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# The lead-lag relationship among select regional islamic equity markets

Feras al Bdiwy[1] and Mansur Masih[2]

**Abstract**

This study investigates the issue of integration in regional Islamic equity markets. For this purpose, four of the Dow Jones Islamic indexes, namely USA, UK, Euro Zone, and Asia Pacific have been selected for analysis. The issue is approached from two perspectives: (i) whether these markets move together (ii) and the dynamic linkages from the lead-lag relationships. Our analysis finds one significant cointegrating relationship among the selected Islamic equity markets, with the U.K Islamic equity market being the follower and the U.S Islamic equity market being the most leading one. These findings may suggest that Islamic equity markets also have a strong long-run equilibrium relationship mostly driven by fundamental element of the economy. In addition, the strong leading role of the U.S. Islamic equity index means that the U.S. market has a strong influence over the other regional markets even within the context of Islamic finance. The global bullish financial market driven by the U.S. market, which was followed by the subprime crisis, may explain this evidence.

**Keywords:** regional Islamic stock markets; Granger-causality, VECM, VDC

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## Introduction

Serious concerns are raised about the role of financial markets after the recent economic crises. Thanks to the tremendous misuse of instruments like derivatives which was a major factor in the shaking of the world's major economies. In spite of this situation, it is not disputed that the development of any nation owes much to these markets. This is due to the fact that these markets provide finance to the real sector of the economy. Thus, it plays the role of fuel provision of the real economy. It is a common observation that all the developed countries of the world have well developed financial markets. The markets of USA, UK and major European countries are examples of this universal fact.

Stock markets are an indispensable part of the overall financial market sector. Stock market performance is indicated by the index. Index represents a combination of companies listed on the stock markets. Apart from the general index that each stock market has, there are more specialized indexes which track the performance of specific sector of the market. For instance, Wilshire is a REIT index which tracks more than 80 US real estate investment trusts, whereas Morgan Stanley Biotech Index consists of 36 US firms from the biotechnology industry. Shariah or Islamic index is one such specialized index that represents the performance of Islamic stocks listed on different stock markets of the world.

During the past one decade, the world has observed the introduction of Islamic finance. The driving force for this innovation is the Islamic Law (simply referred to as Shariah) which obligates the Muslims to avoid certain activities. However, the Shariah finance is no longer confined to Muslim customers and predominantly Islamic regions. Due to the globalized nature of the world economy, it has surpassed its traditional boundaries and has made entry into the heart of major financial hubs and markets throughout the world. Today, there is hardly any stock market where we do not see an index that represents the stocks which fulfill the Shariah criteria. Investors in these stocks are both spiritual and material guided.

Due to the forces of globalization, there is a strong relationship among all the stock markets of the world and this fact has been established by numerous studies. Some of these markets follow others; it is a common observation that most markets of the world follow the US stock market. Hence it was seen that the crises of 2008 spread over the globe and affected

even the far most continents of the world. The impact of an event happening in one part of the world is not restricted to that region; it spreads faster than fire in the forest and affects the other regions and countries in the form of up or downward trend in the stock indexes.

Keeping in view this vibrant relationship among the markets, our aim in this paper is to analyze this established fact in the context of Islamic stock indexes. These indexes are different from conventional indexes in many respects. The foremost difference lies in the fact that Islamic stocks have to follow strict criteria for them to be recognized as Shariah compliant. Thus, their freedom is very limited as compared to their conventional counterparts. Although Islamic stock indexes are scattered over different stock markets of the world, ironically, the vast and more developed Islamic stocks indexes are to be found in the non Muslim majority countries. Hence, it will be interesting to see whether these indexes have any relationship, as is evidenced in the case of non Islamic indexes. In other words, whether the four stock indexes we have chosen, i.e. UK, AP, EU, and US move together or not? If they do move together, which among these is the one that leads the others?

## 1. Motivation of the Study

One of the great lessons of the portfolio theory of finance is that the investors can gain from portfolio diversification. However, if the markets are fully integrated, the gains from diversification would be very limited indeed. A major objective of this study, therefore, is to investigate whether the Islamic stock markets are integrated or not? The answer to this question would have certain implications for portfolio diversification. There have been a lot of studies to investigate the issue of conventional stock market integration. But the studies on the integration of the Islamic stock markets are still very limited.

This study intends to fill in this gap by employing the time series techniques of cointegration, vector error correction model, variance decomposition, impulse response functions, and persistence profile. This study will use Dow Jones Islamic equity indices of United Kingdom, Euro Zone, Asia-Pacific and United States. The results of this study would be valuable for researchers and academicians of economics and finance in general and those of Islamic finance and economics in particular. In addition to academia and research, policy makers would make the best use of the outcome of this study in

formulating effective policy measures to boost the Islamic equity markets globally. Moreover, investors in general and portfolio managers in particular would benefit from the findings of the study with a view to setting up profitable and efficient portfolio strategies.

## 2. Literature review

The literature about the cointegration of Islamic indexes is very scant; it is understandable when we see that the very notion of Islamic index came into being about one decade ago. Hence, one faces difficulty while searching for relevant literature about the issue. Consequently, any debate about this topic starts by looking at the issue from conventional perspective; what do the studies say about cointegration of market/indexes from a conventional perspective? On the other hand, the cointegration of conventional indexes and markets has been well explored in the existing literature.

In fact the stock market integration has been recognized as an indicator of the overall stock market development. Financial integration is the leading factor of today's globalized economies which offer offers opportunities and remove barriers for international portfolio, providing significant impacts for portfolio allocation and asset pricing (Bartram & Dufey, 2001). Other researchers have mentioned that financial openness and integration is important for boosting economic growth, improving factor productivity, lowering the cost of capital, promoting better corporate governance, and increasing size and liquidity (Bekaert, Harvey, & Lundblad, 2005).

Looking at the empirical studies show that there are many attempts to measure to level of stock market integration across different regions of the world. To start with, studies in Eurozone investigated the increase of cross-border assets trading, indicating the increase of financial integration among its members. Lane (2006) has attested that monetary union in Eurozone has increased cross-border asset trading which indicates that financial integration among the member countries is on the rise. De Santis & Gerard (2009) argue that the adoption of Euro monetary union has increased regional financial integration by easing the access of Eurozone investors to euro area markets. As a result, these investors have reallocated considerably higher portfolio shares to Eurozone equity and fixed income assets.

However, the scenario is different when we look at the emerging economies. For instance, Kim et al. (2006) evidence that the financial markets of East Asian countries are less integrated with each other than with the global market. Although the degree of financial integration in East Asia has increased today as compared to the past, it is mainly due to the integration with the global market and not integration inside the region (Jeong et al., 2006). Particularly, Kawai (2005) has stressed the role of foreign direct investment (FDI) and FDI-driven trade due to the rise in Asian newly industrialized economies' investment to push the integration of the East Asian economies.

It can be seen in these studies that the issue of cointegration is not universal. Whereas it has been established in the case of European countries, other parts of the world show a different picture. Hence, the area is still open for further research. The area is, thus, widely open in the case of Islamic indexes cointegration. This is due to the fact that Islamic index is relatively new, the data available are scarce, and even the literature about it lacks depth and scope. It is hoped that the current study will be a useful addition to this field.

## 3. Data and methodology

| Variables | Description |
|---|---|
| UK | Islamic equity indices of United Kingdum |
| US | Islamic equity indices of United State |
| AP | Islamic equity indices of Asia Pacific |
| EU | Islamic equity indices of Euro Zone |

As can be seen in the above list, we have taken four variables for the purpose of this study. These variables are the Islamic equity indices of United Kingdom (UK), the Islamic equity indices of United States (US), the Islamic equity indices of Asia Pacific (AP), and the Islamic equity indices of Euro Zone (EU). The total number of observations is 374 whereas the frequency of data is weekly. Data Stream was used as the source of data and the time period is from January 2005 to February 2012.

### 4.1. Econometric modeling

Traditionally, multivariate regression analysis has been widely used to examine the relationship between variables, which has serious limitations because of non- stationarity

nature of most of the macroeconomic and financial variables. With the non-stationary variables traditional regression provides either spurious relationship (if the original ‘‘level’’ form of the variables was non-stationary) or a short run relationship (if the variables were ‘‘differenced’’ to make the original variables stationary) (Masih, Al-Sahlawi, & Mello, 2010). This study, because of the damaging shortcomings of multivariate regression analysis, employs the Johansen multivariate cointegration approach to examine the cointegration among the Islamic equity index prices with a view to check the long run theoretical relationship of the Islamic indices. After checking cointegration, this study applies vector error correction model (VECM) to determine the speed of the short-run adjustment towards long term equilibrium by the size of the error correction coefficient. VECM also helps to identify the endogenous and exogenous indices. Endogenous equity index is a dependent variable, the movement of which depends on the changes in the exogenous equity indices, which are independent variables. In addition, this study uses the impulse response and error variance decomposition technique to examine the relative exogeneity/endogeneity of the selected Islamic equity indices. Furthermore, this study employs persistence profile (PF) test to find out the time horizon required for the cointegrating relation to move back to equilibrium point following an economy wide shock.

## 4.2. Johansen Cointegration and other related tests

The Augmented Dickey-Fuller (ADF) and Philips-Perron (PP) tests are used to check the stationarity of the variables as a starting point of the Johansen cointegration test. The lag length for the time series analysis is determined by choosing the lag length given by the minimum Akaike Information Criteria (AIC) and Schwarz Information Criteria (SBC). The Augmented Dickey-Fuller (ADF) (2005, 2012) test involves the estimation of the following general specification:

$$\Delta X_t = \alpha_0 + \alpha_1 T + \beta X_{t-1} + \sum_{J=1}^{P} \delta_J \Delta X_{t-J} + \varepsilon_t \qquad (1)$$

The Phillips-Perron (PP) (1988) test suggests a non-parametric method of controlling for higher order autocorrelation in a time series and is based on the following equation:

$$\Delta X_t = \alpha_0 + \beta T + \beta_1 X_{t-1} + \sum_{J=1}^{P} \delta_J \Delta X_{t-J} + \varepsilon_t \qquad (2)$$

In both ADF and PP equations, Δ represents the difference operator, α, β, and δ is coefficients to be estimated. X stands for the variable whose stationarity should be checked and ε is the residual term. The critical values for the Phillips-Perron test are the same as

those for the Dickey-Fuller test (DF) and depend on whether the DF regression contains an intercept term or a time trend.

After testing the stationarity of the variables, Johansen cointegration technique is employed to examine the cointegration of the concerned Islamic equity indices. Johansen (1988) and Johansen and Juselius (1990) suggested considering the vector autoregressive (VAR) model of the following form:

$$\Delta Y_t = C + \sum_{i=1}^{k} \Gamma_i \, \Delta Y_{t-1} + \Pi Y_{t-1} + \varepsilon_t \qquad (3)$$

Where, $Y_t$ is a vector of non-stationary variables and C is a constant term. The matrix $\Gamma_i$ consists of the short run adjustment parameters and matrix $\Pi$ contains long run equilibrium relationship information between the Y variables. The $\Pi$ could be decomposed into the product of two $n \times r$ matrix α and β so that$\Pi = \alpha\beta'$, where β matrix contains $r$ number of conintegration and $\alpha$ represents the speed of adjustment parameters. Johansen (1988) and Johansen & Juselius (1990) developed two statistics for identifying the number of cointegrating vectors, which are Trace statistic ( $\lambda_{Trace}$) and the maximum Eigenvalue statistic ($\lambda_{Max}$). These two statistics can be expressed as follows:

$$\lambda_{Trace} = -T \sum_{i=r+1}^{N} \ln (1 - \hat{\lambda}_i) \qquad (4)$$

&

$$\lambda_{Max} = -T ln\left(1 - \hat{\lambda}_{r+1}\right) \qquad (5)$$

Where, $\lambda_i$ is the estimated value of the each characteristics root obtained from the estimated parameter matrix Π and T is the number of usable observations. The $\lambda_{\mathrm{Max}}$ statistic tests the null hypothesis that there are at least r cointegrating vectors as against the alternative of (r+1) cointegrating vectors.

Presence of cointegration indicates that there exists a theoretical relationship among the variables and they are in equilibrium in the long run in spite of short-run deviation from each other. Masih et al (2010) stated that a test of cointegration can also be considered as a test of the extent of the level of arbitrage activity in the long-term. Cointegration implies that these variables are interdependent and highly integrated (as if they are constituents of

one integrated market). Cointegration also implies that each variable contains information for the prediction of other variables. Moreover, the evidence of cointegration has implications for portfolio diversification by the investors. The possibility of abnormal gain through portfolio diversification is limited in the long run in a cointegrated market.

Presence of cointegration, however, cannot express the direction of Granger causality between the variables as to which variable is leading and which variable is lagging (i.e., which variable is exogenous and which variable is endogenous) (Masih, et al, 2010). The Vector Error Correction Model (VECM) is applied to determine the endogeneity/exogeneity of the variables. The error correction term (ECT) stands for the long term relations among the variables. At least one of the ECT terms should be significant for the validity of the cointegrating relationship among the variables in the long term. If the error correction term is insignificant, the corresponding dependent variable is 'exogenous'. On the contrary, if the error correction term is significant, the corresponding dependent variable is 'endogenous'. This study estimates Vector Error Correction Model (VECM) following finding cointegration among the indices. The VECM implies that changes in the dependent variable are a function of the level of disequilibrium in the cointegrating relationship i.e., the departure from the long-run equilibrium as well as changes in other explanatory variables. Considering the variables of this study, the VECM can be represented as follows:

$$\Delta Y_t = C + \Pi Y_{t-k} + \Gamma_1 \Delta Y_{t-1} \dots\dots\dots\dots\dots + \Gamma_{k-1} \Delta Y_{t-(k-1)} + \varepsilon_t \qquad (6)$$

In equation (6), $\Pi = \left(\sum_{i=1}^{k} \beta_i\right) - I_g$ is the long run coefficient matrix of the lagged $Y_t$ and $\Gamma_i = \left(\sum_{j=1}^{i} \beta_j\right) - I_g$ is a coefficient matrix of k-1 lagged difference variables, $\Delta Y_t$.

For intensive analysis, the generalized (reduced) form of VECM is derived as follows:

$$\Delta Y_t = C + \Pi Y_{t-k} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-i} + \varepsilon_t \qquad (7)$$

In equation (7), $\Delta Y_t$ is the vector of first differences of the variables. The long run parameter matrix, $\Pi$ with r cointegrating vectors$(1 \leq r \leq 5)$, $\Pi$ has a rank of r and can be decomposed as $\Pi = \alpha\beta'$, both α and β are $5 \times r$ matrices.β matrix contains the parameters in the cointegrating relationships and α matrix contains the adjustment coefficients which measure the strength of the cointegrating vectors in the VECM. Following estimation of VECM, this study performs variance decomposition technique to break down the variance

of the forecast error for each variable into proportions attributable to each variable in the model including its own. The variable which is explained mostly by its own past is the most leading variable. The graphical representation of variance decomposition is called impulse response. This approach is to determine how each endogenous variable responds over time to a shock in that variable and in every other endogenous variable. The impulse response function traces the response of the endogenous variables to such shocks.

# 4. Results and Interpretation

The study will perform several empirical tests that include unit root, cointegration, vector-error correction model, variance-decomposition analysis, and impulse response function and persistence profile as follows.

## 5.1. Testing stationarity

The stationary of variable should be checked before proceeding to the cointegration test. This study applied Augmented Dicky Fuller (ADF) unit root tests to check the stationarity of the variables at level and difference form. The requirement is that the level-form variable should follow unit root (non-stationary) while the difference form has to be stationary. The ADF basically tests the null hypothesis $\rho = 0$ given by the t-ratio of the coefficient of xt-1. If the t-ratio of the coefficient is not statistically significant, we can accept the null that $\rho = 0$. Then, the variable is non-stationary and is a random walk which has a long term memory. The advantage of ADF test is that it takes care the autocorrelation which means that it will test with free of autocorrelation problem.

Table 1 summarizes the Stationarity test results.

**Table 1- Stationarity & Non-stationary for ADF t**

| Level Form | | | |
|---|---|---|---|
| **Variables** | ***Test Statistic*** | ***Critical Value*** | ***Result*** |
| LUK | -1.964 | -3.4237 | Non Stationary |
| LUS | -1.7416 | -3.4237 | Non Stationary |
| LAP | -2.0056 | -3.4237 | Non Stationary |
| LEU | -1.9896 | -3.4237 | Non Stationary |

| Difference Form | | | |
|---|---|---|---|
| **Variables** | ***Test Statistic*** | ***Critical Value*** | ***Result*** |
| DUK | -11.1389 | -2.8696 | Stationary |
| DUS | -14.185 | -2.8696 | Stationary |
| DAP | -9.7066 | -2.8696 | Stationary |
| DEU | -10.5614 | -2.8696 | Stationary |

Both tests assume null hypothesis of non-stationarity against the alternative hypothesis of stationarity. Stationarity of the variables necessitates in accurate and efficient prediction in future. The above test results conclude that all variables are non-stationary at level and stationary at first difference, implying that the variables are integrated of order one, that is, I(1).

## *Phillips-Perron - First Diff.*

By using PP test we correcting both the autocorrelation and heteroscedasticity problems by using Newey-West adjusted variance method. The critical values for the Phillip perron test are the same as those for the Dickey-Fuller test, and depend on whether the DF regression contains an intercept term or a time trend. There are no lagged difference terms, unlike the ADF test. Instead, the equation is estimated by ordinary least squares and then t-statistic of the $\rho$ coefficient is corrected for serial correlation in $\varepsilon_t$. Table 2 summarizes the PP test result for both first as well as second difference. The variables were tested in the 'level' form and 'differences' from Table-2. The results are concluded based on the p-value. P-value informs the error we are making when rejecting the null (i.e. variable is non-stationary). If the p-value is high (the value is above 0.05), the null hypothesis cannot be rejected. On the other hand, if the p-value is low (the value is below 0.05), the null hypothesis can be rejected.

**Table 2- Simple Dickey-Fuller regression with Newey-West adjusted standard errors**

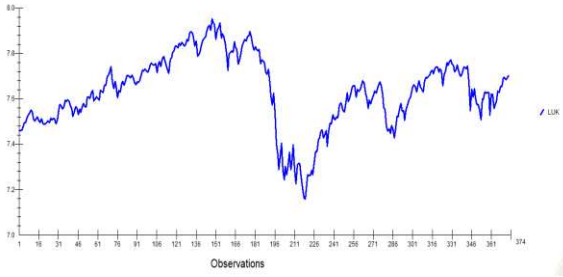
| Level Form | | | | |
|---|---|---|---|---|
| Variables | *Coefficient* | *Standard Error* | *T-Ratio [Prob]* | *Result* |
| LUK | -0.023319 | 0.010059 | -2.3183[.021] | Non Stationary |
| LUS | -0.015483 | 0.0088917 | -1.7413[.082] | Non Stationary |
| LAP | -0.01633 | 0.01044 | -1.5642[.119] | Non Stationary |
| LEU | -0.019729 | 0.0092164 | -2.1407[.033] | Non Stationary |

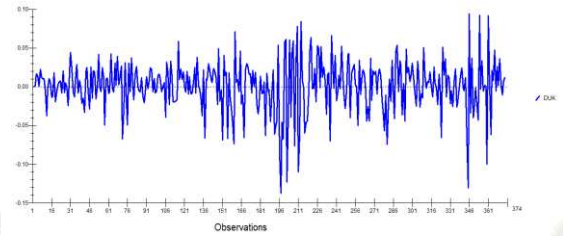
## *Phillips-Perron - Second Diff.*

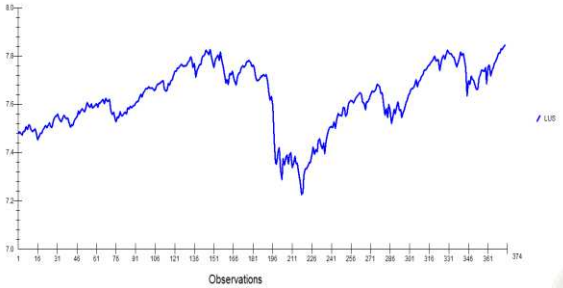
| Difference Form | | | | |
|---|---|---|---|---|
| Variables | *Coefficient* | *Standard Error* | *T-Ratio [Prob]* | *Result* |
| DUK | 1.0598 | 0.062247 | 17.0251[.000] | Stationary |
| DUS | 1.0059 | 0.097942 | 10.2707[.000] | Stationary |
| DAP | 0.99464 | 0.053409 | 18.6230[.000] | Stationary |
| DEU | 1.0396 | 0.068796 | 15.1120[.000] | Stationary |

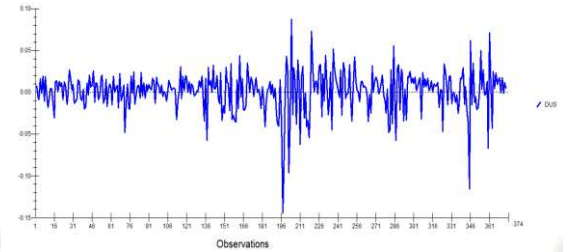
The charts below represent the Stationary and Non-Stationary variable graphically where the graphics on the right side show the Stationary variables and its clear the variance and mean are both constant. In other words, the autocorrelation coefficients die down very quickly after only 2 or 3 significant lags. Shocks are transitory. The graphics on the left side shows the non-stationary variables, where the mean and the variance are not constant with their lags. In other words, the autocorrelation coefficients tend to be unity. Shocks are permanent.

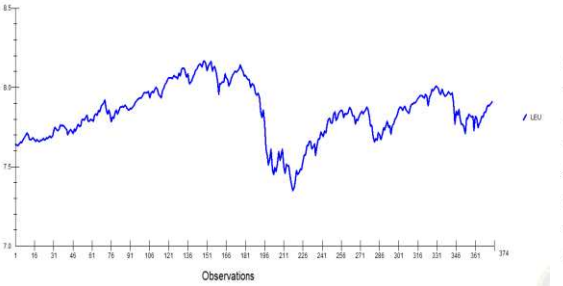
**Non Stationary charts** **Stationary charts**

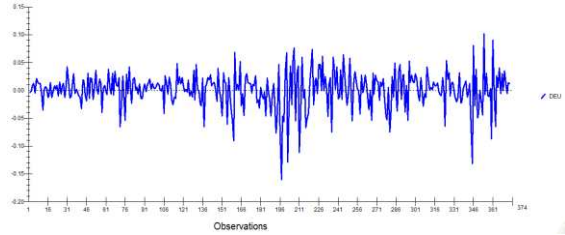


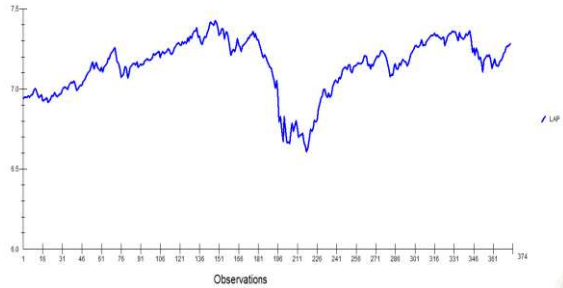



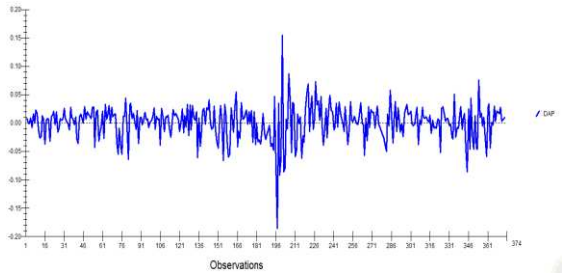



## 5.2. Determination of order of the VAR model

The order of VAR, the test will include AIC and SBC that determine how many lags of each variable we should take for our model. The result shows the best *optimum lags* of 3 or we can take 5 based on AIC (3984.7) or (3969.8) respectively, which represent of the probability of the error is more than 10%. Table 3 summarizes the Order of the VAR test results.

**Table 3- Order of the VAR Model:**

| | Choice criteria | |
|---|---|---|
| | **AIC** | **SBC** |
| **Optimal order** | **3** | **0** |

## 5.3. Testing cointegration

### 5.3.1 Johansen Cointegration test

The study applied the standard Johansen Cointegration test in order to check the cointegration among the variables with a VAR order of 3 or we can take 5. We took 3 orders of lags for this test, the VAR order was determined by the appropriate lag length criteria of AIC. Table 4 summarizes the Johansen Cointegration test results.

**Table 4- *Johansen Cointegration***

❖ **Cointegration LR Test Based on Maximum Eigenvalue**

| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
|---|---|---|---|---|
| R=0 | R=1 | **72.2454** | **63.0000** | **59.1600** |
| R=1 | R=2 | **30.0317** | **42.3400** | **39.3400** |

❖ **Cointegration LR Test Based on Trace of Stochastic Matrix**

| Null | Alternative | Statistic | 95% Critical Value | 90% Critical Value |
|---|---|---|---|---|
| R=0 | R=1 | **42.2137** | **31.79000** | **29.13000** |
| R=1 | R=2 | **15.1216** | **25.42000** | **23.10000** |

Both maximum Eigenvalue test statistic and trace test statistic indicate presence of one cointegrating relationship among the I (1) variables. Results show that calculated Eigenvalue statistic null hypothesis (H0): r = 0 against alternative hypothesis (H1): r =1 is 42.2137 > 31.79000 (95% critical value), which implies rejection of H0 and acceptance of H1, and we conclude that there exists one statistically significant cointegrating relationship among the I (1) variables (theoretically cointegration does exist if both Trace and Maximum Eigenvalue statistic or either of the two measures shows the presence of cointegration). Trace statistic also shows presence of one cointegrating relationship among the concerned variables. Relationship among the variables is not spurious when they are cointegrated. This implies that there is a theoretical relationship among the variables and they are in equilibrium in the long run even though their movement may deviate from each other in the short run. Intuitively, our variables (UK, US, AP, EU) theoretically move together in the long run, as well as each variable contains information to predict another variable when they are cointegrated. Therefore, it helps the policy makers to recognize this relationship in their decision as each variable serve as its indicator in this study (real economy growth, monetary policy, inflation, banking sector). An evidence of cointegrating relationship also implies that there exists a common force that brings each variable to equilibrium in the long term.

### 5.3.2 Engle-Granger methods test

Additionally, we have used the Engle-Granger method Table-5. Refer Appendix E5 for details. Engle-Granger methods test, the intuition behind this test motivates its role as the first cointegration test. It's Start with estimating the cointegrating regression between variables in any, the possibility of no-causation between them is ruled out and there must be at least one way of causation either unidirectional or bidirectional. But this test uses the residual based approach. It only can identify one cointegration.

**Table 5-** ***Engle-Granger method***

| Variables | Test Statistic | | 95%Critical Value | Result |
|---|---|---|---|---|
| | AIC | SBC | | |
| UK | 3.4975 | 4.2490 | 4.1294 | Non-Stationary |
| EU | 3.2101 | 3.8777 | 4.1294 | Non-Stationary |
| AP | 2.1606 | 2.4307 | 4.1294 | Non-Stationary |
| US | 1.7187 | 1.7057 | 4.1294 | Non-Stationary |

Here, it is found that the variables are non-stationary, which means that there is no cointegration between the variables. This result contradicts the earlier Johansen method test of cointegration and maybe due to the inefficiencies of this residual-based cointegration tests. Engle-Granger method may gives contradicting result when there are more than two I(1) variables under consideration as in our case. Thus, we relied on Johansen method which is a better test and confirmed that there is at least one cointegration.

## 5.4. Long run structural modeling (LRSM)

In this step, we attempt to quantify this apparent theoretical relationship among the indices. We do this in order to compare our statistical finding with theoretical expectations. Relying on the Long Run Structural Modeling (LRSM) through ***exact-identification*** which represented by table 5 below. At first, we normalized our interested variable, i.e. **US** equal to **1**, then calculating the t-ratios manually; we found for the first variable UK the t-ratio is 1.9087 which is quite close to 1.96. It means that it is almost significant but, from statistical point of view, we say it is insignificant and the rest of the variables are also not significant. Table-6 shows the result.

**Table 6- Exact identification**

| *Variable* | *Cofficient* | *Standard Error* | *t-Ratio* | *Implication* |
|---|---|---|---|---|
| **LUK** | -8.8357 | 4.6291 | -1.9087 | Insignificant |
| **LEU** | 6.063 | 3.3201 | 1.8261 | Insignificant |
| **LAP** | 1.3708 | 1.0266 | 1.3353 | Insignificant |
| **LUS** | - | - | - | - |

These initial results were generally intuitively appealing, as it is against the theory. Here, to ensure whether it is truly is insignificant or not, we try to run ***over-identifying*** restrictions, we applied this test for all the insignificant variables and the result show by the table 7.

**Table 7- Over identification**

| *Variable* | *ChiSq P-value* | *Implication* |
|---|---|---|
| LUK | 0.000 | Variable is significant |
| LEU | 0.000 | Variable is significant |
| LAP | 0.005 | Variable is significant |
| LUS | - | - |

The Null = our restriction is correct. Our restriction is that the coefficient of LAP = 0 in other words, P-VALUE is 0.5% which is less than 10%, we reject the null that the coefficient of LAP = 0. It means even though coefficient of LAP is insignificant, but it is not equal to 0 Therefore, we go back to our previous model which is ***exact identification*** in the table 6.

## The co-integrating relationship for those variables is:

$$\underset{}{LUS} - \underset{(4.6291)}{8.8357\,LUK} + \underset{(3.3201)}{6.063\,LEU} + \underset{(1.0266)}{1.3708\,LAP}$$

### 5.5. Vector error correction model (VECM)

Presence of cointegration, however, does not indicate the direction of Granger causality between the variables as to which variable is leading and which variable is lagging, i.e. which variable is exogenous and which variables is endogenous. This study applied vector error correction modeling technique in order to precisely identify the exogenous (independent) and endogenous (dependant) variables. If the coefficient of the lagged ECT in any equation is insignificant, it means that the corresponding dependent variable of that equation is exogenous. This variable does not depend on the deviations of other variables. In other words, all the variables want to be leader, It also means that this variable is a

leading variable and initially receives the exogenous shocks which results in deviations from equilibrium and transmits the shocks to other variables. On the other hand, if the coefficient of the lagged ECT is significant, it implies that the corresponding dependent variable of that equation is endogenous. It depends on the deviations of other variables. This dependent variable also bears the brunt of short-run adjustment to bring about the long term equilibrium among the co-integrating variables. At least one of the ECT terms should be significant for the validity of the co-integration relationship among the variables in the long term. Table-8 summarizes the results of vector error correction modeling.

**Table8-VECM**

| Variable | ECM (-1) t-Ratio p-Value | Implication At 5% significance level |
|---|---|---|
| **DLUK** | 0.016 | **endogenous** |
| **DLEU** | 0.346 | **exogenous** |
| **DLAP** | 0.606 | **exogenous** |
| **DLUS** | 0.515 | **exogenous** |

From the above results, we found the exogenous variables (leader) are the EU (Euro Zone), AP (Asia Pacific), US (United State) at the 95% level, while the other variable namely UK (United Kingdom) is endogenous (follower). Intuitively, when there is a shock to the (EU, AP OR US), they will deviate from the equilibrium and transmit the shock to other variable, whereas if the shock occurs to the UK the long run combination will correct it through the short run adjustment to the equilibrium. However, before deriving any useful information, we need to evaluate the response of each variable to the shock in order to observe the relative exogeneity/endogeneity amongst variables. See Appendix (G7).

## 5.6 Variance Decompositions (VDCs)

Error correction models, although tend to indicate the endogeneity/exogeneity, are unable to distinguish the relative degree of endogeneity or exogeneity of the variables. This study applies variance decomposition technique in order to figure out the relative degree

of endogeneity or exogeneity. The relative endogeneity or exogeneity of a variable can be recognized by the proportion of the variance explained by its own past. We recognize the most exogenous or endogenous variable by looking at the proportion of the variable explained by its own past. The variable that is explained mostly by its own past, as compared to other variables, is supposed to be the most exogenous or endogenous variable.

In this study, we will not use Orthogonalized Variance Decomposition Analysis, although we calculate the value for it. The orthogonalized VDCs are not unique and depend on the particular ordering in the VAR. It also assumes that when a particular variable is shocked, all other variables in the system are switched off. Therefore, we use the Generalized Variance Decomposition. We take the time horizon for the 10 days, since the frequency of our data is weekly. Since the portfolio manager are interested to look at the situation after a few days, for that reason we assume that 10 days is more reliable figure to take for computing the weight of each variable. With more curiosity, this study tries to compare whether the result will change if we chose different time horizon or not. We took the 20 days and 30 days to compare these results with the 10 days result. We found that all the results are very close to each other which reflect the robustness of our model. Table 9 shows the three result test for the 10, 20 and 30 days as it are clear below.

**Table 9- Generalized VDCs (10, 20 & 30 days-forecast error variance)**

| Variables | Time Horizon | UK | EU | AP | US |
|---|---|---|---|---|---|
| UK | 10 - Days | 26.67% | 28.25% | 20.09% | 24.99% |
| EU | 10 - Days | 25.73% | 29.27% | 20.61% | 24.39% |
| AP | 10 - Days | 22.23% | 25.48% | 28.48% | 23.82% |
| US | 10 - Days | 23.30% | 24.84% | 16.26% | 35.60% |

| Variables | Time Horizon | UK | EU | AP | US |
|---|---|---|---|---|---|
| UK | 20 - Days | 26.19% | 28.23% | 20.36% | 25.23% |
| EU | 20 - Days | 25.86% | 29.21% | 20.42% | 24.52% |
| AP | 20 - Days | 22.66% | 25.54% | 27.79% | 24.01% |
| US | 20 - Days | 24.09% | 24.89% | 15.77% | 35.25% |

| Variables | Time Horizon | UK | EU | AP | US |
|---|---|---|---|---|---|
| UK | 30 - Days | 25.99% | 28.22% | 20.47% | 25.32% |
| EU | 30 - Days | 25.93% | 29.18% | 20.33% | 24.57% |
| AP | 30 - Days | 22.85% | 25.56% | 27.51% | 24.08% |
| US | 30 - Days | 24.42% | 24.90% | 15.57% | 35.11% |

**Table 10- Orthogonalized VDCs (10 days-forecast error variance)**

| Variables | Time Horizon | UK | EU | AP | US |
|---|---|---|---|---|---|
| UK | 10 - Days | 95.47% | 2.27% | 0.07% | 2.18% |
| EU | 10 - Days | 84.24% | 14.18% | 0.10% | 1.48% |
| AP | 10 - Days | 66.71% | 15.02% | 14.76% | 3.51% |
| US | 10 - Days | 64.62% | 11.18% | 0.23% | 23.96% |

According to Generalized VDCs results, which we tested before for the three time horizon in the table 10, we can found the ranking of islamic indices by degree of exogeneity (extent to which variation is explained by its own past variations) the ranking of exogeneity/endogeneity. See Appendix (H8).

**Table 10- Ranking by degree of exgeneity**

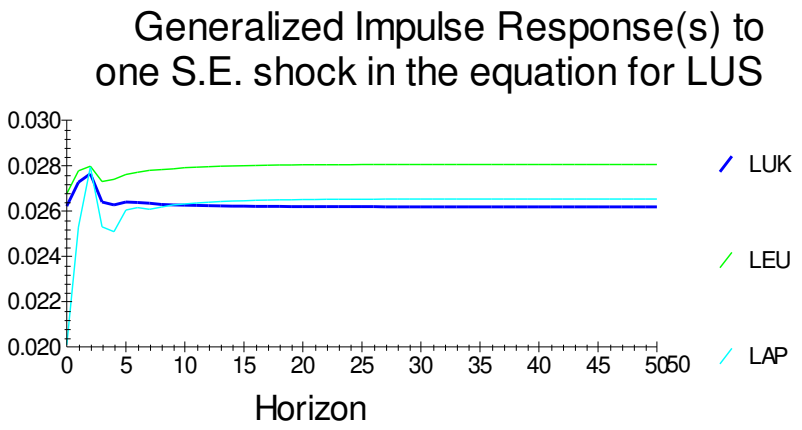
| Ranking | | Islamic Equity Indexs | | |
|---|---|---|---|---|
| | | 10 - Days | 20 - Days | 30 - Days |
| 1 | US | 35.60% | 35.25% | 35.11% |
| 2 | EU | 29.27% | 29.18% | 29.18% |
| 3 | AP | 28.48% | 27.79% | 27.51% |
| 4 | UK | 26.67% | 26.19% | 25.99% |

The empirical result is quite interesting as Islamic market index in for (US) turns out to be the most exogenous since it depends mostly on its own past 35.60% for 10 days, 35.25% for 20 days and 35.11% for one month or 30 days . Overall, this result in line with the economic theories which study the significance of the US Islamic market index and the leading channel in the monetary transmission.

## 5.7 Impulse response functions (IRF)

IRFs portray the dynamic response path of a variable due to one standard deviation shock to another variable. The IRFs are normalized such that zero represents the steady-state value of the response variable. In other words, IRFs map the dynamic response path of all variables owing to a shock to a particular variable. The IRFs trace out the effects of a variable-specific shock on the long-run relations.

The following figure 1 reports graphs of the impulse response functions, where we focus on the shock of LUS and observe the impacts on other concerned three variables.

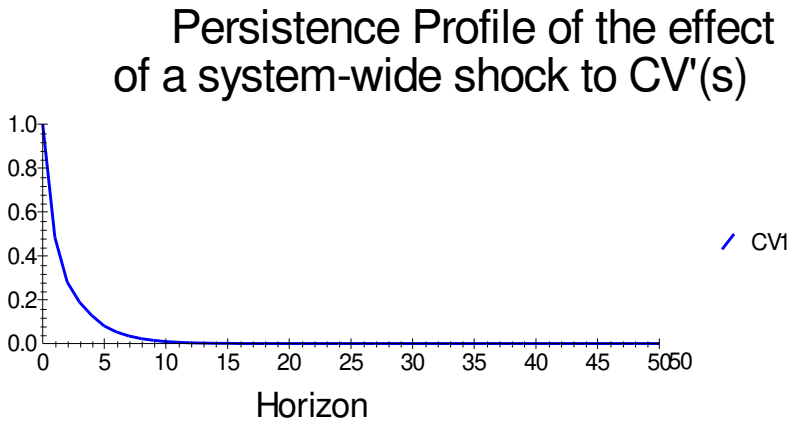



The figure indicates the deviation of our concerned variables when there is a positive shock to the LUS. We can observe the deviation of each variable with the positive relationship in line with the established theory.

Moreover, we proceed with persistence profile in the next test that indicates the time horizon required for all variables to get back to equilibrium when a system-wide shock occurs. Both the persistence profiles and the IRFs map out the dynamic response path of the long-run relation. The main difference between them is that the persistence profiles trace out the effects of a system-wide shock on the long-run relations. On the other hand, the IRFs trace out the effects of a variable-specific shock on the long run relations.

## 5,8 Persistence profile (PP)

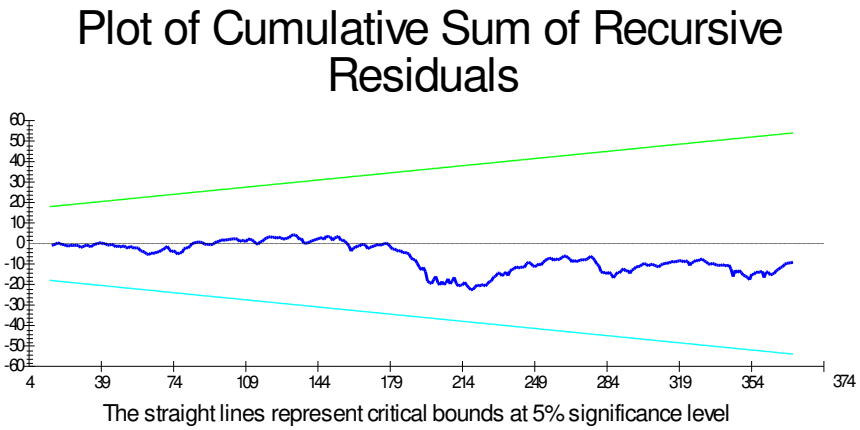
In this step, we shock our whole equation whereby this shock comes from external factor outside our equation or our system.

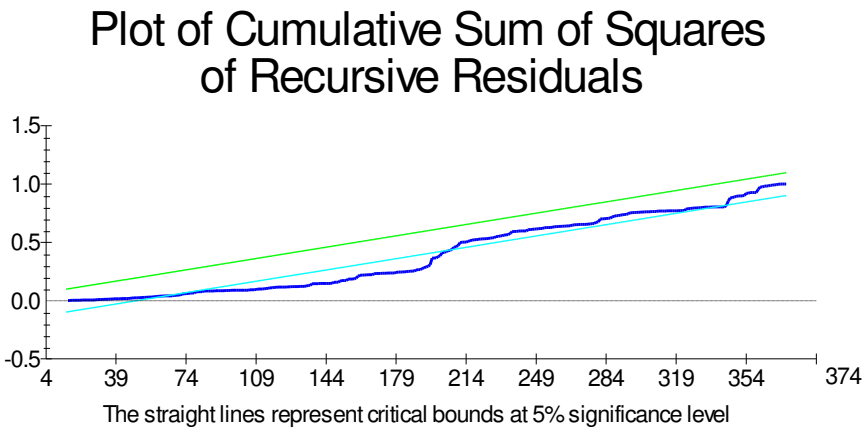



When there is an external shock, the result shows that all variables will deviate from the equilibrium, meaning that each of variables will move differently in the short run. In other words, they are temporarily (Stationary) not co-integrated. However, all variables in the equation will require approximately 6 periods (months) for them to co-integrate again and return to the long-run equilibrium, thereby signifying their long-run equilibrium relationship.

### 5.8.1CUSUM and CUSUM square

This test is based on a plot of the sum of the recursive residuals. If this sum goes outside of a critical bound, one conclude that there exists a structural break at the point at which the sum began its movement toward the bound. On the other hand, both of them (CUSUM & CUSUM square) can identify whether the coefficient has changed over time, and when the change has occurred. In this study we don't have structural beak during our periods form year 2005 till 2012 for 374 observations. At the first figure show that the sum of recursive residual didn't goes outside the critical bound, while the second figure represent the sum of squared recursive residuals, and also it's not goes outside the critical bound.




## Concluding Remarks, Policy Implications and Recommendations

This study applied the time series techniques to examine the issue of integration of five major Islamic indices (equity markets) of the United Kingdom, Asia-Pacific, Euro Zone and United States. This study found one cointegrating relationship among the selected markets. In other words, the selected four markets are tied together by a theoretical relationship as a whole. We found that the UK Islamic equity index is the only endogenous (dependent) market and all other Islamic equity indices are exogenous (independent). This implies that when there is any exogenous shock, the UK market bears the burden of short-run adjustment to bring about long-run equilibrium in the Islamic markets. Among the four selected indices, United State Islamic equity index is the

most exogenous variable, i.e. most influential market among the Islamic equity indices under consideration.

This finding may reflect the evidence of market turbulence in United State, which has considerably affected not only itself but has also impacted other regions. Besides, our result tends to indicate the possible least integration of United Kingdom Islamic equity index with others. When we turn into variance decomposition, the overall results suggest that the United States and Euro zone have played leading roles in Islamic stock market integration. The underlying reason could be attributed to the sequences of crises (2008 subprime crisis and Euro zone crisis in 2010) which triggered the global markets recently. This tends to indicate that even though the Islamic equity markets are moving towards integration, the two recent crises originating in the developed markets have had an impact on the stability and resiliency of Islamic capital markets.

The findings of this study have several implications for the investors and policy makers in general and portfolio managers in particular, especially those involved in Islamic equity markets. Since the markets are cointegrated, the opportunity to gain abnormal profits tends to be less in the long run, which could be less attractive to the portfolio managers and investors. However, there could be a short term gain from the arbitrage activities in these Islamic equity markets even though the abnormal gains from portfolio diversification would tend to disappear in the long term. In addition to portfolio managers, policy makers should be cautious and prudent when markets are cointegrated. Above all, financial integration may be conducive to transmit economic volatility and capital market turbulence from one economy to another more rapidly. Consequently, the efficacy of financial integration would be financial crisis, bank runs and overall economic vulnerability in cointegrated economies. Policy makers should keep in mind that Islamic equities are subset of conventional equities after applying filtering process. Therefore, conventional equity markets are still more comprehensive to exert influence on Islamic equity markets.

In addition, financial integration helps in achieving regulatory independence in the integrated economies that is supposed to improve the financial governance system in those economies. Decomposition of Islamic equity indices into their permanent and transitory components would be of much interest to the portfolio managers and policy makers given the distinct movement pattern of the permanent and transitory components.

Considering the above implications of financial integration, this study attempts to recommend a few suggestions. Most importantly, misallocation of capital resources should be reduced for the Shariah compliant business enterprises in the Islamic capital markets so that these firms can contribute more to the economic growth process of the country. It is also important to stop the Islamic capital flight to less-productive investment projects for the sake of long run economic growth. Long run growth of the economy also depends on the macroeconomic stability of the economy. Financial and stock market integration may bring more potential benefits in terms of co-operation when economies are at a similar stage of growth and development. This study has shown that the convergence process has started in the Islamic equity markets which should be enhanced in order to achieve long run growth in these markets through cooperation and brotherhood. In addition, the portfolio managers may consider incorporating the United Kingdom Islamic equity index in their portfolio as it is the least cointegrated market. Moreover, they should be very much cautious to invest in the Islamic equities from Euro zone and the United States due to higher volatility and contagion effect. Above all, it would be relatively safer to invest in the Asia-Pacific Islamic index. Finally, policy makers should take the results of the study into account while formulating policies in the concerned Islamic equity markets in order to move towards resilient, robust and competitive Islamic capital markets globally.

In addition, a time-varying property should be taken into account in order to evaluate the integration progress as well as some key factors driving the co-movements. Some major indicators also be considered, i.e. cross-border assets trading and listing, the role of foreign capital flows, and regulations etc, in order to capture the comprehensive nature of integration.

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