Islamic Equities Volatility and U.S. Economic Influence: Case of Emerging Market

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Abstract

The emerging markets are evidently very attractive to the international investors especially the shariah compliant equity markets, due to their resistant nature against financial crisis. The economic crisis of 2008, which started in United States (U.S.), had devastating impact on the global economy, yet the past studies validate the fact that the U.S. equity investors exert highly significant influence on the price movement of equities in emerging market, hence it is imperative to study the influence of the U.S. economic determinants in the Shariah Compliant Equity Market of Pakistan. The employed methods are the Autoregressive Distributed Lag (ARDL), Granger Causality, Variance Decomposition, and the function of Impulse Response. Results have shown that the Variance Decomposition test outcome suggests that U.S. T-bill and rate of Interest spread has exerted the highest level of influence by 7% in long-run (month 10), secondly the U.S. money supply has influenced the volatility of the KMI 30 index of Pakistan by 3.14% in 10-month period. The rationale behind the U.S. Interest rate volatility is that any fluctuation in federal fund rate reacts inversely to the equity price index in emerging markets. The outcome of Granger Causality test verifies the existence of unidirectional influence of KMI 30 index on economic growth of U.S. because of high level of U.S. investors' investment interest in emerging markets like Pakistan, keeping other aspects constant. The study reveals that U.S. macroeconomic determinants especially Interest rates both long-run and short-run are crucial to the determination of movement of the Islamic equity returns in emerging market.

Keywords: ARDL Test, Islamic Equities, Macroeconomy, U.S. economy, Variance Decomposition

1: Introduction

1.1 Background:

Economic health and the efficient performance of capital markets are

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prerequisite to the financial wellbeing of the society. Plenty of past researches are available on this area of study related to the conventional equity markets in the flourished economies (Fama 1981; Poon and Taylor 1992; Humpe and Macmillan 2009). However, studies conducted on Islamic equity market are scarce or at infancy stage. Knowing the fact that the investment from U.S. is the biggest source of the foreign stock capital and the emerging markets strive to attract the U.S. equity portfolio investment to strengthen the individual stock performance and the liquidity in market Aggarwal, Klapper, and Wysocki (2005), hence this analysis will broaden the existing Islamic finance literature base regarding the influence of U.S. economic variables on the Islamic equity market of Pakistan.

The emerging financial markets offer a viable alternative investment platform to U.S. investors when they observe lower level of interest rate offered in home country (Adesanmi 2018). Previous researches have shown the movement of determinants of macroeconomy on the volatility of equity prices (Fama 1981; Chen, Roll, and Ross 1986; Schwert 1990; Fama 1990). The international economic influence is one of the premier aspects that shape the behaviour of equity return in Pakistan. Portfolio investment from the U.S. plays a key role deciding the fate of the investors of equity markets of emerging economies, due to its highly liquid nature and the volatility in global economic environment. For instance, the stock market of Pakistan has observed several crashes due to the outflow of foreign equity investment, like the market crash of 2008, primarily caused by the destabilization of international macroeconomic factors (Tribune 2017).

This evaluation, to the best of our information, is one of the earliest attempts of analysing the Shariah stock index performance in Pakistan, and the assessment of the Islamic equity market's behaviour against the influence of volatility induced by U.S. macroeconomic variables, in the perspective of economic developments in the country employing the techniques of ARDL and variance decomposition.

1.2 Objective:

The specific purposes of this research are as follows:

I. To analyze the risk associated with the returns of Islamic stocks in Pakistan.

II. To analyze the long-run and short-run association among U.S. economic variables on Islamic stock return in Pakistan.

III. To understand the significance of international portfolio investment on equity movement of Pakistan.

IV. To forecast the volatility of monthly returns on the Shariah stock exchange of Pakistan.

2. Literature Review

The influence of macroeconomic factors on the volatility of stock prices has been tested by various past studies Fama (1981); Geske and Roll (1983); Chen, Roll, and Ross (1986); Fama (1990); Schwert (1990). The literature of Islamic and conventional stock markets have identified various influential economic factors such as interest rate. Humpe and Macmillan (2009); Chang et al. (2019); Tursoy (2019); Bhuiyan and Chowdhury (2020); Humpe and McMillan (2020); Sheikh et al. 2020; Khan et al. (2021), suggest that there exist negative association between interest rate and stock return. However, on the other hand, rise in interest rate motivates foreign investors to invest in emerging markets like Mexico, which may indicate a possible upsurge in U.S. interest rate. As a result, foreign investors may get motivated to withdraw investment from high-risk countries i.e., emerging markets to low risk environment. Near zero rate has been maintained by the Federal reserve, after the global financial crisis. Nevertheless, massive transfer of capital has been observed from developed country like U.S. to emerging markets which caused the equity price index reacts inversely to a quiver in the interest rate of federal reserve (Adesanmi 2018). Nevertheless, Masih, Kamil, and Bacha (2018) suggested that interest rate level is disregarded due to the fact that the shariah compliant investment are non-interest bearing, which signifies the autonomous linkage between both variables. Hashmi and Chang (2021) found significant long-term association with equity returns.

Real sector progress of the economy leads towards the increase in the firms' profitability hence influence the stock prices positively (Geske and Roll 1983; Wongbangpo and Sharma 2002; Chen et al. 1986; Humpe and Macmillan 2009; Chang et al. 2019). Expected future cash may increase as the increase in the output so the stock prices but during the economic downturn, an inverse relation may observe. Hadi, Irani, and Gökmenoğlu (2020); Shahzad, Hurley, and Ferrer (2021) found large long-term impact on the stock market.

Increase in discount rate reduces the stock prices as a result of augmented money supply which according to Fama (1981); Sheikh et al. (2020) that money growth has positive relation with inflation rate, hence increases the discount rate which subsequently reduces the stock prices. To overcome this inverse impact, money growth economic stimulus may swell the stock prices through increase in cash flows (Mukherjee and Naka 1995). Money supply in U.S. can

explain the variation in international equity indices (Bhuiyan and Chowdhury 2020).

Islamic index is prone to systematic risk in conventional equity. Past studies verify the Islamic equity market has significant implications with conventional stock indices Ajmi et al. (2014); Gupta et al. (2014); Hammoudeh et al. (2014); Naifar (2016); Bahloul, Mroua, and Naifar (2017); Mensi et al. (2017); Cevik and Bugan (2018); Umar et al. (2018), suggest that Islamic indices perform better than conventional indices especially during financial crisis period.

3. Estimation Technique and Model Specification

The long-run equilibrium relationship among time-series variables has been tested by employing different methodologies adopted by Engle and Granger (1987); Johansen (1988); Johansen and Juselius (1990); Phillips and Hansen (1990); Johansen (1991), however they contain lower rigor and do not hold the efficient small sample characteristics. They also entail that determinants utilized in the sample are order of one which is I(1) integrated. Because of the existence of such weaknesses, the ARDL cointegration approach is a superior choice.

To check the influence of international market considering the fact that Pakistan is an open economy, the U.S. real sector variable has been incorporated. Ahmed (2008) found that in global economy, interest rate is one of the most common influential external factors. The goods market representing variable is index of Industrial production, whereas the Money Supply and Treasury Bill Rate represents the money market variables Chen, Roll, and Ross (1986); Mukherjee and Naka (1995); Wongbangpo and Sharma (2002).

Model: LKMI = a + b IR + c IPI + d MS + e TIS + f NSDQ + μt

Where,

LKMI = Log of Karachi Meezan Index (KMI -30)

IR = Interest Rate

IPI = Industrial Production Index

MS = Money Supply

TIS = Treasury Bill and Interest Rate Spread

NSDQ = NASDAQ Stock Index of U.S.

3.1 Methodology

KMI 30 index was started in September 2008 hence the data is taken for the time period of 2008 M9 – 2019 M12, on monthly frequency for variables, Shariah-compliant Index of Pakistan (LKMI), and the set of various Global factors from U.S. economy including, Industrial Production Index (IPI), Interest Rate (IR), Treasury Bill and rate of Interest Spread (TIS), Money Supply (MS), Nasdaq Stock Index of U.S. (NSDQ). Only selected variables are incorporated because of data unavailability on monthly basis. For evaluation of the objective, the techniques employed are Auto Regressive Distributed Lag (ARDL), along with Variance Decomposition and function of impulse response.

The co-integration approach of ARDL suggested by Pesaran, Shin, and Smith (1996), has been adopted for this paper as it has definite advantages over other methodologies to cointegration. For instance, in comparison to other Vector Autoregressive (VAR), it accommodates wider range of factors in the model. The inferences for long-run estimates are allowed, unlike other co-integration techniques, other advantage under the approach of ARDL is that it could be applicable notwithstanding presence of stationary characters of the sampled variables.

According to Laurenceson and Chai (2003) ARDL model allows us to take adequate lags number in the model to apprehend the process of producing data in a framework of general to particular modelling. Model could be selected on the standards like Adjusted R square, (SBC) i.e. Schwartz-Bayesian Criteria, and (AIC) which is Akaike information criteria. Adjusted R square and criteria of Akaike information are recognized for choosing the highest lag-length whereas the criteria of Schwartz-Bayesian are known as model of parsimony i.e. choosing the smallest length of lag. The model in this study based on these three stated criteria. The additional motivation to adopt the ARDL model is our small sample size.

According to Banerjee et al. (1993), that through a linear transformation of ARDL, the error correction dynamic model could be obtained. The ECM model, unaccompanied by the long–term information, incorporates the dynamics equilibrium of short–run. The ARDL model of ECM representation can be presented as under:

$$\Delta \text{ KMI } t = a_0 + \Sigma b_j \Delta \text{ KMI}_{(t-j)} + \Sigma c_j \Delta \text{ IPIPK}_{(t-j)} + \Sigma d_j \Delta \text{ ER}_{(t-j)} + \Sigma e_j \Delta \text{ FPI}_{(t-j)} + \Sigma f_j \Delta \text{ DR}_{(t-j)} + \Sigma g_j \Delta \text{ TBPK}_{(t-j)} + \Sigma h_j \Delta \text{ KSE}_{(t-j)} + \Sigma i_j \Delta \text{ IR}_{(t-j)} + \Sigma j_j \Delta \text{ IPIUS}_{(t-j)} + \Sigma j_k \Delta \text{ MSUS}_{(t-j)} + \Sigma j_l \Delta \text{ TIS}_{(t-j)} + n_1 \text{ IPI}_{(t-1)} + n_2 \text{ ER}_{(t-1)} + n_3 \text{ FPI}_{(t-1)} + n_4 \text{ DR}_{(t-1)} + n_5 \text{ TBPK}_{(t-1)} + n_6 \text{ KSE}_{(t-1)} + n_7 \text{ IR}_{(t-1)} + n_8 \text{ IPIUS}_{(t-1)} + n_9 \text{ MSUS}_{(t-1)} + n_{10} \text{ TIS}_{(t-1)} + t$$

The terms with n_S in the second part of the model represents the long-term association whereas, the dynamics of error correction are represented by sign of summation in the above equation.

The long-run linkage existence is evaluated against the null hypothesis (H_0: $n_1 = n_2 = n_3 = n_4 = n_5 = n_6 = 0$) indicating that there is no long-run association exist. Narayan (2004) tabulated the critical value to check the position of the calculated f-statistic of no co-integration null hypothesis, which could not be repudiate whether the evaluated f-statistic value dips below the lower bound, and similarly, if it falls larger than the bound's upper critical value, the null hypothesis gets repudiated. However, the inconclusive outcome would be considered if it lies within the band of critical value. After the confirmation of cointegration, the long-run association between factors of macro economy and prices of equity are estimated using the selected autoregressive lag model. The estimation of associated ARDL model of error correction is the final step of ARDL test. In the end the model of ARDL stability, goodness of fit, and diagnostic, tests are evaluated. The techniques of cumulative sum of recursive residual and CUSUMSQ i.e. cumulative sum of squares of recursive residual are utilized to examine the structural firmness.

3.2 Variance Decomposition (VDC)

VDC test is utilized in order to identify the level of interaction each factor contributes to another factor. According to Wickremasinghe (2006), that in the model of VECM, the estimation process error, that comes from additional factors. It also examines the variance of error in each variable is explained by another variables exogenous shock affect. Under the method of variance decomposition, the reaction's percentage in each of intervening factor to the selected dependent variable. The results presentation in the table format supports the identification process of which of the chosen economic factor shows the most share in explaining the variation in the shariah equity index.

4. Results

The result section of the paper discusses the outcomes of employed methods i.e., Autoregressive Distributed Lag, function of impulse response, variance decomposition and the test of Granger Causality. The stationarity of data has been analyzed via using Augmented Dickey Fuller (ADF) and Philip-Perron (PP) tests, later, the test of length of optimal lags is conducted to initiate the bond test. To analyze the model stability the tests of Cumulative sum of residuals and the technique of CUSUMSQ i.e. Cumulative sum of squares of recursive residuals whereas the statistical strength of the employed model will be

assessed through test of Heteroskedasticity Breusch-Pagan Godfrey, and technique of Serial Correlation Breusch-Godfrey. Following are the results acquired by performing the statistical tests along with discussion in detail:

4.1 Optimal Lag Length Selection

The Table 4.1. Represents the number of lag lengths estimated by AIC, SC and HQ methods for our model. All criteria show the different length of lags which is the criterion of Akaike information suggest the lag length of 1, whereas, other two approaches of SC and HQ also suggest the lag length of 1. This study has adopted the AIC approach for the lag length selection for our model as suggested by Liew (2004), it affirms the overestimation problems is negligible in all cases and produces the least underestimation among all approaches. For this study the lag length of 1 selected under AIC approach for this model. The time series dataset unit root test of both models will be conducted in next step.

Table 4.1. Optimal Lag Selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3736.145	NA	9.97e+17	58.47101	58.60470	58.52533
1	-2646.793	2059.556	7.10e+10*	42.01239*	42.94821*	42.39262*
2	-2617.353	52.90024	7.89e+10	42.11488	43.85284	42.82102
3	-2594.345	39.18450	9.76e+10	42.31789	44.85798	43.34994
4	-2568.166	42.13278	1.16e+11	42.47134	45.81356	43.82930
5	-2546.457	32.90218	1.49e+11	42.69464	46.83900	44.37851
6	-2525.837	29.31906	1.98e+11	42.93495	47.88144	44.94474
7	-2483.151	56.69221*	1.89e+11	42.83049	48.57911	45.16618
8	-2453.705	36.34776	2.28e+11	42.93289	49.48364	45.59449

4.2 Unit Root Test Results

The nature of financial and economic data is known to be nonstationary, hence it is essential to check whether the employed factors are coherent at same level or not. The tests of stationarity, Philip-Perron (PP) and ADF i.e. Augmented Dickey fuller have been employed to identify the unit root. The outcomes of

ADF and PP conducted first difference and at level are displayed in Table 4.2. The null hypothesis has been rejected as data became stationary at first difference of both ADF and PP tests, which interprets that data is stationary for all variables when tested at first difference. The assessment of variables' stationarity at I(1) enables the process for next step of ARDL which is ARDL BOND test.

Table 4.2. Unite Root Test Results

Variables	ADF Test (At level)	ADF Test (At first difference)	PP Test (At level)	PP Test (At first difference)
LKMI	0.9889	0.0000	0.9918	0.0000
IR	0.8154	0.0000	0.1674	0.0000
IPI	0.7129	0.0000	0.7378	0.0000
MS	1.0000	0.0000	1.0000	0.0007
TIS	0.0202	0.0004	0.0000	0.0000

4.3 Multicollinearity Test Result

The test of variance inflationary factor measures the level of variance of the estimated coefficient of regression is inflated as compared to nonlinearly related independent variable. The Results of variance inflation factors (VIF) test presented in Annex 2. It is essential to perform the VIF test on explanatory variable to identify the multicollinearity among them. According to Kennedy (1992); Hair, et al. (1995), recommend that the maximum accepted value for VIF should be no more than 10 and any value above it will be considered as highly correlated. Our derived results show that none of the independent variable is highly correlated which means that they represent their affect efficiently.

4.4 Cointegration Result

The outcome of test of unit root have shown entire employed factors are either integrated of order I(0) or I(1), hence the test of auto regressive lag distribution (ARDL) can be applied in order to explore the cointegration amid the employed factors. The F-statistic outcome of bonds assessment are represented in Table 4.3. that proves the presence of cointegration and longer period association among factors as the F-statistic value 9.739679 is above the upper bond I(1) values which is 4.15.

Table 4.3 ARDL Cointegration Test Result

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	9.739679	10%	2.08	3
k	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

4.5 Long–Term Estimation

The outcome of coefficients of long-term model are represented in Table 4.4 The estimated statistics, standard error, t statistic values along with probability values are represented in the table for each individual variable. The coefficient values of each explanatory variable shown in Table 4.4 Show positive relationship with all variables except for the coefficients value of U.S. Interest Rates (IR) which is negative. The positive coefficients values of variables explains that a percent increase in Industrial production U.S. (IPI), T-bill and interest rate spread U.S. (TIS), Money supply U.S. (MS), and Nasdaq conventional Index (NSDQ), will increase in returns of the KMI–30 index of Pakistan (LKMI) by 00.015674%, 4.00E-13%, 1.515365%, 2.196523% respectively, except for the coefficients value of Interest rate of U.S. (IR), which means that a one percent increase in IR, will reduce the LKMI by -0.634205%. Almost all selected variables; U.S. Interest Rates (IR), T-bill and interest rate spread U.S. (TIS), Money supply U.S. (MS), and Nasdaq conventional Index (NSDQ), are significant at 0.05 level of significance 0.0000, 0.0000, 0.0034, 0.0045 respectively, except for the Industrial production U.S. (IPI), which is 0.1520 greater than 0.05. our results are consistent with the studies (Granger 1969; Majid and Yusof 2009; Hammoudeh et al. 2014; Mensi et al. 2017; Mohammed and Abu Rumman 2018; Dash and Maitra 2018).

Table 4.4 Long-Run Estimation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IR	-0.634205	0.064366	-9.853166	0.0000
IPI	0.015674	0.010867	1.442393	0.1520
MS	4.00E-13	2.05E-14	19.50945	0.0000
TIS	1.515365	0.506798	2.990079	0.0034
NSDQ	2.196523	0.756904	2.901983	0.0045
C	2.723071	1.353038	2.012561	0.0466

4.6 Short-Run Estimation

The statistical result shows the negative coefficient value and significant at 5% significance level of Error Correction Model (ECM) which means that the prices of KMI-30 have -0.157396 percent tendency to adjust from the past year with highly significant p-value of 0.0000 (Table 4.5). The table represents the effects of auto selected lags effects of the selected variables. Following variables shown in table are significant for the short-run variation estimation; LKMI became significant and negatively in lag 3 with coefficient value of -0.137675, IPI variable reflect negative and significant infect on shariah returns in lag 1 with the coefficient value of -0.003090%. The positively significant impact has been reported by money supply (MS) on LKMI prices with coefficient statistic of 3.10E-13 in lag 2, but it becomes negative in lag 3. TIS has significant relation with LKMI returns in lag 2 and 3 with the coefficient values of positive 0.208585 and negative -0.238981 respectively.

Table 4.5 ARDL Error Correction Term

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LKMI(-1))	-0.084209	0.051547	-1.633630	0.1051
D(LKMI(-2))	0.049915	0.051513	0.968966	0.3346
D(LKMI(-3))	-0.137675	0.049879	-2.760190	0.0068
D(IPI)	0.001903	0.001407	1.352769	0.1789
D(IPI(-1))	-0.003090	0.001379	-2.241173	0.0270
D(MS)	-1.26E-13	1.03E-13	-1.223689	0.2236
D(MS(-1))	-6.06E-14	1.14E-13	-0.533494	0.5947
D(MS(-2))	3.10E-13	1.13E-13	2.755560	0.0068
D(MS(-3))	-2.90E-13	1.07E-13	-2.712709	0.0077
D(TIS)	0.072669	0.075817	0.958490	0.3399
D(TIS(-1))	-0.012300	0.076279	-0.161247	0.8722
D(TIS(-2))	0.208585	0.082003	2.543610	0.0123
D(TIS(-3))	-0.238981	0.063097	-3.787539	0.0002
CointEq(-1)*	-0.157396	0.018571	-8.475266	0.0000

R-squared	0.569633	**Mean dependent var**	0.017330
Adjusted R-squared	0.522219	**S.D. dependent var**	0.057242
S.E. of regression	0.039566	**Akaike info criterion**	-3.521665
Sum squared resid	0.184730	**Schwarz criterion**	-3.215913
Log likelihood	246.4299	**Hannan-Quinn criter.**	-3.397421
Durbin-Watson stat		1.959496	

4.7 Function of Impulse Response

In order to find out the source of quiver in the employed variables, or to analyses the response of shariah stock return to shock of one unit introduced to the independent determinants, the test of variance decomposition and the function of impulse response and have been employed. The graphical representation of the Impulse function shows that how stock returns of (KMI–30 index) reacts to the shocks to each of the economic variable whereas, the variation proportion of that shock from independent variables is represented by the variance decomposition analysis. For this analysis the generalized form of impulse response function has been utilized because of its property of being independent of variables' ordering.

Figure 4.1 given below shows the outcome of the test of impulse response function in a graphical form for the factors, shariah index of Pakistan (LKMI) which is response variable. Results show that LKMI has largely positive but represents downward trending response to the innovations added to the index throughout the selected periods, the Index return response to variable IR shown negative response, the response to LIPI shows no significant movement during studied period; index response to innovation in MS is positive throughout the explored periods, the shock effect of LKMI to TIS remains positive for the 1 to 4 period then become negative post 5 till 10 period, and the response of shariah index of Pakistan to innovations to NSDQ shows negative movement.

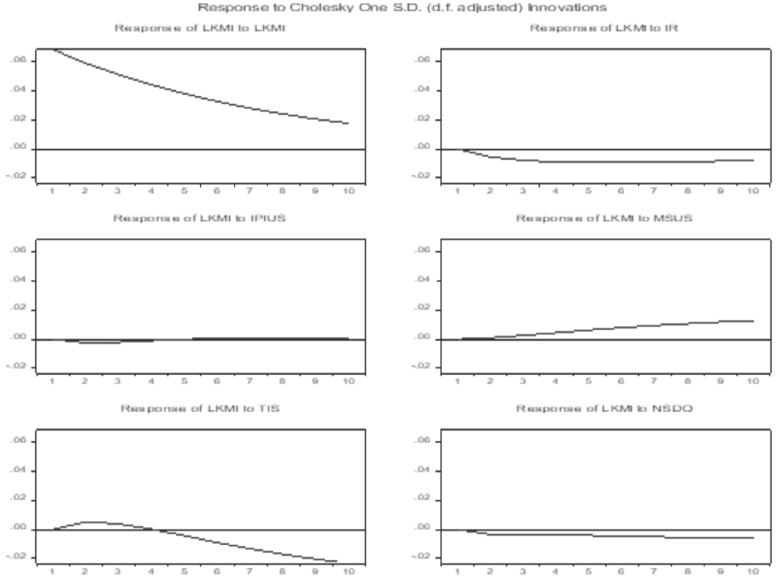

Figure 4.1 Function of Impulse Response Graphs

4.8 Variance Decomposition

The level of economic factors' fluctuation is accountable to the variation in the shariah equities' prices in Pakistan is analysed through the test of variance decomposition. below given results (see Table 4.6.) shows the outcome of test of variance decomposition. For this test, the Cholesky ordering method has been employed. The LKMI variable is accounted for 98% of the variation by its own shocks in the short-run i.e. month 3, and the long-run variation is lower as compared to short-run which is 85% in month 10. IR is accounted for maximum 3% variation throughout the studied period, IPI influences the fluctuation in stock returns for maximum 0.09% in month 3, MS accounted for maximum of 3% variation in KMI returns in period 10, TIS cause index prices to fluctuate maximum of 7.7% in period 10, whereas the U.S. Nasdaq conventional index NSDQ is accounted for the maximum of 0.97% in 10th period of the study.

Table 4.6 Variance Decomposition Results

Period	S.E.	LKMI	IR	IPI	MS	TIS	NSDQ
1	0.068362	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.090636	99.08176	0.358033	0.074978	0.011845	0.332244	0.141144
3	0.104518	98.42915	0.826826	0.095164	0.070021	0.382658	0.196181
4	0.113947	97.81067	1.306718	0.087232	0.210721	0.322074	0.262580
5	0.120784	96.94507	1.750422	0.077643	0.457497	0.420094	0.349274
6	0.126119	95.61767	2.138029	0.073130	0.818511	0.897011	0.455648
7	0.130632	93.72551	2.462348	0.072140	1.287522	1.875165	0.577318
8	0.134743	91.26963	2.722955	0.072037	1.847302	3.379603	0.708471
9	0.138702	88.32743	2.923493	0.071288	2.474199	5.360356	0.843238
10	0.142649	85.01958	3.070103	0.069476	3.142660	7.721647	0.976533

Different test has been conducted to assess the model's statistical robustness like test for Heteroskedasticity Breusch-Pagan Godfrey, and investigation of Serial Correlation Breusch-Godfrey. The test of Heteroskedasticity is employed to identify the weather the errors variance is homoscedastic or constant across observation. It is called Heteroskedastic when error term does not have the homoscedastic variance. The p value is 0.6744 which is > 0.05 hence the accepts the null hypothesis of residual is homoscedastic. The results of serial correlation show the value 0.7589 which is higher than the 0.05 value of significance that depicts that the alternate hypothesis has been rejected and accepts the null hypothesis of no existence of autocorrelation, which infers that there is no transfer of error of time series from one time period to another (see Annex 3.)

4.9 Granger Causality Tests

Technique was developed by Granger (1969), to identify the causal relationship among the employed factors. To put it simply, it determines the causal direction

of the variable correlation in time series analysis. It gauges if the factors are transient relation or if the variable in a model lowers the forecasting variance in the set of information. Causality assessment is the evaluation if the changes in variable cause the change in another variable. Causality does not get proves with the presence of the association within variables rather it gives the influence of the direction. In other words, that events in pasts could influence the event tit could impact an event occurrence in future but not the other way round (Gary 2013). According to the Diebold (2008), that the test of granger causality offers useful information regarding the predictability of another factor. For this purpose of finding the causality among shariah compliant equity prices and the determinants of economy, the VAR multivariate test of Granger Causality test has been adopted. The outcomes are shown in the table below.

The predictive causality of all employed factors is represented in Table 4.7. The causality will be verified through the outputs' corresponding p value and the F statics. The rule of thumb is the 5% significance level, any resultant value of p that is above 0.05 significance level will be considered in order to accept the null hypothesis which depicts that there exists no causality within the two determinants, and if the p value is beneath the value of 0.05, as a result the rejection will be made for the null hypothesis. For this study our focused variable is Islamic index returns (LKMI) hence, the aim of the evaluation is to analyze the influence of determinants of economy over LKMI.

Results show that no causality running among any of the tested factor IR, MS, TIS and NSDQ which are having the value of p above the 0.05 thus no causality null hypothesis amid those factors are repudiated-, except for the IPI with the value of p of 0.0265 that is below the value of 0.05, hence the null hypothesis has been rejected for no causality between LKMI and IPI.

Table 4.7 Results of Granger Causality Test

Null Hypothesis	F-Statistic	Prob.	Decision	Causality
IR does not Granger Cause LKMI	2.38486	0.1249	Reject	No causality
LKMI does not Granger Cause IR	28.0646	5.E-07	Reject	
IPI does not Granger Cause LKMI	0.77768	0.3795	Reject	Unidirectional causality
LKMI does not Granger Cause IPI	5.03783	0.0265	Accept	
MS does not Granger Cause LKMI	0.52644	0.4694	Reject	No causality
LKMI does not Granger Cause MS	0.00372	0.9514	Reject	
TIS does not Granger Cause LKMI	2.87882	0.0921	Reject	No causality
LKMI does not Granger Cause TIS	0.78294	0.3779	Reject	
NSDQ does not Granger Cause LKMI	0.33680	0.5627	Reject	No causality
LKMI does not Granger Cause NSDQ	0.04214	0.8377	Reject	

To evaluate the model's stability, following tests have been conducted Cumulative sum of residuals also the technique of CUSUMSQ i.e. Cumulative sum of squares of recursive residuals.

4.10 Cumulative Sum of Residuals (CUSUM)

It represents the stability of model at the significance level of 5%. It is used to identify the structural breaks within the model. However, CUSUM plot (Fig. 4.2) shows that the model is significant and stable as the tested line (blue) lies within area of 5% level of significance, between the red lines.

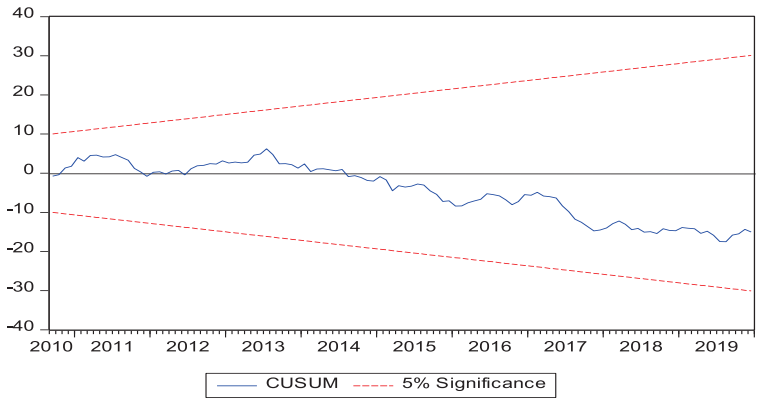

Figure 4.2 CUSUM Test

4.11 Test of Cumulative sum of squares of recursive residuals (CUSUMSQ)

The result of CUSUMSQ plot shows that employed model is stout at the 5% significance level because the assessment's line lies inside the significance area, between the two red lines (see Fig. 4.3).

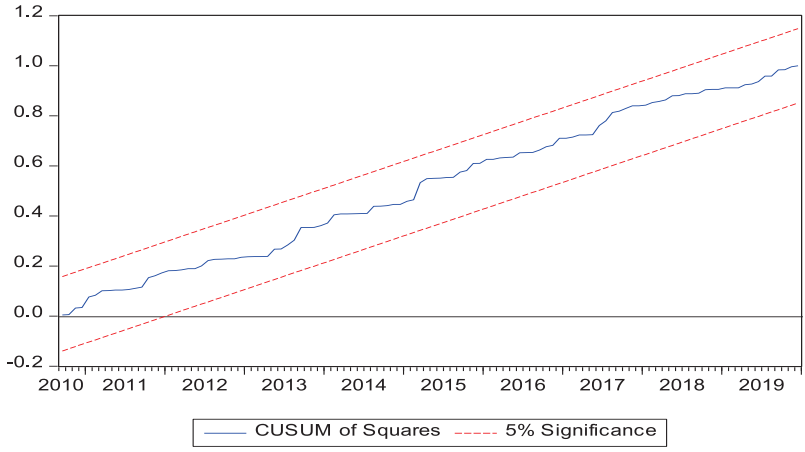

Figure 4.3 Test of CUSUM of Squares

5. Discussion

The U.S. federal fund rate represented by IR depicts the negative linkage with shariah compliant equity indices because the Interest rate movement in U.S. influence inversely to the capital markets of emerging markets (Humpe and Macmillan 2009; Chang et al. 2019; Tursoy 2019; Sheikh et al. 2020; Humpe and McMillan 2020; Bhuiyan and Chowdhury 2020; Khan et al. 2021). The U.S. industrial production index (IPI) has shown positive but insignificant long-term association with the Islamic equities return (Akhtar, Sohail, and Haroon 2017).

The result of IPI is also reflected from the unidirectional relationship of U.S. industrial production index with Islamic stock index of Pakistan. Moreover, the Money Supply in U.S. can explain the variation in Islamic equity indices of Pakistan (Bhuiyan and Chowdhury 2020). The conventional U.S. indices Nasdaq has shown the significant long-term impact on Islamic indices, results are consistent with past studies (Ajmi et al. 2014; Gupta et al. 2014; Hammoudeh et al. 2014; Naifar 2016; Mensi et al. 2017; Bahloul et al. 2017; Umar et al. 2018; Cevik and Bugan 2018).

6. Conclusion

Worldwide investors' interest is attached to Shariah-compliant equity markets, ascribable to its resilient behaviour against the recession of 2008 as compared to its conventional counterpart. Likewise, it gives the opportunity of portfolio diversification to investors. This evaluation was conducted to assess the influence of various global factors from U.S. economy including Money Supply, Interest Rate, Industrial Production Index, Treasury Bill and Interest Rate Spread, and NASDAQ Stock Index of U.S. on the Shariah Compliant Index of Pakistan. For the purpose of evaluation, the techniques have been applied are ARDL i.e. Auto Regressive Distributed Lag, along with function of impulse response function, Variance Decomposition and Granger Causality. The results of this study have shown that the economic variables of U.S. put significant influence on the Pakistan's Islamic equity return. The outcome of variance decomposition test suggests that the U.S. Treasury Bill and Interest rate spread has exerted the highest influence by 7% in long-run (month 10), moreover the higher volatility of 3.14% has been exerted by the U.S. money supply on the KMI 30 index of Pakistan in 10-month period. The rationale behind the U.S. Interest rate volatility is that any fluctuation in federal fund rate reacts inversely to the equity price index in emerging markets. Granger causality test show a unidirectional influence of KMI 30 index on economic growth of U.S. because of high level of U.S. investors' investment interest in emerging markets like Pakistan, keeping other aspects constant. Hence, it is essential for policy makers and investors to stay updated regarding the global economic scenario especially the interest rate movement of the developed countries to foresee the financial performance of the capital market. For future research, the study can be conducted on broader horizon, using the capital market data of more geographical regions.

References

Adesanmi, Adenike Adebola. 2018. The Impact of National and Global Macroeconomic Factors on Emerging Stock Markets: A Multi-Statistical Analysis of the MINT Countries. Cardiff Metropolitan University.

Aggarwal, Reena, Leora Klapper, and Peter D. Wysocki. 2005. "Portfolio Preferences of Foreign Institutional Investors." Journal of Banking & Finance 29(12):2919–46. doi: 10.1016/j.jbankfin.2004.09.008.

Ahmed, Shahid. 2008. Aggregate Economic Variables and Stock Markets in India. SSRN Scholarly Paper. ID 1693544. Rochester, NY: Social Science Research Network.

Ajmi, Ahdi Noomen, Shawkat Hammoudeh, Duc Khuong Nguyen, and Soodabeh Sarafrazi. 2014. "How Strong Are the Causal Relationships between Islamic Stock Markets and Conventional Financial Systems? Evidence from Linear and Nonlinear Tests." Journal of International Financial Markets, Institutions and Money 28:213–27. doi: 10.1016/j.intfin.2013.11.004.

Akhtar, Zahid Mehmood, Muhammad Sohail, and Muhammad Haroon. 2017. "Relationship between Stock Prices and Macroeconomic Variables: A Case Study of Karachi Stock Exchange." NUML International Journal of Business & Management 12(2).

Bahloul, Slah, Mourad Mroua, and Nader Naifar. 2017. "The Impact of Macroeconomic and Conventional Stock Market Variables on Islamic Index Returns under Regime Switching." Borsa Istanbul Review 17(1):62–74. doi: 10.1016/j.bir.2016.09.003.

Banerjee, Anindya, Juan J. Dolado, John W. Galbraith, and David Hendry. 1993. Co-Integration, Error Correction, and the Econometric Analysis of Non-Stationary Data. Oxford, New York: Oxford University Press.

Bhuiyan, Erfan M., and Murshed Chowdhury. 2020. "Macroeconomic Variables and Stock Market Indices: Asymmetric Dynamics in the US and Canada." The Quarterly Review of Economics and Finance 77:62–74. doi: 10.1016/j.qref.2019.10.005.

Cevik, Emrah Ismail, and Mehmet Fatih Bugan. 2018. "Regime-Dependent Relation between Islamic and Conventional Financial Markets." Borsa Istanbul Review 18(2):114–21. doi: 10.1016/j.bir.2017.11.001.

Chang, Bisharat Hussain, Muhammad Saeed Meo, Qasim Raza Syed, and Zahida Abro. 2019. "Dynamic Analysis of the Relationship between Stock Prices and Macroeconomic Variables: An Empirical Study of Pakistan Stock Exchange." South Asian Journal of Business Studies 8(3):229–45. doi: 10.1108/SAJBS-06-2018-0062.

Chen, Nai-Fu, Richard Roll, and Stephen A. Ross. 1986. "Economic Forces and the Stock Market." The Journal of Business 59(3):383–403.

Dash, Saumya Ranjan, and Debasish Maitra. 2018. "Does Shariah Index Hedge against Sentiment Risk? Evidence from Indian Stock Market Using Time–Frequency Domain Approach." Journal of Behavioral and Experimental Finance 19:20–35. doi: 10.1016/j.jbef.2018.03.003.

Diebold, Francis X. 2008. "Elements of Forecasting - JH Libraries." Retrieved (https://catalyst.library.jhu.edu/catalog/bib_2704491).

Engle, Robert F., and C. W. J. Granger. 1987. "Co-Integration and Error Correction: Representation, Estimation, and Testing." Econometrica 55(2):251–76. doi: 10.2307/1913236.

Fama, Eugene F. 1981. "Stock Returns, Real Activity, Inflation, and Money." The American Economic Review 71(4):545–65.

Fama, Eugene F. 1990. "Stock Returns, Expected Returns, and Real Activity." The Journal of Finance 45(4):1089–1108. doi: 10.2307/2328716.

Gary, Koop. 2013. "Analysis of Economic Data, 4th Edition | Wiley." Wiley.Com. Retrieved (https://www.wiley.com/en-us/Analysis+of+Economic+Data%2C+4th+Edition-p-9781118472538).

Geske, Robert, and Richard Roll. 1983. "The Fiscal and Monetary Linkage Between Stock Returns and Inflation." The Journal of Finance 38(1):1–33. doi: 10.2307/2327635.

Granger, C. W. J. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods on JSTOR." Econometrica 37(3):424–38.

Gupta, Rangan, Shawkat Hammoudeh, Beatrice D. Simo-Kengne, and Soodabeh Sarafrazi. 2014. "Can the Sharia-Based Islamic Stock Market Returns Be Forecasted Using Large Number of Predictors and Models?" Applied Financial Economics 24(17):1147–57.

Hadi, Dlawar Mahdi, Farid Irani, and Korhan K. Gökmenoğlu. 2020. "External Determinants of the Stock Price Performance of Tourism, Travel, and Leisure Firms: Evidence from the United States." International Journal of Hospitality & Tourism Administration 0(0):1–17. doi: 10.1080/15256480.2020.1842838.

Hair, Joseph F., William C. Black, Barry J. Babin, and Rolph E. Anderson. 1995. Kennesaw State University. PEARSON.

Hammoudeh, Shawkat, Walid Mensi, Juan Carlos Reboredo, and Duc Khuong Nguyen. 2014. "Dynamic Dependence of the Global Islamic Equity Index with Global Conventional Equity Market Indices and Risk Factors." Pacific-Basin Finance Journal 30(C):189–206.

Hashmi, Shabir Mohsin, and Bisharat Hussain Chang. 2021. "Asymmetric Effect of Macroeconomic Variables on the Emerging Stock Indices: A Quantile ARDL Approach." International Journal of Finance & Economics. doi: 10.1002/ijfe.2461.

Humpe, Andreas, and Peter Macmillan. 2009. "Can Macroeconomic Variables Explain Long-Term Stock Market Movements? A Comparison of the US and Japan." Applied Financial Economics 19(2):111–19. doi: 10.1080/09603100701748956.

Humpe, Andreas, and David G. McMillan. 2020. "Macroeconomic Variables and Long-Term Stock Market Performance. A Panel ARDL Cointegration Approach for G7 Countries" edited by M. Camarero. Cogent Economics & Finance 8(1):1816257. doi: 10.1080/23322039.2020.1816257.

Johansen, Søren. 1988. "Statistical Analysis of Cointegration Vectors." Journal of Economic Dynamics and Control 12(2):231–54. doi: 10.1016/0165-1889(88)90041-3.

Johansen, Søren. 1991. "Estimation and Hypothesis Testing of Cointegration Vectors in Gaussian Vector Autoregressive Models." Econometrica 59(6):1551–80. doi: 10.2307/2938278.

Johansen, Søren, and Katarina Juselius. 1990. "Maximum Likelihood Estimation and Inference on Cointegration — with Applications to the Demand for Money." Oxford Bulletin of Economics and Statistics 52(2):169–210. doi: 10.1111/j.1468-0084.1990.mp52002003.x.

Kennedy, Peter. 1992. A Guide to Econometrics. Available at: https://www.worldcat.org/title/guide-to-econometrics/oclc/802711150.

Khan, Muhammad Kamran, Jian-Zhou Teng, Muhammad Imran Khan, and Muhammad Fayaz Khan. 2021. "Stock Market Reaction to Macroeconomic Variables: An Assessment with Dynamic Autoregressive Distributed Lag Simulations." International Journal of Finance & Economics. doi: 10.1002/ijfe.2543.

Laurenceson, James, and Joseph C. H. Chai. 2003. Financial Reform and Economic Development in China. Edward Elgar Publishing.

Liew, Venus Khim-Sen. 2004. "Which Lag Length Selection Criteria Should We Employ?" Economics Bulletin 3(33):1–9.

Majid, M. Shabri Abd, and Rosylin Mohd Yusof. 2009. "Long-run Relationship between Islamic Stock Returns and Macroeconomic Variables: An Application of the Autoregressive Distributed Lag Model." Humanomics 25(2):127–41. doi: 10.1108/08288660910964193.

Masih, Mansur, Nazrol K. M. Kamil, and Obiyathulla I. Bacha. 2018. "Issues in Islamic Equities: A Literature Survey." Emerging Markets Finance and Trade 54(1):1–26. doi: 10.1080/1540496X.2016.1234370.

Mensi, Walid, Shawkat Hammoudeh, Idries Mohammad Wanas Al-Jarrah, Ahmet Sensoy, and Sang Hoon Kang. 2017. "Dynamic Risk Spillovers between Gold, Oil Prices and Conventional, Sustainability and Islamic Equity Aggregates and Sectors with Portfolio Implications." Energy Economics 67(C):454–75.

Mohammed, Hassan Yousef, and Amer Ali Abu Rumman. 2018. "The Impact of Macroeconomic Indicators on Qatar Stock Exchange: A Comparative Study between Qatar Exchange Index and Al Rayyan Islamic Index†." Journal of Transnational Management 23(4):154–77. doi: 10.1080/15475778.2018.1512342.

Mukherjee, Tarun K., and Atsuyuki Naka. 1995. "Dynamic Relations Between Macroeconomic Variables and the Japanese Stock Market: An Application of a Vector Error Correction Model." Journal of Financial Research 18(2):223–37. doi: 10.1111/j.1475-6803.1995.tb00563.x.

Naifar, Nader. 2016. "Do Global Risk Factors and Macroeconomic Conditions Affect Global Islamic Index Dynamics? A Quantile Regression Approach." The Quarterly Review of Economics and Finance 61:29–39. doi: 10.1016/j.qref.2015.10.004.

Narayan, Paresh Kumar. 2004. "Reformulating Critical Values for the Bounds F-Statistics Approach to Cointegration: An Application to the Tourism Demand Model for Fiji."

Pesaran, M. H., Y. Shin, and R. J. Smith. 1996. Testing for the "Existence of a Long-Run Relationship." 9622. Faculty of Economics, University of Cambridge.

Phillips, Peter C. B., and Bruce E. Hansen. 1990. "Statistical Inference in Instrumental Variables Regression with I(1) Processes." The Review of Economic Studies 57(1):99–125. doi: 10.2307/2297545.

Poon, Ser-Huang, and Stephen J. Taylor. 1992. "Stock Returns and Volatility: An Empirical Study of the UK Stock Market." Journal of Banking & Finance 16(1):37–59. doi: 10.1016/0378-4266(92)90077-D.

Schwert, G. William. 1990. "Stock Returns and Real Activity: A Century of Evidence." The Journal of Finance 45(4):1237–57. doi: 10.2307/2328722.

Shahzad, Syed Jawad Hussain, Dene Hurley, and Román Ferrer. 2021. "U.S. Stock Prices and Macroeconomic Fundamentals: Fresh Evidence Using the Quantile ARDL Approach." International Journal of Finance & Economics 26(3):3569–87. doi: 10.1002/ijfe.1976.

Sheikh, Umaid A., Muzaffar Asad, Zahid Ahmed, and Umer Mukhtar. 2020. "Asymmetrical Relationship between Oil Prices, Gold Prices, Exchange Rate, and Stock Prices during Global Financial Crisis 2008: Evidence from Pakistan" edited by D. McMillan. Cogent Economics & Finance 8(1):1757802. doi: 10.1080/23322039.2020.1757802.

Tribune, Express. 2017. "PSX Ends as World's Worst Market in 2017 | The Express Tribune." Retrieved October 14, 2020 (https://tribune.com.pk/story/1597565/2-psx-ends-worlds-worst-market-2017).

Tursoy, Turgut. 2019. "The Interaction between Stock Prices and Interest Rates in Turkey: Empirical Evidence from ARDL Bounds Test Cointegration." Financial Innovation 5(1):7. doi: 10.1186/s40854-019-0124-6.

Umar, Zaghum, Syed Jawad Hussain Shahzad, Román Ferrer, and Francisco Jareño. 2018. "Does Shariah Compliance Make Interest Rate Sensitivity of Islamic Equities Lower? An Industry Level Analysis under Different Market States." Applied Economics 50(42):4500–4521. doi: 10.1080/00036846.2018.1458191.

Wickremasinghe, G. B. 2006. "Macroeconomic Forces and Stock Prices: Some Empirical Evidence from an Emerging Stock Market." University of Wollongong 41.

Wongbangpo, Praphan, and Subhash C. Sharma. 2002. "Stock Market and Macroeconomic Fundamental Dynamic Interactions: ASEAN-5 Countries." Journal of Asian Economics 13(1):27–51. doi: 10.1016/S1049-0078(01)00111-7.

Appendix

Annex 1. Descriptive statistics

	LKMI	IR	IPI	MS	TIS	NSDQ
Mean	10.47669	0.579706	102.4633	1.13E+13	-0.051544	1.010888
Median	10.73988	0.160000	102.4616	1.13E+13	-0.050000	1.018850
Maximum	11.37879	2.420000	111.1731	1.53E+13	0.190000	1.123454
Minimum	8.810379	0.070000	93.72710	7.85E+12	-0.680000	0.822681
Std. Dev.	0.675227	0.735809	3.035539	2.20E+12	0.091917	0.050089
Skewness	-0.594986	1.407838	0.037276	0.087601	-2.145703	-0.688769
Kurtosis	2.151387	3.488483	3.231293	1.706139	18.79108	4.244210
J.B.*	12.10500	46.27767	0.334643	9.660375	1517.389	19.52545
Prob.**	0.002352	0.000000	0.845928	0.007985	0.000000	0.000058
Obs.***	136	136	136	136	136	136

*J.B = Jarque-Bera, **Prob. = Probability, ***Obs. = Observation

Annex 2. Variance Inflation Factor (VIF) Output for model 02

Variable	Coefficient Variance	Centered VIF
IR	0.001014	2.238369
IPI	3.43E-05	1.289688
MS	1.16E-28	2.291043
TIS	0.032095	1.105973
NSDQ	0.108536	1.110637
C	0.493899	NA

* VIF criteria: values >10 explains the presence of multicollinearity

Annex 3. Statistical Diagnostic Tests

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.798199	Prob. F(19,112)	0.7049
Obs*R-squared	15.74231	Prob. Chi-Square	0.6744
Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.079262	Prob. F(1,111)	0.7788
Obs*R-squared	0.094190	Prob. Chi-Square	0.7589