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Islamic vs Conventional Market Connectedness under Global Uncertainties: Evidence from GCC Countries

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ABSTRACT

Global uncertainty increasingly shapes financial connectedness in oil-dependent economies, particularly in the Gulf Cooperation Council (GCC), where Islamic and conventional markets operate side by side. This study examines the time-varying and directional spillovers between global uncertainty indicators and GCC Islamic and conventional financial indices during 2014–2024. Using the quantitative empirical approach, Dynamic Conditional Correlation GARCH (DCC-GARCH) model and the Diebold-Yilmaz Spillover Index, the analysis evaluates evolving correlations, directional spillovers, and rolling system-wide connectedness. The results show that Islamic and conventional GCC indices remain strongly correlated throughout the sample, while linkages with uncertainty indicators intensify during the 2014–2016 oil price collapse, the COVID-19 pandemic, and the Russia-Ukraine conflict. The rolling Total Connectedness Index (TCI) ranges from 55% to 80%, indicating substantial and crisis-sensitive interdependence. Oil price uncertainty and the GCC conventional index emerge as the main stock transmitters, with the conventional index occupying a central position through strong two-way spillover links. These findings imply that GCC financial stability is highly exposed to external uncertainty, highlighting the need for crisis-responsive risk management and diversification strategies.

Keywords: Conventional Markets; Global Uncertainty; Gulf Cooperation Council; Islamic Finance; Oil Price Uncertainty; Spillover Index; Systemic Risk

JEL Classification: G15; G17; C32; Q43

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INTRODUCTION

Global uncertainties arising from Economic Policy Uncertainty (GEPU), Geopolitical Risk (GPR), and Oil Price Uncertainty (OPU) increasingly shape financial market interdependence by affecting investor sentiment, capital flows, and portfolio allocation across advanced and emerging markets (Chen, 2023; Ftiti & Hadhri, 2019; Li et al., 2022). These forces are especially relevant in the Gulf Cooperation Council (GCC), where financial systems remain closely tied to hydrocarbon revenues, regional geopolitical developments, and ongoing market liberalization (IMF, 2024; World Bank, 2025).

In oil-dependent financial systems, uncertainty does not only affect market returns through direct price movements, but also through changes in expectations, risk perception, and liquidity conditions. When policy uncertainty increases, investors may delay investment decisions or rebalance portfolios toward safer assets because uncertainty can weaken confidence and increase market volatility (Chen, 2023; Ftiti & Hadhri, 2019). When geopolitical tensions intensify, market participants may reassess regional risk exposure, particularly in areas where political instability is closely connected to energy markets and cross-market transmission (Li et al., 2022). Similarly, oil price uncertainty can influence fiscal expectations, corporate profitability, and investor confidence because oil revenues remain an important macroeconomic anchor for GCC economies (Dutta et al., 2024; Gu et al., 2021). These channels suggest that uncertainty transmission in the GCC is unlikely to be stable over time and may become stronger during periods of crisis.

The coexistence of Islamic and conventional financial markets further strengthens the relevance of the GCC as an empirical setting. Although both market segments operate within the same regional macroeconomic environment, they are built on different financial principles and screening mechanisms. Conventional markets are generally more exposed to broad financial leverage and market-based valuation channels, while Islamic markets follow Shariah-based restrictions that may reduce exposure to excessive speculation and interest-based activities (Asl et al., 2024; Elsayed et al., 2023). However, these institutional differences do not necessarily imply full insulation from systemic shocks, since Islamic and conventional indices may remain closely connected during crisis periods (Adekoya et al., 2022; Chazi et al., 2023). Recent evidence also shows that Islamic assets may provide only conditional stability, as contagion and spillovers can still emerge when financial turmoil and oil-related shocks intensify (Hassan et al., 2023; Mensi et al., 2022). Since both market segments are affected by the same oil-market cycle, investor sentiment, and external uncertainty conditions, their connectedness needs to be examined dynamically rather than through static comparisons alone.

The GCC provides a distinctive setting because Islamic and conventional markets operate side by side within the same macro-financial environment. Islamic finance is governed by Shariah principles that prohibit *riba* and *gharar*, and these contractual features may influence cross-market interlinkages and shock transmission differently from conventional markets (Elsayed et al., 2023). At the same time, GEPU, GPR, and OPU affect the region through different channels: policy uncertainty influences investment and capital allocation, geopolitical risk reflects security tensions highly relevant to the Middle East, and oil price uncertainty directly affects fiscal revenues, macroeconomic expectations, and investor sentiment in oil-exporting economies (Elsayed & Helmi, 2021).

Prior studies have documented market integration and spillover effects in GCC and Islamic finance settings, yet the evidence remains fragmented. Several studies examine volatility spillovers, uncertainty transmission, or Islamic-conventional market interactions, but many focus on single sources of uncertainty, static correlations, or pairwise linkages rather than a unified dynamic system (Bouri et al., 2023). Consequently, it remains unclear whether Islamic indices act as stabilizing components, show only relative resilience, or become similarly exposed to systemic shocks when multiple external uncertainties intensify within a dual financial structure.

This issue is theoretically important because any relative stability of Islamic markets may weaken when both market segments are embedded in the same regional liquidity cycle, oil dependency, and investor sentiment. Thus, the central question is not only whether Islamic markets are more stable in general, but whether they transmit and absorb shocks differently from conventional markets when policy, geopolitical, and oil-related uncertainties interact within a closely integrated GCC system.

To address this gap, the present study combines the Dynamic Conditional Correlation GARCH (DCC-GARCH) model with the Diebold-Yilmaz Spillover Index based on the Generalized Forecast Error Variance Decomposition (GFEVD) framework. This integrated approach allows the analysis of both evolving correlation patterns and directional connectedness, including total, directional, and net spillovers over time (Diebold & Yilmaz, 2012).

Accordingly, this study investigates the magnitude and direction of connectedness between GEPU, GPR, OPU, and GCC Islamic and conventional stock indices, compares the roles of both market segments as risk transmitters or receivers under global uncertainty conditions, and evaluates the usefulness of the dynamic connectedness framework beyond static association measures. Its novelty lies in integrating multiple uncertainty dimensions, a dual-market comparison, and a dynamic connectedness approach within one GCC-focused analysis. In doing so, the study contributes to the literature by sharpening empirical understanding of systemic vulnerability and financial resilience in energy-dependent dual financial systems, while offering implications for portfolio diversification, risk management, and policy design.

LITERATURE REVIEW

Financial Connectedness Theory

Financial connectedness theory views systemic risk as a process in which shocks are transmitted across interdependent markets rather than remaining within isolated assets. In this perspective, uncertainty alters expectations, portfolio rebalancing, and risk premia, thereby changing both the intensity and direction of co-movement across financial variables. In the GCC, this logic is especially relevant because Islamic and conventional equity markets operate within the same macro-financial environment, yet differ in contractual structure and leverage exposure. Consequently, systemic vulnerability in the region should be assessed not only through average correlation, but also through time-varying and directional transmission mechanisms (Diebold & Yilmaz, 2012; Engle, 2002).

Global Uncertainty Indicators

GEPU reflects ambiguity in fiscal and regulatory directions that can delay investment and amplify market volatility (Baker et al., 2016). GPR captures tensions, conflicts, and security-related disturbances that affect trade, expectations, and market confidence, especially in politically sensitive regions such as the Middle East (Eissa & Refai, 2024;

Elsayed & Helmi, 2021). OPU represents instability in oil-market conditions that directly influences revenues, fiscal capacity, and investor sentiment in hydrocarbon-dependent economies (Dutta et al., 2024; Gu et al., 2021).

Islamic vs Conventional GCC Markets

Evidence from sharia equity markets also suggests that firm value remains responsive to financial signals, particularly profitability, leverage, and growth expectations, indicating that Islamic market valuation is still shaped by value-relevant firm fundamentals (Marpaung et al., 2025). Within this environment, Islamic and conventional stock markets may respond differently to external shocks. Islamic finance restricts *riba*, *gharar*, and speculative leverage, while emphasizing risk-sharing and asset-backed transactions; these features may moderate transmission intensity under stress, although they do not eliminate exposure to shared macro-financial pressures (Asl et al., 2024). The coexistence of both market systems in the GCC therefore provides a relevant setting for assessing whether institutional differences translate into different spillover roles when policy, geopolitical, and oil-related uncertainty interact simultaneously. Beyond external uncertainty, financial risk may also be shaped by internal firm-level characteristics, as leadership attributes can influence investor perception and stock price risk (Pangestuti & Pujihastuti, 2024).

Prior Studies

Recent studies show that uncertainty spillovers in oil-linked and emerging markets are time-varying and crisis-sensitive. Crisis episodes intensify market volatility, dynamic correlation, and contagion across asset classes, indicating that systemic connectedness is inherently time-varying under stress conditions (Pangestuti, 2025). Evidence from GCC sectors indicates that oil implied volatility and geopolitical risk become more influential during turbulent market conditions (Bouri et al., 2023), while broader cross-market studies report asymmetric responses of stock returns to GEPU and GPR shocks (Eissa & Refai, 2024). In oil-exporting MENA economies, oil-price instability has also been linked to higher financial stress and stronger external-risk transmission (Gu et al., 2021).

The evidence on Islamic versus conventional markets remains mixed. Some studies document relatively lower contagion or stronger diversification potential in Islamic assets, particularly when connectedness is examined dynamically (Billah et al., 2024). Ali et al. (2024) also show that Islamic market indices across countries may exhibit long-run adjustment and cross-market interaction, indicating that Islamic markets should be examined within an interconnected financial system rather than in isolation. Other studies find that Islamic and conventional indices remain closely linked and may display similar volatility patterns, although Islamic indices often exhibit relatively lower volatility during crisis periods (Adekoya et al., 2022; Chazi et al., 2023). This mixed evidence suggests that resilience in Islamic markets is likely relative rather than absolute. More importantly, prior research rarely integrates GEPU, GPR, and OPU in one GCC-focused framework while simultaneously comparing Islamic and conventional indices through both evolving correlations and directional spillovers. That gap motivates the present study.

Hypotheses Development

The hypotheses are developed based on the idea that global uncertainty indicators may influence GCC Islamic and conventional markets through both correlation and spillover channels. Since the GCC financial system is highly exposed to oil-market movements, geopolitical tension, and policy uncertainty, the transmission of shocks is expected to vary across time and across market segments. Therefore, the hypotheses are formulated to test whether global uncertainty affects both markets, whether Islamic markets show

relatively lower spillover intensity, and whether the connectedness structure is time-varying and directional.

Dynamic Spillovers from Global Uncertainty to GCC Dual Markets

Uncertainty shocks are expected to generate dynamic spillovers across GCC equity markets because changes in policy expectations, geopolitical tension, and oil-market instability affect valuation, liquidity, and investor sentiment simultaneously. Prior evidence shows that these channels become more relevant during periods of turbulence and can intensify cross-market transmission within oil-dependent economies (Bouri et al., 2023; Eissa & Refai, 2024; Gu et al., 2021). Therefore, the first hypothesis is formulated as follows.

H1: Global uncertainties exert significant dynamic spillover effects on both Islamic and conventional markets in the GCC region.

Relative Resilience of Islamic Markets

Islamic markets are often viewed as relatively more resilient because Shariah-based principles prohibit *riba* and *gharar* and impose tighter screening on speculative activities; however, empirical evidence suggests that this resilience is conditional rather than absolute, especially when Islamic and conventional assets are embedded in the same macro-financial system and remain dynamically interconnected (Chazi et al., 2023; Elsayed et al., 2023).Based on this reasoning, Islamic indices are expected to display lower net spillover intensity than conventional indices.

H2: Islamic stock markets exhibit lower net spillover intensity compared to conventional stock markets, indicating greater resilience to global uncertainty shocks.

Time-Varying and Directional Connectedness

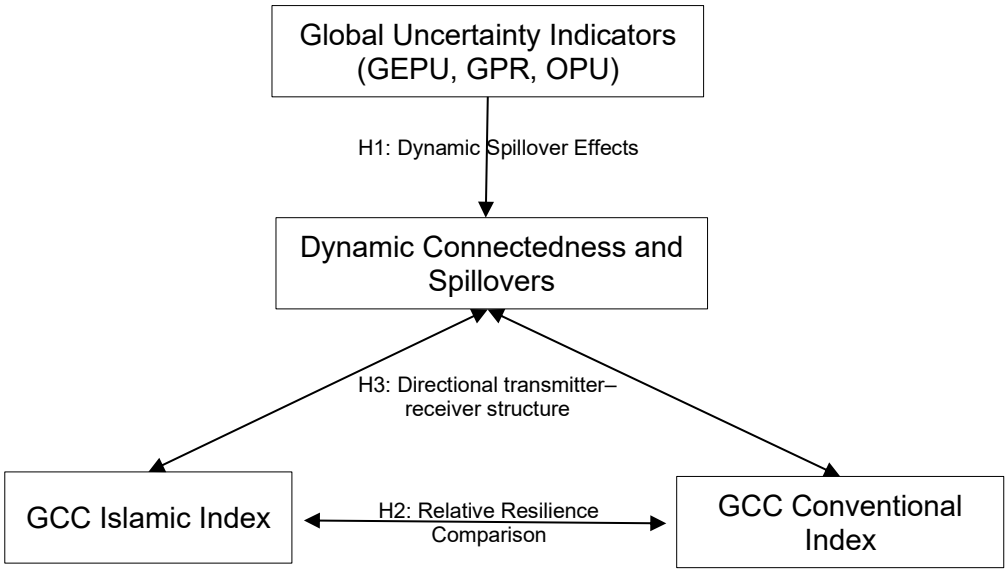
Connectedness in a dual financial system may change over time because uncertainty shocks do not affect all variables with the same intensity or direction. Some variables may become stronger transmitters of shocks, while others may function mainly as receivers, especially during crisis periods. Therefore, static correlations or standard VAR summaries may not be sufficient to explain the full structure of systemic risk transmission. A framework that measures total, directional, and net spillovers is required to identify how shocks move across GEPU, GPR, OPU, GCC Islamic markets, and GCC conventional markets. The Diebold-Yilmaz approach is used in this study as an empirical tool to examine whether the connectedness structure is dynamic and directional under multiple uncertainty sources (Billah et al., 2024; Diebold & Yilmaz, 2012). Hence, the third hypothesis is stated as follows.

H3: Global uncertainty indicators and GCC dual financial markets exhibit time-varying and directional connectedness, with different variables acting as transmitters or receivers of shocks across crisis periods.

Conceptual Framework

The conceptual logic of this study is that global uncertainty indicators act as external shocks that shape the connectedness of GCC Islamic and conventional stock markets. GEPU, GPR, and OPU are expected to influence both markets directly, while the two market segments are also linked through reciprocal spillovers inside the regional financial system. The DCC-GARCH model is used to capture changing correlation patterns, whereas the Diebold-Yilmaz framework identifies total, directional, and net spillovers across variables.

Figure 1. Conceptual Framework and Hypothesized Links



RESEARCH METHOD

Research Approach

This study adopts a quantitative empirical approach to investigate the connectedness between global uncertainty indicators and the GCC dual financial system. The analysis is designed to evaluate how GEPU, GPR, and OPU interact with GCC Islamic and conventional stock indices through time-varying correlations and directional spillover transmission.

Research Design

The empirical design combines two complementary stages. First, the DCC-GARCH model is used to estimate evolving conditional correlations among the variables. Second, the Diebold-Yilmaz connectedness framework based on the GFEVD of a Vector Autoregression (VAR) system is applied to measure total, directional, and net spillovers. In addition, rolling-window estimation is employed to trace how connectedness changes over time during major crisis episodes throughout 2014-2024.

Sampling Method

The study uses purposive sampling. The sample consists of five monthly series selected on the basis of theoretical relevance, data continuity, and comparability within one regional framework, namely the global GEPU index, GPR index, OPU index, GCC Islamic stock index, and GCC conventional stock index. These variables were chosen because they represent the principal external uncertainty channels and the dual-market structure examined in this study.

Data Collection

The data consist of five monthly series covering the 2014–2024 period, as summarized in Table 1. The data were processed using RStudio software.

Table 1. Description of Monthly Data Series

Variable	Description	Data Source	Category

GEPU	Global Economic Policy Uncertainty Index	www.policyuncertainty.com	Uncertainty indicators
GPR	Geopolitical Risk Index		
OPU	Oil Price Uncertainty Index		
GCC Islamic Stock Index	GCC Islamic stock market index	London Stock Exchange Group (LSEG)	Dual financial index
GCC Conventional Stock Index	GCC conventional stock market index		

Source: Authors' compilation based on LSEG and www.policyuncertainty.com data.

To ensure stationarity and to capture proportional changes in each variable, all price and index series are transformed into continuously compounded returns. For each series x_t:

$$r_t = ln\left(\frac{x_t}{x_{t-1}}\right) = l_n(x_t) - ln(x_{t-1})$$

where, r_t is log return at time *t* and x_t is index or price level at time *t*. This transformation stabilizes the variance and converts the level series into a stationary form suitable for volatility modeling.

Data Analysis

Dynamic Conditional Correlation (DCC-GARCH) Model

Following Engle (2002), the DCC–GARCH framework is implemented in two stages. In the first stage, each return series is modeled using a univariate GARCH (1,1) specification to estimate its conditional variance and obtain standardized residuals. In the second stage, these standardized residuals are used to construct a time-varying conditional correlation matrix, allowing the dependence structure across the GCC Islamic index, GCC conventional index, and the uncertainty indicators to evolve over time. This specification is particularly appropriate for the present study because it separates volatility dynamics at the individual series level from correlation dynamics at the system level, thereby providing a clearer representation of changing co-movement during episodes of market stress.

Univariate GARCH (1,1) Specification

Each return series $r_{i,t}$ follows a univariate GARCH (1,1) process:

$$r_{i,t} = \mu_i + \varepsilon_{i,t}$$
$$\varepsilon_{i,t} = \sigma_{i,t} z_{i,t} \quad , \quad z_{i,t} \sim i.i.d.(0,1)$$
$$\sigma_{i,t}^2 = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i \sigma_{i,t-1}^2$$

where, $\sigma_{i,t}^2$denotes the conditional variance, $\alpha_i$captures the ARCH effect (reaction to past shocks), and β_i represents the GARCH effect (volatility persistence).

Standardized Residuals

The standardized residuals represent the innovation terms that have been adjusted by their corresponding conditional standard deviations, so that the remaining disturbances are scale-free and comparable across variables. In the DCC–GARCH framework, this step is essential because the dynamic correlation process is estimated not from the raw

residuals, but from residuals that have been purged of individual volatility effects. As a result, the vector of standardized residuals captures the unexpected shocks remaining after controlling for time-varying variance in each series, providing the appropriate input for constructing the conditional covariance and correlation dynamics across the GCC Islamic index, GCC conventional index, and global uncertainty indicators.

Residuals are standardized as:

$$u_{i,t} = \frac{\varepsilon_{i,t}}{\sigma_{i,t}}$$

and collected into a vector $u_t = [u_{1,t}, u_{2,t}, \dots, u_{N,t}]'$

Dynamic Conditional Correlation (DCC)

The DCC specification is particularly valuable because it allows the correlation structure among variables to change over time rather than remain constant throughout the sample period. This is highly relevant in the present study, since the relationships between GCC Islamic and conventional stock indices and global uncertainty indicators are expected to strengthen during episodes of market stress and weaken during more stable periods. By estimating a dynamic correlation matrix, the DCC model captures how shocks to oil markets, geopolitical developments, and policy uncertainty alter the intensity of comovement across variables, thereby providing a more realistic representation of financial integration and contagion in the GCC dual financial system. Following Engle (2002), the conditional correlation matrix evolves as:

$$Q_t = (1 - a - b)\bar{Q} + a(u_{t-1}u'_{t-1}) + bQ_{t-1},$$

Q_t is time–varying covariance matrix of standardized residuals, $\bar{Q}$ is unconditional covariance of u_t , a and b is non–negative scalar parameters $(a + b < 1)$. The DCCs are computed as:

$$\rho_{i_j,t} = \frac{q_{ij,t}}{\sqrt{q_{ii,t}q_{jj,t}}}$$

and the conditional covariance matrix returns is:

$$H_t = D_t R_t D_t$$

where, $D_t = diag\,(\sigma_{1,t}, \sigma_{2,t}, \dots, \sigma_{N,t})$ and R_t is the matrix containing all $\rho_{i_j,t}$. The DCC-GARCH model thus provides time-varying correlations among markets or indices. The Diebold–Yilmaz framework quantifies the extent and direction of volatility (or return) spillovers across multiple financial variables using a forecast-error variance-decomposition approach based on a VAR model.

To complement the correlation analysis, this study applies the connectedness framework of Diebold and Yilmaz (2012), which is based on the GFEVD derived from a VAR system. The advantage of this method is that it does not rely on orthogonalized shocks that depend on variable ordering. Instead, it measures how much of the forecast error variance of each variable can be attributed to shocks originating from itself and from other variables in the system. This allows the analysis to identify not only the total degree of interconnectedness, but also the direction of spillovers, namely whether a variable mainly transmits shocks to others or predominantly receives shocks from the rest of the system.

Vector Autoregression (VAR p)

The VAR (p) model provides the core multivariate structure for examining how the return of each variable is jointly influenced by its own past values and by the lagged values of all other variables in the system. In this study, the VAR specification is useful because systemic spillovers cannot be assessed through isolated equations; instead, they must be analyzed within an interconnected framework in which shocks may propagate across markets and uncertainty indicators over time. By estimating the joint dynamics among returns, the VAR model serves as the basis for deriving the forecast-error variance decomposition used in the Diebold–Yilmaz connectedness analysis. Let $r_t = [r_{1,t}, r_{2,t}, \dots, r_{N,t}]'$ denote the vector returns:

$$r_t = \sum_{i=1}^{p} \phi_i r_{t-i} + \varepsilon_t, \varepsilon_t \sim (0, \Sigma)$$

where ϕ_i are coefficient matrices and Σ is the residual covariance matrix.

Moving-Average Representation

The moving-average representation rewrites the VAR system as an infinite sequence of current and past shocks, making it possible to trace how an innovation in one variable affects the future path of the entire system. This transformation is important because connectedness measures are based on the extent to which forecast errors in one variable can be explained by shocks originating from other variables. In other words, the moving-average form links the estimated VAR coefficients to the transmission mechanism of shocks over different horizons, thereby providing the analytical foundation for the generalized forecast-error variance decomposition.

$$r_t = \sum_{h=0}^{\infty} A_h \varepsilon_{t-h}$$
$$A_h = \phi_1 A_{h-1} + \phi_2 A_{h-2} + \cdots + \phi_p A_{h-p}$$

Generalized Forecast-Error Variance Decomposition (GFEVD)

The GFEVD is a crucial component of the Diebold–Yilmaz framework because it quantifies how much of the forecast error variance of each variable can be attributed to shocks originating from itself and from other variables in the system. Unlike orthogonalized variance decomposition, the generalized approach is invariant to variable ordering, making it more suitable for a multivariate setting in which no clear theoretical hierarchy exists among uncertainty indicators and financial indices. In this study, the GFEVD provides the empirical basis for measuring total, directional, and net spillovers, thereby enabling a more reliable assessment of how shocks from GEPU, GPR, OPU, and GCC financial markets are transmitted across the interconnected system. The contribution of shocks in variable j to the H-step-ahead forecast-error variance of variable *i* is:

$$\theta_{ij}^{(H)} = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} \left(e_i' A_h \Sigma e_j\right)^2}{\sum_{h=0}^{H-1} \left(e_i^1 A_h \Sigma A_h' e_i\right)}$$

where e_i is a selection vector (1 for the *i*-th position, 0 otherwise) and σ_{jj} s the j-th diagonal element of Σ.

Total Connectedness Index (TCI)

The TCI summarizes the overall degree of spillover intensity within the system by measuring the share of forecast-error variance that comes from cross-variable shocks rather than own shocks. A higher TCI indicates that the variables are more strongly interconnected and that systemic disturbances are more likely to spread across the network. In the context of this study, the TCI is particularly useful for showing whether the GCC dual financial system becomes more tightly linked to global uncertainty indicators during major crisis periods, thereby offering a compact indicator of systemic vulnerability over time.

$$TCI = \frac{\Sigma_{i,j=1}^{N} \ , \ i \neq j \ \tilde{\theta}_{ij}^{(H)}}{N} \times 100$$

where, high TCI indicates stronger total spillovers (systemic interconnectedness) within the system.

Directional Spillovers

Directional spillovers provide a more detailed view of connectedness by distinguishing between shocks transmitted by a variable to the rest of the system and shocks received by that variable from others. This distinction is important because a variable may be highly connected overall, yet its role can differ substantially depending on whether it mainly acts as a sender or receiver of volatility. The net spillover measure further refines this interpretation by comparing outward and inward spillovers: a positive net value indicates that a variable functions as a net transmitter of shocks, whereas a negative value indicates that it is a net receiver. In this study, these measures help identify whether GCC Islamic and conventional indices, as well as GEPU, GPR, and OPU, occupy asymmetric roles in the transmission of systemic risk.

from variable *i to* all others:

$$C_{i \to \cdot}^{(H)} = \sum_{j=1, j \neq i}^{N} \tilde{\theta}_{ji}^{(H)} \times 100$$

from all others to variable *i*:

$$C_{\cdot \to i}^{(H)} = \sum_{j=1, j \neq i}^{N} \tilde{\theta}_{ij}^{(H)} \times 100$$

$$C_i^{net} = C_{i \to \cdot}^{(H)} - C_{\cdot \to i}^{(H)}$$

C_i^{net} > 0 implies that variable *i* acts as a net transmitter while C_i^{net} < 0 implies a net receiver of shocks. A variable is a net transmitter if NET = TO − FROM > 0, and a net receiver if NET < 0.

Rolling Window Dynamic Connectedness

Rolling-window estimation is important because systemic connectedness is unlikely to remain stable over the full sample period, especially in a region exposed to recurring oil, policy, and geopolitical shocks. By recalculating the connectedness measures over successive 24-month subperiods, this approach makes it possible to observe how the intensity of spillovers evolves across different market conditions rather than relying on a single full-sample average. In the context of this study, the rolling-window framework is particularly useful for identifying whether crisis episodes such as the oil price collapse, the COVID-19 pandemic, and the Russia–Ukraine conflict correspond to temporary

surges in interconnectedness, thereby revealing the time-varying nature of systemic risk in the GCC dual financial system. To capture temporal variation, connectedness is computed over rolling windows of fixed length w (24 months):

$$TCI_t = \frac{\Sigma_{i,j=1}^{N} \ , \ i \neq j \ \tilde{\theta}_{ij,t}^{(H)}}{N} \times 100$$

where *t* represents the end point of each window.

The combined use of DCC–GARCH and the Diebold–Yilmaz approach provides a complementary empirical strategy. The DCC–GARCH model captures evolving conditional correlations, indicating whether market co-movements strengthen or weaken over time, whereas the Diebold–Yilmaz framework quantifies the magnitude and direction of spillovers within the system. In this study, the rolling-window connectedness analysis with a 24-month window is employed to trace how systemic linkages change across major events over the 2014–2024 period. This integrated design is therefore suitable for examining both the persistence of market integration and the changing role of each variable as a transmitter, receiver, or central node of systemic risk.

RESULTS

Stationarity Test Results

The stationarity test results in Table 2 reports that all five return series are stationary. For every variable, the ADF and PP p-values are below 0.01, while the KPSS statistics range from 0.02066 to 0.13065, all below the 5% critical value of 0.463. These results indicate that the return series satisfy the stationarity requirement for the subsequent DCC-GARCH and Diebold-Yilmaz analyses. Taken together, the three stationarity tests provide consistent preliminary evidence that the variables can be modeled in return form without unit root concerns.

Table 2. Stationary Test Results

Variable	ADF_p_value	PP_p_value	KPSS_stat	Stationary_Return
r_GPR	0.01	0.01	0.02066	Stationary
r_GEPU	0.01	0.01	0.02557	Stationary
r_OPU	0.01	0.01	0.02145	Stationary
r_GCC_SHAR	0.01	0.01	0.13065	Stationary
r_GCC_CONV	0.01	0.01	0.05727	Stationary

Source: RStudio Output (2025)

Dynamic Correlation Results

Figure 2 presents the dynamic conditional correlations among the uncertainty indicators and the two GCC market indices. The figure is used to examine whether the co-movement among variables changes over time rather than remaining constant throughout the sample period.

Figure 2. DCC Garch

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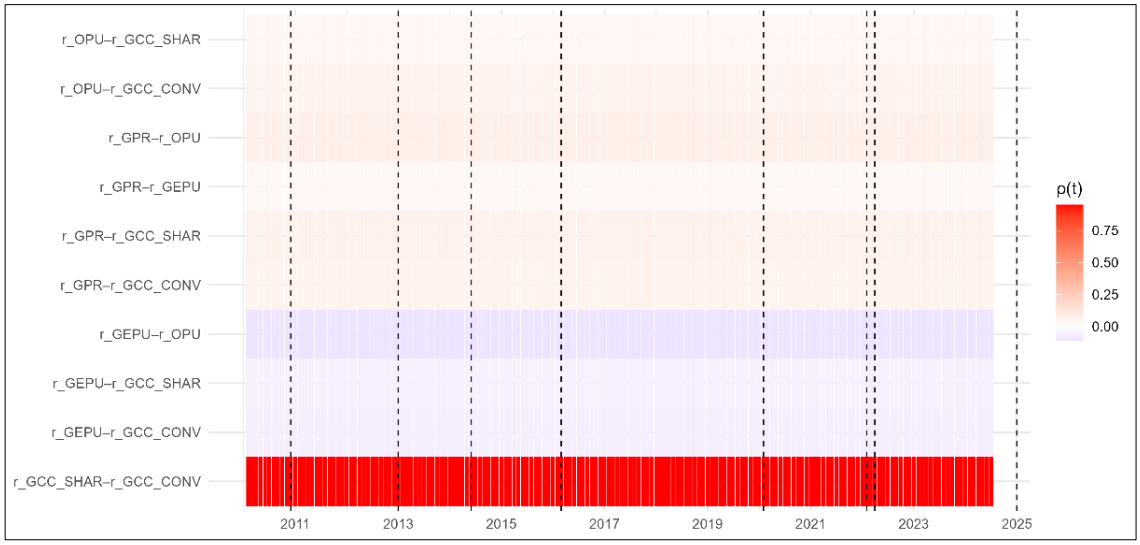


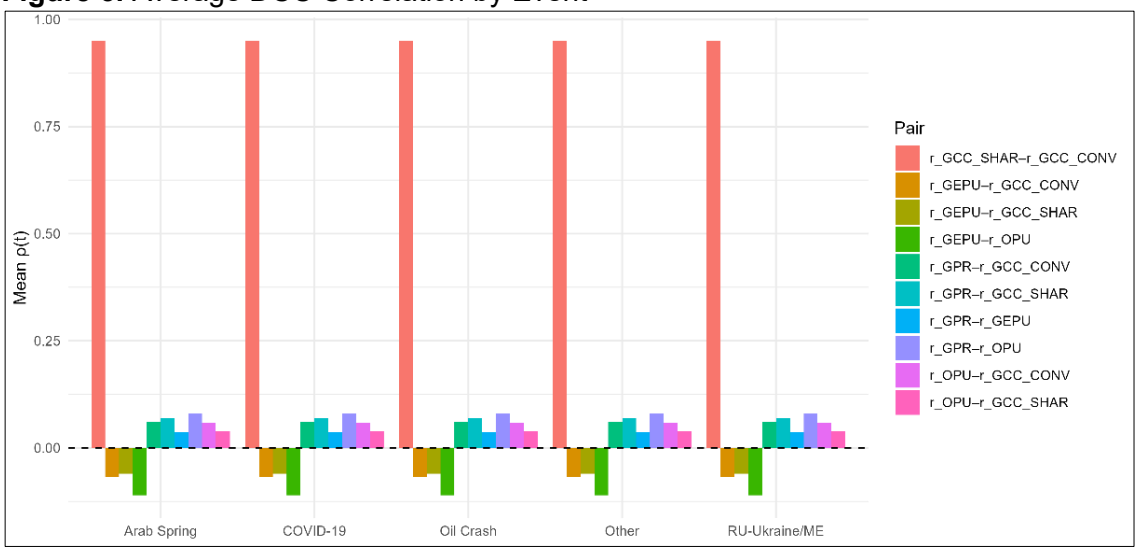
Source: RStudio Output (2025)

Figure 2 shows that the correlation between GCC_SHAR and GCC_CONV remains consistently high throughout the sample. Correlations involving OPU, GPR, and GEPU vary overtime and become more pronounced during the 2014-2026 oil-price shock and the 2020-2022 pandemic period. These patterns indicate that the GCC dual financial system is exposed to time-varying external uncertainty transmission.

Event-Based Correlation Patterns

Figure 3 reports the average DCC correlations across selected event windows. This figure provides a clearer comparison of how correlations differ between normal and crisis periods.

Figure 3. Average DCC Correlation by Event



Source: RStudio Output (2025)

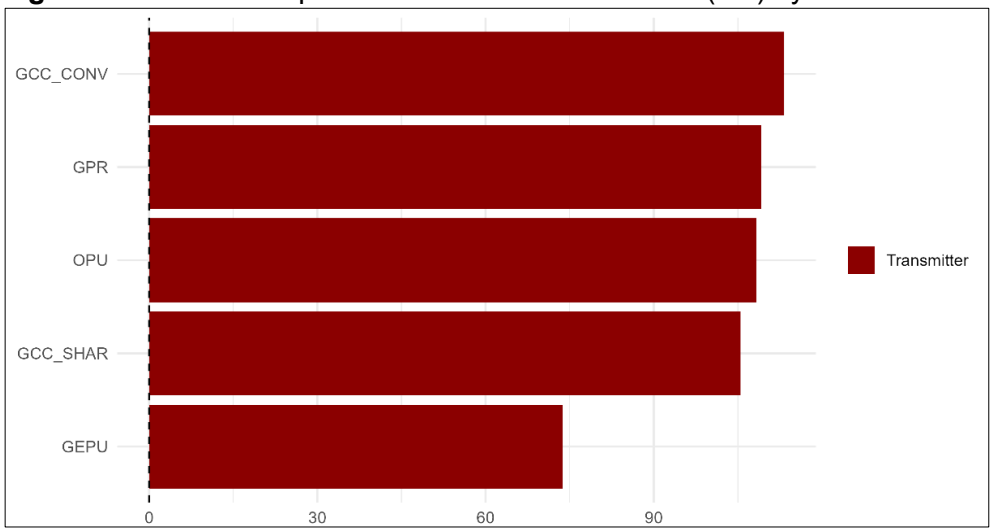
Figure 3 shows event-based average correlations. The GCC Islamic and GCC conventional indices record the highest average correlation in every event window, while correlations involving GPR, GEPU, and OPU are lower but tend to be higher during crisis episodes than in other periods. This finding suggests that external uncertainty indicators

become more relevant to GCC market co-movement during periods of financial and geopolitical stress.

Directional Spillovers and Network Structure

Figure 4 presents the directional spillovers transmitted to others (TO) by each variable. This result identifies which variables have stronger outward shock-transmission roles in the system.

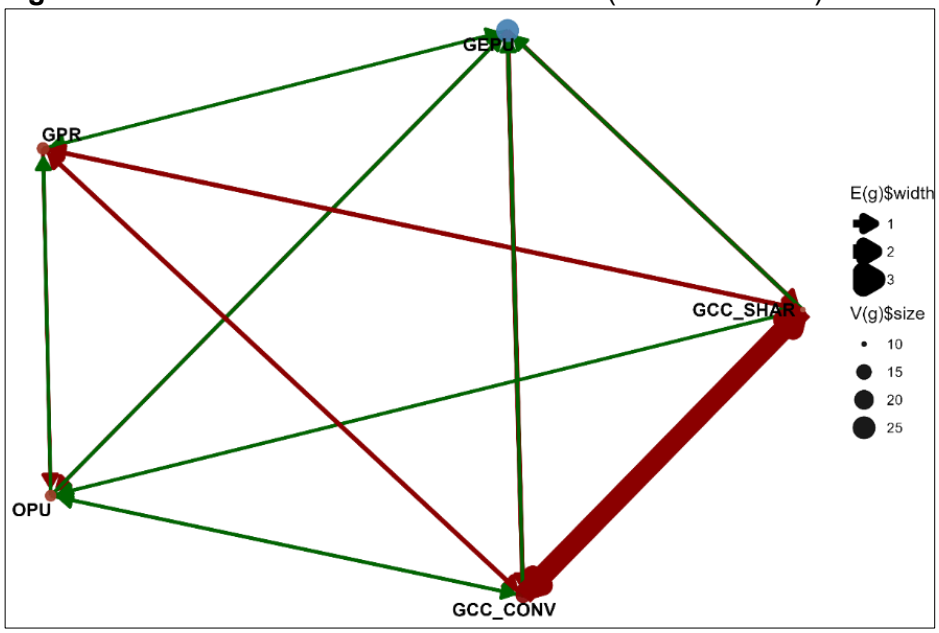
Figure 4. Directional Spillovers Transmitted to Others (TO) by Variable



Source: RStudio Output (2025)

Figure 4 reports the directional spillovers transmitted to others (TO). GCC_CONV and OPU have the largest TO values, followed by GPR and GCC_SHAR, whereas GEPU records the lowest outward spillover. These results identify the variables with the strongest shock-transmission capacity in the system. Figure 5 presents the directional connectedness network based on the Diebold-Yilmaz framework. The network is used to visualize the relative centrality and direction of spillover links among the variables.

Figure 5. Directional Connectedness Network (Diebold-Yilmaz)



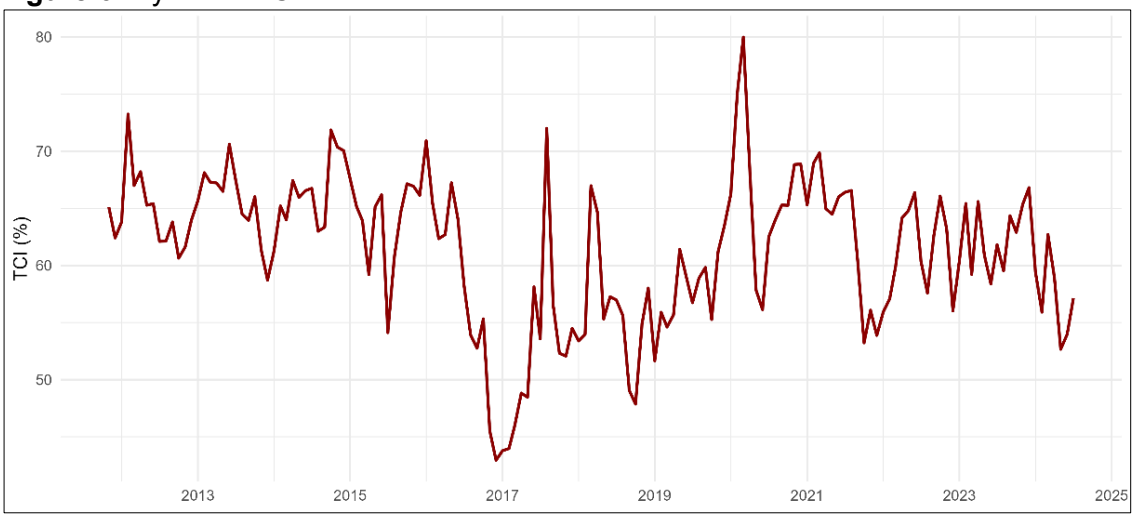
Source: RStudio Output (2025)

Figure 5 visualizes the directional connectedness network. GCC_CONV appears as the most central node, with relatively thicker links connecting it to the other variables. The network also shows visible links from OPU and GPR, while GCC_SHAR remains connected but less central than GCC_CONV. The network confirms that connectedness is asymmetric across variables and concentrated around the conventional index and oil-related uncertainty.

Dynamic System-Wide Connectedness

Figure 6 reports the rolling Total Connectedness Index (TCI). This figure is used to examine whether the overall level of system-wide connectedness changes over time.

Figure 6. Dynamic TCI



Source: RStudio Output (2025)

Figure 6 reports the rolling Total Connectedness Index (TCI). The TCI ranges from about 55% to 80% over the sample and rises noticeably during major stress episodes, including the oil-price shock and the COVID-19 period. This pattern indicates that overall system connectedness is time-varying rather than constant.

Hypothesis Summary

Regarding the hypotheses, the results support H1 because the DCC correlations and rolling TCI show significant time-varying spillovers between global uncertainty indicators and both GCC market indices. H2 is partially supported because GCC_CONV shows stronger outward connectedness and a more central network position than GCC_SHAR, suggesting that Islamic markets display relative, but not absolute, resilience. H3 is supported because the rolling TCI and directional connectedness network show that the relationship among GEPU, GPR, OPU, GCC Islamic markets, and GCC conventional markets is time-varying and directional, with different variables acting as transmitters or receivers across the sample period.

DISCUSSION

Dynamic Spillovers between Global Uncertainties and GCC Dual Markets

The first finding supports H1 and the study's objective of identifying the magnitude and direction of connectedness between global uncertainty indicators and GCC dual financial markets. The results show that spillovers are dynamic rather than constant: the

conditional correlation between the GCC Islamic and conventional indices remains persistently high, while the rolling TCI varies between approximately 55% and 80% and increases during major stress episodes. This pattern indicates that global uncertainty is transmitted through time-varying channels rather than through a uniform mechanism.

The result confirms prior evidence that uncertainty spillovers in oil-linked and emerging markets intensify during turbulent periods and that GCC markets become more sensitive to oil-related and geopolitical disturbances under crisis conditions (Bouri et al., 2023; Eissa & Refai, 2024; Gu et al., 2021). Theoretically, this finding is consistent with financial connectedness theory, which views systemic risk as a dynamic process in which common shocks alter co-movement, expectations, and cross-market transmission over time (Diebold & Yilmaz, 2012).

Relative Resilience of Islamic versus Conventional Markets

The second finding provides partial support for H2 and addresses the objective of comparing the roles of Islamic and conventional markets as shock transmitters or receivers. The results do not indicate full insulation of the Islamic segment; instead, they show relative rather than absolute resilience. GCC_CONV occupies a more central position in the network and records stronger outward connectedness, while OPU emerges as a major shock transmitter, suggesting that oil-market uncertainty and the conventional segment remain dominant transmission channels in the GCC system. GCC_SHAR remains connected to the system but appears less central than its conventional counterpart. These findings are broadly consistent with prior evidence that Islamic segments in dual financial systems are not fully insulated from system-wide shocks, that conventional markets often occupy a more central transmission role, and that oil-related uncertainty remains a major source of connectedness in GCC and related financial markets (BenSaïda et al., 2024; Elsayed et al., 2023).

This evidence extends the mixed literature on Islamic-versus-conventional market resilience. It is consistent with studies showing that Islamic assets may offer only conditional stability, as contagion can still emerge during broad financial turmoil and spillovers tend to intensify when shocks originate from oil-related channels (Hassan et al., 2023; Mensi et al., 2022). At the same time, it is also compatible with recent dynamic connectedness evidence suggesting that Islamic markets can exhibit lower contagion intensity without becoming fully decoupled from conventional markets (Billah et al., 2024). The theoretical implication is that Shariah-based market features may moderate spillover intensity, but they do not remove exposure when both segments share the same regional liquidity conditions, investor sentiment, and oil dependence.

Time-Varying and Directional Connectedness beyond Static Correlations

The third finding supports H3 by showing that connectedness among GEPU, GPR, OPU, GCC Islamic markets, and GCC conventional markets is both time-varying and directional. While the DCC-GARCH model captures evolving co-movement, the Diebold–Yilmaz connectedness measures identify total, directional, and net spillovers and reveal which variables act as central nodes, transmitters, or receivers. In this study, the combination of DCC-GARCH, directional TO measures, the connectedness network, and the rolling TCI demonstrates that systemic risk in the GCC dual financial system is directional and crisis-sensitive.

The time-varying nature of connectedness also implies that systemic risk in the GCC dual financial system cannot be interpreted only from full-sample averages. A full-sample estimate may summarize the overall level of interdependence, but it may hide important changes that occur during periods of oil-price instability, geopolitical tension, or broader

financial stress. In this study, the rolling TCI provides additional evidence that connectedness strengthens during major crisis episodes, suggesting that the transmission mechanism becomes more intense when external uncertainty increases. This pattern is important because investors and policymakers may underestimate systemic vulnerability if they rely only on static correlations or average spillover values.

The directional results further show that the role of each variable is not identical. OPU and GCC_CONV appear more influential in transmitting shocks, while GCC_SHAR remains connected but less dominant in the network. This indicates that Islamic market resilience should be understood as relative and conditional, not as complete separation from the conventional financial system. Theoretically, this finding supports the argument that institutional differences may reduce some forms of risk exposure, but shared macroeconomic conditions, regional liquidity, and oil dependence continue to connect Islamic and conventional markets. Therefore, the evidence strengthens the view that GCC financial stability requires continuous monitoring of both market segments and uncertainty indicators.

This confirms the usefulness of the Diebold–Yilmaz approach for examining multi-source uncertainty within a dual-market structure and supports earlier studies that emphasize the value of directional connectedness measures over static or undifferentiated VAR summaries (Billah et al., 2024; Diebold & Yilmaz, 2012). Overall, the discussion suggests that the GCC dual financial system should be interpreted as an integrated but internally differentiated structure in which external uncertainty is filtered mainly through oil-related shocks and the more central conventional market segment.

CONCLUSION

This study set out to examine how global uncertainty indicators GEPU, GPR, and OPU shape the connectedness between Islamic and conventional financial indices in the GCC over the 2014–2024 period. Using the Diebold–Yilmaz spillover framework, complemented by dynamic connectedness analysis, the findings show that the GCC dual financial system is strongly interconnected and remains highly sensitive to external uncertainty shocks. The results indicate that OPU is a major transmitter of shocks, while the GCC conventional financial index occupies a central position in the spillover system through strong two-way connectedness.

The rolling TCI further reveals that systemic linkages are time-varying and intensify during major crisis episodes, particularly the 2014-2016 oil price collapse, the COVID-19 pandemic, and the Russia-Ukraine conflict. These findings suggest that uncertainty transmission in the GCC is driven mainly by oil-related and geopolitical channels rather than being evenly distributed across all variables. They also show that Islamic and conventional segments are closely linked within the same regional financial architecture, implying that the resilience of Islamic markets should be understood as relative rather than fully insulated from systemic shocks.

Theoretically, this study extends the literature on dual financial systems by showing that market connectedness in the GCC is dynamic, crisis-sensitive, and shaped by multiple external uncertainty sources. Practically, the findings imply that policymakers should strengthen crisis-monitoring mechanisms, especially for oil-market and geopolitical developments, while investors should not assume full diversification benefits between Islamic and conventional GCC indices during turbulent periods. This implication is also consistent with evidence showing that weak financial literacy and poor debt management behavior may increase financial risk exposure, suggesting that financial stability efforts

should also be supported by broader financial literacy and risk-awareness initiatives (Tan et al., 2026). Accordingly, future policy efforts should focus on improving regional risk surveillance, integrating uncertainty indicators into macro-financial monitoring, and promoting portfolio strategies that account for shifting connectedness under crisis conditions.

LIMITATION

The connectedness (Diebold–Yilmaz) and DCC–GARCH frameworks describe spillover dynamics but do not provide strict causal inference. Future research may incorporate country-specific uncertainty indicators, sectoral indices, and alternative model settings to test robustness.

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DECLARATION OF CONFLICTING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

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