

## **RELATIONSHIPS AMONG EQUITY MARKETS OF EMERGING OIC ECONOMIES**

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This study investigates the dynamic inter-linkages among important emerging equity markets of the Organization of Islamic Countries (OIC) for the period 2000-2007 through multivariate co-integration analysis. It focuses on the "big five" emerging markets namely Pakistan, Indonesia, Malaysia, Turkey and Egypt. The Johansen and Juselius multivariate Co-integration analysis indicates presence of a long run relationship among these equity markets. The Bi-Variate Co-integration analysis confirms the result that the Karachi stock market is not co-integrated with equity markets of the emerging economies of OIC. However, the Turkish stock exchange is found to be integrated with Indonesian and Egyptian stock markets. Granger causality test reports the presence of lead lag relationship among Turkish, Indonesian and Malaysian markets. This may be a result of high foreign capital mobility among these markets. Innovative Accounting Approach also indicates that the Karachi stock market is in general independent as most of its shocks are explained by its own innovations. Therefore, funds managers of Indonesia, Malaysia, Turkey and Egypt can get the benefits of portfolio diversification by investing in the Karachi stock market.

### **I. Introduction**

The financial world is reshaping itself as it is liberalizing and dismantling regulatory barriers, while phenomenal development in technology have laid down the foundation for development of new market structures and practices. Time is moving toward a globally integrated financial world and the emerging equity markets have attracted attention of the international fund managers as an opportunity for portfolio diversification. These markets have also intensified the curiosity of academicians. During the last two decades, financial markets have globalised and today investors and policy makers are facing unique challenges. The investors would like to take advantage of the market interaction and policy makers would like to promote efficiency by containing and controlling the undesirable destabilizing effects. Literature on financial markets has emphasized interaction among the international equity markets. Recent developments like cross border movement of funds, technological advances in communication and innovative financial products have significantly increased this interest. There is now a huge volume of empirical research on equity market integration but these studies mostly focus on developed or regional markets and inter-linkages have been explored on the basis of regional integration (i.e., European Union, ASEAN, GCC, OECD). No work has been done on integration on the basis of common ideology or OIC.

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After 9/11 the increased legal requirements for funds flow from the Islamic countries and concept of clash of civilization has been discussed in detail in both in print and electronic media. These requirements have created a situation of uncertainty and additional risk for investors from the Islamic countries. This in turn has affected the flow of funds between these countries and led to an integration of their markets. At the same time voices for increased cooperation and integration in the Islamic world are also being raised from other quarters. This scenario, however, may or may not lead to integration of equity markets of emerging economies from the Islamic world as financial decisions are taken on economic rationale. The World Bank defines seven major Muslim emerging economies as: Pakistan, Indonesia, Malaysia, Turkey, Egypt, Oman and the UAE. This study focuses on the "big five" and does not include Oman and UAE as they are relatively small. Iran also is excluded as it is not considered to be an emerging economy.

This study explores relationship among equity markets and is designed with an objective to understand the dynamic inter-linkages among five important emerging equity markets in the Islamic countries. If these markets are independent then investors in these countries can invest in different markets to diversify their portfolio and the authorities need not worry about any contagious effects.

The paper is organized in the following way. Section II provides a brief review of the literature; it discusses the work undertaken in the developed world with a focus on research done in South Asia. Some of the work done in Pakistan has also been included in the literature review. Section III outline the methodology and provides information on data used in the analysis. Methodology used to test Co-integration of KSE with equity markets of Malaysia, Indonesia, Turkey and Egypt is explained in detail. Section IV discusses the empirical results, while Section V outlines the recommendations and policy implications of the study.

## II. Review of the Literature

The literature on testing the interdependence among the national stock markets suggests that two approaches have been used. First, involves the use of Generalized Autoregressive Conditional Heteroskedasticity approach to analyze the spillover effects of a shock from one country to another and second, involves testing of interdependence among equity markets by using Co-integration (or VAR) techniques. A Co-integration indicates a long term relationship between time series data. This study uses the second approach to test interdependence as it has been used more widely and is considered an appropriate way to explore the long run relationship. In the empirical literature, equity market integration derives from various premises, such as, the law of one price [Cournot (1927), Marshall (1930)], portfolio diversification with risky assets Markowitz (1952) and, asset pricing dynamics [Sharpe (1964), Lintner (1965) and Ross (1976)]. Despite distinctive characteristics, these claims share a common perspective, i.e., prices influenced by risk and the correlation of asset prices and the linkages among financial markets comes from the association in the price of risks due to investors' risk aversion. Prasad et al. (2006) and Yu et al. (2007) state that on the basis of this risk based

theoretical framework, financial integration at the empirical level is studied by employing *de jure* and *de facto* measures. However, the *de facto* measures are more popular as these reflect the actual degree of market linkages. Since the seminal work of Engle and Granger (1991), Johansen (1988) and Johansen and Juselius (1990), large number of studies have been undertaken on the subject. Taylor and Tonks (1989), Kasa (1992), Masih and Masih (2002), Chowdhry [(1997), (2007)] and number of others have used the co-integration hypothesis to assess the international integration of financial markets.<sup>1</sup> Taylor and Tonks (1989) used a bivariate co-integration analysis to examine inter-linkages of the equity market in the U.K. with the equity markets of U.S., Germany, Netherlands and Japan by using monthly stock price indices for the period April 1973 to June 1986. They find that the equity market index of U.K. became co-integrated with the equity market index of U.S., Germany, Netherlands and Japan after the abolition of exchange control. However, no relationship is found in pre-abolition period of the exchange control. Therefore, the results show that no long term gain can be obtained from diversification by investing in these markets.

Kasa (1992) explores the common stochastic trends in the equity markets of U.S., U.K., Japan, Germany and Canada by using monthly and quarterly data for the period 1974 to 1990. He uses Johansen co-integration analysis and provides evidence on existence of one co-integrating equation among the equity market; therefore, indicating a long run relationship between the stock markets of these countries. Roca (1999) investigates the price linkages between the equity markets of Australia, U.S., U.K., Japan, Hong Kong, Singapore, Taiwan and Korea through weekly equity market indices. He uses multivariate co-integration analysis to explore the long run relationship between the price levels of these countries and finds no evidence of long run relationship among these markets. Short term dynamics relationship has also been examined in the study by using Granger causality tests. Results reveal that the Australian equity market is significantly linked with the U.S. and the U.K. markets. Darrat and Hakim (2000) also employ multivariate co-integration techniques and find that emerging equity markets of the Middle East are segmented globally but are highly integrated regionally. Further, a Gonzalo test indicates that the Egyptian equity market is a dominant force and drives other markets in the region. Segmentation of the markets in the Middle East from the global equity markets implies that international investors can get benefits of diversification by investing in these markets. However, diversification benefits cannot be achieved by investing within the region. Neaime (2002) studied the GCC and MENA equity markets after liberalization in the region. The result show that GCC equity markets offer benefits of portfolio diversification to international investors. However, Turkish, Egyptian, Moroccan and to a lesser extent Jordanian equity markets are found integrated with the world financial markets. Granger causality tests and impulse response functions (IRF) reveal that innovations to the U.S and U.K stock markets are transmitted to the MENA region but innovations in the French market do not significantly affect the MENA stock markets.

<sup>1</sup>The literature review incorporates only those studies that have used this approach.

Aqil and Hassan (2003) use the multivariate co-integration techniques to test the existence of long-term relationships between share prices in the gulf region. The study explores the presence of long term as well short term relationship among equity markets of Kuwait, Bahrain, and Oman by using vector error correction model (VECM) and inter-temporal Granger-causality test. The results reveal that there exists one co-integrating vector which is an evidence of presence of a stable, long-term equilibrium relationship between them. Prices in Kuwait and Bahrain are adjustable to the long-term equilibrium state, whereas, prices in Oman are found to be exogenous. Fazal and Saidi (2000) investigate the integration of the Pakistani equity market with equity markets of U.S., U.K., France, Germany, Japan, Singapore and Hong Kong by using weekly indices for the period 1988 -1993.<sup>2</sup> They use the co-integration analysis, correlation analysis and error correction model. Correlation analysis shows low levels of correlation between the Pakistani and other markets. Co-integration analysis suggests no long term relationship among the equity markets. However, after structural shift, evidence of co-integration is found and shows that Pakistani equity market has long term relationship with equity markets of U.S., U.K. and Japan. However the Error Correction Model does not confirm the long term relationship between Pakistan and U.S. equity markets. Some spillover effect is found to be flowing from the US to Pakistan.

Daly (2003) uses the Johansen methodology to examine the interdependencies between five Southeast Asian equity markets which include Indonesia, Malaysia, the Philippines, Singapore, and Thailand and three developed equity markets: Australia, Germany, and the U.S.<sup>3</sup> The study also discusses the behaviour of markets before and after the Asian financial crisis. Correlation analysis reveals an increase in the interdependencies across the Southeast Asian equity markets in the aftermath of the crisis. Multivariate and pair-wise co-integration tests are carried out to identify the long term relationship for all the above stock markets. Evidence of integration between the Southeast Asian stock markets is documented but no significant increase in the integration is found between the Southeast Asian stock markets during the post-crisis period. Suchismita (2005) explores the co-integration between the Indian equity market and the equity markets of Asia and the U.S. by applying the multivariate co-integration technique and the granger causality test. The study finds that Indian equity market is not isolated from the rest of Asia and the U.S. Indian equity market's returns are found correlated with equity market returns of Asian markets as well as the U.S. equity market. Indian market is found to be in the group of Asian markets co-integrated within themselves and with the U.S. market. The degree of integration between the Indian and other markets in the Asian region is not very high, so there is sufficient room for portfolio diversification.

A careful examination of the above literature reveals that lot of work has been done in both developed and the developing countries but limited information is available on the Islamic countries. Therefore, in the changing economic scenario a comprehensive study considering the different periodical time series is needed. This study fills this gap and explores the opportunity of portfolio diversification and active investment management among equity markets of emerging economies of the Islamic World.

<sup>2</sup> State Bank's General Price Index for Karachi Stock Exchange is used for the study.

<sup>3</sup> The series are converted to U.S. dollars and are normalized to a common base.

### III. Data Description and Methodology

#### 1. The Data

The weekly closing prices of KSE-100 index (Pakistan), JKSE Composite Index (Indonesia), KLCI Composite index (Malaysia), CMA-100 index (Egypt) and ISE-100 index (Turkey) for the period 2000 to 2007 have been taken from Yahoo Finance. A brief overview of the market capitalization and the annual turnover of U.S dollars is reported in Table 1.

**TABLE 1**  
Market Capitalization at year end and Annual Turnover

	(Billion US\$)							
Country	2000	2001	2002	2003	2004	2005	2006	2007
Pakistan								
Mkt Cap	6.6	4.9	10.2	16.6	29.0	45.9	45.5	70.3
Turnover	33.0	16.6	26.0	66.6	73.9	141.0	126.6	100.5
Egypt								
Mkt Cap	28.7	24.2	26.1	27.1	38.5	79.7	93.5	139.3
Turnover	11.1	6.9	2.6	3.3	5.6	25.4	47.5	53.1
Malaysia								
Mkt Cap	116.9	119.0	123.9	168.4	190.0	181.2	235.4	325.7
Turnover	58.5	23.6	27.6	50.1	59.9	50.0	66.9	150.0
Indonesia								
Mkt Cap	26.8	23.0	30.0	54.7	73.3	81.4	138.9	211.7
Turnover	14.3	23.3	13.0	14.8	27.6	41.9	48.8	112.9
Turkey								
Mkt Cap	69.7	47.7	34.0	68.4	98.3	161.5	162.4	286.6
Turnover	179.2	64.7	70.7	99.6	147.4	201.3	227.6	302.4

Table 1 indicates that the size of these equity markets has increased rapidly over time. Pakistani and Indonesian equity markets increased geometrically; the size of these markets in 2007 was ten times their size in 2000. Egyptian and Turkish markets increased more than 400 per cent whereas increase in Malaysian market was approximately 300 per cent. Similarly, annual turnover also shows phenomenal growth. Maximum increase is observed in the Indonesian market which shows more than ten times of the turnover between 2000 and 2007. This increase in turnover indicates that confidence of investors in the capital markets is increasing. Turnover to the market capitalization ratio is also found to be more than one in Pakistan and Turkey. The higher turnover also indicates the presence of high level of liquidity in these markets.

## 2. Methodology

The weekly closing value of indices is used for calculating weekly returns. The continuously compound rate of return is used to measure returns for the specific period as:

$$R_t = Ln (P_t / P_{t-1}) \quad (1)$$

where:

- $R_t$  return on at the end of week 't',
- $P_t$  index closing value on week 't',
- $P_{t-1}$  index closing value on week 't-1',
- $Ln$  natural log.

There are several methods for testing the flow of information and co-movement of prices in the stock markets across countries. In this study inter-market relationship among the stock market in Pakistan and other equity markets of emerging economies of the Islamic countries is tested through the following:

- i) Descriptive statistics,
- ii) Correlation matrix,
- iii) Co-integration tests,
- iv) Granger causality test,
- v) Variance decomposition analysis.

First of all, the unit root tests proposed by Phillips and Perron (1988), and Augmented Dickey-Fuller Test proposed by Dickey and Fuller (1979) is used to test the stationarity of data. Secondly, co-integration in the price series of various markets is analyzed by using Johansen and Juselius (1990) Test.

The Augmented Dickey-Fuller Test, determines whether a unit root is present in an autoregressive model. A simple AR(1) model is specified as:

$$X_t = \rho X_{t-1} + u_t \quad (2)$$

where:

- $X_t$  weekly equity market index,
- $t$  the time index,
- $\rho$  a coefficient
- $u_t$  the error term.

The regression model can then be written as:

$$\Delta X_t = (\rho - 1)X_{t-1} + u_t = \delta X_{t-1} + u_t \quad (3)$$

where  $\Delta$  is the first difference operator, therefore, test for unit root involves testing whether  $\delta=0$ .

The Dickey-Fuller test assumes that errors are statistically independent and have a constant variance. This may not be the case with some of the data used here. Therefore, Phillip Perron test which permits the error disturbance to be weakly dependent and heterogeneously distributed is also used. The Phillip Perron test assumes that:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \alpha_2 \{t - T/2\} + u_t \quad (4)$$

The techniques to analyze time series generally use model identification and estimation procedures based on the stationarity assumption of the return generating process. This hypothesis is often violated when financial phenomena which shows its non-stationary features is studied. When multivariate time series is considered, the series can present spurious correlation. Engle and Granger faced this problem while introducing the idea of linear co-integration. Two or more time series are co-integrated if both share a common type of stochastic drift. This means that to a limited degree they share some type of behavior in terms of their long-term fluctuations, but they do not necessarily move together and may, otherwise be unrelated.

Presence of co-integrating vectors in a set of non stationary time series is examined by using the maximum likelihood approach as proposed by Johansen (1988) and Johansen and Juselius (1990). It is hypothesized that no co-integration exists among the series. Vector autoregressive framework investigates the long term relationship among variables. If Johnston and Juselius test of co-integration confirms that both price series are co-integrated in the long run, then the system of equations should be modified by inserting an Error Correction Term to account for the short-run divergence of prices from their respective equilibrium values. Granger (1988) indicates that if two variables are co-integrated, then Granger causality must exist in at least one direction. This is an outcome of the relationships described by the error-correction model. Here, variables may share common stochastic trends, so dependent variables in the VECM must be Granger-caused by lagged values of the error-correction terms which are themselves functions of the lagged values of the level variables. Hence, the temporal Granger-causality between the variables can be investigated by applying a joint F Test to the coefficients of each independent variable in the VECM. Therefore, a variable Granger-causes the other if it helps to predict its future values. In such a case, Innovative Accounting Approach (variance decomposition methods and Impulse Response Function) analysis is performed to quantify the effect of other indices on the KSE 100 Index. This econometric procedure is adopted as Taylor and Tonks (1989) who stated that the cointegration technique is useful from the perspective of the international capital asset price model. Kasa (1992) stated that the short-term return correlation between stock markets is not appropriate from the perspective of long-horizon investors who are driven by the common stochastic trends. A co-integration model is helpful since it not only distinguishes between the nature of the long-run and of the short-run linkages among financial markets, but also captures the interaction among them.

#### IV. Empirical Results

Table 2 presents the descriptive statistics for weekly stock returns for the five emerging Islamic economies, i.e., Pakistan, Malaysia, Indonesia, Turkey and Egypt. A careful examination of weekly returns of equity markets of these Islamic countries indicates that the Karachi stock exchange (KSE) offers the highest mean weekly return of 0.60 per cent, whereas, the Egyptian stock exchange (CMA) stands second with 0.39 per cent and the Indonesian stock market (JKSE) is third with a 0.31 per cent mean weekly return. In an annualized form, these offer 38 per cent, 22.8 per cent and 17.34 per cent returns respectively.

**TABLE 2**  
Descriptive Statistics  
Weekly Returns of Stock Market Indices

	KSE	JKSE	CMA	KLSE	ISE
Mean	0.0060	0.0031	0.0040	0.0014	0.0026
Median	0.0099	0.0045	0.0025	0.0012	0.0057
Standard Deviation	0.0356	0.0320	0.0312	0.0232	0.0625
Kurtosis	2.7181	0.7356	3.9648	4.7873	4.6446
Skewness	-0.5748	-0.2538	0.2808	-0.2175	-0.4231
Range	0.3041	0.2080	0.5763	0.2403	0.6543
Minimum	-0.1762	-0.1132	-0.2734	-0.1144	-0.3686
Maximum	0.1280	0.0947	0.3029	0.1259	0.2857

With reference to the risk, the descriptive statistics reveals that, the Istanbul Stock Market (ISE) is highly risky (6.25 per cent) in comparison to other equity markets of the Islamic countries which may be a result of high foreign portfolio investment in the market. The Malaysian stock market (KLSE) offers lowest risk (2.33 per cent) to the investors on a weekly basis. The highest decrease observed in one week is in Istanbul Stock Exchange where 36.8 per cent of the total value was eroded in one week. The Karachi Stock Exchange, in March 2005, showed 17.6 per cent decrease in the index, which is the maximum loss in any one week during the sample period. According to the report of Securities Exchange Commission of Pakistan (SECP) it was due to liquidity problem on settlement date. This issue may also be linked to the foreign capital mobility and the associated foreign exchange risk. However, it may be noted that the period studied is generally a period of exchange rate stability; the sudden change is visible only after 2007. Table 2 further shows that all equity markets are slightly skewed negatively, except for the Egyptian market.

#### 1. Correlation Matrix

Correlation matrices between the five markets for weekly returns are presented in Table 3. The Karachi stock exchange is positively correlated with the equity markets of Islamic countries. It may be due to liberalization of Pakistani stock market and consistency of government policies. Correlation of KSE is highest with KLSE. Since correlation coefficient is well below one, it indicates that still diversification benefits exist for portfolio investors from the Islamic countries in the Karachi Stock Exchange. An analysis of correlation among weekly returns reveals that they are positively correlated but the value is well below one, therefore, these markets appear to be independent of each other, and open the doors for portfolio diversification to the investors.<sup>4</sup>

**TABLE 3**  
Correlation Matrix for Weekly Returns  
(January 1, 2000 to June 30, 2007)

	KSE	JKSE	CMA	KLSE	ISE
KSE	1.0000	–	–	–	–
JKSE	0.1031	1.0000	–	–	–
CMA	0.1130	0.1612	1.0000	–	–
KLSE	0.1427	0.2509	0.1391	1.0000	–
ISE	0.0415	0.1294	0.1460	0.0848	1.0000

#### 2. Unit Root Tests

For examining the long-run equilibrium relationships among the time series data of indicated emerging markets of OIC the Johansen and Juselius Cointegration test has been used. The relationships between the major emerging equity markets of OIC countries is analyzed using a VAR co-integration framework which allow for an examination of the long-run equilibrium relationships among time series data. The Johansen and Juselius method requires that it should be integrated of the same order. Therefore, behavior of the market index series is examined to first determine whether they are stationary using the augmented Dickey Fuller (ADF), and then the Phillips-Perron (PP) tests on the market index levels and their first differences is applied. Table 4 reports the results, which show that the hypothesis of non-stationarity in the market indices cannot be rejected. However, the hypothesis of non-stationarity in the first differences is rejected for all markets. In other words, the index series is found non stationary and returns series is found stationary. Hence, it is concluded that series are integrated of order one.

<sup>4</sup> These correlations are generally assumed to vary inversely with the level of differential social and economic factors which affect each stock index.

The unit roots for all of the returns series can be rejected and equity returns for these countries are generally stationary for the overall period. These results are also consistent with the overall weak-form efficiency of the stock markets in the Islamic countries and all series are integrated of order one, i.e., I(1).

### 3. Co-integration Tests

Since the index series are found to be integrated of order 1, it is also tested whether the index series are stationary in a linear combination. Johansen's (1991) procedure provides two different test statistics that can be used to test the hypothesis of the existence of "r" co-integrating vectors: (i) Trace Statistics and (ii) Maximum Eigenvalue Statistic.

The "Trace Test Statistic" is used to test the null hypothesis that the number of distinct co-integrating relationship is less than or equal to "r" against the alternative hypothesis of more than "r" co-integrating relationships. The co-integration results for the system of all five stock exchanges are presented in Table 5. Trace Test statistics indicates the presence of one co-integrating equation at  $\alpha = 0.05$  which means that there is a long run relationship among these markets and that they are co-integrated.

Pair wise co-integration analysis has also been performed to explore the relationship among markets on a bivariate basis. Table 6 presents the results of the pair wise co-integration tests for the entire sample period. The results show that the markets under study are not co-integrated except the Indonesian JKSE and the Malaysian KLSE.

The results also confirm that the Karachi stock exchange is not co-integrated with equity markets of other Islamic countries. However, Turkish equity market is found integrated with the Egyptian and the Indonesian equity markets. Results of the bi-variate co-integration analysis confirm the results of multivariate co-integration analysis, and provide evidence of existence of long run relationship among the above stated equity markets. Theoretically, the absence of co-integration among stock market indices implies differential risk premia, i.e., because the indices studied are independent of each other in the long-term, the risks associated with each index bear different prices. One important implication of the preceding econometric analysis is that, because the selected OIC countries are not co-integrated, there is an additional diversification benefit that investors can reap by placing their funds in the Pakistani equity market, as it is likely to change independently of the equity markets of selected OIC economies.

**TABLE 4**

Unit Root Test

	ADF Level	ADF Ist Diff	PP Level	PP Ist Diff
KSE	-1.9328	-16.7877	-1.88585	-16.7671
JKSE	-0.9872	-21.0322	-0.98436	-20.9464
CMA	-1.2954	-17.1066	-1.50750	-24.3928
ISE	-2.3154	-21.2792	-2.24710	-21.2765
KLSE	-0.7226	-12.7541	-0.72520	-19.9841
1% Critical Value	-3.9832	-3.9832	-3.98320	-3.9832
5% Critical Value	-3.4221	-3.4221	-3.42210	-3.4221
10% Critical Value	-3.1338	-3.1338	-3.13380	-3.1338

**TABLE 5**

Johansen Multivariate Co-integration Analysis  
Trace Test Results

	Eigen Value	Trace Statistics	5% C Value	Hypothesized Number of CEs
KSE,	0.083828	74.405590	69.818890	None*
JKSE,	0.052363	42.361780	47.856130	At most 1
CMA,	0.047194	22.676930	29.797070	At most 2
ISE,	0.013308	4.983086	15.494710	At most 3
and KLSE.	0.000218	0.079819	3.841466	At most 4

**TABLE 6**

## Results of Pair Wise Cointegration Analysis

	Eigen Value	Likelihood Ratio	5% Critical Value	Hypothesized No. of CEs	Remarks
KSE,JKSE	0.039496 0.000278	14.850530 0.101652	15.494710 3.841466	None At most 1	No Co-integration
KSE,CMA	0.019823 0.000413	7.479253 0.151319	15.494710 3.841466	None At most 1	No Co-integration
KSE,ISE	0.038350 1.32E-05	14.317160 0.004847	15.494710 3.841466	None At most 1	No Co-integration
KSE,KLSE	0.028988 8.30E-05	10.796640 0.030378	15.494710 3.841466	None At most 1	No Co-integration
JKSE,ISE	0.039195 0.002625	15.596300 0.962095	15.494710 3.841466	None* At most 1	Co-integration
JKSE-CMA	0.023775 0.007891	11.706130 2.899519	15.494710 3.841466	None At most 1	No Co-integration
JKSE-KLSE	0.039275 1.07E-05	14.668620 0.003926	15.494710 3.841466	None At most 1	No Co-integration
CMA-ISE	0.047432 0.004849	19.564400 1.778936	15.494710 3.841466	None* At most 1	Co-integration
CMA-KLSE	0.023413 0.003252	9.863358 1.192130	15.494710 3.841466	None At most 1	No Co-integration
ISE-KLSE	0.028822 0.000312	10.818030 0.114163	15.494710 3.841466	None At most 1	No integration

\* denotes rejection of the hypothesis at 5% level of significance.

#### 4. Granger Causality Test

Table 7 shows the results of Granger Causality Test. A careful examination of this table indicates that no Granger causality exists between returns of KSE and returns of equity markets of the Islamic countries. However, Granger causality exists between the Indonesian equity market and the Malaysian equity market and between the Turkish and the Indonesian stock markets. One possible reason of this lead lag relationship may be a high level of foreign capital mobility in the ASEAN

**TABLE 7**

## Results of Pair Wise Granger Causality Test

Null Hypothesis:	F-Statistic	Probability
JKSE does not Granger Cause KSE	1.85844	0.15740
KSE does not Granger Cause JKSE	1.07481	0.34245
CMA does not Granger Cause KSE	0.23890	0.78762
KSE does not Granger Cause CMA	2.45488	0.08731
KLSE does not Granger Cause KSE	0.87801	0.41649
KSE does not Granger Cause KLSE	0.24015	0.78663
ISE does not Granger Cause KSE	0.08235	0.92097
KSE does not Granger Cause ISE	2.39466	0.09265
CMA does not Granger Cause JKSE	0.53199	0.58789
JKSE does not Granger Cause CMA	2.23953	0.10799
KLSE does not Granger Cause JKSE	1.18403	0.30723
JKSE does not Granger Cause KLSE	3.36212	0.03575
ISE does not Granger Cause JKSE	7.08421	0.00096
JKSE does not Granger Cause ISE	1.47812	0.22944
KLSE does not Granger Cause CMA	2.79237	0.06260
CMA does not Granger Cause KLSE	1.32024	0.26836
ISE does not Granger Cause CMA	1.75522	0.17434
CMA does not Granger Cause ISE	1.06992	0.34412
ISE does not Granger Cause KLSE	1.31272	0.27037
KLSE does not Granger Cause ISE	1.59376	0.20459

region. These results are in line with those of many recent studies that confirm a high level of co-integration among South East Asian markets and may also be cited as the reason of spillover effect of the financial crisis in these markets in the past.

#### 5. Innovative Accounting Approach

Granger causality test is inappropriate as it only shows the degree of feedback of one variable to another and cannot determine the relative strength of the Granger-causal chain or a quantitative measures of the dynamic interactions of different variables beyond the selected sample period [Wolde-Raufeal (2009)]. Therefore, to evaluate the dynamic interactions from various stock markets to Karachi stock

market and to check the strength of causality tests, ahead of the period of analysis, variance decomposition methods and impulse response functions (innovative accounting approach) was also applied. This approach provides the out of sample “unanticipated” impact of a variable on a targeted variable [Wolde-Raufeal, (2009) and Shan (2005)]. The variance decomposition method (VDM) is applied to test the response of Karachi stock market to the shocks occurring in the JKSE, CMA, KLSE and ISE. The VDM is an alternative to the impulse response function (the diagram of impulse response function is given Figure 1). This process explore how much of the predicted error variance of the weekly returns in the Karachi stock market is explained by the shocks being generated throughout each under-considered stock market, over future time horizons. The results reported in Table 8 indicate that the forecasted error on weekly returns on stocks in Karachi Stock Exchange (KSE) is fully explained through its own innovations shocks (99.17 per cent). This reveals that there exist no causality from returns of equity markets of the Islamic countries to the returns in KSE. Hence, results from both approaches i.e., Granger-causality and VDM are same and confirm that no bidirectional relation exists between these markets and KSE. Impulse response function analysis shows that no dynamic response exist in Karachi equity market due to the innovations which occur in other equity market over the under-considered time horizon. Figure 1 shows that the Karachi stock market seems to be exogenous as most of its stocks are completely explained by its own innovations.

TABLE 8

Results of the Variance Decomposition Analysis

Periods	S.E.	KSE	JKSE	CMA	KLSE	ISE
1	214.8811	100.000	0.0000	0.0000	0.0000	0.0000
2	324.8210	99.7143	0.2402	0.0100	0.0348	0.0006
3	411.5784	99.5701	0.2797	0.1124	0.0372	0.0007
4	485.9753	99.5156	0.2702	0.1835	0.0298	0.0009
5	551.2481	99.4864	0.2525	0.2271	0.0234	0.0106
6	610.1438	99.4406	0.2303	0.2817	0.0192	0.0282
7	664.5356	99.3835	0.2072	0.3393	0.0173	0.0526
8	715.3273	99.3191	0.1860	0.3940	0.0175	0.0834
9	763.1807	99.2470	0.1671	0.4476	0.0194	0.1189
10	808.5994	99.1695	0.1506	0.5001	0.0225	0.1572

## Response to Cholesky One S.D. Innovations

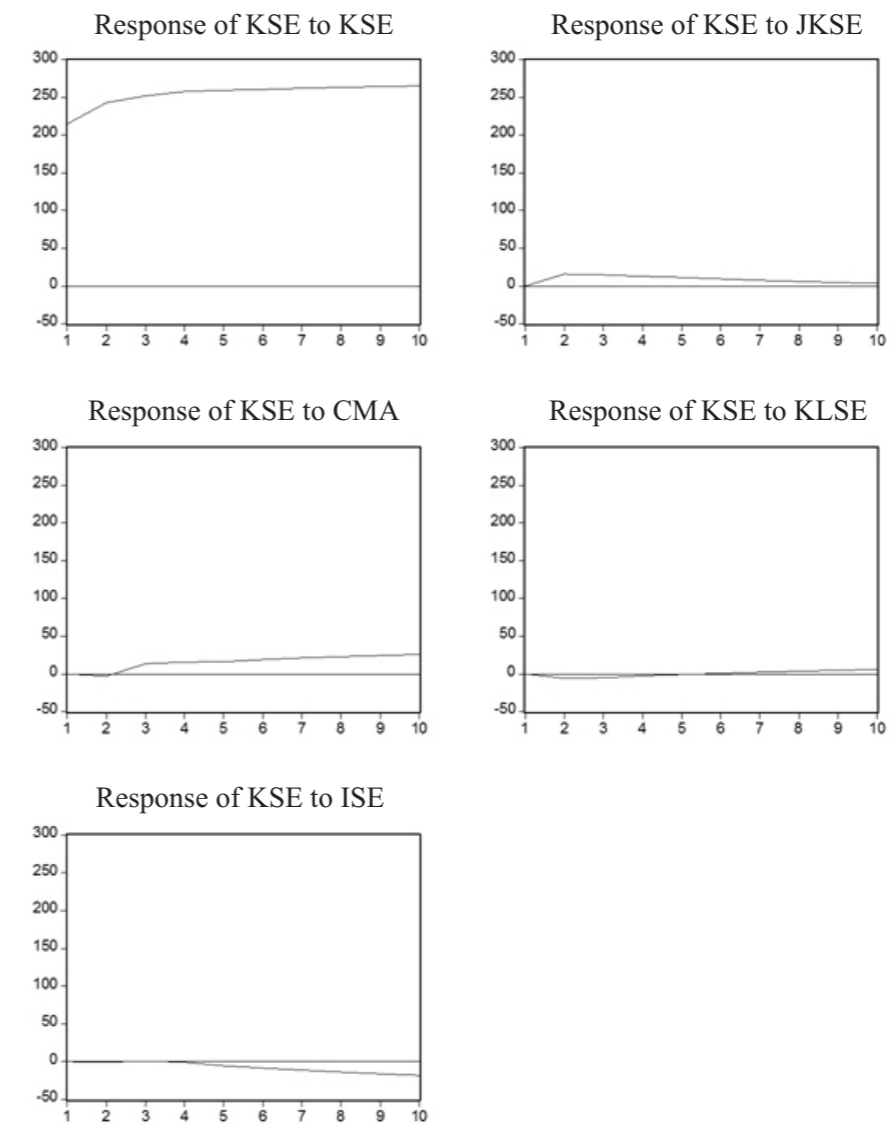


FIGURE 1

Impulse Response Function Analysis



## V. Recommendations and Policy Implications

This study is conducted with the objective of identifying the dynamic inter-linkages among equity markets of the emerging Islamic countries to evaluate the scope for portfolio diversification. Descriptive statistics shows that the Karachi stock exchange offers highest return at reasonable risk, whereas, the Istanbul stock exchange is the most volatile market. The existence of weak or insignificant positive correlation among these markets indicates that they are independent. As the correlation matrix is relatively weak in explaining the cause and effect relationship, therefore, the co-integration analysis is performed.

The stationarity of data has been tested by using the augmented Dickey-Fuller and Phillips-Perron tests on the market index levels and their first differences. Results show that the time series are integrated of order one. The multivariate co-integration analysis indicates that there exists a single co-integration equation. However, pair-wise co-integration analysis shows no co-integration between the Karachi Stock Exchange and equity markets of Egypt, Turkey, Malaysia, and Indonesia. Thus, the co-integration results confirm the correlation analysis results. However, the Turkish and Indonesian markets are found to be integrated. Granger causality test also confirms the unidirectional causality between the Turkish and Indonesian markets and the Indonesian and Malaysian markets. The presence of lead lag relationship among the Indonesian and Malaysian equity markets may be attributed to regional integration and presence of ASEAN links among these countries. However, the lead lag relation among the Turkish and Indonesian markets may be an outcome of high level of foreign capital flows in these countries.

According to the impulse response analysis the Karachi stock market appears exogenous as most of its shocks are explained by its own innovations. The decomposition of variance for KSE indicates that it is not affected by other markets. As these markets are found to be independent, it can be safely concluded that investors make decisions on the basis of economic rationale and no significant segmentation is visible in equity markets of the Islamic world. The Karachi Stock Market appears as an independent market and opens the door for portfolio diversification. Therefore, policy makers should not be worried about the spillover or contagion effect in these independently working markets. From a policy perspective, co-integrated stock markets may contribute to financial stability, as these markets cannot deviate too far from the long-run equilibrium path. From the portfolio diversification objective, investors cannot benefit from the arbitrage activities in the long run. However, in the short run, markets would continue to be influenced by the portfolio diversification objectives of foreign investors.

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