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Volatility Repercussion on Shariah and non-Shariah Stock Market Indices for India and Pakistan through ARCH & GARCH Techniques

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	Abstract
<p>Dr. Sarfaraz Nawaz Khatri* Institute of Cost & Management Accountants of Pakistan (ICMAP), Karachi, Pakistan. Email: sarfraznawaz_khatri@yahoo.com</p> <p>Dr. Muhammad Aqil Shaheed Zulifkar Ali Bhutto Institute of Science & Technology, Karachi – Pakistan. Email: mohammad.aqil@szabist.edu.pk</p> <p>Dr. Asif Ali Abro Director Finance/ Adjunct Faculty, The University of Larkano, Sindh, Pakistan. Email: aliasifabro15@gmail.com</p>	<p>The object of this paper is to examine the volatility repercussion of Shariah and non-Shariah stock market indices of India and Pakistan stock exchanges with the help of non-parametric approaches. The motivation is to examine the risk return trade off between Islamic and conventional stock market indices considering the perspective of investors portfolios. This study measures the performance of Shariah and non-Shariah stock market indices in the context of India and Pakistan stock exchanges. Collection of the secondary source data is from the period of January 03, 2011 to December 29, 2023 respectively with daily frequency. Examining the volatility of both indices for each market is checked through different techniques including risk and return analysis, ARCH and GARCH models. The results intimate that Nifty50 (Non-Shariah) index performs better than its counterparts, i.e. Nifty 50 Shariah index in the Indian stock market, whereas KMI-30 (Shariah) index outperforms to KSE-30 (non-Shariah) index in Pakistan stock exchange. Additionally, volatility repercussion for Indian market especially for Nifty50 Shariah index is high in terms of risk return trade off but Pakistan stock exchange for KMI-30 index applies the strategy of high risk and high return than its KSE-30 (conventional) index. The study could be expanded to macroeconomic variables, other capital markets particularly for Asian markets and panel studies on the selected countries. This study has practical implications particularly to investors, regulatory bodies, financial analysts and potential researchers to make comparison for the performance of Shariah and non-Shariah stock market indices in terms of risk and return trade off. This paper is the first ever study to assess volatility repercussion of Shariah and non-Shariah stock market indices in the context of India and Pakistan stock exchanges.</p>
Keywords:	Shariah index, non-Shariah index, financial performance comparison, ARCH & GARCH models



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1. Introduction

Volatility is embedded to each stock market whether it reflects to Shariah or non- Shariah indices. Since, volatility is an essential element not only for modelling purpose but also for forecasting; and rapid moment in the stock market indices may generate a risk premium for the investors. Conversely, prior studies draw the attention that the volatility has been empirically witnessed for non-Shariah stock market indices (Burhanuddin, 2020) and very few researches have been done for Shariah stock market indices (Das & Manoharan, 2019). However, the important aspect for this study is to investigate which stock market index is better for investors perspective and more resilient to shock when any financial crisis occurs in the stock market.

Volatility repercussion has an important element for India and Pakistan stock exchanges. Investors have the primary object to get maximum returns on their portfolio investments with low volatility. Abduh (2020) stated that when the market is more volatile, then investors show their less interests to engage. In addition to that, both countries markets are too much sensitive and investors may bear either the heavy gains and loses. Besides, ethical investors would rather invest on Shariah stock market indices particularly for Pakistan region. Notably, Shariah following investors just have the intention to receive purified profit as per the Islamic laws and practices.

The object of the study is to explore volatility repercussion for both Shariah and non-Shariah stock market indices with the context of India and Pakistan stock exchanges. Volatility repercussion is examined through Autoregressive Conditional Heteroscedasticity (ARCH) and Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models.

The structure of this paper after introduction part is shown as: chapter II examines the empirical literature review for Shariah and non-Shariah stock market indices. Chapter III describes about methodology part particularly for ARCH and GARCH models. Chapter IV interprets the empirical findings and chapter IV covers the conclusion and recommendation part.

2. Literature Review

Tsay (2005) defines volatility as a conditional variance for stock market return. Consistent volatility in any stock market whether Shariah or non-Shariah indices indicate clustering over time (Fatima et al., 2019). There are very few research articles available which do empirical comparison for Shariah and non-Shariah stock market indices. However, no research has been done in the context of India and Pakistan for considering the volatility repercussion on Shariah and non-Shariah stock market indices and how it reacts to investors sentiments for making their portfolio investments.

Aarif et al. (2021) describes that Shariah based stock market studies are related to very few countries including Egypt, USA and Malaysia. However, Hassan et al. (2006) pointed out that developed and emerging capital markets are entirely different in terms of liquidity, infrastructure, market size and market efficiency. Similarly, the volatility of Indian and Pakistan stock exchanges is embedded with market rumours which adversely affect their performances. Considering the perspective of volatility repercussion of both Shariah and non-Shariah stock market indices within the domain of India and Pakistan requires to assess the performance on the basis of ARCH and GARCH models. The objective of this research can be formulated by the forthcoming hypothesis.

H_1 : Non-Shariah index is relatively more volatile than Shariah Index for the stated period.

Abduh (2020) states that stock market volatility can be measured through GARCH model and it supports financial decisions. ARCH and GARCH models are also helpful in portfolio decisions, forecasting, risk analysis and projections about the future price of the share stock (Engle, 2001).

3. Research Methodology

The volatility repercussion for stock market indices clearly describes that variance should not be having the feature of homoscedasticity but rather having the feature of heteroscedasticity. This study compares the result of Shariah and non-Shariah stock market indices for India and Pakistan by using time series data from the period of January 03, 2011 to December 29, 2023 with daily frequency. In addition to that, selected indices for Shariah and non-Shariah for this sample study is drawn in table 1:

Table 1: Selection of stock market indices

Countries	Category	Indices
India	Shariah	Nifty50 Shariah index
	Non-Shariah	Nifty50 index
Pakistan	Shariah	KMI-30 Index
	Non-Shariah	KSE-30 Index

(Source: Author's work based on Excel-2019)

Volatility in selected stock market indices is a common phenomenon which has the repercussion of high variations during the study period. This study takes a log of closing indices in order to get return for each Shariah and non-Shariah stock market index for Indian and Pakistani stock exchanges. Log return formula is calculated as:

$$R_t = \ln \left(\frac{P_t}{P_{t-1}} \right) \quad (\text{Eq. 1})$$

R_t = Return on stock market on daily basis for Shariah and non-Shariah indices

P_t = Daily closing index value

P_{t-1} = First lag of daily closing index value

Return formula is based on difference of two values; so, it is expected that Autoregressive Moving Average (ARMA) model is being used for checking Autoregressive Conditional Heteroscedasticity (ARCH) effect. Notably, if the Chi-square (χ^2) value is <0.05 then, it shows that error term is white noise. Later on, ARCH effect is to be checked through residual diagnostic test and if the Chi-square (χ^2) value is <0.05 then it provides clear evidence for ARCH effect. This result is a pre-requisite requirement before ARCH and GARCH techniques.

Robert Engle (1982) was the first one who introduced the volatility model of conditional variance being known as Autoregressive Conditional Heteroscedasticity (ARCH) model and later on it was further extended by Bollerslev (1986) and known to be Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Likewise, Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) model was formulated by Nelson (1991) and Threshold GARCH (TGARCH) model was expressed by Zakoian (1994) respectively. Notably, GARCH model is used for symmetric news purpose; whereas EGARCH model incorporates asymmetric good and bad news on stock market and its volatility repercussion on risk and return. According to Fatima et al. (2019) states that bad news has a stronger influence on the stock market volatility than the positive news with the same magnitude. The equation for ARCH (p,q) model is written as:

$$R_t = \alpha_1 + \sum_{k=1}^p \beta_1 R_{t-k} + \sum_{l=1}^q \varphi_1 \varepsilon_{t-l} + \varepsilon_t \quad (1)$$

Where:

R_t = daily return on stock market indices for Shariah and non-Shariah;

α_1 = intercept; $i=1, \dots, p$; $l=1, \dots, q$; β_1, φ_1 = coefficient value;

R_{t-i} = previous lags return up to i ; ε_{t-q} = previous lags error up to q ; ε_t = error term

Later, equation of error term can be constructed as:

$$\varepsilon_t \sim \text{iid } N(0, \sigma_t^2) \quad (2)$$

Where ε_t refers to error term of independent and identically distributed data, N is a symbol of normal distribution provided that zero mean and variance is not constant just because of heteroscedasticity over a period of time. Variance equation will become like this

$$\text{variance } (\varepsilon_t) = \sigma_t^2 = \alpha_0 + \beta_1 \varepsilon_{t-1}^2 + \dots + \beta_q \varepsilon_{t-q}^2 \quad (3)$$

Where:

$\varepsilon_{t-1}^2, \dots, \varepsilon_{t-q}^2$ Variance of error term up to the lag of q

Likewise, equation of GARCH (p, q) model can be constructed as:

$$h_t = \omega_0 + \sum_{m=1}^p \theta_m \epsilon_{t-j}^2 + \sum_{n=1}^q \psi_n h_{t-k} \quad (4)$$

Where $h_t = \sigma_t^2$ is a conditional variance for Shariah and non-Shariah index return for both of the exchanges, $m = 1, \dots, p$, $n = 1, \dots, q$, $\omega_0 =$ omega as an intercept value, $\epsilon_{t-j}^2 =$ Squared error value of past term, $h_{t-k} =$ past values variance. Additionally, it is presumed that $\omega_0 > 0$, $\theta_i \geq 0$, $\psi_i \geq 0$, and summing up of the whole coefficients should be < 1 that can be shown in the model as:

$$\omega_0 + \sum_{m=1}^p \theta_m + \sum_{n=1}^q \psi_n$$

Notably, GARCH model is more reliable and captures the shock especially for parsimony of the data.

4. Empirical Analysis

Since, the object of the study is to compare volatility repercussion on Shariah and non-Shariah stock market indices for Indian and Pakistani stock markets. Graphical presentation of both the markets with the same scale level, i.e., Nifty50 Shariah and Nifty50 indices show the behaviour of the market in the domain of Indian stock market.

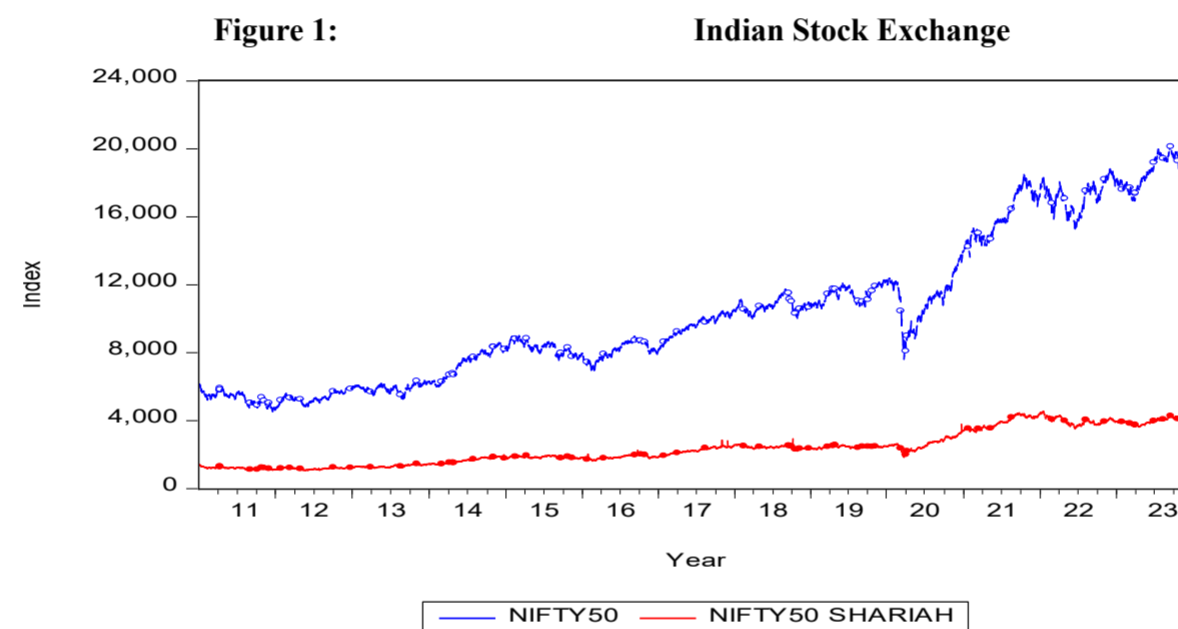


Figure 1 is all about closing price index and its trend for Shariah and non-Shariah indices in the Indian stock market. Figure 1 also points out that Nifty50 index denotes high volatility from the period of 2011 to 2023. However, Nifty50 Shariah index has the low volatility because of limited size of the index.

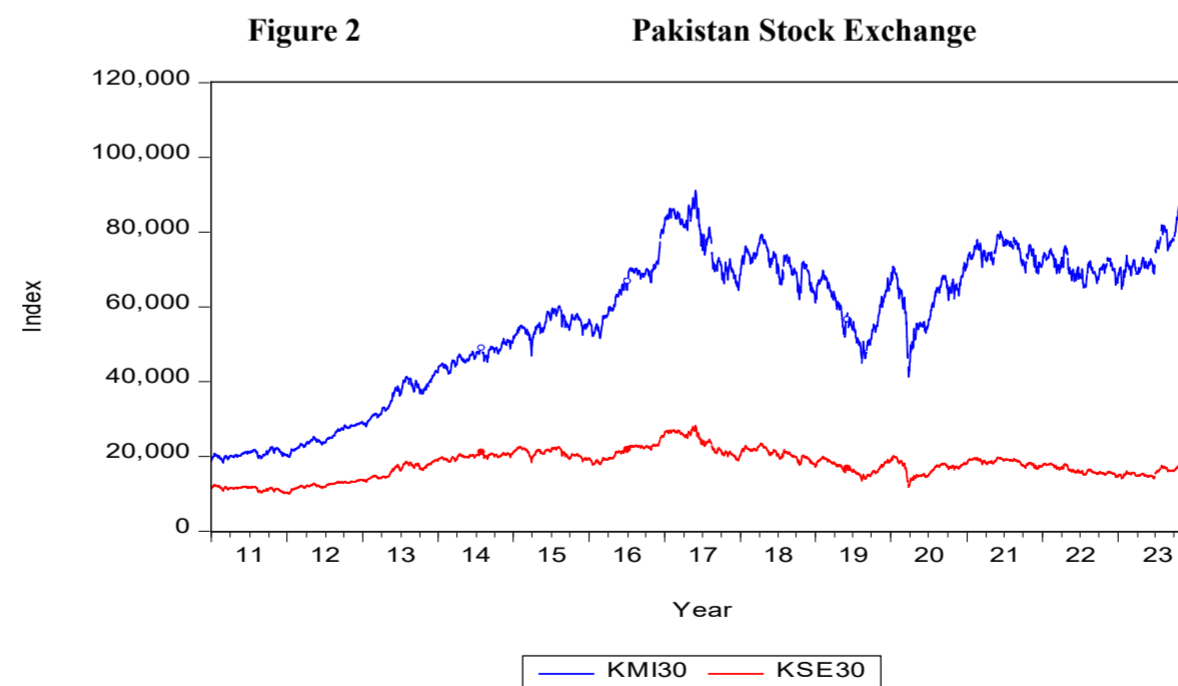
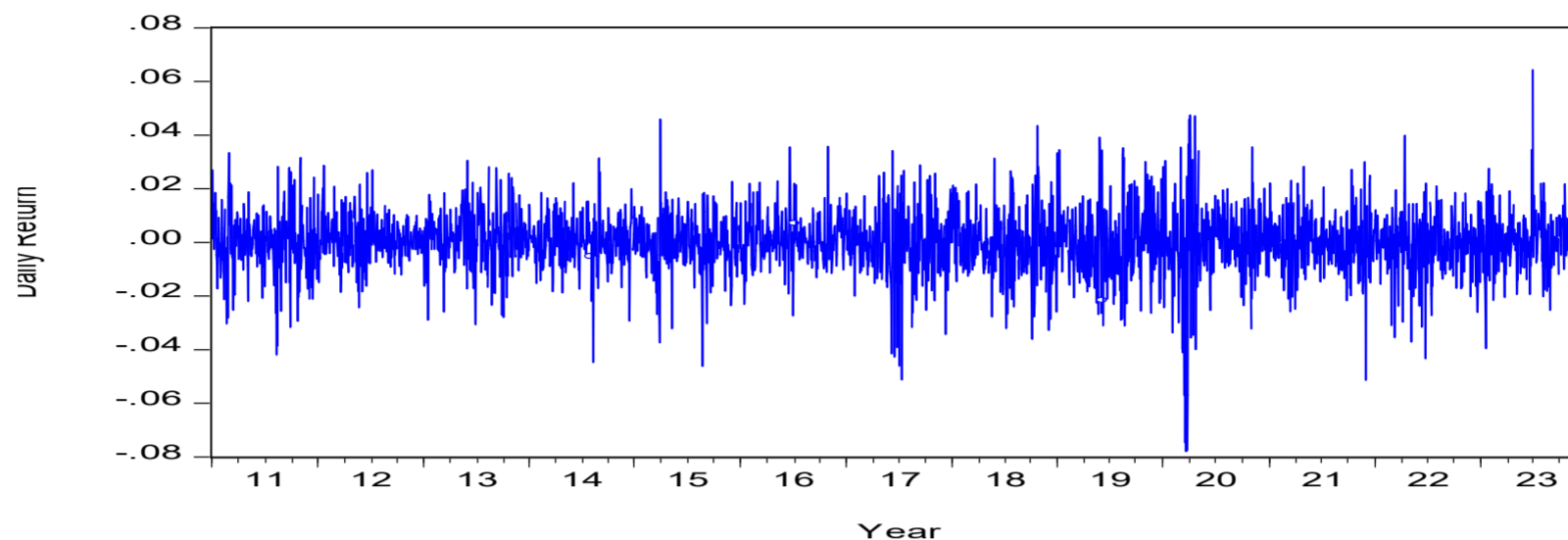


Figure 6: Daily Return on KSE-30 Index



Figures 5 and 6 indicate daily return on KMI-30 index and KSE-30 index on Pakistan stock exchanges. Both of these figures have shown the variability in the return series for the stated period. These results can be further evaluated by ARCH and GARCH models.

Table 02 Descriptive Statistics for Daily Returns				
	India		Pakistan	
Statistics	Nifty50 Shariah Returns	Nifty50 Returns	KMI-30 Returns	KSE-30 Returns
Mean	0.000375	0.000391	0.000533	0.000187
Median	0.000399	0.000604	0.000348	0.000202
Maximum	0.178376	0.084003	0.064647	0.064244
Minimum	-0.175259	-0.139038	-0.078312	-0.077801
Std. Dev.	0.014005	0.010694	0.011926	0.01143
Skewness	0.158772	-0.977812	-0.373778	-0.405584
Kurtosis	53.90324	17.61058	7.008093	6.940713
Jarque-Bera	347982	29180.7	2230.34	2171.784
Probability	0.0000	0.0000	0.0000	0.0000
Sum	1.208467	1.261071	1.717272	0.601038
Observations	3223	3223	3220	3220

Source: Author's work based on E-views-10

Table 2 indicates the statistical report of daily return of Indian and Pakistani stock exchanges. Both of the markets drew the positive return for Shariah and non-Shariah indices. However, Nifty50 Shariah index return on daily basis is 0.0375% which is comparatively lower than Nifty50 index, i.e., 0.0391%. Standard deviation for Nifty50 Shariah index return is 1.4005% which is again higher than Nifty50 index, i.e., 1.0694%. Notably, investors in Indian stock market would rather prefer to invest in Nifty50 index because of higher return and low volatility as compared to Nifty50 Shariah index.

With regard to Pakistan Stock Exchange (PSX), KMI-30 (Shariah) index daily return is 0.0533% which is relatively better than KSE-30 (non-Shariah) index, i.e., 0.0187%. In addition to that, volatility repercussion in KMI-30 index is relatively higher than KSE-30 index. Thus, it is concluded that high risk relates to high return so the risk lover investors in PSX market intend to invest in KMI-30 index because of high risk and high return strategy than KSE-30 index. Notably, both Indian and Pakistani stock markets generate positive return whether they relate to Shariah or non-Shariah indices. The same findings are also witnessed by Khatri et al. (2021), Jabeen and Kausar (2022) for PSX. Conversely, returns of Shariah and non-Shariah stock market indices are stationary at level for both of the markets. So, there is no requirement for unit root test. However, Autoregressive Moving Average (ARMA) model is the pre-requisite requirement before applying ARCH and GARCH techniques. ARMA model is presented in the table #03.

Table 03 ARMA MODEL for Returns

Indices	Order (p,q)	AR Coefficient	MA Coefficient	Residual Statistics	Q- χ^2	p-Value
India						
Nifty50 Shariah	(1,2)	-0.2389	-0.0419	0.0001		
	p-value	0.0000	0.0000	0.9910	0.0000	
Nifty50	(2,1)	-0.8706	0.8912	0.0064		
	p-value	0.0000	0.0000	0.9360	0.0000	
Pakistan						
KMI-30	(1,2)	0.1124	-0.0365	0.0000		
	p-value	0.0000	0.0012	0.9960	0.0000	
KSE-30	(0,1)	N.A.	0.1271	0.0014		
	p-value		0.0000	0.9700	0.0000	

Note: i) N.A. stands for Not Available because of ARMA model requirement.

ii) 1% level of significant

(Source: Author's work)

Table 3 presents the information of ARMA model for returns of Indian and Pakistan stock exchanges. Additionally, the residual is stationary at level where the q-statistics shows the p-value is <0.05 . χ^2 value gives a clear indication for showing ARCH effect. Therefore, ARCH and GARCH models can now be used for further analysis. For this purpose, ARCH equation is drawn in table 04.

Table 04 ARCH Model for Returns

Stock Market Indices	Order (p,q)	Mean Equation			Variance Equation			
		Constant	AR Coefficient	MA Coefficient	Constant	RESID (-1)^2	RESID (-2)^2	RESID (-3)^2
India								
Nifty50 Shariah	(1,2)	0.0007	-0.0556	0.0509	0.0001	0.4578		
	p-value	0.0000	0.0000	0.0000	0.000	0.0000		
Nifty50	(2,1)	0.0005	0.0194	0.0878	0.0001	0.2562		
	p-value	0.0074	0.0246	0.0000	0.0000	0.0000		
Pakistan								
KMI-30	(1,2)	0.0007	0.1636	-0.0200	0.0001	0.3048		
	p-value	0.0006	0.0000	0.0390	0.0000	0.0000		
KSE-30	(0,1)	0.0006	N.A.	0.1790	0.0001	0.1721	0.1916	0.1612
	p-value	0.0033		0.0000	0.0000	0.0000	0.0000	0.0000

(Source: Author's work)

Table 4 findings indicate that the parameters of ARCH model are significant for both Shariah and non-Shariah indices for both India and Pakistan stock exchanges. However, conditional variance also denotes that returns are based on past value shocks which exhibit volatility persistence. Moreover, heteroscedasticity diagnostics outcomes draw the attention that there is no ARCH effect and the residuals are white noise. Lastly, the results are also in line with the findings of Khatri et al. (2021), and Rana and Akhter (2015) respectively.

Table 05

GARCH Model Returns on Daily Data								
Indices	Order (p,q)	Mean Equation (Coefficient)			Variance Equation (Coefficient)			$\alpha + \beta$
		Constant	AR(p)	MA(q)	Constant	RESID(-1) ²	GARCH(1)	
INDIA								
NIFTY50 Shariah	(1,2)	0.0007	-0.0184	0.0274	0.0001	0.3341	0.2571	0.5911
	P-Value	0.0000	0.0000	0.0001	0.0000	0.0000	0.0001	
NIFTY50	(2,1)	0.0007	-0.0040	0.0728	0.0000	0.0810	0.9039	0.9849
	P-Value	0.0000	0.0000	0.0002	0.0000	0.0275	0.0000	
Shariah Remarks		Low			High			
PAKISTAN								
KMI-30	(1,2)	0.0010	0.1494	-0.0359	0.0000	0.1448	0.8080	0.9528
	P-Value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
KSE-30	(0,1)	0.0006	N.A.	0.1577	0.0000	0.1411	0.8069	0.9480
	P-Value	0.0039	N.A.	0.0000	0.0000	0.0000	0.0000	
Shariah Remarks		High			High			

(Source: Author's work)

Table 05 indicates the result of GARCH model of Shariah and non-Shariah stock market indices for India and Pakistan stock exchanges. First and foremost, Nifty50 Shariah and Nifty50 non-Shariah stock market indices in which the returns of Shariah have the low average mean and the variance is witnessed high in Indian stock market. Therefore, investors are more secured to invest in Nifty50 (conventional) index because they get more returns on their investments as compared to Nifty50 (Islamic) index. However, the religious faith believers would rather invest in Nifty50 Shariah index irrespective of their outcomes against their investments.

Conversely, KMI-30 (Shariah) index generates better returns than KSE-30 (non-Shariah) index for Pakistan stock exchange. Interestingly, KMI-30 index is having high variation than its counterparts. So, risk lovers intend to invest in KMI-30 index and try to avoid not investing in KSE-30 index. Since, both of the markets face the abrupt volatility and the investors have the perspective of getting the abnormal returns against their portfolio investments.

5. Conclusion

This paper focuses on volatility repercussion of Shariah and non-Shariah stock market indices for India and Pakistan stock exchanges through ARCH and GARCH techniques. So far, sock market returns are as concerned Nifty50 (conventional) index performs better than Nifty50 Shariah index in Indian capital market whereas KMI-30 (Islamic) index



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performs better than its counterparts, i.e. KSE-30 index. Moreover, the findings also indicate that both of the markets are embedded with high volatility and high risk. Likewise, investors show their keen interests for investing on that index which give them maximum return with low variation in both of the markets.

Faith believers are also another side of the picture where they would rather prefer to invest in Shariah compliant indices irrespective of the rate of return and it is also permissible as per Shariah code of conduct and Shariah mode of financing. Shariah index gives new diversification benefits to the investors because of its resilience during the financial crisis period. Furthermore, this study has the practical implications for policymakers, financial analysts, investors, regulatory bodies.

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