Journal of Economic Cooperation and Development, **31**, 4 (2010), 103-126

Potential Diversification Benefits across Global Islamic Equity Markets

M. Shabri Abd. Majid[1] and Salina Hj. Kassim[2]

In view of the increasing interests on the Islamic stock markets as a potential avenue for portfolio diversification, this study is indeed timely to assess the degree of integration among five major Islamic stock markets, namely Malaysia, Indonesia, Japan, the UK and the US. It also attempts to empirically explore the nature of the long-run equilibrium relationship among the major Islamic stock indexes and to examine the dynamic causal linkages among them. Based on weekly closing stock indexes of the selected stock markets from 1 January 1999 to 31 August 2006, this study relies on a two-step estimation using the Auto-Regressive Distributed Lag (ARDL) and the Vector Error Correction Model (VECM) based on the Generalized Method of Moments (GMM). The study finds that investors who are interested to diversify their portfolio can gain benefits by diversifying in the Islamic stock markets across economic grouping such as that in the developed and developing countries. However, limited benefits are available if investors only diversify their investments within the same economic groupings.

1. Introduction

Studies on stock markets integration convey important information on the potential international diversification opportunities to the investors. Stock markets which are highly cointegrated suggest the non-existence of diversification benefits since the performance and returns in these markets are highly correlated with each other. The degree of stock markets integration provides several important economic implications. Stock markets which are highly integrated tend to move together and

[1] Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia, P.O. Box 10, 50728, Kuala Lumpur, Malaysia.

[2] Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia., P.O. Box 10, 50728, Kuala Lumpur, Malaysia.

have stable long run relationships, which are normally the case for countries having strong economic and financial ties as well as close trade links. Stock markets of two countries could also be highly correlated if there are similarities in the macroeconomic policy implementations in the countries. For instance, countries pursuing macroeconomic policy harmonization could find that their stock markets moving together and becoming more integrated. In the context of emerging markets, Andersen and Moreno (2005) highlight that ongoing efforts of financial integration such as removal of capital controls, financial innovation and technological progress result in increased financial market integration among the countries.

There have been voluminous studies examining the issue of stock market integration. Most of these studies, however, focus on the stock markets in the developed countries. For instance, Taylor and Tonk (1989) study the relationship between the stock markets of the US, UK, Germany, Netherlands and Japan and find that these markets are becoming increasingly cointegrated. Campbell and Hamao (1992) focus on the world's two major stock market, namely the US and Japan and document greater integration due to multi-factor asset pricing. Ayhan et al. (2003) examine the impact of international financial integration on macroeconomic volatility in a large group of industrial and developing economies over the period 1960-99. They found that, on average, the volatility of consumption growth relative to the income growth has increased for more financially integrated developing economies in 1990s. Other studies such as Fischer and Palasvirta (1990), Kasa (1992), Longin and Solnik (1995), and Bracker et al. (1999) also examine the issue of stock market integration in the context of the developed countries. For the case of emerging countries, there has been an increasing body of literature examining this issue particularly for countries in Asia and Latin America. This includes Jang and Sul (2002), Ibrahim (2000; 2005), Mohd. Yusof and Abd. Majid (2006) and Abd. Majid et al. (2007).

Of late, there is an increasing interest towards empirically assessing the integration among the stock markets in the Islamic countries. Some studies focus on the stock markets of a particular region, such as that in the Middle-East and North African (MENA) region. An interesting finding was documented by Marashdeh (2005) whose study suggested that there are no integration between the selected MENA stock markets

(Egypt, Jordan, Morocco and Turkey) and that of the major developed economies (the US, UK and Germany). This suggests potential diversification benefits for the investors from the major stock markets to the MENA stock markets. Bley and Chen (2006) discover that the stock markets of Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates provided benefits of portfolio diversification, but there was evidence that the markets are increasingly becoming integrated due to the on-going attempts to synchronize the markets in the advent of the economic union and single currency area. Despite this, there have been several other studies which provide contradictory findings. For example, Darrat et al. (2000) find that the stock markets of Egypt, Morocco and Jordan are integrated with themselves as well as with the major world stock markets.

Very few studies have focused on the emerging stock markets of the Organization of Islamic Countries (OIC),[3] which covered a wider geographical area. Earlier attempts to study the stock markets of the OIC countries include that of Zeinelabdin (1991), Hassan (2003) and Ceylan and Dogan (2004). These studies, however, are more exploratory in nature. More recently, Abd. Majid et al. (2007) explore the degree of integration among eight Islamic countries stock markets, namely Turkey, Egypt, Oman, Kuwait, Malaysia, Indonesia, Bangladesh and Pakistan, while at the same time, assess the degree of integration between these markets and the world's largest stock markets, namely the US, the UK and Japan. The study finds that the stock markets of Malaysia, Indonesia, Bangladesh and Pakistan (OIC stock markets in the Asian region) are integrated, while the stock markets in Turkey, Egypt, Oman and Kuwait (OIC stock markets in the Middle-East and North African (MENA) region) are not. The results of the study suggest that investors intended to gain from portfolio diversification can benefit by investing in the MENA region, but not the Asian region. In addition, all the Islamic stock markets are integrated with the major stock markets.

While there are extensive studies on integration among conventional stock markets both in the West and OIC countries, studies on the integration among the Islamic stock markets worldwide are still

[3] The Organization of the Islamic Conference (OIC) is an inter-governmental organization which includes membership of 57 states spread over four continents. The Organization was established upon a decision of the historical summit which took place in Rabat, Kingdom of Morocco on 12th Rajab 1389 Hijra (25 September 1969) as a result of criminal arson of Al-Aqsa Mosque in occupied Jerusalem (http://www.sesric.org/sesric-about.php).

relatively meagre. Empirical efforts to examine the interdependence of the Islamic stock indices across the globe have been a rather recent phenomena, mainly due to the increasing interest in the area of Islamic banking and finance. Most of the studies in general highlight the diversification benefits of investing in the various Islamic stock markets. For example, Achsani et al. (2007) find that the interdependence of the Islamic stock markets tends to be asymmetric across a wide geographical area. While there are strong correlations between the Islamic stock indices of Indonesia and Malaysia, the US and Canada, and Japan and Asia Pacific, this is not exactly the case for across the regional stock markets. The Islamic stock market in the US was found to have strong influence on the other Islamic stock markets. However, the stock markets of Indonesia, Malaysia, Canada and Asia Pacific have smaller effects on the US' Islamic stock market.

In view of the increasing demand for information on the nature of integration among the Islamic stock markets particularly from investors intending to diversify their portfolios in the *shari'ah*-compliant stocks in both the West and Muslim countries, this topic provides a potential niche area to be explored. Reflecting the strong interest, funds invested in the Islamic equity market as measured by the market capitalization of the Dow Jones Islamic Markets Index reached US$4.34 trillion at end-2008 (Siddiqui, 2008). Globally, there are more than 500 *shari'ah*-compliant funds available in 2008 and the number is estimated to reach 1,000 by 2010 (Islamic Finance News, September 2008). The rapid growth of the Islamic capital markets have resulted in a more pressing need for more studies on this area. Thus, this study is indeed timely to fulfill the needs of the investors in the current economic and financial situation.

Based on this background, the objective of this study is to analyze the nature of market integration among five major Islamic stock markets, namely Malaysia (Dow Jones Islamic Index of Malaysia), Indonesia (Jakarta Islamic Stock Index), Japan (Dow Jones Islamic Index of Japan), the United Kingdom (Dow Jones Islamic Index of UK) and the US (Dow Jones Islamic Index of America). Specifically, the study aims to empirically determine the long run equilibrium relationship among the Islamic stock indexes and examine the dynamic causal linkages among these markets. To achieve these objectives, the study relies on a two-step estimation of the Auto-Regressive Distributed Lag (ARDL)

approach to cointegration and the Vector Error Correction Model (VECM) based on the Generalized Method of Moments (GMM). Both methods are deemed suitable for the purpose of this study since they help to empirically determine the existence of long-run equilibrium among the markets and assess the nature of dynamic causal relationships among them.

An aspect of novelty of this study is that it covers a larger geographical area of the Islamic stock markets. By considering the Islamic stock indexes of Malaysia, Indonesia, Japan, UK and the US, this study is not confined to considering the Islamic stock markets of a particular region or certain economic groupings as what have been normally the case in the previous studies on the Islamic stock market integration. In addition, the findings of this study are enriching since the study also considers the Islamic stock indexes of the major world stock markets of Japan, UK and the US.

The rest of this study is organized as follows. The next section provides an overview of the Islamic stock markets, while Section 3 discusses the empirical framework and methods undertaken in this study. Section 4 describes the data employed, and Section 5 provides the empirical results and discussions. Finally, Section 6 concludes the study with some implications and recommendations for further research.

2. Characteristics of an Islamic Equity Market

One of the rapidly growing segments of the Islamic banking and finance industry that contributes to the burgeoning growth of the industry is the Islamic equity market. In 2008, market capitalization of the Islamic stock market was valued at US$4.34 trillion with more than 500 *shari'ah*-compliant funds available for the Muslim investors (Siddiqui, 2008).

Compared to the conventional stock markets, there is a general belief that the Islamic stock markets are relatively more stable to financial shocks due to the *shari'ah* rules governing the Islamic stock markets. In general, any financial dealings in the Islamic context are subject to adhere to the basic rules of trading as outlined by the Islamic law or the *shari'ah* with the objective of ensuring justice, fairness and avoidance of

exploitation. In particular, the *shari'ah* provides a clear guideline that financial dealings that involve the elements of interest (*riba*), excessive uncertainties (*gharar*) and gambling (*maysir*) are strictly prohibited. Trading is not allowable for goods that are prohibited (*haram*) such as alcohol and non-*halal* food items. There is also the need to observe the Islamic tax (*zakat*).

In view of this, the Islamic equity market operations are confined to several basic tenets. In the context of investment in the equity market, Muslim investors are only allowed to invest in *shari'ah*-compliant stocks that fulfilled specified requirements. There are various screening processes or criteria in determining the *shari'ah*-compliancy of a particular stock. For example, the screening criteria adopted by the Securities Commission of Malaysia are based on the outcomes of the deliberations of the *Shari'ah* Advisory Council (SAC) which is done at the central level. The screening criteria are based on *shari'ah*-compliancy of core activities and benchmark of tolerance for mixed activities. The Dow Jones Islamic Index Screening criteria is another type of screening criteria which is based on acceptable business activities and acceptable financial ratios (debt to asset, liquid asset to total assets, receivables to assets). The third type of screening criteria is the Meezan Islamic Fund criteria, particularly being adopted in Pakistan. The criteria is based on the business of the investee company, debt to total assets, net illiquid to total asset, investment in *shari'ah* non-compliant activities and income from *shari'ah* non-compliant investments and net liquid versus share price (Ali, 2005).

3. Empirical Framework

Since the objective of the study is to investigate the stock market integration in terms of the long-run equilibrium relationships, the adoption of a two-step estimation – Autoregressive distributed lag (ARDL) approach to cointegration and Vector Error Correction Model (VECM) based on GMM – is suitable for this purpose. The ARDL is capable of determining the existence of integration among the stock markets in the sense that there is a tendency of a long-run equilibrium relationship among the markets to move together in the long-run, while allowing for deviations from the short-run equilibrium. On the other hand, the GMM estimation has more flexibility and no stringent assumption as compared to other estimations such as the Ordinary Least

Squares (OLS) and Maximum Likelihood (ML). It also has a strong distributional assumption such as the error terms, u_t is not necessarily normally distributed (Ogaki, 1993). Thus, the market integration is tested in the first step with the ARDL, whereas the dynamic causal relationships among the markets are determined simultaneously in the second step based on VECM which is estimated using GMM.

3.1. ARDL Bound Testing Approach

To examine the long-run relationship among the markets, this study employs the ARDL bound testing approach to cointegration which involves estimating the conditional error correction version of the ARDL model (Pesaran et al., 2001). The choice of the ARDL approach in this study is based on consideration of cointegration analysis are unbiased and efficient given the fact that, firstly, it can be applied to a small sample size study (Pesaran, et al., 2001) and therefore, conducting bounds testing will be appropriate for the present study. Secondly, it estimates the short- and long-run components of the model simultaneously, removing problems associated with omitted variables and autocorrelation. Finally, the ARDL approach can distinguish between dependent and independent variables (Narayan, 2004).

The ARDL models to be estimated can be written as follows:

$$Mal_t = \alpha_0 + \alpha_1 Ina_t + \alpha_2 JP_t + \alpha_3 UK_t + \alpha_4 US_t + \epsilon_t \quad (1.1)$$

$$Ina_t = \alpha_0 + \alpha_1 Mal_t + \alpha_2 JP_t + \alpha_3 UK_t + \alpha_4 US_t + \varepsilon_t \quad (1.2)$$

$$JP_t = \alpha_0 + \alpha_1 Mal_t + \alpha_2 Ina_t + \alpha_3 UK_t + \alpha_4 US_t + \tau_t \quad (1.3)$$

$$UK_t = \alpha_0 + \alpha_1 Mal_t + \alpha_2 Ina_t + \alpha_3 JP_t + \alpha_4 US_t + \varsigma_t \quad (1.4)$$

$$US_t = \alpha_0 + \alpha_1 Mal_t + \alpha_2 Ina_t + \alpha_3 JP_t + \alpha_4 UK_t + \zeta_t \quad (1.5)$$

Where *Mal, Ina, JP, UK and US* refer to the Islamic stock markets of Malaysia, Indonesia, Japan, the UK and the US, respectively. While ϵ_t, ε_t, τ_t, ς_t and ζ_t are the error terms for each model.

The error correction versions of the ARDL framework pertaining to Equations (1.1) through (1.5) can be reproduced as follows:

$$\Delta Mal_t = \delta_0 + \sum_{i=1}^{p} \varepsilon_i \Delta Mal_{t-i} + \sum_{i=0}^{p} \phi_i \Delta Ina_{t-i} + \sum_{i=0}^{p} \varphi_i JP_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta UK_{t-i} + \sum_{i=0}^{p} \mu_i \Delta US_{t-i} + \lambda_1 Mal_{t-1} + \lambda_2 Ina_{t-1} + \lambda_3 JP_{t-1} + \lambda_4 UK_{t-1} + \lambda_5 US_{t-1} + u_{1t} \quad 2.1)$$

$$\Delta Ina_t = \delta_0 + \sum_{i=1}^{p} \varepsilon_i \Delta Ina_{t-i} + \sum_{i=0}^{p} \phi_i \Delta Mal_{t-i} + \sum_{i=0}^{p} \varphi_i JP_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta UK_{t-i} + \sum_{i=0}^{p} \mu_i \Delta US_{t-i} + \lambda_1 Ina_{t-1} + \lambda_2 Mal_{t-1} + \lambda_3 JP_{t-1} + \lambda_4 UK_{t-1} + \lambda_5 US_{t-1} + u_{1t} \quad (2.2)$$

$$\Delta JP_t = \delta_0 + \sum_{i=1}^{p} \varepsilon_i \Delta JP_{t-i} + \sum_{i=0}^{p} \phi_i \Delta Mal_{t-i} + \sum_{i=0}^{p} \varphi_i Ina_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta UK_{t-i} + \sum_{i=0}^{p} \mu_i \Delta US_{t-i} + \lambda_1 JP_{t-1} + \lambda_2 Mal_{t-1} + \lambda_3 Ina_{t-1} + \lambda_4 UK_{t-1} + \lambda_5 US_{t-1} + u_{1t} \quad (2.3)$$

$$\Delta UK_t = \delta_0 + \sum_{i=1}^{p} \varepsilon_i \Delta UK_{t-i} + \sum_{i=0}^{p} \phi_i \Delta Mal_{t-i} + \sum_{i=0}^{p} \varphi_i Ina_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta JP_{t-i} + \sum_{i=0}^{p} \mu_i \Delta US_{t-i} + \lambda_1 UK_{t-1} + \lambda_2 Mal_{t-1} + \lambda_3 Ina_{t-1} + \lambda_4 JP_{t-1} + \lambda_5 US_{t-1} + u_{1t} \quad (2.4)$$

$$\Delta US_t = \delta_0 + \sum_{i=1}^{p} \varepsilon_i \Delta US_{t-i} + \sum_{i=0}^{p} \phi_i \Delta Mal_{t-i} + \sum_{i=0}^{p} \varphi_i Ina_{t-i} + \sum_{i=0}^{p} \gamma_i \Delta JP_{t-i} + \sum_{i=0}^{p} \mu_i \Delta UK_{t-i} + \lambda_1 US_{t-1} + \lambda_2 Mal_{t-1} + \lambda_3 Ina_{t-1} + \lambda_4 JP_{t-1} + \lambda_5 UK_{t-1} + u_{1t} \quad (2.5)$$

In the above equations, the terms with the summation signs represent the error correction dynamic, while the second part (term with λs) correspond to the long run relationship. The null of no cointegration in the long run relationship is defined by H_0: $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$ is tested against the alternative of H_1: $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq \lambda_5 \neq 0$, by the means of familiar F-test. However, the asymptotic distribution of this F-statistic is non-standard irrespective of whether the variables are $I(0)$ or $I(1)$. Pesaran et al. (1996) have tabulated two sets of appropriate critical values. One set assumes all variables are $I(1)$ and another assumes that they are all $I(0)$. This provides a bound covering all possible classifications of the variables into $I(1)$ and $I(0)$ or even fractionally integrated. If the F-statistic lies above the upper bound level, the null is rejected, which indicates the existence of cointegration. While if the F-statistic falls below the bound level, the null cannot be rejected, which supporting no cointegration exist. If, however, it falls within the band, the result is inconclusive.

Finally, in order to determine the optimal lag-length incorporated into the model and to select the ARDL model to be estimated, the study employs the Akaike (1974) Information Criterion (AIC) with the maximum lag-length to be considered of 8.

3.2. Generalized Method of Moments (GMM)

In efforts to investigate the short- and long-run relationships among the selected Islamic stock markets, the study estimates the equation (3) by GMM estimation, where the error correction terms are incorporated in the models. Based on Hung and Cheung's (1995) study on five variables JJ cointegration test, the vector error correction model (VECM) can then be simply reformulated in matrix form as follows:

$$\begin{bmatrix}\Delta Mal\\ \Delta Ina\\ \Delta JP\\ \Delta UK\\ \Delta US\end{bmatrix}=\begin{bmatrix}\delta_0\\ \delta_1\\ \delta_2\\ \delta_3\\ \delta_6\end{bmatrix}+\sum_{i=1}^{k}\Gamma_i\begin{bmatrix}\Delta Mal\\ \Delta Ina\\ \Delta JP\\ \Delta UK\\ \Delta US\end{bmatrix}_{t-k}+\Pi\begin{bmatrix}Mal\\ Ina\\ JP\\ UK\\ US\end{bmatrix}_{t-1}+\begin{bmatrix}\nu_0\\ \nu_1\\ \nu_2\\ \nu_3\\ \nu_6\end{bmatrix} \quad (3)$$

Since the Equation (3) considers the possibility of the past level of parameters to have an effect on current changes in other parameters, the lagged values have to be incorporated in the models. It is important to note that for the GMM estimator to be identified; there must be at least as many instrumental variables *Z* as there are parameters θ. Following Lee and Lee (1997), this study used lags of explanatory variables as the instrumental variables. These variables were opted for use because of the difficulty in finding other instrument variables, as our study utilized daily data and for an extended period. These variables are, however, obvious instruments and in most cases, should be included in the instrumental list. Another important aspect of specifying GMM is the choice of the weighting matrix to yield a consistent and robust estimate. To get a robust estimate to heteroskedasticity and autocorrelation of unknown forms, the covariance matrix of the orthogonality conditions is estimated as suggested by Newey and West (1987) using Barlett estimators,[4] while the lag truncation parameter is estimated as suggested by Newey and West (1994) with a fixed bandwidth,[5] following the study of Heinesen (1995). In addition, the pre-whitening process is run to soak up the correlation in the moment conditions prior to the GMM estimation.

4. Data

To provide a robust and updated results, this study uses weekly closing data of five selected Islamic stock markets (i.e., Malaysia, Indonesia, Japan, the UK and the US), covering the period from January 1, 1999 to August 31, 2006. All these indexes are denominated in local currency units, extracted from *Bloomberg Database*. In this study, the Islamic stock returns for these markets are calculated from the following indexes: (i) the Dow Jones Islamic Index of Malaysia (DJIM) for

[4] We have also tried the quadratic spectral (QS) kernel estimation as suggested by Andrew (1991); the estimation results are very much the same.

[5] More specifically, it is estimated solely based on the number of observations in the sample. We have also tried bandwidth selection as suggested by Andrew (1991); the estimation results are very much the same.

Malaysia; (ii) the Jakarta Islamic Stock (JAKIS) Index for Indonesia; (iii) the Dow Jones Islamic Index of Japan (DJIJ) for Japan; (iv) the Dow Jones Islamic Index of the UK (DJIUK) for the UK; and (v) the Dow Jones Islamic Index of America (IMUS) for the US.

There are at least two complications in investigating stock market interdependencies across countries. First is the missing observation problem due to different stock market holiday. Since the study extensively incorporates lags in the regressions, missing data is particularly troublesome. Thus, it is desirable to fill in estimate-based information from an adjacent day. Rather than using a sophisticated interpolation, this study follows the studies of Jeon and Von (1990) and Hirayama and Tsutsui (1998) by adopting the method of Occam's razor, i.e., by just filling in the missing data with the previous day's price. Simplistic as it may be, this study justifies this method on the premise that a closed stock exchange does not produce any information on bank holidays. Since no new information is revealed, the previous day's information is carried over to the subsequent day.

Another complication in investigating the stock market integration is the problem of non-contemporaneous markets or different trading hours among the markets. Except for the US stock market, all other markets are exactly or approximately operating in similar time zones with similar opening and closing times. It is therefore important to know the operating hours of one market relative to another when performing tests, and taking this into account implies incorporating appropriate lagged values where necessary.

5. Results and Discussion

Table 1 provides the summary statistics of the stock returns (i.e., stock prices in first difference) for the selected Islamic stock markets. During the period under review, the Islamic stock market in Japan is shown to earn the highest average daily returns of 0.31 percent, followed by Indonesia at 0.08 percent, UK at 0.04 percent, Malaysia at 0.02 percent and the US at 0.01 percent. In line with the “high risk, high return” maxim, the Japanese stock market is shown to have the highest standard deviation at 0.04, followed by the UK stock market at 0.03. The stock markets of Indonesia, Malaysia and the US are shown to have about similar level of standard deviations of around 0.024-0.026.

Table 1: Summary Statistics of Islamic Stock Market Returns

	Mal	Ina	JP	UK	US
Mean	0.0002	0.0008	0.0031	0.0004	0.0001
Median	0.0020	0.0017	0.0045	0.0019	0.0011
Maximum	0.0963	0.1168	0.1687	0.0806	0.0989
Minimum	-0.1752	-0.1129	-0.1398	-0.1368	-0.0850
Std. Dev.	0.0262	0.0259	0.0406	0.0288	0.0237
Skewness	-0.8677	-0.1621	-0.0541	-0.3481	-0.0509
Kurtosis	8.2206	5.6849	4.4556	4.0005	3.9949

To highlight the short-run relations of the movements among the five Islamic stock markets, the standard correlation coefficient analysis is used to measure the extent of the association between the stock markets. As reported in Table 2, during the period under review, all the stock markets show weak correlation as reflected by the low correlation of coefficients among the stock markets. Nevertheless, of all the correlation of coefficients presented in Table 2, the highest value of correlation is recorded between the UK and the US (0.342), followed by Malaysia and Japan (0.282), Malaysia and Indonesia (0.187), and Indonesia and Japan (0.113). The rest of the stock markets show weaker correlation of lesser than 0.1. The weak correlation coefficients between these stock markets suggest the absence of short-term co-movements among the markets, thus, indicating the potential short-term diversification benefits, or speculative activities, in the stock markets. In particular, the correlation coefficients for the following markets are lesser than 0.1: Malaysia-UK (0.001), Malaysia-US (0.003), Indonesia-UK (0.071), and Japan-UK (0.083).

Table 2: Correlation of the Islamic Stock Returns

	Mal	Ina	JP	UK	US
Mal	1.000				
Ina	0.187	1.000			
JP	0.282	0.113	1.000		
UK	0.001	0.071	0.083	1.000	
US	0.003	0.016	0.046	0.342	1.000

5.1. ARDL Analysis

The ARDL analysis determines the existence of a long-run equilibrium relationship among the stock markets. As shown in Table 3, the result shows that the Malaysian and Indonesian stock markets are weakly cointegrated (90 percent significant level) at lag length 1, suggesting that there is a long-run equilibrium relationship between the two markets. The stock markets of the advanced economies also show long run equilibrium (refer to Model 2). When one of the developing countries' Islamic stock markets of Indonesia and Malaysia are being included in the model consisting the developed stock markets (Models 3 and 4), there are no significant evidences of long run relationships among these stock markets.

Table 3: ARDL F-Statistics for Cointegration

Order of Lag	Model 1: (Mal, Ina)	Model 2: (JP, UK, US)	Model 3: (Mal, JP, UK, US)	Model 4: (Ina, JP, UK, US)	Model 5: (Mal, Ina, JP, UK, US)
1	5.504*	5.232**	0.9777	0.6525	3.9875*
2	4.474	5.553**	0.8307	0.5270	2.8255
3	2.010	4.970*	0.9210	0.4759	2.5059
4	2.323	4.321	0.9137	0.5013	2.6155
5	1.744	4.863*	0.8030	0.6168	2.3261
6	1.980	4.418	1.0539	0.6912	2.4287
7	1.763	4.973*	1.0385	0.8594	2.2002
8	1.929	4.728*	1.0637	1.0605	2.1408

Note: The relevant critical value bounds are taken from Pesaran (2001) [Case iv: unrestricted intercept and no trend. For number of regressors = 5, they are 4.09 – 5.40 at the 99%; 3.28– 3.94 at the 95%; and 2.90 – 3.94 at the 90% significance levels respectively. For number of regressors = 4, they are 4.57 – 5.90 at the 99%; 3.66 – 4.71 at the 95%; and 3.22 – 4.24 at the 90% significance levels respectively. For number of regressors = 3, they are 5.38 – 6.54 at the 99%; 4.23 – 5.29 at the 95%; and 3.71 – 4.68 at the 90% significance levels respectively. Finally, for number of regressors = 2, they are 6.65 – 7.80 at the 99%; 5.17 – 6.15 at the 95%; and 4.50 – 5.35 at the 90% significance levels respectively *, and ** denotes that F-Statistics falls above the 90% and 95% upper bound, respectively.

However, when both the emerging Islamic stock markets are included into the major Islamic stock markets (Model 5), these markets are found to become cointegrated. In essence, the results suggest that the Islamic stock markets of similar economic grouping are cointegrated among themselves, but stock markets of different economic groupings are segmented. In particular, the developed Islamic stock markets are found to be cointegrated among themselves, likewise for the developing Islamic stock markets. In the context of portfolio diversification benefits, the results suggest that investors can only gain portfolio diversification benefits by considering stock markets of different economic groupings. Specifically, investor from developing countries can only gain benefits by diversifying in the developed stock markets, as shown in Models 3 and 4.

It is importance to note that the existence of cointegration among the markets does not rule out the possibility of arbitrage profits through diversifying portfolios across these markets in the short-term, which may last for quite a while (Dwyer and Wallace, 1992). In the context of this study, investor can gain from arbitrage opportunities within the period of one and half week, as will be shown later in Table 5. The varying degrees of business and financial risks of different securities and security cash flows co-vary less than perfectly across the markets (and even within the same country) results in the diversification benefits in these markets to be reduced, but are not likely to be fully eliminated in practice in the long-run.

In addition, the existence of cointegration among the markets also implies a common stochastic trend in these markets (Kasa, 1992; Blackman et al., 1994; Jang and Sul, 2002). Since each Islamic stock price series contains information on the common stochastic trends (which bind all the Islamic stock markets together), the predictability of the Islamic stock prices can be enhanced significantly by utilizing information on the other Islamic stock prices. The presence of common stochastic trends among all these stock markets implies that once new information on a stock price is available prior to other stock prices, the other stock prices will deviate from that trend through a transitory component. Individual prices cannot wander too far away from each other over time (Masih & Masih, 1999).

5.2. Bivariate Causalities

More enriching discussions on short-run causality are enabled by conducting the Granger causality analysis. The Granger causality allows for the determination of the direction of causation, thus enabling us to figure out which stock market exerts influence on the other stock market. As shown in Table 4, among the Islamic stock markets in the developed countries, there is a significant causality from the UK market to the Japanese market; and from the US market to the Japanese market. At the same time, there is a significant bi-directional causality between the UK and the US markets. These significant causalities suggest that the stock markets are correlated in such a way that any changes in a particular stock market results in similar impact on the other stock market, thus, reducing the benefits of diversification in these markets. Notably, the stock markets of the developed economies are integrated with each other, while those of the developing economies are integrated among themselves. There are no significant causalities between the Islamic stock markets of the developed and developing economies, suggesting the benefits of diversification exists in the two groups of stock markets. Clearly, the results based on the Granger causality is consistent and lend further support to the earlier results that investors can only gain diversification benefits by considering the Islamic stock markets of different economic groupings.

Table 4: Summary of Bivariate Granger Causality Tests (Lags =1)

Mal <=====> Ina	Ina ======= UK
Mal ======= JP	Ina ======= US
Mal ======= UK	UK ======>JP
Mal ======= US	US ======>JP
Ina ======= JP	UK <=====> US

Note: <===> indicates a bidirectional Granger causality between the stock markets; ===> indicates a unidirectional Granger causality from one stock market to another; and === indicates no Granger causality between the stock markets. They are at least significance at 5% level.

5.3. Multivariate Analysis using GMM

The existence of cointegration between the Indonesian and Malaysian Islamic stock markets and among major Islamic stock markets of Japan, the UK and US rejects non-causality among them. This implies that at least one of the markets react to deviations from the long-run relationship. The next step is to explore whether the market corrects the disequilibrium, which can be done by adopting the VECM based on the GMM estimation. The existence of the short- and long-run multivariate Granger causalities among the stock markets are indicated by significance of the *F*-statistics through joint tests of lagged differences and statistic significance of the *t*-statistic tests for error correction term (ECT). The VECM analysis is conducted on the model containing all five Islamic stock markets during the period under review.

Table 5: Multivariate VECM Causality Analysis using GMM (Model 5: Mal, Ina, JP, UK, US)

Dependent Variables	Lag = 1 Independent Variables						Diagnostic Test
	[F-statistics]					(t-statistics)	
	ΔMal	**ΔIna**	**ΔJP**	**ΔUK**	**ΔUS**	**ECT_{t-1}**	
ΔMal	-	10.1009*** [0.0001]	6.8159*** [0.0012]	6.34749*** [0.0019]	2.7294* [0.0663]	-0.5608*** (-3.3599)	R^2-adj = 0.1593 DW = 2.1240 *J*-stats = 0.0266
ΔIna	14.3503*** [0.000]	-	0.5423 [0.5817]	0.9639 [0.3821]	0.4133 [0.6617]	-0.8162** (-1.9454)	R^2-adj = 0.0504 DW = 2.0862 *J*-stats = 0.0270
ΔJP	15.6802*** [0.0000]	2.6131* [0.0743]	-	7.7273*** [0.0005]	16.4151*** [0.0000]	-0.8314*** (-4.8274)	R^2-adj = 0.2479 DW = 2.0448 *J*-stats = 0.0268
ΔUK	5.8502*** [0.0031]	8.9058*** [0.0002]	0.8216 [0.4403]	-	40.9427*** [0.0000]	-0.6417*** (-4.9984)	R^2-adj = 0.2967 DW = 2.1071 *J*-stats = 0.0251
ΔUS	2.0778 [0.1263]	0.3994 [0.6709]	1.0419 [0.3535]	59.3061*** [0.0000]	-	-0.6583*** (-3.5594)	R^2-adj = 0.2201 DW = 2.0609 *J*-stats = 0.0166

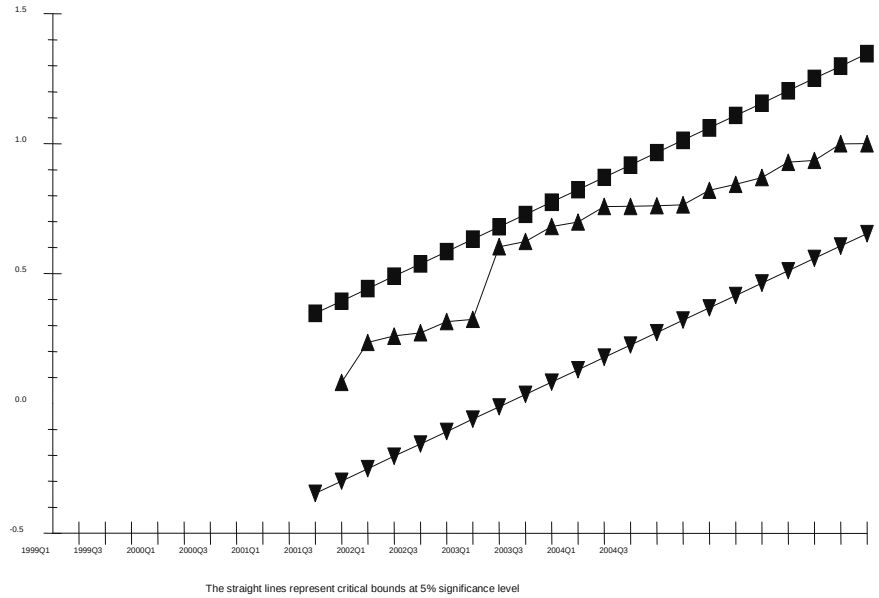
Notes: ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively. ECT_{t-1} is derived by normalizing the cointegrating vectors on the dependent variables, producing residual *r*. By imposing restriction on the coefficients of each variable and conducting Wald test, we obtain *F*-statistics for each coefficient in all equations. Figures in the (.) and [.] represent *t*-statistics and probabilities for *F*-statistics, respectively. The optimal lag-length included in the models is based on the Akaike Information Criteria (AIC). DW is Durbin-Watson *d* test for autocorrelation, and *J*-stats is the Hansen's *J*-statistic test for correct specification (over-identifying restrictions) of the model.

As shown in Table 5, the ECTs are significant for all the Islamic stock markets of Malaysia, Indonesia, Japan, UK and the US, implying that these markets are inter-related with each other in the long run. The ECT coefficients ranging from 0.56 to 0.83 suggest that on average, the stock markets take about one and half week to clear any disequilibrium. In terms of short-run causalities, the Malaysian Islamic stock market is significantly influenced by the Islamic stock markets of Indonesia, Japan and UK, while the impact of the US stock market is somewhat weak. The Malaysian Islamic stock market is shown to be significant in influencing the Islamic stock markets of Indonesia, Japan and UK, but not that of the US. This indicates that there exist diversification benefits by investing in the Malaysian and US Islamic stock markets as there is no significant causal relationship between the two. Similarly, there is no significant nexus of causality running between the Indonesian and the US Islamic stock markets, suggesting the benefits of portfolio diversification still exist between these two markets. With regard to the Islamic stock markets of the developed economies, there seems to be strong short- run causalities among the Islamic stock markets in these countries, suggesting that the potential benefits of portfolio diversification among these stock markets are non-existent.

5.4. Stability Test

Finally, to assess stability of the models and constancy of the parameters and variances, the cumulative sum of recursive residuals of square (CUSUMSQ) tests proposed by Brown et al. (1975) are conducted. The plots of the CUSUMSQ for the model being considered lie inside the area between two critical lines, indicating both short- and long-terms parameters and variances in the models are stable. In conclusion, based on the above batteries of diagnostic tests, therefore, we can conclude that the performances of our estimated models are satisfactory enough to provide information pertaining to the issue of market integration among the Islamic stock markets.

Figure 1: Plot of CUSUMSQ



6. Conclusion

The rapid growth of the Islamic capital market has resulted in an increasing interest on understanding the degree of stock markets integration in the various Islamic stock markets. Thus, this study is indeed timely to fulfill the needs of the investors amid the increasing demand for Islamic capital market products. By studying the nature of market integration among five major Islamic stock markets, namely Malaysia, Indonesia, Japan, the UK and the US, we assess the potential diversification benefits that the *shari'ah*-compliant markets could offer. Specifically, the study aims to empirically explore the short and long-run nature of integration among the major Islamic stock indexes in the period from January 1, 1999 to August 31, 2006. To achieve these objectives, the study relies on a two-step estimation based on the Auto-Regressive Distributed Lag (ARDL) approach to cointegration and the Vector Error Correction Model (VECM) based on the Generalized Method of Moments (GMM).

We find consistent findings that the degree of integration among the Islamic stock markets depends on the level of economic development of the country that the stock markets are in. In particular, the study documents that the Islamic stock markets of Malaysia and Indonesia are closely integrated with each other, while those of the US, UK and Japan are closely integrated with themselves. The argument that stock markets are more closely integrated due to geographical proximity is rejected in this study as there is no strong causal relationship between the stock markets of Japan and Indonesia.

In conclusion, investors who are interested to diversify their portfolio can still gain benefits if they diversify considering the Islamic stock markets across economic grouping such as that in the developed and developing countries. However, limited benefits are available if investors only diversify their investments within same economic groupings that are within the emerging Islamic stock markets or within the developed Islamic stock markets.

Finally, our evidence of the extent of interdependencies among these markets also has important implications for the macro stabilization policies in each Islamic stock market and also for the financial policies of multinational corporations. The extent of the effectiveness of the macro-economic policies of each stock market in dealing with its stock market imbalances will depend crucially on the extent of financial integration of each market with the rest. Similarly, the extent of integration of each of Islamic stock market has important bearings on the formulation of the financial policies of multinational corporations. The findings of cointegrated Islamic stock markets call for policy coordination among these markets to mitigate the impacts of financial fluctuations. Greater policy coordination, including the reduction or removal of trade and investment barriers, is essential for these countries to exploit the advantages of financial interdependence. In addition, since the advanced Islamic stock markets, namely the US, UK and Japan are found to be cointegrated with the Islamic stock markets of Malaysia and Indonesia, any developments in the US, UK and Japanese Islamic markets must be taken into consideration by the Malaysian and Indonesian governments in formulating policies pertaining to their Islamic stock markets.

Further empirical studies on the issue can cover broader areas of market integration, use more advanced techniques of estimation and utilize a more representative data set to add further credibility to the existing literatures on integration among the Islamic stock markets worldwide.

References

Abd. Majid, M.S., Mohd. Yusof, R., and Razali, A.N. (2007), "Dynamic financial linkages among selected OIC countries", *Journal of Economic Cooperation among Muslim Countries,* 28(2): 25-56.

Achsani, N.M., Effendi, J., and Abidin, Z. (2007), "Dynamic interdependence among international Islamic stock market indices: evidence from 2000-2007", *Proceedings of the International Conference of the Islamic Capital Markets*, Jakarta, Indonesia, organized by the Islamic Research and Training Institute: Islamic Development Bank.

Akaike, H. (1974), "A new look at the statistics model identification", *IEEE Transactions on Automatic Control AC,* 19: 716-723.

Ali, S.S. (2005), "Islamic capital market products: development and challenges", *Occasional Paper,* No. 9. Islamic Research and Training Institute, Jeddah.

Andersen, P., and Moreno, R. (2005), "Financial integration: an overview", *BIS Papers*, 23: 1-8.

Andrews, D.W.K. (1991), "Heteroskedasticity and autocorrelation consistent covariance matrix estimation", *Econometrica,* 59: 817-858.

Ayhan, M.K., Eswar S.P., and Terrones, M.E. (2003). "Financial integration and macroeconomic volatility, *IMF Staff Papers* (Special Issue), 50: 1-27.

Blackman, S. C., Holden, K. and Thomas, W. K. (1994), "Long-term relationship between international share prices", *Applied Financial Economics*, 4: 297-304.

Bley, J and Chen, K H. (2006), "Gulf Cooperation Council (GCC) stock markets: the dawn of a new era", *Global Finance Journal*, 17: 95-71.

Bracker, K., Diane, S., and Paul D. K. (1999), "Economic determinants of evaluation in international stock market integration", *Journal of Empirical Finance,* 6: 1-27.

Brown, R. L., Durbin, J., and Evans, J.M. (1975), "Techniques for testing the constancy of regression relationships overtime", *Journal of the Royal Statistical Society,* 37: 149-192.

Campbell, J.Y. and Hamao, Y. (1992), "Predictable stock returns in the United States and Japan: a study of long-term capital market integration". *Journal of Finance,* 47: 43–69.

Ceylan, N.B and Doğan, B. (2004), "Comovements of stock markets among selected OIC countries", *Journal of Economic Cooperation*, 25(3): 47-62.

Darrat, A.F, Elkhal, K and Hakim, S. (2000), "On the integration of emerging stock markets in the Middle East", *Journal of Economic Development,* 25: 119-129.

Dwyer, G., and Wallace, M. (1992), "Cointegration and market efficiency", *Journal of International Money and Finance*, 11: 318-327.

Fischer, K.P., and Palasvirta, A.P. (1990), "High road to a global marketplace: the international transmission of stock market fluctuations", *Financial Review,* 25: 371–394.

Hassan, M.K. (2003), "Portfolio investment of the OIC countries and their implication on trade", *Managerial Finance*, 29(2/3): 122-157.

Heinesen, E. (1995), "A macroeconomic rationing model estimated by cointegration techniques and generalized method of moments", *Economic Modelling*, 12(2): 97-110.

Hirayama, K., and Tsutsui, Y. (1998), "Threshold effect in international linkage of stock prices", *Japan and the World Economy*, 10: 441-453.

Hung, B.W., and Cheung, Y. (1995), "Interdependence of Asian emerging equity markets", *Journal of Business Finance and Accounting*, 22: 281-288.

Ibrahim, M.H. (2000), "Financial integration and diversification among ASEAN equity markets: a Malaysia perspective", *Capital Market Review*, 8(1): 25-40.

Ibrahim, M.H. (2005), "International linkage of stock prices: the case of Indonesia", *Management Research News*, 28(4): 93-115.

Islamic Finance News. (2008). September.

Jang, H., and Sul, W. (2002), "The Asian financial crisis and the co-movement of Asian stock markets", *Journal of Asian Economics*, 13: 4-104.

Jeon, B.N., and Von Furstenberg, G.M. (1990), "Growing international co-movement in stock indices", *Quarterly Review of Economics and Finance*, 30: 15-30.

Kasa, K. (1992), "Common stochastic trends in international stock markets", *Journal of Monetary Economics*, 29: 95-124.

Lee, Byung-Joo and Lee, M. J. (1997), "Generalized method of moments estimation of truncated or censored regression", *Applied Economics Letters*, 4: 365-368.

Longin, F., and Solnik, B. (1995), "Is the correlation in international equity returns constant: 1960-1990?" *Journal of International Money and Finance*, 14(1): 3-26.

Marashdeh, H. (2005), "Stock market integration in the MENA Region: an application of the ARDL bounds testing approach", *Working Paper*, 5(27), University of Wollongong.

Masih, A.M., and Masih, R. (1999), "Are the Asian stock market fluctuations due mainly to intra-regional contagion effects? Evidence based on Asian emerging stock markets", *Pacific-Basin Finance Journal*, 7: 251-282.

Mohd. Yusof, R. and Abd. Majid, M.S. (2006), "Who moves the Malaysian stock market – the US or Japan? Empirical evidence from the pre-, during, and post-1997 Asian financial crisis", *Gadjah Mada International Journal of Business.* 8(3): 367-406.

Narayan, P. K. (2004), "Reformulating critical values for the bounds f-statistics approach to cointegration: an application to the tourism demand model for Fiji", *Discussion Paper,* No. 02/04, Department of Economics, Monash University.

Newey, W. K., and West, K.D. (1987), "Automatic lag selection in covariance matrix estimation", *Review of Economic Studies*, 61: 631-653.

Newey, W.K., and West, K.D. (1994), "A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix", *Econometrica,* 55: 277-301.

Ogaki, M. (1993), "Generalized method of moments: econometric applications", in Maddala, G.S,. C. R. Rao and H. D. Vinod (Ed), *Handbook of Statistics,* 11. Elsevier Science Publishers B. V, pp. 189-234.

Pesaran, M.H., Shin, Y., and Smith, R.J. (2001), "Bounds testing approaches to the analysis of level relationships", *Journal of Applied Econometrics,* 16: 289-326.

Pesaran, M.H., Shin, Y., Smith, R. J. (1996), "Testing for the existence of a long-run relationship", *DAE Working Paper No. 9622*. Department of Applied Economics, University of Cambridge.

SESRIC. (2010). About OIC. Information Accessed at: (http://www.sesric.org/sesric-about.php) on June 20.

Siddiqui, R. (2008). Contributing to the development of the Islamic capital market: the Dow Jones Citigroup Sukuk Index. *Dow Jones Islamic Market Index Newsletter, December 2008*. Assessed at: http://www.djindexes.com/mdsidx/downloads/newsletters/Islamic/DJ_Islamic_Market_Index_Newsletter_200812.pdf. Date Accessed, June 20, 2010.

Taylor, M.P., and Tonk, I. (1989), "The internationalisation of stock markets and the abolition of U.K. exchange control", *The Review of Economics and Statistics*, 71(2): 332-336.

Zeinelabdin, A. (1991), "Stock markets in selected OIC countries", *Journal of Economic Cooperation*, 12(3): 51-74.