. J. H., Rehman, M. U., & Salman, A. (2019). Can alternative hedging assets add value to Islamic-conventional portfolio mix: Evidence from MGARCH models. *Resources Policy*, *61*, 210–230. https://doi.org/10.1016/j.resourpol.2019.02.013

Ren, X., Cao, Y., Liu, P. J., & Han, D. (2023). Does geopolitical risk affect firms' idiosyncratic volatility? Evidence from

China. *International Review of Financial Analysis*, *90*, Article 102843. https://doi.org/10.1016/j.irfa.2023.102843

Salisu, A. A., Ogbonna, A. E., Lasisi, L., & Olaniran, A. (2022). Geopolitical risk and stock market volatility in emerging markets: A GARCH – MIDAS approach. *North American Journal of Economics and Finance*, *62*, Article 101755. https://doi.org/10.1016/j.najef.2022.101755

Shahbaz, M., Lean, H. H., & Shabbir, M. S. (2012). Environmental Kuznets curve hypothesis in Pakistan: Cointegration and Granger causality. *Renewable and Sustainable Energy Reviews*, *16*(5), 2947–2953. https://doi.org/10.1016/j.rser.2012.02.015

Shahzad, S. J. H., Mensi, W., Hammoudeh, S., Rehman, M. U., & Al-Yahyaee, K. H. (2018). Extreme dependence and risk spillovers between oil and Islamic stock markets. *Emerging Markets Review*, *34*, 42–63. https://doi.org/10.1016/j.ememar.2017.10.003

Sherif, M. (2020). The impact of Coronavirus (COVID-19) outbreak on faith-based investments: An original analysis. *Journal of Behavioral and Experimental Finance*, *28*, Article 100403. https://doi.org/10.1016/j.jbef.2020.100403

Sims, C. A. (1980). Macroeconomics and reality. *Econometrica*, *48*(1), 1–48. https://doi.org/10.2307/1912017

Singh, S., Bansal, P., & Bhardwaj, N. (2022). Correlation between geopolitical risk, economic policy uncertainty, and Bitcoin using partial and multiple wavelet coherence in P5+ 1 nations. *Research in International Business and Finance*, *63*, Article 101756. https://doi.org/10.1016/j.ribaf.2022.101756

Tiwari, A. K., Raheem, I. D., & Kang, S. H. (2019). Time-varying dynamic conditional correlation between stock and cryptocurrency markets using the copula-ADCC-EGARCH model. *Physica A: Statistical Mechanics and Its Applications*, *535*, Article 122295. https://doi.org/10.1016/j.physa.2019.122295

World Bank Group. (2014). *Middle East and North Africa*. https://www.worldbank.org/en/region/mena

Wu, H., & Xie, Q. (2023). Volatility spillovers and asymmetric effects of Chinese A-share markets – Enterprise-level data based on high-dimensional social network models. *Applied Economics*, 1–25. https://doi.org/10.1080/00036846.2023.2288051

Xia, Y., Shi, Z., Du, X., Niu, M., & Cai, R. (2023). Can green assets hedge against economic policy uncertainty? Evidence from China with portfolio implications. *Finance Research Letters*, *55*, Article 103874. https://doi.org/10.1016/j.frl.2023.103874

Xu, Z., Mohsin, M., Ullah, K., & Ma, X. (2023). Using econometric and machine learning models to forecast crude oil prices: Insights from economic history. *Resources Policy*, *83*, Article 103614. https://doi.org/10.1016/j.resourpol.2023.103614

Yang, J., Agyei, S. K., Bossman, A., Gubareva, M., & Marfo-Yiadom, E. (2024). Energy, metals, market uncertainties, and ESG stocks: Analysing predictability and safe havens. *The North American Journal of Economics and Finance*, *69*, Article 102030. https://doi.org/10.1016/j.najef.2023.102030

Yang, J., & Yang, C. (2021). The impact of mixed-frequency geopolitical risk on stock market returns. *Economic Analysis and Policy*, *72*, 226–240. https://doi.org/10.1016/j.eap.2021.08.008

Yarovaya, L., Elsayed, A. H., & Hammoudeh, S. (2021). Determinants of spillovers between Islamic and conventional financial markets: Exploring the safe haven assets during the COVID-19 pandemic. *Finance Research Letters*, *43*, Article 101979. https://doi.org/10.1016/j.frl.2021.101979

Yilmaz, K. M., Sensoy, A., Ozturk, K., & Hacihasanoglu, E. (2015). Cross-sectoral interactions in Islamic equity markets. *Pacific-Basin Finance Journal*, *32*, 1–20. https://doi.org/10.1016/j.pacfin.2014.12.008

Yousaf, I., Beljid, M., Chaibi, A., & Al-Ajlouni, A. T. M. (2022). Do volatility spillover and hedging among GCC stock markets and global factors vary from normal to turbulent periods? Evidence from the global financial crisis and Covid-19 pandemic crisis. *Pacific Basin Finance Journal*, *73*, Article 101764. https://doi.org/10.1016/j.pacfin.2022.101764

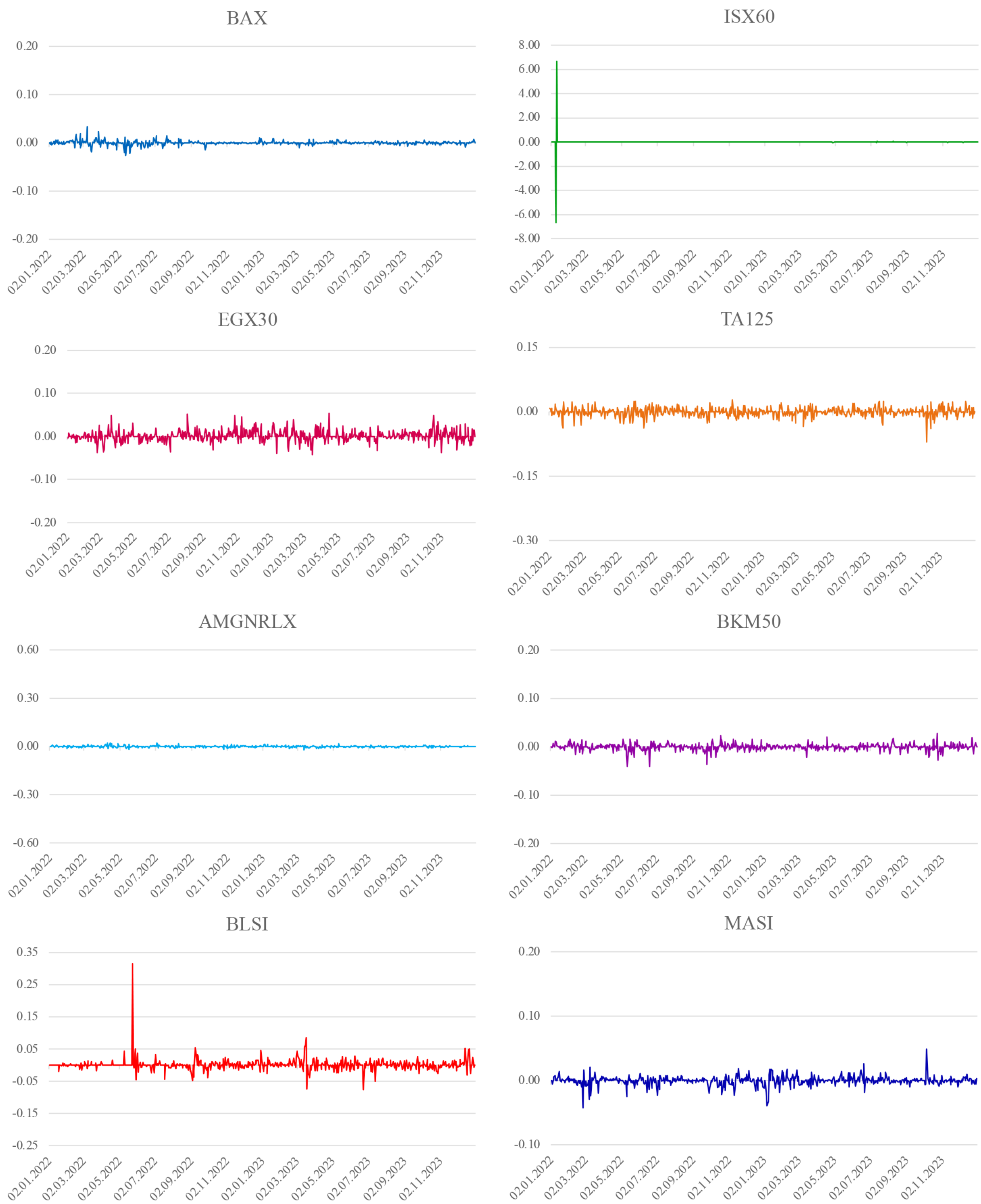
Zavadska, M., Morales, L., & Coughlan, J. (2020). Brent crude oil prices volatility during major crises. *Finance Research Letters*, *32*, Article 101078. https://doi.org/10.1016/j.frl.2018.12.026

Zhang, Y., He, J., He, M., & Li, S. (2023). Geopolitical risk and stock market volatility: A global perspective. *Finance Research Letters*, *53*, Article 103620. https://doi.org/10.1016/j.frl.2022.103620

Zhao, J. (2023). Time-varying impact of geopolitical risk on natural resources prices: Evidence from the hybrid TVP-VAR model with large system. *Resources Policy*, *82*, Article 103467. https://doi.org/10.1016/j.resourpol.2023.103467

APPENDIX 1

Plot of daily stock volatility




MSM30
0.12
0.07
0.02
-0.03
-0.08
PLE
0.15
0.05
-0.05
-0.15
QSI
0.15
0.05
-0.05
-0.15
MSCI TADAWUL 30
0.15
0.05
-0.05
-0.15
TUNINDEX
0.15
0.05
-0.05
-0.15
DFMGI
0.15
0.05
-0.05
-0.15
02.01.2022
02.03.2022
02.05.2022
02.07.2022
02.09.2022
02.11.2022
02.01.2023
02.03.2023
02.05.2023
02.07.2023
02.09.2023
02.11.2023

APPENDIX 2

Lag order

	Lag	LogL	LR	FPE	AIC	SC	HQ
BAX	8	1081.300	16.634*	0.0001*	−3.394*	−3.150	−3.300*
EGX30	8	402.326	30.741*	0.0010*	−1.193*	−0.950*	−1.099*
ISX60	8	631.176	15.733*	0.0004*	−1.935*	−1.691	−1.840*
TA125	8	521.260	15.198*	0.0007*	−1.579*	−1.335	−1.484*
AMGNRLX	8	999.013	21.056*	0.0001*	−3.128*	−2.884	−3.033*
BKM50	8	772.592	17.763*	0.0003*	−2.394*	−2.150	−2.299*
BLSI	8	160.866	17.530*	0.0022*	−0.411*	−0.167	−0.316*
MASI	8	773.934	16.763*	0.0003*	−2.398*	−2.154	−2.303*
MSM30	8	1010.263	14.997*	0.0001*	−3.164*	−2.920	−3.069*
PLE	8	973.865	23.973*	0.0001*	−3.046*	−2.802	−2.951*
QSI	8	627.488	16.537*	0.0005*	−1.923*	−1.679	−1.828*
MSCI TADAWUL 30	8	556.998	15.139*	0.0006*	−1.695*	−1.451	−1.600*
TUNINDEX	8	1281.157	16.261*	6.02e-05*	−4.042*	−3.798	−3.947*
DFMGI	8	738.507	17.459*	0.0003*	−2.283*	−2.039	−2.188*