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Dewandaru, Ginanjar and Alaoui, Abdelkader and Masih, A. Mansur M. and Alhabshi, Syed Othman

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By

Ginanjar Dewandaru
INCEIF, The Global University of Islamic Finance
Lorong University A, 59100 Kuala Lumpur, Malaysia,

Abdel-Kader El Alaoui
INCEIF, The Global University of Islamic Finance
Lorong University A, 59100 Kuala Lumpur, Malaysia,

A. Mansur M. Masih*
INCEIF, The Global University of Islamic Finance
Lorong University A, 59100 Kuala Lumpur, Malaysia

and

Syed Othman Alhabshi
INCEIF, The Global University of Islamic Finance
Lorong University A, 59100 Kuala Lumpur, Malaysia

ABSTRACT

Co-movements in equity markets may reflect either financial contagion or stock market integration. While the former tends to demonstrate financial stability and resiliency, the latter has played an important role for stock market development. This paper attempts to investigate the co-movements, including its transmission channels, of the Gulf Cooperation Council (GCC) Islamic equity index with other Islamic equity indices (Asia Pacific, US, Eurozone, and ASEAN) as well as with Global Sukuk index (Islamic bond). As to the methodology, we employ multi-time scale wavelet analysis as one of the latest techniques in finance to unveil the time varying and multi-horizon nature of these comovements to capture both time and frequency domain simultaneously. Our finding shows that the most recent US-born subprime crisis has generated both long-term and short-term shocks to volatility of all Islamic equity indices. The GCC Islamic equity index is the most susceptible with the shocks mostly transmitted via fundamental linkages. Notably, the nature of co-movements amongst Islamic equity indices are more or less similar as those amongst conventional counterparts. We also find no evidence of flight-to-quality for Islamic investors to flee from compliant equity in GCC to compliant bond during market turbulance, given the leading role of Islamic equity index over Sukuk index in the short run and long run. Finally, we find the nature of weak stock market integration between GCC equity market and others. Some recommendations have been proposed to improve stock market integration, including its stability and resiliency.

*Corresponding Author: Prof. A. Mansur M. Masih, INCEIF, The Global University of Islamic Finance, Lorong University A, 59100 Kuala Lumpur, Malaysia. Phone: +60-3-2272-3254; Fax: +60-3-7651-4110; Email: mansurmasih@gmail.com

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1. Introduction

Market co-movement has been the major trend in the globalized economies. Many studies have theoretically and empirically investigated numerous channels of co-movement between equities markets in different countries, as well as between equity markets and bond markets. Among equity markets, their co-movement may reflect either stock market integration or merely financial contagion. While the latter tends to demonstrate financial stability and resiliency, the former has played an important role as one of the key indicators of stock market development in order to eventually rejuvenate overall economic growth.

The stock market integration may offer opportunities and removes barriers for international portfolio, which provide significant impacts for portfolio allocation and asset pricing (Bartram & Dufey, 2001). The integration and openness are essential to boost economic growth, improve factor productivity, reduce cost of capital, promote better corporate governance and increase size and liquidity (Bekaert, Harvey, and Lundblad, 2005; Quinn and Toyoda, 2008; Rajan and Zingales, 2003; Gourinchas and Jeanne, 2006, and others). The two therefore have been recognized as key indicators of stock market development.

On the other hand, the co-movement may only be observed temporarily during economic downturn, which is commonly defined as contagion. Specifically, financial contagion has been distinguished between "fundamental-based" and "pure" contagion (see for example, Dornbusch et al. (2000); Kaminsky & Reinhart (2000)). The "pure" contagion is defined as an excessive transmission of shocks from the origin of crash in one country into others beyond what fundamental suggests (Forbes & Rigobon, 2002; Bae et al., 2003; Eichengreen et al., 1996). The excessive co-movement only occurs during the crisis, and can be attributed to investors' behavior at periods of greater uncertainty, i.e. herding, financial panic, loss of confidence, and so on. Meanwhile, the "fundamental-based" contagion has been defined as a transmission of shocks by way of real linkages in non-crisis and crisis periods, reflecting normal interdependence across border (Calvo & Reinhart, 1996).

Some have proposed the relevance of co-movement between equity market and bond market, and mention its importance in the context of flight-to-quality, to provide resiliency during crisis period. Baur & Lucey (2009) suggest that the flight-to-quality from stocks to bonds exists when the stock–bond correlations are positive before crisis and they become negative in the crisis period. This may imply that investors flee from stocks (more risky) into bonds (less risky), which ends up with a falling price of stock and, at the same time, an increasing price of bond. The negative correlation therefore has the potential to enhance the stability of the financial system since it can minimize the losses that investors suffer from their equity holding during crises periods.

Apart from conventional financial system, it seems necessary to identify the nature of co-movement amongst Islamic markets. This has been the major concern since the current trend of Islamic finance is to expand from a banking-based industry into capital market-based instruments, which is followed by an increasing number of other innovative products and practices to provide better risk-return profile for Islamic investors. The issue on how Islamic equity markets noticeably differ from their conventional counterparts is mainly due to the role of *Shari'ah* screening. The modern *Shari'ah* scholars have provided general rules to evaluate as to whether a particular firm is *halal* (lawful) or *haram* (unlawful) for investment (Derigs & Marzban, 2008). The *Shari'ah* rules do not allow businesses related to immoral activities (e.g. liquor, gambling, etc.), and the most distinct feature of Islamic firms would be the limit of

leverage using interest-based debt[1]. The filtering criteria consequently will take out the large non-compliant firms from the pool of investable equities, leaving the remaining *Shari'ah* compliant firms available to become smaller and portray more volatile returns (Hussein & Omran, 2005). In other words, the lower leverage, smaller size of firms, and under-diversification of the market, will be the main distinctive features of Islamic equity market.

The main objective of our study, therefore, is to investigate the co-movement amongst Islamic markets. The focus is to evaluate its nature and to unveil its transmission channels in order to understand: (i) the stability and resiliency and (ii) the degree of market integration of Islamic equity markets. We will study the case of the Gulf Cooperation Council (GCC) since it has been well-recognized as one of the center of Islamic financial industry. Specifically, we will study the co-movement: (i) between GCC Islamic equity index and Islamic equity indices in other regions (Asia Pacific, US, Eurozone, and ASEAN), (ii) between GCC conventional equity index and conventional equity indices in other regions (Asia Pacific, US, Eurozone, and ASEAN), (iii) between GCC Islamic equity index and Global Sukuk index (Islamic bond), and (iv) between GCC Islamic equity index and LIBOR. The first is to measure the level of stock market integration and to investigate any evidence of financial contagion during the US-born subprime crisis period. The second is mainly to compare the nature of co-movements in Islamic equity markets to those in their conventional counterparts. This is to identify whether Islamic equity markets are less integrated and less susceptible to most recent crisis impact. The third is to discover the evidence of flight-to-quality in promoting financial stability during subprime crisis period. The fourth is particularly relevant since the use of interest rate as a benchmark for Islamic asset pricing has been extensively debated among Islamic scholars. The stability of Islamic capital markets will be highly influenced by interest rate being adjusted within conventional system.

Remaining part of the study is organized as follows: section two reports the summary of the literature review of the study. Sources of data and methodology of the study are presented in section three. Results and their interpretations are described in section four. Finally, the study wraps up with major summary findings and policy recommendations in section five.

2. Literature review

2.1. Theoretical foundation of financial contagion and empirical studies

Previous studies suggest that financial crisis may reveal the evidence of either financial contagion or interdependence. Specifically, Dornbusch et al. (2000) and Kaminsky & Reinhart (2000) have mentioned the two distinctive characteristics between "fundamental-based" and "pure" contagion. The "pure" contagion is defined as an excessive transmission of shocks from the crash in origin country into others beyond any idiosyncratic disturbances and fundamental linkages (Forbes & Rigobon, 2002; Bae et al., 2003; Eichengreen et al., 1996).The sentiment shift of investors will lead to a general reversal of funds and eventually trigger financial crises. The shifting appetite belongs to a pure financial contagion unrelated to economic fundamentals (Kumar & Persaud, 2002; Dailami et al., 2008). Gonzalez-Hermosillo (2008) mention some

[1] (i) a company's debt financing is not more than 33 percent of its capital, (ii) interest-related income of a company is not more than 10 percent of its total income, (iii) the composition of account receivables and liquid assets (cash at banks and marketable securities) compared to total assets is minimum at 51 percent while a few cite 33 percent as an acceptable ratio.

global market risk factors that may explain the risk appetite of the global investors, which are the default risk, the market liquidity risk, the funding liquidity premium, and volatility.

There have been some mechanisms of transmitting shocks in the origin of crash to others. Firstly, the shocks in one market may represent the economic news which directly gives the impact on the cash flows or collateral values linked to assets in other markets (Kiyotaki & Moore (2002); Kaminsky, Reinhart, & Vegh, 2003). Contagion therefore represents the transmission of information from markets with more rapid price discovery, where the effect of news may spread investors' sentiment across borders (Kaminsky & Schmukler, 1999). Secondly, negative returns in one market may increase the risk premium in other markets, resulting in simultaneous drop of assets prices (Vayanos, 2004; Acharya & Pedersen, 2005; Longstaff, 2008). Thirdly, liquidity shock across countries plays an important role in contagion through a flight-to-quality (Allen & Gale, 2000; Brunnermeier & Pedersen, 2009). Investors who suffer in one market will have difficulty to raise fund, thus the flight-to-quality plays an important role in absorbing the overall market liquidity.

In another study, Masson (1999a) points out three factors of contagion with respect to crisis periods. Firstly, the monsoonal effect or the common shock gives a simultaneous impact on a number of countries due to the oil price, the interest rate of major developed countries, and so on. Secondly, the spillover effects from one country into another can be attributed to commercial operations (one country loses its competitiveness because of currency depreciation in another country) or by financial positions (common investors include both countries' assets in their portfolio). Forbes & Rigobon (2002)and Kleimeier & Sander (2003) argue that the two factors may be usual channel of shock transmission. In a pure contagion, a sentiment shift of investor leads to outflows when all things being equal, i.e. unexplained by commercial and financial channels. It reflects an upsurge of risk aversion in emerging countries.

Masson (1999a, 1999b) also explains the residual process to multiple equilibria whereby self-fulfilling expectations cause contagion if investors' opinions are coordinated across countries. This is in line with other channels such as wake-up calls (Goldstein, 1998) or heightened awareness (Lowell et al., 1998). The transmission of expectations can lead to herd behaviour (Kaminsky & Schmukler, 1999; Calvo & Mendoza, 2000a), which triggers contagion. The contagion in the form of speculative attack is also defined as a residual. In addition, Krugman (1998) mentions the role of herd behaviour that burst asset bubbles created by self-fulfilling expectations, moral hazard, or government guarantees, either implied or explicit. On the other hand, the "fundamental-based" contagion is defined as a transmission of shocks by way of financial market integration and real linkages in non-crisis and crisis periods, reflecting normal interdependence across border (Calvo & Reinhart, 1996).

Some empirical studies have been done in emerging countries to discover as to whether certain crisis was spread via purely excessive linkages or merely interdependence. Candelon, Piplack, & Straetmans (2008) find a significant increase of cross-country correlations in five Asian stock markets of Singapore, Thailand, South Korea, Taiwan and Malaysia, during Asian crisis. The stability test suggests that the rising co-movement is more of a sudden nature (i.e. contagion or ''Asian Flu'') rather than gradual (i.e. financial integration). Chung (2005) finds that the changes in the Thai Baht exchange rate result in contagious effects on Asian ADR and country fund returns and volatility. Kaminsky & Schmukler (1999) study Hong Kong, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand during the 1997 Asian crisis. They find that some of the large unlikely changes can be explained by apparent substantial

news such as international organizations, credit rating agencies, and so on. The herd instincts as an overreaction of investors to bad news have played the major role during turbulence.

During the Argentine default in December 2001, Cifarelli & Paladino (2004) have investigated the crisis on daily spreads on sovereign bonds issued by 10 emerging countries in Latin America and Asia. They find long-lasting contagion effects in Latin America while the changes in daily spreads in Asia due to the Argentinean crisis seem to be less persistent, suggesting a temporary contagious reaction. Some other studies have pointed out the increase of capital inflows into Asia since 2003, which can be attributed to upgraded sovereign ratings in Asia as well as the abundance of world liquidity, the high level of carry trade strategies, and the low level of risk aversion, with the Yen as the funding currency (Galati et al., 2007; Gyntelberg & Remolona, 2007).The role of foreign investor risk appetite becomes relevant and may result in a contagion effect if a reversal of investor opinion with regard to emerging market leads to capital outflows. Fernandez-Arias (1996) suggests that the flows are highly unstable if capital inflows are driven by external factors (push factors). Emerging countries are exposed to the evolution of macro and financial conditions in developed countries as well as foreign investor sentiment, becoming a source of fragility.

Looking at the impact of the most recent US-born crisis, credit spreads in Asia have widened even more than they did in United States and Europe, even though Asian region has a minimum exposure to subprime mortgages (Kim, Loretan, & Remolona, 2010). Their study mentions that an amplification mechanism may well explain the contagion effect driven by valuation losses, which can be attributed to the bursting of a global credit bubble. Specifically, it is a global re-pricing which can be considered as the main channel for contagion in Asian credit and equity markets. They find that the valuation losses on credit default swaps (CDS) have increased in part from movements in global and region-specific risk pricing factors. In another study, Longstaff (2010) uses data of ABX subprime indexes and finds evidence of contagion in the financial markets, which was propagated via liquidity and risk-premium channels. Beirne et al. (2010) study 41 emerging market economies (EMEs) in Asia, Europe, Latin America, and the Middle East using trivariate VAR GARCH (1,1)-in-mean models to capture a transmission channels: spillovers in mean returns, volatility, and cross-market GARCH-in mean effects. They find that spillovers in variance play an important role in emerging Europe while spillovers in mean returns drive the contagion in emerging Asia and Latin America. In addition, regional spillovers have dominated in Latin America and Middle East while Asia is more exposed to global spillovers. In another study, Lagoarde-Segot & Lucey (2006) have used a fixed effect panel data in investigating whether the MENA markets of Turkey, Israel, Jordan, Lebanon, Tunisia, Morocco and Egypt are exposed to joint vulnerability to common exogenous shocks.

Some other studies have found the major role of interdependence during crises periods. Bodart & Candelon (2009) have studied the impact of Mexican and Asian financial crises among eleven emerging countries in Asia and Latin America, and have evidenced a contagion during both crises. Higher interdependence has led to the spread of the crisis in Asia as the spillover effects have been restricted to the region. Contagion is more regional than global (Glick & Rose, 1999; Kaminsky & Reinhart, 2000). By removing heteroscedasticity-bias from correlations, Forbes & Rigobon (2002) document little evidence of a significant increase in market co-movement during the 1994 Mexican and the 1997 Asian crises. This has been a merely interdependence rather than pure contagion. Some recent studies have discussed how the US economic downturn has an impact on the Asia–Pacific economy via the traditional trade linkage (N'Diaye, Zhang, & Zhang, 2010; Zhang, 2008). Chan, Chao, & Chou (2002) have discovered

that Asian currency crisis in 1997 did spread among countries which have similar and close trade ties. Recently, Neaime (2012) has empirically highlighted the impact of the recent subprime crisis to the emerging MENA equity markets through measuring the correlation in returns and variances within the MENA region, and between MENA and the more developed financial markets of the US, UK, and FR. The study finds the common factors which have partially driven the volatilities of the MENA equity markets. He argues that the transmission of external shocks into MENA countries can be attributed to their higher overall trade openness and by mismanagement in domestic financial and macroeconomic policies. It seems to suggest the role of fundamental linkages, where the persistence of shocks will ultimately depend on the future domestic fiscal/financial policy responses.

So far, these empirical findings still involve an intensive debate as to whether shock transmission channels have been transmitted excessively or fundamental-based linkages. Our study therefore attempts to identify a presence of contagion and mainly to unveil the shocks transmission channels between GCC Islamic equity market and other regions Islamic equity markets on one hand, and between GCC conventional equity market and other regions conventional equity markets on the other. The focus will be the most recent US-born subprime crisis.

2.2. Exploring stock market integration in emerging countries

There are numerous empirical studies which attempt to measure the level of stock market integration across countries. The financial landscape of integration in emerging countries is different as compared to that in developed countries. Kim et al. (2006) find that the financial markets of East Asian countries are less integrated with each other than to the global market. Even though the degree of financial integration in East Asia has recently increased but it is mainly due to the integration with the global market (Jeon et al., 2006). Lee (2008) shows that the degree of regional East Asian financial integration lags trade integration. Specifically, Kawai (2005) mentions the role of foreign direct investment (FDI) and FDI-driven trade, due to the rise in Asian newly industrialized economies' investment, to boost the integration of the East Asian economies. Another study measures the savings-investment correlation whereby although the correlation in East Asia has decreased over time, it is still higher compared to that of the OECD economies, which indicates low capital mobility (Kim et al., 2007). Moreover, through applying the cointegration technique to five equity markets in the ASEAN countries, Click and Plummer (2005) find only one cointegrating vector, implying incomplete integration. Yu, Fung, and Tam (2010) assess the market integration among South Korea, Mainland China, Hong Kong SAR, Taiwan, Japan, Singapore, Malaysia, Indonesia, Thailand, and the Philippines, and find incomplete process of integration, which may be due to the political, economic and institutional aspects across jurisdictions in Asia.

In Middle East, some studies have mentioned that this emerging market still lags behind as compared to developed markets. Darat & Hakim (1997) has assessed price linkages among Arab stock markets (Amman, Cairo, and Casablanca) and their integration with global markets. They come up with the finding that these markets are integrated only within the region but not at the international level. In another study, Bulter & Malaikah (1992) find market inefficiency when they study individual stock returns in Kuwaiti and Saudi Arabian markets. The MENA region, as a part of the emerging markets, are typically much smaller, less liquid, and more volatile than developed markets (Domowitz et al., 1998). Recently, Neaime (2012) suggest that

the MENA equity markets of Egypt, Jordan, Morocco, Tunisia and the UAE have already been integrated with the rest of the world's markets.

Instead of studying the conventional markets, we attempt to investigate the degree of stock market integration among Islamic equity markets. We focus on measuring the co-movements between GCC Islamic equity markets with the rest of the world's markets.

2.3. Empirical studies of Islamic equity markets

Many studies have compared Islamic equity markets to their conventional counterparts. Al-Zoubi and Maghyereh (2007), applying the Risk Metrics, Student-t APARCH and skewed Student-t APARCH, show that the DJIM is less risky than its respective benchmark. Hassan and Tag El-Din (2005) apply duration dependence tests of survival analysis, and find none of the evidence of speculative bubbles for weekly and monthly returns of AMANX, AMAGX and DJIMI. Hakim & Rashidian (2002) use a CAPM and find that the DJIMI performs well as compared to the Dow Jones World Index (DJW), but underperforms the Dow Jones Sustainability World Index (DJS). By capturing the effects of industry, size, economic conditions, and performance measures, some studies show that Islamic indices outperform during bull period but underperform during bear period when investing in growth and small-cap firms (Hussein 2004, 2005; Girard & Hassan, 2005). Other studies have focused on mutual funds' performance, and find that Islamic funds perform averagely similar to other conventional counterparts, and even are subject to multiple regimes (Hassan, Antoniou & Paudyal, 2005; Elfakhani, Hassan & Sidani, 2005; Hassan & Antoniou, 2006; Abdullah, Hassan, & Mohamad, 2007). Hoepner, Rammal, & Rezec (2011) find that Islamic funds from Malaysia or GCC neither significantly underperform their respective benchmarks nor are significantly affected by small-size stocks.

What is lacking in the existing literature is any rigorous econometric study which focuses on investigating market co-movements and unveiling transmission channels within Islamic capital markets, as well as comparing them to their conventional counterparts. Our study therefore is mainly aimed at filling this gap and also, to draw any policy implications on how to enhance Islamic stock market development, including its stability and resiliency.

2.4. Measuring financial contagion

The impact of crises has become extensively discussed in theoretical and empirical studies on how to measure financial spillovers and to discover channels of transmission of shocks across borders. Many studies have proposed the numerous ways of measuring financial contagion and interdependence in crisis period. In particular, the standard time-domain instruments, using econometric techniques, have major difficulty to distinguish fundamental contagion from other shock transmissions, due in part to the problematic task with regard to obtaining good proxies of the influence which comes from macroeconomic fundamentals. The major issue in measuring and testing financial contagion has been well-documented by using numerous econometric techniques to detect co-movements among financial market[2].

[2] They include testing for changes in correlation coefficients (Bertero & Mayer, 1989; King & Wadhwani, 1990; Lee & Kim, 1993; Loretan& English, 2000; Forbes & Rigobon, 2002), ARCH and GARCH models (Hamao et al., 1990; Chou et al., 1994; Chiang et al., 2007; Wang & Thi, 2007; Saleem, 2009; Billio & Caporin, 2010), cointegrating relationships (Longin & Solnik, 1995; Cashin et al., 1995; Yuhn, 1997), probit/logit models (Eichengreen et al.,

In another study, Forbes & Rigobon (2002) have pointed out that previous studies did not correct the correlation measure for heteroscedasticity so that the testing of contagion would become biased. Specifically, Forbes & Rigobon (2002) find little evidence of contagion in major crises periods when they use a heteroscedasticity corrected correlation measure. Some have followed their methods and come up with more or less similar findings (Collins & Biekpe, 2003; Lee et al., 2007). However, this method has recently been criticized with regard to an assumed model in their analysis; therefore the results would become biased (Corsetti et al., 2005; Bartram & Wang, 2005; Pesaran & Pick, 2007). On the other hand, wavelet has an ability to decompose each variable into different frequencies to identify financial contagion and interdependence by associating each to its corresponding frequency component. This approach will avoid the heteroscedasticity bias mentioned by Forbes & Rigobon (2002), given volatility should affect both low and high timescales correlations. Bodart & Candelon (2009) and Orlov (2009) have examined contagion by associating high and low frequencies with contagion and interdependence, respectively. Gallegati (2010) has applied wavelet analysis on the stock market indices of G7 countries, including Brazil and Hong Kong. He found that: (i) international financial contagion between countries can be evidenced during the US subprime crisis, and (ii) these financial contagion effects are scale dependent, where the effects are not homogeneous across scales.

As regards the methodology of our study, to the best of our knowledge, this paper would be the first to expand the frontier of knowledge in Islamic Finance by applying the advanced state-of-the-art econometrics techniques known as wavelet analysis. Wavelets are localized in both time and scale and can be used to decompose any observed variable on scale-by-scale basis in order to analyze the dynamics of co-movements across the different time horizons without losing any information and without having to assume stationary process. This may provide an ability to distinguish between higher frequencies (speculative behaviors, market sentiment, liquidity preferences, cross-border asset trading, etc.) and lower frequencies (economic fundamental). The wavelet coherency also has time-varying property to evaluate the integration progress, structural break, multiple regimes, and so on. Finally, wavelet phase-difference will measure lead-lag relationships in order to capture market dynamics in time-frequency space.

3. Data and methodology

We use daily Islamic equity indices and conventional equity indices in five regions, which include GCC, ASEAN, Asia Pacific, Euro zone, and United States. We also use developed countries index, developing countries index, and world index. The individual indices will be obtained from Dow Jones Islamic Market indices and Dow Jones Total Market indices. In terms of Sukuk (Islamic bond), we obtain the data from Dow Jones Global Sukuk index. LIBOR overnight is collected as a proxy for interest rate benchmark. The length of observation is daily from 30 November 2006 till 10 March 2011. All data are sourced from *Datastream International*.

1996; Baig & Goldfajin, 1999; Kaminsky& Reinhart, 2000), regime switching (Gallo & Otranto, 2008; Baele & Inghelbrecht, 2010; Guo, Chen & Huang, 2011), the factor model (Corsetti et al., 2005; Dungey et al., 2005), outlier test (Favero & Giavazzi, 2002), threshold test (Pesaran & Pick, 2007), the copula approach (Costinot et al., 2000; Rodriguez, 2007), principal components models (Kaminsky & Reinhart, 2000), local correlation (Bjerve & Doksum, 1993; Inci, Li, & McCarthy, 2011), structural breaks (Baek& Jun, 2011), shock models (Samarakoon, 2011), cobreaking analysis (Ahlgren & Antell, 2010), a range-based volatility approach (Chiang & Wang, 2011) and wavelet approach (Gallegati, 2010).

As regards the methodology and after calculating the return series for every individual index, we follow the study of Grinsted et al. (2004) and Aguiar-Conraria & Soares (2011) which apply wavelet coherency in the form of continuous wavelet transform to capture time-varying property of co-movement in time-frequency space[3]. The continuous wavelet transform of a time series x_t with respect to is a function of two variables given by the following convolution:

$$W_x(\tau, s) = \int_{-\infty}^{+\infty} x(t)\bar{\psi}_{\tau,s}(t)dt = \frac{1}{\sqrt{s}}\int_{-\infty}^{+\infty}\left[x(t)\,\bar{\psi}\left(\frac{t-\tau}{s}\right)\right]dt, \qquad (1)$$

where the bar denotes the complex conjugate, τ is the time position or translation parameter controlling its location, *s* is the scale or dilation parameter that controls the width of the wavelet, and $\frac{1}{\sqrt{s}}$ is a normalization factor to make sure that wavelet transforms are comparable across scales and time series.

In terms of the mother wavelet, the most frequent choice is the Morlet wavelet which is given by:

$$\psi_{\omega_0}(t) = \pi^{-\frac{1}{4}} e^{j\omega_0 t} e^{-\frac{t^2}{2}} \qquad (2)$$

The Morlet wavelet is a complex sine wave within a Gaussian envelope while ω_0 is the wave number (see, for example, Adisson (2002) for further details). Commonly, the results are obtained with a particular choice ω_0 equal to 6 as it provides a good balance between time and frequency localization (see, for example, Grinsted et al. (2004)). Aguiar-Conraria & Soares (2011) mention that the Morlet wavelet is frequently used mainly due to four properties: (1) the three sensible ways in converting wavelet scales into frequencies are equal; (2) it has optimal joint time-frequency concentration; (3) the time radius and the frequency radius are equal; (4) it is an analytic wavelet.

Similar with Fourier analysis, several interesting features can be obtained in the wavelet domain. We can define the wavelet power spectrum as:

$$(WPS)_x(\tau, s) = |W_x(\tau, s)|^2 \qquad (3)$$

It measures the relative contribution at each time and at each scale to the time series' variance. Similarly, we can define the cross-wavelet spectrum as:

$$W_{xy}(\tau, s) = W_x(\tau, s)\overline{W_y}(\tau, s), \qquad (4)$$

where $Wx(\tau,s)$ and $\overline{W_y}(\tau,s)$ are wavelet transforms of two time series $x(t)$ and $y(t)$. The cross-wavelet spectrum can be decomposed into real and imaginary parts since the mother wavelet is in general complex. We define the cross wavelet power, as $|W_{xy}(\tau, s)|$, which depicts the local covariance between two time-series at each time and frequency. On the other hand, the wavelet coherency has a major advantage of being normalized by the power spectrum of the two time-series. As in Fourier analysis, we can define wavelet coherency of given two time-series $x(t)$ and $y(t)$ as:

[3] We use wavelet coherence package by Grinsted et al. (2004) using MATLAB

$$R_{xy}(\tau, s) = \frac{|S(W_{xy}(\tau,s)|}{\sqrt{S(|W_{xx}(\tau,s)|)S(|W_{yy}(\tau,s)|}} \quad (5)$$

where S denotes a smoothing operator in both time and scale. We can use wavelet squared coherency to measure the co-movement of two time series over time and across frequencies. Such a wavelet-based measure allows for a richer description on the co-movement between two variables of interest. Similar with the squared coefficient of correlation, $R^2(\tau,s)$ is in the range between 0 and 1 with a high (low) value indicating a strong (weak) co-movement. Hence, by observing the contour plot of the above measure, we can identify the regions in the time–frequency space where the two time series move together and, specifically, assess both time and frequency varying features of the co-movement. We will rely on Monte Carlo simulations for statistical inference.

The use of a complex-valued wavelet is a major advantage that we can compute the phase of the wavelet transform of each series. By computing the phase-difference, we can obtain information about the possible delays of the oscillations of the two series as a function of time and scale/frequency. The phase difference can be defined as:

$$\phi_{x,y}(s,\tau) = \tan^{-1}\left(\frac{\Im(W_{xy}(s,\tau))}{\Re(W_{xy}(s,\tau))}\right) \quad (6)$$

The information on the signs of each part is to determine the value of $\phi_{xy} \in [-\pi, \pi]$. A phase-difference of zero indicates that the time-series co-move at the specified frequency; if $\phi_{xy} \in [0,\frac{\Pi}{2}]$, then the series move in phase with time-series y leads x; $\phi_{xy} \in [-\frac{\Pi}{2},0]$ indicates the leading role of x; a phase-difference is π (or $-\pi$) will be an anti-phase relation; if $\phi_{xy} \in [\frac{\Pi}{2}, \pi]$, then x is leading; time-series y is leading if $\phi_{xy} \in [-\pi, -\frac{\Pi}{2}]$.

4. Results and interpretation

We will attempt to investigate the evolution of variance, co-movement, and lead-lag relationship in time-frequency space among Islamic markets on one hand, and among conventional markets on the other. Our empirical results therefore will be described into several sections as follows.

4.1. The evolution of volatility

Figure 1 shows the continuous wavelet power spectrum for Dow Jones Islamic equity indices of GCC, ASEAN, Asia Pacific, United States, Euro zone, developed countries, emerging countries, and Dow Jones Islamic Market (world).

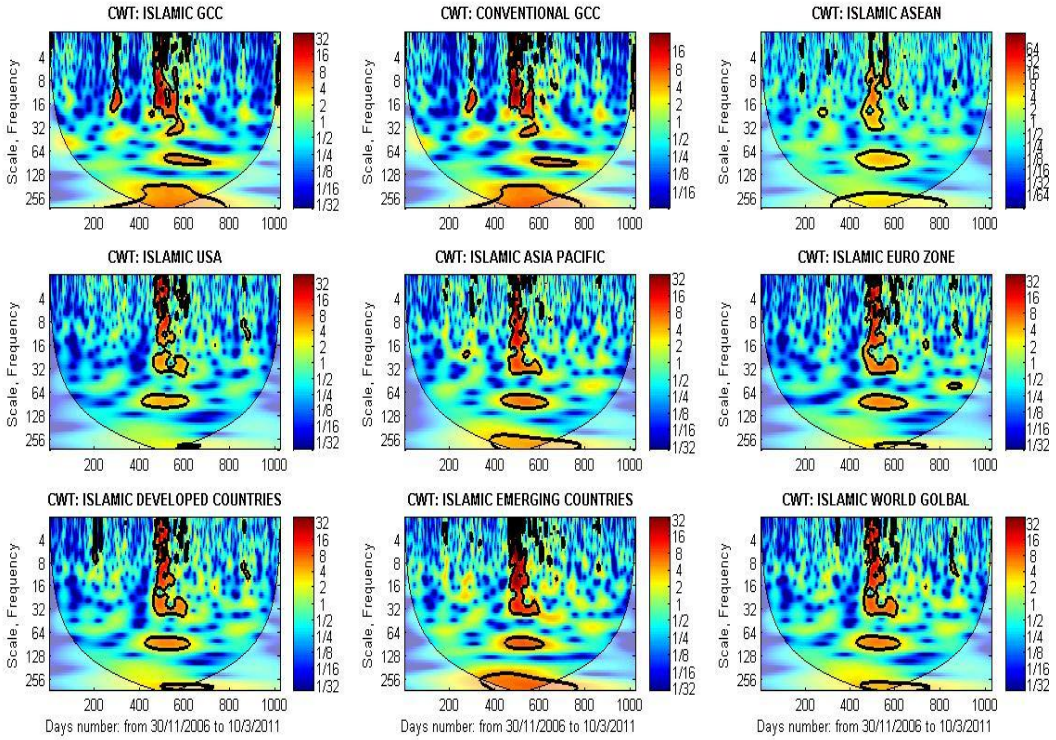


Figure 1. Wavelet power spectrum of Islamic equity indices.
The thick black contour designates the 5% significance level against red noise and the cone of influence (COI) where edge effects might distort the picture is shown as a lighter shade.

The definition of wavelet power spectrum is the absolute value squared of the wavelet transform, which provides a measure of the time series variance at each time and at each scale (frequency). We measure the statistical significance of wavelet power against the null hypotheses of a stationary process with a background power spectrum. As estimated by Monte Carlo simulations using phase randomized surrogate series, the thick black contour in regions designates the 5% significance level (95% confidence level) against red noise. The cone of influence (COI), signaling distortion of the picture by edge effects, is displayed with a lighter shade. We must neglect the areas outside the cone of influence given there is no statistical confidence. The range of power is from blue (low power) to red (high power).

Our plots of wavelet power spectrum have revealed the evolution of variance for all Islamic equity indices along the period 2006-2011. We can clearly evidence structural change of volatility for all the series temporarily, suggesting the important role of crisis at certain period. The wavelet power spectrums of both GCC Islamic and conventional equity indices show a large significant high-power area at 1-16 days frequency-band in the year 2007, attributed to the first stage of US subprime crisis marked by the bursting of the US housing bubble, evaporation of liquidity and investor panic. It may indicate the role of investors' sentiment contributing to short-term shocks to volatility in GCC. Moreover, the GCC Islamic portray a larger area of high-power event relative to GCC conventional, which implies that the Islamic index in this region is more volatile.

When we compare to remaining Islamic equity indices, other region-indices only have a very small medium-power area, thereby indicating that GCC receives a relatively higher impact

from subprime crisis in 2007 through suffering higher fluctuation of stock price. In other words, GCC equity market is more unstable with higher frequency-band (1-16 days) that may imply the presence of short-term shocks (excessive) in the system.

On the other hand, we can clearly see that all Islamic equity indices generally have a significant large power area in 2008 at 1-32 days and 64 days bands. These higher frequencies also infer that Islamic equity markets deal with short-term shocks. The reason can be attributed to the second stage of subprime crisis marked by the Lehman's collapse which has considerably affected the global economic and financial systems. In addition, it seems that ASEAN Islamic equity index is relatively less vulnerable in crisis period since its plot has a relatively smaller high-power area.

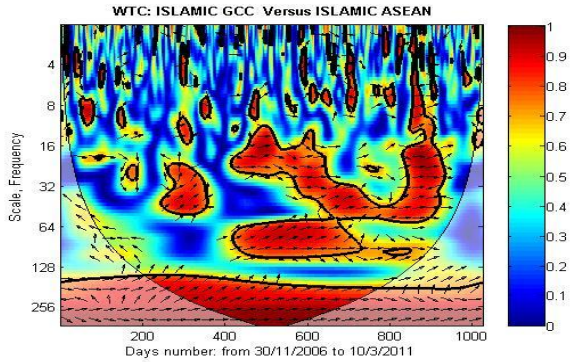
Finally, our plots for all Islamic equity indices have shown a significant high-power area at lower frequency-band (128-256 days) mostly from 2008-2010. Given that the lower frequency-band may represent economic fundamental, it implies that long-term shocks (structural shocks) have taken longer time as compared to short-term shocks within Islamic equity markets. Interestingly, the size of high-power areas are larger for GCC, ASEAN, Asia Pacific, and emerging countries, as compared to those for United States, Euro zone, and developed countries. This evidence tends to suggest that structural shocks are more pronounced in Islamic equity indices in emerging markets. When we turn to GCC, it seems that high-power area (128-256 days) have started earlier in 2007, meaning the structural shock is the largest in this region.

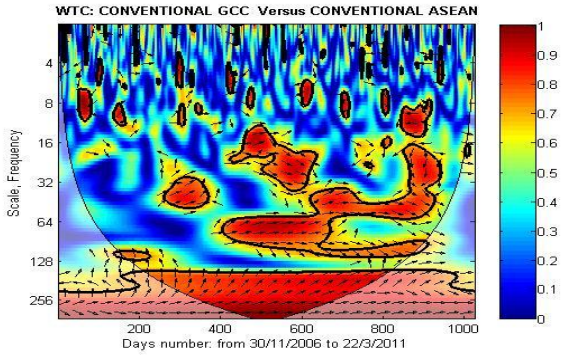
Overall, our finding shows that subprime crisis in United States have generated both long-term and short-term shocks to volatility of all Islamic equity indices. Specifically, GCC Islamic equity index is the most affected by the crisis in 2007 and 2008.

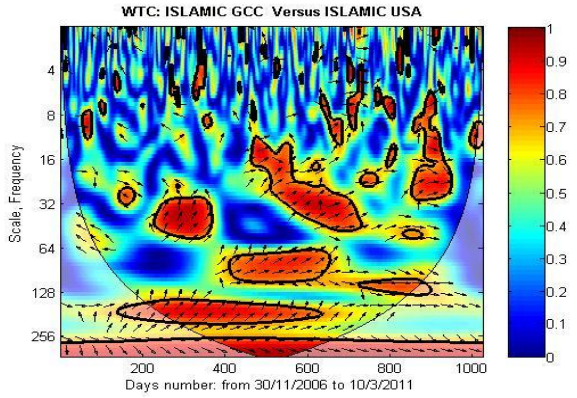
4.2. Stock market integration and financial contagion

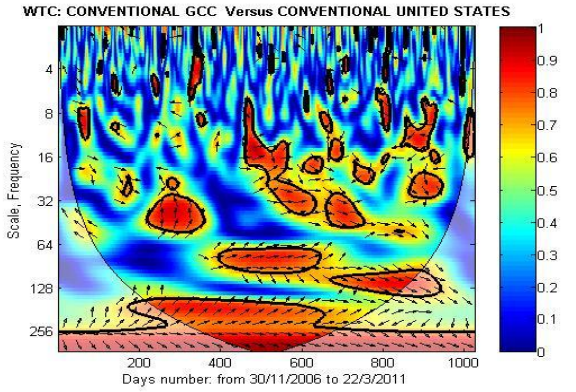
Figure 2 presents wavelet squared coherency and wavelet phase-difference between GCC Islamic equity index and others. Wavelet coherency is displayed through a contour plot. The horizontal axis denotes time component while the vertical axis represents frequency component, which is converted to time units (years). The coherency ranges from blue (low coherency) to red (high coherency) to measure the degree of co-movement. Regions of high coherency between two equity indices indicate strong local correlation. The thick black line in the coherency plots will designate the statistical significant area at 5% significance level estimated from a Monte Carlo simulation[4]. Therefore, the cross-wavelet coherency has a power to investigate varying characteristics of the relationship between index returns in the time–frequency domain. Besides, pointing arrows represent wavelet phase-difference, which reveal the information of lead-lag relationship (market dynamic) in time-frequency space.

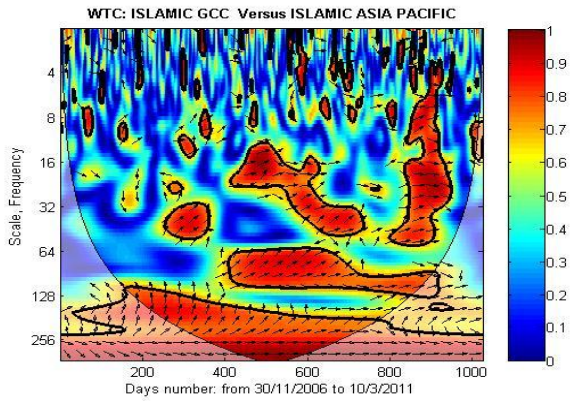
[4] All computations have been performed using Matlab.

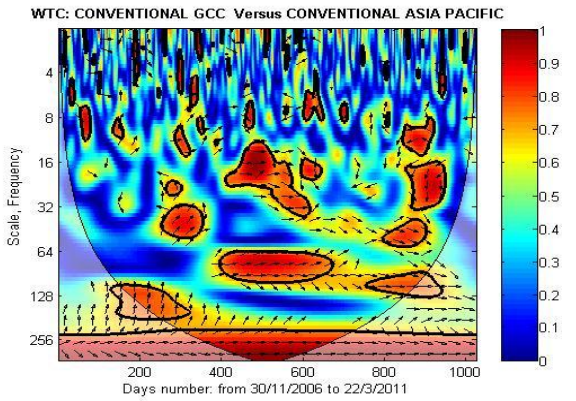

WTC: ISLAMIC GCC Versus ISLAMIC ASEAN
Scale, Frequency
Days number: from 30/11/2006 to 10/3/2011

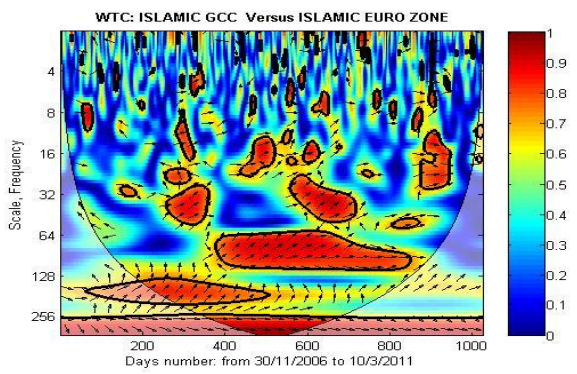

WTC: CONVENTIONAL GCC Versus CONVENTIONAL ASEAN
Scale, Frequency
Days number: from 30/11/2006 to 22/3/2011

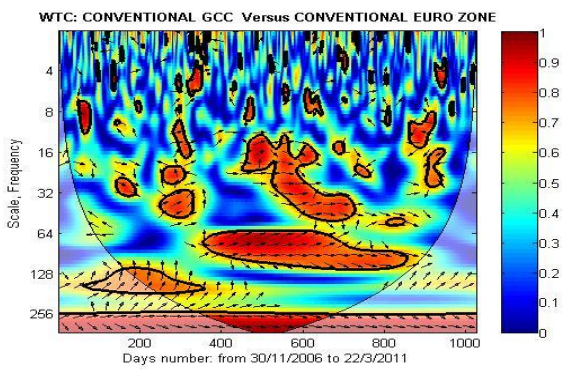

WTC: ISLAMIC GCC Versus ISLAMIC USA
Scale, Frequency
Days number: from 30/11/2006 to 10/3/2011


WTC: CONVENTIONAL GCC Versus CONVENTIONAL UNITED STATES
Scale, Frequency
Days number: from 30/11/2006 to 22/3/2011


WTC: ISLAMIC GCC Versus ISLAMIC ASIA PACIFIC
Scale, Frequency
Days number: from 30/11/2006 to 10/3/2011


WTC: CONVENTIONAL GCC Versus CONVENTIONAL ASIA PACIFIC
Scale, Frequency
Days number: from 30/11/2006 to 22/3/2011


WTC: ISLAMIC GCC Versus ISLAMIC EURO ZONE
Scale, Frequency
Days number: from 30/11/2006 to 10/3/2011


WTC: CONVENTIONAL GCC Versus CONVENTIONAL EURO ZONE
Scale, Frequency
Days number: from 30/11/2006 to 22/3/2011

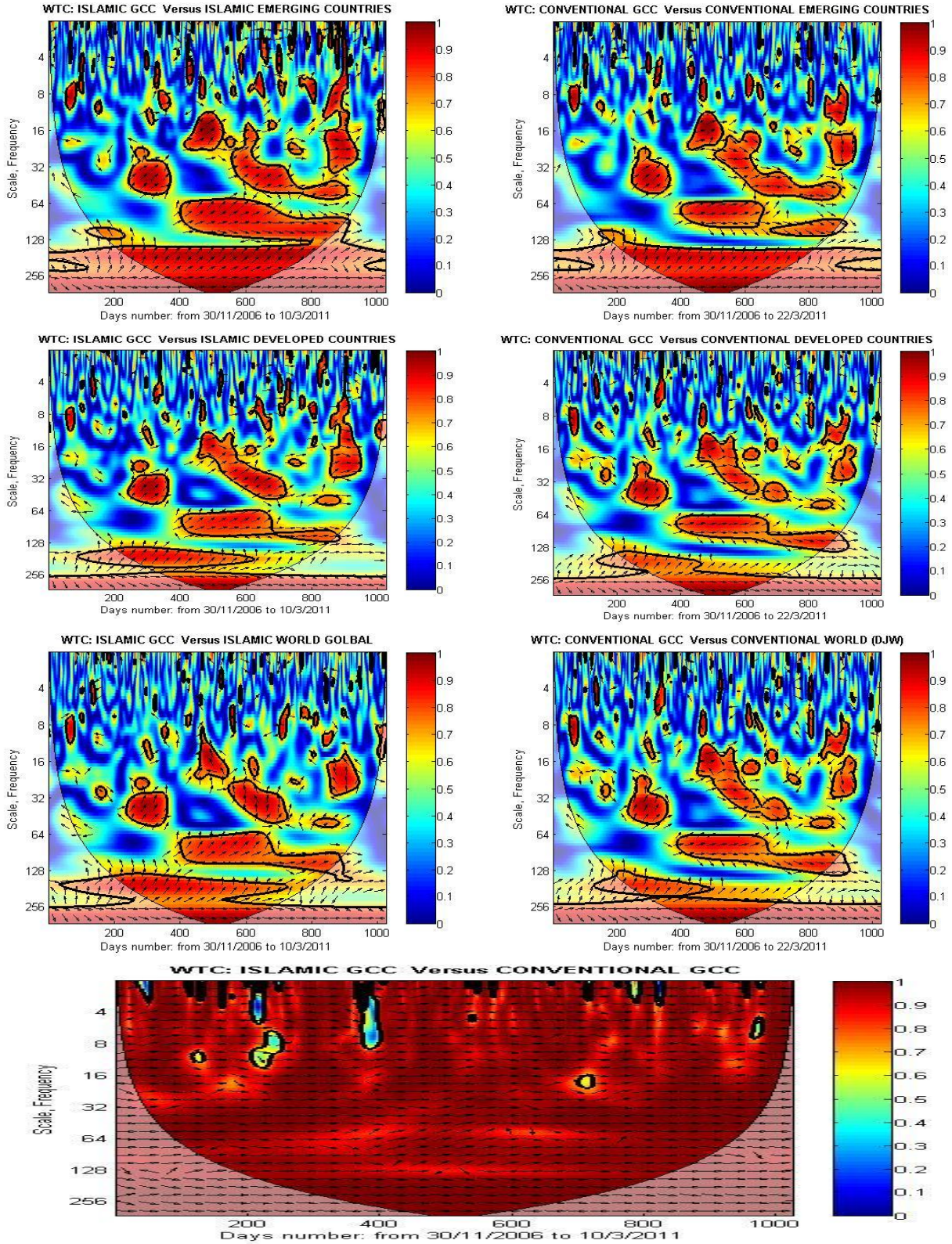


Figure 2. Cross-wavelet coherency and phase plots between GCC equity index and others.

The 5% significance level against red noise is shown as a thick contour. The relative phase relationship is shown as pointing arrows: Right: in-phase; Left: anti-phase; Down: the first series leading the second series by 90°; Up: the second series leading the first series by 90°.

Looking at Figure 2, some important information have emerged and can be drawn intuitively. Firstly, there is a domination of blue (low coherency) areas at bands below 128 days (medium-to-high frequency-bands) for all coherency-plots between GCC Islamic equtiy market and other region-indices. This finding tends to indicate a weak stock market integration between GCC Islamic equity market and others as high frequency-bands might represent short-run market activities, i.e. cross-border trading and listing, liquidity preferences, and so on. Secondly, we find that a high coherency area at low frequency-bands (above 128 days) is spread for entire observations. As a low frequency-band might reveal information of fundamental (real sector, trade-ties, long-run convergence, and so on), our finding may imply that GCC Islamic equity market has strong convergences with other regions-indices. Specifically, GCC Islamic equity market is fundamentally integrated mostly with ASEAN, and followed by Asia Pacific, United States, and Euro zone Islamic equity markets, in that order.

Thirdly, even though medium-to-high frequency-bands (below 128 days) are dominated by low coherency areas, our coherency-plots generally display some high-coherency areas mainly in the year 2007, 2008, and 2010. These periods can be attributed to the first stage of subprime crisis (the bursting housing bubble), the second stage of subprime crisis (Lehman Brothers' collapse), and Euro zone crisis, respectively. These temporary increases of co-movements at higher frequency-bands may indicate reversal funds in dealing with greater uncertainty, which seems to suggest the role of capital outflows due to flight-to-quality. The size of high-coherency areas is relatively larger in 2008 and 2010, signifying the importance of these two crises periods. To discover the transmission channel of shocks, higher frequency-bands (below 128 days) and lower frequency-bands (above 128 days) have increased simultaneously in 2007 and 2008 for co-movements between GCC and Asia Pacific, United States, and Euro zone Islamic equity indices. It tends to imply fundamental-based contagion with shocks that are mainly transmitted by way of fundamental linkages (real sector, trade-ties, etc.). Surprisingly, lower frequency-bands (above 128 days) mostly does not change for coherency-plots between GCC and ASEAN Islamic equity indices, indicating pure contagion with excessive co-movement beyond what fundamental suggest. In addition, there is no evidence of increasing co-movements at lower frequency-bands (above 128 days) in 2010 for all coherency-plots, which means the evidence of excessive co-movement during Euro zone crisis. To obtain the degree of contagion, we can see that contagion in GCC Islamic equity index is the strongest with ASEAN, followed by Asia Pacific, United States, and Euro zone.

From a causal perspective, the wavelet phase-difference shows that the lead-lag relationships between GCC Islamic equity index and others are not homogeneous across frequency-bands, since arrows point right and left, down and up constantly. However, there are some meaningful patterns that can be interpreted intuitively. At higher frequency-bands (below 128 days), we can observe that all region-indices have a leading role against GCC Islamic equity market. It tends to indicate that the source of financial contagion in three crises periods have come from outside GCC, both developed and emerging countries. Interestingly, at lower frequency-bands (above 256 days), GCC Islamic equity market is leading Islamic indices of United States, Euro zone, and developed countries; meanwhile GCC is almost in-phase with indices of ASEAN, Asia Pacific, and emerging countries. This evidence tends to imply that GCC Islamic equity index has a leading role, at fundamental linkages, against developed market. This is attributed to the role of GCC in global oil supply around the globe.

Finally, when we look at coherency plots between Islamic equity markets, as compared to those between conventional equity markets, we can clearly see that they mostly have

demonstrated the same patterns. This tends to indicate that the impacts of crises as well as the degree of integration for Islamic equity markets are more or less similar as those of their conventional counterparts. This finding can be supported by our coherency-plot between GCC Islamic index and GCC conventional index indices that has been dominated by high-coherency areas at whole frequency ranges. This is understandable since *Shari'ah* screening has adopted the principle of tolerance so that Islamic investors would not be at a disadvantage when they want to comply with Islamic rules in their investment. As a result, the movements of Islamic and conventional equity indices more or less tend to be similar.

Interestingly, a few disparities can be evidenced from our coherency plots. Unlike our finding of GCC-ASEAN Islamic equity markets, the contagion between GCC and ASEAN conventional equity markets seems to involve more fundamental linkage rather than merely excessive. For the co-movement of GCC-United States, our plot shows that the increasing longer-run coherency between conventional equity markets is relatively higher than that of Islamic equity markets. This may imply that the conventional index-pair of the two countries is more exposed to greater long-term shocks. On the other hand, we find that the co-movement between GCC and Eurozone Islamic equity markets portrays higher long-term shocks, but with lower short-term shocks, as compared to that of conventional counterparts. This may infer a higher sensitivity of conventional equity markets against a reversal of funds. Lastly, we can see that the index-pair of GCC-Asia Pacific Islamic equity markets is more susceptible to both long-term and short-term shocks than that among conventional ones.

4.3. Flight-to-quality and benchmark

Figure 3 presents wavelet squared coherency and wavelet phase-difference between: (i) GCC Islamic equity index and Global Sukuk index, (ii) GCC Islamic equity index and LIBOR.

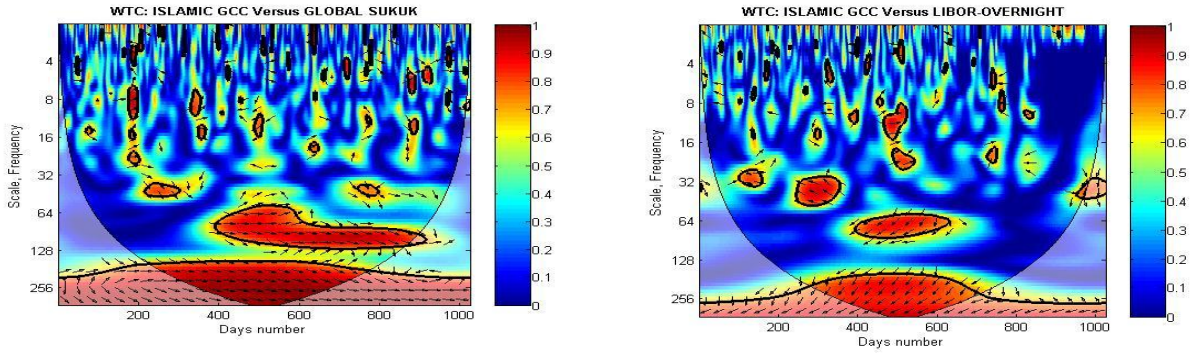


Figure 3. Co-movements with Global Sukuk Index and LIBOR

Cross-wavelet coherency and phase plots between: (i) GCC Islamic equity index and Global Sukuk index, and (ii) GCC Islamic equity index and LIBOR overnight. The 5% significance level against red noise is shown as a thick contour. The relative phase relationship is shown as pointing arrows: Right: in-phase; Left: anti-phase; Down: the first series leading the second series by 90°; Up: the second series leading the first series by 90°.

At coherency-plot between GCC Islamic equity index and Global Sukuk index, we can clearly see a significantly large coherency area at frequency-band 64 days (higher frequencies) in 2008-2010. Moreover, there is a significant increase of coherency at frequency-band above 128 days (low frequencies), which starts from 2007 until 2010. This finding reveals the presence of short-term and long-term shocks in subprime crisis (2007 and 2008) and Euro zone crisis (2010) periods, resulting in temporary co-movement between the two indices. In other words, the

channel of co-movement involves not only excessive (liquidity preference, market panic, portfolio adjustment, etc.) but also economic fundamental. On the other hand, our empirical result shows a positive, rather than negative correlation, between the Islamic equity and Global Sukuk (Isalmic bonds) indices. This tends to indicate that there is no evidence of flight-to-quality for compliant investors to flee from equity (more riskier asset) to Islamic bond (less riskier asset) during market turbulance, given the two assets prices drop simultanously in crises period. Moreover, wavelet phase-difference demonstrates the leading role of GCC Islamic equity index against Global Sukuk index. This is understandable since most of constituent lists of Global Sukuk index contain Sukuk issued in GCC (see Table 1 in the Appendix). Bad economic performance of GCC, reflected by its equity market, therefore will directly affect Sukuk index.

Looking at coherency-plot between GCC Islamic equity index and LIBOR, we may observe a significant high coherency areas at frequency-bands 8-16 days, 32-64 days, and 128-256 days in 2007 and 2008. This implies that the changing of interest rate, to boost the overall demand, in conventional system of developed countries has been used for short-term asset pricing of Islamic equity in GCC. More importantly, we find that GCC Islamic equity index is highly correlated with LIBOR at lower frequency-band above 256 days. This may confirm that LIBOR (conventional rate) has been used as a benchmark for Islamic asset pricing. Low frequency-band co-movement simply means LIBOR has been treated as a discount rate of future cash flows of Islamic equity in fundamental analysis, given the classical asset pricing always deals with a long-run equilibrium framework. To support this evidence, wavelet phase difference demonstrates a leading role of LIBOR negatively against GCC Islamic equity index. The negative relationship between discount rate and asset price is in line with what have been suggested in asset pricing theory.

5. Major summary findings and policy implications

We made an initial attempt to analyze the Islamic equity markets between 2006 and 2011 to examine the multi-horizon nature of co-movement. Continuous wavelet transform, including wavelet power spectrum, cross-wavelet coherency, and wavelet phase difference, are applied to decompose the daily returns and analyze the evaluation of variance, co-movement, and lead-lag relationship in time-frequency space. Our study examines the co-movement of GCC equity index (Islamic and conventional) with other region-indices (Islamic and conventional), as well as between GCC Islamic equity index and Global Sukuk index and LIBOR. The results are plausible and intuitive and have strong policy implications, especially for financial integration and stability in GCC Islamic equity market.

The first finding shows that the most recent US-born subprime crisis in 2007 and 2008 has generated both long-term and short-term shocks to volatility of all Islamic equity indices, where GCC Islamic equity index is the most susceptible. This has been supported by another finding which shows the evidence of fundamental-based contagion between GCC Islamic equity index and others, except with ASEAN. The shocks are transmitted mainly by way of fundamental linkage rather than purely excessive (market sentiment). This is understandable as even though the direct impact from US subprime assets was limited in GCC, the global crisis can be well-explained by a higher overall trade integration of GCC with the rest of the world through the World Trade Organization, the Euro Mediterranean Free Trade Agreements, and other bilateral free trade agreements, rather than at regional level. This fundamental impact may bring

about short-run and long-run turbulences such as a significant drop of stock market capitalization due in part to the plunge in the real estate market, the decline in oil prices and production, higher CDS spreads, liquidity shortages in global financial market, and so on (Khamis et al., 2010). Interestingly, we can see from causal perspective that all sources of contagions have come from the rest of the world to GCC region, given the leading role of remaining Islamic equity markets over GCC Islamic equity market. It tends to signal the vulnerability of GCC Islamic equity market in the globalized economies.

The second finding reveals the evidence of pure contagion between GCC Islamic equity market and ASEAN Islamic equity market during the subprime crisis in 2008, as well as between GCC Islamic equity market and whole world Islamic equity markets in Euro zone crisis period of 2010. The transmission channel is rather excessive unrelated to fundamental, which can be due to investors' behavior during a period of greater uncertainty, i.e. herding, financial panic, loss of confidence, and so on. The shift in investor sentiment will lead to a general reversal of funds and cause capital outflows, becoming a source of fragility. Nonetheless, it seems that the impacts of crises have been demonstrated mostly at frequency band above 16 days. This tends to imply that the reversal of funds is less likely to take place immediately when the crisis begins and could be attributed, amongst other factors, to a weak information linkage, slower adjustment of absorbing negative news, substantial transaction cost, and real-sector stocks.

The third finding shows that there is no evidence of flight-to-quality for compliant investors to flee from equity (more riskier asset) to bond (less riskier asset) during market turbulance, given the prices of the two assets drop simultanously in crises period (positive correlation). Compliant fixed-income securities could not provide financial stability in Islamic capital market in respect to economic downturn. This can be understood if we consider the supply and demand of Sukuk in the global market. On the one hand, the number of Islamic financial institutions is growing rapidly all over the world, such as Takaful, Islamic mutual fund, Islamic banking, etc. They highly need compliant fixed-income securities in order to balance their portfolio well. On the other hand, it seems that there is still lack of Sukuk supply around the globe. Many Sukuk issuances were mostly oversubscribed while Islamic institutions tend to hold them up until maturity. This nature of the industry tends to create illiquid market of Islamic bonds, thus reflecting Sukuk shortage. In addition, another reason can be attributed to constituent lists of Global Sukuk index, which mostly consist of Sukuk issued in GCC (see Table 1 in the Appendix). Bad economic performance of GCC, reflected by its equity market, therefore will directly affect Sukuk index. This evidence can be supported by our wavelet phase difference which mianly shows the leading role of GCC Islamic equity index over Global Sukuk index in the short run and long run.

The fourth finding shows that the natures of co-movements among Islamic equity indices are more or less similar as those among conventional counterparts, which may imply that the two have mostly the same degree of integration as well as the severity of crisis impact. This is understandable since *Shari'ah* screening has adopted the principle of tolerance with the aim that Islamic investors would not be at a disadvantage when they want to comply with Islamic rules in their investment. In addition, the compliant equities are defined merely through a passive *Shari'ah* screening system, where trading of Islamic equities and the behavior of investors in response to shocks are outside the ambit of the screening.

The fifth finding shows the weak stock market integration of GCC Islamic equity market with others. Low (blue) coherency areas have dominated our coherency plots at higher frequency-bands. The less co-movements at this frequency band indicates a low degree of cross-border assets listing and trading, lack of opportunity for liquidity across border, less foreign investments into compliant equities, and so on. This has been confirmed by another result whereby the increasing co-movements at whole ranges of frequency bands are only transitory during economic turbulence, and they generally get back to their equilibrium (weak integration in nature) during crisis recovery. This is understandable as GCC equity market is still relatively less developed. In a previous study, Abdmoulah (2010) examines the evolving efficiency of the GCC markets in relation to the regulatory efforts to develop those markets. He finds insignificant improvement in the efficiency of those markets despite the efforts by regulators. Although the GCC markets implemented important regulations with regard to disclosure and transparency enhancement, the GCC markets are lacking important steps to fix other important aspects that affect market efficiency. For example, the GCC markets are still dependent on individual investors, who are more likely to be less informed, subject to high transaction cost, providers of limited liquidity, and subject to behavioral biases. Masih et al. (2010) had suggested to integrate the GCC markets and to facilitate cross listing, which can enhance liquidity, mitigate thin trading, and provide more depth to the market.

Finally, the sixth finding shows that conventional rate (LIBOR) has a leading role negatively over GCC Islamic equity index. In the industry, Islamic asset pricing refers to conventional rate as there are not enough *Shari'ah* compliant components in other sectors to set new benchmarks. Usmani (1998) has mentioned that a benchmark does not change the basis of a permissible transaction in Islamic teaching and can be used to determine mark-up, profit, or rent. As a benchmark like LIBOR is quoted worldwide and is easily accessible to anyone, anywhere, and at any time, this may provide protection to investors by informing them of a fair price for asset allocation. Simply, it will avoid *ghubn* in the market. However, interest-rate benchmark has caused much debate and criticism in the industry. In particular, Askari et al. (2010) mention that interest rate, when it is not equal to natural rate of return, will be a source of instability of economic system, creating speculative bubbles and recession. Our coherency plot shows the leading role of LIBOR against GCC Islamic equity index not only in the long term (equilibrium of price) but also in the short term during global market downturn. This tends to indicate that Islamic equity market is very sensitive to the monetary tools used in the conventional system in developed countries.

To this end, it is imperative to improve financial development and resiliency in Islamic capital market in GCC. Firstly, as shocks are transmitted via fundamental linkages in GCC, it emphasizes the need to diversify its economy from oil sector into the industrial and services sectors, which eventually will minimize their exposure to external shocks due to their heavy reliance on oil. In addition, it needs to enhance the trade integration at regional level in GCC region to potentially avert the negative impact of the crisis on its economics, and to reduce its fundamental effect of trade channel (Neaime, 2012).

Secondly, it needs to enhance the degree of integration by improving equity market infrastructure and its depth: (i) facilitating cross listing can enhance liquidity, mitigate thin trading, and provide more depth to the market, (ii) restructuring the trading mechanism and

introducing the market maker role in the GCC equity market can reduce transaction cost, excessive volatility, and keep prices closer to their fair value, (iii) expanding equity markets by encouraging public offering by family and public firms to attract more local and foreign savings and to promote the GCC equity market as diversification haven for international investors, and (iv) improving their investment climate through effective financial reforms in order to attract the international funds. The high degree of stock market integration will boost stock market development, where a well-functioning stock market can promote economic growth by fuelling the engine of growth through faster capital accumulation, as well as by improving economic efficiency and productivity through better resource allocation. More importantly, the enhancement of local capital market and investment climate as well as market integration should prioritize on long-term capital flows; therefore, it may potentially minimize the exposures to short-term speculative flows which have been considered as the source of contagions.

Thirdly, it needs to improve financial stability and resiliency of Islamic capital market by: (i) boosting Sukuk supply in order to increase liquidity and (ii) increasing Sukuk issuance around the globe to create well-diversified Sukuk market. Therefore, flight-to-quality may lead Islamic investors to flee from compliant equities to compliant bonds during economic downturn. Finally, Islamic financial industry should create a new benchmark with a rate equal to the natural rate of return of the economy. The solution proposed by Sheikh Taqi Usmani can be adopted to achieve this objective, by creating a common pool that invests in asset-backed instruments like *musharakah, ijarah,* etc, rather than *tawarruq* which still involves controversy. If majority of assets are in tangible form, its units can be traded on the basis of their net asset value on periodical basis. The agreed profit from those assets therefore can be a reference for rate of return.

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APPENDIX

Name	Coupon	Maturity	PAR ($MM)	Quality	Country	Stated Coupon
SIB Sukuk Co Ltd	0.944	10/12/2011	225	BBB	UAE	Floating-rate
Abu Dhabi Islamic Bank	0.936	12/12/2011	800	A	UAE	Floating-rate
Dubai Islamic Bank Sukuk	0.868	03/22/2012	657.5	BBB-	UAE	Floating-rate
Emirates Islamic Bank	0.836	06/12/2012	350	A-	UAE	Floating-rate
QREIC Sukuk LLC	1.074	08/02/2012	300	BBB+	Qatar	Floating-rate
CBB International Sukuk Company	1.151	03/18/2013	350	A	Bahrain	Floating-rate
CBB International Sukuk Company	6.247	06/17/2014	750	A	Bahrain	Fixed-rate
Rak Capital	8.000	07/22/2014	400	A	UAE	Fixed-rate
Petronas Globak Sukuk Ltd	4.250	08/12/2014	1500	A+	Malaysia	Fixed-rate
IDB Trust Services Ltd	3.172	09/16/2014	850	AAA	Supranational	Fixed-rate
TDIC Sukuk Ltd	4.949	10/21/2014	1000	AA	UAE	Fixed-rate
GE Capital Sukuk Ltd	3.875	11/26/2014	500	AA+	United States	Fixed-rate
Malaysia Sukuk Global	3.928	06/04/2015	1250	A-	Malaysia	Fixed-rate
MBB Sukuk Malayan	0.812	04/25/2017	300	BBB+	Malaysia	Floating-rate

Source: Citigroup Index LLC.

Table 1. Constituent lists of Dow Jones Global Sukuk index