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Islamic stock markets and potential diversification benefits

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Abstract

The aim of this paper is to investigate whether the dynamic integration across a large set of developed and emerging Islamic stock markets allows potential diversification benefits in tranquil and turmoil periods. Using the multivariate cointegration test, we find the presence of long-run equilibrium relationship among Islamic stock markets of similar economic grouping. While, Islamic stock markets from different economic grouping are partially segmented. Empirical results of estimated Vector Error Correction Model provide a lowest level of short run integration among the economic grouping of European-Asian emerging markets, MENA-Latin American and European-Latin American Islamic stock markets. In addition, the level of integration and causality relations among Islamic stock markets tends to change over time, mainly during periods characterized by financial crises. Overall, our results suggest that Shariah compliant stocks could offer potential diversification benefits by considering different economic grouping such as that in developed and emerging countries.

JEL classification: G01; G11; G12; G15

Keywords: Islamic finance; Stock market integration; Diversification benefits; VECM

1. Introduction

The integration of the global stock markets represents an expansive area of research in financial economics that includes many different aspects of the interrelationships across stock markets. Stock markets integration has been defined according to two perspectives: the asset pricing perspective and the statically perspective. The first perspective suggests that if stock markets are completely integrated, identical securities should be priced identically in these markets (Naranjo & Aris, 1997). Consequently, in the case of perfect financial integration, international investors cannot obtain benefits from arbitraging opportunities. The second perspective suggests that highly integrated markets tend to move together and have stable long run relationships (Cheng, 2000). Thus, understanding the nature of stock markets integration is crucial for investors who are interested to diversify their portfolios across international stock markets.

According to the importance of information about the integrated markets, there has been voluminous literature examining the issue of stock market integration. Several studies focus on the conventional developed and emerging stocks markets.

Despite the enhanced increasing of Islamic banking and finance industry, particularly in aftermath of the recent global financial crisis, a few empirical studies have been interested to the integration among the stock markets in Islamic countries. The major difference between Islamic capital market and its conventional counterpart is that the former's activities are carried out in ways which does not conflict with the principles of Islam (Kartika and Ferdian, 2012). Islamic investing is based on five main principles, which include the prohibition of interest (riba), the banning of excessive uncertainty (gharar),

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the interdiction of speculation (maysir) risk and return sharing, and the prohibition of investing in 'unethical' industries (haram) (Shanmugam & Zahari, 2009). Nowadays, the stability and the resilience of Islamic finance against the global financial crisis has been an interesting topic of several researches. However, there is still limited number of empirical studies examining the integration of Islamic stock markets and the potential benefit diversification across these markets. Therefore, examining the dynamic pattern of integration among Islamic financial markets has crucial implications for investors, fund managers and other market makers who are interested to international portfolio diversification mainly in turbulent financial context.

This study investigates the dynamic pattern of integration among 27 developed and emerging Islamic stock markets. Specifically, this study allows firstly to empirically examine the potential diversification benefits across developed and developing Islamic stocks markets, secondly to investigate the impact of the subprime financial crisis on the long and short run dynamic relationships among a large set of Islamic stock markets and thirdly to examine influence the economic development level and the geographical factor on the co-movement of Islamic stock markets. This paper contributes to the literature on Islamic finance in numerous ways. To the best of our knowledge, this is the first study to examine the impact of the economic development and geographical factors on the dynamic integration of a large set of Islamic stock markets. Indeed, we use data of developed and emerging Islamic stock markets from a large geographical area including European, American, Asia and MENA countries. Second, according to the severity of the recent global financial crisis, this study is one among the original studies in examining the impact of this crisis in the integration of developed and emerging Islamic stock markets. Third, results extracted from our empirical framework have A great importance for investors who are interested to international diversification benefits across Islamic stock markets mainly in the turmoil period.

The sequence of this paper is as follows. The next section briefly reviews the literature. Section 3 presents the data the empirical framework. Section 4 reports the empirical results. The last section gives the summary and conclusions.

2. Literature review

There has been voluminous literature on stock market integration and interdependence. Most of studies have been interested in conventional developed and emerging financial markets. Several empirical approaches are considered in this area. The first approach is based on the asset pricing modeling. Using multifactor asset pricing model, Campbell and Hamao's (1992) show that the US and Japan stock markets are perfectly integrated. De Jong and De Rong (2005) examine the integration of emerging stock markets with the world market. They develop a factor asset pricing model and find that emerging stock markets are less segmented from world stock markets. Moreover, the integration with the world tends to decrease the cost of capital. Hunter (2006) investigates the interdependence among three Latin American markets: Argentina, Chile and Mexico using a multivariate GARCH-in-Mean asset-pricing model. Empirical results suggest that after liberalization those markets have not become integrated into the world equity market. Imam and Kpodar (2013) show that economic integration between developed and Middle Eastern countries constitutes a factor that contributes to the development of Islamic finance system. Saiti et al. (2014) investigate whether Islamic stock indices provide potential diversification benefits for the US-based investors. Using the DCC- GARCH model, they found that the Islamic indices offer better diversification opportunity compared to the Far East countries.

The second approach examines the correlation coefficients among stock markets over certain time period. A highly correlation coefficients provide evidence that stock markets are integrated. In this sense, Masih and Masih (1999) find that the stocks markets in Thailand, Malaysia, the U.S., Japan, Hong Kong, and Singapore are segmented from 1992 to 1997. Chelley-Steeley (2005) examines the market relationships among several equity markets of Eastern Europe. He models the movement of bivariate equity market correlations as a smooth transition trend. Results show that Hungary is the country which is becoming quickly integrated. Johnson and Soenen (2002) analyzed the equity market co-movements between the Japanese stock market and other twelve equity markets in Asia. In addition, they examine the factors that affect economic integration. They conclude that the equity markets of Australia, China, Hong Kong, Malaysia, New Zealand, and Singapore are highly integrated with the stock market in Japan.

Majdoub and Mansour (2013) investigate the volatility spillovers between the US stock market and five Islamic emerging stock markets. By considering three multivariate GARCH models named BEKK, CCC, and DCC, they find that the US and Islamic emerging equity markets are weakly correlated over time.

The third approach uses the cointegration framework to explore the stock markets interdependence. To assess how the level of integration in equity price levels changes over time, Aggarwal, Lucey, and Muckley (2003) use cointegration techniques to examine time-varying dynamic financial linkage between the European markets and the US equity market over the 1985–2002 period. They document the presence of long-run equilibrium relations especially during the period 1997–1998. By considering the GMM estimation methods, Abd Majid (2005) study the interrelationships among the Asian, Japanese and US stock markets. Results of this study suggest that the stock markets in the Asian region are highly integrated among them and with the Japanese and US stock markets. Rangvid (2001) examine the degree of stock market integration among France, Germany, and the UK during the period 1960–1999. They find that the three major European stock markets have been increasingly integrated in 1990s. This finding has been confirmed by Erdinc and Milla (2009). These authors show that stock exchange markets of France,

Germany, and, United Kingdom are cointegrated with the world capital market and with each others'.

Recently, Abd Majid and Haj Kassim (2010) examine the integration among five Islamic stock markets namely: Malaysia, Indonesia, Japan, the UK and the US. They find that investors can gain benefits by diversifying in the Islamic stock markets among economic grouping such as developed and developing markets.

Abdul Karim, Akila Mohd. Kassim, & Affendy Arip (2010) investigate the effects of the global financial crisis on the integration and co-movements of Islamic stock markets. They use cointegration techniques over the period spanning from February 15, 2006 to December 31, 2008. The period of analysis was divided into two periods, namely the pre-crisis period (February 15, 2006–July 25, 2007) and during crisis period (July 26, 2007–December 31, 2008). Empirical results provide the absence of cointegration among the Islamic stock markets in both periods. Therefore, there is no influence of the 2007 subprime crisis on the long-run co-movements among the Islamic stock markets.

Mohd Yahya Hussin et al. (2013) Use the VAR estimation technique to study the integration among Islamic stock markets in Malaysia, Indonesia and World. They show that there is no co-integration relationship between these Islamic indices implying that the Malaysian Islamic stock markets constitute a profitable destination for both local and international investors to diversify their Islamic investment portfolios. Using a misspecification-robust causality-in-variance test, Taşdemir and Yalama (2014) study the volatility transmission between the Turkish and Brazilian stock markets. They found that financial crises add an additional channel of volatility transmission from Turkey to Brazil which increases the volatility spillovers between the two markets.

Dewandaru, Rizvi, Masih, Masih, and Alhabshi (2014) investigate the contagion during 9 major crises and measure the integration in Islamic and conventional equity markets across different regions. They show relatively higher fundamental integration between Islamic stock markets which can be caused by their real sector allocation nature.

3. Data and empirical framework

3.1. Data

This study uses monthly close prices of Islamic stock market indices in 27 countries. We consider 13 developed countries namely: French, Italy, Germany, Spain, Austria, United Kingdom, Switzerland, Japan, Singapore, Hong Kong, New Zealand, Canada and US. Also, we use data from 14 emerging markets namely: China, India, Indonesia, Korea, Malaysia, Mexico, Brazil, Chile, Bahrain, Kuwait, Oman, Egypt, Jordan and Morocco. The price data are drawn from Morgan Stanley Capital International (MSCI) from June 2002 to December 2012. For each index, return is defined as the continuously compounded returns on stock price index. In order to explore the impact of the U.S subprime crisis on the integration of the selected stock markets, the time interval has been divided into two periods, namely: the tranquil period and turmoil period. The tranquil period started from January 2002 to June 2007 and the turmoil period, including subprime mortgage crisis, spanning from July 2007 to December 2012. Stock markets of the selected countries are then categorized according to the economic level development and to the geographical factor as follow:

- *Developed markets*
  - Region 1: European markets (EUR): French, Italy, Germany, Spain, Austria, United Kingdom, Switzerland
  - Region 2: Asian markets (ASI): Japan, Singapore, Hong Kong, New Zealand
  - Region 3: North American markets (NAM): Canada, US.
- *Emerging markets*
  - Region 4: MENA markets (MENA): Bahrain, Kuwait, Oman, Egypt, Jordan, Morocco
  - Region 5: Asian markets (ASIE): China, India, Indonesia, Korea, Malaysia,
  - Region 6: Latin American markets (LAM): Mexico, Brazil, Chile.

The above categorization of our sample allows us to investigate the impact of economic development and geographical factors on the dynamic integration of Islamic stock markets.

3.2. Empirical framework

The empirical framework in this study considers different approaches to investigate Islamic stock markets integration before and during the global financial crisis periods. Initially, we adopt the Johansen-Juselius co-integration approach (Appendix 1) to examine the long-run relationship among the selected stock markets. Then, the VECM model (Appendix 2) is applied to explore the short-term dynamic relationship among Islamic stock markets. Finally, the granger causality test (Appendix 3) is used to analyze the causality dynamics between Islamic stock markets.

To examine the influence of the economic development level and the geographical factor on the co-movement of Islamic stock markets, the JJ-cointegration test, the VECM model and the granger causality test are estimated firstly for each region of developed markets (European markets (EUR), Asian markets (ASI), North American markets (NAM)) and for each pair of developed regions (EUR-ASI, EUR-NAM, and ASI-NAM). Secondly, we consider the same method for emerging markets regions as follow: MENA market (MENA), Asian emerging markets (ASIE), Latin American markets (LAM), MENA-ASIE, MENA-LAM, ASIE-LAM. Thirdly, we test the short term co-movement across all pairs of developed and emerging markets regions (EUR-MENA, EUR-ASIE, EUR-LAM, ASI-MENA, ASI-ASIE, ASI-LAM, NAM-MENA, NAM-ASIE, and NAM-LAM). This approach allows us to detect the long run and short run integration among

Islamic markets of each region and the integration among all pairs of regions. To analyze the impact of US subprime crisis on the co-movement among Islamic stock markets, we conduct our framework for tranquil and turmoil periods.

4. Results

4.1. Descriptive analysis

Table 1 reports summary statistics for monthly returns on Islamic stock market indices. Panel A concern the developed markets and panel B is relative to emerging markets. Generally, all developed countries have mean positive returns during the sample period. Moreover, all emerging markets have a positive mean return except for Bahrain, Kuwait and Oman markets. The skewness statistic is negative for Islamic index of most developed and emerging markets. This finding suggests that the return distributions are said to be left-tailed. For Egypt, Oman and Morocoo markets, skewness statistic is positive indicating that the right tail of the distribution is longer. All countries have kurtosis values higher than three. Therefore, the assumption of Gaussian returns is rejected by the Jarque–Bera test for all countries.

Fig. 1 plots the monthly prices of Islamic indices for developed markets (panel A) and emerging markets (panel B) over the sample period. All indices show a large price decreasing in the period of 2008–2009 corresponding to the global financial crisis. As consequence, the financial crisis originated in the US conventional financial market spread across several Islamic stock markets inflicting a sharp decrease in the index prices.

In Table 2, we report the unit root tests on first differences based on the Augmented Dickey Fuller (ADF) procedure for tranquil period (panel A) and turmoil period (panel B). First, we test the null hypothesis of unit root for the level, and we failed to reject the null hypothesis. As consequence, we conclude that the level of the time series are non-stationary and so they are not I (0). Then, we took the first differences unit root test. The results from Table 3 indicate the rejection of the null hypothesis of unit root at 5% significance level. In sum, for both pre-crisis and during-crisis periods, all the Islamic stock market indices are stationary at first differences. On the other hand, all of these stock markets are said to be integrated at order one, or I (1).

4.2. The cointegration tests

In this section, we analyze the long term integration among Islamic markets of each developed region and each emerging region and the integration among each pair of developed regions, emerging regions and developed-emerging regions. We set one lag ($p = 1$) on the vector autoregression VAR (P) since the Akaike Information Criteria (AIC) and Schwartz Information Criteria (SIC) are minimal for $P = 1$.

Table 1
Summary descriptive statistics.

	Abrev	Mean	Median	Max	Min	St.d	Kur	Sk	JB
Panel A: developed markets									
Austria	AUS	0.021	0.0201	0.281	−0.0363	0.0978	−0.802	5.1912	36.5733
Germany	GER	0.011	0.0160	0.2072	−0.2638	0.0726	−0.6806	4.5101	20.4955
France	FR	0.005	0.0133	0.1409	−0.1984	0.0617	−0.6767	3.6853	11.4117
Italy	ITA	0.011	0.0160	0.2072	−0.2638	0.0726	−0.1196	4.0855	6.1264
Spain	SPA	0.011	0.0177	0.2360	−0.2654	0.0736	−0.3578	4.6415	15.8994
Switzerland	SWIT	0.008	0.0156	0.1136	−0.1137	0.0444	−0.5719	3.5174	7.8144
United Kingdom	UK	0.006	0.0057	0.1322	−0.1763	0.0534	−0.4033	3.9997	8.1819
Hong Kong	HON	0.008	0.0101	0.1407	−0.2050	0.0562	−0.7093	4.5556	21.977
Japan	JAP	0.002	0.0044	0.1107	−0.1597	0.0476	−0.5213	3.9634	9.9924
New Zealand	NEW	0.008	0.0190	0.2226	−0.2218	0.0707	−0.5617	4.1515	12.8321
Singapore	SING	0.011	0.0196	0.1991	−0.3068	0.0636	−1.1002	8.0623	151.074
Canada	CA	0.001	0.0179	0.2389	−0.2955	0.0731	−0.8102	5.6389	47.546
USA	USA	0.0005	0.0099	0.1123	−0.1539	0.0399	−0.7580	4.7932	27.340
Panel B: emerging markets									
China	CHI	0.0154	0.0149	0.2044	−0.2308	0.0816	−0.4277	3.4493	4.6292
India	IND	0.0154	0.0183	0.3369	−0.3029	0.0902	−0.1560	4.4034	10.2480
Indonesia	INDO	0.0221	0.0287	0.2913	−0.4032	0.1	−0.5356	5.5906	38.9670
Korea	KOR	0.0118	0.0175	0.2845	−0.2161	0.0845	0.0338	3.4045	0.8338
Malaysia	MAL	0.0122	0.0151	0.1735	−0.2113	0.0563	−0.3554	4.9807	21.9572
Mexico	MEX	0.0152	0.0171	0.1945	−0.3016	0.0789	−0.6109	4.8794	24.9137
Brazil	BRA	0.0199	0..021	0.3013	−0.3505	0.1183	−0.3681	4.0768	8.4364
Chile	CHIL	0.0162	0.0182	0.1936	−0.2939	0.0705	−0.6751	5.8646	49.7259
Bahrain	BAH	−0..021	−0.0231	0.2422	−0..286	0.0816	−0.1379	4.9989	15.0986
Kuwait	KUW	−0.0037	−0.0003	0.2071	−0.1837	0.0758	−0.1040	3.2373	0.3695
Oman	OMA	−0.0001	−0.0076	0.2957	−0.2929	0.0759	0.5844	7.7067	87.2180
Egypt	EGY	0.0288	0.0158	0.5431	−0.3437	0.1141	0.6311	6.5010	68.6741
Morocco	MOR	0.0066	0.0024	0.2052	−0.1619	0.0619	0.3008	3.8935	5.7533
Jordan	JOR	0.0028	−0.0033	0.2407	−0.2895	0.0676	−0.3814	6.6122	59.6313

Fig. 1. Price index of Islamic and conventional indices. (a) Developed markets. (b) Emerging markets.

Table 2
Unit Root test of Islamic stock market returns during tranquil and turmoil periods.

	Panel A: tranquil period		Panel B: turmoil period	
	Augmented Dickey-Fuller	Critical values	Augmented Dickey-Fuller	Critical values
Developed markets				
Austria	−9.3171	−4.1485	−14.4300	−3.5300
Germany	−9.9939	−4.1446	−8.4715	−3.5332
France	−6.9395	−4.1525	−8.3371	−3.5332
Italy	−7.5007	−4.1525	−10.7478	−3.5316
Spain	−6.9558	−4.1658	−8.5306	−3.5332
Switzerland	−9.3378	−4.1485	−10.4853	−3.5316
United Kingdom	−8.2654	−4.1485	−9.6803	−3.5316
Hong Kong	−5.6045	−4.1567	−10.4853	−3.5315
Japan	−9.3169	−4.1485	−9.6803	−3.5316
New Zealand	−8.5193	−4.1485	−11.0748	−3.5315
Singapore	−11.1985	−4.1446	−9.9618	−3.5316
Canada	−7.2560	−4.1525	−14.5176	−3.5300
USA	−13.5666	−4.1446	−8.3145	−3.5332
Emerging markets				
China	−15.0768	−4.1446	−14.2398	−2.9048
India	−7.7920	−4.1485	−11.6358	−3.5315
Indonesia	−8.1935	−4.1485	−9.9618	−3.5316
Korea	−8.3541	−4.1485	−12.9269	−3.5376
Malaysia	−7.6510	−4.2529	−9.9526	−3.5316
Brazil	−9.8735	−4.1485	−8.8866	−4.1130
Chile	−12.0231	−4.1446	−11.0471	−4.1130
Mexico	−13.9607	−4.1446	−13.3586	−4.1104
Bahrain	−3.9588	−3.7529	−10.8291	−3.5300
Kuwait	−9.8445	−4.4407	−10.7246	−3.5300
Oman	−4.6279	−4.4679	−14.8325	−3.5300
Egypt	−11.8855	−4.1485	−9.5802	−3.5315
Morocco	−8.1122	−4.1485	−14.9991	−3.5300
Jordan	−8.5386	−4.1485	−7.6920	−3.5600

Table 3 presents the trace and Max-Eigen statistics of multivariate cointegration tests conducted for developed and emerging markets. Panel A of the table is relative to tranquil period and panel B concerns the turmoil period. For reason of condensation, only the large number of cointegrating relations is reported, both for trace and Max tests.

Empirical results in panel A indicate that there is long-run equilibrium relationship among stock markets of similar economic grouping. Indeed, developed and emerging Islamic stock markets are cointegrating among themselves at 5% level of significance. This means that they have a tendency to move together towards the same direction in the long-run. This finding suggests that the opportunity for the international portfolio diversification has been diminishing through time. Our results are conforming to some studies conducting for conventional markets, Barari (2003) suggesting that the American Latin conventional stock markets are significantly integrated. The integration among stock markets of the same economic and geographical grouping can be attributed to the similar characteristics of the economic, political and social climate.

While, Islamic stock markets from different economic grouping are partially integrated. For the pair of EUR-MENA regions, among 26 estimated cointegrating relations only seven relations are significant. The same result is noted for the pairs of EUR-ASIE, EUR-LAM, ASI-MENA, ASI-ASIE and LAM-MENA. Consequently, during tranquil period, investors can obtain gains by diversifying their portfolios across Islamic stocks markets from different economic groupings.

As shown in the panel B of Table 3, global financial crisis affects the long run cointegration among developed and emerging Islamic markets. An increasing of the number of cointegrated markets is noted among different economic and geographical regions as: EUR-ASI, EUR-NAM, MENA-ASIE, MENA-LAM, EUR-MENA, EUR-LAM, ASI-ASIE, ASI-LAM, NAM-ASIE. This finding is conforms to Khan, Sulaiman, and Farooq (2013) results suggesting an increasing of integration among Islamic Asian stock markets during the global financial crisis period. But, our results are different from Abdul Karim et al. (2010) providing that the 2007 subprime crisis does not seem to affect the long-run co-movements among the developed and developing Islamic stock markets.

4.3. Vector error correction model

In the previous section, we find evidence of long term cointegration among the Islamic stock markets from developed and emerging countries, which means that at least one of the markets reacts to deviations from the long-run relationship. We then need to investigate whether the co-movements among the stock markets correct for disequilibrium. In this context, we estimate the VECM model since it allows us to distinguish between long and short dynamic linkages among the Islamic stock markets. Figs. 2–4 depict, in the absolute value, only the negative and significant coefficients of the speed of short run adjustment respectively for developed markets, emerging markets and developed-emerging markets.

4.3.1. Short run integration among Islamic developed markets

Fig. 2 provides the results of the multivariate VECM estimation conducted for Islamic developed stock markets during the tranquil period (panel a) and the turmoil period (panel b). The results of panel (a) indicate a significant decreasing of the short run integration among Islamic stock markets as compared to the long run. This finding confirms the presence of short term potential benefits diversification across Islamic stock markets in tranquil period. Indeed, we show the absence of integration across the Austrian Islamic and all other European indices. French Islamic index seem to be segmented from Italian and Switzerland Islamic indices. For Asian developed markets, we note that Singaporean Islamic market is integrated with all Asian Islamic markets. While, the investors can expect to benefit from the absence of integration among Hong Kong–Japan, Hong Kong–New Zealand and New Zealand–Japan. The analysis of the integration among European and Asian Islamic indices indicates that French, Italy and Germany are highly integrated with Asian developed markets. According to Johnson & Soenen (2002) and Mobarek (2012), the increasing of stock market integration may be caused to the presence of more favorable economic and political

Table 3
Multivariate cointegration among Islamic stock markets.

	Panel A: tranquil period						Panel B: turmoil period					
		Eigenvalue	Trace statistic	Critical value	Max-statistic	Critical value		Eigenvalue	Trace statistic	Critical value	Max-statistic	Critical value
Developed markets												
EUR	At most 6*	0.2188	12.84550	12.51798	12.84550	12.51798	At most 5*	0.346868	38.54821	25.87211	26.41055	19.38704
ASI	At most 3*	0.2800	17.08270	12.51798	17.08270	12.51798	At most 3*	0.233545	16.75673	12.51798	16.75673	12.51798
NAM	At most 1*	0.34285	21.831	12.51798	21.83181	12.51798	At most 1*	0.260260	18.99176	12.51798	18.99176	12.51798
EUR-ASI	At most 5*	0.53146	124.80	117.7082			At most 7*	0.314445	66.07966	63.87610		
	At most 3*				58.41022	56.70519	At most 1*				73.03382	68.81206
EUR-NAM	At most 6*	0.35165	48.209	42.91525			At most 7*	0.30177	34.13539	25.87211	22.23590	19.38704
	At most 4*				43.97386	38.33101						
ASI-NAM	At most 5*	0.26994	16.361	12.51798	16.36108	12.51798	At most 5*	0.225701	16.11521	12.51798	16.11521	12.51798
Emerging markets												
MENA	At most 5*	0.240128	6.0413	12.51798	6.041327	12.51798	At most 4*	0.232546	26.77426	25.87211		
							At most 2*				34.27900	32.11832
ASIE	At most 4*	0.212270	15.031	12.51798	15.03181	12.51798	At most 4*	0.244281	17.64541	12.51798	17.64541	12.51798
LAM	At most 2*	0.292761	18.01211	12.51798	18.01211	12.51798	At most 2*	0.241354	17.40190	12.51798	17.40190	12.51798
MENA-ASIE	At most 6*	0.251457	26.721	25.87211			At most 8*	0.291486	43.31723	42.91525		
	At most 2*				47.93187	44.49720	At most 3*				60.89982	56.70519
MENA-LAM	At most 5*	0.232170	13.737	12.51798	13.73769	12.51798	At most 6*	0.285535	44.67407	42.91525		
							At most 2*				51.86393	50.59985
ASIE-LAM	At most 5*	0.376133	48.743	42.91525			At most 7*	0.226637	16.19146	12.51798	16.19146	12.51798
	At most 1*				73.99105	50.59985						
Developed-emerging markets												
EUR-MENA	At most 7*	0.333027	45.26887	42.91525			At most 8*	0.228987	26.47728	25.87211		
	At most 2*				57.44433	56.70519	At most 2*				67.91537	56.70519
EUR-ASIE	At most 7*	0.374178	49.26408	42.91525			At most 10*	0.249399	27.69657	25.87211		
	At most 2*				64.87994	56.70519	At most 4*				63.58677	56.70519
EUR-LAM	At most 7*	0.359196	45.27839	42.91525			At most 8*	0.221646	27.02390	25.87211		
	At most 3*				50.62495	50.59985	At most 4*				47.46544	44.49720
ASI-MENA	At most 6*	0.115177	4.894691	12.51798	4.894691	12.51798	At most 5*	0.357334	69.69229	63.87610		
							At most 1*				57.39807	56.70519
ASI-ASIE	At most 3*	0.647440	127.9689	117.7082			At most 8*	0.22848	15.37925	12.51798	15.37925	12.51798
	At most 2*				72.60003	50.59985						
ASI-LAM	At most 5*	0.252602	26.80329	25.87211			At most 6*	0.216020	15.33246	12.51798	15.33246	12.51798
	At most 1*				45.62564	44.49720						
NAM-MENA	At most 4*	0.278653	16.98505	12.51798	16.98505	12.51798	At most 4*	0.221190	15.24928	12.51798	15.24928	12.51798
NAM-ASIE	At most 5*	0.347407	26.82378	25.87211			At most 6*	0.247588	17.92168	12.51798	17.92168	12.51798
	At most 3*				33.84966	32.11832						
NAM-LAM	At most 4*	0.203515	11.83245	18.51798	11.83245	18.51798	At most 4*	0.247588	17.92168	12.51798	17.92168	12.51798

conditions towards business in developed markets. While, United Kingdom and Austria are independent form developed Asian Islamic markets which offers an international diversification gains. Also, among twelve estimated integrating relations between European and North American Islamic markets, only six relations are significant.

Results from panel b provide that the recent global financial crisis initiated from the U.S. seems to cause a shift in the pattern of integrating process. A significant decreasing of a number of cointegrated Islamic markets is noted among each region and among each pair of regions. The North American markets are being segmented from each other. In addition only French, Germany, Singapore and Hong Kong are related to US markets during the turmoil period. This finding suggests the lower impact of the subprime crisis on the Islamic stock markets as compared to conventional markets. The use of the sharia principles such as the interdiction of excessive uncertainty (gharar) and speculation (maysir) risk makes Islamic stocks more stable regarding the global financial crisis.

4.3.2. Short run integration among Islamic emerging markets

Fig. 3 reports the short run cointegration relationship among Islamic markets of emerging regions for tranquil period (panel a) and turmoil period (panel b). For the MENA markets, we note the absence of integration among Bahrain–Kuwait, Bahrain–Morocco, Kuwait–Oman and Egypt–Morocco. This finding supports the results of Abd Majid, Mohd Yusof, and Razali (2007) suggesting that investors can benefit from portfolio diversification by investing in the MENA region.

Moreover, American Latin markets offer a possibility of international diversification among Chilly-Mexico. While, a high level of independence is noted among the MENA and the Asian Islamic stock markets. The study of the co-movements across the pair MENA-Latin American provides 7 significant short run cointegrating relationships among 20 estimated relationships. This finding suggests the presence of a potential benefits diversification across the MENA and American Latin Islamic stock markets.

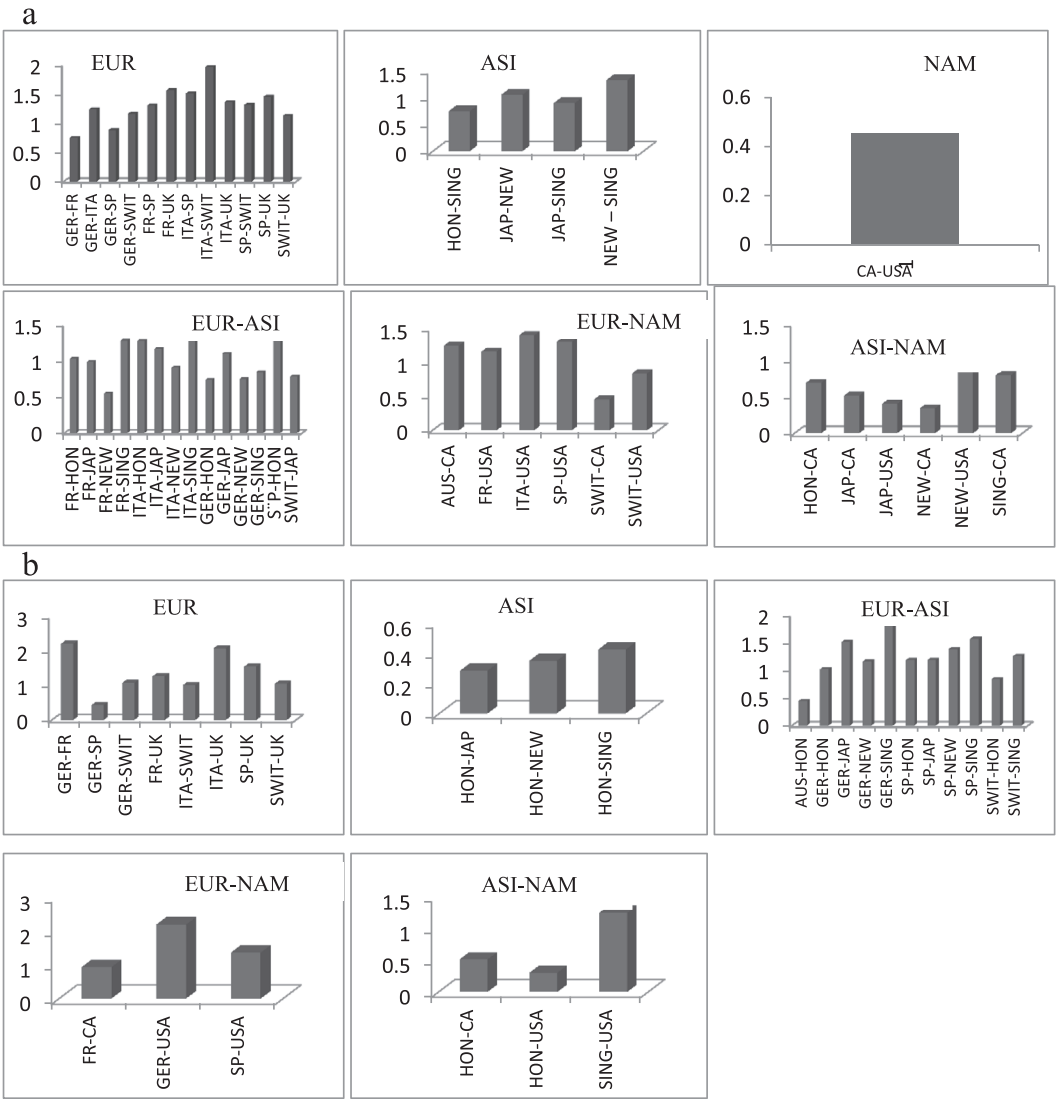

Fig. 2. Short run integration among Islamic developed markets. (a) Tranquil period. (b) Turmoil period.

During the crisis period, we show a decreasing of dependence across the MENA, Asian and American Latin Islamic regions offering more international diversification opportunity. While, MENA region seem to be highly integrated with Asian and Latin American regions during the turmoil period.

4.3.3. Short run integration among Islamic developed-emerging markets

Fig. 4 presents the results of the VECM estimation conducted for all pairs of developed and emerging regions for tranquil period (panel a) and turmoil period (panel b).

During tranquil period, the results indicate that European and MENA Islamic indices seem to be dependent with exception of Oman which is cointegrated only with Austrian and French Islamic stock markets. Also, we show a high level of dependence across the Canadian Islamic index and most of the MENA, Asian and Latin American Islamic indices. This finding suggests the absence of potential benefit diversification across these markets. While, a lowest level of short run integration is noted among European–Asian emerging markets and European–American Latin markets. Also, Japan appears to be segmented from all MENA Islamic indices except for Oman. Moreover, we note that U.S. Islamic market is segmented from Bahrain, Kuwait, Morocco, Malaysia, Korea, China and Brazil Islamic stock markets. In this context, Marashdeh (2005) finds that there is no integration between the MENA stock markets and the major developed financial markets (the US, UK and Germany). This lower extent of stock market co-movement among Islamic of different economic level may be attributed to the different economic and political characteristics, the restrictions on capital flows and other barriers imposed by some emerging countries.

Results of panel b show that US subprime crisis does not affects significantly the short term integration among developed-emerging Islamic markets as compared to tranquil period.

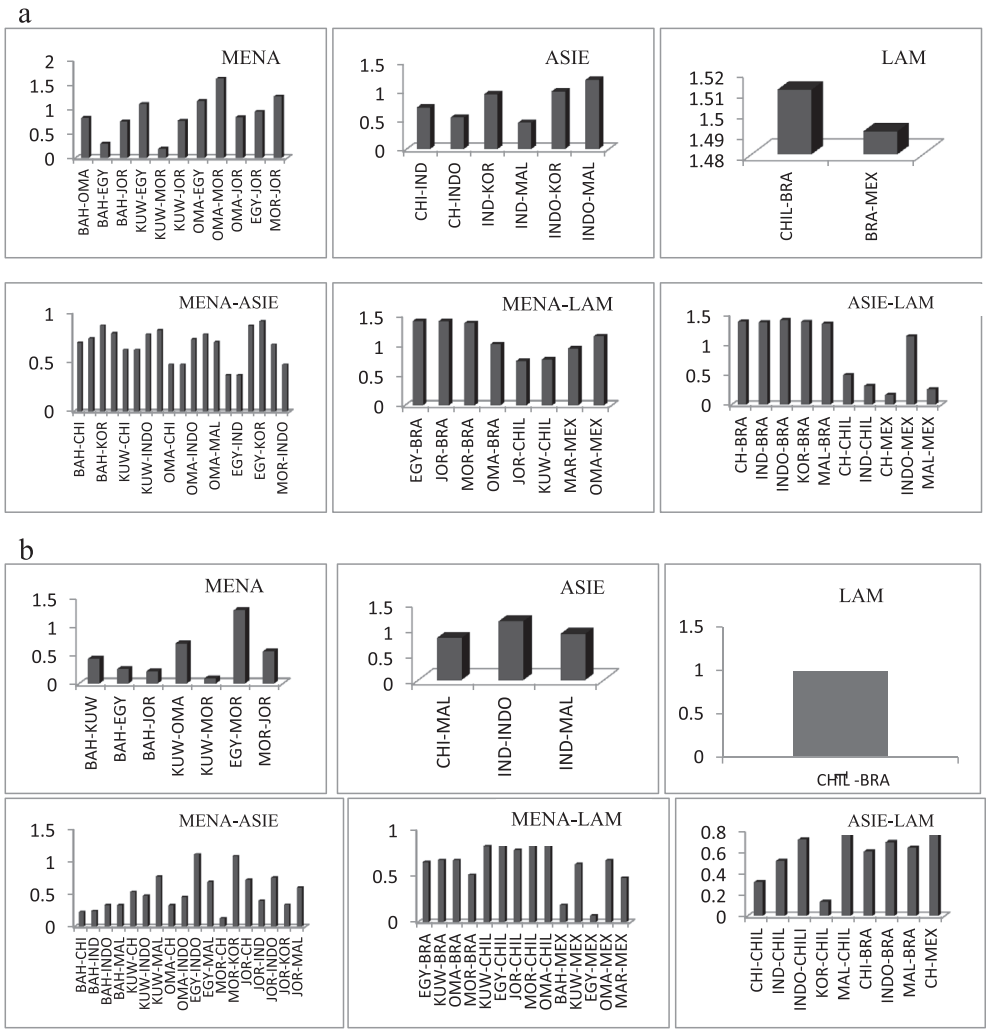

Fig. 3. Short run integration among Islamic emerging markets. (a) Tranquil period. (b) Turmoil period.

4.3.4. Bivariate granger causality test

Table 4 reports the results for bivariate Granger causality test estimated for tranquil and turmoil periods. In the tranquil period, we show that Hong Kong Islamic index causes Japan Islamic index which influence significantly Singapore Islamic market. By considering the pairs Europe −Nord America and Asia-Nord America, we show that Canadian Islamic stock market is insignificant in causing any of the stock markets in these economics regions. While, US Islamic market influences most of Asian developed Islamic markets and European Islamic markets. Our results are no consistent of Abd Majid and Haj Kassim (2010) showing a strong short-run causalities among the developed Islamic indices of US, UK and Japan and so the no existence of potential portfolio diversification benefits among these stock markets.

For the MENA stock markets, Islamic indices of Bahrain and Egypt cause the dynamic of others Islamic indices. While, Jordan and Morocco are not influential in stock markets of MENA region. This result confirms the presence of a potential of international diversification across these markets. For Asian markets, a bidirectional causal relation is recorded between India and Malaysia. Also, only one causal relation from Chili to Brazil is noted for Latin American Islamic indices. Moreover, low level of causality is noted across MENA, Asian emerging and American Latin Islamic stock markets. This finding supports the VECM estimated results. By considering the causality among the pairs of developed and emerging markets, we show that Indonesian Islamic index causes French and United Kingdom Islamic markets. The absence of causality relation among Malaysian and US Islamic stock markets support the finding of Abdel Abd Majid and Haj Kassim (2010) suggesting the existing of diversification benefits by considering the Malaysian and US Islamic stock markets. In addition, we show a fewer number of causal relationships among Asian developed markets and emerging markets in MENA, Asian and American Latin regions. This finding constitutes a strong evidence in favor of potential gains diversification across Islamic stock markets of these regions. Furthermore, our results indicate that Canadian Islamic index does not influence and it does not influenced by any emerging Islamic index. Finally, U.S. and Canadian Islamic indices are being segmented from all American Latin Islamic indices.

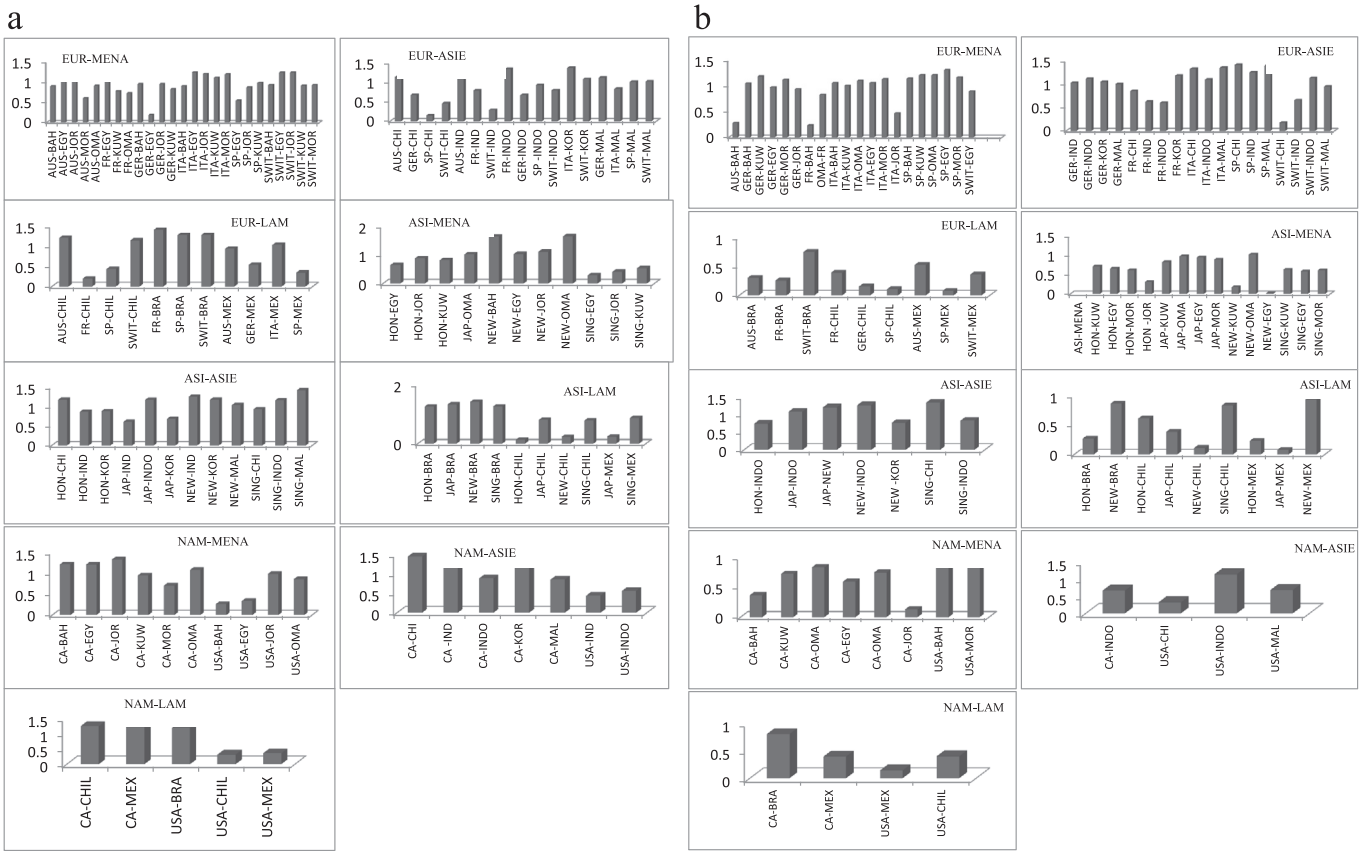

Fig. 4. Short run integration among developed-emerging markets. (a) Tranquil period. (b) Turmoil period.

Results in panel B reveals an increasing of causalities recorded among the pairs of MENA-ASIE and MENA-Latin American Islamic stock markets during the crisis period as compared to the pre-crisis period. This finding suggests that these markets are interrelated which limits the benefits of diversification. While, during crisis period, we show a significant decreasing of causalities among the pairs of developed Asian markets−North American markets, European-Asian emerging markets and European-Latin American markets. Moreover, an absence of causality during turmoil period is noted across Latin American markets and across the pair of North American markets−Latin American markets.

5. Conclusion

While previous financial crises have been geographically limited, the current US subprime crisis has spread to the international financial markets. This was due to the increased level of integration that conventional financial markets experienced over the past decade, which led to a global contagion of the recent subprime crisis to all sectors of the economy, as well as to other countries. This paper investigates the long and short run integration dynamic among a large set of developed and emerging Islamic stock markets from different regions. To test the impact of the global financial crisis in the Islamic stock markets integration, the sample period has been divided in tranquil period and turmoil period. Based on the multivariate JJ-cointegration analysis, we find the presence of long-run equilibrium relationship among Islamic stock markets of similar economic grouping. While, Islamic stock markets from different economic grouping are partially integrated. At short run, the multivariate VECM estimation provides no evidence of integration between the Austrian Islamic market and all other European Islamic markets. Moreover, French Islamic markets seem to be segmented from Italian and Switzerland Islamic markets. For emerging markets, a high level of integration is noted among the MENA and the Asian Islamic Markets.

Although, a lowest level of short run integration is noted among European-Asian emerging markets and European-American Latin Islamic markets. We note that U.S. Islamic market is segmented from Bahrain, Kuwait, Morocco, Malaysia, Korea, China and Brazil Islamic stock markets. Also, Japan appears to be segmented from all MENA Islamic indices except for Oman. This finding suggests the presence of potential benefits diversification across Islamic stock markets at short run. During the subprime crisis period, a significant decreasing of cointegration is noted among developed Islamic markets. The North American markets are being closely segmented from each other's. In addition, only French, Germany, Singapore and Hong Kong are related to US markets during the turmoil period. Moreover, we show a low level of dependence across the MENA, Asian and American Latin Islamic stock markets. Therefore, Islamic stocks may provide potential diversification benefits during turbulent economic

Table 4
Granger causality tests of Islamic stock markets.

Panel A: tranquil period			Panel B: crisis period		
Countries	F-statistic	P-value	Countries	F-statistic	P-value
Developed markets					
European markets					
UK → GER	3.44501	0.0353	FR ↔ GER	3.43703	0.0399
			GER ↔ UK	3.72195	0.0311
Asian developed markets					
HON → JAP	5.10800	0.0257	JAP → SING	4.57405	0.0150
JAP → SING	3.55269	0.0620			
North American markets					
USA → CA	4.15246	0.0439	CA → USA	2.95629	0.0612
European-Asian developed markets					
SWIT → HON	0.6042	0.0846	HON → GER	3.0049	0.0573
JAP → FR	3.2336	0.0483	HON → SP	3.1417	0.0506
GER → JAP	2.7172	0.0764	JAP → AUS	6.6812	0.0024
SWIT → JAP	2.577	0.0866	JAP → UK	3.4381	0.0388
GER → NEW	2.59	0.0856	NEW ↔ AUS	2.7728	0.0707
European-North American markets					
USA → FR	5.8861	0.0052	GER → USA	2.8918	0.0635
USA → ITA	2.5604	0.088	GER → CA	4.17	0.0203
USA → SP	2.9407	0.0626	ITA → CA	3.7628	0.029
Asian developed markets–North American markets					
JAP ↔ USA	2.7211	0.0761	JAP ↔ CA	6.8963	0.002
USA → NEW	2.6799	0.079			
USA → SING	2.8499	0.0678			
Emerging markets					
MENA markets					
EGY → JOR	4.22438	0.0424	EGY → BAH	6.24241	0.0038
EGY → OMA	4.66017	0.0339	EGY → KUW	9.49403	0.0003
BAH → EGY	3.00729	0.0868	BAH → KUW	9.61523	0.0003
BAH → MOR	3.09873	0.0822	MOR → OMA	2.51937	0.0907
OMA → MOR	6.04257	0.0162			
Asian emerging markets					
MAL ↔ IND	3.84943	0.0522	INDO → IND	3.19513	0.0494
Latin American markets					
CHIL → BRA	3.66452	0.0581			
MENA markets–Asian emerging markets					
BAH → CHI	4.3081	0.0306	JOR → CHI	5.9408	0.0045
OMA → IND	3.005	0.0762	CHI → OMA	3.5104	0.0363
INDO → BAH	2.7857	0.0898	BAH → IND	2.5264	0.0887
INDO → MAR	2.769	0.0729	INDO → BAH	4.5033	0.0152
BAH → KOR	3.7926	0.0434	INDO → EGY	5.188	0.0084
			INDO ↔ KUW	2.6914	0.0762
			INDO → OMA	2.8809	0.064
			JOR → KOR	10.2245	0.0001
			MAL → BAH	2.7938	0.0694
			JOR → MAL	6.949	0.002
			KUW → MAL	3.3956	0.004
MENA markets–Latin American markets					
KUW → CHIL	3.6737	0.047	CHIL → KUW	3.904	0.0256
KUW → BRA	3.2684	0.0629	BAH → MEX	5.3124	0.0076
KUW → MEX	3.723	0.0456	KUW → MEX	8.128	0.0007
			KUW → BRA	4.908	0.0107
Asian Emerging markets–Latin American markets					
CHIL → IND	3.2571	0.0473	MEX → CHI	2.6023	0.0827
Developed-emerging markets					
European-MENA markets					
BAH → ITA	4.9394	0.0203	GER → MOR	2.5016	0.0928
ITA → EGY	3.3948	0.0419	OMA → SWIT	5.1686	0.0176
European-Asian emerging markets					
GER → CHI	4.3366	0.018	CHI → AUS	2.5186	0.0893
SWIT → CHI	3.0871	0.0549	CHI → GER	2.5734	0.0845
AUS → INDO	3.068	0.0559	MAL → AUS	4.0217	0.0231
INDO → FR	2.4692	0.0955			
INDO → UK	2.5579	0.088			
European-Latin American markets					
BRA → SWIT	2.6903	0.0783	MEX → AUS	3.0388	0.0555
SP → MEX	7.3605	0.0016	MEX → SP	2.8905	0.0635
Asian developed markets–MENA markets					
KUW → HON	3.38	0.042			
SING → EGY	3.5093	0.0529			
Asian developed markets–Asian Emerging markets					
CHI → HON	2.4846	0.0942	HON → INDO	2.4055	0.0991
SING → MAL	7.55	0.0018	KOR → NEW	3.1141	0.0519
Asian developed markets-Latin American markets					
JAP → CHIL	2.7756	0.0725	BRA → NEW	2.7930	0.0694
Nord American markets–MENA markets					
BAH → USA	3.7158	0.0317	BAH → USA	2.3985	0.0998
JOR → USA	2.9823	0.0636	CA ↔ JOR	6.8963	0.00206
			KUW → CA	3.2692	0.045
Nord American-Asian emerging markets					
USA → CHI	5.58603	0.00666	MEX → CHI	2.60239	0.08273
INDO → USA	4.00126	0.02485			
North American markets-Latin American markets					
–					

periods, as they may decrease the portfolio's sensitivity to international crisis contagion.

The estimation the granger causality for all pairs of developed and emerging markets, show that Canadian Islamic stock market is insignificants in causing any of the developed or emerging Islamic stock markets. In addition, weak level of causality is noted across MENA, Asian, North American and Latin American Islamic markets.

Overall, our results suggest that Shariah compliant stocks could offer potential diversification benefits by considering different economic grouping such as that in developed and emerging countries. This finding has important implications in designing investment strategies for investors who desiring to diversify their portfolios across Islamic stocks, especially during financial crisis period. A future research can take additional variables such as economic indicators, transaction costs and the investment risks of Islamic stock markets into further consideration.

Appendix 1.

The Cointegration tests.

The first step of cointegration test is to examine the stationarity of return series. Indeed, the non stationarity of these series is the prerequisite for the study of cointegration. In addition, all series must be integrated of the same order. To test for stationarity, we employ the standard Augmented Dickey Fuller tests (ADF) unit root tests (Dickey and Fuller, 1979 and 1981) with constant and time trend model. Once the non-stationary return series is checked and the series are integrated of the same order, we can apply the Johansen's cointegration test to study the long-term relationships among

Islamic stock markets. This test, based in Vector Auto-Regressive approach (VAR), allows us to determine the maximum integration order. The VAR model is as follow:

$$\Delta X_t = \alpha + \prod X_t + \Gamma X_{t-p} + \varepsilon_t \quad (1)$$

Where Δ denotes the first difference, ΔX_t is an n × 1 vector of monthly return variables, α is an n × 1 vector of the constant terms, Γ is an n × n matrix of coefficients, ε_t is an n × 1 vector of white noise error terms, and p is the order of autoregression, respectively. $\prod$ is the matrice that determines the number of cointegrating relations.

The trace and the maximal eigenvalue statistics developed by Johansen (1988, p.231) and Johansen and Juselius (1990, p.169) are then used to determine the number of co-integration vectors. The trace statistic used to test the null hypothesis of r cointegrating relations is computed as:

$$LR_{tr}(r/k) = -T\sum_{i=r+1}^{k}\log(1-\lambda_i) \quad (2)$$

where λ_i is the i-th largest eigenvalue of the$\prod$ matrix in Eq. (1).

The Max statistic is considered to test the hypothesis of r cointegrating relations against the alternative of $r + 1$ cointegrating relations. This test statistic is computed as:

$$LR_{\max}(r/r+1) = -T\log(1-\lambda_{r+1}) \quad (3)$$

For $r = 0, 1, \ldots, k - 1$.Where T is the number of effective observations and λr are the estimated eigenvalues. If the trace and Max statistics are bigger than the critical value, the null hypothesis of at most r cointegrating vectors is rejected. The critical values for both tests are obtaineded from the trace and maximum eigenvalue of the stochastic matrix.

Appendix 2.

The Vector error correction model.

The existence of long-run equilibrium relationship among Islamic stock markets leads us to study the short-term relationship using the vector error correction model (VECM). According to Engle and Granger (1987), if the variables are cointegrated then the following VECM representation exists:

$$\Delta X_t = \alpha + \prod X_t + \Gamma \Delta X_{t-p} + \lambda\mu_{t-p} + \varepsilon_t \quad (4)$$

With λ represents the speed of short run adjustment of X_t towards the equilibrium. This coefficient should be significantly negative.

Appendix 3.

The Granger causality test (1969) provides the sense of short term causation among Islamic stock markets which cannot be viewed by the VECM estimation. Granger causality is based on regression modeling and typically captures current and past causal relationships in the data (Menezes, 2013).

In order to test for Granger causality among two Islamic stock markets X_t and Y_t, we estimate the following equation:

$$\Delta X_t = c + \alpha\Delta X_{t-1} + \beta\Delta Y_{t-1} + \varepsilon_t \quad (5)$$

F-test is used for joint insignificance of the coefficient β.

We test the null hypothesis that Y_t does not Granger cause X_t. Therefore, when the null hypothesis is rejected, we conclude the presence of Granger causality.

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