

# CO-INTEGRATION BETWEEN ISLAMIC AND CONVENTIONAL STOCK MARKET INDEX: AN INVESTIGATION OF DIVERSIFICATION (A CASE OF ASIAN PACIFIC REGION)

Salleh Nawaz Khan <sup>1</sup> and Waseem Ahmad Khan <sup>2</sup>

## Abstract

*After the financial crisis of 2007-08 the benefit of diversification had become a question mark. Academic researchers and institutional investors were looking for the remedies. In this process Islamic equity market emerge as a valuable alternative. This study investigates the co-integration between Islamic and conventional stock markets in Asia Pacific region. Dow Jones Islamic Market Asia Pacific (DJIMAP) found co-integrated with BSE Sensex India, TWSE index Taiwan, PSX Pakistan and NZ 50 New Zealand. The short term disequilibriums will not adjust in single time period and it will take 3 to 5 months to restore back to equilibrium.*

**Keywords:** Stock Markets, Co-integration, Deregulations, Diversification.

**JEL Classification:** G 190

## Introduction

Globalization and deregulation in the capital market was started when the United State took an important step by passing the US security act amendments of 1975, which deregulate the stock brokerage rate. After passing of this Act, the world stock markets experience a series of deregulation and internationalization. This deregulations open new doors for investor and led a greater flow of capital between economies. With increase in the stock market integration, the current world financial market have become closely integrated and interdependent over time. There understanding of the market correlation is very important for diversification and for risk management.

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<sup>1</sup> Department of Management Sciences , The Islamia University Bahawalpur.  
Email: [sallehkhan@yahoo.com](mailto:sallehkhan@yahoo.com)

<sup>2</sup> Department of Management Sciences, The Islamia University Bahawalpur.  
Email: [Waseem.khan@iub.edu.pk](mailto:Waseem.khan@iub.edu.pk)

Stock markets co-integration is an important question for financial theory and for portfolio management. Regarding financial theory, when stock market is co-integrated the principal of Efficient Market Hypothesis (EMH) is violated as two markets move together in the long run, one can predict its future price but if they are not co-integrated then EMH is held in any of its form i.e., one cannot predict stock returns using publicly available data such as index prices. Regarding portfolio management, Modern portfolio theory (Markowitz, 1952) introduced the concept of diversification, by the selection of assets that has lower overall risk as compared to any other combination of assets with the same expected return. Different types of assets change their value in opposite direction and combination of such assets make a well diversified portfolio.

The concept of cross country diversification is more effective in the era of globalization, it hedge risk also political risk; for example if one country announces the increase in interest rate this may affect the security prices in one country but not necessary that the other countries also take similar step. Similarly if one industry fails in one country but in other country it grow vigorously so investing in both countries can be a hedge risk.

During the crisis period of 2007 the benefit of portfolio diversification had become a question mark. Almost all of the markets follow the same trends during crisis period. That was a very alarming condition, financial investors and academic researchers started to search for remedies and solutions for this systematic risk of conventional markets. In this process Islamic equity market emerged as a valuable alternative and become a study of interest.

The question whether Islamic and conventional markets are integrated, is difficult to answer without investigating this problem. With the rapid growth of Islamic equity markets many investors would certainly consider to invest in both the Islamic and conventional markets rather than investing in single market. The question whether there is a relationship between the Islamic and conventional stock exchanges is the major concern raised by international investors.

Thus, this study aims at providing some insight to the question above by investigating the co-integration between Islamic and conventional stock markets. Beside this, the growing importance of Asian pacific region especially China, Malaysia, Japan and Indonesia most of the investors prefers to invest in these countries. Unfortunately there is no prior research on stock market integration that widely covers the Asian Pacific geographical region.

### *Research Significance*

This study will provide some useful information to the portfolio managers and international investors who are always looking for the opportunity of diversification. It also contributes to the existing literature in this novel area.

### Literature Review

In this section we will present the relevant studies that are pertaining to our study. There is a bulk of studies on stock market co-integration between the emerging and the developed countries. But we found very few studies on Islamic stock indices co-integration with conventional stock exchanges. Most of the existing literature on the study of inter linkage between stock markets uses the approach of co-integration. Murray(1994) and Smith and Harrison (1995) use the story of drunk and her dog as more time had passed the distance between dog and drunk will be far away from their previous location. They assume an assumption that the “dog belongs to drunk” he adjust his current position from his previous position at the rate of  $\alpha$  from his Mistress ( $Y_{t-1} - X_{t-1}$ ). The expression ( $Y_{t-1} - X_{t-1}$ ) captures the co-integration or the long run equilibrium relationship between the dog and the drunk.

In early 1950 the investment community was talking about the risk but there was no specific tool to measure the risk. Markowitz (1952) measure risk by the variance of returns and derived the formula for computing the variance of portfolio. He argued at the given level of risk investor prefer high return and vice versa. This give the idea of diversification by selection of such assets in a portfolio that are not co-integrated. Institutional investors always look for such opportunities that's why they invest in different stock markets. According to Levy and Sarnat (1970) aof the reason of international diversification is that the returns move in the same direction with in one country. However it is uncommon that returns move in the same direction along different countries. Grubel and Fadner (1971) found that there is benefit of international diversification because returns in a country may be influenced by the government policies or from some economic disturbance.

A successful Diversification strategy across international stock market implies that these markets are not heavily integrated identifying the channel through which shocks are spreading from one market to another has direct impact to active and passive investment strategies, Portfolio diversification and Rebalancing (Grubel ,1968). Moreover the cross market linkage and the potential gains from international investment have become the topic of interest for academic researchers and international investors. Narayan et al. (2004) founds that in the long run stock prices of major South Asian countries were co-integrated. And in the short run the unidirectional causality ran from Pakistan to Indian equity market, Sri Lankan to Indian market and from Pakistani to Sri Lankan stock market.

The term “Financial integration” means abolishment of the limitations which stem the capital flow in the financial market and a process of which capital mobility becomes advance. Ajeet (2005) found that Indian stock market was influenced by the developed stock markets whereas Pakistani and Sri Lankan market had no relationship with the developed markets of the world. As capital markets are liberalize the international stock prices become more integrated. Carrieri et

al. (2006) found that emerging stock markets integration depends upon the interactions between international, regional economic and political variables. Ibrahim (2009) found that North African stock markets were strongly integrated and investors cannot hedge systematic risk by investing in these markets. Kashyna (2010) found that after becoming the part of the European Union the emerging countries became more integrated with developed markets. Parvel (2011) found that South African stock market was not co-integrated with developed markets of the world such as Germany and the USA and also with the markets in Africa but it was low co-integrated with emerging economies like Brazil, Mexico and Poland.

Over the last several decades communication technology has made the world a smaller place. The efficient market hypothesis cannot hold because most of the world equity markets are co-integrated. If EMH does not hold then there will be a huge transfer of wealth from naïve investor to well informed investors (Gupta 1988). Adebol and Dahalan (2012) examined the stock market integration in African countries and found limited diversification opportunities in these countries.

The recent financial crisis, which is also called subprime crisis (2007-08) effect almost all the major equity markets in the world. The benefit of Diversification had become a question mark because all the equity markets followed the same trend. Assidenou (2010) found that during the subprime crisis all the Asian markets were co-integrated and had negative returns. Singh and Kumar (2015) studied the stock market linkage between the US, China and India during subprime crisis. They founds that there is a unidirectional spillover that run from the US equity market to the Indian market and from the Indian market to the Chinese equity market.

The Islamic stock markets emerged as a valuable alternative after subprime crisis. The institutional investors started looking towards the Islamic stock markets for hedging of risk. The companies included in the Islamic index have passed the Shariah screening criteria. Any company which is found not compatible with the Islamic line of business are exclude from the Index. Investing in Islamic equity market is considered as an ethical investment. Khan and Sulaiman (2013) found that Islamic stock markets were also affected from financial crisis but not as much as conventional stock exchanges. Khamlichi and Taylor (2014) is shown in his study that Dow Jones Islamic Index have no long run relationship with S&P conventional index and offer the opportunity of Diversification. Salina (2010) argued that investor can hedge risk by investing across economies such as in developing and developed markets. However, they cannot diversify risk by investing in the same economic groups. Sensoy (2015) found that systematic risk in conventional markets were higher than Islamic equity markets. After reviewing the previous literature, we probably did not find any research which widely investigates the co-integration between the Islamic and conventional equity markets in Asia Pacific region.

## **Research Methodology**

### *Data Description*

The study encompass the weekly stock prices for the period June 2009 to July 2017 consisted of 423 observations. The data is collected from stock exchanges websites and from yahoo finance.

### *Population and Sample*

The islamic and Conventional stock markets of Asia Pacific region are which are population of this study. Bloomberg classifies the Asian pacific region into nineteen countries as follows; Japan, China, Hong Kong, South Korea, India, New Zealand, Taiwan, Australia, Pakistan, Malaysia, Indonesia, Singapore, Thailand, Vietnam, Bangladesh, Mongolia, Laos, Philippines and Sri Lanka. Each country has many regional exchanges but we selected the most representative indices that reflect market performance in their respective countries. The sample consists of fourteen major stock indices which are considered representative of Asian Pacific region stock exchanges. Stock Exchanges of Thailand, Vietnam, Bangladesh, Laos and Mongolia are not included in our sample due to unavailability of data .

### *Variables of the Study*

#### *Independent Variable*

The independent variables are the conventional stock exchanges of Asian pacific region namely; BSE SENSEX ( India), TWSE Index (Taiwan), CSE All shares (Sri Lanka), HANG SANG Index (Hong Kong), KOSPI Index (South Korea), KLSE Index (Malaysia), JKSE Inx (Indonesia), SHANGHAI Index (China), NIKKE 225 Index (Japan), STI Index (Singapore), ASX 200 Index (Australia), NZ50 Index (New Zealand), PSX 100 Index (PAKISTAN) and PSEI (PHILIPPINES).

#### *Dependent Variable*

Dow Jones Islamic Market Asia Pacific (DJIMAP) is selected as the Dependent variable. It tracks the stock traded in Asia Pacific region that passes the shariah compliance screens. DJIMAP index includes the constituents of 14 country-level benchmark indices, each of which cover 95% of float adjusted market capitalization of the underlying countries.

Table 1  
*Country Wise Allocation of DJIMAP*

COUNTRIES	ALLOCATION
JAPAN	35.75 %
CHINA	15.75%
SOUTHKOREA	11.84%
TAIWAN	8.44%
AUSTRALIA	8.03%
INDIA	8.00%
HONGKONG	5.11%
MALAYSIA	1.95%
THAILAND	1.38%
SINGAPORE	1.33%
INDONESIA	1.28%
NEWZEELAND	0.58%
PHILIPPINES	0.54%
SRILANKA	0.02%

Source: [www.djiindex.com/fact sheet](http://www.djiindex.com/fact%20sheet).

### ***Econometrics Techniques Used in Study***

#### ***Augmented Dickey-Fuller Test***

A type of stochastic process that has received a great deal of attention by the time series analysis is called stationary stochastic process. The word stochastic means a data that spread randomly around their mean. Broadly speaking a time series is said to be stationary if its mean and variance are constant to our time and the value of covariance depends upon lag between two time periods not on the time when covariance is computed. Stationary process is very important if time series is not stationary its mean, variance grow over time. The prediction based on non-stationary always underestimate the mean variance in future period. Augmented Dickey fuller test is most popular test that detect the stationarity of time series. Augmented Dickey – fuller test equation :

$$\Delta Y_t = \alpha_1 + \alpha_2 t + S Y_{t-1} + \alpha_1 \Delta Y_{t-i} + \varepsilon_t \dots \dots \dots (3.1)$$

The model (3.1) is Augmented as the following equations:-

$$\Delta Y_t = S Y_{t-1} + \varepsilon_t \quad (\text{Pure Random walk}) \dots \dots \dots (3.2)$$

$$\Delta Y_t = \alpha + S Y_{t-1} + \varepsilon_t \quad (\text{Random walk with drift}) \dots \dots \dots (3.3)$$

$$\Delta Y_t = \alpha + \alpha t + S Y_{t-1} + \varepsilon_t \quad (\text{Random walk with drift and trend}) \dots \dots \dots (3.4)$$

Equation (3.1) includes the lag values of dependent variable  $\Delta Y_t$ . The idea being to include enough lag terms so that the error term is serially uncorrelated.

### *Engle – Granger Test of Co-integration*

The Engle –Granger approach to co-integration is very popular because it is easy to estimate the regression using OLS technique and the ECM model provides the valuable information about the speed of adjustment of previous period disequilibrium. Let us suppose, we have two non-stationary time series i.e., DJIMAP and STI index Singapore both are integrated of  $I(1)$ . Suppose we regress DJIMAP on STI as follows:-

$$DJIMAP = \beta_1 + \beta_2 STI + \varepsilon_t \dots \dots \dots (3.8)$$

where

$$\varepsilon_t = DJIMAP - \beta_1 - \beta_2 STI \dots \dots \dots (3.9)$$

After estimating regression the residuals are obtained, Suppose we run the unit root test on residuals and interestingly found that residuals are stationary or they are integrated of  $I(0)$ . In that case the regression model is no more spurious. The linear combination cancel out stochastic trends in two time series. This means two variables are co-integrated i.e., they have a long run equilibrium relationship and slope parameter  $\beta_2$  is known as long run parameter. Dickey and Fuller critical values are not appropriate in Engle Granger test because error term  $\varepsilon_t$  is based on the estimated co-integrating parameter  $\beta_2$ . Therefore Engle and Granger calculated the critical values for co-integration test.

### *Error Correction Mechanism (ECM)*

The ECM model is first introduced by Sargan (1984) and after popularized by Engle and Granger corrects for disequilibrium. Let us explain, suppose DJIMAP and STI index are co-integrated i.e., there is long run equilibrium relationship between them. In short run there may be disequilibrium which adjusts over time. Therefore the error term of equation (3.9) can be treated as equilibrium error. And use this error term to estimate the short run behavior of DJIMAP. So we have to modify the equation (3.9) by incorporating one period lag of error term. ECM requires stationarity that's why we have to take first difference of DJIAMP and STI to make them stationary. Now consider the following Model :

$$\Delta DJIMAP = \beta_0 + \beta_1 \Delta STI + \beta_2 \varepsilon_{t-1} + u_t \dots \dots \dots (3.10)$$

Where  $\Delta$  as usual denotes as the first difference operator and  $u_t$  is random error term and  $\varepsilon_{t-1} = (DJIMAP_{t-1} - \beta_1 - \beta_2 STI_{t-1})$  one period lagged value of error term. The coefficient of  $\varepsilon_{t-1}$  Tells

the speed of adjustment of Previous period Disequilibrium. If the Prices of  $\Delta DJIMAP$  increases in period  $t$  then the term  $\beta_2 \epsilon_{t-1}$  will be negative in next period to adjust this Disequilibrium and vice versa. Moreover the parameter  $\beta_1$  is the short term parameter and tells the short term changes in DJIMAP.

## Results and Discussion

Table 4.1

*Augmented Dickey Fuller Test (01 JUN 2009 - 09 JUL 2017)*

Stock Market	Intercept	Intercept & Trend	Intercept	Intercept & Trend
DJIWAP	-2.39	-3.68	<b>-23.74*</b>	<b>-23.71*</b>
BSE SENSEX	-0.38	-2.22	<b>-20.52*</b>	<b>-20.51*</b>
COLOMBO	-2.79	-2.34	<b>-15.26*</b>	<b>-15.36*</b>
HANG SENG	-2.71	-3.07	<b>-20.21*</b>	<b>-20.19*</b>
JKSE	-1.83	-2.90	<b>-23.34*</b>	<b>-23.34*</b>
KLSE	-2.72	-2.39	<b>-20.78*</b>	<b>-20.90*</b>
KOSPI	-2.55	-3.42	<b>-21.58*</b>	<b>-21.56*</b>
PSX	<b>0.10</b>	<b>-2.12</b>	<b>-12.92*</b>	<b>-12.92*</b>
NIKKE225	-0.51	-2.36	<b>-20.22*</b>	<b>-20.21*</b>
SHANGAI	-1.78	-1.95	<b>-18.50*</b>	<b>-18.49*</b>
STI	-3.07	-3.02	<b>-19.34*</b>	<b>-19.34*</b>
TWSE	-2.04	-2.91	<b>-22.23*</b>	<b>-20.20*</b>
ASX200	-1.99	-3.05	<b>-22.68*</b>	<b>-22.66*</b>
NZ50	0.88	-1.83	<b>-20.21*</b>	<b>-20.27*</b>
PSEI	<b>1.40</b>	<b>-2.29</b>	<b>-21.38*</b>	<b>-21.39*</b>

*Note:* \* Indicates that null hypothesis is Rejected at 1% critical value based on Mackinnon (1991). Critical values when including only intercept: 1%: -3.44; 5%: -2.86; 10%: -2.57. Critical values when including both intercept and trend: 1%: -3.97; 5%: -3.42; 10%: -3.13 .

Table 4.1 Represents the results of Augmented Dickey Fuller. We employed both models i.e., with intercept and intercept with trend. Practically it is very difficult to recognize the true model, So in most of the time academic researchers uses both models. The result indicate that stock prices are non-stationary at level in both models. The ADF test statistic is smaller than critical



value in absolute at 1% probability level. The reason is that stock prices follow random walk i.e., their means, variance and covariance changes over time. Non stationary data as a rule are unpredictable and cannot be modeled and forecasted. Most of the time series become stationary after taking first difference. Our data had also become stationary at first difference. The ADF test statistic is greater than critical values at 1% probability level.

Table 4.2

*Engle- Granger Approach of Cointegration (01 Jun 09- 09 July 17)*

Pairs	Constant $\beta_0$	Coefficient $\beta_1$	Test Statistic ADF (on Residuals) Intercept & Trend	Results
DJIMAP – BSE SEN	909 p(0.000)	0.02 p( 0.000)	-3.55**	Co integrated
DJIMAP - COLOMBO	944 p(0.000)	0.08 p(0.000)	-2.92	No co integrated
DJIMAP- HANGSENG	217 p(0.000)	0.05 p(0.000)	-2.27	No co integrated
DJIMAP – JKSE	915 p(0.000)	0.12 p(0.000)	-2.94	No co integrated
DJIMAP –KLSE	584 p(0.000)	0.53 p(0.000)	-1.79	No co integrated
DJIMAP – KOSPI	-25 p (0.46)	0.76 p (0.000)	-3.00	No Co integrated
DJIMAP –NIKKE	1105 p (0.000)	0.02 p (0.000)	-3.33	No co integrated
DJIMAP – SHANGAI	1214 p (0.000)	0.08 p (0.000)	-2.61	No Co integrated
DJIMAP – STI	288 p (0.000)	0.38 p (0.000)	-0.88	No Co integrated
DJIMAP – TWSE	138 p (0.000)	0.15 p (0.000)	-4.32*	Co integrated
DJIMAP – PSX	1246 p (0.000)	0.008 p (0.000)	-3.90*	Co integrated
DJIMAP – ASX200	380 p (0.000)	0.21 p (0.000)	-2.94	No Co integrated
DJIMAP - NZ50	1103 p (0.000)	0.07 p (0.000)	-3.78**	Co integrated
DJIMAP - PSEI	1079 p (0.000)	0.06 p (0.000)	-2.69	No Co integrated

Note: \* and \*\* Indicates that null hypothesis is Rejected at 1% and 5% critical value based on Davidson and Mackinnon, 1993 (critical values of co integration test ). Critical values when including only intercept : 1 %: -3.90; 5%: -3.34;

Table 4.2 Represents the result of Engle - Granger test of co-integration. The ADF test statistic on residuals are -3.55 , -4.32 , -3.90 and -3.78 which in absolute are larger than critical values at 5% significance level. Which show that DJIMAP has long run equilibrium relationship with BSE SENSEX (India), TWSE (Taiwan), PSX (Pakistan), and NZ50 (New Zealand) . The result are surprising different what expected , it was thinking that Islamic equity market will not be integrated with commercial stock markets due to their unique shariah screening criteria . The implications of the findings are very useful for International investors and for portfolio managers . The results reveals that investor cannot diversify their risk by investing in those stock indices which are co-integrated with Islamic stock indices. Pakistan stock index and Taiwan stock index are found co integrated with Islamic stock indexes in Asian pacific region at 1% probability level. The EMH will not hold in these markets i.e., their returns moves in the same direction over the long run. However, the remaining indexes which are not co-integrated with DJIMAP provide an opportunity of diversification. The EMH hold in these markets and no one can earn abnormal returns. Institutional investor and portfolio managers can make portfolio by the combination of Islamic and conventional stock indexes and can achieve the benefit of diversification in this region.

Table 4.3

*Error Correction Mechanism (31 DEC 2007-29 SEP 2015)*

Variables	Coefficients	Probability	R Square	DW Statistics
D(BSE India) ECT (-1)	0.04 <b>-0.05*</b>	0.0000 0.0005	0.38	2.34
D( TWSE Taiwan) ECT(-1)	0.13 <b>-0.11*</b>	0.0000 0.0000	0.52	2.24
D(PSX Pakistan) ECT(-1)	0.006 <b>-0.06*</b>	0.0213 0.0001	0.04	2.20
D(NZ50 New Zealand) ECT(-1)	0.19 <b>-0.05*</b>	0.0000 0.0008	0.17	2.34

Note: \* Indicates significant at 5% Probability level. ECM requires that data should be in stationary form so that's why we take the first difference of log indices . The coefficient ECT should lie between

0 and 1 . where 0 suggesting no adjustment one time period later and 1 indicates full adjustment.

According to Granger and Newbold , if R square is greater than D statistic then the model is spurious but in our model R square is smaller than D statistic, so our error correction model is not spurious. If the two time series have long run relationship then in short run there may be disequilibrium which adjusts over time. The ECM model captures the short run disequilibrium and its speed of adjustment.

Let us interpret the results of table no. 4.3 the coefficient of  $D(\text{BSE Sensex})$  is short run coefficient and its value is 0.04 and found significant ( $p \leq 0.05$ ). This means in short run if BSE Sensex Index increase by 1% then DJIMAP increase by 4%. The coefficient of error term is 0.05 which is also significant meaning that system corrects the previous period disequilibrium at the rate of 5% per week. Moreover, The sign of error correction term is negative which validates the long run relationship between DJIMAP and BSE Sensex India. Similarly, in short run if Taiwan stock index increases by 1% then DJIMAP index increases by 13 percent. And in this case system corrects the previous period disequilibrium at the rate of 11% per week.

The short run coefficient of  $D(\text{PSX Pakistan})$  has very small impact on DJIMAP Index Its only 0.06% and it corrects the short run disequilibrium at the rate of 6% per week. On the other hand New Zealand stock Index has larger impact on DJIMAP than any other commercial stock markets in this region. It is found that 1% increase in NZ 50 index increases DJIMAP by 19 percent. And it adjusts the previous period disequilibrium at the rate of 5% per week.

The results of the error correction model are very useful for international investors it tells that the random shocks which the system receives will adjust in between 3 to 5 months and these random shocks will adjust at the rate of 5% per week in case of BSE Sensex, 11% in case of TWSE, 6% in case of PSX and 5% in case of NZ 50.

### Conclusion

The aim of this study is to investigate the co-integration between Islamic and conventional stock indices. Dow Jones Islamic market Asian Pacific (DJIAMAP) index has been taken as dependent variable which represents the Islamic stock markets in Asian Pacific region. The Independent variable includes 14 major conventional stock indices of Asian Pacific region. The ADF test was performed to test the stationary / non stationary property of data. It is found that all indices are not stationary at level but after taking first difference they become stationary.

For Co-integration two tests are commonly used; Johansen test and Engle Granger Approach. We employed the second one which is preferable in case of bivariate model. The results indicate that DJIMAP is co-integrated with BSE Sensex, TWSE Index Taiwan, PSX Pakistan

and NZ50 New Zealand. The ECM results reveals that the random shocks which the system receives will adjust in between 3 to 5 months. These short run dis equilibrium adjusts at the rate of 5 % per week in case of BSE Sensex, 11% in case of TWSE, 6% in case of PSX and 5 % in case of NZ 50.

### *Recommendation*

On the basis of this study the following recommendations are given to the policy makers, portfolio managers and for international investors:

1. Investor cannot diversify their risk by investing in those stock indices which are co-integrated with Islamic stock indices. Making a portfolio by the combination of these co-integrated markets investors cannot achieve the benefit of diversification.
2. The short run dis equilibriums due to random shocks will not adjust in single time period, it will take 3 to 5 months for coming back to their equilibrium position.

### **References**

- Adebola, S. S., & Dahalan. J. (2012). An Empirical analysis of stock market integration in selected African Countries. *Euro Economica*, 31(2) , 166-177.
- Assidenou, K. E. (2011). Cointegration of major stock market indices during the 2008 global financial distress. *International Journal of Economics and Finance*, 3(2), 212.
- Carrieri, F,V.Errunza, and K.Hogan. (2007). Characterizing world market integration through Time series. *Journal of Financial and Quantitative Analysis*, 42(4), 915-940.
- Engle R.F and C.W Granger. (1987). Co-integration and error correction: Representation, Estimation and Testing. *Econometrica*, 55(2), 251-276.
- Granger C.W.J and P. Newbold. (1977). *Forecasting Economic Time Series*. New York Academic Press.
- Granger , C. W. J., & Newbold, P. (1986). *Forecasting Economic Time Series* (2ND ed.). New York : Academic Press, INC.
- Grubel , H. G., & Fadner, K. (1971). The interdependence of International Equity market. *Journal of Finance*, 26(1), 89-94.
- Gupta, O. P. (1990). Stock market efficiency and random character of share price behaviour in India. *Asia Pacific Journal of Management*, 7(2), 165-174.
- Kashyna, O., & Sotnyk, K. (2010). Stock market integration of European emerging markets: Rolling window and Dynamic conditional correlation approaches (Unpublished Master Thesis). *Lund University, Scania, Sweden*.
- Kassim,S.H. (2013). The global financial crisis and the integration of Islamic stock markets in developed and developing countries, *Asian Academy of Management Journal of accounting and finance*, 9(2), 75-94.
- Khamlichi, A., Sarkar, K., Arouri, M. & Teulon, F. (2014). Are Islamic equity markets are

- more efficient than their conventional counterparts. *Journal of applied business research*, 30(4), 1137-1150.
- Lamba, A. S. (2005). An analysis of short run and long run relationship between south Asian and developed equity markets. *International Journal of Business*, 10(4), 384-402.
- Levy, H., & Sarnat, M. (1970). International diversification of investment portfolios. *The American Economic Review*, 60(4), 668-675.
- Majid, M. S., & Kassim, S. (2010). Potential benefit across Global Islamic equity market. *Journal of Islamic Cooperation and Development*, 31(4), 37-39.
- Markowitz, H. (1952). Portfolio selection. *The journal of finance*, 7(1), 77-91.
- Murray, M. P. (1994). A Drunk and her dog: An illustration of co-integration and Error correction. *The American statistician*, 48(1), 37-39.
- Narayan, P. K., & Smyth, R. (2004). Interdependence and dynamic linkages between the emerging stock markets of South Asia. *Journal of accounting and finance*, 44(3), 419-439.
- Onour, I. (2009). Financial integration of North Africa stock market. (API- working paper series 0908). *Arab planning Institute – Kuwait Information center*.
- Paval, P. (2011). Co-integration in equity market: A comparison between South African and major developed and emerging markets ( unpublished master thesis), *Rodhes University, Makhanda, South Africa*.
- Sensoy, A. (2015). Systemic Risk in Conventional vs Islamic Equity Markets. *Research Department of Borsa Istambul Working Paper Series*, (28).
- Singh, A., & Kaur, P. (2015). Stock market linkage : Evidence from the US, China and India during the subprime Crisis. *Journal of Economics and Business*, 8(1), 137-162.