IJISEF INTERNATIONAL Journal of Islamic Economics and Finance Studies
ULUSLARARASI İSLAM EKONOMİSİ VE FİNANSI ARAŞTIRMALARI DERGİSİ

ISSN: 2149-8407 **Yayın Tarihi:** 30.03.2025

Makale Türü: Araştırma Makalesi **Cilt/Volume:** 11 **Geliş Tarihi** : 25.12.2024
Article Type : Research Article **Sayı/Issue** : 1 **Kabul Tarihi:** 15.03.2025

Dynamic Interconnectedness Between Islamic and Conventional Stocks in GCC Economies: Application of TVP-VAR Analysis

Körfez İş birliği Konseyi Ekonomilerinde İslami ve Geleneksel Hisse Senetleri Arasındaki Dinamik Bağlantı: TVP-VAR Analizi Uygulaması

Abstract
Islamic finance has become one of the most important sources of the global financial system, and its growth potential has necessitated a detailed market analysis. In this study, Islamic markets are analyzed by comparing them with conventional markets to find out whether they act differently from other financial products in crisis and protect their investors, that is, whether they act as a safe haven. The extent to which Islamic and conventional stocks experience connectedness during crisis periods, their aggregate dynamic connectedness structure, and which markets transmit or receive the most shocks have prompted this research. This study examines the dynamic connectedness structure between Islamic and conventional stocks in Gulf Cooperation Council (GCC) economies by using daily data for 23.06.2015- 8.08.2024 through the TVP-VAR model. The research includes additional analyses for investors with a short-term and long-term investment approach. The degree of short-term and long-term connectedness is analyzed to determine whether the market is a transmitter or a receiver of shocks. Short-term (frequencies in the 1-5 day period) and long-term (frequencies in the period longer than 5 days) forecast horizons are modeled. According to the findings on frequency connectedness, in both markets, short-run transmission rather than long-run transmission is found to be the main source of connectedness. The connectedness in Islamic and conventional markets has a similar structure during periods when risk decreases and increases. In general, during the 2015-2016 oil crisis period, the 2020 COVID-19 period, the February 2022 Russia-Ukraine war, and the October 2023 Israel-Palestine war, total connectedness increased and the market's receiver or transmitter positions changed. Conventional markets have a higher level of connectedness than Islamic markets. However, this level is not strong enough to support the view that Islamic markets provide protection to investors and national economies in crisis and offer a safe harbor effect.

Jel Classifition: G10, G11
Keywords: TVP-VAR, Islamic Stock, Conventional Stock, GCC.

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Öz
Küresel finansal sistemin önemli kaynaklarından biri haline gelen İslami finansın ulaştığı hacim ve muhtemel büyüme potansiyeli ayrıntılı piyasa analizi gereğini doğurur. Söz konusu öneminden dolayı kriz dönemlerinde diğer finansal ürünlerden farklı davranarak yatırımcısını koruma özelliği yani güvenli liman görevi görüp görmediğini tespit etmek amacıyla bu çalışmada İslami piyasalar, geleneksel piyasalar ile kıyaslanarak incelenmiştir. İslami ve konvansiyonel hisse senetlerinin kriz dönemlerinde ne ölçüde bağlantılılık yaşadıkları, toplam dinamik bağlantılılık yapıları ve hangi piyasaların daha fazla şok yaydığı veya aldığı bu araştırmayı yapmaya teşvik etmiştir. Bu çalışmada Körfez İş birliği Konseyi (KİK) ekonomilerinde İslami ve geleneksel hisse senetleri arasındaki dinamik bağlantılılık yapısı 23.06.2015- 8.08.2024 dönemine ait günlük veriler kullanılarak TVP-VAR modeli ile incelenmiştir. Araştırma ayrıca kısa vadeli ve uzun vadeli yatırım yaklaşımına sahip yatırımcılar için ek analizler de içermektedir. İncelenen piyasalar için kısa vadeli ve uzun vadeli bağlantılılık derecesi analiz edilerek piyasanın şokların alıcısı mı yoksa şokların yayıcısı mı olduğu belirlenmiştir. Bu amaçla, kısa vadeli (1-5 günlük dönemdeki frekanslar) ve uzun vadeli (5 günden uzun dönemdeki frekanslar) tahmin ufukları modellenmiştir. Frekans bağlantılılık yaklaşımı modeli kullanılan araştırma bulgularına göre, her iki piyasada da uzun dönemli bağlantılılıktan ziyade kısa dönemli bağlantılılığın temel kaynak olduğu görülmüştür. Toplam dinamik bağlantılılık sonuçlarına göre ise İslami ve konvansiyonel piyasalardaki bağlantılılık, riskin azaldığı ve arttığı dönemlerde benzer bir yapıya sahiptir. Genel olarak 2015-2016 petrol krizi dönemi, 2020 COVID-19 dönemi, Şubat 2022 Rusya-Ukrayna savaşı ve Ekim 2023 İsrail-Filistin savaşı dönemlerinde toplam bağlantılılık artmış ve piyasanın şokları alıcı veya yayıcı pozisyonları değişmiştir. Araştırma sonucunda elde edilen bir diğer önemli bulgu ise geleneksel piyasaların İslami piyasalara göre daha yüksek bir bağlantılılık düzeyine sahip olmasıdır. Ancak bu düzey, İslami piyasaların kriz dönemlerinde yatırımcılara ve ulusal ekonomilere koruma sağladığı ve güvenli liman etkisi sunduğu görüşünü destekleyecek kadar güçlü değildir.

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Jel Sınıflandırması: G10, G11
Anahtar Kelimeler: TVP-VAR, İslami Piyasa, Geleneksel Piyasa, KİK.

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Atıf/Citation
Demir, S. (2025). Dynamic Interconnectedness Between Islamic and Conventional Stocks in GCC Economies: Application of TVP-VAR Analysis. International Journal of Islamic Economics and Finance Studies, 11(1), 48-77. https://doi.org/10.54427/ijisef.1607288

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Introduction

The 20th-century crises and the unpredictability of the risks and uncertainties of conventional financial markets have increased financial actors' orientation toward Islamic financial markets. The value it adds to the development of countries and the real economy lies in its support for more realistic and impactful investments compared to the traditional financial system (Çetinkaya, 2023: 142), the fact that it has a structure to protect investors and the country economies from global fluctuations (Kuşat, 2014: 1), the fact that high leverage ratios and complex instruments in the conventional system lead to vulnerabilities and fragilities, causing many growth and recessions around the world (Koçak, 2018: 71-72), and the fact that Islamic finance involves lower risk than the conventional finance system with its asset-based structure (Güçlü and Kılıç; 2020: 89) can be counted among the reasons for the increasing interest in Islamic finance. Islamic finance is based on ethical banking, socially responsible investment, and community banking. Five fundamental principles govern Islamic finance: Freedom from Riba, Shari'a-Approved Activities, Risk-and-return sharing, sanctity of contract, and avoidance of Gharar. It aims to provide a domestic, equitable, and ethical financial system (Shanmugam & Zahari, 2009: 7-8). Islamic finance also allows non-Muslims to participate in the system. This contributes to market growth. According to the Islamic Financial Services Board and Islamic Development Bank Institute (2014: i), modern Islamic finance has developed more robust and better than ever in its 40-year history. Islamic finance is a $3.9 trillion industry across over eighty countries (Domat, 2024). The high development potential of Islamic finance has attracted the attention of organizations that have a say in the world economy, such as the World Bank and the IMF, as well as multinational conventional banks, and increased the interest of these institutions in Islamic finance (Güçlü and Kılıç; 2020: 89).

Determining factors affecting returns on financial assets has been one of the most researched topics in finance (Demir, 2024: 265), and it is essential to investigate Islamic financial markets in every period as much as conventional markets to guide the relevant parties. Islamic finance systems are based on Islamic beliefs; thus, all actions and deeds must be Sharia-compliant (Kuşat, 2014: 2). Islamic stocks are subject to Shariah screening to qualify as Shariah-compliant. The objectives of this study are (i) the aggregate dynamic connectedness structure of the Islamic and conventional markets of the GCC countries, (ii) the level of connectedness of Islamic and conventional stocks during crisis periods, and (iii) which markets transmitted or received the most significant shocks among Islamic and conventional markets. To answer these questions, TVP-VAR model was used. In choosing TVP-VAR over alternative econometric models, several advantages of TVP-VAR were taken into account. For instance, TVP-VAR can update its parameters according to time-varying dynamics. Traditional fixed-parameter models (DCC-GARCH, Rolling Window VAR, etc.), which could be alternative models, usually run with fixed parameters or update the parameters based on a given window length. For example, DCC-GARCH may be limited in modeling structural breaks. TVP-VAR can make more accurate forecasts in periods when markets are more dynamic and volatile. cADCC dynamic conditional correlation model, on the other hand, cannot explain which series are receivers and which series are transmitters (Benlagha et al. 2022: 2; Mishra & Ghate, 2022: 3-4; Gökgöz, 2022: 87). Moreover, TVP-VAR is faster in detecting structural changes than conventional fixed-parameter models. The study also applied the TVP-VAR model with frequency connectedness to provide guidance to investors considering short- and long-term investment plans and to test the model against each other. The TVP-VAR frequency connectedness approach makes it possible for the decomposition of volatility connectedness into short-run and long-run components when taking into account the time-varying coefficient and variance-covariance structure simultaneously without losing observations as no arbitrary rolling-window is employed, and meanwhile there is no need for the concern of outliers or erratic parameters (Huang et al.2023: 2). It is important to adapt to changing conditions in Islamic and conventional markets. In this study, TVP-VAR model is chosen because of its ability to detect changes in market structure, risks and uncertainties and to make fast and accurate forecasts. In addition to the advantages of the model, it has some limitations. These are as follows: a large and high-frequency data set is required to make accurate forecasts; the forecasting ability is weakened when low-frequency data or small data sets are involved. If we find answers to our questions, we will shed light on (i) whether Islamic and conventional equity markets offer diversification for investors, especially during crises, and (ii) whether the market's position as a shock receiver/transmitter should be taken into account when making investment decisions. The findings show that the level of dynamic connectedness between Islamic and conventional markets increased to a similar degree during the period of political, economic and policy events. In addition, there was a change in the receiver or transmitter positions of the markets. This result does not support the view that Islamic markets are safe havens.

1.Literature Review

Islamic finance, which has become one of the significant sources of the global financial system, has become an important research topic in the literature. The volume it has reached, its probability of growth and its relatively low level of risk compared to other financial products have led to the need for a detailed market analysis. If we briefly mention these study topics, Najeeb, et al. (2017) and Pirgaip et al. (2021) highlighted that Islamic financial markets offer risk management and portfolio diversification to investors, especially for conventional bond investors; Kontesa (2023) pointed out in terms of risk management, Sharia-compliant debt financing will provide advantages in stock price collapse risk management. Moreover, the effects of Islamic events (such as Ramadan Meelad ul Nabi, Ashura and Eid al-Adha) on Islamic and conventional stock markets have been investigated by various studies (Almaida et al., 2024; Shah et al., 2017; Wasiuzzaman, 2018). The impact of the market on macroeconomic factors such as economic growth (Abduh & Omar, 2012; Johnson, 2013; Nawaz et al. 2019), interest rate (Nahar & Sarker, 2016; Nursyamsiah, 2018), sustainable development (Hassan, 2014), risk factors (Shahzad et al., 2017), exchange rate, and inflation (Rifai et al., 2017; Widarjono, 2018; Abusharbeh, 2020) have been assessed, and it has been declared that these examinations should be taken into account when making investment decisions.

The interconnectedness/interaction between conventional and Islamic equity markets is a hot topic in the literature. These studies are detailed in this section as the basis per this study. Abu Bakar and Masih (2014) tested the link between the six major international stock markets:

Europe, the United States, Japan, the United Kingdom, Malaysia, and China and international Islamic stock using wavelet time-scale decomposition analysis. This study finds that volatility and co-movement among stock indices are higher and more volatile during financial crises and that there is bidirectional causality between the Islamic index and other international indices. In a similar study, Saiti et al. (2016) tested the extent of contagion for 18 indices of conventional and Shari'ah-compliant stocks using wavelet analysis, specifically observing crisis periods. The results show that Sharia-compliant indices mostly show no evidence of contagion (except during crisis periods). Umar and Suleman (2017) analyzed the interdependence between Islamic and conventional stocks in the US, Japan, and the UK using multivariate VAR-EGARCH. They found support for the divergence hypothesis in the post-crisis period. Shahzad et al. (2017) -similar to Umar and Suleman (2017)-examined the global Islamic stock market, including three main conventional national stock markets (the US, Japan, and the UK), using a VAR-based spillover index approach. Strong interconnectedness is observed between the global Islamic and conventional stock markets. Majdoub and Sassi (2017) examined the volatility spillovers between Asian (India, Thailand, Malaysia, Korea and Indonesia) and China Islamic stock markets using the VARMA-BEKK-AGARCH model. Significant negative and positive return spillovers from China to the Asian Islamic equity market and bidirectional volatility spillovers between China, Korea, and Thailand. It is concluded that the long-term volatility spillover effect from China to India, Indonesia, and Korea's Islamic stock markets is not persistent. Anas et al. (2020) examined region-wise (the Americas, Europe, Asia and Africa) the divergence and integration between emerging markets' Islamic and conventional stock returns. They developed using the daily wavelet and ADCC-based model. This study finds that all regions developed and emerging conventional and Islamic equity markets are highly positively correlated, and the divergence hypothesis is rejected. Using the TVP-VAR method, Mandaci and Cagli (2021) examined the interconnectedness of Middle East and North Africa (MENA) countries with Islamic and conventional markets. They supported the hypothesis of separating Islamic equity markets from conventional equity markets. Examining the interconnectedness between Islamic markets and country stock markets using the TVP-VAR model, Bossman et al. (2022) sampled 17 Islamic country stock market indices (Bahrain, India, Bangladesh, Malaysia, Kazakhstan, Indonesia, Pakistan, Iraq, Egypt, Kuwait, Jordan, Oman, Qatar, Palestine, United Arab Emirates (UAE), Morocco and Saudi Arabia) and stock market indices of G7 countries (Canada, France, Germany, Italy, Japan, UK, and the USA). The study found that Islamic markets are less (more) correlated with conventional markets during normal (stressed) trading periods. Smolo et al. (2022) investigated the dynamic interconnectedness and volatility spillovers between Islamic and conventional stock markets in the BRICS and Türkiye, utilizing the Diebold&Yilmaz Connectedness Index and the Barunik&Krehlik Frequency Connectedness Indexes. This study found that Islamic equities are more likely to be in the "transmitter" position and relatively less likely to be in the "receiver" position than conventional equities. The study also observed that the co-movement between BRICS+T countries increased during the COVID-19 and Global Financial Crisis, but this effect was weaker for Islamic stocks. Mensi et al. (2023) examined the multiscale spillovers between BRICS country stock markets, the Dow Jones Sukuk index and the Dow Jones Islamic stock index using multivariate and bivariate wavelet approaches. This study concludes that, in the long run, the Islamic stock market is integrated with the BRICS stock markets, reducing hedging gains. Sahabuddin et al. (2023) utilized multivariate GARCH multiscale maximal overlap discrete wavelet transform (MODWT) approaches to investigate the dynamic conditional correlation and volatility spillovers between Islamic and conventional equity markets in developed (US, UK and Japan) and emerging (Malaysia, Indonesia and China) countries. This study finds that Islamic and conventional markets move together in the long run and exhibit time-varying volatility and dynamic conditional correlation. In contrast, volatility movements change due to financial crises. Naeem et al. (2024), on which we base our study, examined the dynamic interconnectedness between conventional and Islamic stock markets in the GCC economies using the TVP-VAR method. This study finds that the interconnectedness of conventional and Islamic equities increased during the crisis period, that both markets behaved similarly, and that they did not offer diversification for hedging.

To encapsulate previous studies, dynamic connectedness in both markets varies by country, except during crisis periods; as a common conclusion: COVID-19 (Smolo et al., 2022; Bossman et al., 2022) and financial crises (Abu Bakar & Masih, 2014; Saiti et al., 2016; Umar & Suleman, 2017; Smolo et al., 2022; Sahabuddin et al., 2023). As a result of these results, this study has emerged to guide investors in determining whether Islamic markets act similarly to conventional markets and whether they are related or not. Different from the literature, for the GCC countries, the study aims to determine the level of dynamic connectedness between the markets and to evaluate the findings in the context of political, economic and policy events that took place during the period of increased connectedness. To this purpose, the advantages of the TVP-VAR model can be used to identify the behavior of both markets during crisis periods.

2. Methodology

This section provides an explanation of the methodology and data set used in the study, along with a statement on ethics.

2.1. Time-Varying Parameter (TVP-VAR) Model

The TVP-VAR model was first introduced in macroeconometrics by Primiceri (2005). Diebold and Yilmaz (2012, 2014) developed the connectedness approach using variance decompositions to dynamically measure spillovers. Antonakakis and Gabauer (2017, 2020) extended the TVP-VAR connectedness methodology by incorporating Kalman filter estimation to allow for time-varying variance-covariance matrices. Diebold and Yilmaz (2009) used a Cholesky-type VAR method to investigate whether the ordering of variables changes the results and the interrelationship of variables. The authors also presented the concept of connectedness and ways of measuring connectedness in their 2014 study (Antonakakis et al., 2020: 2).

The proposed method extends the connectedness approach by varying the variance-covariance matrix through Kalman filter estimation with forgetting factors. The TVP-VAR model is expressed by the following equations (Antonakakis et al., 2020: 3-7):

$$y_t = K_t z_{t-1} + \varepsilon_t \qquad \varepsilon_t \mid \Omega_{t-1} \sim N(0, \Sigma_t). \tag{1}$$

$$vec(K_t) = vec(K_{t-1}) + \xi_t \qquad \xi_t \mid \Omega_{t-1} \sim N(0, \Xi_t), \tag{2}$$

$$z_{t-1} = \begin{pmatrix} y_{t-1} \\ y_{t-2} \\ \vdots \\ y_{t-p} \end{pmatrix} \qquad K_t^{'} = \begin{pmatrix} K_{1t} \\ K_{2t} \\ \vdots \\ K_{pt} \end{pmatrix}$$

n the equation, Ω_{t-1} represents the information up to t-1, while y_t and z_{t-1} describe the m × 1 and mp × 1 vectors. K_t and K_{it} represent m × mp and m × m dimensional matrices, respectively. ε_t and ξ_t are m × 1 vector and m^2p × 1 dimensional matrix, respectively, and time-varying variance-covariance matrices Σ_t and Ξ_t are m × m and m^2p × m^2p dimensional matrices. Vec (K_t) is the vector form of K_t, which is a vector of dimension m^2p × 1. Koop et al. (1996) used time-varying coefficients and time-varying variance-covariance matrices based on generalized impulse-response functions (GIRF) and generalized forecast error variance decompositions (GFEVD), according to Pesaran and Shin (1998). For this purpose, the TVP-VAR model is transformed into a vector moving average (VMA) in accordance with Wold's representation theorem.

$$y_t = J'(D_t(z_{t-2}+\eta_{t-1}) + \eta_t \qquad (3)$$

$$= J'(D_t\ (D\ (z_{t-3}+\eta_{t-2})+\eta_{t-1})+\eta_t \qquad (4)$$

$$\vdots$$

$$= J'\left[D_t^{k-1}\ z_{t-k-1} + \sum_{j=0}^{k} D_t^{j}\ \eta_{t-j}\right] \qquad (5)$$

$$D_t = \begin{pmatrix} K_t & \\ I_{m(p-1)} & 0_{m(p-1)xm} \end{pmatrix} \qquad (6)$$

In the equations above, Dt is an mp × mp dimensional matrix, ηt is an mp × 1 dimensional vector, and J represents an mp × m dimensional matrix.

The process of taking the limit when approaching k is formulated as follows:

$$y_t = lim_{k\to\infty}\ J'\ \left[D_t^{k-1}\ z_{t-k-1} + \sum_{j=0}^{k} D_t^{j}\ \eta_{t-j}\right] = \sum_{j=0}^{\infty} J'\ D_t^{j}\eta_{t-j}\ , \qquad (7)$$

$$y_t = \sum_{j=0}^{\infty} J'\ D_t^{j} J \varepsilon_{t-j} \qquad B_{jt} = J\ 'D_t^{j}\ J, \quad j=0,1,\ldots \qquad (8)$$

B_{jt} denotes an m × m dimensional matrix.

Rs $\Psi_{ij,t}$ (F) represent responses of all j variables following a shock to the variable i. Because it is not a structural model, it calculates the differences between an H-step-ahead forecast when variable i is and is not a shock. The resulting difference is attributed to the shock in variable i, and the process proceeds as follows:

$$GIRF_t\ (F,\delta_{j,t}, \Omega_{t-1}) = E\ (y_t + F \mid e_j = \delta_{j,t}, \Omega_{t-1}\ ) - E(y_t + J \mid \Omega_{t-1}) \qquad (9)$$

$$\Psi_{j,t}(F) = \frac{B_{F,t}\ \Sigma_t\ e_j}{\sqrt{\Sigma_{jj,t}}}\ \frac{\delta_{j,t}}{\sqrt{\Sigma_{jj,t}}} \qquad \delta_{j,t} = \sqrt{\Sigma_{jj,t}} \qquad (10)$$

$$\Psi_{j,t}(F) = \Sigma_{jj,t}^{-\frac{1}{2}} B_{F,t}\ \Sigma_{t\ e_j} \qquad (11)$$

In the equation, e_j is an m × 1 selection vector, which is unity at position E and zero otherwise. In turn, it calculates the GFEVD'yi ($\widetilde{\varphi_{ij,t}}$ (F)), which expresses the pairwise dependence from j to i and shows the effect of variable j on variable i in terms of the estimation error variance share, using the following equation:

$$\widetilde{\varphi_{ij,t}}\ (F) = \frac{\Sigma_{t-1}^{F-1} \Psi_{ij,t}^2}{\Sigma_{j=1}^{m} \Sigma_{t-1}^{F-1} \Psi_{ij,t}^2} \tag{12}$$

When $\Sigma_{i,j=1,i\neq j}^{m}\ \widetilde{\varphi_{ij,t}}(F)=1$ *and* $\Sigma_{i,j=1}^{m}\ \widetilde{\varphi_{ij,t}}(F)$= m, the denominator represents the cumulative effect of all shocks, and the numerator explains the cumulative effect of one shock on variable i. Using the GFEVD, the total connectedness index is expressed by the following equation:

$$C_t\ (\mathrm{F}) = \frac{\Sigma_{i,j=1,i\neq j}^{m}\ \widetilde{\varphi_{ij,t}}(F)}{\Sigma_{i,j=1}^{m}\ \widetilde{\varphi_{ij,t}}(F)} * 100 = \frac{\Sigma_{i,j=1,i\neq j}^{m}\ \widetilde{\varphi_{ij,t}}\ (F)}{m} * 100 \tag{13}$$

Connectedness is defined as the propagation of a shock from one variable to another variable. First, the variable i transmits its shock to all other j variables called aggregate directional connectedness, which is represented by the following formula:

$$C_{i\rightarrow j,t}\ (\mathrm{F}) = \frac{\Sigma_{i,j=1,i\neq j}^{m}\ \widetilde{\varphi_{ij,t}}\ (F)}{\Sigma_{i,j=1}^{m}\ \widetilde{\varphi_{ij,t}}\ (F)} * 100 \tag{14}$$

Second, the directional connectedness variable from j variables, which is the total directional connectedness from the others, is defined as follows:

$$C_{i\rightarrow j,t}\ (\mathrm{F}) = \frac{\Sigma_{i,j=1,i\neq j}^{m}\ \widetilde{\varphi_{ij,t}}\ (F)}{\Sigma_{i,j=1}^{m}\ \widetilde{\varphi_{ij,t}}\ (F)} * 100 \tag{15}$$

Finally, the net total directional connectedness is obtained by subtracting the total directional connectedness to others from the total directional connectedness analyzed. This is explained as the impact variable of the variable "i" in the analysis.

$$C_{i,t} = C_{i\rightarrow j,t}\ (F) - C_{i\rightarrow j,t}(F) \tag{16}$$

If $C_{i,t}$ is positive, then variable i is influenced more than the others in the network. If $C_{i,t}$ is negative, then variable i is driven by the network.

By combining the TVP-VAR connectivity framework with the spectral representation of variance decompositions offered by the BK-18 model, we can explore the connectedness between variables of variables of interest in the frequency domain. Moreover, this analysis further extends the analysis to capture connectedness from both short-term and medium-to-long-term horizons by using the frequency response function function $\varsigma(e^{-ns}) = \sum_{f=0}^{\infty} \varepsilon^{-nsf} \varsigma_f$. In the equation, n is defined as the square root of $\sqrt{-1}$, representing the complex unit, and s symbolizes the frequency. This provides the basis for analyzing the spectral density of r_t at a given frequency v. The approach allows the spectral density of r_t to be assessed at various frequencies, facilitating the computation of frequency-based GFEVDs. These are normalized for a refined analysis of spillover effects in specific frequency ranges (Dammak et al., 2024: 10-12). r_t spectral density at frequency s is conceptualized as the Fourier transform of an infinite order Time-Varying Parameter Vector Moving Average model ($TVP - VMA(\infty)$):

$$Q_r(s) = \sum_{f=-\infty}^{\infty} E\left(r_t r'_{t-f}\right) e^{-nsf} = \varsigma\left(e^{-nsf}\right) \sum_t \varsigma'\left(e^{+nsf}\right) \tag{17}$$

Then, the frequency-based GFEVD is calculated. To ensure correct interpretation, this requires normalization, which results from applying the following equation:

$$\phi_{npt}(s) = \frac{(\Sigma_t)^{-1}_{pp} \left| \sum_{f=0}^{\infty} \left(\varsigma\left(e^{-nsf}\right) \Sigma_t\right)_{npt} \right|^2}{\sum_{f=0}^{\infty} \left(\varsigma\left(e^{-nsf}\right) \Sigma_t \, \varsigma\left(e^{nsf}\right)\right)_{np}} \tag{18}$$

$$\tilde{\phi}_{ijt}(\omega) = \frac{\phi_{npt}(s)}{\sum_{i=1}^{K} \phi_{npt}(s)} \tag{19}$$

The term $\tilde{\phi}_{npt}(s)$ stands for the section of the spectrum of variable n's at a given frequency s that can be attributed to the shocks originating from variable p. For this study, data is collected on all frequencies within a given range to assess short- and medium-long term connectedness effects and aggregate them to provide a comprehensive assessment.

$$w = (a, b) \colon a, b \in (-\pi, \pi), \quad a < \mathrm{b} \tag{20}$$

$$\tilde{\phi}_{npt}(w) = \int_a^b \tilde{\phi}_{npt}(s) ws \tag{21}$$

Finally, within this analysis, we calculate a couple of key indices: the net connectedness index (NET) and the total connectedness index (TOTAL). These calculations are crucial for studying the degree of connectedness in a given frequency range, denoted z.

$$NET_{nt}(w) = TO_{nt}(w) - FROM_{nt}(w) \tag{22}$$

$$\mathrm{TCI}_t\,(w) = K^{-1} \sum_{n=1}^{K} \mathrm{TO}_{nt}\,(w) = K^{-1} \sum_{n=1}^{K} \mathrm{FROM}_{nt}\,(w) \tag{23}$$

2.2. Data Set

By conducting this study, Islamic and conventional stocks of Gulf Cooperation Council (GCC) economies (Bahrain, Oman, Kuwait, Saudi Arabia, Qatar and the UAE) are the indices calculated by S&P. 23.06.2015- 8.08.2024 period daily data were used, and all variables were converted into return series with the following formula:

$r_t = \ln (P_t / P_{t-1})$ formula was used.

In this formula, r_t is the return of the series at the time, the closing price of the index at the time P_t, the closing price of the index at the time of P_{t-1} denotes t = 1..., T.

The descriptions of the variables transformed into return series are presented in Table 1, and time path graphs are presented in Figure 1. All data were synchronized to ensure date unity.

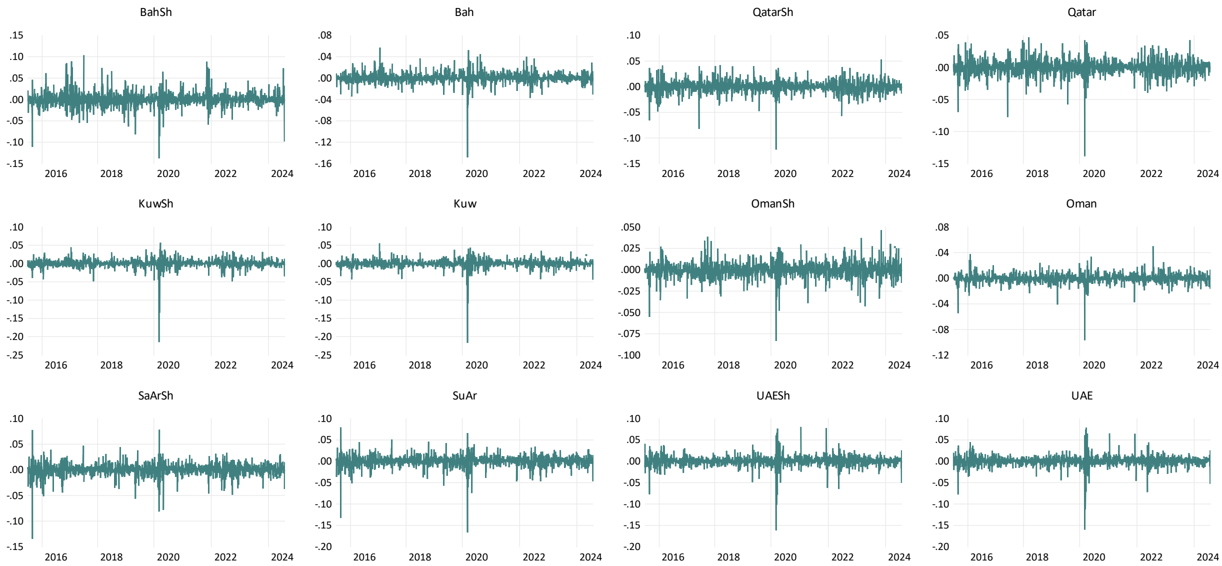
Table 1: Descriptions of the Variables

Islamic	BAH SH	S&P Bahrain Shariah Domestic price index	**Conventional**	BAH BMI	S&P Bahrain
	QAT ARSH	S&P Qatar Shariah Domestic price index		QAT AR	S&P Qatar BMI

KUWSH	S&P Kuwait Shariah Domestic price index	KUW	S&P Kuwait BMI
OMSH	S&P Oman BMI Shariah	OMAN	S&P Oman BMI
SAARSH	S&P Saudi Arabia Shariah Domestic price index	SAAR	S&P Saudi Arabia BMI
UAESH	S&P U.A.E. Shariah Domestic price index	UAE	S&P UAE Domestic Index

Note(s): The variables were obtained from www.spglobal.com.

Figure 1: Time Series of Variables



Source(s): Authors' calculations.

When the time path graphs of the logarithmized return series are examined, all variables experienced intense waves in March 2020 with the declaration of COVID-19 as a pandemic by the World Health Organization. Fluctuations indicate that the global health crisis has caused turbulence in Islamic and conventional equity markets. A similar situation occurred during the Russian-Ukrainian war in February 2022 and the Israeli-Palestinian war in October 2023. Fluctuations in such periods make it necessary to examine the existence of dynamic connectedness between series.

3. Research Findings

The study focuses on assessing the aggregate dynamic connectedness and spillover relationship between Islamic and conventional stocks in GCC countries through the TVP-VAR model. The results derived from the analysis are outlined in this section. The descriptive statistics of the variables are presented in Table 2, and the correlation matrix is presented in Table 3.

Table 2: Descriptive Statistics

		Mean	Std.Dev.	Skewness	Ex. Kur.	JB	ERS	Q(10)	Q^2 (10)
Islamicc	**BAHSH**	0.000204	0.014443	-0.125**	14.279***	19197.515***	-17.59***	19.441***	147.973***
	QATARSH	-0.00012	0.010254	-1.133***	14.346***	19855.153***	-18.60***	22.951***	43.113***
	KUWSH	0.000254	0.010231	-5.216***	101.566***	981213.619***	-8.326***	73.861***	185.393***
	OMANSH	-0.00031	0.007637	-0.770***	12.391***	14675.305***	-14.57***	14.739***	43.624***
	SAARSH	0.000123	0.010879	-1.493***	18.780***	34037.395***	-18.04***	24.302***	286.078***
	UAESH	0.000082	0.010943	-1.927***	35.690***	121292.982***	-2.209**	18.709***	538.800***
Conventional	**BAH**	0.000319	0.008332	-2.357***	50.662***	243678.237***	-10.33***	40.367***	71.696***
	QATAR	-0.00011	0.010340	-1.421***	19.060***	34954.278***	-20.11***	19.366***	51.500***
	KUW	0.000174	0.009604	-5.839***	124.187***	1464470.42***	-12.59***	64.917***	123.228***
	OMAN	-0.00005	0.006354	-1.626***	31.201***	92626.960***	-18.00***	53.452***	12.787**
	SAAR	0.000116	0.011378	-2.393***	33.280***	106403.478***	-17.33***	46.019***	107.306***
	UAE	0.000031	0.010928	-2.020***	35.884***	122735.036***	-4.580***	17.691***	605.816***

Note(s): The number of observations for each stock market is 2,260. *** indicates significance at 1%, ** indicates significance at 5%; Skewness test: D'Agostino (1970); Kurtosis test: Anscombe & Glynn (1983); JB normality test: Jarque & Bera (1980); ERS unit-root test: Elliott et al. (1996); Q (10) and Q^2 (10) weighted Portmanteau test statistics: Fisher & Gallagher (2012).

Based on the descriptive statistics results in Table 2, it is determined that all of the series are not normally distributed (skewness≠0; kurtosis≠3). There is a multicollinearity (autocorrelation) problem in the standard errors (Q) and squares of the standard errors (Q2) of all series. The presence of autocorrelation in the squares of the errors of the series indicates that the variance is changing. The results of the ERS test indicate that the existence of a unit root is rejected.

Table 3: Correlation Matrix

		BAHSH	QATARSH	KUWSH	OMANSH	SAARSH	UAESH
Islamic	**BAHSH**	1	0.23477	0.34076	0.14459	0.21728	0.40643
		-	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	QATARSH	0.23477	1	0.33289	0.22178	0.29447	0.41000
		(0.0000)	-	(0.0000)	(0.0000)	(0.0000)	(0.0000)
	KUWSH	0.34076	0.33289	1	0.20534	0.26780	0.43770
		(0.0000)	(0.0000)	-	(0.0000)	(0.0000)	(0.0000)
	OMANSH	0.14459	0.22178	0.20534	1	0.11180	0.18961
		(0.0000)	(0.0000)	(0.0000)	-	(0.0000)	(0.0000)
	SAARSH	0.21728	0.29447	0.26780	0.11180	1	0.29528
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	-	(0.0000)
	UAESH	0.40643	0.41000	0.43770	0.18961	0.29328	1
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-

Conventional	BAH	QATAR	KUW	OMAN	SAAR	UAE
BAH	1	0.22956	0.45291	0.21175	0.27763	0.35249
	-	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
QATAR	0.22956	1	0.33649	0.27517	0.44365	0.48329
	(0.0000)	-	(0.0000)	(0.0000)	(0.0000)	(0.0000)
KUW	0.45291	0.33649	1	0.30350	0.42023	0.45557
	(0.0000)	(0.0000)	-	(0.0000)	(0.0000)	(0.0000)
OMAN	0.21175	0.27517	0.30350	1	0.25413	0.28758
	(0.0000)	(0.0000)	(0.0000)	-	(0.0000)	(0.0000)
SAAR	0.27763	0.44365	0.42023	0.25413	1	0.51326
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-	(0.0000)
UAE	0.35249	0.48329	0.45557	0.28758	0.51326	1
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	-

Table 3 presents the correlation matrix between the series. All series are positively correlated. The UAE Islamic market is highly correlated with other Islamic markets, except OMANSH. In the conventional markets, Bah has a higher correlation with QATAR, SAAR, and UAE with BAH, SAAR, and UAE with KUW. In comparison, OMAN has a higher correlation with SAAR, QATAR, KUW, and UAE with KUW.

Table 4 presents the average dynamic connectedness among the series. In this table, the series in the row is the affected value, and the series in the column is the influencing value.

Table 4: Average Dynamic Connectedness

				Islamic			
	BAHSH	**QATARSH**	**KUWSH**	**OMANSH**	**SAARSH**	**UAESH**	**FROM**
BAHSH	71.99	4.58	6.59	2.97	4.17	9.69	28.01
QATARSH	4.43	67.68	7.02	3.84	6.15	10.88	32.32
KUWSH	6.61	7.27	69.36	3.01	5.85	7.89	30.64
OMANSH	3.36	4.8	3.23	82.4	2.62	3.59	17.6
SAARSH	5.41	9.61	6.93	2.38	66.3	9.37	33.7
UAESH	8.94	10.29	7.21	2.93	5.73	64.91	35.09
TO	28.74	36.55	30.98	15.13	24.52	41.43	177.36
							TCI
NET	0.73	4.22	0.34	-2.47	-9.17	6.34	29.56
NPT	3	4	2	0	1	5	
				Conventional			
	BAH	**QATAR**	**KUW**	**OMAN**	**SAAR**	**UAE**	**FROM**
BAH	69.18	4.76	12.05	3.34	4.79	5.87	30.82
QATAR	3.86	61.52	7.09	5.15	10.25	12.13	38.48
KUW	9.64	7.35	62.6	4.89	8.11	7.41	37.4
OMAN	3.53	6.39	5.4	76.56	4.25	3.87	23.44
SAAR	3.43	10.42	7.06	3.03	64	12.06	36
UAE	4.32	11.72	6.86	3.15	12.5	61.45	38.55
TO	24.78	40.65	38.46	19.56	39.91	41.34	204.69
							TCI
NET	-6.03	2.17	1.06	-3.89	3.91	2.79	34.12
NPT	1	4	2	0	4	4	

Note(s): Results are based on a TVP-VAR model with lag length of order one (BIC-1) and a 100-step-ahead generalized forecast error variance decomposition**.** Lag length:1. This information also includes the following tables and figures. *Robustness tests are included in the appendix.* The variable in the row is the affected value and the variable in the column is the affecting value. During the evaluation, table values will be mentioned within the limits of the research topic. Numbers are in rates. This explanation also applies to the other Average Dynamic Connectedness Tables. In order to avoid repetition, this explanation is included only in this table.

The total connectedness among all variables in terms of return variation in the Islamic markets of the GCC countries is 29.56%. Of the variation in BAHSH returns, 71.99% is explained by itself and 28.01% is explained by other indicators. In terms of influence percentages, 9.69% is explained by UAESH, 6.59% by KUWSH, 4.58% by QATARSH, 4.17% by SAARSH, and 2.97% by OMANSH.

Of the variation in QATARSH returns, 67.68% is explained by itself and 32.32% is explained by other indicators. According to the percentage of influence; 10.88% is explained by UAESH, 7.02% by KUWSH, 6.15% by SAARSH, 4.43% by BAHSH, and 3.84% by OMANSH.

While 69.36% of the change in KUWSH returns is explained by itself, 30.64% is explained by other indicators. In terms of influence percentages, 7.89% is explained by UAESH, 7.27% by QATARSH, 6.61% by BAHSH, 5.85% by SAARSH, and 3.01% by OMANSH.

While 82.4% of the change in OMANSH returns can be explained by itself, 17.6% can be explained by other indicators. In terms of influence percentages, 4.8% is explained by QATARSH, 3.59% by UAESH, 3.36% by BAHSH, 3.23% by KUWSH, and 2.62% by SAARSH.

66.3% of the change in SAARSH returns is explained by itself, whereas 33.7% is explained by other indicators. In terms of percentage of influence, 9.61% is explained by QATARSH, 9.37% by UAESH, 6.93% by KUWSH, 5.41% by BAHSH, and 2.38% by OMANSH.

Although 64.91% of the change in UAESH returns is explained by itself, 35.09% is explained by other indicators. In terms of influence percentages; 10.29% is explained by QATARSH, 8.94% by BAHSH, 7.21% by KUWSH, 5.73% by SAARSH, and 2.93% by OMANSH.

The total interconnectedness among all variables in terms of return variation in the conventional markets of the GCC countries is 34.12%. 69.18% of the variation in BAH returns are explained by itself, and 30.82% are explained by other indicators. In terms of influence percentages, 12.05% is explained by KUW, 5.87% by the UAE, 4.79% by SAAR, 4.76% by QATAR, and 3.34% by OMAN.

61.52% of the change in QATAR returns can be explained by itself, whereas 38.48% can be explained by other indicators. According to the percentage of influence; 12.13% is explained by the UAE, 10.25% by SAAR, 7.09% by KUW, 5.15% by OMAN, and 3.86% by BAH.

62.6% of the change in KUW returns can be explained by itself, and 37.4% can be explained by other indicators. According to the percentage of influence; 9.64 per cent is explained by BAH, 8.11 per cent by SAAR, 7.41 per cent by UAE, 7.35 per cent by QATAR, and 4.89 per cent by OMAN.

While 76.56% of the change in OMAN returns is explained by itself, 23.44% is explained by other indicators. According to their influence percentages; 6.39 per cent is explained by QATAR, 5.41% by KUW, 4.25% by SAAR, 3.87% by UAE, and 3.53% by BAH.

While 64% of the change in SAAR returns is explained by itself, 36% is explained by other indicators. According to their influence percentages; 12.06 percent is explained by the UAE, 10.42 percent by QATAR, 7.06 percent by KUW, 3.43 percent by BAH, and 3.03 percent by OMAN.

61.45% of the change in UAE returns is explained by itself, and 38.55% is explained by other indicators. According to the percentage of influence; 12.5 percent is explained by SAAR, 11.72 percent by QATAR, 6.8% by KUW, 4.32% by BAH, and 3.15% by OMAN.

When the net dynamic connectedness results are analyzed: In the Islamic markets of GCC countries, the series that transmit shocks the most are UAESH (6.34), followed by QATARSH (4.22), BAHSH (0.73) and KUWSH (0.34); while the series that absorb shocks are SAARSH (-9.17), OMANSH (-2.47). In the conventional markets of GCC countries, SAAR (3.91) is the most shock-e transmitting series, followed by UAE (2.79), QATAR (2.17), and KUW (1.06); while the shock-receiving series are BAH (-6.03), OMAN (-3.89).

Table 5: Average Dynamic Connectedness (The Short-Run & Long Run)

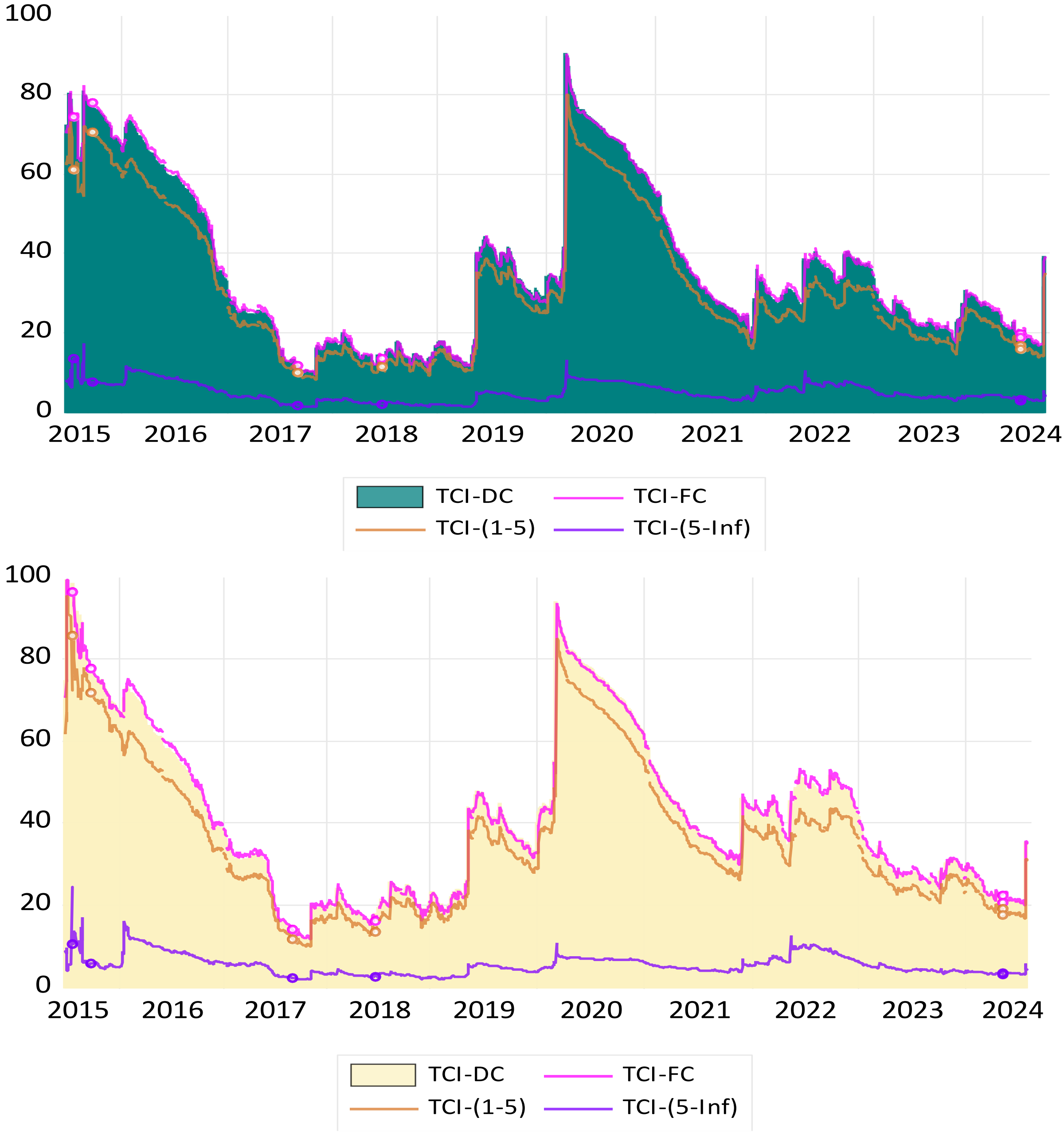
					Islamic					
	BAHSH	QATARSH	KUWSH	OMANSH	SAARSH	UAESH	TO		Net	NPDC
BAHSH.1-5	63,24	3,77	5,72	3,02	4,74	7,89	25,14		0,55	2
QATARSH.1-5	3,95	58,62	6,08	4,20	8,44	9,11	31,78		3,61	4
KUWSH.1-5	5,82	6,08	59,23	2,85	6,16	6,44	27,36		0,96	3
OMANSH.1-5	2,61	3,40	2,60	71,70	2,07	2,61	13,29		-2,40	0
SAARSH.1-5	3,65	5,42	5,27	2,38	56,65	5,04	21,77		-7,90	1
UAESH.1-5	8,56	9,49	6,73	3,24	8,26	57,35	36,28		5,18	5
FROM.1-5	24,59	28,17	26,40	15,69	29,67	31,10	155,62	TCI	**25,94**	
BAHSH.5-Inf	8,57	0,47	1,03	0,47	0,72	0,85	3,54		-0,07	4
QATARSH.5-Inf	0,47	8,90	1,19	0,59	1,53	1,16	4,93		0,62	3
KUWSH.5-Inf	0,90	0,86	9,14	0,44	1,16	0,76	4,12		-1,11	1
OMANSH.5-Inf	0,34	0,52	0,41	10,18	0,29	0,32	1,88		-0,55	0
SAARSH.5-Inf	0,53	0,91	1,16	0,39	8,50	0,64	3,63		-1,55	2
UAESH.5-Inf	1,36	1,55	1,45	0,55	1,49	7,82	6,39		2,66	5
FROM.5-Inf	3,61	4,32	5,23	2,43	5,18	3,73	24,49	TCI	**4,08**	
					Conventional					
	BAH	QATAR	KUW	OMAN	SAAR	UAE	TO		Net	NPDC
BAH.1-5	59,93	3,15	8,23	2,86	2,99	3,81	21,04		-6,64	0
QATAR.1-5	4,19	53,23	6,36	5,49	9,22	10,39	35,65		1,71	3
KUW.1-5	10,59	6,12	53,52	4,69	6,25	6,06	33,71		0,98	2
OMAN.1-5	3,11	4,61	4,43	65,96	2,70	2,90	17,74		-2,46	1
SAAR.1-5	4,49	9,26	7,22	3,82	56,55	10,78	35,57		3,57	4
UAE.1-5	5,30	10,80	6,48	3,35	10,83	53,68	36,76		2,84	5
FROM.1-5	27,68	33,95	32,72	20,21	32,00	33,93	180,48	TCI	**30,08**	
BAH.5-Inf	8,10	0,35	1,26	0,46	0,30	0,46	2,82		-1,47	1
QATAR.5-Inf	0,67	7,88	1,07	0,93	1,18	1,56	5,41		0,46	3
KUW.5-Inf	1,57	0,75	8,01	0,69	0,78	0,77	4,55		-1,20	1
OMAN.5-Inf	0,43	0,62	0,70	10,51	0,27	0,37	2,38		-0,95	1
SAAR.5-Inf	0,75	1,47	1,40	0,65	7,57	1,43	5,71		1,84	5

UAE.5-Inf	0,86	1,76	1,32	0,60	1,35	7,82	5,89		1,32	4
FROM.5-Inf	4,29	4,95	5,75	3,33	3,87	4,58	26,76	TCI	**4,46**	

Note(s): Results are based on a TVP-VAR model based generalized forecast error variance decomposition and its frequency spectral presentation by BK-18 approach.

Tablo 5 presents the short-run (1–5 traded days) and long-run (5-infinite days) components. From a frequency decomposition perspective, the connectedness between Islamic markets is driven by short-run transmission (25.94%) rather than long-run (4.08%). From a frequency decomposition perspective, the connectedness between the conventional markets is driven by short-run transmission (30.08%) rather than long-run (4.46%).

Figure 2: Total Dynamic Connectedness Structure (Islamic- Conventionel)

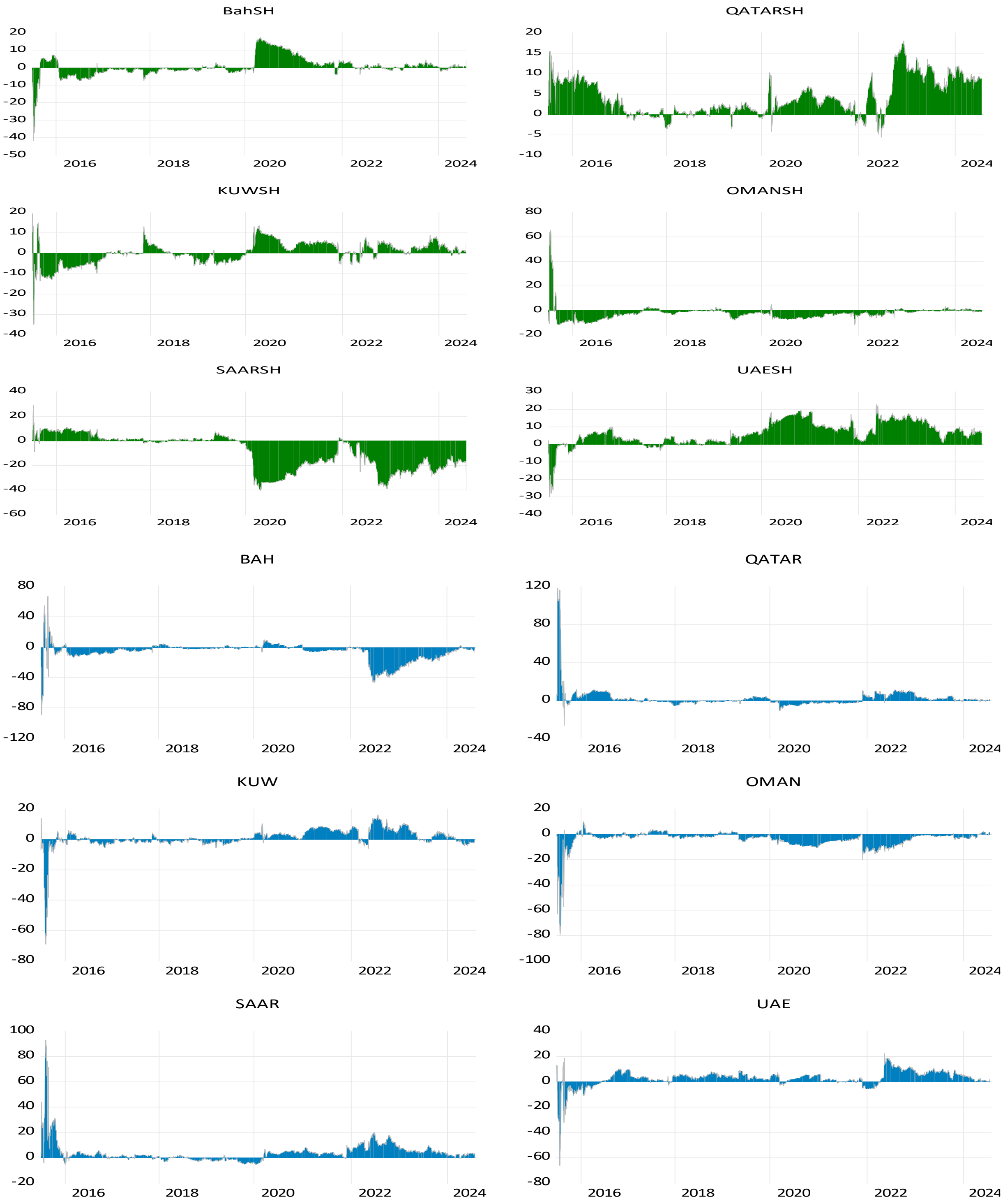


Source(s): Authors' calculations. The green graph shows the connectedness of Islamic markets and the yellow graph shows the connectedness of conventional markets.

Figure 2 illustrates the total dynamic connectedness (TCI-DC) structure of Islamic (green area and conventional markets. For investors with a short-term or long-term investment approach, it is important to know the level of connectedness in the analyzed markets. For this purpose, we also model short-term (frequencies in the period of 1-5 days (TCI-(1-5)) and long-term (frequencies in the period longer than 5 days (TCI-(5-Inf)) forecast horizons. With TCI-DC, we can observe periods when markets' total risk increases or decreases. As of the period analyzed, the average total connectedness of the Islamic markets of the GCC countries is 35.47, the lowest value is 9.27 (31.10.2017), and the highest value is 90.46 (10.03.2020). The average total connectedness of Conventional markets is 40.93; the highest is 99.14 (2015-06-30), and the lowest is 11.09 (2017-10-31). From June 2015 to December 2016, connectedness was above average. It can be said that the oil crisis during this period increased connectedness. In this period, stock market indices declined, there was a flight to the US dollar, government expenditures decreased as oil income declined, which had a negative impact on banks' profitability and growth, and the safe-haven effect diminished. From early 2017 to April 2019, the level of connectedness was low. In May 2019, the percentage increased from 18.54 to 41.78. Four oil ships were attacked in the Strait of Hormuz during this period within 48 hours (Mengüç, 13 May 2019). The highest jump in interconnectedness levels in both markets was experienced in March 2020. Connectedness reached its highest value of 90.46 on March 10, 2020, when COVID-19 was declared a pandemic by the World Health Organization. For almost a year (between March 2020 and March 2021), Connectedness remained high due to the impact of the pandemic. During this period, Expo 2020 was postponed, schools were closed, and cases were seen in the royal family of Saudi Arabia; entrances and exits were banned in the cities of Riyadh, Mecca, and Medina, and large-scale labour migrations were experienced in these countries, where most of the workers were foreigners. Another period of increased connectedness is in February 2022. Another period of relatively high connectedness was the period of the Russian-Ukrainian war. Although there was a short fluctuation in this period due to global uncertainties, it can be said that Europe survived this period profitably as it was in search of oil and natural gas. As can be seen in the graph, the increase in connectedness lasted for a short period.

Regarding the decomposition of aggregate dynamic connectedness in the frequency domain, it shows that aggregate connectedness during the outbreak of the pandemic was mainly driven by the short-term component. This can be interpreted as shocks are realized and transmitted in a shorter period of time and investors' expectations can change instantaneously.

Figure 3: Net Total Directional Connectedness

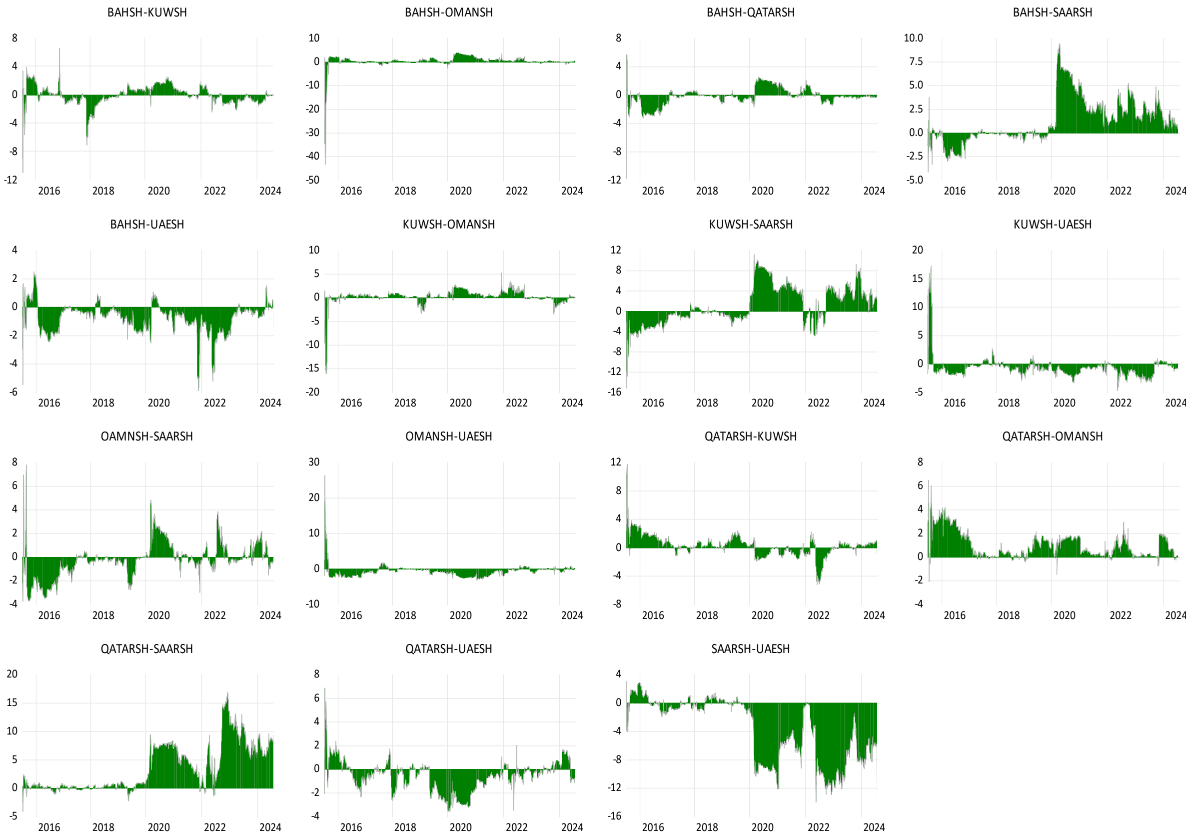


Note(s): Lags = 1 (BIC). Forecast horizon of 10 days.

Source(s): Authors' calculations.

The Net Total Directional Connectedness illustrates how the positions of the series in receiving and spreading shocks change over time in response to shifting circumstances. When we look at the total over the period analyzed; in the Islamic markets of GCC countries, the series that transmit shocks are UAES, QATARSH, BAHSH and KUWSH, while the series that receive shocks are SAARSH and OMANSH. In the conventional markets of GCC countries, the series that transmit shocks are SAAR, UAE, QATAR, and KUW, whereas the series that receive shocks are BAH and OMAN.

Figure 4: Net Pairwise Directional Connectedness



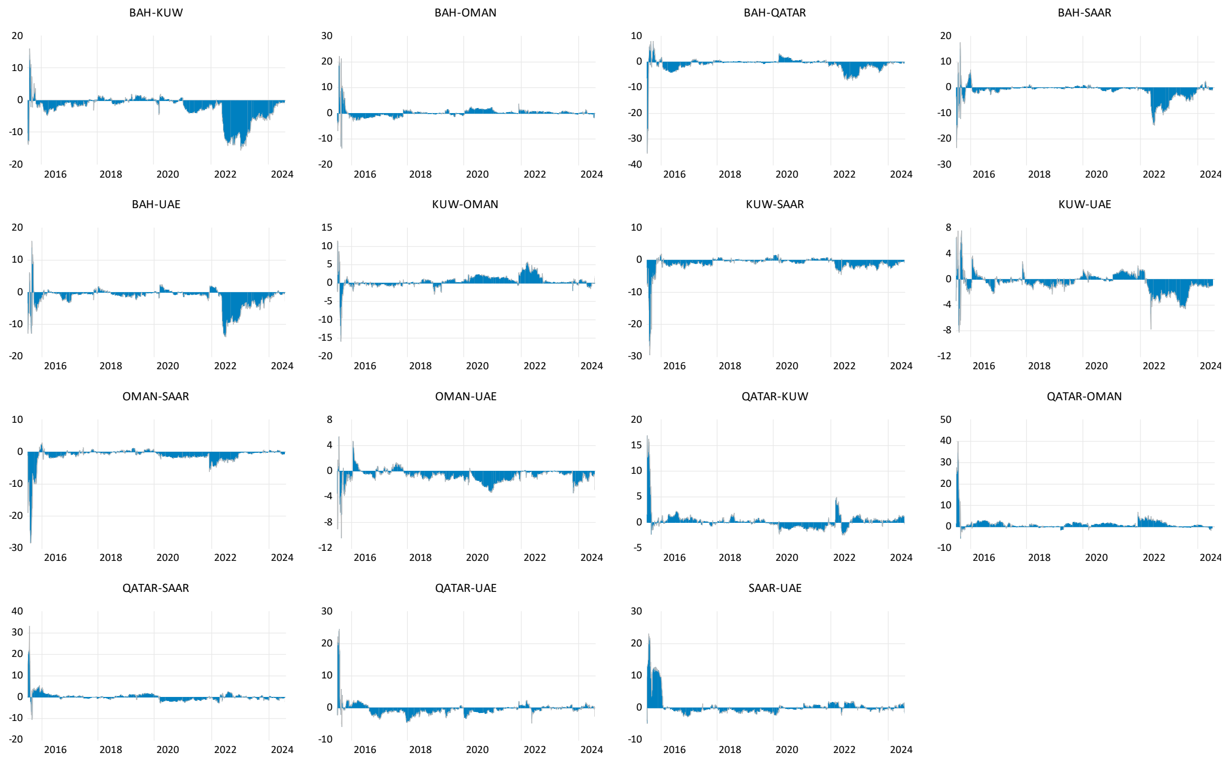
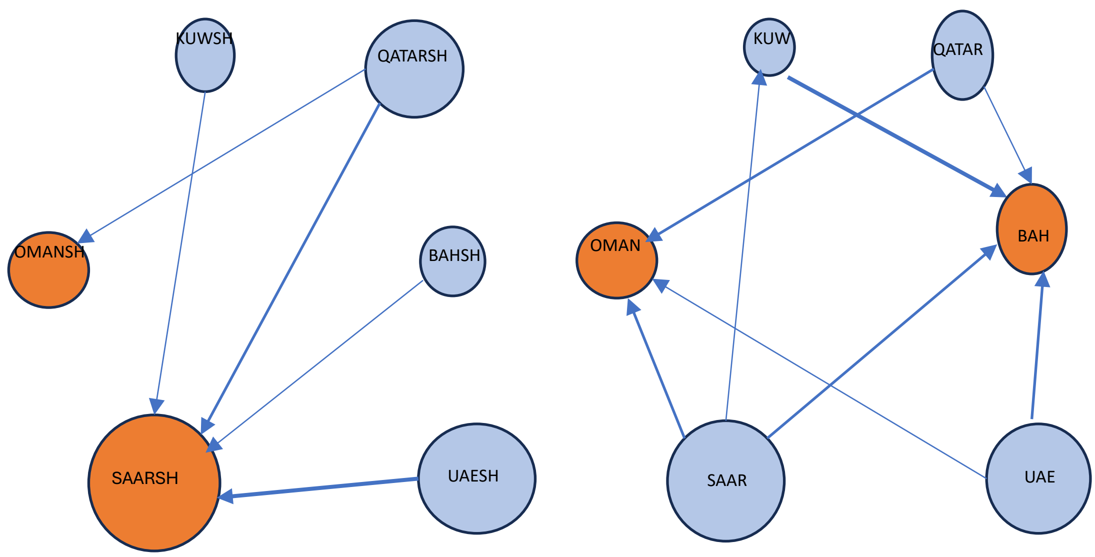


Figure 4 depicts the time-varying net total pair-wise connectedness between Islamic and conventional markets. A positive and negative y-axis value denote a transmitter and a negative y-axis value implies a receiver. Within the scope of the analysis period, the status of the bilateral series as shock recipients or transmitters changes over time. In general, the roles change during the 2015-2016 oil crisis period, the 2020 COVID-19 period, the February 2022 Russia-Ukraine war, and the October 2023 Israel-Palestine war period.

Figure 5: Net- Connectedness Network



Note: Forecast horizon of 10 days; Lag = 1 (BIC)

Source (s): Authors' calculations.

Figure 5 shows the network connectedness among the series. In this figure, orange represents the net receivers, and blue represents the net transmitters in the series. In addition, while the thickness of the arrow indicates the link intensity, its direction is from the net transmitter to the net receiver. As a result of the analysis, OMANSH and SAARSH are net receivers, whereas UASH, BAHSH, QATARSH, and KUWSH are net transmitters in Islamic markets. In conventional markets, OMAN and BAH are net receivers, whereas SAAR, UAE, KUW, and QATAR are net transmitters.

Conclusion

This study analyzed the dynamic connectedness of the Islamic and conventional stock markets in the Gulf Cooperation Council (GCC) economies using the TVP-VAR model. The analysis determined the overall structure of dynamic connectedness. It also examined the connectedness levels of the markets during crisis periods and explored the events that occurred during these periods. Additionally, it identified the markets that received and transmitted shocks during the examined periods. The study also conducted additional analysis for investors with short-term and long-term investment approaches. In the analyzed markets, the degree of connectedness in the short and long term was analyzed to determine whether the market is a transmitter or a receiver of shocks. For this purpose, in this part of the study, the short-term (frequencies in the period of 1-5 days) and long-term (frequencies in the period longer than 5 days) forecast horizons were modeled. This procedure also allowed to observe whether the results are consistent across different model specifications. The average dynamic connectedness results showed that the Saudi Arabia Islamic market had the highest impact on the Bahrain and Qatar Islamic markets. The Saudi Arabia and Qatar Islamic markets had the highest impact on the Kuwait Islamic market. The Qatar Islamic market had the highest impact on the Oman and UAE Islamic markets. Finally, the UAE and Qatar Islamic markets had the highest impact on the Saudi Arabia Islamic market. The highest impact on Bahrain's conventional market is from Kuwait's conventional market, the highest impact on Qatar's conventional market is from the UAE and Saudi Arabian conventional markets, the highest impact on Kuwait's conventional market is from Bahrain conventional market, The highest impact on the Oman conventional market is observed from the Qatar conventional market, the highest impact on the Saudi Arabian conventional market is observed from the UAE and Qatar conventional markets, and the highest impact on the UAE conventional market is observed from the Saudi Arabian and Qatar conventional markets. Regarding the decomposition of aggregate dynamic connectedness in the frequency domain, it shows that aggregate connectedness during the outbreak of the pandemic was mainly driven by the short-term component. This can be interpreted as shocks are realized and transmitted in a shorter period of time and investors' expectations can change instantaneously.

According to the Net Connectedness Network Between Series results, the Oman and Saudi Arabia Islamic markets are net receivers of shocks. In conventional markets, the Oman and Bahrain markets are net shock receivers. The transmission of shocks to these markets from other markets may be because these markets have larger economies than other markets and are more dominant in the region. In general, during the 2015-2016 oil crisis period, the 2020 COVID-19 period, the February 2022 Russia-Ukraine war, and the October 2023 Israel-Palestine war periods, total connectedness increased, and there was a change in the receiver or transmitter positions of the market.

The aggregate dynamic connectedness results showed that the connectedness in Islamic and conventional markets, similar to Abu Bakar & Masih (2014), was the same during both decreasing and increasing risk periods. Conventional markets have a higher level of connectedness than Islamic markets (similar to the study of Smolo et al., 2022). However, this level is not strong enough to support the argument that Islamic markets provide protection to investors and national economies in times of crisis and act as a safe haven (Kuşat, 2014; Şahin, 2018; Güçlü and Kılıç, 2020). The GCC stock markets are heavily dependent on the oil and gas sector, market liquidity and diversity are relatively low, global integration is high, and the interest-free structure is perceived as a risk by some investors, which may result in investors shifting to alternative safe havens. As a conclusion of the results, investors can invest in other financial instruments such as gold, silver, oil, foreign currency, Government Domestic Debt Securities, which are widely believed in the literature to act as safe havens and protect investors in times of crisis. Investors who want to invest in Shariah-compliant instruments can invest in sukuk, Islamic ETFs or defensive sectors.

The findings will help decision-makers understand how markets behave, particularly in times of crisis, and where market shocks originate or spread.

References

Abduh, M., & Omar, M. A. (2012). Islamic banking and economic growth: the Indonesian experience. International Journal of Islamic and Middle Eastern Finance and Management, 5(1), 35–47.

Abu Bakar, N., & Masih, A. M. M. (2014). The dynamic linkages between Islamic index and the major stock markets: new evidence from wavelet time-scale decomposition analysis. MPRA Paper

Abusharbeh, M. T. (2020). Determinants of Islamic bank financing in the Middle East: vector error correction model (VECM). Investment Management and Financial Innovations, 17(4), 285–298. https://doi.org/10.21511/imfi.17(4).2020.25

Almaida, A., Abbas, U., Watto, W., Asdullah, M., Fahlevi, M., & Ichdan, D. (2024). The Islamic effect: Exploring the dynamics of Islamic events on the sustainable performance of Islamic and conventional stock markets. Uncertain Supply Chain Management, 12(1), 235-248.

Anas, M., Mujtaba, G., Nayyar, S., & Ashfaq, S. (2020). Time-frequency-based dynamics of decoupling or integration between Islamic and conventional equity markets. Journal of Risk and Financial Management, 13(7), 156.

Anscombe, F.J., & Glynn, W.J. (1983). Distribution of the kurtosis statistic b2 for normal samples. Biometrika, 70 (1), 227–234.

Antonakakis, N., Chatziantoniou, I., & Gabauer, D. (2020). Refined measures of dynamic connectedness based on time-varying parameter vector autoregressions. Journal of Risk and Financial Management, 13(4), 84.

Benlagha, N., Karim, S., Naeem, M. A., Lucey, B. M., & Vigne, S. A. (2022). Risk connectedness between energy and stock markets: Evidence from oil importing and exporting countries. *Energy Economics*, *115*, 106348.

Bossman, A., Junior, P. O., & Tiwari, A. K. (2022). Dynamic connectedness and spillovers between Islamic and conventional stock markets: time-and frequency-domain approach in COVID-19 era. Heliyon, 8(4).

D'Agostino, R.B. (1970). Transformation to normality of the null distribution of g1. Biometrika 57(3), 679–681.

Dammak, W., Gökgöz, H., & Jeribi, A. (2024). Time-frequency connectedness in global banking: volatility and return dynamics of BRICS and G7 banks.

Demir, S. (2024). Yatırımcı duyarlılığı ile ABD geleneksel ve yeşil tahvil piyasaları arasındaki bağlantılılık analizi. Afyon Kocatepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 26(2), 264–275. https://doi.org/10.33707/akuiibfd.1451827

Diebold, F. X., & Yılmaz, K. (2014). On the Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms. Journal of Econometrics, 182(1), 119–134.

Diebold, F. X., & Yilmaz, K. (2012). Better to give than to receive: Predictive Directional Measurement of Volatility Spillovers. International Journal of Forecasting, 28(1), 57–66.

Domat, C. (2024) "Islamic finance: Just for Muslim-Majority Nations?" Global Finance https://gfmag.com/banking/islamic-finance-just-muslim-majority-nations/ Accessed 1 Aug 2024.

Elliott, G., Rothenberg, T.J., & Stock, J.H. (1996). Efficient tests for an autoregressive unit root. Econometrica 64(4), 813–836.

Fisher, T.J., & Gallagher, C.M. (2012). New weighted portmanteau statistics for time series goodness of fit testing. J. Am. Stat. Assoc. 107(498), 777–787.

Gökgöz, H. (2022). Kripto para getiri oynaklığı üzerinde etkili olan faktörlerin modellenmesi. T.C. Afyon Kocatepe Üniversitesi, Sosyal Bilimler Enstitüsü, İşletme Anabilim Dalı, Doktora Tezi.

Güçlü, F., & Kiliç, M. (2020). İslami Finansın Dünyadaki Gelişimi ve İslami Finansa Yön Veren Uluslar arasi Kuruluşlar Üzerine Bir İnceleme. Uluslararası Yönetim Iktisat ve İşletme Dergisi, 16(1), 75–91.

Hassan, M. K. (2014). Islamic finance, sustainable development with financial inclusion. University of New Orleans.

Huang, J., Chen, B., Xu, Y., & Xia, X. (2023). Time-frequency volatility transmission among energy commodities and financial markets during the COVID-19 pandemic: A Novel TVP-VAR frequency connectedness approach. *Finance Research Letters*, *53*, 103634.

Islamic Development Bank Institute & Islamic Financial Services Board, (2014). Islamic Financial Services Industry Development: Ten-Year Framework and Strategies. A Mid-Term Review, Islamic Financial Services Industry Development Report: Other Reports

Jarque, C.M., & Bera, A.K. (1980). Efficient tests for normality, homoscedasticity and serial independence of regression residuals. Econ. Lett. 6(3), 255–259.

Johnson, K. (2013). The Role of Islamic Banking in Economic Growth. CMC Senior Theses Paper, 642, Claremont McKenna College.

Koçak, E. (2018). İslami finans ve ekonomik büyüme: Türkiye üzerine ekonometrik bir uygulama. Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, (51), 67–91.

Kontesa, M. (2023). Does Sharia-compliant debt financing reduce stock price crash risk? Managerial Finance, 50(3), 498-513. https://doi.org/10.1108/mf-12-2022-0596

Koop, G. (1996). Parameter Uncertainty and Impulse Response Analysis. Journal of Econometrics, 72(1-2), 135–149.

Kuşat, N. (2014). Modern İslami Finans Sektörünün İnovatif Gücü: Sukuk. Akademik Bakış Uluslararası Hakemli Sosyal Bilimler Dergisi, (41).

Majdoub, J., & Sassi, S. B. (2017). Volatility spillover and hedging effectiveness among China and emerging Asian Islamic equity indexes. Emerging Markets Review, 31, 16–31.

Mandaci, P. E., & Cagli, E. C. (2021). Dynamic connectedness between Islamic Mena stock markets and global factors. International Journal of Economics, Management and Accounting, 29(1), 93–127.

Mengüç, D. "Hürmüz Boğazı'nda 48 saatte dört petrol gemisi saldırıya uğradı", 13 May 2019, https://www.indyturk.com/node/30751/d%C3%BCnya/h%C3%BCrm%C3%BCz-bo%C4%9Faz%C4%B1%E2%80%99nda-48-saatte-d%C3%B6rt-petrol-gemisi-sald%C4%B1r%C4%B1ya-u%C4%9Frad%C4%B1. Accessed 3 OCT 2024.

Mensi, W., Rehman, M. U., Maitra, D., Al-Yahyaee, K. H., & Vo, X. V. (2023). Frequency spillovers and portfolio risk implications between Sukuk, Islamic stock and emerging stock markets. The Quarterly Review of Economics and Finance, 91, 139–157.

Mishra, A. K., & Ghate, K. (2022). Dynamic connectedness in non-ferrous commodity markets: Evidence from India using TVP-VAR and DCC-GARCH approaches. *Resources Policy*, *76*, 102572.

Naeem, M. A., Khan, S., & Rehman, M. Z. (2024). Comparing Islamic and conventional stock markets in GCC: a TVP-VAR analysis. International Journal of Emerging Markets.

Nahar, S., & Sarker, N. (2016). Are Macroeconomic Factors Substantially Influential for Islamic Bank Financing? Cross-Country Evidence. In IOSR Journal of Business and Management, 18(6), IOSR Journal of Business and Management. https://doi.org/10.9790/487X-1806012027

Najeeb, S. F., Bacha, O., & Masih, M. (2017). Does a held-to-maturity strategy impede effective portfolio diversification for Islamic bond (sukuk) portfolios? A multi-scale continuous wavelet correlation analysis. Emerging Markets Finance and Trade, 53(10), 2377–2393.

Nawaz, H., Abrar, M., Salman, A., & Bukhari, S. M. H. (2019). Beyond finance: impact of Islamic finance on economic growth in Pakistan. Economic Journal of Emerging Markets, 11(1), 8–18. https://doi.org/10.20885/ejem.vol11.iss1.art2

Nursyamsiah, T., (2018). Macroeconomic determinants of Islamic banking financing. Tazkia Islamic Finance and Business Review, 11(2). https://doi.org/10.30993/tifbr.v11i2.136

Pesaran, H. H., & Shin, Y. (1998). Generalized Impulse Response Analysis in Linear Multivariate Models. Economics Letters, 58(1), 17–29.

Pirgaip, B., Arslan-Ayaydin, Ö., & Karan, M.B. (2021). Does Sukuk provide diversification benefits to conventional bond investors? Evidence from Turkey. Global Finance Journal, 50, 100533.

Rifai, S.A., Susanti, H., & Setyaningrum, A. (2017), Analisis pengaruh kurs rupiah, laju inflasi, jumlah uang beredar dan pertumbuhan ekspor terhadap total pembiayaan perbankan syariah dengan dana pihak ketiga sebagai variabel moderating. Muqtasid: Juornal Ekonomi Dan Perbankan Syariah, 8(1), 13–27.

S&P Global. www.spglobal.com. Accessed 28 Sept. 2024.

Sahabuddin, M., Islam, M. A., Tabash, M. I., Alam, M. K., Daniel, L. N., & Mostafa, I. I. (2023). Dynamic conditional correlation and volatility spillover between conventional and Islamic stock markets: Evidence from developed and emerging countries. Journal of Risk and Financial Management, 16(2), 111.

Saiti, B., Bacha, O. I., & Masih, M. (2016). Testing the conventional and Islamic financial market contagion: evidence from wavelet analysis. Emerging Markets Finance and Trade, 52(8), 1832–1849.

Shah, N., Qureshi, M. N., & Aslam, Y. (2017). An Empirical Investigation of Islamic Calendar Effect in Global Islamic Equity Indices. International Journal of Economics and Finance, 9(6), 57–68.

Shahzad, S. J. H., Ferrer, R., Ballester, L., & Umar, Z. (2017). Risk transmission between Islamic and conventional stock markets: A return and volatility spillover analysis. International Review of Financial Analysis, 52, 9–26.

Shanmugam, B., & Zahari, Z. R. (2009). A primer on Islamic finance. Charlottesville: Research Foundation of CFA Institute.

Smolo, E., Jahangir, R., Nagayev, R., & Tarazi, C. S. (2022). Performances of Islamic and conventional equities during the global health crisis: Time-frequency analysis of BRICS+ T markets. Review of Financial Economics, 40(3), 259–280.

Şahin, N. (2018). İslami Bankaların Düzenlenmesi ve Denetlenmesi. In 1st International Congress on Islamic Economy and Finance Proceedings Book, 27, 40.

Umar, Z., & Suleman, T. (2017). Asymmetric return and volatility transmission in conventional and Islamic equities. Risks, 5(2), 22.

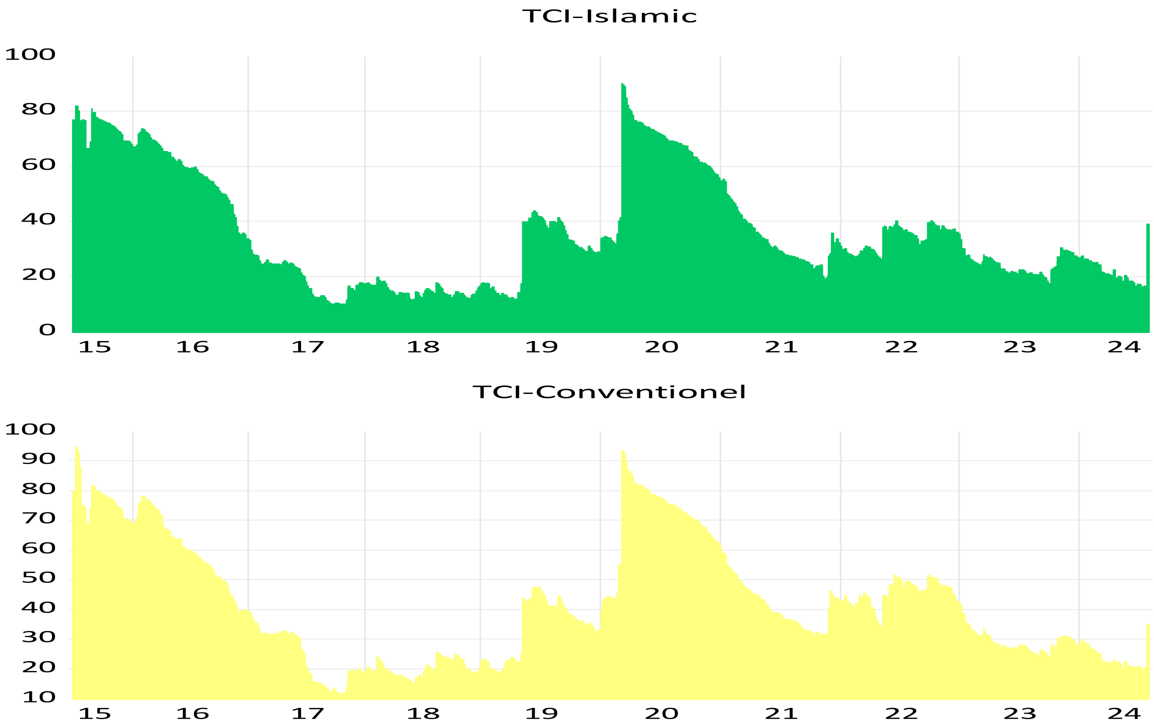
Wasiuzzaman, S. (2018). Seasonality in the Saudi stock market: The Hajj effect. The Quarterly Review of Economics and Finance, 67, 273–281.

Widarjono, A. (2018). Estimating profitability of Islamic banking in Indonesia. Jurnal Keuangan dan Perbankan, 22(3), 439–454. https://doi.org/ 10.26905/jkdp.v22i3.2197

Appendix

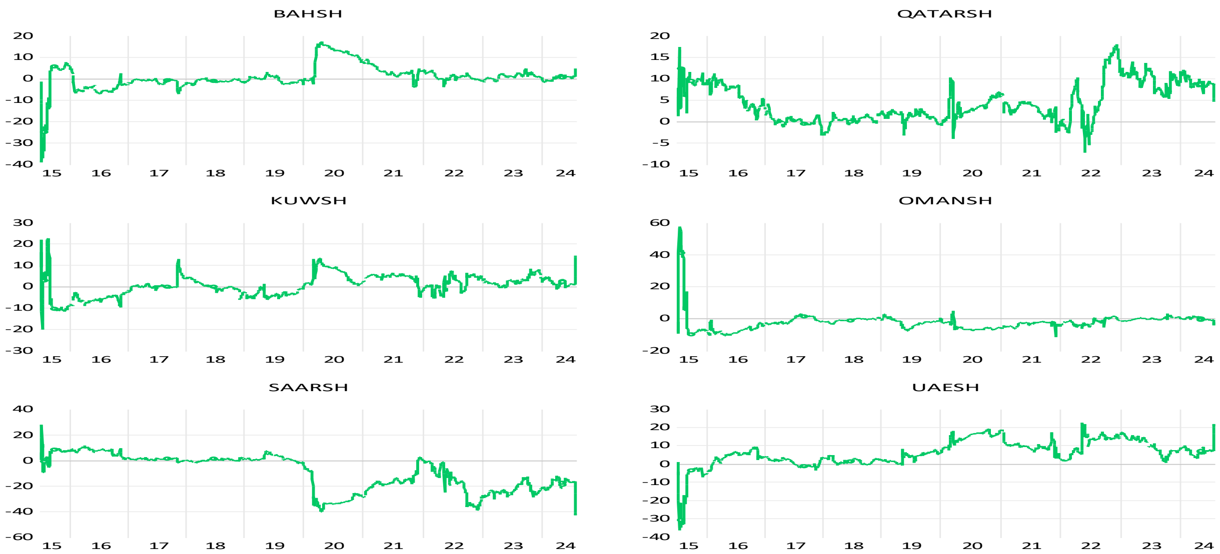
Robustness Test

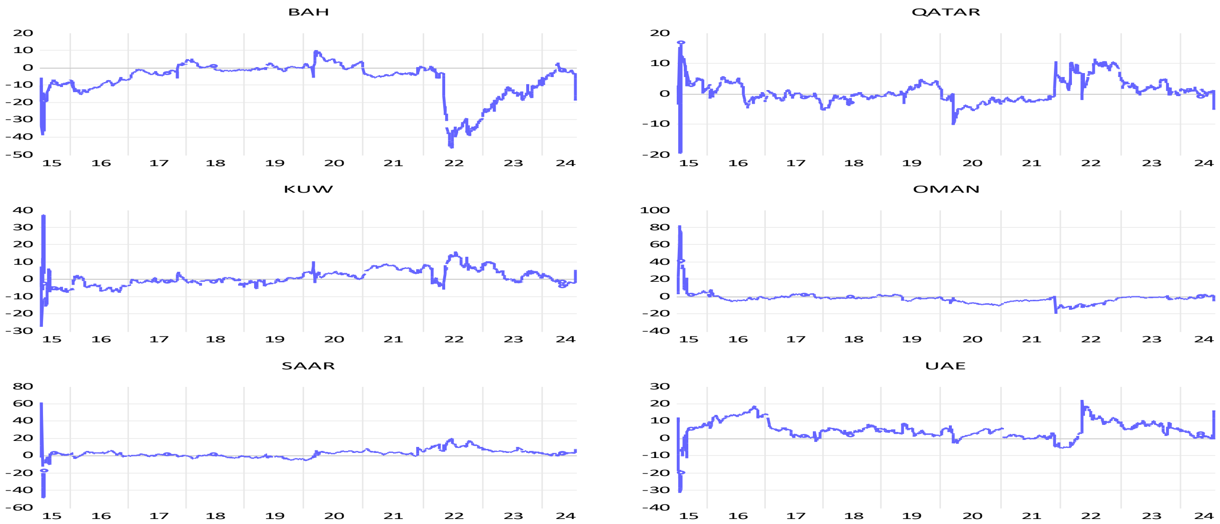
Figure 6: Total Dynamic Connectedness Structure



Note: Results are based on a TVP-VAR model with lag length of order one (BIC-3) and a 150-step-ahead generalized forecast error variance decomposition.

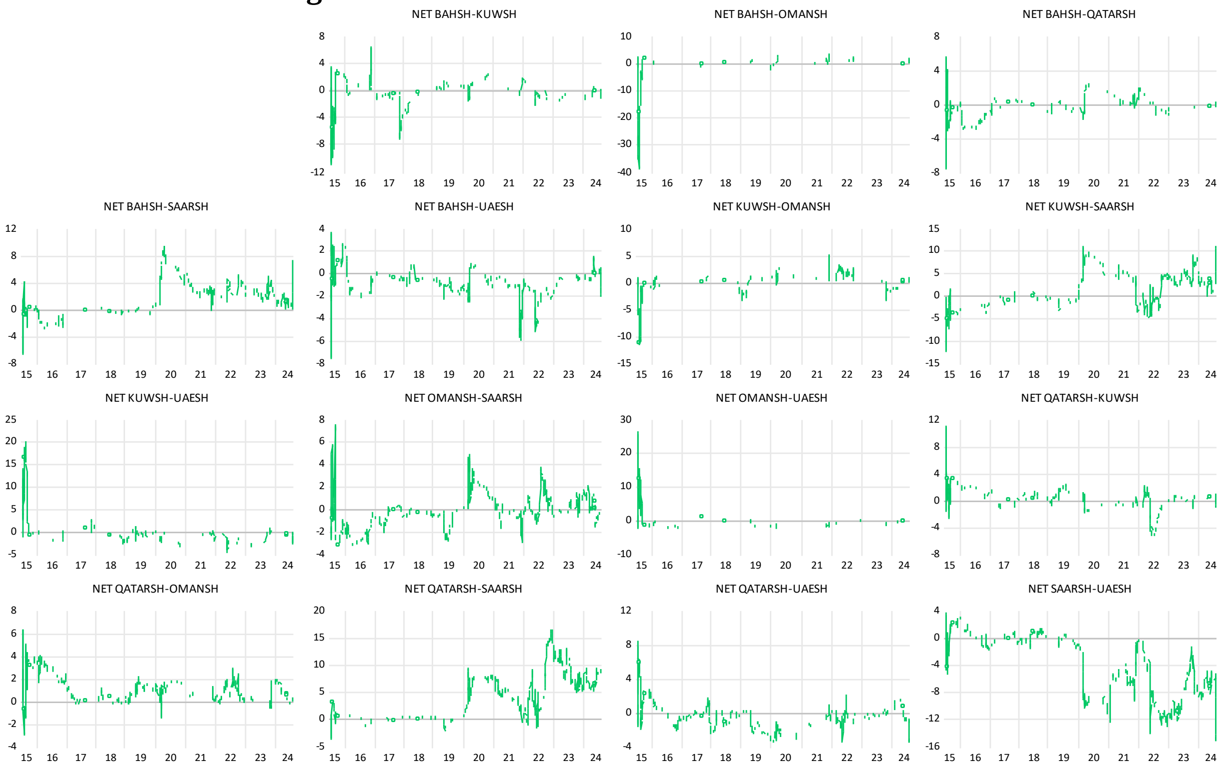
Figure 7: Net Total Directional Connectedness

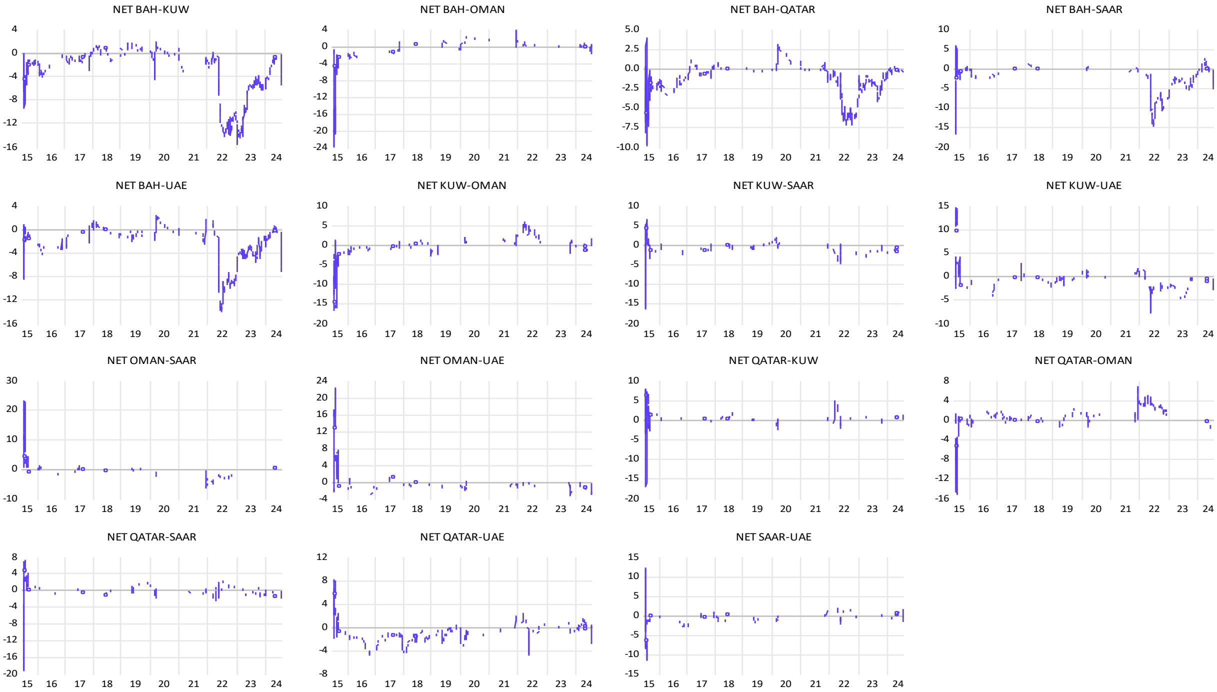




Note: Results are based on a TVP-VAR model with lag length of order one (BIC-3) and a 150-step-ahead generalized forecast error variance decomposition**.**

Figure 8: Net Pairwise Directional Connectedness





Note: Results are based on a TVP-VAR model with lag length of order one (BIC-3) and a 150-step-ahead generalized forecast error variance decomposition**.**