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Quantifying the connectedness and portfolio implications between Islamic and conventional bonds: Evidence from global and GCC regions

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ABSTRACT

We explore the connectedness and portfolio implications between Islamic and conventional bonds in global and GCC regions. We also compare which bonds performed better during our sample period. Unlike previous studies, we focus on Islamic bond markets compared to their conventional counterparts and highlight the GCC bonds (Islamic and conventional) in respect of global bonds. We apply the DCC-GJR-GARCH (1,1) method, the Sharpe ratio, and the portfolio implications strategy over the period from September 1, 2013, to February 23, 2022. Our time-varying results suggest that the relationship among all variables varies over time, but most of them are positive, suggesting that there are fewer diversification opportunities between Islamic and conventional bonds. Hedging and diversification benefits are found only in the limited period among these variables, especially between GCC bonds and global bonds, and global Sukuk and GCC Sukuk. The findings of risk-adjusted returns reveal that Islamic bonds outperform their conventional counterparts. Moreover, mixed results are found in the case of hedging costs, and the majority of the fund, based on optimal weights, should be invested in Islamic bonds. Our study endows investors and regulators in the global and GCC markets with new insights on how to shield their investments and the financial system from financial crises through a hedging strategy with Islamic finance.

KEYWORDS

Conventional bonds; Sukuk; Time-varying analysis; Portfolio implications

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1. Introduction

The unending spread of the COVID-19 pandemic has shrunk the global economic and financial markets. As the representative of this crisis, a 3% drop in the global economy has been projected by the International Monetary Fund (2020) this year. Furthermore, the rate of unemployment in the United States jumped from 3.7% to 14.8% in the early two months of the pandemic (Yarovaya et al., 2021). Recently, Sharif et al. (2020), Corbet et al. (2020), Ramelli and Wagner (2020), and Akhtaruzzaman et al. (2020) have provided evidence of the repercussions of the COVID-19 pandemic on the financial markets. Therefore, almost every corner of the financial and economic system is hit by this pandemic, causing investors worldwide to experience great uncertainty regarding portfolio diversification. It is essential to search for alternative assets that have hedging and safe-haven properties, such as gold (Baur & Lucey, 2010; Baur & McDermott, 2010) and cryptocurrencies (e.g., Aysan et al., 2018; Feng et al., 2018), to safeguard their investments from global risks caused by this ongoing pandemic. Recent studies show that traditional and potential safe-haven assets, such as gold (Hasan et al., 2021a; Cheema et al., 2022), Bitcoin (Conlon & McGee, 2020; Hasan et al., 2022c), and the Swiss Franc (Hasan et al., 2021a), fail to protect investors' portfolios from crises.

Shariah-based assets are typically regarded as safer, more stable, and less volatile due to their unique features compared to their conventional counterparts. Akhtar & Jahromi (2017) find the safe haven role of Islamic financial products due to the banning of sub-prime mortgage securities and derivatives amid the global financial crisis. Additionally, several factors, such as unwise loaning practices, accounting models, and poor risk management, influenced the global financial crisis. However, these factors did not impact the Islamic finance industry due to their prohibition under Islamic laws. Moreover, under Shariah rules, interest (riba), intentional lack of accountability (gharar), transactions containing needless complexity or uncertainty, alcohol, tobacco, and gambling (gimar) relating to short sales, arbitration, and speculation are strictly banned (Hasan et al., 2021b). All of these principles regarding Islamic assets are set by Shariah scholars worldwide.

Although the literature concerning Shariah-compliant assets is comprehensive, several factors persuade us to choose these financial markets for further investigation. Islamic finance has come into the spotlight not only for investors in Muslim countries but also for non-Muslim countries around the world, with a market capitalization of US$3.50 trillion and around 10.3% growth in 2020 (Sharif, 2020). Empirical findings are ambiguous regarding the behavior of Shariah indices and demonstrate that Islamic financial assets show better performance compared to non-Islamic financial products during crisis periods (Arouri et al., 2013; Ashraf, 2013; Akhtar & Jahromi, 2017; Boo et al., 2017). However, opposing findings are also evident in studies such as Rejeb (2017), Cevik and Bugan (2018), Mezghani and Boujelbène (2018), and Ahmad et al. (2018), among others. Similarly, Foglie and Panetta (2020) extensively reviewed the related literature in this regard, with 42 papers favoring Islamic stock indices and 27 studies opposing the hedging and safe haven nature.

In general, Sukuk is "certificates of equal value representing undivided shares in ownership of tangible assets, usufruct, and services or (in the ownership of) the assets of particular projects. The returns on the certificates are directly related to the returns generated by the underlying assets" (World Bank report, 2015)[1]. However, among the Shariah-compliant assets, Islamic bonds (Sukuk) have been established recently as an alternative to interest-bearing instruments like conventional bonds. The Sukuk markets around the world have experienced tremendous growth, with Malaysia dominating those markets, followed by the Gulf Cooperation Council (GCC) countries (Naifar & Hammoudeh, 2016). Additionally, there is significant motivation for many investors of various faiths to apply their faith in investing, especially in the GCC markets, which are extremely affluent and strongly oriented toward their own religions. Furthermore, the GCC area, along with Malaysia, dominates the worldwide Sukuk market, accounting

[1] The World Bank report is available at: http://www.worldbank.org/en/topic/financialsector/brief/islamic-finance.

for almost two-thirds of all Islamic financial assets in the world. Very few or no studies have focused on GCC bonds (both Islamic and conventional) compared to global ones to offer hedging opportunities.

Recently, Yarovaya et al. (2021) found that there is no safe haven property in Islamic assets except the Sukuk index. In another study, Mirza et al. (2022) found that the risk-adjusted performance of Islamic equity funds is higher than that of conventional equity funds during the COVID-19 pandemic. However, the financial markets have been seriously impacted by the pandemic in several ways, including liquidity shortages, volatility jumps, capital outflows, currency depreciation, and poor risk management. Therefore, it is timely to investigate the hedging or safe-haven status of these markets, especially global and GCC Islamic bonds, against their traditional counterparts, both pre-and post-COVID-19 pandemic.

To address the gaps in the literature, we examine the association between Islamic and conventional bonds (both global and GCC) to explore the diversification benefits and portfolio choices between Islamic and conventional bonds. We use daily closing prices of these assets from September 1, 2013, to February 23, 2022. Based on the OLS method, we find that both Islamic and conventional bonds are closely connected with each other during the sample period. However, our time-varying results suggest that the relationship among all the variables varies over time, but most of them are positive, suggesting that there is less hedging or diversification opportunity between Islamic and conventional bonds. Hedging and diversification benefits are found only in a limited period, particularly between GCC bonds and global bonds, and global Sukuk and GCC Sukuk. Our findings on risk-adjusted returns reveal that Islamic bonds outperform their conventional counterparts. Moreover, we find mixed results in the case of hedge ratio, and based on optimal weights, the majority of funds should be invested in Islamic bonds to achieve the highest hedging effectiveness. Finally, our results suggest that Islamic bonds can be used as an alternative tool to protect investors' portfolios against future crisis events.

Our study contributes to the literature in several ways. First, unlike previous studies, we focus on Islamic bond markets compared to their conventional counterparts in the GCC and global contexts. Yarovaya et al. (2021) analyzed Shariah-compliant stocks and bonds during the pandemic crisis but did not examine GCC bonds (Islamic and conventional) in relation to global bonds. Second, our study highlights the GCC markets, which is a novel contribution, as no research has been conducted recently on the GCC bond and Sukuk markets. Furthermore, we compare the GCC markets with the global ones in terms of their hedging and diversification potentials, which will help investors construct an optimum portfolio structure to diversify portfolio risks. Third, we apply DCC-GJR-GARCH (1,1) and portfolio implications (hedge ratio, optimal weights, and hedging effectiveness), which enable us to provide a clear overview of the time-varying results and portfolio strategies. Finally, the findings of our study have implications not only for investors and regulators of Muslim countries but also for those of non-Muslim countries, since our study focuses on the world as well as GCC markets.

The rest of this study is organized as follows. Section 2 discusses the previous literature relevant to this paper. Section 3 describes the data and research methodology. Section 4 presents the empirical results and their relevant discussion. Finally, Section 5 provides the conclusions, implications, and limitations of this research.

2. Literature Review

A growing number of studies (e.g., Arouri et al., 2013; Ajmi et al., 2014; Al-Khazali et al., 2014; Dewandaru et al., 2014; Ho et al., 2014; Akhtar & Jahromi, 2017; El Mehdi & Mghaieth, 2017) have investigated the performance, volatility, and co-movement between Islamic finance and its conventional counterparts, and they have all found contradictory and mixed results. Similarly, a comprehensive literature review ranging from 2009 to 2019 related to the interdependence, decoupling, and contagion of Islamic finance compared to its conventional counterparts was conducted by Foglie & Panetta (2020), uncovering mixed results. Although some studies have been performed to examine these issues, their findings are divergent, highlighting the lack of consensus on these concerns. However,

in this section, we highlight some relevant papers that focus on the relationship between Islamic (Sukuk) and conventional bonds from several perspectives.

The Islamic bond (Sukuk) has come to the spotlight for its tremendous diversification or hedging role in the time of the global financial crisis. Some studies (Cakir & Raei, 2007; Alam et al., 2013; Azmat et al., 2014) attempt to differentiate Sukuk from conventional bonds, and their evidence suggests that Sukuk has dissimilarities over conventional bonds with respect to contractual arrangements. Bhuiyan et al. (2020) examine whether the Sukuk market is different from conventional bond markets based on the value-at-risk (VaR) approach. They observed that the VaR amount of Sukuk indices is comparatively much lower than the VaR of bond indices in all cases. However, this research is limited to covering only six years of data. Aloui et al. (2015) inspect whether Sukuk and Islamic stocks move in tandem in the GCC regions. They indicate that the co-movement is dominated in the long run and depends on the time and frequency. The diversification benefit is strongly evidenced, depending on the market circumstances. Maghyereh and Awartani (2016) explore the returns and volatility spillovers between Islamic bonds (Sukuk) and conventional bonds. They highlight the importance of Sukuk in the strategic asset allocation and hedging of international investors.

Recently, Shahzad et al. (2019) constructed a portfolio including the Sukuk index with major Islamic stock indexes, i.e., world, USA, UK, Canada, and Japan. Their empirical findings suggest that Sukuk provides potential hedging benefits for the largest Islamic stock indices. Both studies focus only on the portfolio formation between Islamic bonds (Sukuk) and stocks but do not focus on the comparative analysis of Sukuk and its conventional counterpart. Likewise, Ahmed and Elsayed (2019) examine the decoupling hypothesis between Islamic and conventional capital markets by analyzing the dynamic interdependencies among conventional stocks, Islamic stocks, bonds, and Sukuk markets in Malaysia. They find that the conventional stock and bond markets are regarded as the main net transmitters of spillovers toward other markets, whereas the Sukuk market is a net receiver of modest levels of return shocks from conventional, Islamic, and bond markets.

Hassan et al. (2018) adopted a multivariate GARCH framework to examine conditional correlations and volatility linkages between Sukuk (Islamic bonds) and conventional bond markets in Europe, the United States, and emerging markets. They found that Sukuk returns are much less volatile than those of U.S. and EU investment-grade bonds. They observed that during recessions, the dynamic correlation between Sukuk and bond markets tends to increase. Hossain et al. (2021) examined whether Sukuk and conventional bonds are different assets in terms of their return and risk profile. They found that Sukuk returns are insignificantly different from those of bonds but have a significantly higher risk. However, they found that Sukuk investors are not sufficiently compensated for the higher risk. Furthermore, Pirgaip et al. (2020) unveiled the diversification behavior of bond portfolios (conventional and Sukuk) in Turkey, and their results confirmed the presence of these benefits in times of economic downturns. They also constructed different risk-return patterns individually or mixed, where risk substantially differs based on the direction of the risk-return profile.

From the perspective of risk factors, Naifar and Hammoudeh (2016) analyzed the effects of various risk and uncertainty factors such as economic policy uncertainty (EPU), global financial distress (CFSI), global commodity and financial market risk indices on Sukuk markets (both global and GCC). They found that GCC Sukuk is negatively affected by all the factors they examined except the conventional bond and gold market uncertainties, while the global Sukuk is only affected by the global conventional bond uncertainty index. Their findings suggest that the effects on the GCC Sukuk markets are more pronounced compared to the global Sukuk index due to the unprecedented movement of oil prices. To date, Paltrinieri et al. (2019) uncovered a wide range of literature (80 papers) in connection with Sukuk's research spanning the period 1950-2018, and they recommended making a comparison of the return pattern across several time frames and expanding the study on profitability, considering trading tactics on Islamic financial assets.

From the literature discussed above, several features can be drawn. First, we observe that no consensus has been reached by earlier studies regarding the connectedness between Islamic and conventional bonds in the GCC and global perspectives. Second, we notice that most of the research focuses only on the relationship between Islamic and conventional bonds in the global or country-wise context. However, no research has been performed regarding the comparative analysis of global and GCC regions in the context of Islamic and conventional bonds, except Naifar and Hammoudeh (2016), who considered various risk and uncertainty factors to explore the impact on the global and GCC Sukuk market only. Third, prior studies do not cover the COVID-19 pandemic period to see whether the relationship or connectedness between these variables differs in normal and crisis periods. Therefore, it is crucial to study the connectedness between Islamic and conventional bonds (GCC and global) to offer both investors and policymakers better investment and policy decisions. If the relationship differs between global and GCC bonds (both Islamic and conventional), stakeholders may make useful decisions in formulating or redesigning policy decisions. However, this study is attempting to fulfill the abovementioned literature gap.

3. Data and Methodology

3.1. Data

In this paper, we use the closing/spot price of two Islamic bonds (global and GCC Sukuk) and their conventional counterparts. The Islamic and conventional bonds carry two pairs. These are Dow Jones World Sukuk and Gulf Co-operation Council (GCC)[2] countries Sukuk and their conventional assets. The two pairs of bonds are the Dow Jones world Sukuk index, the S&P International Corporate Bond Index, GCC Sukuk, and the GCC bond index. However, for all the selected assets in this study, we gather data from S&P (http://us.spindices.com) (Ashraf & Khawaja, 2016), spanning the data period from 01 September 2013 to 23 February 2022. Based on the availability of data, we select this sample period. Our sample period covers the COVID-19 pandemic crisis, which has adversely impacted the global economic and financial system (Hasan et al., 2021a). Moreover, we estimate the daily returns of all chosen assets as the first difference in the logarithms to conduct this study. The specification for logarithmic returns can be expressed as follows:

$$R_t = ln(\frac{P_t}{P_{t-1}}) \times 100$$

Here, R_t refers to logarithmic returns of a given asset at period t, ln refers to natural logarithm, P_t and P_{t-1} are the closing prices of the index on periods, t and t-1, respectively.

The prices and returns of Islamic and conventional bonds in the global and GCC regions are depicted in Figure 1. We notice that the prices of the global bond (reported in Panel A of Figure 1) started increasing from the beginning of the sample period and started decreasing after 2014. We also observe that there is a general upward trend in the case of the global bond after mid-2015. We further witness that the prices of Global Sukuk, GCC Sukuk, and GCC Sukuk are following the general increasing trend. However, the prices of these assets drastically reduced during early 2020, which is considered the COVID-19 pandemic period. The pandemic has had a negative impact on the global economic and financial systems, and asset prices were negatively affected by this crisis. Therefore, the prices of these assets decreased during the early COVID-19 phase. After that period, the prices of these assets started increasing and continued up to the study period. On the other hand, we find that the returns of all assets considered

[2] There are six countries from Middle Eastern region, i.e., Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman are included in GCC. GCC market is designed to measure the performance of these countries. This study covers the GCC region countries for Islamic and non-Islamic bond.

in this study (illustrated in Panel B of Figure 1) are more volatile during the early 2020 period when the COVID-19 pandemic occurred in the world.

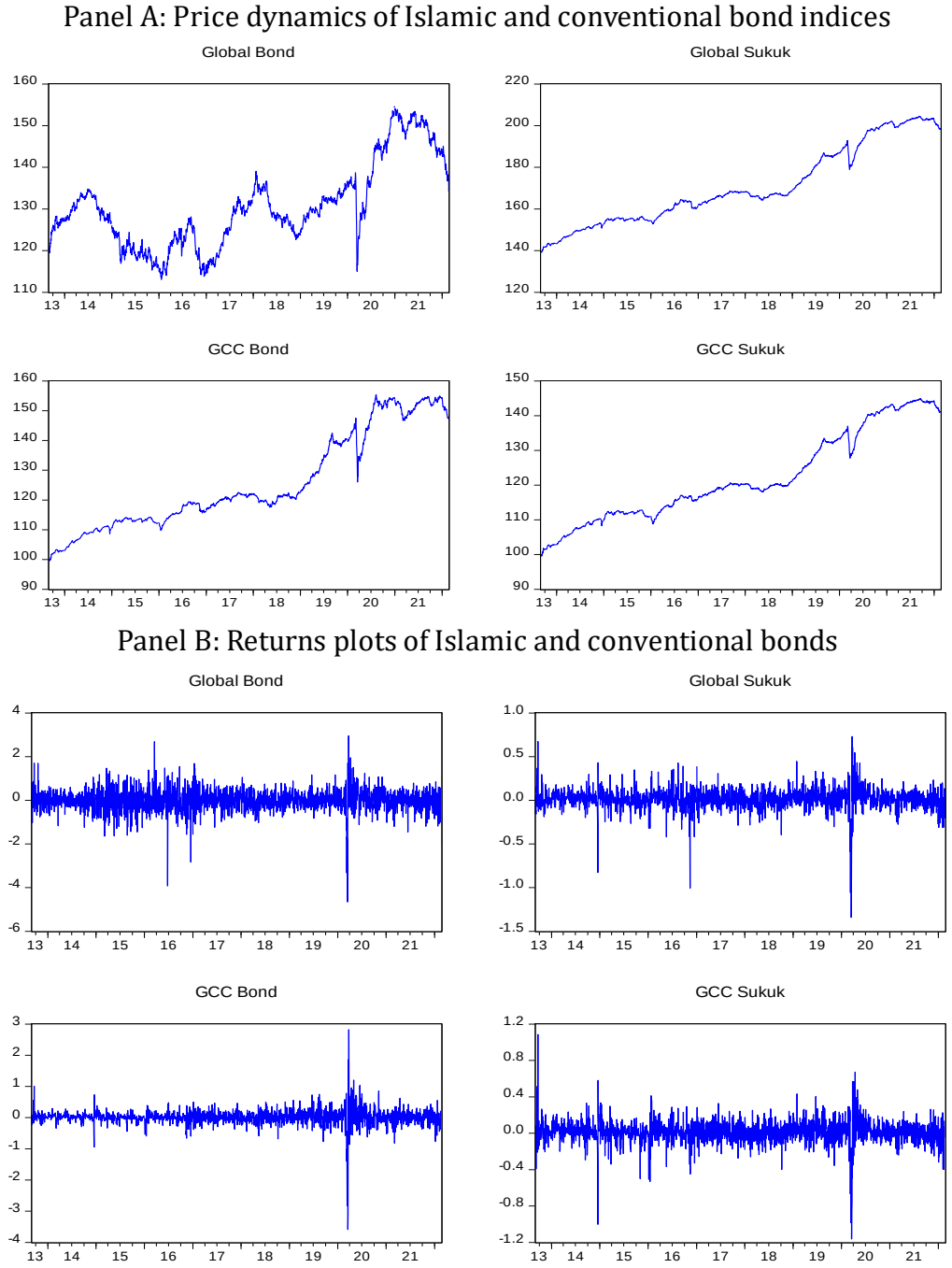

Figure 1. Price dynamics and returns of Islamic and conventional bond indices.

3.2. Econometric methodology

3.2.1. Ordinary Least Square

We begin with the Ordinary Least Square (OLS) estimation that measures the association between Islamic and conventional bonds from global and GCC regions. This is widely used as the parameter of dependency, which shows the simple statistical link between the variables. The following is the specification of simple linear We begin with Ordinary Least Squares (OLS) estimation, which measures the association between Islamic and conventional bonds

from the global and GCC regions. This is widely used as the parameter of dependency, which shows the simple statistical link between the variables. The following is the specification of simple linear regression:

$$R_t = \alpha_1 + \beta_i U_{it} + \epsilon_t R_t = \alpha_1 + \beta_i U_{it} + \epsilon_t \quad (1)$$

where R_t denotes the returns of dependent variables. U_{it} indicates the vector of independent variables used in this study that are expressed as a natural logarithm as the first difference of their values. ϵ_t is the error term. However, this technique only captures a simple linear relationship between the variables. The simple linear estimation can lose its significance, however, when we measure the range of data beyond the mean value or in the extreme values.

3.2.2. DCC-GJR-GARCH (1,1) model

In this study, we consider the multivariate Glosten, Jagannathan, and Runkle (1993) (GJR) Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model with dynamic conditional correlation (DCC) proposed by Engle (2002), formed GJR-GARCH model.[3] The asymmetric response of volatility to positive and negative shocks can be measured using the DCC-GJR-GARCH model. This method involves adding a new term that recognizes asymmetries to the GARCH model. Furthermore, the inclusion of a leverage element to describe asymmetric volatility is one of the novel aspects of the GJR-GARCH model (Al Mamun et al., 2019). A major negative shift in the GJR-GARCH model is more likely than a large positive change to be followed by another large negative change. Recent studies (e.g., Brownlees et al., 2011; Laurent et al., 2012) suggest that GJR models outperform the GARCH specification. Some recent studies (e.g., Hassan et al., 2021; Hasan et al., 2022b) also utilize this method. The conditional return on the dependent variables follows the process:

$$r_t = \mu + \psi R_{t-1} + \varepsilon_t, \varepsilon_t = z_t h_t, z_t \sim N(0,1) \quad (2)$$

where $r_t = [R_{i,t}, \ldots\ldots, R_{n,t}]$ is the (n×1) vector of the returns on the Islamic and conventional bonds under consideration. μ is the vector of the constant terms, and ψ denotes the coefficient vector of the autoregressive terms. $\mathcal{E}_t = [\mathcal{E}_{i,t}, \ldots\ldots, \mathcal{E}_{n,t}]$ represents the vector of standard residuals. In the next step, we estimate the conditional variance (conditional volatility) of the i-th element follows from the GJR-GARCH (1, 1) model as follows:

$$h_{i,t}^2 = \omega + \alpha \mathcal{E}_{i-1}^2 + \beta \sigma_{i-1}^2 + \Upsilon \mathcal{E}_{i-1}^2 I_{t-1} \quad (3)$$

where $I_{t-1} = 1$ if $\mathcal{E}_{t-1} < 0$, otherwise $I_{t-1} = 0$. Υ is the leverage coefficient term to capture the asymmetric influence. When $\Upsilon > 0$, this indicates that the negative shocks impact more than the positive shocks. The parameters ω, α, β, and Υ in Equation (3) can assure the stationarity of the conditional volatility process only when the conditions $\omega > 0$, $\alpha, \beta, \Upsilon \geq 0$, and $\Upsilon + \frac{\alpha+\beta}{2} < 1$ are satisfied.

The diagnostic tests on the standardized squared residuals indicate that our selected GJR-GARCH (1, 1) model with a Student-t distribution is correctly specified because the estimated residuals are free from autocorrelation effects. The model also detects the possibility of the existence of the second or higher-order moment of the GJR-GARCH. Finally, the residuals of the marginal models adequately capture the return distributions.

We obtain the dynamic correlations between the Islamic and conventional bond markets using the Dynamic Conditional Correlation (DCC) model of Engle (2002). Assume that $E_{t-1}[\varepsilon_t] = 0$and $E_{t-1}[\varepsilon_t \varepsilon'_t] = H_t$, where $E_t[.]$ is the conditional expectation at the time t. Therefore, the conditional variance-covariance matrix (H_t) is the product of the variance and correlation matrices and can be defined as the following form:

[3] Based on the Akaike Information Criterion (AIC) and Schwarz Criterion (SC), we choose the GJR-GARCH (1, 1) model. The details frameworks are available upon request.

$$H_t = D_t^{\frac{1}{2}}(DCC)_t D_t^{\frac{1}{2}} \tag{4}$$

where $\mathrm{DCC_t}$ is the $\mathrm{n \times n}$ time-varying correlation matrix, while the diagonal matrix of the square roots of the variances is given by$D_t = diag(h_{i,t}, K, h_{n,t})$. Engle (2002) models the right-hand side of equation (5) rather than H_t directly by proposing the following dynamic correlation structure:

$$DCC_t = diag(Q_t)^{-\frac{1}{2}} Q_t diag(Q_t)^{-\frac{1}{2}} \tag{5}$$

$$Q_t = (1 - a - b)S + adiag(Q_{t-1})^{\frac{1}{2}} \hat{\varepsilon}_{i,t-1} \hat{\varepsilon}'_{i,t-1} diag(Q_{t-1})^{\frac{1}{2}} + bQ_{t-1} \tag{6}$$

This implies that the conditional correlation is dynamically driven by the process of (Q_t) where S is the $\mathrm{n \times n}$ unconditional covariance matrix for the standardized residuals $\hat{\varepsilon}_{i,t}$, and a, b are non-negative scalars satisfying $a + b < 1$. The resulting model is called DCC-GARCH.

3.2.3. Hedge ratio, optimal portfolio weights, and hedging effectiveness

Furthermore, the hedge ratio (HR), optimal portfolio weights, and hedging effectiveness (HE) are used to offer a superior hedging strategy and portfolio implications to investors and portfolio managers with a better (Antonakakis et al., 2019). Some contemporary research (e.g., Yousaf & Yarovaya, 2021; Hasan et al., 2022a) also utilizes these calculations in their studies to do the same. However, we estimate the HR, introduced by Kroner and Sultan (1993), based on the conditional variance and covariances of the DCC-GARCH t-Copula. The HR evaluates the hedging cost of a \$1 long position in asset i with a β_{ijt} USD short position in asset j, in this case, several global and GCC bonds (both Islamic and conventional). The specification is expressed as follows:

$$\beta_{ijt} = \frac{h_{ijt}}{h_{jjt}} \tag{7}$$

It indicates that higher conditional variances lead to lower hedging costs for long positions, whereas greater conditional covariance leads to higher hedging costs for long positions.

This research also estimates the optimal portfolio weights (proposed by Kroner and Ng (1998)), W_{ijt} , based on the DCC-GARCH t-Copula approach. The optimal portfolio weights between the green bond and ESG indices pair can be estimated through the following specification:

$$W_{ijt} = \frac{h_{jjt} - h_{ijt}}{h_{iit} - 2h_{ijt} + h_{jjt}} \tag{8}$$

where W_{ijt} could be more than one or less than zero. We establish the following constraints to capture this drawback:

$$W_{ijt} = \begin{cases} 0, & if\ W_{ijt} < 0 \\ W_{ijt}, & if\ 0 \le W_{ijt} \le 1 \\ 1 & if\ W_{ijt} > 1 \end{cases}$$

Finally, Ederington's (1979) HE approach is employed in measuring the effectiveness of hedging and different portfolio strategies between the green bond and ESG indices. It can be expressed as follows:

$$HE_i = 1 - \frac{V(r_{\beta,w})}{V(r_{unhedged})} \quad (9)$$

where the $r_{\beta,w}$ can be computed as

$$\begin{cases} r_\beta = y_{it} - \beta_{ijt} y_{jt} \\ r_w = w_{ijt} y_{it} + (1 - w_{ijt}) y_{jt} \end{cases}$$

HE_i denotes the percent decrease in the unhedged position's variance. The variance of the unhedged position of asset i is denoted by $V(r_{unhedged})$. $V(r_{\beta,w})$ suggests the hedged portfolio variance either from the optimal HR or the optimal weight strategy. The higher risk reduction in the portfolio is linked with a greater HE_i.

4. Analysis of Results

4.1. Summary statistics and correlation matrix

The descriptive statistics for all the variables are presented in Panel A of Table 1. The results indicate that the global Sukuk and GCC bonds have the highest mean returns, whereas the global bond has the lowest mean return and the highest volatility (measured by standard deviation) in the sample period. This result suggests that, on average, global Sukuk and GCC bonds outperform other assets. On the other hand, the global bond exhibits maximum one-day returns (2.94%) and minimum one-day losses (-4.65%). Our risk-adjusted returns, based on the Sharpe ratio, indicate that Islamic bonds (both global and GCC) reveal the highest Sharpe ratio, suggesting that Islamic bonds outperform conventional bonds (both global and GCC). This result is supported by some recent studies, such as Al-Yahyaee et al. (2020), Sherif (2020), Mirza et al. (2022), and Ashraf et al. (2022). However, negative skewness and high kurtosis values are observed for all the selected assets, indicating that the return series is symmetric with heavy fat tails or outliers. The Jarque-Bera statistic is rejected at the 1% level of significance, highlighting that the return series are abnormally distributed for all the chosen assets.

Stationarity issues are a serious problem in time series data. However, several methods are introduced to test the stationarity of financial data. The return series stationarity is tested with the augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and Phillips-Perron (PP) test (Phillips & Perron, 1988). Although there are several tests for stationarity, we have used ADF and PP tests as they have some benefits compared to other tests, particularly in capturing the residuals' autocorrelation issues (Hasan et al., 2022c). The results suggest that there are no stationarity issues in the return series for all the assets in the sample period. The results of the unconditional correlation are reported in Panel B of Table 1. The correlation matrix's results suggest that all the variables, whether Islamic or conventional, are strongly and positively correlated with each other during our sample period. These findings imply that there is no diversification opportunity among the variables, as all the assets are strongly correlated.

4.2. Ordinary least square analysis

Table 2 shows the results of the OLS estimations during the whole study period. The relationship between the global bond and the global Sukuk is positive and significant. This result indicates that an increase in the returns of the global bond increases the returns of global Sukuk, and vice versa. In this case, there is no hedging or diversification opportunity between the global bond and global Sukuk, highlighting that these two assets might be equally impacted by any financial and economic crises, such as the COVID-19 crisis. On the other hand, the

Table 1. Descriptive statistics and correlation matrix.

Panel A: Descriptive statistics and unit root tests				
Variables	Global Bond	Global Sukuk	GCC Bond	GCC Sukuk
Mean	0.0054	0.0159	0.0178	0.0157
Maximum	2.9475	0.7293	2.8212	1.0862
Minimum	-4.6551	-1.3398	-3.5884	-1.1634
Std. Dev.	0.4809	0.1191	0.2417	0.1230
Sharp ratio	0.0112	0.1335	0.0736	0.1276
Skewness	-0.8954	-1.7571	-2.4834	-0.9720
Kurtosis	12.9293	22.5892	58.6200	17.6337
Jarque-Bera	9323.06***	36274.82***	285580.00***	19958.35***
ADF	-8.807***	-17.048***	-11.667***	-17.025***
PP	-15.424***	-20.566***	-22.025***	-24.025***
Panel B: Correlation matrix				
Global Bond	1			
Global Sukuk	0.3189***	1		
GCC Bond	0.1447***	0.3760***	1	
GCC Sukuk	0.1377***	0.4644***	0.7275***	1

*Note: The table reports the results of descriptive statistics for the return series of all selected assets. The sample period spans from September 30, 2013 to February 23, 2022. The Sharpe ratio is calculated by dividing an asset's mean returns by its standard deviation following Bouri et al. (2020). The ADF and PP tests are used to test for stationarity in the return series. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.*

association between the GCC bond and the GCC Sukuk is positive and statistically significant, implying that GCC Sukuk doesn't serve as a hedging or diversification opportunity for GCC bonds. The Durbin-Watson (DW) test statistic results indicate that the OLS estimations are free from autocorrelation problems in the datasets, as the values of DW are greater than 2.

Table 2. Relationship between Islamic and conventional bond.

Dependent Variable: Global Sukuk				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Global Bond	0.0790	0.0050	15.7679	0.0000
C	0.0154	0.0024	6.417876	0.0000
Durbin-Watson stat		2.1980		
Dependent Variable: GCC Sukuk				
GCC Bond	0.3701	0.0074	49.6928	0.0000
C	0.0090	0.0018	5.0408	0.0000
Durbin-Watson stat		2.0481		

Note: The table presents the linear relationship between Islamic and conventional bonds (both global and GCC) during the period of September 01, 2013, to February 23, 2022.

4.3. DCC-GJR-GARCH (1, 1) estimations

Furthermore, we use Engle's (2002) dynamic conditional correlation (DCC) approach in combination with the GJR-GARCH method of Glosten et al. (1993) to capture the asymmetric time-varying dependency between Islamic and conventional bonds. Figure 2 depicts the DCC plots for the variables during our sample period. We find a consistently positive correlation between GCC bonds and GCC Sukuk throughout the entire sample period, suggesting that there is no hedging or safe-haven ability between the variables. The probable reason for these outcomes is that the economies of the GCC countries are profoundly reliant on the global oil market, which has recently experienced significant fluctuations due to the Russia-OPEC price war and the trade war between the US and China (Sharif et al., 2020). The COVID-19 pandemic caused the oil price crisis to worsen, which threw the GCC

nations' financial markets into chaos. This notion is further supported by Hassan et al. (2022a).

On the other hand, we observe a mixed relationship between GCC bonds and Global bonds. For example, there is a positive correlation across most of the study period, whereas we notice a negative association in around 450 and 1000 observations. The period of these observations might correspond to late 2014 and 2016. This result implies that there is a diversification opportunity between GCC bonds and Global bonds in the late 2014 and 2016 sample period. The same phenomenon (e.g., negative relations) is further evidenced during the observations from 1600 to 1900 (corresponding to late 2019 to late 2020), which are considered as the COVID-19 pandemic periods, suggesting that there is a hedging or diversification opportunity between these variables.

We further find that the relationship between Global bonds and Global Sukuk is positive throughout the entire sample period (except in observation 1000), reflecting the non-existence of diversification opportunities. On the other hand, when we examine the connectedness between Global Sukuk and GCC Sukuk, we find that the association is positive, up to 800 observations. Then, this relation turns negative, offering the diversification benefit between Global Sukuk and GCC Sukuk. Overall, our results suggest that the Islamic and conventional bond pairs can be utilized as a hedge and safe-haven tools, depending on the time period, which is partially in line with Hasan et al. (2022a). Investors can review our findings and create several trading strategies to diversify their portfolio risk. Policymakers can also make better decisions using our findings. Since most of the variables' relations are positive, they have a high chance of being equally affected by any crisis. Therefore, policymakers should be aware of the crisis when making policy decisions.

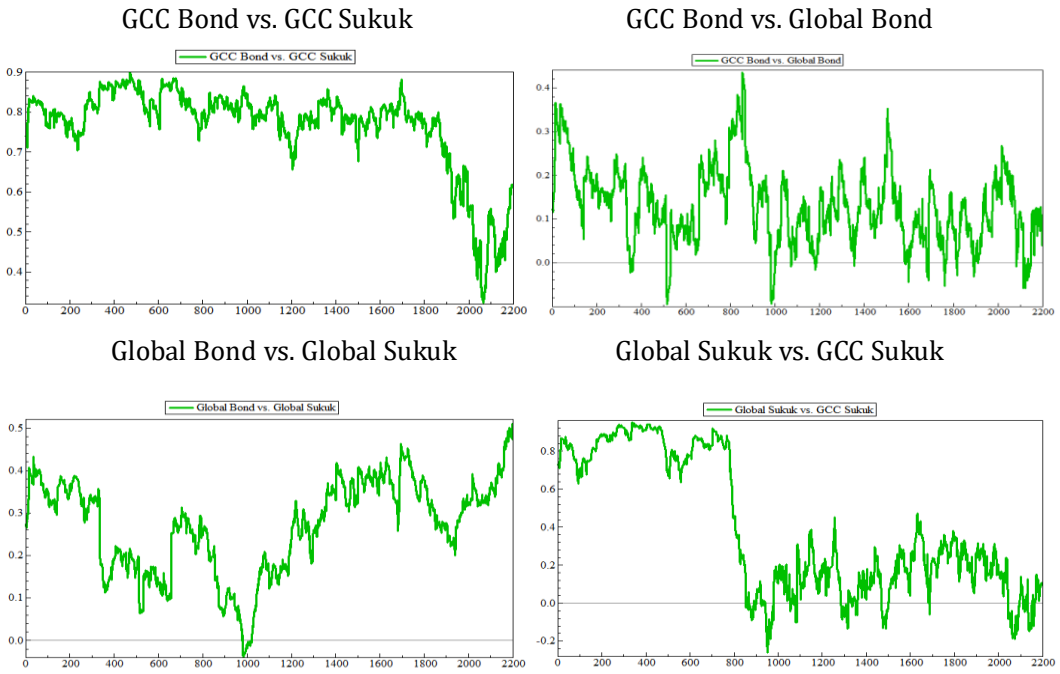

Figure 2. Dynamic conditional correlation plots among the variables.

4.4. Portfolio implications (Hedge ratio, Optimal weights, Hedging effectiveness)

Table 3 displays the hedge ratio (HR) (long/short), optimal weights, and hedging effectiveness (HE) for global and GCC bonds over the sample years. According to the HR, a $1 long position in a bond can be hedged with the average value of the hedging ratio percentage of a short position in their relative pairs. The results show that HRs are lower between Global Sukuk/Global Bond, GCC Sukuk/Global Bond, and GCC Bond/Global Bond assets, ranging from 3% to 7% across the whole sample period. These outcomes suggest that investors require investing 3-7 cents

in a short position in global bonds to hedge a USD 1 long position in global Sukuk, GCC Sukuk, and GCC bonds. The HR in the remaining pairs is somewhat higher and significant in most cases, indicating that the hedging cost is higher to hedge the cross or conventional pairs. On the other hand, the optimal weights between Global Bond and Global Sukuk, GCC Bond and GCC Sukuk, GCC Bond and Global Sukuk, and Global Bond and GCC Sukuk are 0.01 and 0.04, 0.09, and 0.19, respectively, suggesting that investors should invest the majority of their funds in both the global and GCC Sukuk markets to achieve maximum HE. Furthermore, when we consider only the Sukuk portfolios, the allocation of the fund should be 55% in the global Sukuk and 45% in GCC Sukuk.

Table 3. Hedge Ratio and optimal portfolio weights.

Panel A: Hedge Ratio			
Variables	Mean	HE	p-value
Global Sukuk/Global Bond	0.07	0.09**	0.03
GCC Sukuk/Global Bond	0.03	0.01	0.88
GCC Bond/Global Bond	0.05	0.01	0.77
Global Bond/Global Sukuk	1.23	0.15***	0.00
GCC Sukuk/Global Sukuk	0.42	0.24***	0.00
GCC Bond/Global Sukuk	0.58	0.22***	0.00
Global Bond/GCC Sukuk	0.57	0.02	0.61
Global Sukuk/GCC Sukuk	0.39	0.30***	0.00
GCC Bond/GCC Sukuk	1.30	0.63***	0.00
Global Bond/GCC Bond	0.44	0.03	0.47
Global Sukuk/GCC Bond	0.29	0.11***	0.01
GCC Sukuk/GCC Bond	0.53	0.51***	0.00
Panel B: Optimal weights			
Global Bond/Global Sukuk	0.01	0.94***	0.00
Global Bond/GCC Sukuk	0.04	0.93***	0.00
GCC Bond/GCC Sukuk	0.09	0.74***	0.00
GCC Bond/Global Sukuk	0.19	0.74***	0.00
Global Bond/GCC Bond	0.13	0.79***	0.00
Global Sukuk/GCC Sukuk	0.55	0.22***	0.00

*Notes: The table presents the hedge ratio, optimal weights, and hedging effectiveness between the global and GCC bonds. HE represents hedging effectiveness. ***, **, * indicate the significance at the 1%, 5%, and 10% levels, respectively.*

5. Conclusions

Since the ongoing outbreak of the COVID-19 pandemic, individual investors and fund managers are still searching for resilience properties to safeguard their investments from unprecedented risks triggered by this pandemic in the global financial markets. This study is a relevant and timely assessment of financial assets, especially for the investors of Islamic finance, to safeguard their investments from pandemic risks. In this vein, we examine the relationship between Islamic bonds and conventional bonds. To do so, we utilize two (global and GCC) Islamic bond indices and their conventional opposite parts. We use several methodologies, such as ordinary least squares (OLS), DCC-GJR-GARCH (1,1) models, and portfolio implications. In addition, we also consider the Sharpe ratio. Our sample period started from September 1, 2013, to February 23, 2022, which covers the pre- and post-COVID-19 periods.

The results of our study, based on the OLS estimation, show that Islamic bond indices (both global and GCC) are highly interrelated with conventional bond indices, suggesting that Islamic bond indices are unable to provide significant diversification benefits. Some exceptions are also observed in the case of DCC estimation. The DCC estimation suggests that the Islamic and conventional bond pairs can be utilized as hedge and safe-haven tools, depending on the time period. Besides, the results of risk-adjusted (Sharpe ratios) returns unveil that the Islamic

bonds outperformed compared to non-Islamic bonds during the whole sample period. However, mixed results are found in the case of hedging cost, and the majority of the fund, according to optimal weights, should be invested in Islamic bonds to gain maximum HE. Our overall finding suggests that Islamic bonds offer more resilience to the investors than other assets investigated in this study throughout the normal and financial downturn (COVID-19) periods.

The findings of this study have several implications for practice and research in the global financial system. Firstly, we provide insights regarding the trading, economic and financial reforming of faith-based sources of investments, particularly Shariah-based investments, compared with the conventional markets. Investors should invest most of their funds in Islamic bonds to achieve the highest hedging effectiveness. Secondly, our results also will be supportive in making policy evaluations for policymakers to authorize and improve the bond markets, especially during crisis periods. Lastly, this paper explores new insights for investors and regulators in the global and GCC markets about how to shield their investments and the financial system from market downfalls through a hedging and diversification strategy with Islamic finance, especially during this pandemic.

Moreover, our study opens the door for forthcoming researchers to investigate other individual country's Islamic financial markets, sub-indices, and also the rest of the Islamic financial products, especially Islamic banks, and mutual funds. Besides, we only cover Shariah-based investments; accordingly, other faith-based investments, such as Jewish and Christian, should be incorporated by future studies.

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Conflict of interest

All the authors claim that the manuscript is entirely original, and they declare no conflicts of interest.

Author contributions

Conceptualization: Md. Ruhul Amin, Md. Mamunur Rashid; Investigation: Md. Ruhul Amin, Md Abdul Hakim, Md. Mamunur Rashid; Methodology: Md. Ruhul Amin, Md. Mamunur Rashid; Formal analysis: Md. Ruhul Amin, Md Abdul Hakim, Md. Mamunur Rashid; Writing – original draft: Md Abdul Hakim, Md. Mamunur Rashid; Writing – review & editing: Md. Ruhul Amin, Md Abdul Hakim, Shaikh Masrick Hasan.

References

Ahmad, W., Rais, S., & Shaik, A. R. (2018). Modeling the directional spillovers from DJIM Index to conventional benchmarks: Different this time? *The Quarterly Review of Economics and Finance*, 67, 14-27. https://doi.org/10.1016/j.qref.2017.04.012

Ajmi, A. N., Hammoudeh, S., Nguyen, D. K., & Sarafrazi, S. (2014). How strong are the causal relationships between Islamic stock markets and conventional financial systems? Evidence from linear and nonlinear tests. *Journal of International Financial Markets, Institutions & Money*, 28, 213–227. https://doi.org/10.1016/j.intfin.2013.11.004

Akhtar, S., & Jahromi, M. (2017). Impact of the global financial crisis on Islamic and conventional stocks and bonds. *Accounting and Finance*, 57, 623-655. https://doi.org/10.1111/acfi.12136

Akhtaruzzaman, M., Boubaker, S. & Sensoy, A. (2020). Financial contagion during COVID-19 crisis. *Finance Research Letter*, 38, 101604. https://doi.org/10.1016/j.frl.2020.101604

Al Mamun, M., Uddin, G. S., Suleman, M. T., & Kang, S. H. (2020). Geopolitical risk, uncertainty and Bitcoin investment. *Physica A: Statistical Mechanics and its Applications*, 540, 123107. https://doi.org/10.1016/j.physa.2019.123107

Alam, N., Hassan, M. K., & Haque, M. A. (2013). Are Islamic bonds different from conventional bonds? International evidence from capital market tests. *Borsa Istanbul Review*, 13(3), 22-29. https://doi.org/10.1016/j.bir.2013.10.006

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. https://doi.org/10.1016/j.pacfin.2013.09.003

Aloui, C., Hammoudeh, S., & Hamida, H. B. (2015). Co-movement between sharia stocks and Sukuk in the GCC markets: A time-frequency analysis. *Journal of International Financial Markets, Institutions & Money*, 34, 69–79. https://doi.org/10.1016/j.intfin.2014.11.003

Al-Yahyaee, K. H., Mensi, W., Rehman, M. U., Vo, X. V., & Kang, S. H. (2020). Do Islamic stocks outperform conventional stock sectors during normal and crisis periods? Extreme co-movements and portfolio management analysis. *Pacific-Basin Finance Journal*, 62, 101385. https://doi.org/10.1016/j.pacfin.2020.101385

Antonakakis, N., Chatziantoniou, I., & Gabauer, D. (2019). Cryptocurrency market contagion: Market uncertainty, market complexity, and dynamic portfolios. *Journal of International Financial Markets, Institutions and Money*, 61, 37-51. https://doi.org/10.1016/j.intfin.2019.02.003

Arouri, M. E., ben Ameur, H., Jawadi, N., Jawadi, F., & Louhichi, W. (2013). Are Islamic finance innovations enough for investors to escape from a financial downturn? Further evidence from portfolio simulations. *Applied Economics*, 45(24), 3412–3420. https://doi.org/10.1080/00036846.2012.707776

Ashraf, D. (2013). Performance evaluation of Islamic mutual funds relative to conventional funds: Empirical evidence from Saudi Arabia. *International Journal of Islamic and Middle Eastern and Management*, 6(2), 105–121. https://doi.org/10.1108/17538391311329815

Ashraf, D., & Khawaja, M. (2016). Does the Shariah screening process matter? Evidence from Shariah compliant portfolios. *Journal of Economic Behavior & Organization*, 132, 77–92. https://doi.org/10.1016/j.jebo.2016.10.003

Ashraf, D., Rizwan, M. S., & Ahmad, G. (2022). Islamic equity investments and the COVID-19 pandemic. *Pacific-Basin Finance Journal*, 73, 101765. https://doi.org/10.1016/j.pacfin.2022.101765

Aysan, A. F., Demir, E., Gozgor, G., & Lau, C. K. M. (2018). Effects of the Geopolitical Risks on Bitcoin Returns and Volatility. *Research in International Business and Finance*, 47, 511-518. https://doi.org/10.1016/j.ribaf.2018.09.011

Azmat, S., Skully, M., & Brown, K. (2014). Issuer's Choice of Islamic Bond Type. *Pacific-Basin Finance Journal*, 28, 122-135. https://doi.org/10.1016/j.pacfin.2013.08.008

Baur, D. G., & Lucey, B. M. (2010). Is gold a hedge or a safe haven? An analysis of stocks, bonds and gold. *Financial Review*, 45(2), 217-229. https://doi.org/10.1111/j.1540-6288.2010.00244.x

Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking and Finance*, 34(8), 1886–1898. https://doi.org/10.1016/j.jbankfin.2009.12.008

Bhuiyan, R. A., Puspa, M., Saiti, B., & Ghani, G. M. (2020). Comparative analysis between global Sukuk and bond indices: value-at-risk approach. *Journal of Islamic Accounting and Business Research*. 11(6), 1245-1256. https://doi.org/10.1108/JIABR-02-2018-0019

Boo, Y. L., Ee, M. S., Li, B., Rashid, M. (2017). Islamic or conventional mutual funds: Who has the upper hand? Evidence from Malaysia. *Pacific-Basin Finance Journal*, 42, 183-192. https://doi.org/10.1016/j.pacfin.2016.01.004

Bouri, E., Shahzad, S. J. H., Roubaud, D., Kristoufek, L., & Lucey, B. (2020). Bitcoin, gold, and commodities as safe havens for stocks: New insight through wavelet analysis. *The Quarterly Review of Economics and Finance*, 77, 156-164. https://doi.org/10.1016/j.qref.2020.03.004

Brownlees, C. T., Engle, R. F., & Kelly, B. T. (2011). A practical guide to volatility forecasting through calm and storm. *Available at SSRN*: http://dx.doi.org/10.2139/ssrn.1502915

Cakir, S. & Raei F (2007). Sukuk vs. Eurobonds: Is there a difference in value-at-risk? *International Monetary Fund Working Paper WP/07/237*.

Cevik, E. I., & Bugan, M. F. (2018). Regime-dependent relation between Islamic and conventional financial markets. *Borsa Istanbul Review*, 18(2), 114-121. https://doi.org/10.1016/j.bir.2017.11.001

Cheema, M. A., Faff, R., & Szulczyk, K. R. (2022). The 2008 global financial crisis and COVID-19 pandemic: How safe

are the safe haven assets?. *International Review of Financial Analysis*, 83, 102316. https://doi.org/10.1016/j.irfa.2022.102316

Conlon, T., & McGee, R. (2020). Safe haven or risky hazard? Bitcoin during the COVID-19 bear market. *Finance Research Letters*, 35, 101607. https://doi.org/10.1016/j.frl.2020.101607

Corbet, S., Larkin, C., & Lucey, B. (2020). The contagion effects of the COVID-19 pandemic: Evidence from Gold and Cryptocurrencies. *Finance Research Letters*, 35, 101554. https://doi.org/10.1016/j.frl.2020.101554

Dewandaru, G., Rizvi, S. A. R., Masih, R., Masih, M., & Alhabshi, S. O. (2014). Stock market co-movements: Islamic versus conventional equity indices with multi-timescales analysis. *Economic Systems*, 38, 553–571. https://doi.org/10.1016/j.ecosys.2014.05.003

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. https://doi.org/10.2307/2286348

El Mehdi, I. K., & Mghaieth, A. (2017). Volatility spillover and hedging strategies between Islamic and conventional stocks in the presence of asymmetry and long memory. *Research in International Business and Finance*, 39, 595–611. https://doi.org/10.1016/j.ribaf.2016.04.006

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

Feng, W., Wang, Y., & Zhang, Z. (2018). Can cryptocurrencies be a safe haven: a tail risk perspective analysis. *Applied Economics*, 50(44), 4745-4762. https://doi.org/10.1080/00036846.2018.1466993

Foglie, A. D., & Panetta, I. C. (2020). Islamic stock market versus conventional: Are Islamic investing a "Safe Haven" for investors? A systematic literature review. *Pacific-Basin Finance Journal*, 64, 101435. https://doi.org/10.1016/j.pacfin.2020.101435

Glosten, L.R., Jagannathan, R., Runkle, D.E., (1993). On the relation between the expected value and the volatility of the nominal excess return on stocks. *Journal of Finance* 48(5), 1779– 1801. https://doi.org/10.1111/j.1540-6261.1993.tb05128.x

Hasan, M. B., Hassan, M. K., Karim, Z. A., & Rashid, M. M. (2022c). Exploring the hedge and safe haven properties of cryptocurrency in policy uncertainty. *Finance Research Letters*, 46, 102272. https://doi.org/10.1016/j.frl.2021.102272

Hasan, M. B., Hassan, M. K., Rafia, H. T., & Rashid, M. M. (2022b). Searching Hedging Instruments Against Diverse Global Risks and Uncertainties. *Available at SSRN*: https://ssrn.com/abstract=4164794.

Hasan, M. B., Hassan, M. K., Rashid, M. M., & Alhenawi, Y. (2021a). Are safe haven assets really safe during the 2008 global financial crisis and COVID-19 pandemic? *Global Finance Journal*, 50, 100668. https://doi.org/10.1016/j.gfj.2021.100668

Hasan, M. B., Hassan, M. K., Rashid, M. M., Ali, M. S., & Hossain, M. N. (2021b). Calendar anomalies in the stock markets: conventional vs Islamic stock indices. *Managerial Finance*, 48(2), 258-276. https://doi.org/10.1108/MF-12-2020-0601

Hasan, M. B., Rashid, M. M., Shafiullah, M., & Sarker, T. (2022a). How resilient are Islamic financial markets during the COVID-19 pandemic? *Pacific-Basin Finance Journal*, 74, 101817. https://doi.org/10.1016/j.pacfin.2022.101817

Hassan, M. K., Hasan, M. B., & Rashid, M. M. (2021). Using precious metals to hedge cryptocurrency policy and price uncertainty. *Economics Letters*, 206, 109977. https://doi.org/10.1016/j.econlet.2021.109977

Hassan, M. K., Paltrinieri, A., Dreassi, A., Miani, S., & Sclip, A. (2018). The determinants of co-movement dynamics between Sukuk and conventional bonds. *The Quarterly Review of Economics and Finance*, 68, 73-84. https://doi.org/10.1016/j.qref.2017.09.003

Ho, C. S. F., Abd Rahman, N. A., Yusuf, N. H. M., & Zamzamin, Z. (2014). Performance of global Islamic versus conventional share indices: International evidence. *Pacific-Basin Finance Journal*, 28, 110-121. https://doi.org/10.1016/j.pacfin.2013.09.002

Hossain, M. S., Uddin, M. H., & Kabir, S. H. (2021). Sukuk and bond puzzle: an analysis with characteristics matched portfolios. *Emerging Markets Finance and Trade*, 57(13), 3792-3817. https://doi.org/10.1080/1540496X.2019.1706478

Kroner, K. F., & Ng, V. K. (1998). Modeling asymmetric comovements of asset returns. *The Review of Financial Studies*, 11(4), 817-844. 10.1093/rfs/11.4.817

Kroner, K. F., & Sultan, J. (1993). Time-varying distributions and dynamic hedging with foreign currency futures. *Journal of Financial and Quantitative Analysis*, 28(4), 535-551. https://doi.org/10.2307/2331164

Laurent, S., Rombouts, J. V., & Violante, F. (2012). On the forecasting accuracy of multivariate GARCH models. *Journal of Applied Econometrics*, 27(6), 934-955. https://doi.org/10.1002/jae.1248

Maghyereh, A. I., & Awartani, B. (2016). Dynamic transmissions between Sukuk and bond markets. *Research in International Business and Finance*, 38, 246-261. https://doi.org/10.1016/j.ribaf.2016.04.016

Masih, M., Kamil, N. K. & Bacha, O. I. (2018). Issues in Islamic equities: A literature survey. *Emerging Markets Finance and Trade*, 54(1), 1–26. https://doi.org/10.1080/1540496X.2016.1234370

Mezghani, T., & Boujelbène, M. (2018). The contagion effect between the oil market, and the Islamic and conventional stock markets of the GCC country: Behavioral explanation. *International Journal of Islamic and Middle Eastern Finance and Management*, 11(2), 157-181. https://doi.org/10.1108/IMEFM-08-2017-0227

Mirza, N., Rizvi, S. K. A., Saba, I., Naqvi, B., & Yarovaya, L. (2022). The resilience of Islamic equity funds during COVID-19: Evidence from risk adjusted performance, investment styles and volatility timing. *International Review of Economics & Finance*, 77, 276-295. https://doi.org/10.1016/j.iref.2021.09.019

Naifar, N., & Hammoudeh, S. (2016). Do global financial distress and uncertainties impact GCC and global sukuk return dynamics?. *Pacific-Basin Finance Journal*, 39, 57-69. https://doi.org/10.1016/j.pacfin.2016.05.016

Paltrinieri, A., Hassan, M. K., Bahoo, S., & Khan, A. (2019). A bibliometric review of Sukuk literature. *International Review of Economics & Finance*. https://doi.org/10.1016/j.iref.2019.04.004

Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*., 75(2), 335–346. https://doi.org/10.1093/biomet/75.2.335

Pirgaip, B., Arslan-Ayaydin, Ö., & Karan, M. B. (2020). Does Sukuk provide diversification benefits to conventional bond investors? Evidence from Turkey. *Global Finance Journal*, 50, 100533. https://doi.org/10.1016/j.gfj.2020.100533

Ramelli, S., & Wagner, A. F. (2020). Feverish Stock Price Reactions to COVID-19. *Review of Corporate Finance Studies*, 9(3), 622–655. https://doi.org/10.1093/rcfs/cfaa012

Rejeb, A. B. (2017). On the volatility spillover between Islamic and conventional stock markets: A quantile regression analysis. *Research in International Business and Finance*, 42, 794-815. https://doi.org/10.1016/j.ribaf.2017.07.017

Shahzad, S. J. H., Aloui, C., Jammazi, R., & Shahbaz, M. (2019). Are Islamic bonds a good safe haven for stocks? Implications for portfolio management in a time-varying regime-switching copula framework. *Applied Economics*, 51(3), 219-238. https://doi.org/10.1080/00036846.2018.1494376

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis*, 70, 101496. https://doi.org/10.1016/j.irfa.2020.101496

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

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, 101979. https://doi.org/10.1016/j.frl.2021.101979

Yousaf, I., & Yarovaya, L. (2021). Spillovers between the Islamic gold-backed cryptocurrencies and equity markets during the COVID-19: A sectorial analysis. *Pacific-Basin Finance Journal*, 101705. https://doi.org/10.1016/j.pacfin.2021.101705