

Investigating the Impact of Business Cycles and Macro-Economic Variables on Time Scaled Volatility of Islamic Stock Indices

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ABSTRACT

The purpose of the current study is to investigate the relationship among Real Business cycles, Islamic stock indices, and selected macro-economic variables of Pakistan, Indonesia, and Bangladesh. In this study Panel ARDL approach has been used. The findings confirm that real business cycles play a significant role in explaining the volatility of the Islamic stock indices. It shows that in the period of economic growth, they prove to be less volatile and become stagnant during the economic downturn. At the same time, oil pricing, internationalization, inflation and the banking sector also significantly impact the volatility of Islamic stock indices. The aftermath of the study suggests the vitality and importance of the Islamic stock market and also endorses that Islamic stock indices could be considered an integral tool to strengthen the economic stability.

Keywords: Islamic stock indices (ISI), Real Business Cycles (RBC), Banking development (BD), Trade openness (TO), oil prices (OP)

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INTRODUCTION

Economic growth of a country consists of several aspects. This includes interaction of macro-economic variables like GDP, oil prices, inflation, exports, imports, foreign exchange, industrial production, trade cycles other elements with each other or with certain global factors .On the other hand Capital markets are also considered an integral part of the economy, as it involves massive turnover of the capital all over the country. Hence, the interdependence of capital markets and economic growth is inevitable. Capital markets have a high potential to contribute to the economic growth of the country (Kolapo & Adaramola, 2012;Khan, & Ali, 2017). In this context stock markets are an important component of the capital market (Alam & Hussein, 2019; Mahmood, I., & Khan, S. N.

(2019). On account of this, the relationship between economic growth and the stock market is quite clear because they mutually work together to uplift the progress of the country. However, the role of economic activities is relatively high because of their scale and vitality.

Due to their fundamental nature, economic variables are subject to certain patterns that are technically termed as economic shocks and business cycles. These ups and downs usually bring some unwanted changes that restrain the country's stock markets to perform swiftly and fluently (Hossin & Islam, 2019. Ali, H., Khan, S. N. 2020). The occurrence of business cycles in the economy is due to the inconsistency of governmental policies and the unpredictable pattern of various national and international factors and variables. As a result, it affects every country's business activities and stock markets. The maturity of the stock markets usually becomes a restraining factor to grasps this kind of economic ups and downs; however, except for certain markets, business cycles majorly affects the activities of the stock market (Candelon & Metiu, 2011: S., Nawaz, S., Rasul, F., & Ali, R. (2019).

Islamization in the capital and stock market has gained enough standing over the last two decades. The growth of the Islamic banking, capital and stock markets has been rising since 2007 globally and now reaches 3.374 trillion dollars globally with a growth rate of 14% in 2020, of which Islamic banking solely contributes 6%. The overall breakup of Islamic finance comprises of 70% of the Islamic banking sided, and the rest consists of the Islamic stock market, Sukuk, takaful and other sources of finance (Refinitive, 2020). Figure 01 represents Islamic finance growth from 2012-to 2020.

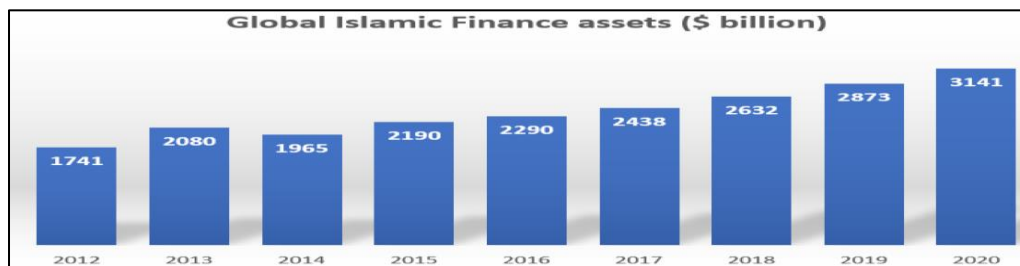


Figure 01: Global Islamic Finance Assets

The study's main objective is to discover the connection of ISI volatility with the business cycles and certain macroeconomic indicators. Further to unravel the concept of whether ISI shows more steadiness during business cycles.

Literature Review

The growth of Islamic banking and economic growth of the country are inter-reliant in this regard Furqani and Mulyany (2009) concluded that a rise in GDP matters for growth in Islamic banking, whereas the relationship is on the way as the development of Islamic banks does not count for economic growth of the country. Abduh and Azmi Omar (2012) augmented that relationship between Islamic banking, and economic growth is bi-directional. For the MENA region, Boukhatem and Moussa (2017) conclude that Islamic banking can enhance a country's economic growth if the institutional framework becomes stronger and more resilient.

Tabash and Dhankar (2014) also confirm that Islamic banking shows a positive and significant impact on the country's economy. It also reinforces that long term investment of the country creates a positive impact on the country's economic conditions. Hussin, Muhammad, Abu, and Awang (2012) deduced that Islamic stock price and IPI, CPI, M3, and Malaysian Ringgit Rate (MYR) are cointegrated with each other at the same time IPI and CPI show a positive relationship with Malaysian Stock indices for M3, and Malaysian Ringgit Rate (MYR) shows a negative relationship (Nuseir et al.,2020).

Jamaludin, Ismail, and Ab Manaf (2017) are of the view that in the case of ASEAN countries, exchange rate and inflation rate show significant association with the conventional and Islamic stock indices, whereas money supply does not show a promising trend with the performance of Islamic stock indices In Malaysia, Arshad (2016), in the context of the volatility of stock markets, concludes that Islamic stock indices are more volatile in the declining phase of the economy and less volatile in the rising growth sessions. Islamic stock has shown a notable tendency in terms of effectiveness and productivity (Raoof et al., 2021).

Yan et al. (2020) explored the performance of conventional and Islamic stock indices economically distressed situation they augment Islamic stock could be a safe option under financial and economic distress. Jawadi, Jawadi, and Louhichi (2014) confirm that although conventional stock indices show the resilient trend in economic downturn situation, however, Islamic stock indices outperform them in both steady and declining periods and further during the subprime crises Islamic stock market also considered as the least affected avenue as compared to the conventional stock market (Basheer et al.,2020).

Whereas Chau, Deesomsak, and Wang (2014) challenge the nature of Islamic stock concerning distress situation that Islamic stocks are equally affected by the financial crises as in the case of conventional stock indices. On the contrary, Ashraf and Mohammad (2014) endorse that as compared to conventional indices, Islamic stocks show better performance. Mensi, Hammoudeh, Reboredo, and Nguyen (2014) deduced that Islamic stock indices are somewhat similar to conventional indices as they are largely dependent on the later and a global financial system.

Arshad and Rizvi (2013) argue that in the case of an economic downturn, Islamic stock indices show more volatility than conventional counterparts, whereas it shows less volatility in the case of an economic uprising. On the contrary. Girard and Hassan (2008) endorse that Islamic stock indices are showing a steadier trend in the period of crises than their conventional indices. Shyu and Hsia (2008), in the case of Taiwan conclude an underlying relationship between them the stock return volatility and the business cycle (Abdulmuhsin et al.,2021).

Enisan and Olufisayo (2009) concludes a bi-directional relationship among stock market performance and economic growth of the country and suggest that stock market performance can play an active role in the growth of sample countries Ou and Wang (2010) test the link between the stock price volatility and China's Stock market. They discover that there is no causal relationship between stock market volatility and Real GDP, whereas a bilateral relationship exists between inflation and stock market (Asada et al.,2020)

Hussin et al. (2012) confirm a positive relationship between the industrial production index and the inflation rate (CPI) with the stock market's performance. Yusof, Majid, and Shabri

(2007), while testing the performance of conventional and Islamic stock market with the economic growth, conclude that except interest, all the selected variables have shown significant results

In the context of Malaysia, Hussin et al. (2012) deduced that Islamic stock prices have a long term relationship with economic variables. Other shariah indices are related positively and significantly with the Industrial production index (IPI) and Consumer price index (CPI), whereas the relationship is negative and significant with M3 and Malaysian Ringgit. Vejzagic and Zarafat (2013) deduced that shariah indices show a significant relationship with interest rates, exchange rates and money supply, whereas CPI shows an insignificant pattern with the shariah indices. Sakti and Harun (2015) conclude that Jakarta Islamic stock indices have a long-term relationship with the exchange rate, industrial production, inflation, and money supply. Sakti, Harun, and Business (2015) inferred that there is a negative relationship between the Islamic stock indices and the consumer price index (CPI) in the case of Indonesia.

Muhamad Yusuf et al. (2020) resolved that inflation, money supply, and the exchange rate have significant and negative relations with the FMII; however, money supply, GDP and oil price has a positive and insignificant relationship with FMII. Jamaludin, Ismail, Ab Manaf, and Issues (2017) deduced that the Indonesia Islamic stock index (ISSI) is significantly affected by inflation, industrial production index and interest rates.

Naseri and Masih (2013) find cointegration between the Islamic stock indices money supply, consumer price index, and exchange rate. They believe that the performance of the Islamic stock indices largely depends on these selected economic variables. For Pakistan, Atif, Jadoon, Zaman, Ismail, and Seemab (2010) conclude a cointegrated relationship between financial development, trade openness, and GDP growth in the long and short run. As in the case of Bangladesh, Adnan Hye and Islam (2013) narrate that real interest rates and financial development index negatively relate to the country's economic growth. Mahzabeen (2016), while testing Dhaka stock exchange and economic growth, confirms a significant and positive relationship between interest rates and money supply.

Tee and Kew (2019) concluded that stock risks increase during financial turbulence. Moreover, the risk of Islamic stock is lower than its conventional counterpart. Enein (2020), while reviewing the performance of Islamic and conventional indices, examined whether Islamic filtering criteria act as a shield of protection for investors during crisis periods or not. Findings suggest that filtering criteria positively relate to the return for the post-crisis period and positively related to the other two periods.

The study's outcome mainly involves that, compared to the conventional counterpart, the Islamic stock market relies on the real sector, thus prone to less vulnerability. The present study is an effort to fill the dearth in the present literature and focuses empirically to substantiate that Islamic stock could be a safer option to the investor's class of capital market.

Hypothesis of the study

H1: Real Business Cycle has a significant impact on the volatility of Islamic Stock indices in the long run

H1 (b): Real Business Cycle has an asymmetrical impact on the volatility of Islamic Stock indices in the Short-run

H2: Internationalization (Trade Openness) has a significant impact on the volatility of Islamic Stock Indices

H3: Oil prices have a significant impact on the volatility of Islamic Stock indices

H4: Consumer Price Index has Significant Impact on the Volatility of Islamic Stock Indices

Methodology

Monthly prices of Islamic stock indices have been obtained from the stock exchanges of the respective countries comprising a period of 12 years

Model of the study comprises these three equations:

$$\delta SI(16 - 32 \text{ days}) = \alpha + \sum_{i=0}^n \beta 1RBC1 + \sum_{i=0}^n \beta 2RBC2 + \sum_{i=0}^n \beta 3BD + \sum_{i=0}^n \beta 4TO + \sum_{i=0}^n \beta 5CPI + \sum_{i=0}^n \beta 6OP + \sum_{i=0}^n \beta 7Str + \epsilon$$

(1)

$$\delta SI(32 - 64 \text{ days}) = \alpha + \sum_{i=0}^n \beta 1RBC1 + \sum_{i=0}^n \beta 2RBC2 + \sum_{i=0}^n \beta 3BD + \sum_{i=0}^n \beta 4TO + \sum_{i=0}^n \beta 5CPI + \sum_{i=0}^n \beta 6OP + \sum_{i=0}^n \beta 7Str + \epsilon$$

(2)

$$\delta SI(> 64 \text{ days}) = \alpha + \sum_{i=0}^n \beta 1RBC1 + \sum_{i=0}^n \beta 2RBC2 + \sum_{i=0}^n \beta 3BD + \sum_{i=0}^n \beta 4TO + \sum_{i=0}^n \beta 5CPI + \sum_{i=0}^n \beta 6OP + \sum_{i=0}^n \beta 7Str + \epsilon$$

(3)

Where

δSI : volatility of Stock indices

$RRBC\ 1$: Real Business Cycle (Increase) D.E. trending *IPI using a bandpass filter

$RRBC\ 2$: Real Business Cycle (Decrease)

OP : Oil Prices

CPI : Consumer Price Index (Inflation)

STR : Structural Break (Unknown)

BD : Banking Development (M2) TO

Trade openness : (Internationalization) = Imports + Exports / GDP

Dependent variable

The study's dependent variable consists of stock prices of the selected countries. ARCH/GARCH (R. Engle, 2001) is applied to the stock price to check the volatility

Volatility

The volatility of the stock indices has been generated with the help of Autoregressive conditional heteroskedasticity (ARCH) and Generalized Autoregressive conditional heteroskedasticity (GARCH) (R. F. Engle, 1982) (Bollerslev, 1986) Data relating to the

stock market has a property of high frequency. The ARCH model determines to estimate the time-dependent volatility as a function of past volatility in the variables.

Wavelet Analysis

Wavelet filters decompose and reconstruct the time series and its correlation structure across time scales. Thus as the decomposition can be orthogonalized, decomposition of one scale is uncorrelated with the decomposition at another. Wavelet functions as compared to Fourier series transform well as they are localized in scale and time (Burrus, Gopinath, & Guo, 1998; Gallegati, 2008)

Maximum Overlap Discrete Wavelet Transformation (MODWT) (Gallegati, 2008) is applied to the extracted residuals from the ARCH/GARCH model by sampling evenly spaced points in time.

(Wavelet graphs for each country see Appendix- II)

Formulation of the business cycle

The Christiane Fitzgerald bandpass filter (Christiano & Fitzgerald, 2003) is applied to Industrial production index (IPI) data to obtain real business cycles. The current study incorporates IPI for extracting the business cycle. (Mohanty, Singh, & Jain, 2003) Afterwards, the NARDL approach is applied to extract positive and negative directions of the real business cycle *(see Appendix –I)*.

Result and Analysis

Table 1 represents the descriptive statistics of the study.

Table 01 Descriptive Results

	W1	W2	W3	RBC1	RBC2	CPI	OP	TO	BD
Mean	0.00032	0.00018	-4.75E-05	3.96327	-3.9701	4.38851	3.83834	0.02885	3.46828
Median	0	0	0	4.52727	-4.5261	4.86472	4.22795	0.03003	2.32383
Maximum	0.16321	0.0938	0.087786	5.89244	0.38406	5.26582	4.88903	0.05734	8.72202
Minimum	-0.1239	-0.1433	-0.0956	0	-5.8855	0	0	0	0
Std. Dev.	0.03597	0.02712	0.019439	1.6483	1.6513	1.45353	1.34746	0.01662	2.94542
Observations	433	433	433	433	433	433	433	433	433

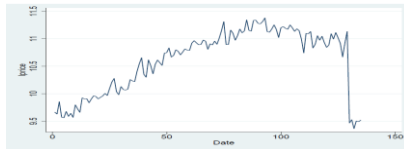
The mean value for the negative business cycles yields -3.97, whereas the maximum mean value yield for CPI is a proxy for inflation, which is 3.83. Table 2 shows the unit root test results individually for all the selected variables in the study. After applying Phillip Perron test confirm that TO, oil pricing, banking development, and CPI have unit root or non-stationary levels.

Table 02 Unit root test results table (PP)

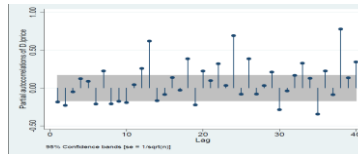
At Level		W1	W2	W3	RBC1	RBC2	CPI	TO	OP	BD
With Constant	t-Statistic	0.0001	0.000	0.1882	0.3666	0.3461	0.0111	0.0181	0.1149	0.0115
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***
With Constant & Trend	t-Statistic	0.0001	0.000	0.4737	0.9993	0.9982	0.1216	0.1254	0.6634	0.1292
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***
Without Constant & Trend	t-Statistic	0.000	0.000	0.022	0.4153	0.4085	0.7096	0.6071	0.3939	0.7217
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***
At First Difference										
With Constant	t-Statistic	d(W1) 0.0001	d(W2) 0.000	d(W3) 0.000	d(RBC1) 0.0099	d(RBC2) 0.0007	d(CPI) 0.000	d(TO) 0.000	d(OP) 0.000	d(BD) 0.000
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***
With Constant & Trend	t-Statistic	0.0001	0.000	0.0003	0.0285	0.0012	0.000	0.000	0.000	0.000
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***
Without Constant & Trend	t-Statistic	0.000	0.000	0.000	0.0004	0.000	0.000	0.000	0.000	0.000
	Prob.	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***	NA***

ARCH and GARCH Result for Volatility Pakistan

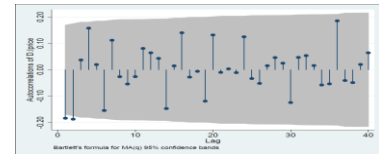
Line Graph



Partial Auto Correlation

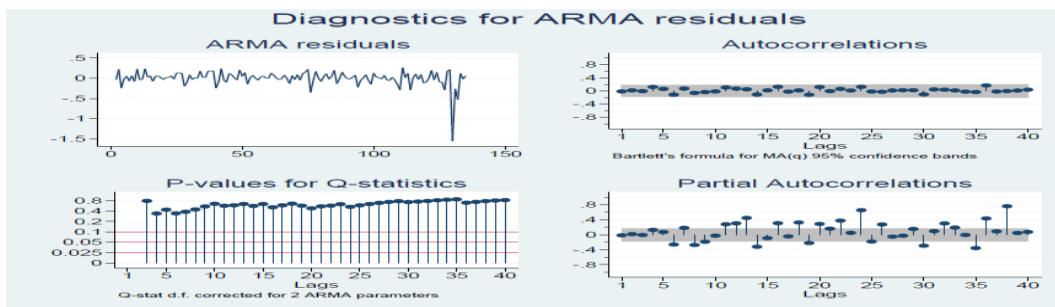


Auto Correlation



To forecast the volatility of the stock, data for each country has been tested for Skewness so that the normality of the data should be ensure. The data stationarity has been tested with the help of the dickey fuller test. In case of Pakistan, partial correlation and autocorrelation suggest 2 lags for the Autoregressive moving average (ARMA).

ARMA Diagnostics – Pakistan



The residuals of the ARMA has been taken to categorize the volatility. The L.M. test has been applied to confirm the autoregressive conditional heteroskedasticity (ARCH) movement in the data. From table 3, we can see that as the probability value is significant, it confirms ARCH disturbance in the data. It also confirms that we should apply lag 1 for the ARCH model. The result of ARMA regression can be viewed in table 4 as we can see that ARMA is significant, and the value of sigma suggest volatility in the data.

Table: 3 L.M. test for autoregressive conditional heteroskedasticity (ARCH) – Pakistan

lags(p)	chi2	df	Prob > chi2
1	36.606	1	0

H0: no ARCH effects vs H1: ARCH (p) disturbance

The results of ARMA- ARCH confirm that values are significant. To further stabilize the variance equation, the generalized autoregressive conditional heteroskedasticity (GARCH) has been applied with the help of residuals being predicted by the ARCH model in table 4. After adjusting the lags of GARCH, the results of GARCH can be viewed in table 5, which shows the combined result of ARMA as well as ARMA and ARCH.

Table: 4 ARMA and ARCH Results – Pakistan

VARIABLES	(1) ISI	(2) ARMA	(3) sigma	(4) ISI	(5) ARMA	(6) ARCH
L.ar		-0.224*** (0.0740)			-0.501*** (0.0650)	
L2.ar		-0.228*** (0.0386)			-0.390*** (0.0663)	
L.arch						1.540*** (0.286)
Constant	-0.00132 (0.0178)		0.186*** (0.00503)	0.0122*** (0.00385)		0.00526*** (0.00137)
Observations	134	134	134	134	134	134

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table: 5 ARCH and GARCH Results – Pakistan

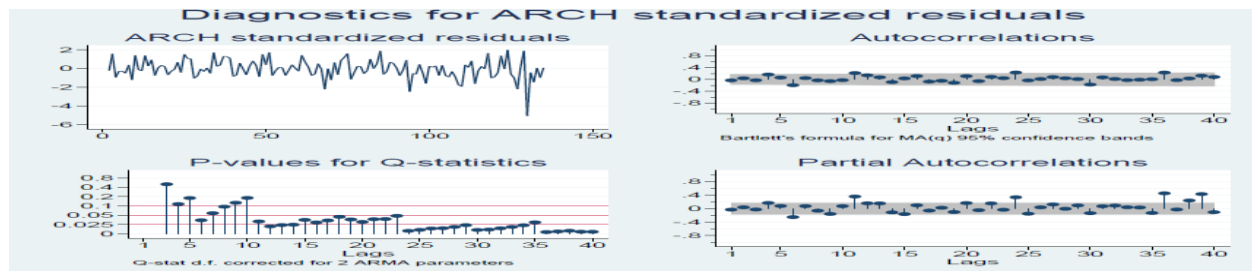
VARIABLES	(1) ISI	(2) ARMA	(3) ARCH
L.arch			1.025*** (0.308)
L.garch			-0.0633 (0.0385)
L2.garch			0.335** (0.163)
L.ar		-0.439*** (0.0616)	
L2.ar		-0.410*** (0.0784)	
Constant	0.0132*** (0.00404)		0.00238* (0.00136)
Observations	134	134	134

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

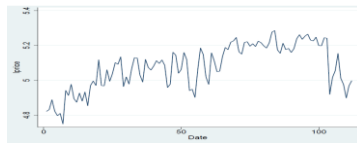
The diagnostic of ARCH and GARCH in the case of Pakistan is suggesting ARCH (1/1), Garch (1/2) and Arima (2, 1, 0).

ARCH Diagnostics – Pakistan

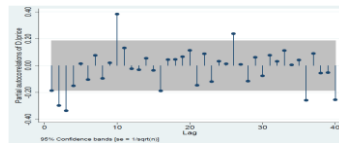


Indonesia

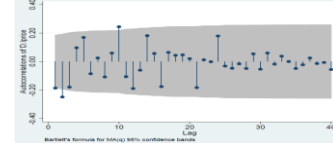
Line Graph



Auto Correlation



Partial Auto Correlation



For ARMA test, PAC and AC suggest 3 and 2 lags respectively however, it becomes (2, 1, 2) after modifying the model.

Table: 6 ARMA Results Indonesia

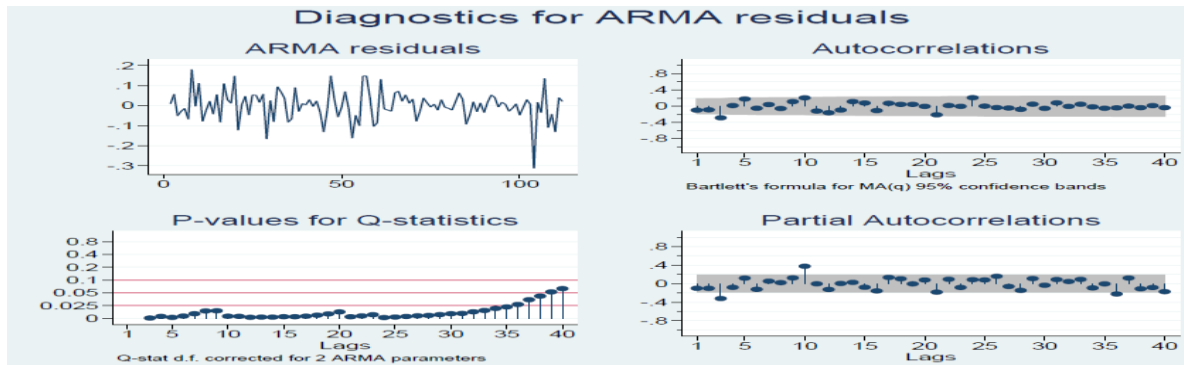
VARIABLES	(1) ISI	(2) ARMA	(3) sigma
L.ar		1.0963*** (0.1529)	
L2.ar		-0.5512*** (0.1252)	
L.ma		-1.5401*** (0.1620)	
L2.ma		0.7634*** (0.1295)	
Constant	0.0014 (0.0035)		0.0672*** (0.0033)
Observations	111	111	111

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 6 confirms that the results become significant at lag 2 for both A.R. and M.A., whereas the sigma value shows the volatility in the data. To proceed further, the residuals of the ARMA has been extracted. For normalization of the variance equation, the ARCH test needs to be incorporated for this L.M. test has applied, which fails to find the ARCH effect in the given residuals. Hence the extracted residuals being taken after ARMA results will be used for the volatility of stock prices of Indonesia. Further, the ARMA diagnostics also supports the stability of the residuals at this level as they lie in the shaded area of PAC and A.C.

ARMA Diagnostics – Indonesia

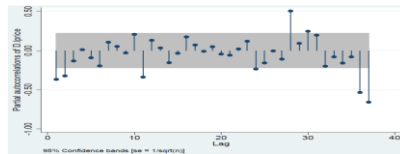


Bangladesh

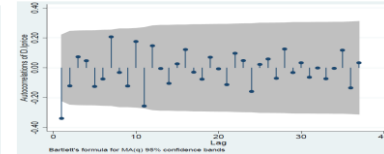
Line Graph



Partial Correlation



Auto Correlation



To estimate the volatility of the stock prices initially, the data for Bangladesh has been tested for Skewness so that the normality of the data should be maintained. The ADF results confirm that the data is stationary at first difference. PAC and A.C. diagnostic suggest taking 2 lags for PAC and 1 lag for A.C. Hence the model formulated for Auto Regressive Moving Average (ARMA) based on augmented information becomes ARIMA (2, 1, 1)

After adjusting the lags of ARMA, table 7 shows the results of ARMA for Bangladesh. It shows an autoregressive effect, whereas the moving average does not impact; hence, the model is significant (2, 1, 0). The sigma value shows that though the volatility is present, the impact is not strong in this regard. Further, however, we need to confirm it by employing the ARCH effect. We need to predict the residuals of the ARMA, and after regressing, we have applied the ARCH LM test. The test, in this case, fails to detect the ARCH disturbance effect of the data

Table: 7 ARMA Results – Bangladesh

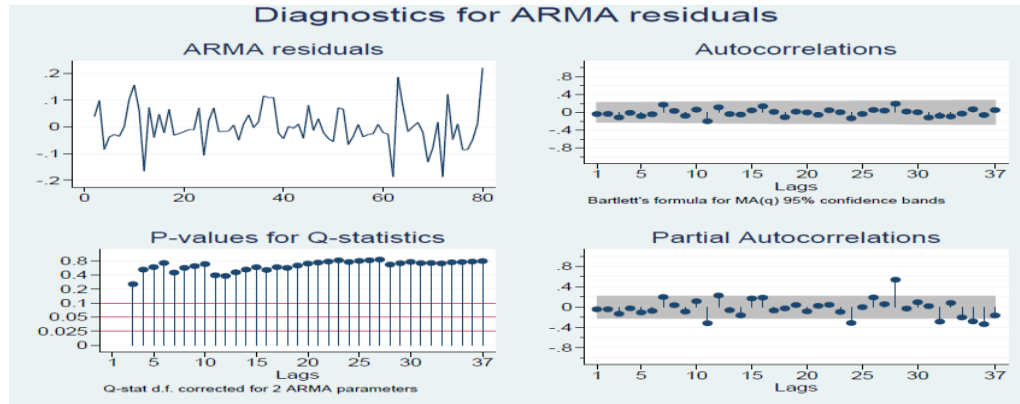
VARIABLES	(1) ISI	(2) ARMA	(3) sigma
L.ar		-0.4897*** (0.0914)	
L2.ar		-0.3215** (0.1484)	
Constant	0.0001 (0.0046)		0.0730*** (0.0048)
Observations	79	79	79

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The ARMA diagnostics in this regard shows that the data stabilize and lies in the shaded area for both PAC and A.C. Hence, the residuals after running the ARMA test have predicted the volatility of the stock price data in the case of Bangladesh.

ARMA Diagnostics – Bangladesh



PANEL ARDL Results

Table 8: Long Run Results

Variable	Model 1		Model 2		Model 3	
	Coefficient	Prob.*	Coefficient	Prob.*	Coefficient	Prob.*
RBC1	-1.33946	0.002	-0.18913	0.269	-0.19731	0.487
RBC2	-1.31858	0.002	-0.20656	0.225	-0.19876	0.482
BD	-0.00547	0.751	-0.03748	0.018	-0.03102	0.022
OP	-0.00442	0.283	0.013651	0.068	0.012639	0.089
TO	0.316433	0.142	-0.59437	0.03	-0.53689	0.035
CPI	0.019716	0.1	0.008793	0.066	0.013651	0.03
SB	0.036393	0.036	-0.01381	0.059	-0.00261	0.858

In the long run, the results suggest that business cycles in both directions play for model 1 only as it shows less volatilities in the growth phase when contraction volatilities become higher. Model 2 and 3 business cycles show insignificant results with the volatility of stock indices. Banking development plays a significant role to reduce the volatilities of Islamic stock indices in case of models 2 and 3. This suggests that increasing a strong banking network plays a vital role in developing Islamic stock indices. Oil pricing initially does not

show a promising trend; however, it causes volatilities to the Islamic stock indices as time progresses.

The result of trade openness also shows that the passage of time brings less volatilities. The magnitude of the trade openness also confirms that it is a strong predictor explaining the volatilities of ISI. On the other hand, inflation also shows significant results for models 2 and 3, whereas the co-efficient value suggests that it does not lay a heavy impact. Structural results confirm that the Islamic stock market is subject to irregularities; however, the ISI volatility decreases as time progresses. Table 9 shows the direction of the long run results with respect to each model that how the volatility of the stock indices behaves along with the selected macroeconomic variables.

Table: 9 Long Run Results Direction

	Model 1	Model 2	Model 3
Variables	Direction	Direction	Direction
RBC1	-	-	-
RBC2	-	-	-
B.D.	-	-	-
O.P.	-	+	+
TO	+	-	-
CPI	+	+	+
S.B.	+	-	-

Table 10: Model 1

Variable	Pakistan		Bangladesh		Indonesia	
	Coefficient	Prob. *	Coefficient	Prob. *	Coefficient	Prob. *
COINTEQ01	-1.710107	0.0000	-1.610708	0.0000	-1.789159	0.0000
D(RBC1)	2.181581	0.0169	1.794125	0.0462	2.232238	0.0314
D(RBC1(-1))	1.575571	0.0146	2.598522	0.0258	2.242261	0.0257
D(RBC1(-2))	1.004237	0.0136	3.160393	0.0379	1.699994	0.0329
D(RBC1(-3))	0.611172	0.0109	2.766092	0.1122	1.377244	0.0395
D(RBC1(-4))	0.071911	0.454	3.266129	0.1568	1.502752	0.0165
D(RBC1(-5))	-0.340297	0.034	2.961815	0.2541	0.83787	0.0418
D(RBC1(-6))	-0.800554	0.003	3.283237	0.2053	0.279494	0.2397
D(RBC1(-7))	-0.513708	0.0042	2.839557	0.1871	0.126208	0.2662
D(RBC1(-8))	-0.405115	0.0011	2.677095	0.113	-0.33349	0.0103
D(RBC1(-9))	-0.286573	0.0001	1.20535	0.115	-0.279456	0.0022
D(RBC1(-10))	-0.118645	0.0001	0.280068	0.2573	-0.079362	0.0061
D(RBC1(-11))	-0.051837	0.0000	0.309902	0.0033	-0.013984	0.001
D(RBC2)	1.810868	0.0263	2.406367	0.0165	2.204112	0.0305
D(RBC2(-1))	1.709353	0.0138	2.044703	0.0502	2.252692	0.0238
D(RBC2(-2))	1.213013	0.0085	2.77599	0.0538	1.950055	0.025
D(RBC2(-3))	0.454377	0.0238	3.096339	0.1053	1.419798	0.03
D(RBC2(-4))	0.04047	0.6449	3.278385	0.153	1.042211	0.0384
D(RBC2(-5))	-0.380914	0.0195	3.506508	0.1779	0.833904	0.0326
D(RBC2(-6))	-0.483244	0.0095	3.060455	0.2273	0.432843	0.089
D(RBC2(-7))	-0.560009	0.0023	2.49668	0.208	0.115344	0.348

D(RBC2(-8))	-0.568975	0.0003	1.654959	0.1806	-0.251945	0.0189
D(RBC2(-9))	-0.197294	0.0005	1.763718	0.044	-0.25858	0.0009
D(RBC2(-10))	-0.131866	0.0000	0.817782	0.0184	-0.180311	0.0002
D(RBC2(-11))	-0.040006	0.0001	0.176342	0.036	-0.075565	0.0002
D(BD)	-0.988224	0.0001	-1.054738	0.0196	0.297024	0.0067
D(BD(-1))	0.309192	0.0044	0.453758	0.1835	0.216989	0.0147
D(BD(-2))	0.789277	0.0003	2.822609	0.0058	0.757126	0.0001
D(BD(-3))	-0.14255	0.0352	0.382013	0.4991	0.106573	0.0174
D(BD(-4))	-0.608804	0.0006	-1.251113	0.0689	-0.269439	0.001
D(BD(-5))	-0.446269	0.0007	-1.453685	0.0325	-0.218709	0.0017
D(BD(-6))	0.525828	0.0004	0.262489	0.4619	-0.213472	0.0033
D(BD(-7))	0.043977	0.2449	0.852147	0.043	0.293533	0.0043
D(BD(-8))	-0.586302	0.0003	-0.048273	0.8545	0.066663	0.1729
D(BD(-9))	0.122083	0.0126	1.339558	0.0145	-0.441456	0.0005
D(BD(-10))	0.093359	0.0353	-0.135588	0.6867	0.183404	0.0034
D(BD(-11))	0.065005	0.06	-0.420716	0.1377	0.202989	0.0011
D(TO)	0.753716	0.6993	0.939587	0.0128	-2.100109	0.101
D(TO(-1))	2.615789	0.4085	1.119513	0.0131	-1.34862	0.229
D(TO(-2))	-0.16722	0.9564	-1.24374	0.0104	-0.673093	0.5328
D(TO(-3))	-4.430422	0.2656	0.081239	0.7486	-1.008812	0.3562
D(TO(-4))	1.618917	0.6622	0.193497	0.5664	0.621106	0.5504
D(TO(-5))	4.669014	0.2833	-0.642205	0.1287	0.711487	0.5231
D(TO(-6))	-0.157627	0.9648	0.252683	0.4979	0.621811	0.5931
D(TO(-7))	-2.671902	0.4423	-0.286242	0.4561	2.110953	0.0764
D(TO(-8))	0.046567	0.9879	-0.017776	0.9546	-0.295806	0.6841
D(TO(-9))	0.020802	0.9942	0.49347	0.1491	-2.227658	0.0273
D(TO(-10))	-0.1931	0.9459	0.157016	0.5122	-0.845528	0.1697
D(TO(-11))	-0.502669	0.7854	-1.498186	0.0054	0.446808	0.1439
D(OP)	-0.010346	0.0000	-0.000612	0.0045	0.035814	0.0000
D(OP(-1))	-0.000968	0.3746	-0.046032	0.0001	-0.012371	0.0001
D(OP(-2))	0.00828	0.0025	0.07363	0.0000	-0.024425	0.0000
D(OP(-3))	0.100247	0.0000	-0.004856	0.0324	0.09866	0.0000
D(OP(-4))	0.004021	0.0168	0.041567	0.0002	-0.093661	0.0000
D(OP(-5))	-0.119339	0.0000	0.046587	0.0001	-0.014787	0.0002
D(OP(-6))	0.078363	0.0000	-0.063947	0.0000	0.072791	0.0000
D(OP(-7))	0.058031	0.0000	-0.020547	0.0007	-0.005776	0.0019
D(OP(-8))	-0.067484	0.0000	0.087063	0.0000	-0.023971	0.0000
D(OP(-9))	0.017657	0.0002	-0.077367	0.0000	0.02487	0.0000
D(OP(-10))	-0.008609	0.0017	-0.004469	0.0193	-0.009637	0.0004
D(OP(-11))	0.019377	0.0002	-0.001595	0.1424	-0.006371	0.0005
D(CPI)	0.052572	0.7063	-1.386423	0.0372	0.793497	0.0319
D(CPI(-1))	0.024404	0.8576	-0.081506	0.8564	-0.953234	0.042
D(CPI(-2))	-1.203749	0.0037	0.509928	0.2042	-1.199922	0.0005
D(CPI(-3))	-0.230728	0.1823	1.292649	0.034	-0.251717	0.0286
D(CPI(-4))	0.800806	0.0078	-0.193469	0.5682	0.709464	0.0009
D(CPI(-5))	-0.829728	0.01	-0.662424	0.1555	0.480701	0.0035
D(CPI(-6))	0.504511	0.0391	-1.49763	0.0255	0.399705	0.0085
D(CPI(-7))	0.00761	0.9516	1.773141	0.0176	-0.396294	0.0267
D(CPI(-8))	-0.137761	0.3165	-0.907771	0.0106	-0.083007	0.4738

D(CPI(-9))	0.475049	0.0187	-0.176232	0.3106	0.784976	0.0012
D(CPI(-10))	-0.606493	0.0061	0.595482	0.0372	-0.152704	0.0583
D(CPI(-11))	0.61477	0.0044	0.093673	0.3932	-0.377825	0.0042
D(SB1)	-0.101994	0.0000	13.50047	0.4406	-0.056837	0.0000
D(SB1(-1))	-0.045294	0.0000	-3.935649	0.7819	-0.009888	0.0005
D(SB1(-2))	-0.000419	0.659	-12.48829	0.3912	0.069065	0.0000
D(SB1(-3))	-0.063405	0.0000	-6.307262	0.6841	-0.036728	0.0000
D(SB1(-4))	0.012919	0.0004	4.364503	0.7446	-0.04714	0.0000
D(SB1(-5))	0.002973	0.0164	10.56203	0.4247	0.025636	0.0000
D(SB1(-6))	-0.024503	0.0000	6.051033	0.6339	-0.004303	0.0044
D(SB1(-7))	-0.048156	0.0000	-13.72781	0.283	0.056868	0.0000
D(SB1(-8))	-0.04307	0.0000	-0.037445	0.0001	-0.071512	0.0000
D(SB1(-9))	0.027083	0.0000	0.058311	0.0000	0.034049	0.0000
D(SB1(-10))	0.001647	0.0531	0.021911	0.0001	0.057972	0.0000
D(SB1(-11))	-0.077301	0.0000	-0.004643	0.0159	-0.078661	0.0000
C	-0.105813	0.0000	-0.055467	0.0000	-0.021209	0.6496
@TREND	0.001005	0.0000	0.000381	0.0000	0.000536	0.0000

Table 11:
Model 2

Variable	Pakistan		Bangladesh		Indonesia	
	Coefficient	Prob. *	Coefficient	Prob. *	Coefficient	Prob. *
Variable	Coefficient	Prob. *	Coefficient	Prob. *	Coefficient	Prob. *
COINTEQ01	-0.662933	0.0000	-0.65284	0.0000	-0.752846	0.0000
D(RBC1)	0.23057	0.0002	0.628812	0.0005	0.041222	0.0925
D(RBC1(-1))	0.122996	0.0005	0.930536	0.0004	0.135415	0.0062
D(RBC1(-2))	-0.074988	0.0013	1.168378	0.0007	0.331852	0.0004
D(RBC1(-3))	-0.161096	0.0002	1.446398	0.0006	0.191607	0.0033
D(RBC1(-4))	-0.08551	0.0017	1.389207	0.0008	0.075223	0.0136
D(RBC1(-5))	-0.072573	0.0006	1.157239	0.0023	0.121368	0.005
D(RBC1(-6))	-0.163401	0.0000	1.053017	0.0012	0.075971	0.0033
D(RBC1(-7))	-0.097949	0.0000	0.760086	0.0005	0.075933	0.0002
D(RBC1(-8))	-0.030218	0.0000	0.138316	0.0027	0.040433	0.0000
D(RBC2)	0.088322	0.0021	0.368596	0.0007	0.100525	0.0088
D(RBC2(-1))	0.035851	0.01	0.896206	0.0003	0.150925	0.002
D(RBC2(-2))	-0.009794	0.2408	1.41385	0.0003	0.149663	0.0047
D(RBC2(-3))	-0.114039	0.0006	1.384931	0.0009	0.186162	0.0016
D(RBC2(-4))	-0.140976	0.0002	1.521724	0.0007	0.148686	0.0028
D(RBC2(-5))	-0.199832	0.0000	1.428168	0.0005	0.095731	0.0026
D(RBC2(-6))	-0.091307	0.0000	0.856104	0.0012	0.076954	0.0012
D(RBC2(-7))	-0.072308	0.0000	0.283626	0.0061	0.043803	0.0005
D(RBC2(-8))	-0.038995	0.0000	0.255795	0.0011	0.000589	0.4794
D(BD)	-0.104819	0.0216	0.976748	0.0049	-0.15136	0.0028
D(BD(-1))	-0.224036	0.0032	1.391626	0.0032	-0.199721	0.001
D(BD(-2))	0.013427	0.6222	-0.184437	0.3753	0.022202	0.2454
D(BD(-3))	0.03097	0.2082	-1.110327	0.0104	-0.151206	0.0016
D(BD(-4))	-0.12886	0.0075	-0.548124	0.0755	-0.248072	0.0004
D(BD(-5))	-0.152955	0.0032	0.07604	0.7261	0.241115	0.0005
D(BD(-6))	0.014707	0.4713	1.007128	0.0113	0.298282	0.0002
D(BD(-7))	0.131382	0.005	0.663231	0.04	0.143886	0.0016
D(BD(-8))	0.230773	0.0006	-0.162833	0.3862	0.191584	0.0005

D(TO)	0.106754	0.9395	-1.160967	0.0028	0.045405	0.0000
D(TO(-1))	0.572977	0.7948	-0.940352	0.0108	0.053381	0.0000
D(TO(-2))	0.353012	0.8802	0.686576	0.0212	-0.027573	0.0000
D(TO(-3))	1.099632	0.6544	0.823923	0.0124	-0.012855	0.0001
D(TO(-4))	2.431659	0.34	0.047951	0.7813	0.049598	0.0000
D(TO(-5))	3.509957	0.1869	-0.103087	0.5572	0.00998	0.0001
D(TO(-6))	2.537101	0.2978	0.370816	0.1387	0.009156	0.0001
D(TO(-7))	-0.140352	0.9433	-0.649766	0.0313	0.040045	0.0000
D(TO(-8))	-1.394575	0.2965	-0.145423	0.4188	0.040646	0.0000
D(OP)	-0.009363	0.0000	-0.009054	0.0000	-0.771553	0.1136
D(OP(-1))	0.00768	0.0016	-0.004601	0.022	-1.482944	0.0769
D(OP(-2))	-0.003528	0.0269	-0.146005	0.0000	-0.438099	0.491
D(OP(-3))	-0.021972	0.0001	-0.018518	0.0005	0.261906	0.6054
D(OP(-4))	-0.004781	0.0098	0.032377	0.0001	-1.022002	0.1133
D(OP(-5))	-0.031676	0.0000	0.084708	0.0000	-3.015331	0.0075
D(OP(-6))	-0.03056	0.0000	0.022149	0.0001	-3.416706	0.0044
D(OP(-7))	2.57E-06	0.9974	-0.080244	0.0000	-2.148367	0.0095
D(OP(-8))	0.024495	0.0000	-0.038199	0.0000	-0.917381	0.014
D(CPI)	-0.728356	0.0026	-0.412997	0.1619	0.230904	0.0133
D(CPI(-1))	-0.013195	0.9063	0.546322	0.0776	0.314163	0.0049
D(CPI(-2))	0.353338	0.0394	0.947562	0.0165	0.014232	0.7445
D(CPI(-3))	0.031182	0.7766	0.166292	0.4114	0.260426	0.0052
D(CPI(-4))	0.070076	0.4911	-0.556856	0.1014	0.40265	0.0016
D(CPI(-5))	-0.512378	0.0104	0.059817	0.7758	-0.393907	0.0018
D(CPI(-6))	0.302749	0.035	0.302331	0.2126	-0.501428	0.0008
D(CPI(-7))	-0.226367	0.0508	0.169819	0.4583	-0.248003	0.0055
D(CPI(-8))	-0.242581	0.0197	-0.079767	0.6752	-0.308651	0.0024
D(SB2)	-0.044909	0.0000	-1.853766	0.8128	-0.034343	0.0000
D(SB2(-1))	-0.038059	0.0000	-6.297658	0.497	-0.009222	0.0000
D(SB2(-2))	0.019621	0.0000	-3.094991	0.7395	0.027218	0.0000
D(SB2(-3))	0.026668	0.0000	1.785629	0.8216	0.010821	0.0000
D(SB2(-4))	-0.008887	0.0001	4.781132	0.6204	0.006124	0.0000
D(SB2(-5))	-0.015686	0.0000	0.788825	0.9159	0.037667	0.0000
D(SB2(-6))	0.015565	0.0000	-5.055857	0.539	-0.013462	0.0000
D(SB2(-7))	0.041001	0.0000	-5.01743	0.452	-0.05416	0.0000
D(SB2(-8))	0.009968	0.0003	1.471423	0.8478	0.00149	0.0053
C	0.033745	0.0000	-9.79E-05	0.0031	-6.55E-05	0.495

Table 12:
Model 3

Variable	Pakistan		Bangladesh		Indonesia	
	Coefficient	Prob. *	Coefficient	Prob. *	Coefficient	Prob. *
Variable	Coefficient	Prob. *	Coefficient	Prob. *	Coefficient	Prob. *
COINTEQ0						
1	-0.228155	0.0000	-0.255459	0.0000	-0.273359	0.0000
D(RBC1)	0.040314	0.0007	0.007623	0.5255	0.03313	0.0128
D(RBC1(-1))	0.013827	0.0068	0.254099	0.0001	0.03647	0.011
D(RBC1(-2))	-0.052138	0.0001	0.355106	0.0001	0.01288	0.1441
D(RBC1(-3))	-0.098033	0.0000	0.411811	0.0001	-0.004537	0.5075

D(RBC1(-4))	-0.127066	0.0000	0.361172	0.0002	-0.138213	0.0000
D(RBC1(-5))	-0.07813	0.0000	0.373411	0.0003	-0.181778	0.0000
D(RBC1(-6))	-0.044348	0.0000	0.246397	0.0002	-0.097853	0.0000
D(RBC1(-7))	-0.027673	0.0000	0.233658	0.0000	-0.06128	0.0000
D(RBC1(-8))	-0.013277	0.0000	0.083081	0.0000	-0.004249	0.0001
D(RBC2)	-0.012589	0.0196	0.159962	0.0002	0.039568	0.0074
D(RBC2(-1))	-0.072317	0.0000	0.171389	0.0006	-0.006727	0.326
D(RBC2(-2))	-0.074065	0.0000	0.362004	0.0001	-0.071033	0.0012
D(RBC2(-3))	-0.098708	0.0000	0.453489	0.0001	-0.075978	0.0008
D(RBC2(-4))	-0.062875	0.0000	0.41786	0.0001	-0.097647	0.0002
D(RBC2(-5))	-0.069501	0.0000	0.326974	0.0002	-0.069357	0.0002
D(RBC2(-6))	-0.042081	0.0000	0.229672	0.0002	-0.115773	0.0000
D(RBC2(-7))	-0.008286	0.0001	0.07975	0.0008	-0.055283	0.0000
D(RBC2(-8))	-0.001524	0.0021	0.07611	0.0001	-0.010643	0.0000
D(BD)	-0.166159	0.0001	-0.111457	0.0081	-0.03733	0.0014
D(BD(-1))	-0.173425	0.0001	0.081704	0.017	0.080594	0.0001
D(BD(-2))	-0.141957	0.0002	0.559247	0.0000	0.109281	0.0001
D(BD(-3))	-0.083205	0.0008	0.552849	0.0000	0.182325	0.0000
D(BD(-4))	0.123609	0.0002	0.532872	0.0001	0.300346	0.0000
D(BD(-5))	0.083339	0.0006	0.535861	0.0000	0.135166	0.0000
D(BD(-6))	0.049934	0.0018	0.191897	0.0002	0.119725	0.0001
D(BD(-7))	0.029519	0.0081	0.1371	0.0018	0.010617	0.0482
D(BD(-8))	-0.099925	0.0002	0.169983	0.0009	-0.063135	0.0002
D(OP)	0.000687	0.0000	-0.001382	0.0000	0.00467	0.0000
D(OP(-1))	0.017143	0.0000	0.011719	0.0000	0.004528	0.0000
D(OP(-2))	-0.001748	0.004	0.003987	0.0001	0.015359	0.0000
D(OP(-3))	-0.023028	0.0000	-0.005584	0.0000	0.004393	0.0000
D(OP(-4))	-0.021797	0.0000	-0.012701	0.0000	0.007644	0.0000
D(OP(-5))	-0.01709	0.0000	-0.015926	0.0000	0.014529	0.0000
D(OP(-6))	-0.014861	0.0000	-0.012353	0.0000	-0.018021	0.0000
D(OP(-7))	-0.003518	0.0004	-0.002598	0.0002	0.007825	0.0000
D(OP(-8))	-0.0065	0.0001	0.022093	0.0000	-0.007744	0.0000
D(TO)	0.788311	0.1161	0.240841	0.0008	0.040106	0.595
D(TO(-1))	0.667408	0.3139	0.198228	0.0025	-0.088068	0.4537
D(TO(-2))	1.514168	0.0796	0.17678	0.0043	-0.237878	0.1108
D(TO(-3))	2.052063	0.0381	0.250306	0.0018	0.009282	0.9249
D(TO(-4))	2.338538	0.0329	0.373131	0.0004	-0.661186	0.0052
D(TO(-5))	2.185149	0.0376	0.246618	0.0013	-0.745006	0.0038
D(TO(-6))	0.712288	0.2992	0.136819	0.0113	-0.791673	0.0031
D(TO(-7))	-0.32475	0.5514	0.12353	0.012	-0.788302	0.002

D(TO(-8))	-0.42177	0.2549	-0.118664	0.009	-0.296546	0.0043
D(CPI)	0.023245	0.3422	-0.229873	0.0027	0.058246	0.0069
D(CPI(-1))	-0.03333	0.2809	-0.407934	0.0006	-0.135311	0.0006
D(CPI(-2))	0.206961	0.0048	-0.27623	0.0000	-0.185788	0.0002
D(CPI(-3))	0.165844	0.0087	-0.23747	0.0001	-0.301986	0.0000
D(CPI(-4))	0.17398	0.0058	-0.215508	0.0001	-0.500783	0.0000
D(CPI(-5))	-0.078023	0.0503	-0.321897	0.0000	-0.254785	0.0001
D(CPI(-6))	-0.055599	0.0818	-0.116861	0.0003	-0.190821	0.0003
D(CPI(-7))	0.048886	0.0737	-0.242407	0.0001	-0.038965	0.0216
D(CPI(-8))	0.243792	0.0004	-0.1012	0.0005	0.132426	0.0005
D(SB3)	-0.082054	0.0000	2.242165	0.1273	-0.044822	0.0000
D(SB3(-1))	-0.089431	0.0000	1.471011	0.3103	-0.028895	0.0000
D(SB3(-2))	-0.030324	0.0000	-0.045114	0.0000	-0.015106	0.0000
D(SB3(-3))	0.026709	0.0000	-0.02627	0.0000	-0.004771	0.0000
D(SB3(-4))	0.04321	0.0000	0.004986	0.0000	0.00894	0.0000
D(SB3(-5))	0.05506	0.0000	0.004014	0.0000	0.001773	0.0001
D(SB3(-6))	0.015809	0.0000	0.005701	0.0000	0.002679	0.0001
D(SB3(-7))	-0.011527	0.0000	0.006609	0.0000	-0.014812	0.0000
D(SB3(-8))	-0.010092	0.0000	0.01936	0.0000	-0.020988	0.0000
C	0.017033	0.0000	5.38E-05	0.0000	-0.000795	0.0000

Tables 10,11 and 12 represent cross-section results for models 1, 2 and 3 for each country. The results confirm that business cycles in both directions for each model play a significant role in explaining Islamic stock indices' volatility. This infers that in the case of economic expansion, the volatility of the Islamic stock indices becomes high in each country, and volatility becomes low in the economy's contraction phase. The banking sector for model 1 plays a significant role in the volatilities of the Islamic stock indices; however, in the case of Pakistan and Bangladesh, the relationship is negative, suggesting banking sector development causes less variations in the Islamic stock indices. Model 2 also shows significant results for each country selected, whereas, for model 3, the relationship is negative and significant, suggesting that as time progresses, the banking channel plays a vital role in maintaining the vitality of the indices on the lower side for each country.

Initially, the trade openness does not count for as the results show an insignificant pattern with dependent variable; however, in model 2, results are significant for Bangladesh and Indonesia only. This deduces that volatility increases if the country indulges in exports and imports. For model 3, only Bangladesh has shown positive and significant results. Oil pricing, as evident, plays a crucial role to elucidate each sector of the country in this regard initially, oil pricing brings more variations to the Islamic stock indices as the relationship is negative and significant for model 1, whereas the time progression suggests that it become vibrant causes less volatilities as the results are significant and negative both for model 2 and 3.

For Pakistan, CPI does not show a significant relationship for all the selected models, whereas, in the case of Bangladesh and Indonesia, it has shown a significant relationship. This concludes that change in inflation is vital for these countries as it brings volatilities to the Islamic stock market. Results of structural breaks have shown that the selected countries' Islamic stock markets are subject to irregularities. For model 2 and 3, the results

show that in the case of Pakistan and Indonesia, structural shocks shows a significant pattern, whereas the relationship is negative

Conclusion

Long run results suggest that RBC significantly explain the volatility of the Islamic stock indices, and ISI is subject to economic expansion and contraction. Further, in economic growth, ISI proves to be less volatile, whereas it remains stagnant in the case of an economic downturn. Oil prices initially do not increase volatilities; however, the ISI volatility increases as time progresses. The volume of exports and imports decreases the volatility as it interacts negatively with the ISI. On the other hand, inflation does not create any impact initially, but it becomes vital and increases volatiles of ISI as the relationship is positive and significant. Strong banking channels in the country assist in making Islamic investments less volatile. Results also endorse that ISI is subject to market irregularities, but it becomes stable as time progresses. Countrywide analysis showed that Islamic stock markets of selected countries are receptive to shrinkage and expansion of economic activities. At the same time, all the economic variables significantly impact the volatility of the Islamic Stock indices. For Bangladesh and Indonesia, Inflation shows positive and significant results; however, in Pakistan, it remains silent. Oil price also initially brings variations in ISI for all the selected countries, but time progression shows a decrease in the volatility of ISI. Trade openness also brings positive variations in the ISI, whereas, on the contrary, results relating to banking sector development shows less volatilities in ISI. Findings of structural irregularities confirm that although ISI faces situation like this, it becomes stable after a short period. The study's outcome would be beneficial for prospective investor class as they could analyze that Islamic investment avenue is a safer option because the nature of resistance for economic shocks is different, and they prove to be less volatile in the period of growth and become stagnant in case of economic recession. The author would like to recommend that more in-depth could be made in future by incorporating more Islamic countries and other proxies may be adopted for the business cycle. Moreover, other wavelet filters can be applied to decompose the time frame into various time horizons.

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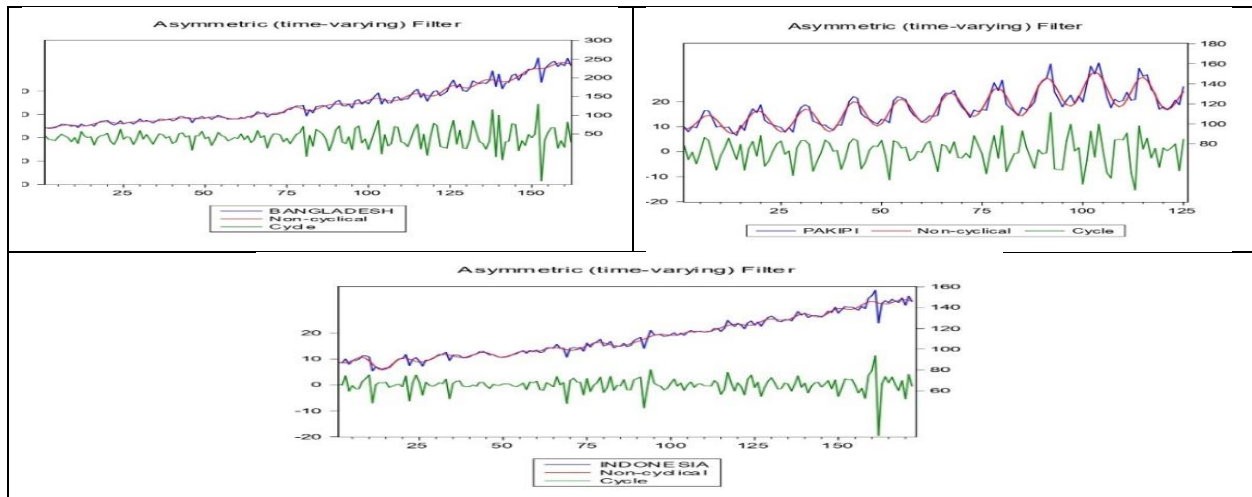
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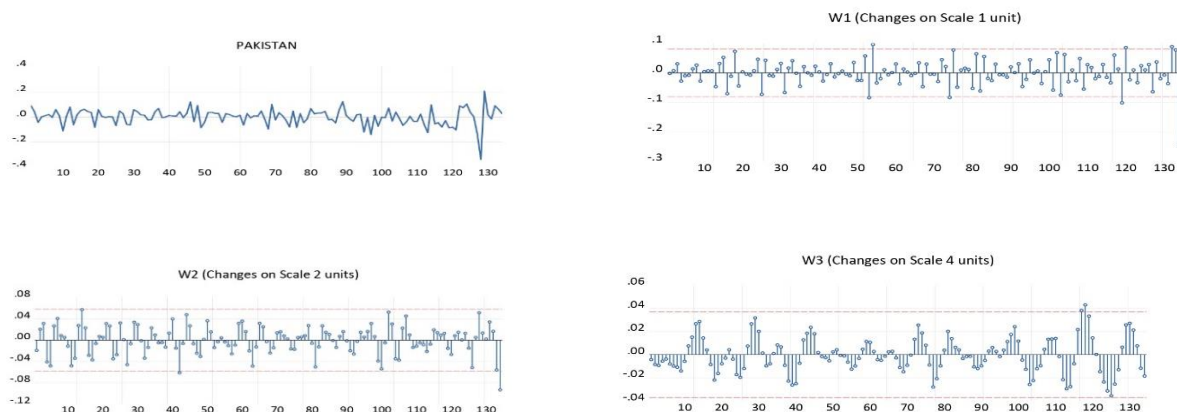
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Appendix – 1: Business Cycle – Graphs

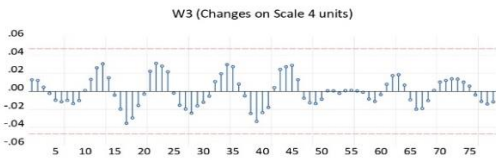
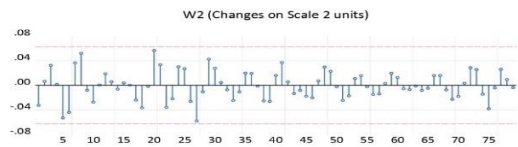
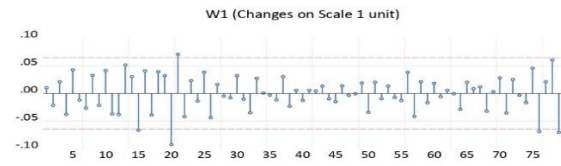
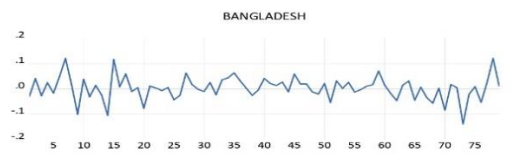


Appendix II: Wavelet Graphs for each country

Pakistan



Bangladesh



Indonesia

