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## Article

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# Islamic and conventional equity index co-movement and volatility transmission: Evidence from Pakistan

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## Abstract

This study investigates the Islamic and conventional Index integration over the period 3rd September, 2008 to 30th September, 2015. This study uses Johansen and Juselius cointegration method for exploring the long run association. The short run association is explored using VECM model. The volatility spillover dynamics is examined using the GARCH and EGARCH models. The robustness of the results is analyzed by using Granger causality method, Variance Decomposition method, and Impulse Response Function. The estimation results show significant long run and short run association between Islamic and Conventional index. Furthermore, this study finds asymmetric bidirectional volatility spillovers between Islamic and conventional index. The findings suggest that domestic investors have low diversification opportunities by adding both Islamic and conventional index in their portfolios. However, international investors can add one of the indices in their portfolios, in order to benefit from portfolio diversification.

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*Keywords:* Islamic index; Conventional index; EGARCH; GARCH; Pakistan

## 1. Introduction

One of the most extensively studied areas in finance literature is stock market integrations. Cheng (2000) define stock market integration as “the situation where markets moves together and have stable long run relationship”. There will be no potential diversification opportunities for investors, if the stock markets are integrated (Jebran, 2014). Similarly, investors cannot obtain benefits from arbitrage opportunities in case of perfect financial integration (Abbes & Trichilli, 2015). Therefore understanding the integration of stock markets is important for investors for decision making in international portfolios.

The importance of exploring integrations of financial markets led many researchers to search for potential diversification opportunities across markets. Most of the studies are interested in exploring integrations of developed

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equity markets (Baele, 2002; Diebold & Yilmaz, 2009; Harris & Pisedtasalasai, 2006; Ng, 2000; Wagner & Szimayer, 2004; Xiao & Dhesi, 2010). There are also studies which investigate the integrations of emerging and developed equity markets (Beirne et al., 2009; Li and Majerowska 2008; Jebran 2014; Jebran & Iqbal, 2016). Few of the studies are contributed in investigating the integrations of Islamic equity markets with other markets (Arshad and Rizvi 2013; Nazlioglu, Hammoudeh, & Gupta 2015; Miniaoui et al. 2015; Majdoub and Mansour 2014; Saadaoui and Boujelbene 2015). Most of the studies are carried out after the US subprime financial crises, because the empirical evidences shows that Islamic stock indices perform better, and also provide potential diversification benefits in tranquil and turmoil period (Abbes & Trichilli, 2015). Saiti, Bacha, & Masih (2014) argue that Islamic stock indices performs better due to many specific features that includes exclusion of financial sectors, ethical and ration screenings, the limits of interest-based leveraged, and exclusion of conventional financial assets like derivatives etc. The aforementioned specific features may make an Islamic product less risky. It is generally argued that the features of Islamic stocks are different from conventional stocks because the former is based on Islamic Shariah criteria. Therefore the risk-return tradeoff will be also different and it is important to explore the potential diversification opportunities across Islamic and conventional indices.

This study is a pioneering attempt to investigate the dynamics of integrations between the Islamic and conventional index of Pakistan. More specifically, this study will explore the co-movement and volatility spillovers between the two indices. This study contributes to the existing literature in numerous ways. First, to the best of our knowledge, this is the first study to explore the dynamic integration of Islamic index and its conventional counterpart in reference to Pakistan. Second, this study use data since the formation of Islamic index in Pakistan, so it will provide valuable insights. Third, the results of the study will provide valuable information to domestic and international investors, who are interested in portfolio diversification. Fourth, this study will add valuable knowledge to the existing literature in terms of an emerging economy. Finally, this study applied several econometric techniques to explore the interdependence of the indices to get more robust results.

The rest of the study is organized as follows. The second section presents the Islamic investment criteria in Pakistan. The third section presents the results. The last section concludes.

## 2. Islamic investment criteria

The Islamic index (known as Karachi Meezan Index) in Pakistan is based on Shariah Compliant Criteria. The Islamic index includes 30 companies, which are selected on the basis of Shariah Compliant Criteria. The board members of Al Meezan Investment Management Limited provide the Shariah screening services. The Islamic Shariah Criteria in Pakistan is based on six screening criteria's. The first screening criterion is based on the fact that the core business of the company should not violate any principle of Shariah. Therefore the companies providing financial services on interest like insurance companies, leasing companies, conventional banks etc are not included in the Shariah. In addition, the companies selling or making products from pork, haram meat, and involved in gambling are also excluded from Shariah criteria. The second criterion is based on the idea that the interest bearing debt to assets ratio of the company should be less than 37%. The third screening criterion is that the non compliant investment to total assets ratio of the company should be less than 33%. The non Shariah compliant investment includes investment in commercial paper, bonds, interest bearing bank deposits, derivatives, and any other commercial interest bearing investments. The fourth criterion is that the non compliant income to total revenue of the company should be less than 5%. The non compliant income includes income from interest based transactions, income from derivatives, insurance companies or any other income from impermissible activities declared by Shariah. The fifth criterion is that the ratio of non-current assets to total assets should be less than 25%. The last criterion includes that the market price per share of the company should be equal to or greater than the net liquid asset per share. The net liquid asset per share is calculated by subtracting non-current assets and total liabilities from total assets and dividing by number of outstanding shares. These screening criteria are strictly followed for inclusion of a company in the Islamic index.<sup>1</sup>

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<sup>1</sup>For more discussions, see Majdoub and Mansour (2014); Jebran and Chen (2017).

Table 1  
Summary statistics.

	CI	II
Mean	0.067837	0.085200
Median	0.045396	0.000000
Maximum	5.301220	5.379038
Minimum	-5.134857	-5.191604
Std. Dev.	1.068087	1.157113
Skewness	-0.442853	-0.379992
Kurtosis	6.744767	7.170146
Jarque-Bera	1138.963***	1382.015***
ARCH Test	149.2939***	229.2779***
Observations	1846	1846

Notes: \*\*\* indicates significance at 1%. II represents Islamic Index, CI represents conventional index. ARCH test is applied for the exploring the presence of heteroskedasticity and autocorrelation.

### 3. Empirical results

#### 3.1. Data

This study aims to explore the integration and volatility spillover between Islamic index and conventional index in Pakistan. The Karachi Meezan Index is selected as a proxy of Islamic index because it is based on Shariah Compliant Criteria and it applies strict criteria on selection of companies in the Index. The Pakistan Stock Exchange 100 index (formerly Karachi Stock Exchange) is selected as a proxy of conventional index because it is not based on Shariah Compliant Criteria. This study consider daily data from the period 3rd September, 2008 to 30th September, 2015, considering 5 trading days from Monday to Friday. The total sample includes 1846 observations. The Islamic Index was introduced on 30th

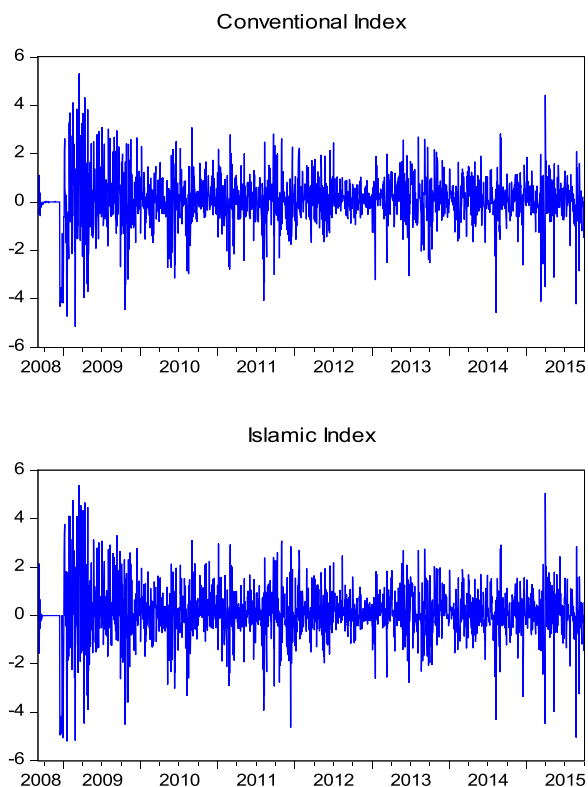


Fig. 1. Return series.

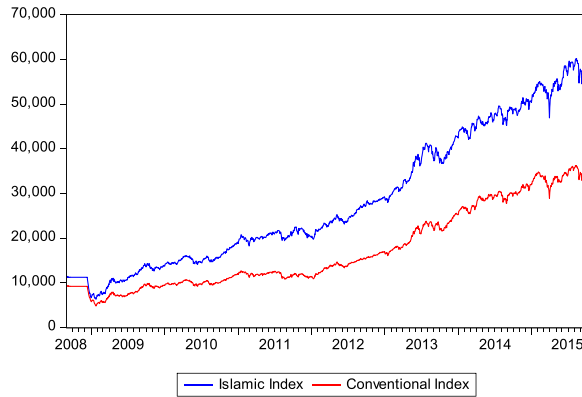


Fig. 2. Index series.

June, 2008, which restricted this study to use the mentioned sample. The datasets are obtained from the official website of Pakistan Stock Exchange.

3.2. Summary statistics

The Table 1 reports the summary statistics of the conventional and Islamic index return dataset. The results indicate that Islamic index offers highest mean returns (0.085%) than its conventional counterpart. This finding suggests that the investors can earn highest returns by investing in Islamic stocks rather than investing in conventional stocks. The standard deviation of the Islamic index is higher than the conventional index suggesting that the former is more volatile market than the later. The kurtosis statistics are positive and higher than 3 for both indices, reflecting leptokurtic distribution. The results also show that the datasets of both indices are negatively skewed indicating left skewed index distribution. This study examines the ARCH effect by applying ARCH test for testing the presence of heteroskedasticity and autocorrelation problems in datasets. The presence of ARCH effect validates the applicability of the GARCH models. The results of ARCH test show significant ARCH effect in the indices, suggesting presence of heteroskedasticity and autocorrelation. Therefore the GARCH models are applicable in such conditions.

The Fig. 1 shows the time plot of the return series of the Islamic and conventional index. The visual examination represents that both indices are characterized by the volatility clustering in which the small (large) volatility is followed by large (small volatility).

The Fig. 2 presents the time plot of the index series of the Islamic and conventional index. The first impression of the Fig. 2 represents that the indices follow similar movements. More specifically, the two index series are following same upward and downward trends suggesting co-movement between the two series. Moreover, the stock price index series are showing upward trends over the time.

3.3. Unit root test results

The stationarity of the datasets is examined by applying two commonly used methods i.e. Phillips and Perron (1988) test and Dickey and Fuller (1979) tests. The results are presented in Table 2. This study applied the two tests of stationarity by taking natural logarithm of the data sets. The results show that both indices, Islamic and conventional are non stationary with respect to levels, while stationary at the first difference. This result validates the assumption of cointegration test, which is applicable on datasets stationary of same order.

3.4. Cointegration test results

In the next step, this study applied Johansen and Juselius (1990) cointegration test to trace the long run relationship between Islamic and conventional index. This study applied cointegration test because it is suitable technique to examine long run association between variables having

Table 2  
Results of unit root tests.

	ADF test		PP test	
	Level	1 <sup>st</sup> Diff.	Level	1 <sup>st</sup> Diff.
Islamic Index	-0.442665	-36.85742***	-0.505775	-37.72906***
Conventional Index	-0.041153	-25.34429***	-0.151501	-37.89027***

Notes: \*\*\* indicates significance at 1%. ADF and PP represents Augmented Dickey and Fuller (1979) and Phillips and Perron (PP) (1988) test respectively.

Table 3  
Results of cointegration test.

H	Trace test			Maximum Eigen-Value test			
	Eigenvalue	Trace statistics	Critical values	H	Eigenvalue	Max-Eigen statistics	Critical values
$r \leq 0$	0.007711	18.49169**	15.49471	$r \leq 0$	0.007711	14.26715**	14.26460
$r \leq 1$	0.002290	4.224544**	3.841466	$r \leq 1$	0.002290	4.224544**	3.841466

Notes: \*\* indicates significance at 5%. H represents the hypothesis. The lag order for estimating cointegration test is selected on the basis of Schwartz criterion.

large number of observations. The suitable lag length for estimating the cointegration test is selected by using VAR statistics and selecting minimum value of Schwartz criterion. The cointegration test is based on two tests, Trace test and Maximum Eigen value test. These tests are presented in Eqs. (1) and (2).

$$\lambda_{trace} = -T \sum \ln(1-\lambda_1) \tag{1}$$

The Trace test evaluates the H0 of the existence of “r” co-integrating vectors in contradiction of the alternative (H1) of “r+1”co-integrating vectors.

The Maximum Eigen value test is based on Eq. (2).

$$\lambda_{max} = -T \ln(1-\lambda_{r+1}) \tag{2}$$

In Eq. (2), the parameters  $\lambda_{r+1}, \lambda_{r+2} + \lambda_{r+3} + \dots + \lambda_n$  represents the n-r smallest squared canonical correlations and the T represents the observations.

The results obtain from cointegration test are reported in Table 3. The results highlight significant long run association between Islamic and conventional index. The Trace test and Maximum Eigen value test confirms the presence of long run association between the two indices. The findings suggest strong correlation between the two indices. Such results suggest low potential diversification opportunities for investors. These results suggest that there will be no diversification benefits to investors having both, Islamic and conventional indices in their portfolios. However, investors can add one of the indices in their portfolio to diversify their risk.

### 3.5. GARCH and EGARCH model

This study uses GARCH and EGARCH model for exploring return and volatility spillover between Islamic and conventional index. We apply both models in order to get more robust results. It is generally argued that negative shocks produce more volatility than positive shocks of the same magnitude. The EGARCH model is selected specifically for exploring the asymmetric volatility spillover. Following (Jan & Jebran, 2015; Jebran & Iqbal, 2016a, 2016b), this study uses a two step procedure to measure volatility spillover. In first step, we generated volatility residuals for each index (i.e. Islamic and conventional index) separately using a GARCH model. In the second step, the generated volatility residuals were used as a proxy of shock emanating from one index to other index. The volatility residuals were introduced to the mean and variance equation of each GARCH and EGARCH model for measuring volatility spillover. The specification of GARCH model is represented as follows

$$R_{t(i)} = \zeta_0 + \zeta_1 R_{t-1} + \psi R_{t-1(k)} + \epsilon_t \tag{3}$$

$$h_{t(i)} = \lambda_0 + \lambda_1 \epsilon_{t-1}^2 + \lambda_2 h_{t-1} + \delta_{(volatilityresidualsofk)} \tag{4}$$

The Eqs. (3) and (4) are mean and variance equation of GARCH model. In Eq. (3),  $R_t$  represents the continuous compounding return;  $\zeta_0$  is the intercept;  $\zeta_1$  measures effect of lagged return on  $I$ ;  $\psi$  measure the returns spillover from  $k$  to  $i$ , and  $\epsilon_t$  is error term. In Eq. (4),  $h_{t(i)}$  is conditional variance of  $i$ ;  $\epsilon_{t-1}^2$  are squared residuals from mean equation;  $h_{t-1}$  is last period forecast variance. The parameter  $\delta$  measures volatility spillover from the index “k” to index “i”, where the volatility residuals of index “k” were used as a proxy of shock emanating to index “i”.

In order to examine asymmetric volatility spillover, this study applied Exponential GARCH model. The specification of EGARCH model is represented as follows

$$R_{t(i)} = \zeta_0 + \zeta_1 R_{t-1} + \psi R_{t-1(k)} + \epsilon_t \tag{5}$$

$$\ln h_{t(i)} = \lambda_0 + \lambda_1 \left| \frac{\epsilon_t - 1}{\sqrt{h_{t-1}}} \right| + \varphi \frac{\epsilon_t - 1}{\sqrt{h_{t-1}}} + \lambda_2 h_{t-1} + \delta_{(volatilityresidualsofk)} \tag{6}$$

The Eqs. (5) and (6) are mean and variance equation respectively. In Eq. (6),  $\ln h_{t(i)}$  is the log of variance of  $i$ , which restricts the volatility to be positive;  $\lambda_0$  is constant level of volatility;  $\lambda_1$  measure reaction of volatility to change in news;  $\lambda_2$  is function of volatility;  $\varphi$  captures the asymmetric effect of volatility;  $\delta$  measures volatility spillover from the  $k$  to index  $i$ , where the volatility residuals of  $k$  were used as a proxy of shock emanating to index  $i$ .<sup>2</sup>

<sup>2</sup>For more discussion see Jebran and Iqbal (2016a, b).

Table 4  
Results of GARCH and EGARCH model.

GARCH model			EGARCH model		
	CI → II	II → CI		CI → II	II → CI
$\zeta_0$	0.146457*** (0.023096)	0.133461*** (0.019972)	$\zeta_0$	0.152725*** (0.018694)	0.143558*** (0.016317)
$\zeta_1$	0.07648 (0.052522)	-0.029617 (0.044933)	$\zeta_1$	0.076358 (0.045829)	-0.062712*** (0.040087)
$\psi$	0.019797 (0.055626)	0.150980*** (0.039044)	$\psi$	0.012067 (0.046243)	0.178571*** (0.034931)
$\lambda_0$	0.037946*** (0.004938)	0.019139*** (0.003028)	$\lambda_0$	-0.221082*** (0.019606)	-0.250922*** (0.020390)
$\lambda_1$	0.115010*** (0.011814)	0.108102*** (0.010597)	$\lambda_1$	0.289000*** (0.025745)	0.310228*** (0.026000)
			$\varphi$	-0.072402*** (0.019555)	-0.087855*** (0.021024)
$\lambda_2$	0.852048*** (0.012697)	0.874463*** (0.010473)	$\lambda_2$	0.927902*** (0.007946)	0.935405*** (0.007964)
$\delta$	-0.077455*** (0.005406)	-0.066101*** (0.003998)	$\delta$	-0.095888*** (0.010986)	-0.092061*** (0.009595)

Notes: \*\*\* indicates significance at 1%. II represents Islamic Index, CI represents conventional index. The arrow represents volatility spillover from the respective index.

$$R_{t(i)} = \zeta_0 + \zeta_1 R_{t-1} + \psi R_{t-1(k)} + \varepsilon_t \quad (3')$$

$$h_{t(i)} = \lambda_0 + \lambda_1 \varepsilon_{t-1}^2 + \lambda_2 h_{t-1} + \delta_{(\text{volatilityresidualsof}k)} \quad (4')$$

$$R_{t(i)} = \zeta_0 + \zeta_1 R_{t-1} + \psi R_{t-1(k)} + \varepsilon_t \quad (5')$$

$$\ln h_{t(i)} = \lambda_0 + \lambda_1 \left| \frac{\varepsilon_t - 1}{\sqrt{h_{t-1}}} \right| + \varphi \frac{\varepsilon_t - 1}{\sqrt{h_{t-1}}} + \lambda_2 h_{t-1} + \delta_{(\text{volatilityresidualsof}k)} \quad (6')$$

Table 5  
Results of vector error correction model.

DV	C	II	CI	ECT <sub>(t-1)</sub>
II	2.60E-05 (-0.02991)	0.291018*** (0.06553)	-0.67797*** (-0.0651)	-1.302065*** (0.09365)
CI	-0.000308 (0.02820)	0.310086*** (0.06178)	-0.756578*** (0.06138)	-0.288179*** (0.08831)

Notes: \*\*\* indicates significance at 1%. II represents Islamic Index, CI represents conventional index. ECT(t-1) is the error correction term, which measures the speed of adjustment towards long run.

The results of GARCH and EGARCH model are represented in Table 4. The estimation results show some interesting results. The mean equation results of GARCH model show evidence of significant return spillovers from Islamic index to conventional index. Similar results are obtained from estimation of EGARCH model, which further validates the results of GARCH model. The variance equation results of GARCH model results show significant bidirectional volatility spillover between Islamic and conventional index. The results obtained from EGARCH model show asymmetric volatility spillover between Islamic to conventional index, suggesting that bad news has more effect than the good news. The volatility spillover between the two markets suggests that the presence of these two indices in portfolios will not provide potential diversification benefits. However, investors may include one of the indices in their portfolios to benefit from diversification. These results are inconsistent with Saiti et al. (2014) that reported that there are potential diversification opportunities within the same country.

### 3.6. Vector error correction model

After confirmation of significant long run association between the Islamic and conventional index, we test the short run association using the vector error correction model. The results are reported in Table 5. The results show significant short run association between the Islamic and conventional index. The error correction term is significant negative which further validates the significant long run association between the two indices. The significant negative error correction term suggests that the short run disequilibrium can be achieved towards long run. Furthermore, the significant short run association suggests the absence of potential diversification opportunities for investors having both indices in their portfolios.

### 3.7. Granger causality test

In order to trace causal linkages between the Islamic and conventional index, this study apply Granger causality method between the return series of the two indices. The results of Granger causality test are reported in Table 6. The results show evidence of bidirectional causal association between Islamic and conventional index in Pakistan. More specifically, this study finds strong lead lag association between the two indices. These results justify strong co-movement between Islamic and conventional index. These results are consistent with Ajmi, Hammoudeh, Nguyen and Sarafrazi (2014) who reported significant bidirectional causal relationship between Islamic and conventional indices.

### 3.8. Variance decomposition test

This study apply variance decomposition test to explore the contribution of variance to the variances of the other variables. The results are reported in Table 7. The results show that Islamic index has negligible contribution to the variance of conventional index. However conventional index explains approximately 85% variations in Islamic index. This result suggests that conventional index volatility contributes more variations in

Table 6  
Results of Granger causality test.

Null hypothesis:	Obs	F-statistic	Prob.
LN_II does not Granger Cause LN_CI	1845	12.0924**	6.E-06
LN_CI does not Granger Cause LN_II		3.22498**	0.0400

Notes: \*\* indicates significance at 5%. II represents Islamic Index, CI represents conventional index.

Table 7  
Results of variance decomposition test.

Conventional index				Islamic index			
Period	S.E.	LN_CI	LN_II	Period	S.E.	LN_CI	LN_II
1	0.010440	100.0000	0.000000	1	0.011433	84.87625	15.12375
2	0.015953	99.66377	0.336235	2	0.017359	84.58549	15.41451
3	0.020677	99.58706	0.412937	3	0.022088	84.94690	15.05310
4	0.024617	99.51617	0.483835	4	0.026051	85.08088	14.91912
5	0.028062	99.46561	0.534387	5	0.029517	85.13828	14.86172
6	0.031133	99.42105	0.578946	6	0.032623	85.13887	14.86113
7	0.033926	99.38062	0.619376	7	0.035458	85.10814	14.89186
8	0.036502	99.34215	0.657848	8	0.038081	85.05689	14.94311
9	0.038902	99.30475	0.695245	9	0.040532	84.99217	15.00783
10	0.041157	99.26783	0.732173	10	0.042841	84.91802	15.08198

Note: II represents Islamic Index, CI represents conventional index.



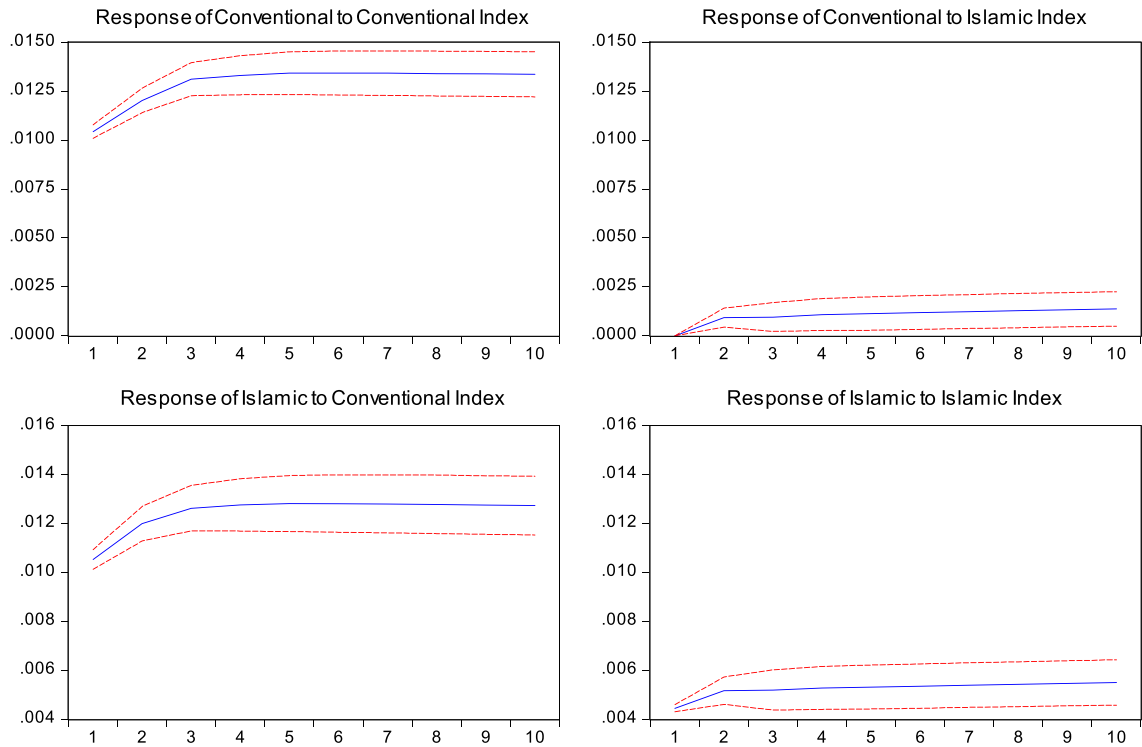


Fig. 3. Impulse response function.

variance of Islamic index.

### 3.9. Impulse response function

In order to test, how the Islamic and conventional indices respond to the short run temporary shocks, this study employ the impulse response function. The impulse response function is derived from the estimation of VAR model. The impulse response function of the Islamic and conventional index are presented in Fig. 3. The visual examination of the Fig. 3 shows that conventional index respond positively to shock of Islamic index. Similarly the Islamic index responds positively to the shocks of conventional index. These results are consistent with Nazlioglu et al. (2015), who reported similar results between Dow Jones Islamic stock and S&P 500 index. Fig. 3.

## 4. Conclusions and implications

This study examined the co-movement and volatility spillover dynamics between Islamic and conventional index in Pakistan considering period from 3rd September, 2008 to 30th September, 2015. This study applied various economic techniques to examine the association between Islamic and conventional indices. The stationarity of the data sets was tested by using unit root tests namely Phillips and Perron (1988) and Dickey and Fuller (1979). The long run relationship was examined using Johansen and Juselius (1990) cointegration test. The short run association was tested by using VECM model. The volatility spillover dynamics was examined using GARCH and EGARCH models. Furthermore the robustness of the results was tested using Granger causality test, impulse response function, and variance decomposition analyses. The results highlighted certain interesting findings. This study finds significant long run and short run association between the Islamic and conventional indices. Furthermore, this study also finds significant bidirectional volatility spillover between Islamic and conventional index. The EGARCH model confirmed asymmetric volatility spillover between the two indices. This study finds bidirectional causal association between Islamic and conventional indices, conforming strong lead lag association between the two indices. The variance decomposition analyses confirmed that both indices explain variations in their variance. The impulse response function showed that the Islamic and conventional indices respond positively to the shocks of each other. In sum, this study finds strong co-movement and volatility spillovers between Islamic and conventional index in Pakistan.

The findings of this study are important for policy makers and investors. The evidence of financial interdependence indicates that the financial shocks in one market will spill over to other market. The policy makers may develop such policies to deal with the interdependence of the indices for financial stability perspective. Furthermore, the knowledge of the integrations of the markets is important for domestic and international investors for portfolio diversifications. The integration of Islamic and conventional indices in Pakistan provides knowledge that the investors may be not able to benefit from diversification, if they have both indices in their portfolios. However, investors may add one of the indices in their portfolios to benefit from diversification. Furthermore, investors can invest in Islamic indices which provide highest returns as compared to its conventional counterpart.

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