Akademik Hassasiyetler **The Academic Elegance**
Yıl/Year: 2025 **Sayı/Issue: 27**
Cilt/Volume: 12 **Sayfa/Page: 399-428**
Araştırma Makalesi
Makale Gönderim Tarihi: 23/11/2024 **Makale Kabul Tarihi: 29/04/2025**

DYNAMIC LINKAGES BETWEEN TURKISH ISLAMIC STOCK MARKET AND GLOBAL MACROECONOMIC RISK FACTORS: EVIDENCE FROM DCC-GARCH MODEL

Nehir BALCI*

Abstract

Over the past two decades, Islamic finance has gained increasing prominence, with Islamic equities emerging as particularly attractive to investors. This study aims to investigate the volatility transmission between the Turkish Islamic stock market and selected global macroeconomic risk factors, specifically the US Dollar Index, the CBOE Gold Volatility Index, the CBOE Crude Oil Volatility Index, and the CBOE Volatility Index. Using the DCC-GARCH model and daily data from April 11, 2013, to April 25, 2024, we analyzed the dynamic connectivity between these indices. The results of the study show a negative interaction between macroeconomic risk factors and the Turkish Islamic stock market. There is a volatility transmission from all macroeconomic risk factors to the Turkish Islamic stock market in the long-term investment period, but there is a volatility transmission only from the US dollar index to the Turkish Islamic stock market in the short-term investment period. Investors view the Turkish Islamic stock market as a safe haven, less susceptible to macroeconomic risk indicators, and less integrated with the international financial system in the short term. According to the findings of the DCC-GARCH model, investments in the Turkish-Islamic equity market should be viewed as riskier over the long term due to the transmission of volatility between selected macroeconomic risk factors and the Turkish-Islamic equity market. This study provides valuable insights for investors and portfolio managers seeking to enhance their portfolio management strategies.

Keywords: *Islamic Finance, Volatility Spillovers, Turkish Islamic Stock Market, Macroeconomic Indicators, DCC-GARCH.*

TÜRKİYE İSLAMİ HİSSE SENEDİ PİYASASI VE KÜRESEL MAKROEKONOMİK RİSK FAKTÖRLERİ ARASINDAKİ DİNAMİK İLİŞKİLER: DCC-GARCH MODELİNDEN KANITLAR

Öz

Son yirmi yılda İslami finans, özellikle de geniş bir yatırım cazibesine sahip olan İslami hisse senetleri giderek daha önemli hale gelmiştir. Bu çalışmanın amacı, Türk İslami Hisse Senedi Piyasası ile ABD Dolar Endeksi, CBOE Altın Oynaklık Endeksi, CBOE Ham Petrol Oynaklık Endeksi ve CBOE Oynaklık Endeksi gibi seçili

* Dr. Öğr. Üyesi, Dokuz Eylül Üniversitesi Uygulamalı Bilimler Yüksekokulu Uluslararası Ticaret Bölümü, nehir.balci@deu.edu.tr, https://orcid.org/0000-0002-9317-7491

küresel makroekonomik risk faktörleri arasındaki oynaklık aktarımını araştırmaktır. Değişkenler arasındaki dinamik ilişkiyi incelemek için 1 Mart 2013 ile 25 Nisan 2024 tarihleri arasındaki günlük veri seti ile DCC-GARCH modeli kullanılmıştır. Çalışmanın sonuçları, makroekonomik risk faktörleri ile Türk İslami hisse senedi piyasası arasında negatif bir etkileşim olduğunu göstermektedir. Uzun vadeli yatırım döneminde tüm makroekonomik risk faktörlerinden Türk İslami hisse senedi piyasasına bir volatilite aktarımı varken, kısa vadeli yatırım döneminde sadece ABD doları endeksinden Türk İslami hisse senedi piyasasına bir volatilite aktarımı vardır. Kısa vadede, Türk İslami hisse senedi piyasası yatırımcılar için güvenli bir liman olarak hizmet vermekte, küresel risklerden daha az etkilenmekte ve küresel finansal sistemle daha az entegrasyona sahiptir. DCC-GARCH modelinin sonuçları ayrıca, seçilen tüm makroekonomik risk faktörleri ile Türk-İslam hisse senedi piyasası arasında uzun vadede bir volatilite aktarımı olduğundan, Türk-İslam hisse senedi piyasasına yapılan yatırımların uzun vadeli yatırım döneminde daha riskli olarak değerlendirilmesi gerektiğini göstermektedir. Bu çalışma, portföy yönetimi stratejilerini geliştirmek isteyen portföy yöneticileri ve yatırımcılar için değerli bilgiler sunmaktadır.

Anahtar Kelimeler: *İslami Finans, Volatilite Yayılımları, Türkiye İslami Hisse Senedi Piyasası, Makroekonomik Göstergeler, DCC-GARCH.*

Introduction

The rising interest of religiously conscious investors in Shariah-compliant investments has driven a significant shift towards Islamic stock indices. Consequently, the Islamic stock market has garnered considerable attention, experiencing a surge in interest from academic researchers and financial market practitioners. The Turkish Islamic stock market is to witness exponential growth in Shariah-compliant investments, maintaining a consistent pace of expansion (Bayram & Abdullah Othman, 2019).

Capital investments in Islamic finance should fulfil an ethical and social objective beyond profit maximization. Furthermore, the core of Islamic finance practices is the relationship between return and risk, profit and loss sharing, and partnership principles inherent in Islamic contracts. The prohibition of interest in Islamic law has prompted Muslim scholars to devise alternative financing methods to comply with interest-free principles. One notable development in this field is the creation of Islamic indices, which serve as reference points for stock indices to monitor the financial performance of publicly traded firms that adhere to Shariah compliance (Naifar, 2016).

Some studies on Islamic stock markets examine how volatility moves among stock markets (Al-Khazali et al., 2014; Dania & Malhotra, 2013; Kamışlı & Esen, 2020; Nazlıoğlu et al., 2015). Others examine how Islamic stock market indices change over time and relate to larger economic factors (Bahloul et al., 2017; Majid et al., 2009; Xu et al., 2019).

Volatility in macroeconomic factors can significantly affect Islamic market volatility. The main purpose of this study is to investigate the impact of macroeconomic variables on explaining returns in Türkiye's Islamic stock market. Specifically, it analyses the interaction between the volatility of the Turkish Islamic stock market as a developing economy and the volatility of global macroeconomic variables. The Dow Jones Turkish Islamic Market Index (IMTR) represents the volatility of the Islamic stock market in Türkiye. This study analyses the US Dollar Index (DXY), a measure of the US dollar's variability, given its significant impact on inflation, interest rates, and other economic phenomena. The study aims to investigate the interaction between the volatility of the dollar in the world market and the volatility of the IMTR index. The analysis also incorporates the CBOE Gold Volatility Index (GVZ), which reflects volatility in gold prices, serving as a safe haven for investors amidst market fluctuations. Volatility in gold prices can significantly affect Islamic portfolios and the broader Islamic stock market. Investors might use bonds or derivatives in conventional portfolios as alternative hedging instruments. However, in Islamic finance, such instruments are often prohibited or limited. If gold becomes highly volatile, it reduces the effectiveness of this key hedge, leaving Islamic portfolios more exposed to market risks. The study also examines the CBOE Crude Oil Volatility Index (OVX), which reflects changes in crude oil prices. Rising crude oil prices adversely affect Türkiye, an oil-importing country, by increasing production costs and increasing inflation pressure. As an indicator of the real sector, the interaction between the risk arising from the volatility in oil prices and the volatility in the IMTR should be considered. Additionally, the CBOE Volatility Index (VIX), or the fear index, estimated based on the indicated volatility of S&P 500 index options, is analyzed to reflect investors' expectations of future market volatility. It is anticipated that investigating the existence of volatility interaction between the IMTR index and the variables considered in this study would strengthen the understanding of factors affecting the Islamic market risk structure of Borsa Istanbul.

This study uses the DCC-GARCH model to examine the volatility interaction between the IMTR index and the selected macroeconomic variables. This approach allows for an analysis of the volatility interaction between the IMTR index and the financial variables and the dynamic correlation relationship. The literature concerning the shortcomings of Islamic stock indices often revolves around a predominant focus on global Islamic indices, lacking country-specific implications. The main motivation of this study is a scarcity of extensive literature that incorporates global macroeconomic factors related to the Turkish Islamic market. The study is expected to contribute to the understanding and monitoring of the integration between the Turkish Islamic stock market and international financial markets.

This study is structured in five sections, presenting the literature review in the second section, the data set and methodology in the third section, empirical findings in the fourth section, and the conclusion in the final section.

1. LITERATURE REVIEW

DCC-GARCH models are commonly employed to study volatility interactions in financial markets. We present some examples of studies from the literature below, which investigate dynamic connectivity between stock markets, especially using M-GARCH models. For instance, Majdouba and Mansour (2014) examined conditional correlations between Islamic stock markets in Indonesia, Malaysia, and Türkiye, finding weak correlations with the US market, suggesting limited integration. There is no substantial evidence to suggest that the US market exerts spillover effects on the Islamic emerging markets.

The literature includes studies that investigate the interconnectivity of financial markets using a multivariate DCC model, emphasizing the importance of investigating intermarket linkages and volatility transmission in a global context. Gamba-Santamaria et al. (2017) examined dynamic connectivity between Latin American countries' stock markets and the US stock market, built upon the frameworks of Diebold & Yılmaz (2009, 2012), and the study applied the DCC-GARCH model. This model determines the multivariate volatility relationships among stock market indices of four Latin American countries and the US. The results indicate that a net transmitter of volatility is Brazil, whereas net receivers are Mexico, Colombia, and Chile. Zhong and Liu (2021) conducted a study that examined the volatility spillovers and dynamic conditional correlations among five Southeast Asian stock markets. The study used the diagonal BEKK, CCC, and DCC-GARCH models and examined Thailand, Singapore, the Philippines, Malaysia, Indonesia, and China stock markets. The results reveal a positive dynamic conditional correlation among the five Southeast Asian and Chinese stock markets. Moreover, during the 2015 stock market crash, the US subprime crisis, and the Asian financial crisis, the volatility spillovers between these stock markets reached their peak. Yadav et al. (2023) examined the volatility transmission in the Indian stock market from the American and Eurozone stock markets utilizing the DCC-GARCH model. They found a short-term spillover from the global financial markets to the Indian stock market. While long-term investments are considered safe because of the absence of volatility transmission from the Eurozone and American stock markets, short-term investments are not advisable in light of the existence of spillover effects from these developed financial markets. Belanes et al. (2024) explored the advantages of potential diversification for the US and its primary trading partners including the UK, Japan, and Canada, and Islamic and conventional indexes were considered. They utilized a DCC-GARCH model, and the results show that, in contrast to Canadian indexes, Japanese indices exhibit a low

dynamic correlation with US indices, indicating potential diversification opportunities for US investors. This example is particularly relevant to the present study as it highlights the interconnectedness of financial markets while employing a multivariate DCC model, thereby illustrating the importance of investigating cross-market linkages and volatility transmissions in a global context.

Some studies evaluate volatility spillover in the context of Islamic stock markets. Sclip et al. (2016) used symmetric M-GARCH models with DCC to examine how international stock indices and sukuk move together and how volatility patterns change over time. Their findings indicate that US and EU stock markets exhibit high correlations with the sukuk market without the typical flight-to-quality behavior often associated with Islamic bonds. Additionally, the study indicates that the volatility connections between financial markets intensify during financial crises. Charfeddine & Refai (2019) also used multivariate GARCH models to examine the impact of volatility transmission and stock market reliance between Qatar and other Gulf Cooperation Council (GCC) countries. In particular, they examined the effect of the crises in March 2014 and June 2017. Using DCC, asymmetric DCC (aDCC), and cADCC-GARCH models, the study findings reveal that only the GCC crisis in June 2017 significantly affected stock market dependence. Additionally, the study found evidence of volatility transmission between Qatar and other GCC countries, except Bahrain.

In contrast to the aforementioned studies that examine the volatility coaction between financial markets of different countries using DCC-GARCH models, this study focuses on the volatility interaction between specific macroeconomic financial indicators and the IMTR. The literature review shows that the interrelationship between the macroeconomic variables considered in this study and various equity market indices have been analyzed using extensive methods.

The link between the US dollar index, gold prices, crude oil prices, VIX, and Islamic stock markets, a global macro-economic risk indicator, is important for understanding the integration between markets and for investment and risk management strategies. In the literature, some studies demonstrate a notable relationship between macroeconomic risk factors and Islamic index returns, while others indicate that such a relationship is insignificant. Hussin et al. (2012) examined the co-integration between the Malaysian Islamic stock market and macroeconomic indicators, particularly the US dollar exchange rate and crude oil prices. Variance Decomposition (VDC), Impulse Response Function (IRF), and the multivariate Granger causality test co-integration analysis were employed in this study. The results indicate that Islamic stock market prices are integrated with the US dollar exchange and oil prices. Similarly, Sakti and Harun (2013), employing VDC and co-integration analysis, found a co-integrative relationship between the US dollar exchange rate and the Islamic stock index of Jakarta.

Hammoudeh et al. (2014) analyzed the dependency between three conventional global stock markets, the Dow Jones Islamic Market World Index (DJIM), and four risk indicators. These risk indicators included the VIX, the interest rate of the 10-year constant maturity US Treasury bond, the benchmark for 10-year EMU government bonds, and Western Texas Intermediate (WTI) oil prices from 1999 to 2013. Utilizing a variety of copula functions, the study found indicative lower and upper tail dependence between the DJIM index and primary conventional markets and macroeconomic risk indicators.

To investigate risk transmission and the time-varying equi correlations among crude oil, the conventional, sustainability, and Islamic stock indices of Dow Jones, and gold prices, Mensi et al. (2017) utilized the multivariate DECO-FIAPARCH model. The study indicated that the telecommunications, technology, financial, energy, gold, and oil sectors were net receivers of risk spillovers. Conversely, sustainability and conventional/DJIM indices were identified as net contributors of risk transmission.

Paltrinieri et al. (2019) analyzed cointegration and dynamic correlations among conventional stock indices and Islamic and socially responsible investment (SRI) stock indices. Using the DCC-GARCH model, they assessed these indices' reactions to global economic risk factors, specifically oil prices and VIX. Their findings indicated a negative relationship between the VIX and both conventional and Islamic indices, while all three types of stock indices responded positively to changes in oil prices. These results align with those of Naifar (2016), who investigated the co-movement and dependence structure among the Competitive Industrial Performance Index (CIP), Credit Default Swap (CDS), crude oil prices, DJIMI returns, S&P 500 returns, inflation rates, investor sentiment indicators, slopes of the yield curves, and VIX, employing a quantile regression approach. The study revealed that DJIM index returns and the VIX index exhibited an asymmetric correlation, with dependence intensifying during bullish and diminishing during bearish markets.

Kumar & Sahu (2017) examined the relationship among the exchange rate, Indian Islamic stock returns, inflation rate, interest rate, and money supply. They conducted Johansen's co-integration and Vector Error Correction Model (VECM), and the study findings revealed a relationship between the macroeconomic indicators and the Indian Islamic Market Index in the long run. Habib & Islam (2017) obtained similar results by employing Ordinary Least Squares (OLS) regression to analyze the relationship between Indian Islamic market returns and various macroeconomic variables, including exchange rates, inflation, industrial production, money supply, and interest rates. The study revealed that exchange and interest rates significantly affected the Indian Islamic stock market. Also, Adnan (2023) examined the impact of foreign and domestic factors on the long-term net asset value (NAV) of Indonesian Islamic mutual funds for the long and short term. Using the

Error Correction Model (ECM) approach, the study found that, in the long term, gold prices negatively affected Islamic mutual funds, while oil prices had no significant impact. Conversely, in the short term, oil prices exerted a negative effect on Islamic mutual funds, whereas gold prices did not show a significant influence.

Raza et al. (2019) examined the hedging validity of stock market portfolios consisting of conventional and Islamic stock indices. The main alternatives considered for hedging include the VIX, gold price, crude oil price, and bond indexes. The study employed multivariate GARCH models, namely DCC, aDCC, corrected DCC (cDCC), and GO-GARCH models. The results indicated that the VIX hedging effectiveness was the highest one. All alternative assets were found to effectively hedge Islamic stock portfolios compared to their conventional stock indexes.

Haddad et al. (2020) examined the transmission mechanisms of financial shocks across seven Islamic stock markets alongside global risk factors such as the VIX, oil prices, the US equity market-related uncertainty index, and the US 10-year Treasury bond yield, employing Diebold & Yılmaz (2012). Their analysis revealed that the seven DJIM stock indices displayed only a weak correlation with the fluctuations of these global risk factors.

During the COVID-19 pandemic, Yarovaya et al. (2021) studied the impact of Bitcoin, economic policy uncertainty (EPU), gold price, oil price, and VIX indices on the conventional and Islamic stock market returns. Utilizing the VARMA-BEKK-AGARCH methodology, their analysis, covering the period from April 11, 2019, to May 4, 2020, revealed that oil price and gold price indices were significant predictors of spillovers between conventional and Islamic markets. In contrast, Bitcoin did not represent a crucial role in these relationships during the studied timeframe.

Hamma et al. (2021) employed multivariate GARCH models, namely DCC-GARCH, aDCC, and FDCC models, to investigate six different asset classes' hedging effectiveness for conventional and Islamic stock market portfolios. The CDS Europe index (CDSEU), crude oil prices, Dow Jones Commodity Index (DJCOM), EURO STOXX 50 Volatility Index (VISTOXX), gold prices, and VIX were alternative assets in the study. Their findings revealed that hedge ratios differed based on portfolio composition, the inclusion of hedging assets, and the chosen model. VISTOXX was identified as the most effective asset for hedging both conventional and Islamic stock portfolios. Additionally, the DCC-GARCH analysis frequently provides greater hedging effectiveness than other models.

Sheikh et al. (2023) investigated the effect of some economic risk indicators on the returns of conventional and Shariah indices in the US, Europe, and Asia. The risk factors included gold prices, gold-VIX, oil prices, oil-VIX, and VIX. Employing OLS and quantile regression techniques, they found that prior to the COVID-19 pandemic, GVZ, OVX, and VIX indices affected the returns of all indices. Additionally, they observed that all

variables, except the spot price of oil, exerted a greater impact during bear phases, according to quantile regression findings. Moreover, volatility indices had a heightened impact on index return volatility during COVID-19. These conclusions are supported by the BEKK-GARCH model findings, which indicate that volatility transcends all markets and emanates from commodities such as gold, oil, gold-VIX, and VIX.

Mezghani et al. (2024) analyzed the dynamic interconnections and hedging opportunities between Bitcoin, WTI crude oil, gold, wheat, and palladium, alongside Islamic stock markets in Russia, Ukraine, and the US, utilizing DCC-GARCH and spillover connectedness models. The analysis revealed that connectivity contributed to 35.81% of the return spillover across commodities and financial assets, with the remaining 64.19% originating from individual shocks. Bitcoin emerged as a potential safe haven against losses in Islamic stock markets.

Hachicha et al. (2024) analyzed the most favorable hedging ratios over time for the Dow Jones conventional and Islamic emerging stock market indices, using hedges with gold, oil, VSTOXX, and sectoral CDS indices from four emerging markets—namely raw materials, industry, healthcare, and telecommunications. They identified the most effective hedging instruments by employing DCC, aDCC, and GO-GARCH models alongside a hedging effectiveness criterion. Their research indicates that CDS indices are the most superior hedging instruments for Islamic and conventional portfolios and demonstrate the best hedging effectiveness. Conversely, the VSTOXX and oil proved less effective than the four CDS indices for hedging the examined conventional and Islamic stocks. The study also found that gold exhibited negative hedging effectiveness, suggesting that using gold to hedge these portfolios may actually increase risk.

In general, these studies show that the increase in global risk and uncertainty is reflected in both conventional and Islamic stock markets and that there is a stronger link between these stock markets, especially during crisis periods. These results indicate the importance of investigating the relationship between the Turkish Islamic stock market and macro-economic risk factors for both investors and financial decision makers. As mentioned above, limited research has examined the effect of global macroeconomic factors on the Turkish Islamic stock market. Sakarya et al. (2018) investigated the causality and cointegration relationship between gold ounce prices, Brent oil prices, and the Türkiye Participation-30 Index from January 2011 to June 2018 using the Fourier SHIN Cointegration Test. The analysis revealed no cointegration relationship between the Participation-30 Index and the commodity markets. Consequently, investors who include gold or oil alongside the Participation-30 Index can diversify their portfolios and minimize risk.

Lin & Su (2020) conducted an analysis of the relationship between the Islamic stock market and OVX using a quantile-on-quantile approach across

four countries, including Türkiye. Their findings indicated that OVX variations asymmetrically affected the Turkish participation index.

Erdoğan et al. (2020) analyzed volatility transmission between foreign exchange and Islamic markets in Türkiye, Malaysia, and India. They employed the causality-in-variance test. The results indicated no volatility transmission from India and Malaysia's Islamic stock markets to foreign exchange markets. Conversely, there was a significant volatility spillover from the Turkish Islamic stock market to the foreign exchange market.

Kevser & Doğan (2020) also analyzed the relationship between Türkiye Participation-30 Index and the DJIM, gold, and crude oil markets using causality tests from January 2011 to August 2019. Their analysis found no causality between the Participation-30 Index and the commodity markets.

Aziz et al. (2020) examined the volatility transmission from global economic policy uncertainty, industrial production, consumer price index, and exchange rate to Islamic stock market returns in Indonesia, Malaysia, and Türkiye. Using the EGARCH model, their results indicated that fluctuations in these macroeconomic factors did not affect the volatility of Islamic stock index returns in Türkiye and Indonesia over the period from December 2010 to September 2019.

In his study, Emeç (2021) investigated the correlation between the Turkish participation index, the amount of funds collected by participation Turk banks, and the price of gold. The study utilizes the Fourier co-integration test and generalized analysis of variance. The results indicate that the amount of funds collected by the participation banks and the gold price affect the participation index in the long term.

Employing the quantile regression approach, Essayem et al. (2022) examine the impact of local macroeconomic indicators—namely, inflation rate, sovereign credit risk, and the term structure slope—as well as global risk factors—namely, the OVX, VIX, EPU, and MSCI World Index—on the participation index in the Turkish stock market from 2011 to 2021. The results suggest that both the VIX and OVX affect the participation index. Specifically, the impact of the VIX on the participation index is stronger during market downturns. In contrast, the impact of the OVX is stronger when the market is in a favorable economic condition.

Gökgöz and Kayahan (2024) used the DCC-GARCH model to investigate the dynamic relationship between the Dow Jones Islamic Markets World Index (DJIM), the Turkish Participation 30 Index, and the VIX. Their findings reveal a negative volatility transmission between the VIX, the DJIM, and the Turkish Participation 30 Index. Additionally, the study highlights that Islamic stock market indices are less integrated with the global financial system, making them a relatively lower-risk option for investors.

The literature on the relationship between macroeconomic factors and Islamic stock indices has yielded varied results. These discrepancies may arise

from data frequency, sample periods, and differences in research methods. These inconsistencies underscore the need for further investigation using more recent data and robust analytical frameworks. Accordingly, this study seeks to offer up-to-date evidence on how key macroeconomic variables interact with Islamic equity markets, thereby contributing to the growing body of research and offering valuable insights for both academics and practitioners.

2. DATA AND METHODOLOGY

The study's methodological framework discusses the dataset and the statistical methods selected for analysis while also defining the variables in detail.

2.1. Data

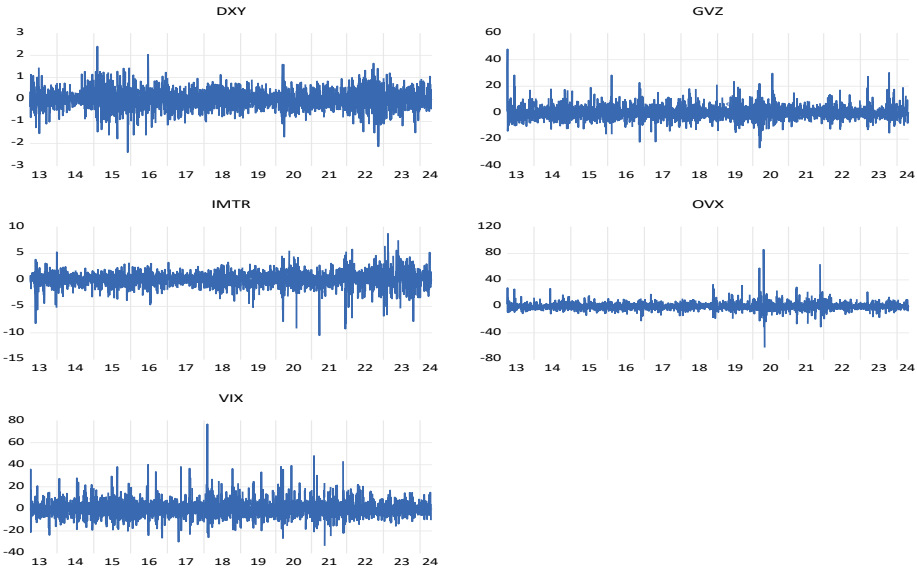
The primary objective of this study is to examine the transmission of volatility across macroeconomic risk factors in the Turkish Islamic stock market. To achieve this objective, the IMTR index, which tracks the performance of stocks adhering to Shariah investment principles in the Turkish stock market, served as a proxy for the Turkish Islamic stock market. Additionally, the DXY index was utilized as a proxy to gauge the volatility of the US dollar against a basket of global currencies. Furthermore, the CBOE GVZ index was employed to assess the short-term volatility of gold prices as perceived by the market. In contrast, the CBOE OVX index indicates uncertainty within the oil market. Moreover, the other macroeconomic factor indicator is CBOE VIX, which is a widely utilized global indicator that serves as a measure to assess the level of uncertainty in the stock market and is also used as a proxy of investors' future expectations.

This study employed daily closing prices of the DXY, GVZ, IMTR, OVX, and VIX indices from April 11, 2013, to April 25, 2024. Daily index closing prices were collected from investing.com, and the availability of relevant data determined the initial date of the dataset. During the study period, risk and volatility in financial markets increased due to many reasons, such as the Brexit Referendum, the United Kingdom’s subsequent departure from the European Union, the escalating trade disputes between China and the US, the COVID-19 pandemic, the Russia-Ukraine war, global inflationary pressures, the FED's interest rate cut policy, growing geopolitical tensions in the Middle East, and the impending US presidential election.

In financial research, the calculation of stock index returns typically utilizes logarithmic variables, as evidenced in the studies by Said and Ouerfelli (2024) and Mezghani et al. (2024). The primary rationale for adopting logarithmic variables is normalization. All variables are standardized onto a comparable metric by transforming the data logarithmically, enabling the analysis of relationships between variables despite the original price series having differing magnitudes. Accordingly, in this study, the daily closing

prices of each index were converted into daily logarithmic returns, which represent the changes in prices from one day to the next. They were subsequently standardized by multiplying by 100. Figure 1 plots the daily log returns of all stock indices.

Figure 1. Daily Returns of Series



Volatility in return series refers to variations and fluctuations in the index returns in time. Figure 1 illustrates that all return series exhibit significant volatility, with clustering observed during specific periods.

2.2. DCC-GARCH Model

In the spillover literature, different multivariate volatility models analyze conditional covariances, such as diagonal BEKK, ARMA-GARCH, and DCC-GARCH. The DCC-GARCH model is ideal for analyzing market interdependencies, as it allows for evolving relationships without assuming fixed correlations over time. One of the key applications of the DCC-GARCH method in the literature is to measure the dynamic correlation or relationship between assets within a market or between instruments across different markets. This approach enables capturing time-varying correlations and understanding how market relationships evolve over time. Furthermore, the literature suggests that DCC-derived models are often more effective than BEKK-derived models in capturing dynamic correlations (Do et al., 2019; Tsay, 2013).

The DCC-GARCH model, introduced by Engle (2002), extends Bollerslev's (1990) CCC-GARCH model by allowing for time-varying correlations between market instruments. The critical difference between the

DCC-GARCH model and the CCC-ARCH model is that it is designed with the dynamic interaction of variables (Engle 2002). One of the key advantages of the DCC-GARCH model is its ability to estimate the correlation coefficients of the standardized residuals from the GARCH model, thereby directly accounting for the changing variance over time (Chiang et al., 2007). This allows for a more accurate and dynamic assessment of the evolving relationships between financial assets. The DCC-GARCH model calculates time-varying volatility, allowing a continuous graph of the correlation to be observed (Cho and Parhizgari, 2009). After reviewing these analyzing methods and considering their explanatory power, we chose the DCC-GARCH model introduced by Engle (2002). To the best of the author's awareness, the DCC-GARCH model has not been applied for this purpose in the Turkish Islamic market literature.

The dynamic conditional correlation method calculates the current correlation between financial assets as a function of past realizations of volatility between assets. Since we calculate the correlation between the variables of interest at a specific date, the correlations are time-dependent. The DCC-GARCH model is conducted in a two-step process. First, the GARCH parameters from the GARCH (1,1) model are calculated. The conditional correlations between the series are determined in the second step (Engle, 2002).

The DCC-GARCH model estimates dynamic conditional correlation multivariate generalized autoregressive conditional variance (GARCH) parameters. Engle's (2002) DCC-GARCH model effectively models multivariate and high-dimensional data sets (Caporin & McAleer, 2013). The conditional variances in the model are obtained from the univariate GARCH model.

The following equation is used for modeling a conditional correlation matrix (R_t):

$$R_t = a + b_1 P_{t-1} + \varepsilon_{it} = h_{it\frac{1}{2}} v_t \quad (1)$$

a: Constant

b_1: Lagged return coefficient

ε_{it}: Random error term with conditional variance

h_{it} and v_{it} is the vector nxm of residuals

The correlations are estimated using equation (2), in the second step of the DCC-GARCH model:

$$H_t = D_t R_t D_t \quad (2)$$

H_t in Equation (2) represents an n×n conditional covariance matrix. While R_t is a conditional correlation matrix, D_t is a diagonal matrix with time-varying standard deviations.

Explicit formulation of the H_t matrix:

$$H_t = \begin{pmatrix} h_{s,t}^2 & h_{sb,t} \\ h_{sb,t} & h_{b,t}^2 \end{pmatrix} = \begin{pmatrix} h_{s,t} & 0 \\ 0 & h_{b,t} \end{pmatrix} \begin{pmatrix} 1 & \rho_t \\ \rho_t & 1 \end{pmatrix} \begin{pmatrix} h_{s,t} & 0 \\ 0 & h_{b,t} \end{pmatrix} = D_t R_t D_t \quad (3)$$

The demonstration of the return series' diagonal matrix of conditional standard deviations:

$$D_t = diag\left(h_{1,t}^{\frac{1}{2}}, \dots, h_{n,t}^{\frac{1}{2}} \right) \quad (4)$$

Modeling conditional variances calculated via univariate GARCH (1,1) to generate the D_t matrix:

$$h_{i,t} = \omega_i \sum_{\rho_i}^{p_i} \alpha_{i,p} r_{i,t-p}^2 + \sum_{\rho=1}^{Q_i} \beta_{i,q} h_{i,t-q} \quad (5)$$

In Equation 5, ω_i is the constant term, i = 1, 2, ..., k and r_t is the residuals. r_t is a vector of size $kx1$ with mean zero and covariance matrix H_t. All available information at time t-1 is denoted by the notation Φ_{t-1} and $r_t \mid \Phi_{t-1} \sim N\ (0,\ H_t)$. GARCH constraints for non-negativity of variances and stationarity are that the parameters are non-negative and $\sum_{\rho_i}^{p_i} \alpha_{i,p} r_{i,t-p}^2 + \sum_{\rho=1}^{Q_i} \beta_{i,q} h_{i,t-q} < 1$. When these conditions are met, H_t will be positive definite for all values of t.

Dividing the residuals by the conditional standard deviations yields a vector of standardized residuals, $\varepsilon_t = \frac{r_t}{\sqrt{h_t}}$, $\varepsilon_t \sim N\ (0,\ R_t)$. This vector is used to generate Engle's (2002) model for calculating the dynamic correlation of residuals.

$$Q_T = (1 - \sum_{m=1}^{M} \alpha_m - \sum_{n=1}^{N} \beta_n)\bar{Q} + (\sum_{m=1}^{M} \alpha_m (\varepsilon_{t-m} \varepsilon'_{t-m}) + \sum_{n=1}^{N} \beta_n Q_{t-n} \quad (6)$$

In Equation (6), $\bar{Q}$ represents the standardized residuals' unconditional covariance matrix of the standardized residuals from the estimation of the univariate GARCH model. For α and β:

$$\alpha = \sum_{m=1}^{M} \alpha_m \ ; \beta = \sum_{n=1}^{N} \beta_n \quad (7)$$

by appointment,

$$\mathrm{Q}_t = (1 - \alpha - \beta)M + \alpha \varepsilon_{t-1} \varepsilon'_{t-1} + \beta \mathrm{Q}_{t-1} \quad (8)$$

In Equation (8), α and β are non-negative parameters. The sum of two parameters should be less than 1 and govern the dynamics of conditional quasi-correlation. α is the non-negative shock, and β is the persistence parameter.

A conditional correlation matrix will be obtained as below:

$$P_t = \left[diag(Q_t)^{-\frac{1}{2}}\right] Q_t \left[diag(Q_t)^{-\frac{1}{2}}\right] \quad (9)$$

$$P_t = Q_t^{*-1} Q_t Q_t^{*-1} \quad (10)$$

The P_t matrix consists of the variables

$$\rho_{ij,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t} q_{ıı,t}}} \quad (11)$$

Q_t^* denotes the diagonal matrix formed by the square root of the diagonal elements of Q_t. The Q_t matrix consists of the variables $q_{ij,}$, $q_{ii,t}$ and $q_{\text{jj,t}}$ and Q_t=⌊q_{ij},t_t⌋; kxk is the dynamic covariance matrix of the standardized residuals with dimensions

The explicit representation of the correlation coefficient in the bivariate case for the DCC (1,1) model is as follows:

$$\rho_{12,t} = \frac{(1-\alpha-\beta)\overline{q_{12}} + \alpha\varepsilon_{1,t-1}\varepsilon_{2,t-1} + \beta q_{12,t-1}}{\sqrt{\left((1-\alpha-\beta)\overline{q_{11}} + \alpha\varepsilon_{1,t-1}^2 + \beta q_{11,t-1}\right)\left((1-\alpha-\beta)\overline{q_{22}} + \alpha\varepsilon_{2,t-1}^2 + \beta q_{22,t-1}\right)}} \quad (12)$$

The number of parameters calculated in the correlation process does not depend on the number of series being analyzed, and it is the one notable advantage of the DCC-GARCH model (Mandacı & Kırkpınar, 2022). Though estimating large covariance matrices, this provides a significant numerical advantage (Engle, 2002).

In the context of volatility modeling, alpha quantifies the short-term effect of volatility, considering the persistence of residuals from the former period. The beta of the DCC-GARCH determines the long-term impact of a shock on the conditional correlation (Yadav et al., 2023).

3. EMPIRICAL FINDINGS

This research examines the dynamics of volatility transmission between the Turkish Islamic stock market and a set of key global macroeconomic risk indicators, namely the DXY, the GVZ, the OVX, and VIX. Employing the DCC-GARCH model, the study explores the time-varying interdependencies and the extent of volatility spillovers among these markets, offering more profound insights into their interconnected behavior over time.

3.1 Preliminary Analysis

Table 1 presents the descriptive statistics of DXY, GVZ, OVX, IMTR, and VIX return series utilized in this study. It is observed that all data series exhibit positive mean returns. However, the data series deviate from a normal distribution according to the Kurtosis and Skewness coefficients and the results of the Jarque-Bera test statistics.

Table 1. Descriptive Statistics*

	DXY	GVZ	IMTR	OVZ	VIX
Mean	0.0091	0.0040	0.0828	0.0110	0.0071
Median	0.0000	-0.4334	0.0712	-0.3711	-0.6601
Maximum	2.4075	48.0734	8.7046	85.7700	76.8245
Minimum	-2.3988	-26.5662	-10.5114	-62.2251	-33.5820
Std. Dev.	0.4369	5.2358	1.4466	6.0104	7.7996
Skewness	-0.0583	1.0681	-0.6276	1.7541	1.1887
Kurtosis	4.9920	9.2163	8.7163	32.6154	9.9961
Jarque-Bera	456.5485	101982.4	3927.484	4954.17	6260.528
Probability	0.0000	0.0000	0.0000	0.0000	0.0000
Sum	25.11291	30.25368	227.8777	11.04971	19.55812
Sum Sq. Dev.	525.0215	99380.89	5757.145	75414.16	167354.2
Observations	2,752	2,752	2,752	2,752	2,752

*The return series for the DXY, GVZ, IMTR, OVX, and VIX indices were calculated using the logarithmic return formula: $\ln(P_t/P_{t-1})*100$, where P_t denotes the closing price on day t.

To assess the presence of unit roots and the order of integration among the variables, two tests were utilized: The Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. The outcomes of the ADF, PP, and ARCH-LM tests are presented in Table 2. The ADF test rejected the 1% significance level null hypothesis, suggesting that the series was stationary. To ensure the robustness of our findings, the Phillips-Perron test was used and confirmed the stationarity of the data. Additionally, we conducted the ARCH-LM test to identify autoregressive conditional heteroskedasticity (ARCH) effects and to determine potential issues of heteroskedasticity and autocorrelation within variables. The results indicate the presence of the ARCH effect. Consequently, we employed DCC-GARCH models to analyse the relationship between the macroeconomic risk factor indicators and Turkish Islamic market returns.

Table 2. ADF, PP and ARCH LM Tests

	DXY	GVZ	OVZ	VIX	IMTR
Augmented Dickey-Fuller Test Statistics (ADF)					
At level					
With constant					
t-statistics	-52.5242	-35.7438	-40.2708	-56.7763	-51.613
Prob	0.0001***	0.0001***	0.0000***	0.0000***	0.0001***
With constant and trend					
t-statistics	-52.5158	-35.7414	-40.2669	-56.7667	-51.745
Prob	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Without constant and trend					
t-statistics	-52.5102	-35.7499	-40.2781	-56.7866	-51.458
Prob	0.0001***	0.0001***	0.0000***	0.0000***	0.0001***
Philips-Perron Test Statistics (PP)					
At level					
	-52.5958	-59.5879	-55.2159	-63.8465	-51.6187
	0.0001***	0.0001***	0.0000***	0.0001***	0.0001***
ARCH-LM Statistics					
	3.510914	16.46502	12.25727	8.724571	12.83749
	0.0611*	0.0001***	0.0005***	0.0032***	0.0003***

(*) Significant at the 10%; (**) significant at the 5%; (***) significant at the 1% and (no) not significant

The covariance and correlation among the selected variables are displayed in Table 3. Data analysis showed an evident negative correlation between IMTR and the macroeconomic risk indicators, indicating that the price fluctuations of IMTR were inconsistent with those observed in the macroeconomic risk indicators. The results reveal that the shocks to IMTR do not directly impact the macroeconomic risk indicators. Additionally, there is a positive but moderate correlation among the macroeconomic risk indicators themselves, indicating that their price movements tend to align within the markets.

Table 3. Covariance and Correlation Matrix

	DXY	GVZ	IMTR	OVX	VIX
DXY					
Covariance	0.190778				
Correlation	1				
GVZ					
Covariance	0.02644	27.4034			
Correlation	0.011564	1			
IMTR					
Covariance	-0.02143	-0.79099	2.091986		
Correlation	-0.03392	-0.10447	1		
OVX					
Covariance	0.160911	9.023532	-0.56554	36.11224	
Correlation	0.061305	0.286845	-0.06507	1	
VIX					
Covariance	0.094296	16.81902	-1.6601	17.44993	60.81185
Correlation	0.027684	0.412007	-0.14718	0.372368	1

3.2 DCC-GARCH Results

In order to examine the volatility connections between macroeconomic risk factors and the Turkish Islamic Stock Market, four pairs were analyzed utilizing a DCC-GARCH model. Among various multivariate GARCH models, including the asymmetric DCC (aDCC), constant DCC (cDCC), and combined asymmetric constant DCC (cADCC), the DCC-GARCH model was selected for this study. The selection was based on its superior performance metrics, specifically lower Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values, alongside higher log-likelihood values. These indicators demonstrate that the DCC-GARCH model achieves an optimal balance between model fit and complexity, thereby providing a more accurate representation of the underlying data dynamics. The chosen model is particularly suitable for detecting spillover effects and volatility transfers between the assets, which is crucial for contagion analyses. The DCC-GARCH model is especially advantageous because it provides immediate insights into covariance and variance. Additionally, its flexibility allows for the variation of conditional correlations over time, unlike other more restrictive models.

The outcomes of this analysis are presented in Table 4, which is divided into distinct panels. Panel (A) illustrates the transmission effects from the Dollar Index to the Turkish Islamic Stock Market, while panel (B) depicts the transmission effect from the Gold Index to the Turkish Islamic Stock Market.

Similarly, panel (C) showcases the transmission effect from the Crude Oil Index to the Turkish Islamic Stock Market, and panel (D) elucidates the transmission effect from the Volatility Index to the Turkish Islamic Stock Market.

In Table 4, the symbol 'mu' represents the overall mean, while 'omega' denotes the intercept term. Furthermore, alpha l shows the ARCH effect. The ARCH effect is the effect of past disturbances or error terms obtained through mean conditioning. Beta I shows the GARCH effect. The ARCH effect estimates the short-term volatility spillover involving the identification of residuals from previous periods, while the GARCH effect estimates the long-term volatility impact of conditional correlations or shocks. Rho represents the dynamic conditional correlation between two variables. Finally, DCC-alpha (dcca1) represents the short-term spillover effect, while DCC-beta (dccb1) represents the long-term spillover effect.

Table 4. Dynamic Conditional Correlation GARCH

Panel A: DCC from DXY to IMTR				
	Estimate	Std. Error	t-value	Pr(>ItI)
[DXY].mu	0.0090	0.0071	1.2800	0.2010
[DXY].omega	0.0014	0.0006	2.4200	0.0150
[DXY].alpha I	0.0420	0.0070	6.0200	0.0000
[DXY].beta I	0.9527	0.0077	123.7400	0.0000
[IMTR].mu	0.0945	0.0215	4.3900	0.0000
[IMTR].omega	0.0580	0.0181	3.2100	0.0010
[IMTR].alpha I	0.0882	0.0169	5.2200	0.0000
[IMTR].beta I	0.8812	0.0233	37.8500	0.0000
[joint]rho	-0.0521	0.0254	-2.0500	0.0400
[joint]dcca1	0.0407	0.0147	2.7600	0.0060
[joint]dccb1	0.7882	0.0611	12.9000	0.0000
Panel B: DCC from GVZ to IMTR				
	Estimate	Std. Error	t-value	Pr(>ItI)
[GVZ].mu	-0.2710	0.0776	-3.49	0.0000
[GVZ].omega	1.6497	0.3991	4.1300	0.0000
[GVZ].alpha I	0.1133	0.0182	6.2300	0.0000
[GVZ].beta I	0.8258	0.0276	29.8900	0.0000
[IMTR].mu	0.1038	0.0215	4.8300	0.0000
[IMTR].omega	0.0648	0.0218	2.9700	0.0030
[IMTR].alpha I	0.0922	0.0191	4.8200	0.0000
[IMTR].beta I	0.8799	0.0260	33.8300	0.0000

[joint]rho	-0.0608	0.0225	-2.7100	0.0020
[joint]dcca1	0.0267	0.0195	1.3700	0.1700
[joint]dccb1	0.6440	0.2128	3.0300	0.0020

Panel C: DCC from OVZ to IMTR

	Estimate	Std. Error	t-value	Pr(>ItI)
[OVZ].mu	-0.2607	0.0779	-3.3500	0.0010
[OVZ].omega	1.9588	0.4622	4.2400	0.0000
[OVZ].alpha I	0.1108	0.0199	5.5600	0.0000
[OVZ].beta I	0.8189	0.0302	27.1000	0.0000
[IMTR].mu	0.1075	0.0212	5.0700	0.0000
[IMTR].omega	0.0851	0.0260	3.2800	0.0010
[IMTR].alpha I	0.1074	0.0214	5.0300	0.0000
[IMTR].beta I	0.8596	0.0283	30.3400	0.0000
[joint]rho	-0.0908	0.0247	-3.6700	0.0000
[joint]dcca1	0.0150	0.0111	1.3600	0.1740
[joint]dccb1	0.8926	0.0627	14.2500	0.0000

Panel D: DCC from VIX to IMTR

	Estimate	Std. Error	t-value	Pr(>ItI)
[VIZ].mu	-0.3390	0.1138	-2.9800	0.0030
[VIZ].omega	8.7854	1.6272	5.4000	0.0000
[VIZ].alpha I	0.1877	0.0291	6.4600	0.0000
[VIZ].beta I	0.6683	0.0447	14.9300	0.0000
[IMTR].mu	0.1062	0.0214	4.9700	0.0000
[IMTR].omega	0.0563	0.0209	2.6900	0.0070
[IMTR].alpha I	0.0877	0.0198	4.4200	0.0000
[IMTR].beta I	0.8905	0.0260	34.1900	0.0000
[joint]rho	-0.0947	0.0263	-3.6000	0.0000
[joint]dcca1	0.0066	0.0059	1.1100	0.2680
[joint]dccb1	0.9639	0.0252	38.2800	0.0000

The coefficient for the alpha term is significant for all index series but not high. It turns out that their own lagged squared residuals have a significant effect on the current volatility of their own for all index series. The coefficient for the beta term is significant and high for all index series. It can be seen that own past volatility has a very strong influence on own current volatility for IMTR, DXY, GVZ, OVX and VIX.

The rho coefficient is also statistically significant at the 5% level for all index series. The rho coefficient indicates a weak negative correlation

between the volatilities of DXY, GVZ, OVZ, VIX, and IMTR over time, suggesting minimal interaction. The negative sign indicates a weak negative correlation between the volatilities of the two series over time. In other words, when the volatility of DXY, GVZ, OVZ, and VIX increases, the volatility of IMTR tends to decrease slightly.

The coefficient dcca1 does not appear to be statistically significant for gold, crude oil, and volatility indices, suggesting that the short-term effects of changes in the conditional correlations between macroeconomic variables and IMTRs are not strong. This means there is no volatility transmission from these macroeconomic risk factors to IMTR in the short run. Conversely, the dcca1 value for the dollar index is statistically significant, indicating a short-term volatility transmission from the dollar index to the IMTR. There are many studies in the literature showing that there is volatility transmission between the DXY index and the Borsa Istanbul indices (Akçalı et al., 2019; Erdoğan et al., 2020). In addition, the results obtained in the short term mean that IMTR can be a safe haven for investors during a market downturn or recession.

However, the parameter dccb1 is statistically significant in all panels, indicating a long-term transmission of volatility from macroeconomic risk factors to IMTRs, including the dollar, gold, crude oil, and volatility indices. In other words, the correlation between macroeconomic variables and the Turkish Islamic stock market is very consistent over time. That is to say, investors need to exercise caution both in the short term, as the transmission of volatility from the US dollar index to the IMTR has been confirmed, and in the long term, as the transmission of volatility from the dollar, gold, crude oil, and volatility indices to the Turkish Islamic stock market has been confirmed. Similar results can be found in the literature (Aziz et al., 2020; Emeç, 2021; Essayem et al., 2022; Lin & Su, 2020). The results clearly suggest that investors may consider short-term investments in the IMTR, as there is no observed volatility transmission from macroeconomic risk factors, except for the volatility of the US dollar index. On the other hand, when considering long-term outcomes, investment in the IMTR may pose risks because of macroeconomic indicators' volatility transmission.

Additionally, Figure 2 provides graphical representations of the conditional correlations between the IMTR and global macroeconomic risk factors.

Figure 2. Conditional Correlations

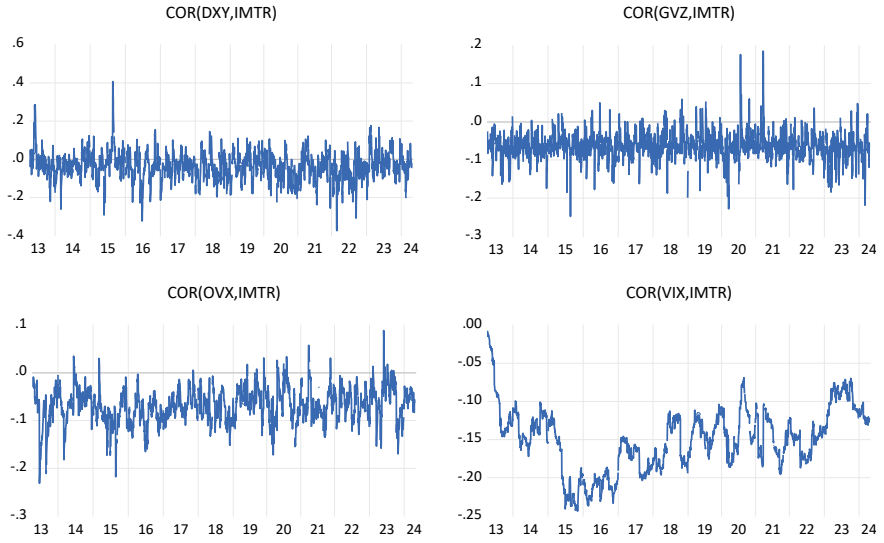


Figure 2 illustrates that the correlation coefficient of return series remains mostly negative throughout the study period and series varies over time. The correlation coefficient of GVZ, OVX and VIX with IMTR is lower than the correlation coefficient of DXY with IMTR. The interconnections between the IMTR index and GVZ, OVX, and VIX exhibit a more pronounced structure than the DXY index regarding portfolio diversification. The correlation coefficient of DXY with IMTR is higher than the correlation coefficients of GVZ, OVX, and VIX with IMTR. Regarding portfolio diversification, the relationship between the IMTR index and GVZ, OVX, and VIX exhibits a more pronounced structure than the DXY index. Furthermore, it is shown that the relationship between IMTR and DXY, GVZ, OVX, and VIX experiences significant fluctuations.

4. DISCUSSION

The main idea behind the present study was to examine the dynamics of volatility transmission between the IMTR and a set of global macroeconomic risk factors, namely DXY, GVZ, OVX, and VIX. Study findings reveal that, in the short term, volatility transmission occurs solely between the DXY and IMTR. However, in the long term, it extends to all four macroeconomic risk factors. Moreover, the findings indicate that the correlation coefficient between all macroeconomic risk factors and the Turkish Islamic stock index fluctuated during the study period but is predominantly negative. This suggests a negative interaction between all the macroeconomic risk factors and the Turkish Islamic stock market. Similar findings are supported in the literature regarding the US dollar (Dewanti et al.,

2022; Hatipoğlu & Sekmen, 2018), oil (Chang et al., 2020; Maghyereh & Awartani, 2016; Widad & Hadjer, 2018), gold (Bouri et al., 2021; Chkili, 2022; Putra & Darmansyah, 2015), and the VIX (Arfaoui & Raggad, 2021; Gökgöz & Bahadır, 2024; Naifar, 2016; Sial et al., 2022). These consistent patterns across various studies underline the significant and often negative relationship between global risk factors and the Turkish Islamic stock market. When the dollar exchange rate rises, global investors exit emerging economies' stock markets and move to markets and market instruments they perceive as safer. Since Türkiye is an emerging economy, it is directly affected by this movement. In particular, upward fluctuations in the exchange rate increase production costs and inflationary pressure in Türkiye. This may cause downward movements in the Turkish stock market in the short and long term.

The literature contains studies with similar and contrasting results regarding the transmission between international risk indicators and Islamic stock markets. Naifar (2016) analyzed the impact of global risk factors such as the VIX Index, oil prices, and interest rates on Islamic stock markets, finding a positive correlation between crude oil prices and Islamic stocks but a negative correlation with the VIX. In this study, crude oil prices and VIX negatively correlate with IMTR. This may be due to Türkiye's dependence on energy imports. Uncertainty and high volatility in oil prices may cause adverse movements in firms' balance sheets in the IMTR index and in the index. Moreover, Maghyereh & Awartani (2016) explored the effect of oil price uncertainty on stock returns for oil-importing and exporting countries, including Türkiye, concluding that Islamic stocks in oil-exporting countries are negatively correlated with declines in oil prices, leading to increased volatility.

Hatipoğlu & Sekmen (2018) examined the effects of the USD exchange rate, Economic Policy Uncertainty Index, and VIX on the World Islamic Stock Index, concluding that the USD exchange rate significantly and negatively affected the risk level of the index. The results of this study are also in line with our study. The World Islamic Stock Index includes mostly stocks from emerging markets such as Türkiye, Malaysia, Indonesia, Saudi Arabia and the Gulf countries. A rising USD may increase exchange rate pressure in these countries and cause investors to flee risky assets.

Similarly, Arfaoui & Raggad (2021) and Sial et al. (2022) found a negative relationship between the Islamic stock indices they examined and the VIX. Gökgöz and Bahahır (2024) also identified a negative relationship between the Participation 30 Index, representing the Turkish Islamic stock market, and the VIX. Investors generally perceive a rise in the VIX as increased market volatility and risk. When the VIX rises, investors may turn to safer instruments such as government bonds and gold and may exit emerging markets. This may put downward pressure on Islamic stock indices.

Putra & Darmansyah (2015) investigated the relationship between the Indonesian Islamic market and macroeconomic factors, finding a negative

relationship with gold prices. In a similar vein, Bouri et al. (2021) examined the relationship between Islamic equity markets and commodity markets (e.g., gold, oil) during the COVID-19 pandemic, finding a negative volatility relationship between gold and Islamic stock markets. Additionally, Emeç (2021) discovered that gold prices influenced the Turkish Participation Index in the long run. In this study, both a negative and a long-run relationship between gold and IMTR were found. As mentioned above, investors are expected to turn to gold as a safe haven if there is an increase in uncertainty and risk in the markets. This situation has a negative impact on the Islamic stock market indices. Moreover, Islamic stock markets worldwide react faster to gold volatility and global risk perception, mainly since they include oil-producing companies in the Gulf countries. Therefore, short-term changes in the GVZ can quickly affect the World Islamic Stock Indices. IMTR is a representative index for Turkish markets and has lower trading volumes. IMTR tends to be affected in the long run rather than reacting immediately to global fluctuations.

Conclusion

Islamic finance has offered an alternative model of financial intermediation and has become a crucial component of the financial system with its impressive financial performance over the last decade. Shariah-compliant stock market indices contribute to the financial sector by providing religiously conscious investors with an alternative investment path compatible with Shariah principles and offering traditional investors opportunities for hedging and portfolio diversification (Danila et al., 2021).

The Islamic stock market index is crucial for Islamic stock market investments and functions as a significant proxy for tracking the progress of Islamic finance. Therefore, understanding whether changes in macroeconomic risk indicators impact the Islamic stock market index is a key consideration for investors when diversifying their portfolios. Moreover, comprehending the connection between macroeconomic risk factors and the index, identifying sources of economic instability, and formulating consistent policy implementations are important for investors and policymakers.

This paper analysed the contagion impacts of four macroeconomic risk factors on the Turkish Islamic Stock Market. Our study validated that the DCC-GARCH model is an appropriate tool for analyzing spillovers between markets. The findings reveal that, in the short run, only the US Dollar Index influences the Turkish Islamic Stock Market. However, in the long run, all macroeconomic factors contribute to spillover effects.

In the short term, the Turkish Islamic Stock Market acts as a safe haven, but long-term volatility spillovers increase investment risks. Investors should focus on the volatility of the US Dollar Index when developing entry and exit strategies in the short term. Over the long term, economic instability and inconsistencies lead to rapid changes in macroeconomic risk indicators,

affecting the Islamic stock market as well. Hence, this study provides valuable insight for investors seeking sound short-term or long-term investments. It identifies entry and exit strategy points based on prevailing macroeconomic risk factors.

The study findings provide valuable information for investors looking for a risk management or portfolio investment strategy and hedging and diversification alternatives. Shares in Islamic equity markets generally act as portfolio diversifiers. Given the weak correlations and long-term spillover effect between macroeconomic risk factors and the Islamic stock market in Türkiye, the Turkish Islamic stock market serves as an important diversifier for global assets.

This study consternates on the volatility transmission between the Turkish Islamic Stock Index and selected global macroeconomic risk factors, addressing the scarcity of research on the Turkish stock market. The DCC-GARCH model was employed due to its empirical advantages in capturing dynamic correlations and volatility spillovers. Future studies could examine additional macroeconomic indicators, such as inflation and interest rates, using models like BEKK-GARCH or Markov-switching approaches to refine volatility transmission analysis. Additionally, different Islamic stock indices could be considered to compare the Turkish Islamic stock market's response to changes in economic indicators from other Islamic markets. Lastly, future research could explore alternative models derived from the DCC-GARCH framework and compare the outcomes to enrich the analysis.

Peer Review: Independent double-blind

Author Contributions: Nehir Balcı: 100%

Funding and Acknowledgement: No support was received for the study.

Ethics Approval: This study does not contain any human or animal research that requires ethical approval.

Conflict of Interest: There is no conflict of interest with any institution or person related to the study.

Hakem Değerlendirmesi: Dış Bağımsız

Yazar Katkısı: Nehir Balcı: %100

Destek ve Teşekkür Beyanı: Çalışma için destek alınmamıştır.

Etik Onay: Bu çalışma etik onay gerektiren herhangi bir insan veya hayvan araştırması içermemektedir.

Çıkar Çatışması Beyanı: Çalışma ile ilgili herhangi bir kurum veya kişi ile çıkar çatışması bulunmamaktadır.

Önerilen Atıf: Balcı, N. (2025). Dynamic linkages between Turkish Islamic stock market and global macroeconomic risk factors: Evidence from DCC-GARCH Model. *Akademik Hassasiyetler, 12*(27), 399-428. https://doi.org/10.58884/akademik-hassasiyetler.1590078

References

Adnan, M. (2023). Exploring the role of domestic and foreign factors in Indonesian Islamic mutual funds. *Journal of Enterprise and Development (JED)*, *5*(3), 414-430.

Akçalı Y., B., Mollaahmetoğlu, E., & Altay, E. (2020). Borsa İstanbul ve küresel piyasa göstergeleri arasındaki volatilite etkileşiminin DCC-GARCH yöntemi ile analizi. *Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Dergisi*, *14*(3), 597-614.

Al-Khazali, O., Lean, H. H., & Samet, A. (2014). Do Islamic stock indexes outperform conventional stock indexes? A stochastic dominance approach. *Pacific-Basin Finance Journal*, *28*, 29-46. http://dx.doi.org/10.1016/j.pacfin.2013.09.003

Arfaoui, M., & Raggad, B. (2021). Do Dow Jones Islamic equity indices undergo speculative pressure? New insights from a nonlinear and asymmetric analysis. *International Journal of Finance & Economics*.

Aziz, T., Marwat, J., Mustafa, S., & Kumar, V. (2020). Impact of economic policy uncertainty and macroeconomic factors on stock market volatility: Evidence from Islamic indices. *The Journal of Asian Finance, Economics and Business*, *7*(12), 683-692

Bayram, K., & Othman, A. H. A. (2019). Islamic versus conventional stock market indicates performance: Empirical evidence from Turkey. *Iqtishadia: Jurnal Kajian Ekonomi dan Bisnis Islam*, *12*(1), 74-86. http://dx.doi.org/10.21043/iqtishadia.v12i1.4631

Bahloul, S., Mroua, M., & Naifar, N. (2017). The impact of macroeconomic and conventional stock market variables on Islamic index returns under regime switching. *Borsa Istanbul Review*, *17*(1), 62-74. http://dx.doi.org/10.1016/j.bir.2016.09.003

Belanes, A., Saâdaoui, F., & Abedin, M. Z. (2024). Potential diversification benefits: A comparative study of Islamic and conventional stock market indexes. *Research in International Business and Finance*, 67. https://doi.org/10.1016/j.ribaf.2023.102098

Bollerslev, T. (1990). Modelling the coherence in short-run nominal exchange rates: a multivariate generalized arch model. *Rev Econ Stat 72*(3), 498

Bouri, E., Cepni, O., Gabauer, D., & Gupta, R. (2021). Return connectedness across asset classes around the COVID-19 outbreak. *International review of financial analysis*, 73, 101646.

Caporin, M., & McAleer, M. (2013). Ten things you should know about the dynamic conditional correlation representation. *Econometrics*, *1*(1), 115-126.

Chang, B. H., Sharif, A., Aman, A., Suki, N. M., Salman, A., & Khan, S. A. R. (2020). The asymmetric effects of oil price on sectoral Islamic

stocks: new evidence from quantile-on-quantile regression approach. *Resources Policy*, 65, 101571.

Charfeddine, L., & Al Refai, H. (2019). Political tensions, stock market dependence and volatility spillover: Evidence from the recent intra-GCC crises. The North American Journal of Economics and Finance, 50,

Chiang, T. C., Jeon, B. N., & Li, H. (2007). Dynamic correlation analysis of financial contagion: Evidence from Asian markets. *Journal of International Money and Finance*, *26*(7), 1206-1228.v https://doi.org/10.1016/j.najef.2019.101032

Chkili, W. (2022). The links between gold, oil prices and Islamic stock markets in a regime switching environment. *Eurasian Economic Review*, *12*(1), 169-186.

Cho, J. H., & Parhizgari, A. M. (2009). East Asian financial contagion under DCC-GARCH. *International Journal of Banking and Finance*, 6(1), 17-30.

Dania, A., & Malhotra, D. K. (2013). An empirical examination of the dynamic linkages of faith-based socially responsible investing. *The Journal of Wealth Management*, *16*(1), 65.

Danila, N., Azizan, N. A., Suprihadi, E., & Bunyamin, B. (2021). Dynamic co-movement and volatility spillover effect between Sukuk and conventional bonds: A comparison study between ASEAN and GCC. *Global Business Review*. https://doi.org 10.1177/09721509211026203

Dewanti, L. A., Rusmita, S. A., & Abd Samad, K. (2022). Sensitivity Islamic stock return in Asia: The effect of exchange rate volatility. *Jurnal Ekonomi & Bisnis Islam*, 8(2).

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, *74*(366a), 427–431.

Diebold, F. X., & Yilmaz, K. (2009). Measuring financial asset return and volatility spillovers, with application to global equity markets. *The Economic Journal*, *119*(534), 158-171.

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. https://doi.org/10.1016/j.ijforecast.2011.02.006

Do, A. Powell, R., Yong, J. & Singh, A. (2019). Time-Varying Asymmetric Volatility Spillover between Global Markets and China's A, B and H-Shares Using EGARCH and DCC-EGARCH models. *The North American Journal of Economics and Finance*, 54, 10196.

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity

models. *Journal of Business & Economic Statistics*, 20(3), 339-350. https://doi.org/10.1198/073500102288618487

Emeç, A. S. (2021). Türkiye'de katılım endeksi, altın fiyatları ve katılım fonları arasındaki ilişki. *Journal of Pure Social Sciences*, 2(2), 63-75.

Essayem, A., Görmüş, Ş., & Güven, M. (2022). Testing the effect of local macroeconomic indicators and global risk factors on the Turkish participation stock market: Evidence from quantile regression approach. *Trends in Business and Economics*, *36*(3). https://doi.org/258-267. 0.5152/TBE.2022.1018360

Erdoğan, S., Gedikli, A., & Çevik, E. İ. (2020). Volatility spillover effects between Islamic stock markets and exchange rates: Evidence from three emerging countries. *Borsa Istanbul Review*, *20*(4), 322-333. https://doi.org/10.1016/j.bir.2020.04.003

Gamba-Santamaria, S., Gomez-Gonzalez, J. E., Hurtado-Guarin, J. L., & Melo-Velandia, L. F. (2017). Stock market volatility spillovers: Evidence for Latin America. *Finance Research Letters*, 20, 207-216. http://dx.doi.org/10.1016/j.frl.2016.10.001

Gökgöz, H., & Kayahan, C. (2023). Analysis of the interaction of Participation 30 Index with Dow Jones Islamic Markets Index and CBOE Volatility Index. *Afyon Kocatepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 25(2), 246-256.

Habib, M., & Islam, K. U. (2017). Impact of macroeconomic variables on Islamic stock market returns: Evidence from Nifty 50 Shariah Index. *Journal of Commerce and Accounting Research*, *6*(1), 37.

Hachicha, N., Ghorbel, A., Feki, M. C., Tahi, S., & Dammak, F. A. (2022). Hedging Dow Jones Islamic and conventional emerging market indices with CDS, oil, gold and the VSTOXX: A comparison between DCC, ADCC and GO-GARCH models. *Borsa Istanbul Review*, *22*(2), 209-225. https://doi.org/10.1016/j.bir.2021.04.002

Haddad, H. B., Mezghani, I., & Al Dohaiman, M. (2020). Common shocks, common transmission mechanisms and time-varying connectedness among Dow Jones Islamic stock market indices and global risk factors. *Economic Systems*, *44*(2). https://doi.org/10.1016/j.ecosys.2020.100760

Hamma, W., Ghorbel, A., & Jarboui, A. (2021). Hedging Islamic and conventional stock markets with other financial assets: Comparison between competing DCC models on hedging effectiveness. *Journal of Asset Management*, *22*(3), 179-199.

Hammoudeh, S., Mensi, W., Reboredo, J. C., & Nguyen, D. K. (2014). Dynamic dependence of the global Islamic equity index with global conventional equity market indices and risk factors. *Pacific-Basin Finance Journal*, *30*, 189-206. http://dx.doi.org/10.1016/j.pacfin.2014.10.001

Hatipoğlu, M., & Sekmen, T. (2018). Seçilmiş bazı risk faktörlerinin islami borsalar üzerindeki etkileri. *MANAS Sosyal Araştırmalar Dergisi*, *7*(4).

Hussin, M. Y. M., Muhammad, F., Abu, M. F., & Awang, S. A. (2012). Macroeconomic variables and Malaysian Islamic stock market: a time series analysis. Journal of business studies quarterly, *3*(4), 1.

Kamışlı, S., & Esen, E. (2020). İslami hisse senedi endeksleri arasındaki oynaklik ilişki yapısı. *Journal of Management and Economics Research*, 18(1). http://dx.doi.org/10.11611/yead.607940.

Kevser, M., & Doğan, M. (2020). The analysis of relationship between participation-30 index in Turkey and commodity markets, national and international indexes. *Financial Studies, 24*(2 (88)), 38-48.

Kumar, K. K., & Sahu, B. (2017). Dynamic linkages between macroeconomic factors and Islamic stock indices in a non-Islamic country India. *The Journal of Developing Areas*, *51*(1), 193-205.

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

Lin, B., Wesseh Jr, P. K., & Appiah, M. O. (2014). Oil price fluctuation, volatility spillover and the Ghanaian equity market: Implication for portfolio management and hedging effectiveness. *Energy Economics*, *42*, 172-182. http://dx.doi.org/10.1016/j.eneco.2013.12.017

Ling, S., & McAleer, M. (2003). Asymptotic theory for a vector ARMA-GARCH model. *Econometric Theory*, 19(2), 280–310.

Majid, M. S. A., & Yusof, R. M. (2009). Long-run relationship between Islamic stock returns and macroeconomic variables: An application of the autoregressive distributed lag model. *Humanomics*, 25(2), 127-141. http://dx.doi.org/10.1108/08288660910964193

Majdoub, J., & Mansour, W. (2014). Islamic equity market integration and volatility spillover between emerging and US stock markets. *The North American Journal of Economics and Finance*, 29, 452-470. http://dx.doi.org/10.1016/j.najef.2014.06.011

Maghyereh, A., & Awartani, B. (2016). Oil price uncertainty and equity returns: Evidence from oil importing and exporting countries in the MENA region. *Journal of Financial Economic Policy*, *8*(1), 64-79.

Mandacı, P. E., & Kırkpınar, A. (2022). Oil assets and portfolio diversification: Firm-level analysis for Borsa Istanbul. *Borsa Istanbul Review*, 22(3), 571-585. https://doi.org/10.1016/j.bir.2021.07.004.

Mensi, W., Hammoudeh, S., Al-Jarrah, I. M. W., Sensoy, A., & Kang, S. H. (2017). Dynamic risk spillovers between gold, oil prices and conventional, sustainability and Islamic equity aggregates and sectors

with portfolio implications. *Energy Economics*, 67, 454-475. http://dx.doi.org/10.1016/j.eneco.2017.08.031

Mezghani, T., Rabbani, M. R., Trichilli, Y., & Abbes, B. (2024). Revisiting the dynamic connectedness, spillover and hedging opportunities among cryptocurrency, commodities, and Islamic stock markets. *Journal of Islamic Monetary Economics and Finance*, 10(1), 35-92. https://doi.org/10.21098/jimf.v10i1.1813

Naifar, N. (2016). Do global risk factors and macroeconomic conditions affect global Islamic index dynamics? A quantile regression approach. *The Quarterly Review of Economics and Finance*, 61, 29-39. http://dx.doi.org/10.1016/j.qref.2015.10.004

Nazlıoğlu, S., Hammoudeh, S. & Gupta, R. (2015). Volatility transmission between Islamic and conventional equity markets: evidence from causality-in-variance test. *Applied Economics*, 47 (46), 4996-5011.

Paltrinieri, A., Floreani, J., Kappen, J. A., Mitchell, M. C., & Chawla, K. (2019). Islamic, socially responsible, and conventional market comovements: Evidence from stock indices. *Thunderbird International Business Review*, 61(5), 719-733.

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

Said, A., & Ouerfelli, C. (2024). Downside risk in Dow Jones equity markets: hedging and portfolio management during COVID-19 pandemic and the Russia–Ukraine war. *The Journal of Risk Finance*, 25(3), 443-470.

Sakarya, Ş., Zeren, F., & Akkuş, H. T. (2018). The relationship between Islamic indices and commodity markets in Turkey: Evidence Fourier-based approaches. *Ekonomski horizonti*, 20(3), 243-256.

Sakti, M. R. P., & Harun, M. Y. (2013). Relationship between Islamic stock prices and macroeconomic variables: Evidence from Jakarta stock exchange Islamic index. *Global Review of Islamic Economics and Business*, 1(1), 071-084.

Sclip, A., Dreassi, A., Miani, S., & Paltrinieri, A. (2016). Dynamic correlations and volatility linkages between stocks and sukuk: Evidence from international markets. *Review of Financial Economics*, 31, 34-44. http://dx.doi.org/10.1016/j.rfe.2016.06.005

Sheikh, S. P., Jamil, S. A., Aysan, A. F., Atif, M., Rabbani, M. R., & Kayani, U. N. (2023). Do implied volatilities of stock and commodity markets affect conventional & shariah indices differently? An evidence by OVX, GVZ and VIX. *Heliyon*, 9(11). https://doi.org/10.1016/j.heliyon.2023.e21094

Sial, M. S., Cherian, J., Meero, A., Salman, A., Rahman, A. A., Samad, S. & Negrut, C. V. (2022). Determining financial uncertainty through the dynamics of sukuk bonds and prices in emerging market indices. *Risks*, *10*(3), 61.

Tsay, R. S. (2013). *Multivariate time series analysis: with R and financial applications*. ABD: John Wiley & Sons.

Yadav, N., Singh, A. B., & Tandon, P. (2023). Volatility spillover effects between Indian stock market and global stock markets: A DCC-GARCH model. *FIIB Business Review*, 23197145221141186. https://doi.org/10.1177/23197145221141186

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

Zhong, Y., & Liu, J. (2021). Correlations and volatility spillovers between China and Southeast Asian stock markets. *The Quarterly Review of Economics and Finance*, 81, 57-69. https://doi.org/10.1016/j.qref.2021.04.001

Xu, W., Ma, F., Chen, W., & Zhang, B. (2019). Asymmetric volatility spillovers between oil and stock markets: Evidence from China and the United States. *Energy Economics*, 80, 310-320. https://doi.org/10.1016/j.eneco.2019.01.014

Widad, M., & Hadjer, B. (2018). Causal relationship between Islamic bonds, oil price and precious metals: evidence from Asia pacific. *Al-Iqtishad Journal of Islamic Economics, 10*(2), 285-298.