Volatility Contagion and Portfolio Diversification among Sharīʿah and Conventional Indices: An Evidence by MGARCH Models

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ABSTRACT. Risk mitigation is one of the main concerns for an investor, and has gotten renewed attention after the 2007-2008 financial crisis. This paper tries to examine the scope of Sharīʿah indices in offering an opportunity for portfolio diversification. The paper empirically analyzes the existence of volatility contagion among conventional and Sharīʿah indices and delves into the presence of portfolio diversification opportunities among them. The considered sample ranges from 11th July 2008 to 30th July 2018, and includes conventional and Sharīʿah indices of the major economies and regions of the world (USA, Asia, Africa, and Europe). We employ ARDL cointegration and MGARCH family models viz. DCC and BEKK. The results illustrate a clear assortment among Sharīʿah and conventional indices, suggesting an opportunity for portfolio diversification. ARDL models espouse weak cointegration among the indices, particularly during the financial crisis period. Furthermore, the BEKK model also indicates little volatility contagion for this period. The findings of this study are supportive of the argument that Sharīʿah compliant indices offer a feasible and practical opportunity for portfolio diversification.

KEYWORDS: Co-integration; Financial crisis; Sharīʿah-compliant index; Volatility spillover.

JEL CLASSIFICATION: C36, C51, G01, G11

KAUJIE CLASSIFICATION: L43, I31

1. Introduction

Recent years have witnessed quite an upsurge in the Islamic financial industry, not only in the Muslim-majority countries but also in many deve-loped and emerging economies. The surge of investments in Islamic financial instruments has partly been so in the wake of the 2007-2008 global financial crisis.

The global Islamic finance industry grew year-on-year by about 11%, reaching US$ 2.4 trillion in assets in 2017, or by a CAGR growth of 6% from 2012, based on figures reported for 56 countries. The magnitude of investment is expected to rise to US$ 3.8 trillion by 2023 with an average growth of 10% per year, taking into consideration the developments in the overall ecosystem (Mohamed, Goni, & Hasan, 2018, p. 4).

The global *ṣukūk* issuance reached around US$ 100 billion in 2018 (World Bank Group, 2018, p. 2). The total amount of Islamic banking assets, which are the main drivers of the global Islamic financial indus-try, were estimated to be US$ 1.7 trillion at the end of 2017 (Mohamed, Goni, & Hasan, 2018, p. 5).

The growing Islamic financial industry is offering viable alternative investment opportunities and is thereby widening the investor's choice for portfolio diversification (as argued by studies like Ahmed, 2009, Hassan & Kayed, 2009, and Derbel, Bouraoui, & Dammak, 2011).

Conventional capital markets are predominantly interest-based and debt-driven where risk transfer rather than risk sharing takes place. This over-dependence on debt-based products led to an impru-dent growth of debt and easy availability of credit over the years. This, in turn, is considered to have been a significant contributor to major financial crises in history.

A number of researchers have attempted to con-firm this theory in reference to the financial crisis of 2007-2008. For instance, Blundell-Wignall, Atkin-son, and Lee (2008), report that mixing credit with equity culture leads to financial crises. Similarly, Carmassi, Gros, and Micossi (2009), state that exces-sive leverage contributes to the reckless expansion of global economic crises.

Further, Palley (2011, p. 4) notes the adverse con-sequences of mortgage loan and suggests a new model with less dependence on debt to avoid and recover from the financial crash.

While discussing the East-Asian financial crisis of 1997-1998, Wade (1998) argues that interest-based capital account operations played a major role in that crisis. In the same context, Mitton (2002) reports that centralized and less diversified administration is the main cause of the meltdown.

In the backdrop of such issues associated with the conventional financial system, Sharīʿah finance has been seen by some researchers as an emerging in-vestment alternative devoid of some of these prob-lems. Ahmed (2009) identifies the failure of interest risk mitigation as the main cause of the 2007-2008 economic meltdown and recommends Islamic fi-nance as a cure.

Similarly, Ahmed (2010), while analyzing the Sharīʿah-based financial system, suggests the adop-tion of this model in order to prevent future financial crises. Along the same lines, others like Derbel, Bouraoui and Dammak (2011), and Hassan and Kayed (2009), draw attention towards Islamic fi-nance as an option to prevent financial meltdowns. Thus, a number of studies consider Islamic finance as a relatively immune system during the periods of economic turmoil.

The main motivation for this study arises from the perception that the Islamic finance industry provides a safeguard against certain risks, inherent in the con-ventional financial markets. Moreover, there are a number of investors who are seeking such type of investment alternatives for social-religious reasons. This supposed dichotomy of finance into Sharīʿah and conventional finance indices demands an empiri-cal verification. Hence, it is essential to investigate Sharīʿah finance indices in comparison to conven-tional indices. The study provides a comparative em-pirical analysis of the Sharīʿah and conventional fi-nance indices to draw certain inferences with regard to opportunities for portfolio diversification.

After the introduction in the present section, the rest of the paper comprises the following sections. Section 2 discusses the related literature. The research methodology (data and empirical framework) is presented in section 3. Section 4 presents the data analysis and discusses the results. Finally, section 5 gives the summary and conclusions.

2. Literature Review

In this section, we focus on the linkages between Sharīʿah indices with their conventional counterparts. In line with the previous studies, Abdul Karim, Kassim and Arip (2010) investigate the existence of a relationship between Sharīʿah and their conventional indices for Malaysia, Indonesia, Japan, the UK, and the USA. The study is based on closing values of indices for the period ranging from February 2006 to December 2008, frag-mented into two sub-periods, pre-crisis and crisis period. The results from co-integration test indicate that investing in Sharīʿah compliant alternatives offer higher returns.

Hassan and Girard (2010) endeavor to comparatively analyze various performance indices with their Sharīʿah agreeable counterparts, using Jensen ratio, Sharpe ratio, Treynor ratio and Fama's ratio. Their study also concentrates on the consistency of performance and co-association among the indices. The study is based on the period January 1996 to December 2005, which is split into two parts: the first being from 1996 to 2000 and second being from 2001 to 2005. The results indicate that there is no noteworthy distinction between these two types of indices across the whole sample period.

Another study by Charles, Darne, and Pop (2012) examines the sensitivity of Sharīʿah compliant indices and conventional indices, to the occurrence of major events, universally or locally. They utilize the method of Iterative Cumulative Sum of Squares (ICSS) to identify auxiliary breaks in the instability of select Sharīʿah and ordinary indices from the Dow Jones family, for the period from 1996 to 2009. The results from the study reveal that both types of indices are influenced by shifts in variance but Sharīʿah compliant indices are more responsive to the economic events.

Bhatt and Sultan (2012), in their study, analyze the impact of financial risks on three indices namely,

socially responsible, customary and Sharīʿah compliant indices. The study finds that socially responsible securities are less elastic to financial risks in comparison to customary and Sharīʿah compliant securities.

In another study, Lean and Parsva (2012) analyze the Sharīʿah-compliant and regular stock indices of Malaysia for the period 2007-2011. The study particularly focuses on the period from March 2008 to March 2009 (considering it as the peak of the financial crisis) to analyze the behavior of these indices during the crisis period. The study reveals that Sharīʿah indices perform better during the economic downturn.

Tyagi and Rizwan (2012) also analyze the movements of Sharīʿah compliant and conventional indices listed on the Bombay Stock Exchange after the 2007-2008 financial crisis. Analyzing the effects of economic recession, the study reveals that the TASIS Sharīʿah index and the Sensex conventional index exhibit similar behavior during that particular time period.

Romli, Mohamad, and Yusof (2012) have studied the behavioral pattern and uncertainty of Sharīʿah compliant and traditional indices. The study uses Sharīʿah compliant and benchmark stock indices data of Malaysia for the period 2007 to 2009 as a sample for analysis. Using the CAPM and ARCH model, the study finds that FTSE-BM Hijrah is more unstable than the composite index and provides ample opportunity for good returns by having higher uncertainty for risk-taking investors.

Sukmana and Kholid (2012) attempt a comparative analysis of Sharīʿah and conventional indices of Indonesia. The sample timeline includes the period from January 2001 to December 2009, incorporating the Dotcom decay and global financial crisis. Using ARCH and GARCH models, the results from the study indicated that the Jakarta Islamic Index is less unstable.

To assess the efficiency of Sharīʿah compliant and conventional indices, Natarajan and Dharani (2012) study both types of indices by analyzing associated risk and return in the Indian context. The evidence from the study reveals that both types of indices demonstrate very similar tendencies.

Furthermore, Chiadmi and Ghaiti (2012) comparatively analyzes the Sharīʿah and parent indices of USA while focusing on the heteroscedasticity impact, serial correlation and leptokurticity. The study finds that the conventional index is more uncertain than the S&P 500 Sharīʿah in crisis period. However, volatility persistence is found to be significant for both indices. Haq and Rao (2013) also examine the Sharīʿah and conventional indices and find that both indices exhibit a bidirectional flow of news for 2 to 4 days and are correlated in the long run.

To find out safer investment alternatives, Jawadi, F., Jawadi, N., & Louhichi (2014) seek to compare the performances of the Sharīʿah and con-ventional indices. The study is conducted for three principal regions namely, Europe, the USA, and the world as a whole for the period from 2000 to 2011. They use different econometric proportions, GARCH model, and CAPM to quantify profi-ciency of the respective indices. The study reveals that Islamic indices performed better during the 2007-2008 crisis in contrast to conventional stock indices.

In their study, Ashraf and Deo (2014) analyze the Sharīʿah and conventional indices of India in order to examine their efficiency. The daily closing values of CNX 500, CNX Nifty, and S&P BSE TASIS50 are taken as sample data for the period from January 2008 to June 2013. The results reveal that random walk hypothesis is rejected for both the indices. However, the study argues that returns cannot be predicted in the long run, even though it is possible in the short run.

Rizvi and Masih (2013) compare the behavioral pattern of Sharīʿah acquiescent and the conventional indices. The analysis is conducted using data from the Dow Jones indices family for the period from January 2001 to December 2011. Employing the MGARCH model, the results from the study reveal that Sharīʿah investment options perform better during the recession.

Similarly, Miniaoui, Sayani and Chaibi (2015) analyze the volatility and returns of Sharīʿah and standard indices of the GCC countries. The study focuses on the 2008 financial crisis period and tries to identify the riskier index. The results from the study reveal that Sharīʿah compliant indices don't exhibit lesser volatility than their conventional counterparts.

In the Indian context, Kumar, Reddy, Angelena, and Patel (2015) compare the performance of CNX 500 Sharīʿah index with other broader indices namely, Nifty Midcap 50, BSE Sensex, NSE Defty. The study assesses the effect of economic variables such as GDP, IIP and Inflation on these indices. The study uses the closing values of indices from January 2007 to June 2015 for the analysis. Results from the study indicate that CNX 500 Sharīʿah does not perform better in the comparison to other indices and is more responsive to macro-economic variables.

In their study, Rahim and Masih (2015) compare the exposure of Sharīʿah equity index and conventional index to interest rate risk. The study is conducted by analyzing FTSE Bursa Malaysia Hijra Sharīʿah index and FTSE Bursa Malaysia KLCI index for the period 2007 to 2014, using the technique of 'wavelets'. The study argues that both types of indices are sensitive to interest rate changes in the long run, though Sharīʿah index exhibits less exposure in the short run.

Naifar (2016) analyzes the impact of macroeconomic variables (crude oil prices, investor's sentiments, yield curves, sovereign credit risk) and conventional index on Sharīʿah equity index. Employing the Quantile Regression approach, the study finds that conventional stock market returns, stock market implied volatility, and the slope of the yield curve significantly influence the Sharīʿah index.

Siddiqui and Sheikh (2016a) assess the performance of Sharīʿah and parent indices in the Indian context. The analysis is conducted using daily closing prices of Nifty 50 and Nifty 500 and their Sharīʿah counterparts for the period from January 2007 to December 2015. Using GMM and 3SLS techniques, the results from the study indicate that the Sharīʿah index is more proficient to be included in a portfolio.

Further, Siddiqui and Sheikh (2016b) extend this concept by analyzing the performance of Nifty 500 Sharīʿah on different time phases of the global financial crisis in comparison to its conventional counterparts. The study doesn't find any long-term relationship between the two indices.

In their third study, Siddiqui and Sheikh (2016c) attempt to model volatility by univariate GARCH models, viz. GARCH (1, 1), EGARCH and

CGARCH models and reveal that each index displayed the persistence of volatility.

In their 2017 study, Siddiqui and Sheikh (2017) analyze the performance of Nifty 50 Sharīʿah compared to the Nifty 50. They utilize various autoregressive models for the period from January 2008 to April 2015. The results from the study reveal that the Sharīʿah index is a more profitable investment alternative in the Indian equity market.

Similarly, Nugroho, Moehaditoyo, and Anam (2017) assess the performance of single index model in investment decision making and also compares the performance of JII Sharīʿah and IDX 30. The study uses the data on returns of these indices for the period 2013 to 2015. The analysis is conducted by employing a single index model and Sharpe model. The study finds the evidence supportive of better performance of portfolio including Sharīʿah complaint instruments than those comprised only of conventional instruments.

Further, Ahmad, Rais and Shaik (2018) attempt to evaluate the volatility spillover or financial contagion between Sharīʿah and conventional benchmark indices. The results of the study reveal that Sharīʿah investment alternatives serve as a better hedge during the financial crisis period.

This literature survey shows that most of the studies focused on Malaysia, Indonesia, India and the USA. These studies do not encompass the broader globalized financial market. Furthermore, there are very few studies that simultaneously analyze the cointegration and volatility contagion between Sharīʿah and conventional indices. Moreover, the reviewed studies do not consider multivariate generalized autoregressive heteroscedasticity models while examining the volatility spillover of indices. MGARCH models have the advantage in recognizing the dependency in movement of indices in a more reliable way than separate univariate models (Su & Huang, 2010, p.6). MGARCH models allow the conditional covariance matrix of the dependent variables to follow a flexible, dynamic structure and allow the conditional mean to follow a vector autoregressive (VAR) structure.

Considering the above points, this study has the following objectives:

(i) To give an exhaustive descriptive analysis of the Sharīʿah and conventional indices.

(ii) To ascertain the feasibility of portfolio diversification among the selected Sharīʿah and conventional indices of the world since the financial crisis period of 2008.

(iii) To examine volatility spillover or financial contagion among selected Sharīʿah and conventional indices.

3. Data and Empirical Framework

3.1 Data

With the aim to make inferences about portfolio diversification, the study empirically examines world over conventional and Sharīʿah compliant investment alternatives by assessing the stock index performances of four continents, viz. USA, Europe, Asia and Africa.

The study uses S&P 500 and S&P 500 Sharīʿah to represent conventional and Sharīʿah indices of the USA. For Europe, S&P Europe 350 and S&P Europe 350 Sharīʿah are used. Similarly, S&P Pan Asia and S&P Pan Asia Sharīʿah represent the conventional and Sharīʿah indices of Asia. S&P Africa frontiers and S&P Arica frontier Sharīʿah are employed to represent conventional and Sharīʿah indices of Africa. The daily closing values are extracted from the official website of SP Dow Jones, for the period from July 2008 to June 2018. This sample period covers the decade after the 2007-2008 financial crisis to evaluate the performance and volatility spillover among select world indices during this period. The failure of IndyMac (one of the major financial corporations of the US) on the 11th of July 2008, which with other factors lead to the financial crisis, is taken as the starting date of the sample data.

Figure 1 gives a graphical representation of the return of each of the sample indices. From a cursory look at the graphs, it can be seen that there are certain periods displaying higher volatility than the rest of the periods. High spikes imply high volatility in returns. Moreover, we observe maximum volatility clustering in the initial phase of the financial crisis as high spikes are concentrated between the 1st to the 250th day. However, both the indices of Africa are showing long spikes between the 1750th day to the 2000th day also.

Figure (1) Returns of Sample Indices
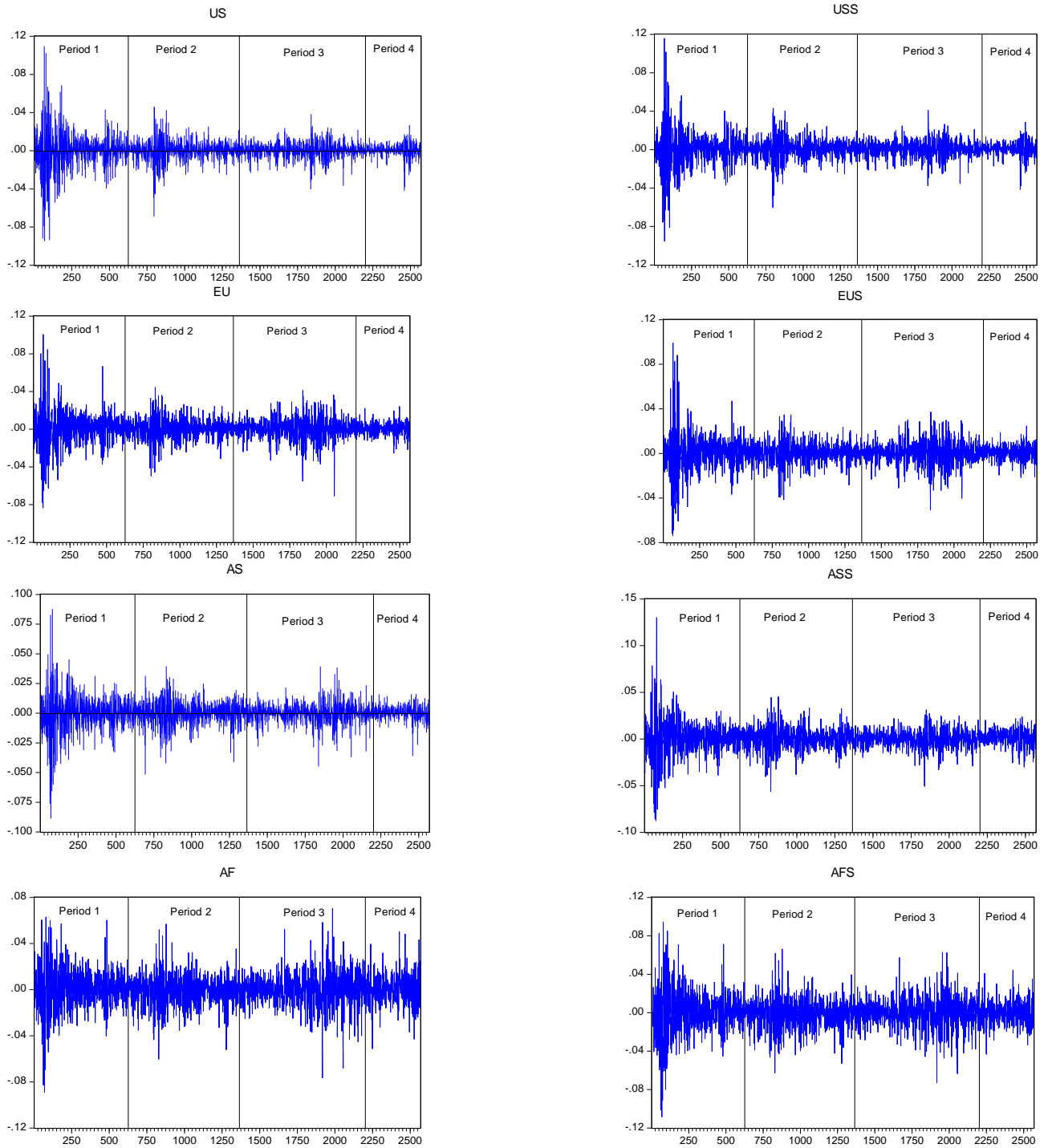
Source: Prepared by Authors.

Further, in order to check the spillover of this volatility among the indices, we split the sample data into sub-periods by using Bai and Perron (2003) test for the presence of structural breaks. In accordance with the results from the Bai-Perron test, period 1 ranges from 11th July 2008 to 9th December 2010, period 2 ranges from 10th December 2010 to 17th October 2013, period 3 is ranging from 18th October 2013 to 23rd January 2017 and the last period ranges from 24th January 2017 to 30th July 2018.

Table (1) Indices abbreviated as

		Period 1 (11th July 2008 to 09th December 2010)	Period 2 (10th December 2010 to 17th October 2013)	Period 3(18th October 2013 to 23rd January 2017)	Period 4 (24th January 2017 to 30th July 2018)
USA	*S&P 500(Conventional)*	US1	US2	US3	US4
	S&P 500 Shariah (Sharīʿah)	USS1	USS2	USS3	USS4
Europe	*S&P Europe 350 (Conventional)*	EU1	EU2	EU3	EU4
	S&P Europe 350 Shariah (Sharīʿah)	EUS1	EUS2	EUS3	EUS4
Asia	*S&P Pan Asia BMI (Conventional)*	AS1	AS2	AS3	AS4
	S&P Pan Asia BMI Shariah (Sharīʿah)	ASS1	ASS2	ASS3	ASS4
Africa	*S&P Africa Frontier (Conventional)*	AF1	AF2	AF3	AF4
	S&P Africa Frontier Shariah (Sharīʿah)	AFS1	AFS2	AFS3	AFS4

Source: Prepared by Authors.

3.2 Empirical Framework

In order to assess the performance and efficiency of the indices, various descriptive statistics are calculated such as mean return, standard deviation of returns, and skewness.

3.2.1 Process of Co-integration

ARDL model, Pesaran and Shin (1999), and Pesaran, Shin, and Smith (2001), has been employed to analyze cointegration among the indices. In this study, we apply ARDL cointegration technique as a VAR model of order p in Z_t, where Z_t is a vector composed of all indices: Z_t: (US, USS, EU, EUS, AS, ASS, AF, AFS). The model can be expressed as:

$$
\begin{aligned}
D(\ln(US_t)) = a_0 &+ b_{11}\ln(US_{t-1}) \\
&+ b_{21}\ln(USS_{t-1}) \\
&+ b_{31}\ln(EU_{t-1}) + b_{41}\ln(EUS_{t-1}) + b_{51}\ln(AS_{t-1}) + b_{61}\ln(ASS_{t-1}) \\
&+ b_{71}\ln(AF_{t-1}) + b_{81}\ln(AFS_{t-1}) + \sum_{i=1}^{p} a_{1i} D(\ln(US_{t-i})) + \sum_{i=1}^{q} a_{2i} D(\ln(USS_{t-i})) \\
&+ \sum_{i=1}^{q} a_{3i} D(\ln(EU_{t-i})) + \sum_{i=1}^{q} a_{4i} D(\ln(EUS_{t-i})) + \sum_{i=1}^{q} a_{5i} D(\ln(AS_{t-i})) + \sum_{i=1}^{p} a_{6i} D(\ln(ASS)) \\
&+ \sum_{i=1}^{q} a_{7i} D(\ln(AF_{t-i})) + \sum_{i=1}^{q} a_{8i} D(\ln(AFS_{t-i})) + E_{1t}
\end{aligned}
$$

Where, US is taken as dependent variable and USS, EU, EUS, AS, ASS, AF, AFS act as explanatory variables, D is the first difference and E_t are the error terms. Further, we have run this equation using each index as dependent variable and the remaining indices as independent variables for each period of the study.

3.2.2 Process of Volatility Spillover by using Multivariate GARCH

The study also makes use of DCC and BEKK models of Multivariate GARCH. These models have been used to check the volatility spillover process and to figure out the impact of information or news on Sharīʿah and conventional indices. Some of the papers that have used DCC and BEKK models for checking volatility spillover are: Sehgal, Berlia, and Ahmad (2013), and Bala and Takimoto (2017).

DCC is a type of correlation model of GARCH, in which the matrix of conditional covariance is disintegrated into two parts namely, the standard deviation and the correlation. DCC GARCH was introduced by Engle (2002). In this model, conditional covariance can be shown mathematically as:

$$ H_t = D_t P_t D_t $$

Here, H_t is a N x N conditional covariance matrix, P_t is the matrix of conditional correlation and D_t is the matrix of standard deviation, where on diagonal

$$ D_t = diag \; (h_{lt}^{\frac{1}{2}} \dots \dots \dots \dots \dots \dots \dots h_{Nt}^{\frac{1}{2}}) $$

$$ P_t = (I \odot Q_t)^{-1/2} Q_t (I \odot Q_t)^{-1/2} $$

Where, h is the conditional variance and Q_t is a symmetric definite matrix:

$$ Q_t = (1 - a - b)S + a\varepsilon_{t-1}\varepsilon'_{t-1} + bQ_{t-1} $$

Here, S is the unconditional correlation matrix of standard residuals with NxN elements, a and b are scalar parameters, with a sum of less than 1. The Multivariate GARCH models are based on Quasi-Maximum likelihood estimation.

The BEKK model deals very appropriately with the operations that have multivariate matrix. It has the property that conditional covariance matrices are positive definite by construction. The conditional covariance of this model can be represented as:

$$
\begin{aligned}
H_t = CC' &+ \sum_{j=1}^{q}\sum_{k=1}^{k} A'_{kj} r_{t-j} r'_{t-j} A_{kj} \\
&+ \sum_{j=1}^{p}\sum_{k=1}^{k} B'_{kj} H_{t-j} B_{kj}
\end{aligned}
$$

Where, A_{kj}, B_{kj}, and C are $N \times N$ parameter matrices, and C is the lower triangular.

The matrix of the constant terms is decomposed into two parts, the upper triangular and the lower triangular in order to confirm definiteness of H_t. In this model, the off-diagonal elements on matrix A_{kj} point to short-term volatility spillover and in matrix B_{kj} indicate long-term volatility spillover among the indices.

3.2.3 Testable Hypotheses

H$_{01}$: There is no opportunity of diversification among the select Sharīʿah and conventional indices of the world.

H$_{02}$: There is no dynamic conditional correlation among the volatility of selected Sharīʿah and conventional indices of the world.

H₀₃: There is no volatility spillover among the select Sharīʿah and conventional indices of the world.

These hypotheses are tested for each sample period separately to demonstrate the results on the time varying basis.

4. Empirical Results

Descriptive statistics displaying the mean return, standard deviation, and skewness were calculated to evaluate the performance and efficiency of the respective indices. Table 2 illustrates the descriptive statistics of all the indices under study for each sub-period.

Table (2) Descriptive Statistics of the return of the Indices

		US	USS	EU	EUS	AS	ASS	AF	AFS
Period 1	*Mean*	8.11E-05	9.53E-05	0.000159	0.000235	0.000142	0.000269	0.000241	0.000122
	Median	0.000962	0.000846	0.000676	0.00058	0.001299	0.000941	0.000828	0.000455
	Std. Dev.	0.020064	0.018173	0.017914	0.016412	0.016677	0.019141	0.018149	0.022867
	Skewness	-0.20695	0.043615	0.050946	0.211749	-0.41126	-0.02006	-0.27222	-0.24253
	Kurtosis	8.526404	10.28578	8.319803	10.13242	7.95656	9.250849	5.370902	6.183256
	Jarque-Bera	798.524	1380.346	736.0777	1327.321	656.3448	1015.943	153.8574	269.5787
	Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period 2	*Mean*	0.000537	0.000501	0.000322	0.000369	0.00021	0.000304	9.96E-05	-6.20E-05
	Median	0.000695	0.000747	0.000524	0.000835	0.000702	0.000761	0.001287	0.001044
	Std. Dev.	0.010504	0.010141	0.010725	0.009321	0.010184	0.011259	0.013129	0.015149
	Skewness	-0.57543	-0.51436	-0.28876	-0.35244	-0.51573	-0.18139	-0.28076	-0.21078
	Kurtosis	8.451916	7.557766	5.561603	5.428927	5.103369	4.967697	4.795856	4.563322
	Jarque-Bera	953.4287	670.4094	211.7444	196.4269	168.5288	122.9389	108.7201	80.50752
	Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period 3	*Mean*	0.000394	0.000375	0.000268	0.000315	9.31E-05	0.00015	-9.23E-05	-0.00043
	Median	0.00031	0.000214	0.00057	0.000741	0.000174	0.0003	0.000301	-0.00016
	Std. Dev.	0.008167	0.008272	0.011037	0.010148	0.008391	0.008871	0.014395	0.015096
	Skewness	-0.35666	-0.28927	-0.50729	-0.21066	-0.29932	-0.34501	-0.25707	-0.16264
	Kurtosis	5.543434	5.407466	6.745268	5.229444	6.255455	5.019494	6.087093	5.018866
	Jarque-Bera	243.3533	213.8046	525.0927	179.5338	382.1028	158.8379	341.5829	145.8341
	Probability	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Period 4	*Mean*	0.000638	0.000723	0.000302	0.000448	0.000557	0.000967	0.000291	-0.00013
	Median	0.000694	0.000889	0.000615	0.000511	0.000822	0.000993	0.000388	-0.00019
	Std. Dev.	0.006904	0.007247	0.006493	0.006581	0.005943	0.008331	0.012934	0.01171
	Skewness	-1.32531	-1.13138	-0.22515	-0.18053	-0.98839	-0.48699	0.084849	0.125673
	Kurtosis	10.45362	9.223523	4.425541	3.800582	7.683455	4.091237	4.584783	3.978421
	Jarque-Bera	956.988	670.5748	34.17603	11.79439	395.1733	32.71558	38.84594	15.60486
	Probability	0.00	0.00	0.00	0.002747	0.000	0.00	0.000	0.000409

Source: Prepared by Authors.

In this table, it can be seen that in period 1, Sharīʿah indices of US, Europe, and Asia can be considered as investment alternatives given their higher returns. However, they also turn out to be more volatile than conventional indices as inferred from the higher standard deviation. Values of skewness show that except for the indices of Europe (EU1 & EUS1) and Sharīʿah index of US (USS1), all other indices are negatively skewed indicating a large possibility of negative returns during period 1.

In period 2, it is observed that the Sharīʿah indices of Europe and Asia perform better in comparison to the conventional indices as their mean return is greater. However, the US conventional index provides better earnings while in Africa, the Sharīʿah index is seen to exhibit negative returns in period 2. The values for standard deviation in period 2 indicate that Sharīʿah indices are less volatile in general except that of Asia. Values of skewness during this period reveal that all markets are negatively skewed, thereby indicating that all indices have a large possibility of decreasing returns during this period.

Further, in period 3 it is observed that only in the US, the conventional index exhibits better returns while the Sharīʿah indices perform better in Asia and Europe as inferred from higher mean returns. However, Sharīʿah indices are seen to be more volatile in US, Asia, and Africa in this period. The values of skewness show that all the indices are negatively skewed, indicating a large possibility of decreasing returns during this period.

In period 4, except for Africa, the Sharīʿah compliant indices perform better – exhibiting higher returns in the US, Europe, and Asia. However, Sharīʿah compliant indices prove to be a volatile investment alternative having higher standard deviation, thus being arguably more suitable for risk-loving investors. Values of skewness shows that, except for the indices of Africa, all other indices are negatively skewed, again implying a large possibility of negative returns during this period.

4.1 Time Varying Co-integration

Stationarity of the log returns of the indices are verified by the ADF test. The ADF test shows that all the indices are non-stationary at level but become stationary after first differencing, except the Sharīʿah index of Africa in period 2. In this regard, therefore, we have used the ARDL model for cointegration analysis.

Table (3) F-Statistics of ARDL Model

	US	USS	EU	EUS	AS	ASS	AF	AFS
Period 1	2.583767	2.474278	2.823324	2.531795	2.440615	3.113951	4.715831	4.516371
Period 2	1.869328	1.58569	1.249048	1.503566	1.99885	4.260024	2.493249	2.574667
Period 3	1.738401	2.324436	1.414354	1.833516	3.035425	1.729658	1.902796	1.925292
Period 4	1.584293	1.287648	3.685063	3.517255	3.28982	1.64553	4.389627	5.828872

Source: Prepared by Authors.

Table 3 presents the F-statistics values of bound test for each index under study. If the value of F-statistics is greater than the critical bound value (3.5), it implies there is cointegration among the variables. From the bounds test of ARDL model, it is evident that only the two indices of Africa have cointegrating relationship with other indices in period 1. Therefore, it can be argued that there is a clear evidence in favor of potential for portfolio diversification by including Sharīʿah complaint instruments in the portfolio.

The results of period 2 can be interpreted in a similar manner as only the Sharīʿah index of Asia is moving parallel to other indices. In period 3, the bounds test reveals no cointegration among the indices, whereas in period 4, both the indices of Europe, as well as Africa, are showing cointegration among the indices. From the table, it is clear that except for the few periods mentioned, the majority of periods do not show any cointegration. Hence, we can conclude that the results are in support of the view that Sharīʿah indices provide opportunity for portfolio diversification.

4.2 Time Varying Conditional Correlation

Dynamic Conditional Correlation (DCC) model has been employed to find out the dynamic conditional correlation between the variance of Sharīʿah and conventional indices for each of the sub periods. Here, we can find out the dynamic conditional correlation of volatility among the indices for the long-run and the short-run. Table 4 shows the outcomes of MGARCH-DCC. The ARCH term of Dynamic Conditional Correlation (DCC-A) will be examined to find out cross-market contagion in the short run and the GARCH term of Dynamic Conditional Correlation (DCC-B) will be examined likewise for the long run.

Table (4) MGARCH DCC

	DCC A	DCCB	A+B
Period 1	0.0172**	0.97979**	0.99699
Period 2	0.0169**	0.9273**	0.9442
Period 3	0.036**	0.6513**	0.6873
Period 4	0.00951**	0.9528**	0.96231

*indicates 5% significance level.
Source: Prepared by Authors.

Here both the ARCH and GARCH terms of DCC are found to be significant for each index, thereby indicating the dynamic conditional correlation among the indices for each period. Furthermore, the value of the sum of A+B is showing volatility persistence and contagion in period 1, period 2 and period 4 but not in period 3. We can see that DCC-A and DCC- B are higher in period 1 than other periods. This shows high dynamic conditional correlation among the indices but is decreasing over time as we move to subsequent periods. The presence of higher dynamic conditional correlation can be argued to result from pervasive pessimism among the investors due to the severity of the crisis.

4.3 Time Varying Volatility Spillover Process

The BEKK model is a multivariate GARCH model. Here, we have evaluated the volatility spillover among the indices and also the impact of a given index's past volatility as well. Furthermore, in the below tables, ARCH and GARCH terms are shown, which are upshots of BEKK model for each index with respect to other indices. In these tables, diagonal cells display volatility persistence of an index and off diagonal cells indicate volatility spillover from one index to another. Here the ARCH-term shows effects of the shock in short run (or impact of previous day market volatility) while GARCH-term measures the impact of residual of one index on the volatility of another, more specifically it measures volatility spillover in the long run.

Table (5A) MGARCH-BEKK Period 1

	US1	USS1	EU1	EUS1	AS1	ASS1	AF1	AFS1
A(1,i)	0.1445**	-0.004	-0.4806**	-0.1992**	-0.5185**	-0.6813**	-0.6741**	-0.7145**
A(2,i)	-0.2438**	-0.0978**	-0.033	-0.3061**	0.2856**	0.4541**	0.3243**	0.2966**
A(3,i)	-0.0299	-0.0056	0.1959**	0.2942**	-0.2297**	-0.1796**	0.2921**	0.3365**
A(4,i)	0.3347**	0.2964**	0.258**	0.1264**	0.2057**	0.2589**	-0.0701**	-0.0958**
A(5,i)	0.1368**	0.1326**	-0.0467	-0.0288	0.108**	0.1063**	-0.1127**	-0.103**
A(6,i)	-0.0309	-0.0357**	0.0018	0.0213	-0.1168**	-0.0948**	0.0235	0.0192
A(7,i)	-0.3181**	-0.3105**	-0.4099**	-0.2987**	0.0595	-0.143**	-0.1744**	-0.2895**
A(8,i)	0.19**	0.191**	0.2817**	0.1761**	-0.0454	0.0694	0.1297**	0.2421**
B(1,i)	1.0466**	0.0615**	0.3194**	0.2069**	-0.1505**	-0.0573**	0.0926**	0.075**
B(2,i)	-0.0909**	0.9023**	-0.2032**	-0.1166**	0.524**	0.3909**	0.1556**	0.2334**
B(3,i)	0.044**	0.0402**	0.8765**	-0.0191	-0.0322	-0.011	-0.1611**	-0.1799**
B(4,i)	0.0385**	0.0313**	-0.1446**	0.7942**	-0.1956**	-0.198**	-0.0551**	-0.0615**
B(5,i)	-0.1659**	-0.1708**	-0.0779**	-0.0755**	0.8932**	-0.0777**	-0.0471**	-0.0689**
B(6,i)	-0.0248**	-0.0142	0.0203	0.0362**	-0.0158	0.9637**	-0.0104	-0.0172
B(7,i)	0.1322**	0.115**	-0.0631**	-0.0506**	-0.0573	-0.0584**	0.9262**	-0.0567**
B(8,i)	-0.155**	-0.1423**	0.0359**	0.0189	0.0384	0.0433	0.0324**	1.0109**

*indicates 5% significance level.
Source: Prepared by Authors.

Table 5(A) shows that in the case of US1, each of the ARCH and GARCH terms are significant except A(3,i) and A(6,i). This indicates that volatility of all indices cause volatility transmission to US1 but the shocks of the conventional index of Europe and the Sharīʿah index of Asia do not influence in the short run. Further, USS1 shows that A(1,i), A(3,i) and B(6,i) are not significant at the 95% confidence level. Thus, implying that shocks to USS1 do not result from shocks in US1 in short-run and does not show volatility spillover due to AS1 in the long run.

The BEKK result shows that the conventional index of Europe for the period 1 (EU1) does not reveal any volatility contagion from USS1 and AS1 in the short run as A(2,i) and A(5,i) are not significant. Further, EU1 is not showing any volatility spillover from ASS1 in log run or short run, as A(6,i) and B(6,i) are not significant.

The Sharīʿah index of Europe in Period 1 (EUS1) exhibits volatility spillover from all other indices except the two indices of Asia (AS1 and ASS1) in the short-run. Moreover, EUS1 in the long run shows volatility transmission from all other indices except that of the conventional indices of Europe and Africa (EU1 and AF1). AS1 is neither seen to be influenced by the shocks of the African indices in the long run nor in the short run.

Further, the Sharīʿah index of Asia (ASS1) doesn't exhibit any volatility spillover from AFS1 in the short-run and doesn't display any volatility contagion from EU1 and AFS1 in the long run. Again, both the indices of Africa do not display any volatility spillover from ASS1 in the short run or in the long run, as A(6,i) and B(6,i) are not significant in period 1. This analysis of table 5(A) only explains the insignificant terms and not the significant ones (which are numerous) to conserve space.

Table (5B) MGARCH-BEKK Period 2

	US2	USS2	EU2	EUS2	AS2	ASS2	AF2	AFS2
A(1,i)	0.588**	0.4695**	0.4251**	0.3468**	-0.1584	-0.0713	-0.3728**	-0.2899**
A(2,i)	-0.4225**	-0.298**	-0.6511**	-0.5696**	-0.4342**	-0.5874**	-0.0782	-0.1838
A(3,i)	-0.2963**	-0.2667**	-0.1447	-0.1581	-0.5337**	-0.2545**	0.1624	0.2301
A(4,i)	0.3199**	0.2666**	0.3857**	0.4083**	0.6219**	0.3954**	0.1918	0.116
A(5,i)	0.0084	0.016	0.1032**	0.0803**	0.373**	0.2617**	0.1492**	0.1794**
A(6,i)	0.03	0.0251	-0.0004	-0.0022	-0.1548**	-0.0505	-0.0795	-0.0594
A(7,i)	-0.1989**	-0.1495**	-0.4643**	-0.3828**	0.1298	-0.4371**	-0.1394	-0.3031**
A(8,i)	0.1412**	0.09**	0.3574**	0.2953**	-0.1338	0.258**	0.1069	0.2486**
B(1,i)	-1.0965**	-1.807**	-1.2057**	-0.7571**	1.3333**	0.6332	-0.9503**	-0.6956
B(2,i)	1.4704**	2.1714**	0.6194**	0.3493**	-1.2708**	-0.4254	0.5684**	0.1669
B(3,i)	0.8123**	0.6923**	0.7673**	-0.181**	-0.0142	-0.3459	-0.1616	-0.061
B(4,i)	-0.158**	-0.0454	0.4867**	1.3537**	0.25	0.5271**	0.5559**	0.6876**
B(5,i)	-0.022	-0.0672	0.0246	0.0321	-0.0265	-0.1023	-0.5878**	-1.162**
B(6,i)	-0.5056**	-0.4306**	-0.6297**	-0.4997**	-0.0283	0.023	-0.2443	0.1466
B(7,i)	0.2204**	0.0841**	0.1546	0.0707	-1.6613**	0.0543	0.7137**	0.6991**
B(8,i)	-0.1358**	-0.0147	-0.0321	-0.02	1.5733**	0.1555	0.2326**	0.2984**

*indicates 5% significance level.
Source: Prepared by Authors.

Table 5(B) shows the results of MGARCH-BEKK model for period 2. From the table, it is evident that US indices (US2 and USS2) are exposed to volatility contagion in the short run as well as in the long run. The shocks in all indices cause volatility spillover to the US indices (US2 and USS2) except that of the two indices of Asia in the short-run and the conventional index of Asia in the long-run. In the case of Europe, we can see that EU2 and EUS2 don't display any volatility contagion from EU2 and ASS2 in the short run.

Furthermore, the residuals of AS2, AF2, and AFS2 do not lead to volatility in European indices in the long run. In the case of AS2, A(1,i), A(7,i) and A(8,i) are not significant, thereby implying that volatility of all the indices spills over to AS2 except that of the US2, AF2, and AFS2 in the short run. Moreover, B(3,i), B(6,i), B(7,i) and (8,i) are not significant which indicates that AS2 doesn't exhibit volatility spillover from the indices of Europe and Asia (EU2, EUS2, AS2, and ASS2). The Sharīʿah index of Asia (ASS2) doesn't display volatility transmission from US2 and ASS2 in the short run. However, residuals of EUS2 are seen to influence on the volatility of ASS2 in the long run.

Further, in the conventional index of Africa A(1,i) and A(5,i) are significant showing that only shocks of US2 and AS2 are contagious towards AFS2 in the short run. Likewise, US2, USS2, EUS2, AS2, AF2, and AFS2 cause volatility spillover to AF2 in the long run as B(1,i), B(2,i), B(4,i), B(5,i), B(7,i), and B(8,i) are significant at the 95% confidence level. Also, the Sharīʿah index of Africa shows volatility transmission from US2, AS2, AF2, and AFS2 in the short run and EUS2, AS2, AF3, and AFS2 in the long run.

Table (5C) MGARCH-BEKK Period 3

	US3	USS3	EU3	EUS3	AS3	ASS3	AF3	AFS3
A(1,i)	0.0428	-0.1243	-0.3086	-0.3342	-1.2534**	-0.9641**	-0.5504	-0.2478
A(2,i)	0.1821	0.3403**	-0.1209	-0.0953	0.855**	0.5751**	0.0663	-0.1641
A(3,i)	0.0153	0.0356	0.5535**	0.4672**	0.4608**	0.5969**	0.9761**	0.8364**
A(4,i)	-0.0957	-0.1379	-0.539**	-0.4542**	-0.6185**	-0.6801**	-0.9925**	-0.8318**
A(5,i)	0.0409	0.0448	0.1492**	0.147**	0.1958**	-0.0334	0.2917**	0.347**
A(6,i)	0.014	0.0049	0.1014	0.085	-0.1013	0.1437**	-0.0558	0.0152
A(7,i)	-0.0802	-0.0651	-0.2313**	-0.1969**	0.0023	0.0009	0.2596**	0.2675**
A(8,i)	0.0532	0.0547	0.1975**	0.1886**	-0.0306	-0.0708	-0.2235**	-0.282**
B(1,i)	0.5611	-0.3656	-0.6089**	-0.7794**	-0.002	-0.7904**	-0.1632	0.1309
B(2,i)	0.2697	1.1786**	0.8636**	1.0236**	0.3151	1.1352**	0.4373**	0.0967
B(3,i)	0.0164	0.0886	0.9435**	0.0782	0.1183	-0.0868	-1.1362**	-0.8668**
B(4,i)	0.0391	-0.0468	-0.1704	0.711**	-0.3632**	0.0054	0.938**	0.6183**
B(5,i)	-0.3005**	-0.3546**	-0.2602	-0.2536	0.3652**	0.0119	-0.3872**	-0.2579
B(6,i)	0.0295	0.0568	-0.0885	-0.0056	0.3857	0.5081**	-0.0164	-0.1316
B(7,i)	-0.1281**	-0.1699**	-0.0031	-0.1687**	-0.0425	0.0575	0.9463**	0.0674
B(8,i)	0.2428**	0.2826**	0.1059	0.1963**	0.1027	0.0724	0.0864	0.9783**

*indicates 5% significance level.
Source: Prepared by Authors.

Table 5(C) shows the results of MGARCH-BEKK for period 3. Here, in this period, we can see lesser volatility spillover among all the indices under study. The conventional index of US doesn't exhibit any volatility contagion in the short run. However, residual of Sharīʿah index of Asia and both the indices of Africa seem to influence its volatility in the long run. Further, in the case of USS3, both the diagonal cell of ARCH term and GARCH term are significant, thereby displaying volatility persistence in the long run as well as the short run. Also, USS3 exhibits volatility contagion from both the indices of Africa and the Sharīʿah index of Asia in the long run.

Further, both the indices of Europe (EU3 and EUS3) show volatility persistence in the short run and display volatility transmission from ASS3, AF3, and AFS3. Moreover, it can also be seen that residuals of US3 and USS3 show significant impact on European indices. Additionally, EUS3 exhibits volatility persistence and displays volatility spillover from both the indices of Africa in the long run. AS3 displays volatility spillover from the American and European indices in the long run. It also exhibits volatility persistence in the long run as well as the short run. In the case of conventional and Sharīʿah indices of Asia, short run volatility contagion from European and American Indices is seen along with the short run volatility persistence.

Also, ASS3 exhibits volatility persistence and volatility spillover from US indices in the long run. Further, both the indices of Africa show diagonal spillover (volatility persistence). Additionally, these also show volatility spillover from both the European and African indices in the short run as well as from both the indices of Europe in the long run.

Table (5D) MGARCH-BEKK Period 4

	US4	USS4	EU4	EUS4	AS4	ASS4	AF4	AFS4
A(1,i)	0.6829**	0.6455**	0.3947	0.3538	0.3465	1.2538**	1.2115**	0.5229
A(2,i)	-0.5095**	-0.4278**	-0.7468**	-0.6731**	-0.7007**	-1.5867**	-1.5633**	-0.8216**
A(3,i)	-0.4282**	-0.5724**	-0.2043	-0.2782**	-0.5276**	-0.405**	-0.7671**	-1.0331**
A(4,i)	0.3711**	0.489**	0.159	0.3105**	0.3872**	0.096	0.8357**	1.0925**
A(5,i)	-0.027	0.0124	0.0572	0.0631	0.2108**	0.2845**	1.0081**	0.8446**
A(6,i)	0.0848**	0.0146	0.0692	-0.0035	-0.0778	-0.0105	-0.1977	-0.2393**
A(7,i)	-0.007	0.0107	0.0786	0.046	-0.0504	-0.1781**	-0.0073	-0.0737
A(8,i)	0.0024	-0.0096	-0.0468	-0.0261	0.0718	0.2574**	-0.2792**	-0.2547**
B(1,i)	0.6032**	-0.1872	-0.2992	-0.9172**	1.1915**	0.2425	2.0508**	2.1156**
B(2,i)	0.3681**	1.179**	0.4502	1.026**	-0.9088**	0.1693	-1.5321**	-1.6987**
B(3,i)	-0.0989	0.1079	0.3367	-0.3468	-0.1788	-0.5027	-0.2929	-0.5848
B(4,i)	0.0449	-0.1939	0.2843	0.9669**	-0.0437	0.0413	0.33	0.42
B(5,i)	0.0041	0.0372	-0.2751	-0.2761	0.7558**	0.4333	0.0133	-0.3433
B(6,i)	0.0484	-0.022	0.1696	0.1708	-0.1607	0.2008	-0.5134	-0.1147
B(7,i)	-0.0895**	-0.0751	-0.1611**	-0.1009	-0.0121	0.2587**	0.7438**	-0.1922
B(8,i)	-0.019	-0.0155	-0.0566	-0.0592	-0.0221	-0.3415**	-0.1317	0.8001**

*indicates 5% significance level.
Source: Prepared by Authors.

Table 5(D) presents the MGARCH BEKK results for period 4. In this period, little volatility spillover among the indices is seen, in comparison to period 1 and period 2. It can be seen from the table that both the indices of US (US4 and USS4) show significant ARCH and GARCH terms in the diagonal cell. Therefore, indicating volatility persistence in the long run as well as the short run. Contagion between the two indices is also observed.

Moreover, the volatility of US4 is seen to display volatility contagion from EU4, EUS4, and ASS4 in the short-run and from AF4 in the long-run. In the case of EU4, only A(2,i) and B(7,i) are significant, implying that only shocks from USS4 cause volatility spillover in the short-run while from residuals of AF4 in the long-run. The Sharī'ah compliant index of Europe (EUS4) shows diagonal volatility spillover (persistence) in both the short-run and the long-run.

In the off-diagonal cells, only A(2,i), A(3,i), B(1,i), and B(2,i) are significant. This indicates that the index (EUS4) shows volatility transmission from USS4 and EU4 in the short-run and volatility spillover is seen to exist from both the indices of US (US4 and USS4) in the long run.

In the Asian context, the conventional index exhibits volatility persistence (diagonal spillover). However, the Sharī'ah compliant index (ASS4) doesn't show volatility persistence but exhibits volatility spillover from the African continent (AF4 and AFS4).

Further, AF4 shows short term volatility spillover from each index except that of ASS4 and doesn't display volatility persistence in the short run. This is inferred from the fact that A(6,i) and A(7,i) are not significant at the 95% confidence level. However, it displays volatility contagion from American indices and also exhibits diagonal spillover in the long-run. AFS4 shows almost the same results as its conventional counterpart in period 4 at the 5% significance level.

Table 6 provides a conclusive summary of the main results from the analysis.

Table (6) Summary

		USA	Europe	Asia	Africa
Returns	*Conventional*	0.000413	0.000263	0.000251	0.000135
	Sharīʿah	0.000424	0.000342	0.000423	-0.00012
Std. Dev.	*Conventional*	0.01141	0.011542	0.010299	0.014652
	Sharīʿah	0.010958	0.010616	0.011901	0.016206

		Period 1	Period 2	Period 3	Period 4
No. of cointegrated Indices		2	1	0	4
Dynamic Conditional Correlation		0.99699	0.9442	0.6873	0.96231
Pairs for Volatility spillover	*ARCH Term (Short run)*	49	41	31	34
	GARCH Term (Long run)	52	38	28	19

Source: Prepared by Authors.

From the descriptive statistics, it is seen that the Sharīʿah indices generally provide better returns than their conventional counterparts. From the standard deviation, we conclude that the Sharīʿah indices are comparable to that of their conventional counterparts in terms of risk.

Table 6 also presents the summary of ARDL cointegration, DCC, and BEKK model results. These models have been applied to find volatility contagion among the indices and also to make inferences about portfolio diversification opportunity among them. From the results it is clear that the number of cointegrated indices is quite less. This means that when the co-movement is little, the opportunity for portfolio diversification is high.

Moreover, from the table it can be seen that the pattern of volatility contagion is decreasing overtime as we move further away from the crisis period. The fact that volatility contagion is high in period 1, can be argued to be the result of pervasive pessimism among the investors reflecting the severity of the crisis. In sum, therefore, we can conclude from the results that the Sharīʿah indices provide an opportunity for portfolio diversification.

5. Summary and Conclusion

The study has assessed the co-movements and volatility contagion between the Sharīʿah-based indices and their conventional counterparts. The results provide insights for portfolio diversification based on the empirical analysis of data using ARDL cointegration approach and multivariate GARCH models.

The descriptive statistics reveal that the Sharīʿah indices are providing better returns in the USA, Asia, and Europe for the periods from 11th July 2008 to 09th December 2010, 10th December 2010 to 17th October 2013 and 24th January 2017 to 30th July 2018. However, these returns are characterized by high standard deviation implying higher volatility. The higher standard deviation can be implied to indicate that Sharīʿah indices extend investment opportunities to the risk-loving investors (securing higher returns with higher risk taking).

Furthermore, the study reveals that the Sharīʿah and conventional indices exhibit no cointegration for the majority of the study periods. The absence of cointegration among the Sharīʿah and conventional indices, implies that the Sharīʿah indices offer the opportunity of portfolio diversification. Results of

DCC are indicative of the presence of dynamic conditional correlation among the indices for each period. As per the results of the BEKK MGARCH, we could see that maximum indices have diagonal volatility spillover and also contain volatility spillover with their respective counterparts. From the results it is clear that the number of cointegrated indices is quite less indicating that when the co-movement is little the opportunity for portfolio diversification is higher.

Moreover, it is also seen that the pattern of volatility contagion is decreasing overtime as we move further away from the crisis period. Further, it is also inferred from the results that the volatility contagion among the indices is very high during the period of the financial meltdown. There can be two plausible

reasons for this, the loss of investor confidence during the crisis period, and instinctively, negative information tends to be more contagious than positive information. After the phase of the crisis, the USA and Europe are less contagious and show less volatility persistence with other indices. The broader argument from the study in favor of portfolio diversification opportunities through the inclusion of Sharīʿah compliant instruments can have two implications:

(i) the presence of Sharīʿah compliant investment alternative has the potential to strengthen the overall financial system; and

(ii) the financial system becomes more inclusive through providing suitable investment alternatives for investors with specific ethical views.

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عدوى التقلبات وتنوع التصورات في أحكام الشريعة الإسلامية والأحكام التقليدية: إثبات توكيدي من خلال تطبيق نماذج MGARCH

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المستخلص. إن عملية التخفيف من المخاطر هي واحدة من اهم الأمور التي تشغل بال المستثمر خلال السنوات التي تلت الأزمة المالية في العام ٢٠٠٧-٢٠٠٨م والتي قد حظيت باهتمامات متجددة. تحاول هذه الورقة البحثية أن تتحرى مجال أحكام الشريعة الإسلامية في تقديم فرصة للتنوع في الحلول و التصورات. تقوم هذه الورقة البحثية بإجراء تحليلات تجريبية بصدد وجود عدوى التقلبات ضمن أحكام الشريعة الإسلامية و الأحكام التقليدية مع إمعان النظر في فرص وجود التنوع في التصورات ضمن تلك الأحكام. لقد اشتملت مديات النماذج التي أُخذت بالاعتبار للفترة ١١ تموز/يوليو ٢٠٠٨ – ٣٠ تموز/يوليو ٢٠١٨م على أحكام للشريعة الإسلامية و أحكام تقليدية لاهم الاقتصادات في مختلف مناطق العالم (أمريكا، آسيا، أفريقيا، وأوروبا). لقد تم استخدام نماذج . لقد أظهرت النتائج تنوعا ملحوظا ضمن BEKK و DCC و التي هي MGARCH Family مع استخدام ARDL أحكام الشريعة الإسلامية و الأحكام التقليدية بما يعطي إمكانية وجود فرص للتنوع في التصورات. لقد أظهرت نماذج ضعفا إزاء المشاركة في التكامل ضمن الأحكام المتخذة، و على وجه الخصوص إبان فترة الأزمة المالية. فضلا ARDL مستوى منخفضا من عدوى التقلبات خلال الفترة المذكورة. BEKK عن ذلك فلقد أظهر نموذج لقد كانت النتائج إيجابية و مشجعة إزاء النقاش حول مدى ملاءمة أحكام الشريعة الإسلامية للتكيف بما يقدم فرصة عملية و مجدية للتنوع في الحلول و التصورات.

الكلمات الدَّالة: المشاركة في التكامل، الأزمة المالية، ملاءمة أحكام الشريعة الإسلامية للتكيف، احتواء التقلبات.