On the Robustness of Portfolio Diversification Benefits within MENA Stock Markets

Wajih KHALLOULI*

Department of Economics, Higher School of Economic and Commercial Sciences of Tunis (ESSECT), University of Tunis, Tunisia.

Received: 29 May 2020; Accepted: 25 May 2025.

Abstract:

This study aims to examine whether the benefits of diversification within MENA stock markets are robust to changes across volatility regimes over the weekly period spanning from January 2004 to March 2025. The methodology adopted in this paper is based on testing the stability of shock transmission mechanisms across markets in the presence of regime-switching volatility, using a bivariate Markov switching model. The findings show that, in general, intra-MENA market linkages are unstable, with little evidence of robust portfolio diversification benefits during turbulent periods. From the perspective of portfolio strategies, our results highlight differences in portfolio allocation depending on the volatility regime and the country group, due to their heterogeneous characteristics. These findings are of great interest to policymakers, who should consider short-term responses to prevent the spread of contagion during crisis periods.

Keywords: Market linkages, MENA stock markets, international portfolio diversification, regime switching

JEL classification: C32, F42, G15

* E-mail: wajih.khallouli@gmail.com

1. Introduction

Throughout the last decades, countries in the Middle East and North Africa (MENA) region have conducted financial liberalization policies alongside a gradual relaxation of controls on outward capital flows. Nowadays, given its economic potential, this region has become an increasingly attractive destination for international investors. Moreover, despite moderate intra-regional correlations, MENA markets generally exhibit low integration with major global indices, suggesting substantial risk-reduction potential for foreign and regional equity fund managers (Thomas Lagoarde-Segot and Brian M. Lucey, 2007b). Furthermore, the heterogeneity of the MENA markets - in terms of economic structure, sectoral composition, and financial openness - makes them more attractive by offering investors different risk-return profiles within a single geographic area. However, the MENA region has faced major shocks—GFC 2007, Arab Spring 2011, and COVID-19—during which market correlations spike, undermining portfolio diversification (Thomas J. Flavin and Ekaterini Panopoulou, 2009; Balcilar, Elsayed, and Hammoudeh, 2023). Thus, this questions the robustness of MENA diversification under different market conditions.

The aim of this study is to assess the robustness of intra-MENA stock markets diversification benefits across calm and turmoil market regimes. To do this, we investigate the stability of financial linkages between pairs of MENA stock markets to explicitly test whether diversified portfolios benefits are robust to changes across volatility regimes. In addition, identifying the mechanisms by which shocks are propagated within markets during tumultuous periods can help policymakers to implement the most effective policy strategies to deal with contagion in order to regulate financial markets.

The remainder of the paper proceeds as follows. Section 2 reviews the literature; Section 3 details data and methodology; Section 4 reports results; Section 5 concludes.

2. Literature Review

In the existing literature, a large body of research has examined the issue of interdependencies between MENA and developed equity markets, seeking to investigate the financial integration of the MENA region (Michael Graham, Jarno Kiviaho, and Jussi Nikkinem, 2013; Rizwan, Mushtaq, and Syed Zulfiqar Ali Shah, 2014; Abdullah R. Alotaibi and Anil V. Mishra, 2017; Burcu Kapar, Jose Olmo, and Rim Ghalayini, 2019; Salam A. Ziadat, Patrick Herbst, David G. McMillan, 2020; Hamidreza Habibi and Hassan Mohammadi, 2022). Other studies have focused on return and/or volatility shocks transmission within MENA stock markets. In this context, Yochanan Shachmurove (2005) employs Bayesian vector autoregression model to study how a shock in one MENA stock market is transmitted to others in the region over the period from October 1996 to September 1999. The author found that there was a dynamic linkage among MENA stock markets, although it appears to be relatively small. Yaser A. Alkulaib, Mohammad Najand, and Ahmad Mashayekh (2009) sought to analyze dynamic linkages within MENA stock markets during a period of explosive growth episode from 1999-2004. Their findings indicated no causality or spillover between markets; however, there were more linkages within the Gulf Cooperation Council (GCC) markets than between other non-oil-producing countries. Abdullah R. Alotaibi and Anil V. Mishra (2015) focused on GCC countries and examined return and volatility spillover effects from Saudi Arabia equity markets to other GCC stock markets (Bahrain, Oman, Kuwait, Qatar, and United Arab Emirates). They proposed various bivariate GARCH models to test the asymmetric effect, using weekly returns over the period from June 2005 to May 2013. They found significant and positive regional spillover effects in GCC markets. Furthermore, Lanouar Charfeddine and Hisham Al Refai (2019) examined stock market dependence and volatility spillovers between Qatar and the other GCC countries (Saudi Arabia, the United Arab Emirates, Bahrain, Kuwait and Oman). They employed various multivariates GARCH models (MVAR-EGARCH) estimated using daily data from January 3, 2011 to September 20, 2018. Despite the political crisis of 2017, they found significant time-varying GCC stock market dependence that could be explained by co-movements with major global markets or their common sensitivity to oil price fluctuations. They also found that volatility spillovers declined following the Qatar-Saudi Arabia political crisis of June 2017, which may have discouraged investors from exploring investment strategies in GCC stock markets. Salem Adel Ziadat, Herbst, and David G. McMillan (2020) investigated inter- and intra-regional relations among GCC stock markets. Using weekly data over the period from 2004 to 2019, they estimated a DCC-GARCH model to capture the time-varying intra-regional correlation, addressing heteroscedasticity and contemporaneous linkages. Additionally, they used the Diebold and Yilmaz spillover index based on a generalized VAR framework to quantify directional return and volatility spillovers, as well as analyzing shock transmission across markets. Their results showed that the UAE acted as a major hub for spillovers within the GCC, while Bahrain and Kuwait showed signs of being more disconnected.

More recently, Kapar Burcu, Syed Mabruk Billah, Faisal Rana, and Faruk Balli (2024) examined intra-regional patterns of return and volatility spillovers between equity sectors of GCC countries over the period from 2007 to 2021. Using weekly data, they estimated spillovers through a Time-Varying Parameter Vector Autoregressive (TVP-VAR) frequency connectedness method, exploring different patterns and magnitudes. Their findings confirm the heterogeneous linkages in GCC return and volatility spillovers, which are regime-dependent increase in intensity during periods of turmoil. Another recent study from Mohamad Husam Helmi, Jinxin Cui, Ahmed H. Elsayed, and Mohammad Enamul Hoque (2025) has examined shock spillovers among 13 MENA stock markets. Using daily stock index returns, the authors applied the TVP-VAR connectedness approach based on the Autoregressive Conditional Density (ACD) model. The results reveal that total volatility spillovers among MENA stock markets are significantly stronger than skewness and kurtosis spillovers. Moreover, the cross-moment spillovers between volatility and kurtosis are more pronounced. The findings also confirm that both geopolitical risk (GPR) and global fear (VIX) indicators significantly drive these spillovers during periods of turmoil.

Within the same strand of MENA stock markets interdependencies - but focusing on a portfolio diversification perspective - many studies examining the degree of integration and segmentation among financial markets in the MENA region have provided important insights into portfolio diversification opportunities (Lagoarde-Segot and Lucey, 2007b; 2008; Elie I. Bouri, Georges Yahchouchi, 2014; Elie I. Bouri, Andre Eid, and Imad Kachacha, 2014; Aktham I. Maghyereh, Basel Awartani, and Khalil Al Hilu, 2015; Fatma Khalfallah, 2023; Mohamed Malek Belhoula, Walid Mensi, and Kamel Naoui, 2024), particularly within GCC countries (Jamaledin M. Zonouzi, Gholamreza Mansourfar, and Fateme B. Azar, 2014; Mehmet Balcılar, Riza Demire, and Shawkat Hammoudeh, 2015; Mouna Youssef and Khaled Mokni, 2018). Recently, Heni Boubaker, Bassem Saidane, and Mouna Ben Saad Zorgati (2022) aimed to examine the persistence and dynamic properties of stock market returns and volatility in GCC countries, offering insights into diversification opportunities. Utilizing daily data from June 1, 2005 to July 1, 2019, the research employed advanced dual long-memory models, including fractional integration and GARCH-type specifications, to capture long-range dependencies, asymmetries, non-linearity, and seasonal effects in both returns and volatility. Their findings suggest that these markets are not completely efficient in processing regional news, thus providing a sound alternative for regional portfolio diversification.

However, very little is known about what non-oil-producing MENA countries offer as opportunities to investors, despite their relative openness, development, and diversification. Thomas Lagoarde-Segot and Brian M. Lucey (2007a) opt for various cointegration methodologies to study the capital market integration's implications for international portfolio investment allocation in MENA stock markets over the period from 1998 to 2004. In line with previous studies, they found that the MENA region may offers significant diversification opportunities for international investors. Lagoarde-Segot and Lucey (2007b) used five optimization models to examine the diversification benefits of portfolio investment in the MENA region over the 1998-2006 period. They computed optimal portfolios and compared their ex-post performance to some constructed international portfolios in dollars and local currencies. The results confirm evidence of potential diversification benefits in the MENA region.

The above studies are based on the benefits of portfolio diversification for the international investors. That is why Riza Demirer (2013) has looked into the benefits on portfolio diversification, but from the local investors' perspective in the frontier markets in the GCC. Using daily and monthly data from 2000 to 2008, and two diversification measures (the correlation index and return dispersion), results show that investors in GCC markets (with the exception of Bahrain), could not achieve the desired levels of diversification using domestic stocks only. Abdul Aziz Buriev, Ginanjar Dewandaru, Mohd-Pisal Zainal and Mansur Masih (2018) investigated the portfolio diversification benefits of the Turkish investors from investment in MENA countries. They used a combined correlation approach between the MGARCH-DCC and Wavelet techniques, including the period from June 2005 to April 2015. Results suggest that portfolio diversification of the Turkish investors, with only Oman and Lebanon stock markets, may generate long-term benefits.

More recently, Seema Wati Narayan, Mobeen Ur Rehman, Yi-Shuai Ren, and Chaoqun Ma (2023) investigate the long-term effectiveness of correlation-based diversification strategies across stock markets in MENA, but comparing them to Asia, Central and Eastern Europe, and Latin America regions. Using data from 2000 to 2022, they constructed five regional portfolios based on the average unconditional correlation between domestic and foreign assets. They employed the panel cointegration methods to test the long-term behavior of each regional portfolio, and their study found that selecting low-correlated portfolios does not consistently yield long-term diversification gains.

In the same context, some empirical works turn to the role of turmoil periods in MENA diversification opportunities. Simon Neaime (2012) employed the causality-in-variance test to analyze the global and regional financial linkages between MENA and more developed markets on one hand, and between MENA stock markets on the other. The author used a period from January 1, 2007, to December 31, 2010, which included the global financial crisis (GFC) in 2008. The results revealed that the GFC did not significantly affect the Saudi Arabia stock market. Despite this, in the instance of a new financial crisis erupting, Saudi stock market can offer a potential diversification opportunity for regional and international portfolios, in contrast to the remaining non-oil-producing MENA markets. Bouri, Eid, and Kachacha, (2014) examined the sensitivity of MENA stock market linkages to some regional (the Israeli-Hezbollah war of 2006) and global events (the global financial crisis of 2008). Testing the stability of the pair-wise conditional correlations of returns derived from a multivariate GARCH model, the results indicate that the correlation between MENA stock markets tends to decrease over stress periods. This suggests a significant diversification opportunity during turmoil episodes. Maghyereh, Awartani, and Al Hilu (2015) investigated the consequences of temporal volatility spillovers between the U.S and a group of MENA equities on the diversification benefits of international investors, before and after the global financial crisis in 2008. The authors also analyzed the financial crisis's impact on intra-MENA diversification. The findings indicate that financial crisis had a negative effect not only on the diversification benefits of the U.S. investor but also on diversification within MENA equities. Simon Neaime (2016) investigated the vulnerability of the international and regional financial linkages of the MENA stock markets over a relatively long period of time (2005-2014) including global financial and debt crises. Using cointegration and Granger causality tests and the impulse response functions to assess diversification potential of MENA portfolios, the results reveal that even during major crises, MENA-GCC stock markets constitute potential safe havens for remaining MENA investors and investors in France, the UK and the US.

More recently, Ahmed H. Elsayed and Larisa Yarovara (2019) analyzed the dynamic co-movement of financial distress between eight MENA countries during the political turmoil of the Arab Spring. They used the frequency domain to identify a change in intensity of financial stress spillovers across pre-, during, and after- Arab spring periods, using a dataset from December 12, 2005 to July 31, 2018. This frequency connectedness framework was based on spectral representations of variance decomposition that allowed decomposition of stress transmission between markets in high frequencies (short-term effect) and low frequencies (long-term effect). Their empirical results showed that stress spillovers between MENA countries occurred in the long term, which helped investors with different investment horizons and trading strategies to adjust their expectations. In the same line, Besma Hkiri, Azza Bejaoui, Cheima Gharib, Hashem A. AlNemer (2021) employed a multi-step methodology based on a battery of advanced techniques, such as Wavelet Transform Modulus Maxima (WTMM) and the Multifractal Detrended Fluctuation Analysis (MF-DFA), to analyze the diversification potential within MENA stock markets, especially during significant political shocks such as the Arab Spring. They used daily stock returns from eleven MENA countries over the period 2005–2016, capturing pre- and post-political event periods. The findings reveal significant multifractality and anti-persistent behavior across markets, indicating inefficiencies that could be exploited for diversification. These results further show that the benefits of diversifying within MENA can change considerably over time and are affected by political events in each country.

Although the above studies have examined MENA portfolio diversification during international financial crises, their main focus was on identifying diversification opportunities under crisis conditions. However, while numerous recent studies have explored the robustness of the portfolio diversification in developed economies and major emerging markets in Asia and Latin America (Nicholas Apergis, Christina Christou, and Iason Kynigakis, 2019, Mohti, Wahbeeah, Andreia Dionisio, Isabel Vieira, and Paulo Ferreira. 2019; Rong Huang, Dimos Kambouroudis, David G. McMillan, 2025), the MENA region remains relatively understudied in this respect. Given the growing number of global shocks and international financial crisis, it is crucial to assess whether the benefits of diversification of intra-MENA portfolio are robust to time-varying asset return volatility that reflects changing market conditions. To the best of our knowledge, this is the first study that aims to fill this gap by using a parsimonious approach based on the bivariate Markov-switching approach. Methodologically, our approach differs from earlier works by avoiding the subjective identification of crisis periods and instead endogenously capturing regime shifts in time-varying volatility. Finally, the study adds a novel regional dimension by distinguishing between GCC and non-oil-producing MENA markets, offering deeper insight into the heterogeneity of diversification and resilience across the region.

3. Econometric Methodology

To investigate the robustness of diversification gains between MENA stock markets during the international financial crisis, we test for the stability of market linkages through shocks transmission mechanisms across different volatility regimes. To do that, we employ a bivariate Markov-switching model, which is a parsimonious yet powerful approach introduced by Toni Gravelle, Maral Kichian, and James Morley (2006) and extended by Thomas J. Flavin, Ciara E. Morley, Ekaterini Panopoulou (2014). This framework allows us to capture regime-dependent changes in market co-movements and, therefore, enable us to test whether diversification benefits hold consistently across different volatility regimes. Moreover, it allows for testing the stability of the shocks-propagation mechanisms' parameters in a structural model, which corrects not only for the bias due to the heteroskedasticity, endogeneity, and omitted variables, but also for other problems. For example, the selection bias caused by the regime-switching volatility identification is also corrected since the timing of the change in volatility is determined endogenously by the switching approach. On the other hand, testing for stability is realized even without knowing the ground-zero country source of turmoil, which could not be linked to analyzed markets. This feature is valuable as several crisis episodes encompass large common shocks, implying that the choice of the ground-zero country can be arbitrary. Moreover, the novelty of this approach lies also in its application to MENA markets, which, to the best of our knowledge, has not yet been addressed in the literature.

More formally, our model distinguishes between common and idiosyncratic shocks. Instability of common shock transmission refers to increase markets co-movement in turbulent periods corresponding to international crisis (Gravelle, Kichian, and Morley 2006; Giovanna Bua and Carmine Trecroci, 2019; Mehdi Mili, Jean-M. Sahut, and Frédéric Teulon, 2020). In addition, an increase in market linkages occurs when idiosyncratic shocks spill over between market pairs during regimes of high-volatility (Flavin, Morley, and Panopoulou, 2014).

Let a pair of returns r_{1t} and r_{2t} of two MENA stock markets, are decomposed as follows:

$$r_{it} = \mu_i + u_{it}\,,\ E(u_{it}) = 0,\ i = 1,2 \qquad (1)$$

where μ_i is an expected return of market i and the forecast errors u_{it} which are contemporaneously correlated $(E(u_{1,t}, u_{2,t}) \neq 0)$, implying the existence of common structural shocks on both markets. In addition, the forecast error of each asset return is decomposed into z_{ct} and z_{it} which denote the common and idiosyncratic structural shocks, respectively. Then the forecast errors are given by the following equation:

$$u_{it} = \sigma_{cit} z_{ct} + \sigma_{it} z_{it}\,,\ i = 1, 2 \qquad (2)$$

where σ_{cit} and σ_{it} represent the impact of common and idiosyncratic structural shocks on asset returns. The two coefficients are interpreted as standard deviations since shock variances are normalized to unity.

On the one hand, according to Gravelle, Kichian, and Morley (2006), the common shock coefficients are used to investigate linkage stability between two markets during international crises. The rationale behind this idea relies on the argument that a large common shock hurting both markets will produce the same size of negative impact on each market and, therefore, does not change the real interdependence, even with an observed increase in co-movements. In other words, the ratio $\frac{\sigma_{c,1}}{\sigma_{c,2}}$ will remain constant before and after the episode of international crisis although the observed increase in variances and correlation between the returns of two assets is due to the larger effect of common shock, and not due to the change in specific shock-propagation mechanisms (Flavin and Panopoulou, 2009). In this case, linkages between two markets remain stable during a high- volatility regime, and therefore, any benefits from diversification could be robust. In contrast, new channels of specific shocks transmission are generated during the high-volatility regime of common shock, amplifying the existed financial linkages - hence instability of transmission mechanisms. According to the Kristin Forbes and Roberto Rigobon's (2001) crisis-contingent theories, this instability is qualified as a "Shift-contagion". It occurs when there is a structural shift in interdependencies that already exists between markets. Such interdependencies are generated by pre-existing real links, such as trade (Reuven Glick and Andrew Rose,1999; Giancarlo Corsetti, Paolo Pesenti, Nouriel Roubini, and Cedric Tille, 2000) and financial links (Graciela Kaminsky and Carmen Reinhart, 2000; Caroline Van Rijckeghem and Beatrice Weder di Mauro, 2003) or exposure to permanent common shocks such as common exogenous shocks (Paul Masson, 1999).

On the other hand, to investigate stability in shocks transmission mechanisms between MENA stock markets during turmoil periods, we test the significant impact of idiosyncratic shocks transmission, which is active only during crisis periods, according to Flavin, Morley, and Panopoulou (2014). If an idiosyncratic shock in one market causes the transition of another market across low- and high-volatility regimes, we consider that there is instability in financial linkages between two markets. This is considered a "Pure contagion", which occurs when the transmission of negative idiosyncratic shocks results from financial panic characterized by expectation's switch (Masson, 1999). In this case, portfolio diversification benefits are not robust during turmoil periods due to spillover of idiosyncratic shocks between MENA stock markets.

Following Gravelle, Kichian, and Morley (2006), we assume both common and idiosyncratic shocks are independents and can switch between a low- and high-volatility regimes:

$$\sigma_{it} = \sigma_i(1 - S_{it}) + \sigma_i^* S_{it} \quad i = 1, 2 \qquad (3)$$

$$\sigma_{cit} = \sigma_{ci}(1 - S_{ct}) + \sigma_{ci}^* S_{ct} \quad i = 1, 2 \qquad (4)$$

where $S_{it} = \{0,1\}, i = 1, 2, c$ are unobserved state variables. Parameters with an asterisk refer to the high-volatility regime which corresponds to the turmoil period (i.e.,$|\sigma^*| > |\sigma|$). We assume that the state jumps between regimes endogenously and follows a Markov-switching path using the following conditional probabilities, P:

$$P = \begin{pmatrix} p_{00} & p_{01} \\ p_{10} & p_{11} \end{pmatrix}$$

where p_{HS} represents the conditional probability in which state of stability (S) at time $(t - 1)$ is followed by a state of high volatility (H) at time (t):

$$p_{HS} = \Pr(S_{it} = H \mid S_{i,t-1} = S), \ \forall \ i = 1,2, c \text{ and } H, S = 0,1 \qquad (5)$$

In addition, we relax the assumption of constant expected returns in Equation (1) and we assume that the expected return is time-varying and depends only on the state of common shocks:

$$\mu_{it} = \mu_i(1 - S_{ct}) + \mu_i^* S_{ct}, \quad i = 1, 2 \qquad (6)$$

Moreover, as highlighted by Flavin, Morley and Panopoulou (2014), we augment our return equation of market i with the idiosyncratic shock of market j $(i \neq j)$ during the high volatility regime. This extension allows us to assess the stability of both common and idiosyncratic shocks mechanisms within a unified framework. The new return equations of our model is represented as:

$$r_{it} = \mu_{i,S_{ct}} + \sigma_{c,i,S_{ct}} z_{ct} + \sigma_{i,S_{it}} z_{it} + \delta_i \sigma_{j,(S_{jt}=1)} z_{jt} \ i, j = 1, 2 \qquad (7)$$

where δ_i is the parameter which detects and measures the impact strength of idiosyncratic shocks of market j $(i \neq j)$ on market i during high-volatility regime.

To test the stability for two kinds of shocks transmission mechanisms, the estimated variance-covariance matrix is used to make inferences about different parameters. This matrix contains eight distinct regimes given different state variables. For instance, in high-volatility regime of common and two idiosyncratic shocks, the variance-covariance matrix of returns is given by:

$$\Sigma_8 = \begin{bmatrix} \sigma_1^{*\,2} + \sigma_{c,1}^{*\,2} + \delta_1^2 \sigma_2^{*\,2} & \sigma_{c,1}^* * \sigma_{c,2}^* + \delta_2\, \sigma_1^{*\,2} + \delta_1 \sigma_2^{*\,2} \\ \sigma_{c,1}^* * \sigma_{c,2}^* + \delta_2\, \sigma_1^{*\,2} + \delta_1 \sigma_2^{*\,2} & \sigma_2^{*\,2} + \sigma_{c,2}^{*\,2} + \delta_2^2\, \sigma_1^{*\,2} \end{bmatrix} \quad (8)$$

Given the assumption of structural shocks normality, this complete model is estimated using a one-step maximum likelihood technique for Markov-switching model (James D. Hamilton, 1989).

Finally, the chosen methodology offers a valuable tool to detect time-varying stability linkages within markets, even though it has some limits. For instance, the bivariate nature of the model may miss connections that involve several markets. That said, its relative simplicity facilitates interpretation and allows for a clearer focus on the core issue of regime-dependent co-movement.

3.1. Testing for stability of the common shock transmission mechanisms

We follow Gravelle, Kichian, and Morley (2006) to test the null hypothesis that large unexpected common shock affect both markets negatively and similarly, and independently from its transmission mechanisms. In this case, there is no change in interdependence and the ratio $\frac{\sigma_{c,1,t}}{\sigma_{c,2,t}}$ remains stable even during high-volatility regime, showing the stability of the shock transmission mechanisms. We formally test stability using a likelihood ratio (LR) statistic and the following null and alternative hypotheses:

$$\begin{cases} H_0: \dfrac{\sigma_{c,1}^*}{\sigma_{c,2}^*} = \dfrac{\sigma_{c,1}}{\sigma_{c,2}} \\ H_1: \dfrac{\sigma_{c,1}^*}{\sigma_{c,2}^*} \neq \dfrac{\sigma_{c,1}}{\sigma_{c,2}} \end{cases}$$

The estimated impact coefficient of common structural shock is given by the ratio γ:

$$\gamma = \max\left\{ \left| \frac{\sigma_{c,1}^* \sigma_{c,2}}{\sigma_{c,2}^*\ \sigma_{c,1}} \right| \quad \left| \frac{\sigma_{c,2}^* \sigma_{c,1}}{\sigma_{c,1}^*\ \sigma_{c,2}} \right| \right\}$$

The absolute value is considered in the construction of this ratio, in order to compare country pairs by normalizing the order, such that γ is greater than or equal to 1. Indeed, it measures the impact coefficients in the high-volatility regime proportionally to their corresponding values in the low-volatility regime. When this ratio is equal to unity according to the null hypothesis, it indicates that the change in the size of common shock impact across markets is extremely proportionate. Therefore, there is no change in the structural transmission mechanisms of common shock (no shift-contagion). MENA portfolio holdings could realize potential gains using portfolio diversification and they are robust against international crises. When γ is greater than 1, it implies a stronger reaction from one market relatively to second market. The reaction is partially due to common shock but also to the intensification of existing financial links between two markets, which occurs by generating new specific shock mechanisms. To explain these new shocks qualified as shift-contagion, Forbes and Rigobon (2001) refer to crisis-contingent channels such as multiple equilibria, endogenous liquidity shocks or political contagion. International diversification using MENA portfolio, in this case, is not preferred because it could be a source of shock transmission during the high-volatility regime no longer provide benefits during international crises. To test null hypothesis, a likelihood ratio test (LR) is implemented with a statistic that follows a $\chi^2(1)$ distribution.

3.2. Testing for stability of the idiosyncratic shock transmission mechanisms

As described above, the second type of linkage instability is observed when idiosyncratic shocks are spill over between two markets during the crisis period. To test the null hypothesis of stability (no pure contagion), we use a simple t-test to assess the statistical significance of the coefficient δ_i (in Eq. 7). In addition, a LR test is implemented with a statistic that follows a $\chi^2(2)$ distribution to jointly test the significance of bi-directional transmission of idiosyncratic shocks. A significant impact of specific shocks from one market to another, and/or the presence of bi-directional pure contagion between the two markets, is evidence of instability in the mechanisms of shock transmission. This instability implies that a crisis in one MENA market, within a diversified portfolio, is considered news for investors who would react by reducing their portfolio losses. Therefore, a diversification strategy using a MENA portfolio, in this case, is not robust during times of crisis.

Therefore, if shock transmissions mechanisms are stable during episodes of market turmoil (i.e. no shift-contagion and no pure contagion), intra-MENA equity markets diversification should reduce risk during the high-volatility regime. In contrast, evidence of shift-contagion and/or pure contagion would imply that markets do not provide a perspective of diversification for an equity fund manager to protect their portfolio and promise benefits during turmoil periods. Besides, identifying the mechanisms by which shocks are propagated helps policymakers to implement the best policy strategies to deal with contagion in order to regulate financial markets.

Moreover, from the portfolio strategy perspective, we also compute optimal weights and hedge ratios for our MENA portfolio holdings, allowing us to realize potential gains from portfolio strategies. To do that, model results are incorporated into the estimation of the conditional covariance matrix of equity returns, which can lead to enhanced portfolio optimization decisions.

3.3. Portfolio Designs

The time-varying conditional variances and covariances of returns are computed from our estimated model given by Eqs. (2)-(8). It is worth noting that, as shown in Eq. (8), the variance-covariance matrix includes eight distinct states, corresponding to high-or low- volatility regimes of both idiosyncratic and common shocks. Therefore, in adherence to Flavin and Panopoulou (2009), we use the filtered probabilities for each type of shock as a weight for these eight state matrices to compute the time-varying conditional covariance matrix of returns. Taking into account the joint high- and low-volatility regimes to consider the eight state matrices, this conditional covariance matrix can be used for computing effective portfolio designs that hedge risks coming from unstable idiosyncratic and/or common shocks transmission mechanisms. To that effect, we adopt Kenneth F. Kroner and Victor K. Ng's (1998) methodology to construct a dynamic risk-minimizing strategy using the conditional variance and covariance estimated from our model. Thus, we compute thus a first measure which is the time-varying optimal portfolio weight holdings of stock market i in one-dollar portfolio of the pair i/j as follow:

$$w_{ij,t} = \frac{h_{jj,t} - h_{ij,t}}{h_{ii,t} - 2h_{ij,t} + h_{jj,t}}$$

and

$$w_{ij,t} = \begin{cases} 0 & \text{if } w_{ij,t} < 0 \\ w_{ij,t} & \text{if } 0 \le w_{ij,t} \le 1 \\ 1 & \text{if } w_{ij,t} > 1 \end{cases}$$

where $h_{ii,t}$ and $h_{jj,t}$ are the conditional variances of the stock market returns i and the stock market returns j , respectively, and $h_{ij,t}$ is the conditional covariance between them. It notices that the weight of stock market j in one-dollar portfolio of this asset pair is equal to $(1 - w_{ij,t})$. The second considered measure is the time-varying optimal portfolio hedge ratio suggested by Kenneth Kroner and Jahangir Sultan (1993), which shows that to minimize the portfolio risk, an investor should short approximately $\beta_{ij,t}$ dollar of the stock market j that is one dollar long in stock market i. This optimal hedge ratio is computed as follow: $\beta_{ij,t} = \frac{h_{ij,t}}{h_{jj,t}}$

4. Data and Results

4.1. Data

This study employs weekly data for twelve MENA stock indices, divided into two groups: non-oil-producing countries - namely Egypt (EGY), Jordan (JOR), Lebanon (LEB), Morocco (MOR), Tunisia (TUN), and Turkey (TUR), and GCC countries, namely - Bahrain (BAH), Kuwait (KUW), Oman (OMA), Qatar (QAT), Saudi Arabia (KSA), and the United Arab Emirates (UAE). To mitigate the issues of heterogeneity and the influence of oil-related factors, we analyze each group separately. All stock index data are extracted from the following website (https://www.investing.com) and are denominated in local currencies. We use the spot exchange rate (dollar/local currency), also obtained from the same database, in order to convert local real stock prices into U.S. dollars to reflect the perspective of a global investor concerned with portfolio diversification within the region. We assume that using weekly data would not hinder the analysis of synchronous trading across the selected countries. Although there is some temporal misalignment due to different weekend closures across markets, the weekly frequency helps smooth out these differences. Due to data availability, the study period spans from 4th January 2004 to 9th March 2025 for the non-oil-producing countries, and from 31st May 2009 to 2nd March 2025 for the GCC countries. These periods were chosen to encompass several major international financial crises, including the global financial crisis (2007–2009), the oil price collapse (2014–2016), the Russian financial crisis (2014–2016), the Chinese stock market turbulence (2015–2016), the Turkish currency and debt crisis (2018), the COVID-19 pandemic (2020), and the Ukraine-Russia war (2022). This enables us to assess the robustness of diversification benefits within MENA stock markets during periods of international crises. For each index, continuously returns are computed between two consecutive trading weeks using the natural logarithm.

Table 1a Correlations and Descriptive Statistics for non-oil producing countries

	EGY	**JOR**	**LEB**	**MOR**	**TUN**	**TUR**
JOR	0.248					
LEB	0.047	0.062				
MOR	0.179	0.141	0.029			
TUN	0.15	0.132	0.002	0.323		
TUR	0.185	0.089	-0.027	0.215	0.202	
Mean	0.103	0.05	0.151	0.119	0.107	0.081
Median	0.33	-0.047	0.000	0.207	0.116	0.527
Std. dev	4.46	2.201	3.02	2.18	1.708	4.972
Skewness	-2.354	-0.344	1.297	-0.691	-0.827	-0.381
Kurtosis	21.983	9.039	31.642	7.285	9.504	8.126
J-B (p-value)	0.00***	0.000***	0.000***	0.000***	0.000***	0.000***

Note: * indicates statistical significance at 10%. ** indicates statistical significance at 5%. *** indicates statistical significance at 1%. J-B is the statistic of Carlos M. Jarque and Anil K. Bera (1980) normality test.

Table 1b Correlations and Descriptive Statistics for GCC countries

	BAH	**KUW**	**OMA**	**QAT**	**KSA**	**UAE**
KUW	0.422					
OMA	0.267	0.303				
QAT	0.268	0.296	0.357			
KSA	0.275	0.375	0.326	0.517		
UAE	0.276	0.379	0.406	0.513	0.43	
Mean	0.028	-0.0002	-0.034	0.123	0.072	0.161
Median	0.037	0.051	-0.027	0.249	0.26	0.212
Std. dev	1.28	2.276	1.65	2.302	2.447	2.118
Skewness	-1.22	-5.584	-0.326	-0.232	-0.855	-0.704
Kurtosis	13.375	83.619	12.381	6.706	9.025	10.664
J-B(p-value)	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***

Note: * indicates statistical significance at 10%. ** indicates statistical significance at 5%. *** indicates statistical significance at 1%. J-B is the statistic of Jarque and Bera (1980) normality test.

Tables 1a and 1b provides cross-market return correlations, descriptive statistics, and results for the normality diagnostic test. As shown in Tables 1a, return correlations between non-oil-producing MENA stock markets do not seem high, confirming the low financial integration of these markets. This corroborates with the literature results on the segmented MENA markets (Ai-Ru Cheng, Mohammad R. Jahan-Parvar, and Philip Rothman, 2010; Neaime, 2016). The highest correlations are between Egypt and Jordan

(0.248), both of which are among the most open and liberalized in the region. Tables 1b shows the return correlations among GCC stock markets. Compared to the non-oil MENA markets, the correlations among GCC countries are notably higher, suggesting a relatively stronger level of financial integration within the region. The highest correlation observed is between Qatar and the Saudi Arabia (0.517), followed closely by Qatar and UAE (0.517). Overall, we can conclude that correlations between MENA stock markets are moderate, but they remain below levels typically seen in highly integrated financial markets, indicating that diversification opportunities still exist within region markets. Nevertheless, the high-identified correlations are probably generated by the risk aversion of international investors to risk premium conveyed by portfolios diversification (Kaminsky and Reinhart, 2000).

On the other hand, all MENA stock returns show a positive average, except for the Kuwaiti and Omani stock markets. The UAE stock market shows the best performance compared to the other MENA markets since it records the highest returns (0.161%). However, Egyptian and Turkish display the highest volatility, while the remaining MENA markets appear to have a relatively identical standard deviation, indicating the great similarities in the evolution patterns of market returns. With the exception of Lebanon, all skewness measures are negative. This result shows that only the Lebanon market seems to yield relatively more favorable return distribution for portfolio diversification. For the other MENA markets, their skewness to the left implies higher likelihood of extreme negative returns. Moreover, all markets have a kurtosis value larger than three. In addition, results of the J-B test reject the null hypothesis of normality in all cases. These findings support the adoption of the Markov-switching methodology to study shocks transmission mechanisms.

4.2. Empirical Results

4.2.1. MENA stock market linkage estimates and potential portfolio diversification benefits

Before testing the stability of the shock transmission mechanisms across low- and high-volatility regimes, we start by selecting the appropriate specification of our model (Eq. 1). Specifically, we test whether the expected mean returns differ across the two regimes. Tables 2a and 2b present the estimated model parameters and the likelihood ratio (LR) test results of the equality of means for non-oil-producing and GCC countries, respectively. In both tables and for each country pair, the estimated expected mean returns during the low-volatility regime are reported in Columns 2 and 3, while the corresponding estimates for the high-volatility regime are reported in Columns 4 and 5.

Table 2a Estimates of mean returns across low- and high-volatility regimes in non-oil-producing countries

Country pairs (1/2)	μ_1	μ_2	μ_1^*	μ_2^*	LR
EGY/JOR	0.461 (0.13)	-0.043 (0.039)	-0.83 (0.712)	-0.025 (0.033)	5.672*
EGY/LEB	0.641 (0.298)	0.405 (0.268)	-0.194 (0.222)	-0.252 (0.144)	0.427
EGY/MOR	0.47 (0.1)	0.247 (0.068)	-1.795 (0.704)	-0.428 (0.18)	15.668***
EGY/TUN	0.408 (0.012)	0.231 (0.009)	-0.168 (0.326)	-0.702 (0.29)	0.255
EGY/TUR	0.944 (0.159)	1.097 (0.186)	-1.194 (0.311)	-1.749 (0.419)	44.726***
JOR/LEB	0.029 (0.047)	0.273 (0.131)	-0.087 (0.048)	-0.117 (0.037)	7.855**
JOR/MOR	0.031 (0.03)	0.436 (0.217)	-0.295 (0.324)	-0.861 (0.199)	6.605**
JOR/TUN	0.085 (0.113)	0.387 (0.231)	-0.0248 (0.226)	-0.239 (0.508)	1.88
JOR/TUR	0.112 (0.074)	0.864 (0.227)	-0.519 (0.176)	-1.643 (0.694)	35.986***
LEB/MOR	0.307 (0.094)	0.567 (0.13)	-0.196 (0.103)	-0.791 (0.451)	8.108**
LEB/TUN	0.241 (0.124)	0.450 (0.093)	-0.109 (0.04)	-0.089 (0.073)	25.519***
LEB/TUR	0.075 (0.03)	1.267 (0.363)	-0.027 (0.19)	-1.859 (1.406)	9.422***
MOR/TUN	0.159 (0.072)	0.3122 (0.074)	0.113 (0.082)	-0.119 (0.072)	12.677***
MOR/TUR	0.534 (0.241)	1.512 (0.267)	-0.323 (0.187)	-1.303 (0.55)	25.296***
TUN/TUR	0.177 (0.092)	1.220 (0.298)	0.039 (0.102)	-2.270 (2.388)	25.461***

Notes: Chi2 (2) = 9.21 for 1% level, Chi2 (2) = 5.99 for 5% level and Chi2 (2) = 4.60 for 10% level.
The figures in parentheses are standard error of the estimators. * Significance of the coefficients at the 10% level. ** Idem 5% level.*** Idem 1% level.

Table 2b Estimates of mean returns across low- and high-volatility regimes in GCC countries

Country pairs	μ_1	μ_2	μ_1^*	μ_2^*	LR
BAH/KUW	0.061 (0.035)	0.123 (0.05)	-2.847 (0.554)	-1.166 (2.72)	11.485**
BAH/OMA	0.103 (0.047)	0.078 (0.062)	-0.916 (0.636)	-1.247 (0.433)	1.65
BAH/QAT	0.080 (0.04)	0.244 (0.071)	-1.366 (1.06)	-0.580 (1.038)	5.349*
BAH/KSA	0.106 (0.039)	0.333 (0.066)	-0.643 (0.235)	-1.602 (0.641)	15.248***
BAH/UAE	0.508 (0.134)	0.795 (0.2)	-0.150 (0.077)	-0.053 (0.237)	10.283***
KUW/OMA	0.152 (0.022)	0.019 (0.033)	-0.996 (0.507)	-0.417 (0.941)	15.898***

KUW/QAT	0.203 (0.058)	0.294 (0.068)	-1.034 (0.365)	-0.803 (0.438)	12.415***
KUW/KSA	0.629 (0.162)	0.757 (0.115)	-0.776 (0.262)	-0.679 (0.534)	39.826***
KUW/UAE	0.186 (0.054)	0.156 (0.058)	-1.137 (0.384)	-0.771 (0.426)	10.109***
OMA/QAT	0.012 (0.024)	0.260 (0.062)	-0.694 (0.463)	-0.373 (0.508)	2.53
OMA/KSA	0.033 (0.045)	0.321 (0.068)	-1.287 (0.652)	-1.827 (0.744)	10.848***
OMA/UAE	0.001 (0.049)	0.203 (0.068)	-0.141 (0.145)	-0.745 (0.27)	6.332**
QAT/KSA	0.488 (0.114)	0.538 (0.094)	0.100 (0.094)	-0.063 (0.058)	12.904***
QAT/UAE	0.610 (0.119)	0.963 (0.123)	0.084 (0.083)	-0.023 (0.044)	14.856***
KSA/UAE	0.732 (0.138)	0.510 (0.028)	-1.005 (0.498)	-0.435 (0.076)	13.301***

Notes: Chi2 (2) = 9.21 for 1% level, Chi2 (2) = 5.99 for 5% level and Chi2 (2) = 4.60 for 10% level.
The figures in parentheses are standard error of the estimators. * Significance of the coefficients at the 10% level. ** Idem 5% level. *** Idem 1% level.

In table 2a and 2b, we can observe that the low-volatility regime is characterized by positive mean returns in the vast majority of cases for the two groups of MENA stock markets. In addition, returns in the high-volatility regime tend to be negative or lower. The last column of Table 2a and 2b reports the LR test results. The hypothesis of equal means is accepted for a few pairs (EGY/LEB, EGY/TUN, JOR/TUN, BAH/OMA, and OMA/QAT). Therefore, for these cases, we re-estimate our equity returns model, taking into account the equality of means across regimes.

Following Flavin and Panopoulou (2009) and Flavin, Morley, and Panopoulou (2014), and based on our estimated pair model results, we assess the relative importance of common and idiosyncratic shocks to examine the portfolio diversification benefits within MENA stock markets. Indeed, there is a potential for country-specific risk to diversify if high-volatility regime frequency for idiosyncratic shocks is greater than high-volatility regime frequency for common shock. In such cases, there are potential benefits of an intra- regional diversification strategies. Table 3a and 3b report the results of two statistics for common and idiosyncratic shocks. The first statistic reveals the proportion of time that common or idiosyncratic shocks are in the high-volatility regime (Frequency), while the second statistic measures persistence of these shocks in time (Duration). Columns 2 and 3 in both tables refer to common shock, while Columns 3 and 4 refer to idiosyncratic shocks of the first country and Columns 5 and 6 refer to idiosyncratic shocks of the second country.

Table 3a Frequencies and durations of common and idiosyncratic shocks for non-oil-producing countries

	Common shocks		Idiosyncratic shock (first country)		Idiosyncratic shock (second country)	
Country pairs	Frequency (%)	Duration (years)	Frequency (%)	Duration (years)	Frequency (%)	Duration (years)
EGY/JOR	17.185	0.038	18.2	0.145	31.56	0.242
EGY/LEB	35.432	0.035	19.121	0.069	22.728	0.088
EGY/MOR	18.463	0.069	69.191	0.05	18.753	0.223
EGY/TUN	5.321	0.032	18.693	0.05	4.642	0.038
EGY/TUR	31.442	0.08	2.3	0.07	21.829	0.091
JOR/LEB	36.841	1.122	32.377	0.236	9.066	0.051
JOR/MOR	26.073	0.058	32.463	0.242	16.151	0.258
JOR/TUN	8.696	0.033	33.209	0.256	3.818	0.038
JOR/TUR	32.664	0.112	31.357	0.226	2.594	0.071
LEB/MOR	33.056	0.041	22.869	0.084	22.849	0.165
LEB/TUN	41.66	0.444	11.146	0.07	9.087	0.048
LEB/TUR	30.195	0.048	23.195	0.086	9.426	0.086
MOR/TUN	63.299	0.681	14.244	0.268	7.972	0.04
MOR/TUR	49.363	0.681	26.04	0.185	3.792	0.055
TUN/TUR	32.065	0.055	6.849	0.042	2.254	0.055

Notes: Frequency is calculated as $(1 - P_{11})/(2 - P_{11}-P_{00})$, and Duration = $1/(1 - P_{11})$ where P_{11} and P_{00} are as defined in equation 5.

Table 3b Frequencies and durations of common and idiosyncratic shocks for GCC countries

	Common shocks		Idiosyncratic shock (first country)		Idiosyncratic shock (second country)	
Country pairs	Frequency (%)	Duration (years)	Frequency (%)	Duration (years)	Frequency (%)	Duration (years)
BAH/KUW	0.86	0.048	25.138	0.049	28.638	0.101
BAH/OMA	9.403	0.082	26.179	0.068	86.49	0.28
BAH/QAT	4.664	0.106	53.741	0.06	37.741	0.358
BAH/KSA	10.581	0.096	22.405	0.055	61.707	0.35
BAH/UAE	34.5	0.267	22.259	0.079	12.138	0.101
KUW/OMA	10.809	0.08	2.682	0.08	58.177	0.252
KUW/QAT	12.29	0.071	3.841	0.08	47.204	0.783
KUW/KSA	36.677	0.675	10.541	0.069	20.899	0.121
KUW/UAE	11.685	0.088	5.136	0.078	52.363	0.433
OMA/QAT	9.266	0.081	80.329	0.399	38.872	0.437
OMA/KSA	7.44	0.071	16.58	0.091	51.837	0.349
OMA/UAE	7.871	0.056	3.705	0.073	49.795	0.436
QAT/KSA	60.666	0.272	47.117	0.817	9.307	0.142
QAT/UAE	75.872	0.902	41.681	0.356	23.358	0.061
KSA/UAE	31.009	0.054	10.361	0.157	21.913	0.06

Notes: Frequency is calculated as $(1 - P_{11})/(2 - P_{11}-P_{00})$, and Duration = $1/(1 - P_{11})$ where P_{11} and P_{00} are as defined in equation 5.

Focusing on common shocks' results, we can observe that non-oil-producing MENA countries are more affected by common shocks than GCC countries. The average of common shock frequencies of the first group is 30.78%, compared to

21.57% for the GCC group. The frequency of common shocks in non-oil-producing MENA stock markets varies from 5.32% in the case of Egypt/Tunisia to 63.29% for Morocco/Tunisia, while it ranges from 0.86% for Bahrain/Kuwait pair to 75.87% for Qatar/UAE pair. However, only three pairs out of 30 cases (MOR/TUN, QAT/KSA, and QAT/UAE) for which common shocks are in their high-volatility regime more than half time and with a long duration. The remaining pairs experience lower high-volatility common shock frequencies, with shorter durations that does not exceed 2 months. This finding indicates the vulnerability of MENA markets to common shocks, regardless of their magnitude but for a short duration. This result is in line with Neaim (2016) who found that the international financial crisis had significantly affected the MENA region but only for short periods. This is due, not only to the weak financial integration with the more advanced economies, but also to weak intra-regional integration. Although common risk is non-diversifiable, it may be relevant to note that our results could be potentially important information for portfolio managers who could undertake intra-regional diversification strategies that may provide significant protection against common risk factors.

Results of Frequency/Duration idiosyncratic shocks in Table 3a and 3b reveal some further insights. Looking at idiosyncratic shocks within non-oil-producing MENA countries, the average frequency of high-volatility idiosyncratic shocks is 18.25%, which is lower than that of common shocks (30.78%). In contrast, the average frequency of high-volatility idiosyncratic shocks for GCC markets reaches 32.4% which is higher than that of their common shocks (21.57%). Moreover, the persistence of idiosyncratic shocks is generally similar to that of common shocks in both cases. This finding suggests that, in general, diversifying in GCC stock markets offers greater potential gains than diversifying in non-oil-producing stock markets, corroborating the results of Boubaker, Saidane, and Ben Saad Zorgati (2022).

In summary, our findings suggest that there are potential diversification gains from investing in non-oil-producing countries and GCC markets, which can help minimize risk against common international crises and/or specific shocks. In the following analysis, we seek to test whether the benefits of intra-regional portfolio diversification remain robust to time-varying return volatility.

4.2.2. Robustness of MENA portfolio diversification benefits

To investigate the robustness of MENA portfolio diversification benefits across volatility regimes, we start with the first test of the stability of common shock transmission mechanisms. Tables 4a and 4b report the results for non-oil-producing and GCC markets, respectively. In both tables, Columns 2 and 3 (and Columns 4 and 5) contain the common shocks' impact coefficients for each pair during the low (high) volatility regime. Column 6 reports the estimation of the γ ratio. Recall that when this ratio equals to unity, it reveals that the common shock transmission between both markets is stable across regimes. Column 7 reports the formal likelihood ratio (LR) test for stability. It consists of testing the statistical significance of the null hypothesis of stability in the mechanisms of the common shock $(H_0: \gamma = 1)$. From both tables, we observe that the estimated coefficients of common shock impacts during high-volatility regimes are higher than those during the calm periods for all pairs. This confirms the vulnerability of MENA markets during international crises, yet we infer that there is a need for an in-depth statistical analysis to confirm the presence of additional specific shock transmissions.

Table 4a Estimates of the impact coefficients of common shocks and tests for shift contagion in non-oil-producing countries

Country pairs (1/2)	σ_{c1}	σ_{c2}	σ^*_{c1}	σ^*_{c2}	γ	LR
EGY/JOR	1.074 (0.081)	0.176 (0.092)	4.197 (0.949)	0.579 (0.216)	1.187	11.273***
EGY/LEB	0.009 (0.051)	0.080 (0.109)	0.031 (0.172)	0.289 (0.242)	-	0.015
EGY/MOR	0.098 (0.603)	0.067 (0.087)	2.543 (0.099)	0.072 (0.066)	-	2.712
EGY/TUN	0.0001 (0.004)	0.543 (0.473)	0.0002 (0.007)	2.045 (0.484)	-	3.652
EGY/TUR	0.125 (0.091)	3.324 (0.145)	0.142 (0.086)	5.667 (0.295)	-	0.605
JOR/LEB	0.016 (0.017)	0.256 (0.371)	0.033 (0.035)	2.106 (0.17)	-	0.057
JOR/MOR	0.025 (0.042)	0.077 (0.135)	0.200 (0.264)	0.317 (0.089)	-	0.051
JOR/TUN	0.120 (0.2)	0.084 (0.27)	0.210 (0.397)	0.355 (0.78)	-	0.078
JOR/TUR	0.022 (0.04)	1.301 (1.331)	0.030 (0.048)	4.912 (0.862)	2.768	38.616***
LEB/MOR	0.162 (0.108)	0.228 (0.25)	0.346 (0.257)	0.400 (0.414)	-	0.105
LEB/TUN	0.676 (0.218)	0.022 (0.042)	2.060 (0.184)	0.028 (0.053)	-	0.303
LEB/TUR	0.093 (0.239)	0.102 (0.147)	0.226 (0.453)	0.327 (0.398)	-	0.133
MOR/TUN	0.445 (0.171)	0.337 (0.048)	1.671 (0.105)	0.795 (0.086)	-	0.044
MOR/TUR	0.061 (0.178)	1.368 (1.83)	0.113 (0.242)	4.116 (0.613)	1.624	33.756***
TUN/TUR	0.118 (0.112)	0.893 (0.239)	0.441 (0.489)	4.476 (0.641)	1.341	42.134***

Notes: Chi2 (1) = 6.63 for 1% level and Chi2 (1) = 3.84 for 5% level. The figures in parentheses are standard error of the estimators. ** Significance of the coefficients at the 5% level. *** Idem 1% level. To ensure robustness of the test results, we consider only the 5% and 1% significance levels when rejecting the null hypothesis

Table 4b Estimates of the impact coefficients of common shocks and tests for shift contagion in GCC countries

Country pairs (1/2)	σ_{c1}	σ_{c2}	σ^*_{c1}	σ^*_{c2}	γ	LR
BAH/KUW	0.127 (0.065)	1.027 (0.062)	0.414 (0.443)	14.905 (4.66)	4.452	62.39***
BAH/OMA	0.015 (0.043)	0.073 (0.255)	0.831 (0.182)	3.446 (0.454)	1.173	13.032***
BAH/QAT	0.304 (0.584)	0.143 (0.025)	2.419 (0.504)	0.243 (0.264)	-	1.336
BAH/KSA	0.184 (0.076)	0.927 (0.112)	0.889 (0.187)	4.382 (0.534)	1.022	51.088***
BAH/UAE	0.109 (0.691)	0.066 (0.167)	0.357 (0.191)	0.222 (0.194)	-	0.827
KUW/OMA	0.445 (0.393)	0.144 (0.178)	1.831 (0.139)	3.521 (0.297)	5.942	4.198**
KUW/QAT	0.428 (0.136)	0.778 (0.12)	2.589 (0.318)	3.285 (0.529)	-	0.169
KUW/KSA	0.054 (0.364)	0.016 (0.096)	0.112 (0.768)	0.033 (0.205)	-	0.003
KUW/UAE	0.505 (0.167)	0.695 (0.235)	2.899 (0.362)	3.485 (0.439)	-	0.207
OMA/QAT	0.118 (0.077)	0.096 (0.302)	3.473 (0.471)	3.328 (0.525)	1.177	39.657**
OMA/KSA	0.486 (0.009)	0.775 (0.138)	2.730 (0.501)	4.352 (0.704)	-	0.723
OMA/UAE	1.052 (0.258)	0.308 (0.079)	3.628 (0.504)	1.439 (0.295)	-	2.087
QAT/KSA	0.609 (0.09)	1.027 (0.049)	0.753 (0.118)	2.332 (0.159)	1.836	5.347**
QAT/UAE	0.016 (0.032)	0.083 (0.127)	0.034 (0.066)	0.148 (0.242)	-	0.044
KSA/UAE	0.157 (0.077)	0.068 (0.255)	0.037 (0.185)	0.143 (0.537)	-	0.006

Notes: Chi2 (1) = 6.63 for 5% level and Chi2 (1) = 3.84 for 5% level. The figures in parentheses are standard error of the estimators. ** Significance of the coefficients at the 5% level. *** Idem 1% level. To ensure robustness of the test results, we consider only the 5% and 1% significance levels when rejecting the null hypothesis

The results of our first formal test show that changes in transmission mechanisms governing common shocks on MENA stock markets between high- and low-volatility regimes are not frequent. Indeed, the ratio γ is statistically equal to unity for the majority of cases (20 pairs out of 30) for the two groups. For these pairs, the propagation mechanisms of common shocks are stable across high- and low-volatility regimes, suggesting the potential robustness of diversification benefits.

However, our results strongly reject the null hypothesis of common shock transmission mechanisms stability for EGY/JOR, JOR/TUN, MOR/TUR, and TUN/TUR pairs in the non-oil-producing markets group. In the GCC markets group, the stability hypothesis is rejected for BAH/KUW, BAH/OMA, BAH/KSA, KUW/OMA, OMA/QAT, and QAT/KSA pairs. These results indicate evidence of shift-contagion, suggesting that during international crises, there is significant specific shock transmission between market pairs through new mechanisms. For these pairs, the diversification benefits do not seem to be robust in times of turmoil. For international investors, it may not be beneficial to simultaneously hold these pairs equities in their portfolios.

To complete our investigation, we now apply the second formal test of the stability of idiosyncratic shocks transmission mechanisms between pairs of MENA stock markets. Tables 5a and 5b reports results for non-oil-producing and GCC markets, respectively. These results evaluate the importance of pure contagion between MENA markets.

Table 5a Estimates of impact coefficients of idiosyncratic shocks and test in non-oil-producing countries

Country pairs (1/2)	σ_1	σ_2	σ_1^*	σ_2^*	δ_1	δ_2	LR
EGY/JOR	2.048 (0.138)	0.995 (0.021)	7.887 (1.223)	3.499 (0.154)	0.166** (0.083)	0.020 (0.014)	6.091**
EGY/LEB	2.576 (0.103)	0.986 (0.022)	8.708 (0.656)	5.963 (0.307)	0.021 (0.015)	0.022** (0.011)	4.106
EGY/MOR	0.310 (0.254)	1.468 (0.075)	0.326 (0.149)	3.715 (0.299)	0.392*** (0.091)	-1.599 (0.908)	14.542***
EGY/TUN	2.562 (0.107)	1.197 (0.261)	8.497 (0.643)	4.632 (1.146)	0.294** (0.122)	0.028** (0.012)	11.703**
EGY/TUR	2.374 (0.115)	0.025 (0.104)	3.595 (0.263)	0.268 (0.121)	-28.488** (12.802)	4.385*** (0.979)	21.114***
JOR/LEB	1.029 (0.047)	0.798 (0.113)	3.547 (0.164)	8.416 (0.823)	0.037 (0.023)	0.057** (0.028)	7.94**
JOR/MOR	1.002 (0.012)	1.491 (0.119)	3.528 (0.152)	3.920 (0.308)	0.091** (0.045)	0.054 (0.033)	5.48
JOR/TUN	1.015 (0.01)	1.390 (0.053)	3.505 (0.156)	5.069 (1.015)	0.105 (0.075)	0.048** (0.022)	6.573**
JOR/TUR	0.996 (0.005)	3.036 (0.569)	3.579 (0.158)	14.711 (2.925)	0.005 (0.023)	0.082 (0.071)	0.922
LEB/MOR	0.949 (0.036)	1.256 (0.148)	5.970 (0.323)	3.557 (0.354)	0.031 (0.024)	-0.002 (0.005)	1.336
LEB/TUN	0.440 (0.328)	1.292 (0.065)	7.934 (0.741)	3.816 (0.58)	-0.024 (0.013)	-0.020 (0.016)	1.566
LEB/TUR	0.995 (0.007)	3.652 (0.088)	5.985 (0.278)	10.777 (1.278)	0.020 (0.015)	-0.025 (0.035)	1.842
MOR/TUN	0.957 (0.08)	1.142 (0.052)	3.743 (0.308)	3.892 (0.552)	-0.005 (0.023)	0.028 (0.044)	0.246
MOR/TUR	1.347 (0.174)	2.571 (1.097)	3.478 (0.245)	12.760 (1.96)	0.050 (0.026)	0.218** (0.067)	10.004***
TUN/TUR	1.315 (0.077)	3.100 (0.479)	4.258 (0.708)	14.125 (3.148)	-0.016 (0.04)	0.517** (0.149)	11.293***

Notes: Chi2 (2) = 9.21 for 1% level and Chi2 (2) = 5.991 for 5% level. The figures in parentheses are standard error of the estimators. ** Significance of the coefficients at the 5% level. *** Idem 1% level. To ensure robustness of the test results, we consider only the 5% and 1% significance levels when rejecting the null hypothesis.

Table 5b Estimates of impact coefficients of idiosyncratic shocks in GCC countries

Country pairs (1/2)	σ_1	σ_2	σ_1^*	σ_2^*	δ_1	δ_2	LR
BAH/KUW	0.740 (0.058)	0.353 (0.213)	1.899 (0.2)	2.487 (0.211)	0.309*** (0.038)	0.268*** (0.069)	70.542***
BAH/OMA	0.773 (0.048)	0.451 (0.101)	2.037 (0.157)	1.308 (0.062)	-0.011 (0.018)	0.158*** (0.053)	6.396**
BAH/QAT	0.453 (0.411)	1.384 (0.063)	1.354 (0.252)	3.198 (0.185)	0.105*** (0.03)	0.155 (0.108)	9.035**
BAH/KSA	0.777 (0.054)	0.652 (0.091)	2.066 (0.183)	2.066 (0.133)	-0.027 (0.033)	0.168** (0.076)	5.248
BAH/UAE	0.737 (0.103)	1.527 (0.082)	2.076 (0.182)	4.129 (0.632)	0.196*** (0.04)	0.125 (0.091)	41.964***
KUW/OMA	0.846 (0.19)	0.190 (0.307)	9.277 (2.672)	0.470 (0.425)	-3.215 (4.208)	0.032 (0.031)	36.148***
KUW/QAT	1.215 (0.059)	0.997 (0.004)	7.351 (1.154)	2.356 (0.142)	-0.016 (0.053)	0.004 (0.015)	0.05
KUW/KSA	1.081 (0.085)	1.580 (0.083)	5.724 (0.603)	4.078 (0.401)	0.254*** (0.031)	0.145*** (0.053)	32.471***
KUW/UAE	1.171 (0.079)	0.818 (0.216)	6.957 (0.971)	2.055 (0.142)	0.017 (0.076)	0.039 (0.025)	1.792
OMA/QAT	0.562 (0.11)	1.324 (0.064)	1.375 (0.064)	2.761 (0.144)	-0.016 (0.086)	0.217 (0.687)	13.247***
OMA/KSA	0.990 (0.021)	1.006 (0.028)	2.329 (0.338)	2.379 (0.148)	-0.041 (0.048)	-0.123 (0.14)	2.848
OMA/UAE	0.561 (0.497)	1.122 (0.086)	3.100 (0.599)	2.274 (0.115)	0.030 (0.071)	1.692*** (0.181)	2.427
QAT/KSA	1.103 (0.073)	0.478 (0.268)	2.343 (0.113)	4.489 (0.603)	0.835*** (0.077)	-0.015 (0.037)	0.13
QAT/UAE	1.311 (0.084)	1.181 (0.096)	3.053 (0.179)	3.483 (0.534)	0.338*** (0.078)	0.336*** (0.048)	112.026***
KSA/UAE	1.723 (0.033)	1.266 (0.299)	4.940 (0.514)	3.277 (1.036)	0.183 (0.049)	0.511*** (0.051)	65.026***

Notes: Chi2 (2) = 9.21 for 1% level and Chi2 (2) = 5.991 for 5% level. The figures in parentheses are standard error of the estimators. ** Significance of the coefficients at the 5% level. *** Idem 1% level. To ensure robustness of the test results, we consider only the 5% and 1% significance levels when rejecting the null hypothesis.

In both tables, Columns 2–5 report the estimation of impact coefficients for the country-specific shocks. The increase in these impacts in the high-volatility regime (Columns 4–5) is clearly observed for all pairs. The results of the LR test (see Column 8 in Table 5a) show that bi-directional transmission mechanisms of idiosyncratic shocks between non-oil-producing countries for several pairs (8 out of 15) are unstable across low- and high-volatility regimes. In addition, although the bi-directional impact is not confirmed, we can identify a pure contagion effect from Egypt to Lebanon, and from Morocco to Jordan, given the significance of their respective δ_i (see Columns 6 and 7 in Table 5a). Shocks transmission mechanisms in these cases are also considered as unstable across volatility regimes. For GCC markets, bi-directional pure contagion is confirmed in 9 out of 15 cases (see Column 8 in Table 5b). Moreover, the results indicate evidence of pure contagion during high-volatility regime from Bahrain to KSA, from

Oman to UAE, and from KSA to the Qatar market, indicating linkage instability for these pairs. These results of instability in non-oil-producing countries and GCC suggest that, generally, these MENA stock market pairs do not provide the robustness of intra-regional diversification portfolios benefits for international investors during a sudden change to a high-volatility regime, which characterizes turbulent periods.

In the end, for non-oil-producing group, only pairs of LEB/MOR, LEB/TUN, LEB/TUR, and MOR/TUN are spared from both bi-directional pure contagion and shift-contagion, suggesting the stability of their shock transmission mechanisms. It is worth noting that although there is no evidence of pure contagion between Jordanian and Turkish markets, their shock transmission mechanisms appear unstable due to the presence of shift-contagion, as demonstrated above. Regarding the GCC markets, our results confirm the stability of shock transmission mechanisms only for the Kuwait market when paired with Qatar and the UAE, as well as between Omani and KSA markets. All these identified MENA pairs constitute a potential refuge for international investors who want to take advantage of intra-MENA diversification portfolio benefits in times of turmoil. In addition, our finding underscores the importance for these investors of adopting a well-structured allocation strategy. By optimizing portfolio weights, they can better manage risk exposure, especially during crisis periods.

4.2.3. Optimal portfolio weights and hedge ratios

The evidence from our empirical results about robustness of diversification benefits within MENA stock markets motivates us to investigate the implication of such results on the optimal portfolio allocation, which can be taken by investors. In this context, as discussed above, these investors aim to minimize the risk of their portfolio, composed of two-assets, without reducing the expected returns, in order to hedge risk - regardless of its origin, such as instability of idiosyncratic or common shocks transmission. The average values of the optimal weights ($w_{ij,t}$) for non-oil-producing and GCC market pairs are computed using the results of the estimated time-varying variances-covariance matrix that distinguish idiosyncratic risk from common risk. However, estimating a single set of portfolio weights without considering each regime on its own would mix different risk conditions and hide the real pattern of optimal asset allocation. For this reason, to ensure that the portfolio strategies derived from our model reflect the underlying regime dynamics, we complete our portfolio designs analysis by computing the $w_{ij,t}$ distinguishing between low- and high-volatility regimes in the calculus of the conditional time-varying variances-covariance matrix. Therefore, firstly, we use only state matrices that consider only the high-volatility regime as a weight. Secondly, we compute the conditional time-varying variance-covariance matrix using only weights based on state matrices of low-volatility regimes. This distinction is essential to capture the structural changes in risk and benefits of diversification that are not uniformly distributed across volatility regimes, especially for non-robust portfolio pairs that presented evidence of shift-contagion and/or pure contagion.

Table 6 reports the average optimal portfolio weights $w_{ij,t}$ for country pairs in the MENA region, grouped into non-oil-producing countries and GCC countries, under three different cases , whilst taking into account joint high- and low- volatility regimes, only the high-volatility regime, and only the low-volatility regime. The results reveal important variations in portfolio allocation strategies depending on the volatility regime and the country group.

For non-oil-producing country pairs, the average weights tend to be more balanced across regimes, but some significant shifts can be observed. For example, in the Egypt/Tunisia portfolio, the weight allocated to Egypt rises from 18.5% in the case of joint regimes to 19.1% under high-volatility regime and 31.2% under low-volatility regime. This indicates that, for this pair, the optimal weight of Egypt holdings in a one-dollar Egypt/Tunisia portfolio should be 18.5% and the remaining budget of 81.5% is invested in Tunisia stock market. Focusing on separate regimes, the weight allocated to Egypt should rise from 19.1% under high-volatility regime to 31.2% under low-volatility regime, suggesting a preference for Egyptian assets during stable periods. Conversely, for the remaining portfolios with Egypt, the optimal weight for Egypt drops under a stable regime, showing investors' shifting preference toward Jordanian, Lebanese, Moroccan, and Turkish assets when markets are calmer.

It is also noteworthy that, under both high- and low-volatility regimes, the optimal weights of Turkey are the lowest, regardless of the portfolio. Combining this result with those of common shock transmission stability (Table 4a), that pointed to the transmission of shocks between Turkish and both Jordanian, Moroccan, and Tunisian stock markets, it would seem that the Turkish stock market is among the most vulnerable markets to common shocks. Therefore, investors holding in MENA region should have fewer Turkish stock indices than other markets from the region in their portfolios, in order to minimize the risk without reducing the expected return.

For the GCC pairs group, the safest markets are Bahrain, with an average optimal investment of around 76%, followed by Oman, with an average optimal weight exceeding 50%. However, the variation across regimes is even more pronounced. For instance, the Bahrain/UAE pair shows a sharp increase in Bahrain's weight from 36.2% under high volatility to 79.8% under low volatility, suggesting investors' preference of Bahrain assets when markets are calmer. Similarly, Oman tends to dominate allocations in stable volatility regime (e.g., 83.6% in the Oman/Qatar pair under low volatility versus 36.9% in high volatility), suggesting that certain GCC markets, such Bahrain and Oman, are perceived as safer or more attractive during calm periods.

Overall, comparing the three regimes reveals that investors should dynamically adjust their non-robust portfolio weights depending on prevailing market conditions. For both non-oil and GCC country groups, optimal allocation strategies are not static, and failure to account for regime shifts may lead to increased risk exposure.

Table 6 Optimal portfolio weights for both regimes (turmoil vs. stable) for non-oil-producing and GCC countries

Non-oil-producing country pairs	w_{ij} *(Joint regimes)*	w_{ij} *(high-volatility regime)*	w_{ij} *(Low-volatility regime)*	GCC country pairs	w_{ij} *(Joint regimes)*	w_{ij} *(high-volatility regime)*	w_{ij} *(Low-volatility regime)*
EGY/JOR	0.234	0.316	0.122	**BAH/KUW**	0.776	0.59	0.815
EGY/LEB	0.254	0.425	0.18	**BAH/OMA**	0.653	0.824	0.102
EGY/MOR	0.253	0.442	0.272	**BAH/QAT**	0.817	0.498	0.701
EGY/TUN	0.185	0.191	0.312	**BAH/KSA**	0.801	0.828	0.691
EGY/TUR	0.572	0.65	0.469	**BAH/UAE**	0.787	0.362	0.798
JOR/LEB	0.473	0.466	0.56	**KUW/OMA**	0.486	0.317	0.596
JOR/MOR	0.563	0.401	0.742	**KUW/QAT**	0.601	0.921	0.312
JOR/TUN	0.497	0.193	0.76	**KUW/KSA**	0.659	0.768	0.596
JOR/TUR	0.835	0.69	0.943	**KUW/UAE**	0.538	0.921	0.223
LEB/MOR	0.539	0.536	0.607	**OMA/QAT**	0.665	0.369	0.836
LEB/TUN	0.512	0.291	0.779	**OMA/KSA**	0.709	0.831	0.457
LEB/TUR	0.808	0.563	0.924	**OMA/UAE**	0.584	0.907	0.125
MOR/TUN	0.357	0.083	0.61	**QAT/KSA**	0.539	0.631	0.609
MOR/TUR	0.832	0.806	0.859	**QAT/UAE**	0.369	0.432	0.589
TUN/TUR	0.888	0.948	0.86	**KSA/UAE**	0.351	0.839	0.32

Finally, the average values of hedge ratios ($\beta_{ij,t}$) are reported in table 7a and 7b. For non-oil-producing pairs, they vary from 0.01 for Tunisia/Lebanon pair to 0.298 for Jordan/Egypt pair that is considered as the most expensive hedge, where a one-dollar long position in the Jordanian market should be shorted by 29.8 cents in the Egyptian stock market. In contrast, one-dollar long position in the Tunisian stock market can be hedged by only a 1 cent short position in the Lebanese market, implying that this portfolio is the most effective. For GCC country pairs, the ratios are slightly higher than those of the non-oil-producing pairs but they remain relatively low, reflecting a balanced risk exposure between them. The highest hedge ratio is observed for the KUW/BAH pair at 0.633, indicating that a one-dollar long position in Kuwait market should be hedged by shorting approximately 63.3 cents in the Bahraini stock market, making it the most expensive hedge among GCC pairs.

Table 7a Hedge ratios for non-oil-producing countries

β_{ij}/β_{ji}	EGY	JOR	LEB	MOR	TUN	TUR
EGY		0.1	0.021	0.073	0.017	0.063
JOR	0.298		0.108	0.085	0.042	0.067
LEB	0.119	0.099		0.067	0.01	0.06
MOR	0.142	0.081	0.022		0.231	0.186
TUN	0.141	0.082	-0.038	0.398		0.218
TUR	0.016	0.02	-0.007	0.046	0.037	

Notes: Values are organized with index i corresponding to the columns and index j corresponding to the rows.

Table 7b Hedge ratios for GCC countries

β_{ij}/β_{ji}	BAH	KUW	OMA	QAT	KSA	UAE
BAH		0.633	0.15	0.594	0.37	0.263
KUW	0.223		0.26	0.237	0.235	0.291
OMA	0.079	0.212		0.249	0.294	0.316
QAT	0.107	0.185	0.176		0.441	0.308
KSA	0.102	0.138	0.152	0.372		0.122
UAE	0.061	0.29	0.252	0.483	0.187	

Notes: Values are organized with index i corresponding to the columns and index j corresponding to the rows.

In summary, our results point to the fact that the linkages within the MENA stock markets do not appear to be stable, except for some pairs. This instability generates a significant risk, which is due not only to common shock, but also to idiosyncratic shocks that generate the contagion effect. Our results show that diversification using Lebanon, Morocco, and Tunisia assets for non-oil-producing countries, and Kuwait and Oman for GCC countries, increases the risk-adjusted performance of portfolios that seem to be robust during the episode of high-volatility regime – given the stability in their mechanisms of both idiosyncratic and common shocks transmission. The optimal weights and hedge ratio analysis shows differences in MENA stock markets in potentials of intra-MENA stock markets diversification that are explained, maybe, by the dissimilarities in terms of economic structure (essentially financial and trade openness) and in terms of stock market characteristics, such as the number of listed companies, liquidity level, and market capitalization

(Mohamed El H. Arouri, Amine Lahiani, and Duc K. Nguyen 2011; Jamel Jouini and Nizar Harrathi, 2014). Another plausible explanation is the fact that some MENA markets are already more integrated with the rest of the world (Simon Neaime, 2005).

5. Conclusion and Policy implication

This paper investigates international diversification benefits between pairs of six non-oil-producing MENA and six GCC equity markets. In this vein, it is important to seek whether shock transmission mechanisms are stable across volatility regimes, and if so, how it affects international diversification strategies. Indeed, stability linkages imply more robustness of intra-MENA portfolio diversification benefits, especially in times of turmoil.

Our empirical framework is based on the recent, flexible regime-switching model, which allows distinguishing between common and idiosyncratic shocks. We focus, therefore, on testing for stability of the transmission mechanism of separately common and idiosyncratic shocks across low- and high-volatility regimes. Moreover, the estimated results are used to calculate risk-minimizing hedge ratios, in order to assess the hedge effectiveness in the MENA region, taking into account different market conditions.

From our empirical results, some interesting findings are reported. First, stock markets of non-oil-producing countries seem to be more affected by common shocks than GCC countries. Given common risk is non-diversifiable, this finding suggests that, in general, diversifying a portfolio using GCC pairs offers more potential gains than diversifying using non-oil-producing countries.

Second, the results show little evidence of stability of shock transmission mechanisms between pairs of MENA markets under review. Only seven pairs out of 30 for which the null hypothesis of stability of both idiosyncratic and common shocks transmission mechanisms is accepted. The pairs of LEB/MOR, LEB/TUN, LEB/TUR, and MOR/TUN from non-oil-producing group, and KUW/QAT, KUW/UAE OMA/KSA from GCC group confirm evidence of robustness in times of crisis of their portfolio diversification gains.

Third, for most of the remaining market pairs, the results point to widespread evidence of instability of idiosyncratic/common shocks transmission between them. There is evidence that new specific-country shocks generated during turmoil periods are transmitted between MENA stock markets, suggesting the non-robustness of their diversification benefits during turmoil periods. This finding is useful for investors that are engaged in intra-MENA portfolio diversification. It helps them to carefully select optimal portfolio weights, in order to minimize risk during periods of financial turmoil.

Finally, the results reveal notable differences in portfolio allocation strategies depending on the volatility regimes and the country group. Based on stability tests and portfolio design analysis, there is evidence that including Lebanon, Morocco, and Tunisia assets for non-oil-producing countries, as well as Kuwait and Oman for GCC countries, in a well-diversified portfolio improves its risk-adjusted performance. This dissimilarity may be due to differences in characteristics in MENA stock markets or to different levels of integration with the rest of the world.

Our empirical findings are a great interest to both policymakers and investors alike. Policy makers in MENA countries should not ignore the impact of the international common shock, such as the major international crisis, which can trigger transmission of important specific shocks between them. They may introduce more innovative financial derivatives to reduce vulnerability to the global financial crisis. In addition, they should take a short-term response to avoid the spread of contagion in case of occurrence of idiosyncratic shocks in one country of the region, especially in cases of Jordan, Egypt, Turkey, and Bahrain, Qatar, KSA, and UAE. On the other hand, policymakers should not engage in regulations or decisions that can drastically increase the volatility of their market, subsequently causing significant shocks that may spread to other markets of the region.

In terms of investment, results have indicated the expected advantages of diversification within MENA stock portfolios. However, investors should be cautious while holding equities from Turkey, Egypt and Jordan equities during high-volatility episodes. Idem for Bahrain, Qatar, KSA, and UAE for GCC group. Risk reduction benefits, in this case, appear not to be robust. Additionally, investors should pay specific attention while forming their portfolios using equities from two MENA countries that exhibit pure contagion or shift-contagion. Hedging strategies in these cases also become costlier and more demanding and therefore, not robust during the high-volatility regime.

REFERENCES

Alkulaib, Yaser A., Mohammad Najand, and Ahmad Mashayekh. 2009. "Dynamic linkages among equity markets in the Middle East and North African countries". Journal of Multinational Financial Management, 19: 43-53. https://doi.org/10.1016/j.mulfin.2008.03.002

Alotaibi, Abdullah R., and Anil V. Mishra. 2015. "Global and regional volatility spillovers to GCC stock markets". Economic Modelling, 45: 38-49. http://dx.doi.org/10.1016/j.econmod.2014.10.052

Alotaibi, Abdullah R., and Anil V. Mishra. 2017. "Time Varying International Financial Integration for GCC Stock Markets". The Quarterly Review of Economics and Finance, 63: 66-78. https://doi.org/10.1016/j.qref.2016.03.001

Apergis, Nicholas, Christina Christou, and Iason Kynigakis. 2019. "Contagion across US and European financial markets: Evidence from the CDS markets". Journal of International Money and Finance, 96:1-12. http://dx.doi.org/10.1016/j.jimonfin.2019.04.006

Arouri, Mohamed El H., Amine Lahiani, and Duc K. Nguyen. 2011. "Return and volatility transmission between world oil prices and stock markets of the GCC countries". Economic Modelling, 28: 1815-1825. http://dx.doi.org/10.1016/j.econmod.2011.03.012

Balcılar, Mehmet, Riza Demire, and Shawkat Hammoudeh. 2015. "Regional and global spillovers and diversification opportunities in the GCC equity sectors". Emerging Markets Review, 24: 160-187. http://dx.doi.org/10.1016/j.ememar.2015.06.002

Belhoula, Mohamed Malek, Walid Mensi, and Kamel Naoui.2024. "Dynamic efficiency in MENA stock markets during COVID-19 outbreak and vaccines".

International Journal of Emerging Markets, 2024(01):1-29. http://dx.doi.org/10.1108/IJOEM-10-2022-1566

Bouri, Elie I., and Georges Yahchouchi. 2014. "Do return and volatility traverse the Middle Eastern and North African (MENA) stock markets borders?". Journal of Economic Studies, 41(2): 317-344. https://doi.org/10.1108/JES-02-2012-0020

Bouri, Elie I., Andre Eid, and Imad Kachacha. 2014. "The dynamic behavior and determinants of linkages among Middle Eastern and north African stock markets". Economic Issues, 19(1): 1-22.

Bua, Giovanna, and Carmine Trecroci. 2019. "International equity markets interdependence: bigger shocks or contagion in the 21st century?". Review of World Economics, 159(6): 43-69. http://dx.doi.org/10.1007/s10290-018-0325-5

Buriev, Abdul Aziz, Ginanjar Dewandaru, Mohd-P. Zainal, and Mansur Masih. 2018. "Portfolio diversification benefits at different investment horizons during the Arab uprisings: Turkish perspectives based on MGARCH-DCC and Wavelet approaches". Emerging Markets Finance and Trade, 54(14):3272-3293. http://dx.doi.org/10.1080/1540496X.2017.1362555

Charfeddine, Lanouar, and Hisham Al Refai. 2019. "Political tensions, stock market dependence and volatility spillover: Evidence from the recent intra-GCC crises". North American Journal of Economis and Finance, 50: 1010-1032. http://dx.doi.org/10.1016/j.najef.2019.101032

Cheng, Ai-Ru, Mohammad R. Jahan-Parvar, and Philip Rothman. 2010. "An empirical investigation of stock market behavior in the Middle East and North Africa". Journal of Empirical Finance, 17:413-427. http://dx.doi.org/10.1016/j.jempfin.2009.11.002

Corsetti, Giancarlo, Paolo Pesenti, Nouriel Roubini, and Cedric Tille. 2000. "Competitive devaluations: a welfare-based approach". Journal of International Economics, 51(1): 217-241. http://dx.doi.org/10.1016/S0022-1996(99)00043-4

Demirer, Riza. 2013. "Can advanced markets help diversify risks in frontier stock markets? Evidence from Gulf Arab stock markets". Research in International Business and Finance, 29: 77-98. http://dx.doi.org/10.1016/j.ribaf.2013.04.001

Elsayed, Ahmed H., and Larisa Yarovaya. 2019. "Financial stress dynamics in the MENA region: Evidence from the Arab Spring". Journal of International Financial Markets, Institutions & Money, 62: 20-34. http://dx.doi.org/10.1016/j.intfin.2019.05.004

Flavin, Thomas J., and Ekaterini Panopoulou. 2009. "On the robustness of international portfolio diversification benefits to regime-switching volatility". Journal of International Financial Markets, Institutions & Money, 19: 140-156. http://dx.doi.org/10.1016/j.intfin.2007.09.002

Flavin, Thomas J., Ciara E. Morley, and Ekaterini Panopoulou. 2014. "Identifying safe haven assets for equity investors through an analysis of the stability of shock transmission". Journal of International Financial Markets, Institutions & Money, 33:137-154. http://dx.doi.org/10.1016/j.intfin.2014.08.001

Forbes, Kristin, and Roberto Rigobon. 2001. "Contagion in Latin America: Definition, Measurement, and Policy Implications". Economia, 1(2): 1-35. http://dx.doi.org/10.1353/eco.2001.0001

Glick, Reuven, and Andrew Rose. 1999. "Contagion and trade: Why are currency crises regional?". Journal of International Money and Finance, 18:603–617. http://dx.doi.org/10.1017/CBO9780511559587.019

Graham, Michael, Jarno Kiviaho, and Jussi Nikkinem. 2013. “Integration of 22 emerging stock markets: A three-dimensional analysis”. Global Finance Journal, 23(1): 34-47. http://dx.doi.org/10.1016/j.gfj.2012.01.003

Gravelle, Toni, Maral Kichian, and James Morley. 2006. “Detecting shift contagion in currency and bond markets”. Journal of International Economics, 68:409-423. http://dx.doi.org/10.1016/j.jinteco.2005.07.005

Hamidreza, Habibi, and Mohammadi Hassan. 2022. “Return and volatility spillovers across the Western and MENA countries”. The North American Journal of Economics and Finance, 60: 1-10. http://dx.doi.org/10.1016/j.najef.2022.101642

Hamilton, James D. 1989. “A new approach to the economic analysis of nonstationary time series and the business cycle”. Econometrica, 57: 357-384. http://dx.doi.org/10.2307/1912559

Helmi, Mohamad Husam, Jinxin Cui, Ahmed H. Elsayed, and Mohammad Enamul Hoque. 2025. “Higher-order moment and cross-moment spillovers among MENA stock markets: Insights from geopolitical risks and global fear”. Research in International Business and Finance, 77(1): 1-32. http://dx.doi.org/10.1016/j.ribaf.2025.102885

Heni, Boubaker, Bassem Saidane,and Mouna Ben Saad Zorgati. 2022. “Modelling the dynamics of stock market in the gulf cooperation council countries: evidence on persistence to shocks”. Financial Innovation, 8(1): 1-22. http://dx.doi.org/10.1186/s40854-022-00348-3

Hkiri, Besma., Azza Bejaoui, Cheima Gharib, and Hashem A. Alnemer. 2021. “Revisiting Efficiency in MENA Stock Markets during Political Shocks: Evidence from A Multi-Step Approach”. Heliyon, 7(9):1-17. http://dx.doi.org/10.1016/j.heliyon.2021.e08028

Huang, Rong, Dimos Kambouroudis, and David G. McMillan. 2025. “Is portfolio diversification still effective: evidence spanning three crises from the perspective of U.S. investors”. Journal of Asset Management, 26: 115-135. http://dx.doi.org/10.1057/s41260-025-00398-z

Jarque, Carlos M., and Anil K. Bera. 1980. “Efficient tests for normality, homoscedasticity and serial independence of regression residuals”. Economics Letters, 6(3), 255-259. http://dx.doi.org/10.1016/0165-1765(80)90024-5

Jouini, Jamel., and Nizar Harrathi. 2014. “Revisiting the shock and volatility transmissions among GCC stock and oil markets: A further investigation”. Economic Modelling, 38:486-494. http://dx.doi.org/10.1016/j.econmod.2014.02.001

Kaminsky, Graciela, and Carmen Reinhart. 2000. “On crises, contagion and confusion”. Journal of International Economics, 51(1): 145-168. http://dx.doi.org/10.1016/S0022-1996(99)00040-9

Kapar, Burcu, Jose Olmo, and Rim Ghalayini. 2019. “Financial Integration in the United Arab Emirates Stock Markets”. Finance Research Letter, 33. http://dx.doi.org/10.1016/j.frl.2019.06.017

Kapar, Burcu, Syed Mabruk Billah, Rana Faisal, and Balli Faruk. 2024. “An investigation of the frequency dynamics of spillovers and connectedness among GCC sectoral indices”. International Review of Economics & Finance, 89:1442-1467. http://dx.doi.org/10.1016/j.iref.2023.09.004

Khalfallah, Fatma. 2023. “The Risk Premium on Mediterranean Emerging Stock Markets”. Journal of Economics, Finance and Management Studies, 6(2): 691-706. http://dx.doi.org/10.47191/jefms/v6-i2-14

Kroner, Kenneth F., and Jahangir Sultan. 1993. "Time varying distributions and dynamic hedging with foreign currency futures". The Journal of Financial and Quantitative Analysis, 28(4): 535-551. http://dx.doi.org/10.2307/2331164

Kroner, Kenneth F., and Victor K. Ng. 1998. "Modeling asymmetric comovements of asset returns". The Review of Financial Studies, 11:817–844. http://dx.doi.org/10.1093/rfs/11.4.817

Lagoarde-Segot, Thomas, and Brian M. Lucey. 2007a. "Capital market integration in the Middle East and North Africa". Emerging Markets Finance and Trade, 43(3): 34-57. http://dx.doi.org/10.2753/REE1540-496X430303

Lagoarde-Segot, Thomas, and Brian M. Lucey. 2007b. "International portfolio: is there a role for the Middle east and North Africa?". Journal of Multinational Financial Management, 17 (5):401-410. http://dx.doi.org/10.1016/j.mulfin.2007.01.001

Maghyereh, Aktham I., Basel Awartani, and Khalil Al Hilu. 2015. "Dynamic transmissions between the U.S. and equity markets in the MENA countries: New evidence from pre- and post-global financial crisis". The Quarterly Review of Economics and Finance, 56:123-138. http://dx.doi.org/10.1016/j.qref.2014.08.005

Masson, Paul R. 1999. "Contagion: macroeconomic models with multiple equilibria". Journal of International Money and Finance, 18:587-602. https://doi.org/10.1016/S0261-5606(99)00016-9

Mili, Mehdi, Jean-M. Sahut, and Frédéric Teulon. 2020. "Shift-contagion in energy markets and global crisis". Journal of Forecasting, 39(5): 725-736. http://dx.doi.org/10.1002/for.2654

Mushtaq, Rizwan, and Syed Zulfiqar Ali Shah. 2014. "International portfolio diversification: United States and South Asian equity markets". Panoeconomicus, 61(2):241-252. http://dx.doi.org/10.2298/PAN1402241M

Narayan, Seema Wati, Mobeen Ur Rehman, Yi-Shuai Ren, and Chaoqun Ma. 2023. "Is a correlation-based investment strategy beneficial for long-term international portfolio investors?". Financial Innovation, 9(1): 1-26. http://dx.doi.org/10.1186/s40854-023-00471-9

Neaime, Simon. 2005. "Financial market integration and macroeconomic volatility in the MENA region: An empirical investigation". Review of Middle East Economics and Finance, 3:231-253. http://dx.doi.org/10.2202/1475-3693.1045

Neaime, Simon. 2012 "The global financial crisis, financial linkages and correlations in returns and volatilities in emerging MENA stock markets". Emerging Markets Review, 13:268-282. http://dx.doi.org/10.1016/j.ememar.2012.01.006

Neaime, Simon. 2016. "Financial crises and contagion vulnerability of MENA stock markets". Emerging Markets Review, 27:14-35. http://dx.doi.org/10.1016/j.ememar.2016.03.002

Van Rijckeghem, Caroline, and Beatrice Weder di Mauro. 2003. "Spillovers through banking centers: a panel data analysis of bank flows". Journal of International Money & Finance, 22(4): 483-509. http://dx.doi.org/10.1016/S0261-5606(03)00017-2

Wahbeeah, Mohti, Andreia Dionisio, Isabel Vieira, and Paulo Ferreira. 2019. "Financial contagion analysis in frontier markets: Evidence from the US subprime and the Eurozone debt crises". Physica A: Statistical Mechanics and its Applications, 525:1388-1398. http://dx.doi.org/10.1016/j.physa.2019.03.094

Yochanan, Shachmurove. 2005. "Dynamic linkages among the emerging Middle Eastern and the United States Stock Markets". International Journal of Business, 10(1): 103-132.

Youssef, Mouna, and Khaled Mokni. 2018. "On the effect of herding behavior on dependence structure between stock markets: Evidence from GCC countries". Journal of Behavior and Experimental Finance, 20:52-63. http://dx.doi.org/10.1016/j.jbef.2018.07.003

Ziadat, Salem Adel, Patrick Herbst, and David G. McMillan. 2020. "Inter- and intra-regional stock market relations for the GCC bloc". Research in International Business and Finance, 54(3):1-16. http://dx.doi.org/10.1016/j.ribaf.2020.101292

Zonouzi, Jamaledin M., Gholamreza Mansourfar, and Fateme B. Azar. 2014. "Benefits of international portfolio diversification Implication of the Middle Eastern oil-producing countries". International Journal of Islamic and Middle Eastern Finance and Management, 7(4):457-472. https://doi.org/10.1108/IMEFM-02-2014-0017