Dynamics of islamic stock market returns and exchange rate movements in the ASEAN Countries in a regime-switching environment: Implications for the islamic investors and risk hedgers

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10 August 2017

Dynamics of islamic stock market returns and exchange rate movements in the ASEAN Countries in a regime-switching environment: Implications for the islamic investors and risk hedgers

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Abstract

This research is motivated by the increasing systemic relevance of Islamic finance and Islamic stock markets beyond the borders of Arabia and other Muslim majority territories. It makes the initial attempt to consider the degree to which the five Islamic stock markets in the original ASEAN-5 and their foreign exchange markets are correlated with a view to assessing the feasibility of policy initiatives to enhance ASEAN Islamic stock market integration and the implications for portfolio investors and risk hedgers. We applied a combination of Wavelet transformation model with appropriate regime-switching models to investigate the dynamic linkages between the foreign exchange and Islamic stock market returns for these ASEAN countries (Malaysia, Indonesia, Thailand, Philippines, Singapore). The analysis tends to indicate that stock returns of the ASEAN countries evolve according to two different regimes: a low volatility regime and a high volatility regime, which explains the bearish and bullish market periods. Furthermore, we investigated what evidence Markov switching analysis unfolds in regard to the dynamic linkage between the Islamic stock markets and exchange rate volatility of the ASEAN countries during both the calm and turbulent periods.

This seeks to provide a valuable insight for the Islamic Investors, fund and portfolio managers, and policymakers whether to pay heed to these regime-specific dynamic interactions or not, particularly when they make capital budgeting decisions and implement regulation policies.

Keywords: ASEAN, Exchange Rates, Islamic Stock Markets, Continuous Wavelet Transformation (CWT), Markov Switching

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1.0 Introduction

The profitability of Islamic financial markets has generated judicious interest recently, especially in the wake of the unstable world financial markets. The aftermath of the 2007 subprime crisis in the United States, the 2008–2009 global financial crises (GFC), the 2010–2011 Eurozone debt crises, plunges in global oil prices and its effect on exchange rates has fuelled interest in alternatives to traditional asset classes that might be less affected by large market gyrations and provides for the development of profitable and less volatile portfolio. Hence, the impressive growth of Islamic finance has been accompanied by wide acceptance of Islamic stocks as an asset class. Recent research shows that Islamic stocks are relatively more profitable than non-Islamic (conventional) stocks (Narayan and Bannigidadmath, 2016 ; Ho et al., 2014).

This research is motivated by the increasing systemic relevance of Islamic finance and Islamic stock markets beyond the borders of Arabia and other Muslim majority territories. Also, the need to understand the role of foreign exchange interaction with Islamic stocks in this age of highly integrated international financial markets ushered by the increased cross-border investment in financial assets that is accompanied by foreign exchange exposures. This further highlights the importance of volatility transmission mechanisms, which stems from the fact that they provide insights into asset pricing, risk management and portfolio diversification issues.

Hence, the dynamic linkages between stock prices and exchange rate movements play crucial role in economic growth of any economy, thus attracts significant attention from both the academics and the practitioners. More so, a strong relationship between them would have important implications for economic policies and international capital budgeting decisions because negative shocks affecting one market may be transmitted quickly to another through contagious effects.

In this study we examine the dynamic linkages between Islamic stock markets and foreign exchange (FX) markets in a regime-switching framework. Our focus is on five original ASEAN countries (Malaysia, Indonesia, Thailand, Philippines, Singapore) which represent, the most advanced emerging countries in terms of economic growth and the Islamic stock market development in the ASEAN Economic Community with a combined GDP of over US$2.5 trillion, and average GDP per capita growing by almost 80% to over US$4,000 as at 2015. Over the same period, ASEAN has also become more influential, with widening markets regionally and globally. By 2014, it is Asia's 3rd largest, the world's 7th largest, and among the most advanced integrated markets. With a combined population of over 622 million, ASEAN has a vast consumer base, behind only to China and India globally and over 50% of its population is under the age of 30, making up a large portion of both the current and future workforce in Asia. The results from our study would interest not only policymakers who are concerned with contagious effects and better regulations of these fast growing Islamic markets to promote sustainable economic growth, but also Islamic investors and Islamic fund managers who seek to hedge their investment risks in these ASEAN countries. The presence of foreign exchange turbulences and domestic market uncertainty over the past decade justifies entirely our choice of regime-switching models because, as discussed in subsequent sections, the Islamic stock market and FX markets in the ASEAN countries are effectively linked to each other in a regime-shifting environment.

Specifically, a Markov switching vector autoregressive model (MS-VAR) is used to detect the interactions between stock and FX markets over recent turbulent periods following the Greek debt crises and political turmoil of 2010-2016. The use of this model is motivated by at least three points: 1) This model allows the variance of stock returns to switch across different regimes. 2) The model is able to detect regime dependence in the impact, persistence and asymmetric response to shocks since the conditional variance depends on past shocks and the present and past states of the economy. 3) This model is founded on the assumption that stock returns may shift across different volatility regimes, which is linked to the diverse perceptions and reactions of FX traders and stock market participants to volatility spill overs between FX and equity markets (e.g. Aloui & Jammazi, 2009; Wang & Lee, 2010)

The remainder of this study is organized as follows. Section 2 presents a review of literature, Section 3 presents the methodology of Continuous Wavelets Transformation (CWT) and Markov switching model used in this study. Section 4 describes the data. Section 5 reports and discusses the results. Section 5 concludes the study.

2.0 Review of Literature

The existing literature in financial economics, present two main theoretical explanations for the relationship between stock prices and exchange rates, namely the goods market approach and the portfolio balance approach. The goods market approach states that real exchange rate induces real stock price. Depreciation of real exchange rate will increase the export competitiveness of local firms in terms of lower prices and will increase their sells to other country, which in turn leads to increases in exports and future cash. This will increase the values and stock prices of the firms. Hence, depreciation of real exchange rate will increase real stock price whilst appreciation of real exchange rate will decrease real stock price (Dornbusch and Fischer, 1980; Pan et al., 2007 ; Ülkü and Demirci, 2012; Chkili & Nguyen 2014).

On the other hand, the portfolio balance approach asserts that real stock price affects real exchange rate. A bull stock market will attract inflows of capital from abroad for investment in the stock market. This will increase demand for stocks in the stock market. The higher demand for the stocks will increase stock prices and the inflows of capital from abroad for investment in the stock market will appreciate real exchange rate. Moreover, increase in stock prices will lead to increase in the net-worth of the firms. The firms will expand their production and sale. This will increase aggregate demand in the economy, which will increase interest rate and attract more inflows of capital from abroad. Conversely, a bear stock market will lead to depreciation of real exchange rate (Branson, 1983; Frankel, 1983; Ülkü and Demirci, 2012; Tsagkanos and Siriopoulos, 2013; Moore and Wang, 2014 ; Caporale et al., 2014).

Recently, empirical evidence on the stock price – exchange rate relationship has been documented in numerous studies. Yang and Doong (2004) For instance, find that stock market movements have a significant impact on future exchange rate changes for the G7 countries over the period 1979-1999. More interestingly, they note that stock markets contain a more important informative content than foreign exchange markets. Also, Phylaktis and Ravazolo (2005) demonstrated, from the application of cointegration methodology and multivariate Granger causality test to a group of Pacific Basin countries, that stock and foreign exchange markets are positively linked. Furthermore, Pan, Fok, & Liu, (2007) use a VAR approach to analyze the links between exchange rates and stock markets for seven East Asian countries, and provide evidence of a significant bidirectional relationship between these markets before the Asian financial crisis. Walid, Chaker, Masood, & Fry, (2011) also use a Markov-Switching EGARCH model to investigate the dynamic relationships between exchange rates and stock returns in four emerging countries (Hong Kong, Singapore, Malaysia and Mexico) during both normal and turbulent periods. They provide evidence of regime-dependent links and asymmetric responses of stock market volatility to shocks affecting foreign exchange market. Diamandis and Drakos (2011) examine the long-run and short-run dynamics between stock and foreign exchange markets for four Latin American countries (Argentina, Brazil, Chile and Mexico), as well as their interactions with the U.S. stock markets. These authors find that the two markets in these economies are positively related and the U.S. stock market represents a transmission channel for these links. Lin, (2012) adopts a similar approach to investigate the co-movement between exchange rates and stock prices for several Asian emerging markets, and shows evidence of stronger co-movement during crisis periods, after some economic and policy events such as, market openings and crises are accounted for. More recently, Chkili & Nguyen (2014b), applied regime-switching model approach to investigate the

dynamic linkages between the exchange rates and stock market returns for the BRICS countries (Brazil, Russia, India, China and South Africa) and their findings suggests that stock markets have more influence on exchange rates during both calm and turbulent periods.
However, to the best of our knowledge, there is a paucity in the literature pertaining to the examination of the selected dynamic linkages between Islamic stock markets and foreign exchange (FX) markets in a regime-switching framework.

The Islamic stock market, which is one of the important branches of the Islamic capital market whereby its components and activities are based on Islamic law, which is based on venerable sources and approved by the Fiqh Ulama (Mohd Hussin and Muhammad; 2013). The Islamic stock market has been established based on 5 main principles of operation: preventing any practice of usury, sharing risks, preventing widespread speculation, compliance with the stated contract and the activity implemented must be legal in the Shariah aspect (Bacha; 2004). The guidelines governing the Islamic stock markets are derived from the main sources of Islam, namely the holy Quran and Sunnah (traditions of Prophet Muhammad). In applying the relevant guidelines to the concrete context of the stock market, Islamic scholars embark on a comprehensive assessment of the appropriate guidelines from these sources and establish basic doctrine that govern the rights and obligations of the players in the Islamic stock markets. Besides the main sources, ijtihad (exertion or logical deduction) is also involved in the shari'ah rulings (Kassim, 2010).

3.0 Methodology

3.1 The Continuous Wavelet Transformation Model(CWT)

Wavelet analysis is a powerful mathematical tool for signal processing in the time-frequency domain that overcomes the main limitations of the Fourier transform (Ferrer, Bolós, & Benítez, 2014). As stated in Dewandaru, Masih, & Masih, (2016), due to its flexibility, wavelet analysis is extensively used in disciplines such as geophysics, medicine, climatology or astronomy, although its application in economics and finance is a relatively new phenomenon.

A wavelet is a small "wave packet" that grows and decays in a limited time period. It is given by a function ψ in L2(ℝ) centered at the origin (more or less), with zero average and normalized. A family of daughter wavelets ψu , s(t) can be obtained by simply scaling and translating ψ:

$$\psi_{u,s}(t) := \frac{1}{\sqrt{s}}\psi\left(\frac{t-u}{s}\right),$$

Equation 1

where s is a scaling parameter that controls the length of the wavelet, and u is a location parameter that indicates where the wavelet is centered. Given a signal x(t) inL2(ℝ), its continuous wavelet transform CWT with respect to the wavelet ψ is a function of two variables.

equation(2)

$$W_x(u,s) := \int_{-\infty}^{+\infty} x(t)\psi^*_{u,s}(t)\mathrm{d}t,$$

Equation 2

where $*$ denotes complex conjugation. It represents the frequency components (or details) of x(t) corresponding to the scale s and time location u, providing a continuous time-frequency decomposition of x(t), while the discrete wavelet transform (DWT) uses a specific subset of discrete scale and location values.

The CWT by its very nature, contains a large amount of redundant information on the original signal that makes it much easier to interpret the empirical results as it provides a more visually intuitive output. As argued by Grinsted, Moore, & Jevrejeva (2004), the CWT is better for feature extraction purposes, while the DWT is more useful for multi-resolution analysis, particularly for noise reduction and data compression. For a long time, the discrete wavelet analysis has prevailed in economic research (Gallegati, 2008, Hacker et al., 2014, Jammazi, 2012, Reboredo and Rivera-Castro, 2014a and Reboredo and Rivera-Castro, 2014b) due to its greater simplicity and more parsimonious nature. However, in recent years the continuous wavelet analysis has also become very popular in the economic-finance literature (Aguiar-Conraria and Soares, 2014, Jiang et al., 2015, (Dewandaru et al., 2016). One of the major benefits of the CWT is its ability to describe localized co-movement between two time series in the time-frequency space through the use of cross-wavelet tools.

Several types of wavelet families with different characteristics are available in the literature. The application presented here utilizes the Morlet wavelet because it is the most commonly used wavelet and implies a very simple inverse relationship between scale and frequency. Moreover, the Morlet wavelet is a complex wavelet that can be decomposed into real and imaginary parts. This feature allows separation of amplitude and phase of the signal under study, providing more information about synchronization and delays between two time series. The Morlet wavelet was introduced by Goupillaud, Grossman, & Morlet (1984) and can be defined as $\psi(t) = \pi - 1/4 e i\omega 0 t e - t2/2$, where $\omega 0$ denotes the central frequency of the wavelet. We set $\omega 0 = 6$ since this choice provides a good balance between time and frequency localization and it is very often employed in economic and financial applications.

In order to detect and quantify relationships between time series, two cross-wavelet tools, introduced by Torrence & Compo (1998) within the framework of the CWT, can be used, namely the wavelet coherence and wavelet phase-difference. According to Torrence & Webster (1999), the wavelet coherence between two time series x(t) and y(t) is defined by.

$$R^2(u,s) = \frac{\left|S\left(s^{-1}W_{xy}(u,s)\right)\right|^2}{S(s^{-1}|W_x(u,s)|^2)S\left(s^{-1}\left|W_y(u,s)\right|^2\right)},$$

Equation 3

where $Wxy(u, s) := Wx(u, s)Wy*(u, s)$ is the cross-wavelet spectrum ($*$ indicates the complex conjugate), and S is a smoothing operator in both time and frequency. The wavelet coherence (3) ranges from 0 (no correlation) to 1 (perfect correlation) and is analogous to the squared correlation coefficient in linear regression. This concept is particularly useful for determining the regions in the time-frequency domain where two time series have a significant co-movement or interdependence.

In spite of its usefulness for measuring the strength of the linkage between any two time series in the time-frequency space, the wavelet coherence is able neither to determine the sign of this link nor to identify lead–lag relations between the two series. This problem can be solved by using the wavelet phase-difference, which characterizes possible delays in the oscillations between the two series, providing information on lead–lag effects as well as the sign of the association. Following Torrence & Webster (1999), the phase-difference is defined by

$$\phi_{xy}(u,s) = \tan^{-1}\left(\frac{\Im\left(S\left(s^{-1}W_{xy}(u,s)\right)\right)}{\Re\left(S\left(s^{-1}W_{xy}(u,s)\right)\right)}\right),$$

Equation 4

where $\Re$ and $\Im$ represent the real and imaginary parts, respectively.

The phase information is graphically displayed on the same figure that the wavelet coherence by plotting arrows inside the regions characterized by high coherence. A phase-difference of zero indicates that the two time series move together at the specified frequency. Arrows point to the right (left) when the two time series are in phase (anti-phase). When the two series are in phase, they move in the same direction. Anti-phase means that the two series move in the opposite

direction. Arrows pointing up suggest that the first time series leads the second one, while arrows pointing down indicate that the second series leads the first one.

3.2 The Markov switching models

Following Hamilton, (1996), a time-series variable yt can be modeled by a Markov switching autoregressive of order p (MS-AR) with regime shifts in mean and variance as follows

$$y_t = \mu(s_t) + \left[\sum_{i=1}^{P} \phi\,(y_t = \mu(s_{t-i}))\right] + \sigma(s_t)\varepsilon_t$$

Equation 5

where ϕi are the autoregressive coefficients. μ and σ are the mean and standard deviation depending on the regime St at time t. yt represents the Islamic stock market returns of the ASEAN countries. This MS-AR framework allows us to not only detect potential regime shifts in the stock market returns, but also investigate the impact of crises on the stock market volatility.

As we are concerned by the relationships between Foreign Exchange and Islamic stock markets in the ASEAN giant countries, the MS-VAR model developed by Krolzig, (1998) is a suitable approach. This model is a generalization of the MS-AR model of Hamilton (1989) we presented above. The MS-VAR model can be written as follows

$$r_t = \alpha + \sum_{k=1}^{l} \alpha_{2j}\,(s_t) r_{t-k} + \sum_{k=1}^{l} \alpha_{3j}\,(s_t) e_{t-k} + v(s_t) u_{r,t}$$

Equation 6

$$e_t = \beta_1 + \sum_{k=1}^{l} \beta_{2j}\,(s_t) e_{t-k} + \sum_{k=1}^{l} \beta_{3j}\,(s_t) r_{t-k} + v(s_t) u_{e,t}$$

Equation 7

where rt and et denote the stock market and exchange rate returns for each country, respectively. ut is the innovation process with a variance v(st) depending on regime St which is assumed to follow an irreducible ergodic two-state Markov process, defined by the transition probabilities pij between states as follows:

$$P_{ij} = P[S_t = \frac{j}{S_{t-1}} = i] \text{ with } \quad P_{ij} = P[S_t = \frac{j}{S_{t-1}} = i]$$

Equation 8

where

$$\begin{cases} P_{11} = P(S_t = 1 | S_{t-1} = 1) \\ P_{12} = 1 - P_{11} = P(S_t = 1 | S_{t-1} = 2) \\ P_{21} = 1 - P_{11} = P(S_t = 2 | S_{t-1} = 1) \\ P_{22} = P(S_t = 2 | S_{t-1} = 2) \end{cases}$$

Equation 9

Overall, the MS-VAR model is flexible enough to capture the potential of regime shifts in the data generating processes of stock and exchange rate returns, to the extent that financial markets have experienced several periods of important instabilities and long swings over the last three decades. Ignoring the importance of structural breaks in explaining the dynamics of stock returns and exchange rates may lead to misleading conclusions about their time-varying behaviour and interactions. (Krolzig, 2000) notes that taking the regime-switching features of economic processes into account might lead to better forecasting devices than time-invariant linear models and traditional robustifying methods (e.g., differencing, intercept correction and multistep estimation) in case where breaks recur in a systematic and stochastic pattern.

4.0 Data

Our dataset consists of weekly stock prices and US dollar exchange rates for five ASEAN giants countries (Malaysia, Indonesia, Thailand, Philippines and Singapore). The sample period spans from 3rd January 2010 to 27th March 2016. The US dollar exchange rate series represent the amount of US dollars per one unit of local currency and are extracted from Datastream International currencies. Islamic stock market data are obtained from the FTSE Russell and Thomson Reuters Datastream international and are expressed in local currency. The weekly continuously compounded returns are computed by taking the difference in the logarithm of two consecutive prices.

Table 1 reports summary statistics and unit root tests for the return series. On average, stock market returns are higher than the returns on exchange rates for all countries, but they are more volatile as indicated by the associated standard deviations. The Malaysian Islamic stock market is the least volatile (1.43%) among the Islamic stock markets of the ASEAN, while the Jakarta Islamic market of Indonesia is the most volatile (2.80%). The exchange rate volatility varies between 1.125% for Malaysia and 0.685% for Thailand.

We also perform the Augmented Dickey-Fuller unit root test and report the results in the last column of *Table 1*. We see that all the return series are stationary at the 1% significance level. They are thus appropriate for further statistical analysis.

Descriptive statistics and unit root tests

Panel A: Exchange Rate in USD

	Mean %	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	ADF
Malaysia (MYR)	0.0577	1.1253	-0.5722	9.1905	536.67*	-17.5226*
Indonesia (IDR)	0.1104	0.9700	-1.5298	19.3092	3728.7*	-17.2136*
Philippines (PHP)	0.0035	0.7151	0.5038	4.2522	34.983*	-17.9144*
Thailand (THB)	0.0199	0.6849	-0.0776	4.3622	25.453*	-16.0145*
Singapore (SGD)	-0.0032	0.8308	0.4361	6.0107	133.045*	-17.776*

Panel 2: Islamic Stock Returns

	Mean %	Std. Dev.%	Skewness	Kurtosis	Jarque-Bera	ADF
EMAS Shariah (Malaysia)	0.11	1.43	-0.372664185	5.18405772	72.1178*	-17.1695*
Jakarta Islamic (Indonesia)	0.12	2.80	-0.397626677	5.314514037	79.6091*	-23.2641*
PSE (Philippines)	0.24	2.29	-0.498009551	4.220761597	33.6146*	-18.6336*
FTSE SET Shariah (Thailand)	0.10	2.48	-0.324561245	3.796265212	14.2919*	-12.1123*
FTSE SGX Shariah (Singapore)	0.07	2.08	-0.264650968	4.999406541	51.6899*	-17.6121*

Notes: JB is the Jarque-Bera test statistics for normality. ADF is the Augmented Dickey-Fuller unit root tests. * indicates that the null hypothesis is rejected at the 1% level

Table 1:Descriptive statistics and unit root tests

5.0 Results

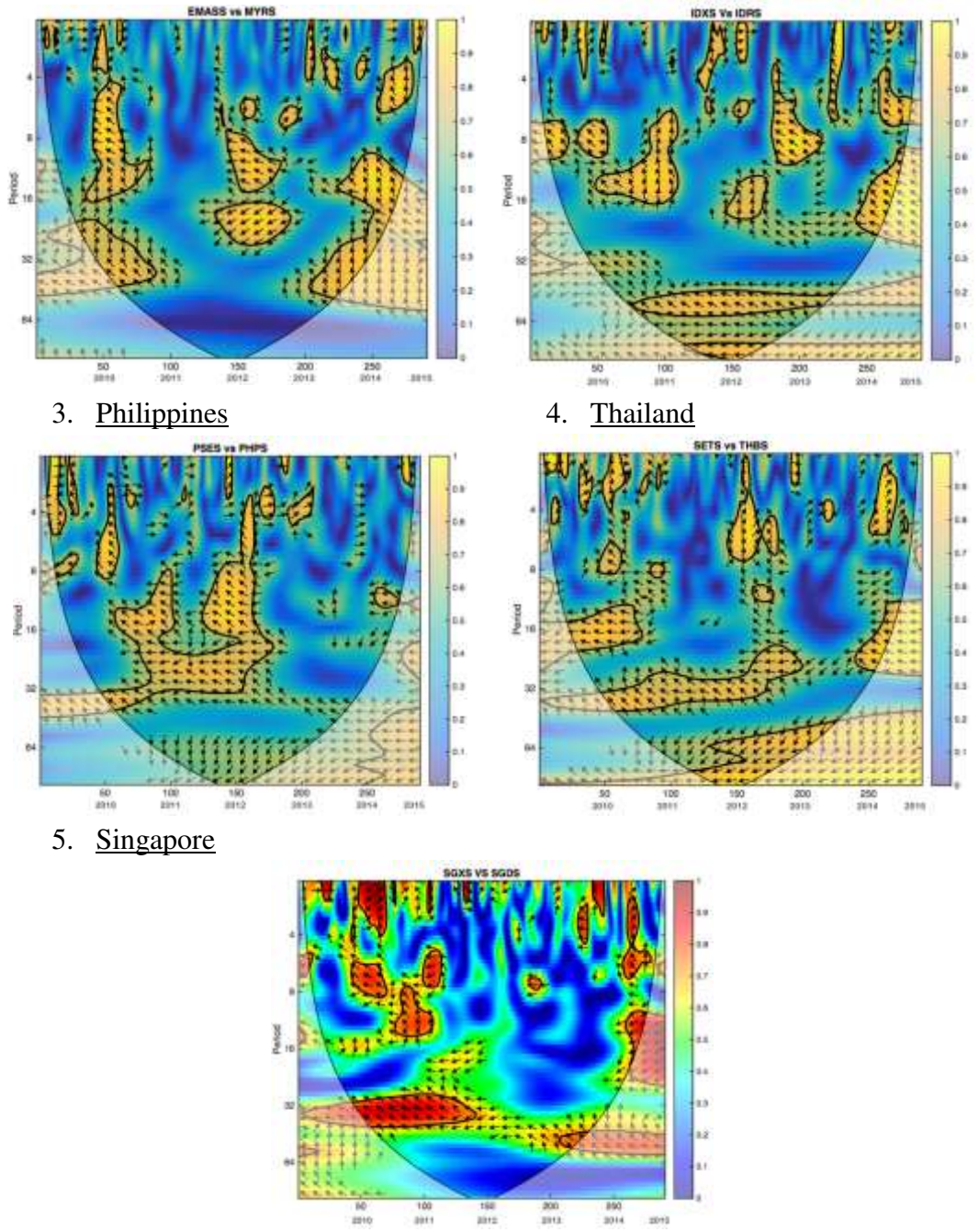
5.1 Islamic Stock and Foreign Exchange Market: Wavelet Analysis

Following the recent study by Dewandaru et al., (2016) in the context of Asian equity markets, in this section our study also uses wavelet coherence in the continuous form to decompose the series. As stated by Dewandaru et al., (2016), the advantage is that we may extend our decomposition to obtain more frequency bands (timescales) in longer horizon. This may provide robustness in discovering the evidence of: (i) pure contagion without relation to a sudden stop described in our previous empirical results; and (ii) fundamental-based contagion in multiple frequency bands rather than only in one smooth timescale. Wavelet coherence also applies a rolling-window in a multi-horizon nature.

According to Dewandaru et al. (2015), in interpreting the result of wavelet coherence and phase-difference in the field of finance and economics, we should be aware that the leading role of one market over another market does not necessarily mean that there is a specific causality between the two. We should interpret with caution that the two markets, in fact, co-move with one market taking a leading role over another. To explore further whether it implies any causation, we commonly need to investigate several channels of transmission, according to the documented theoretical and empirical studies, and are estimated using Granger causality in a multivariate framework. Since we focus on measuring market co-movements in a bivariate framework, this is therefore beyond the scope of our study, which may be a subject for future research.

Figure 1 presents wavelet squared coherency and wavelet phase-difference between changes in Islamic stocks return and exchange rate for each of the ASEAN-5 countries. Following standard practice in the literature, the wavelet coherence is presented by using contour plots as it involves three dimensions: frequency, time and wavelet coherence power. Frequency and time are represented on the vertical and horizontal axes, respectively. With the aim of easing interpretation, the frequency is converted into time units (years) and it ranges from the highest frequency of one week (top of the plot) to the lowest frequency of 64 weeks (5 quarters) at the bottom of the plot. The wavelet coherence is depicted by colour ranging from blue (low power) to Gold Yellow (high power). The Gold Yellow colour simply means that the two series have high common power. Intuitively, the two series experience the same high volatility regime.

The thin black line represents the cone of influence below which edge effects become important. Hence, values outside the cone of influence should be interpreted very carefully. The thick black line isolates regions where the wavelet coherence is significant at the 5% level estimated from the Monte Carlo simulations.



Cross Wavelet Transform

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: Country's Islamic stocks return leading Country's Exchange rate by 90°; Up: s Country's Exchange rate leading Country's Islamic stocks return by 90°. The yellow-Gold colour denotes high power spectrum.

Figure 1: Cross Wavelet Transformation for ASEAN Islamic Stock Market and Foreign Currency Market

Result shows that, in all cases, the variables exhibit less coherence(an increase/decrease of the Islamic stock and Foreign markets) in the short run (first four weeks) and more coherence in the long run. In general, for the entire analysed period, the colour code shows that the co-movements between series are more persistent in the long-run (32-64 weeks cycles). In the short-run, the direction of the contagion cannot be identified.
Over the medium-run (8-16 weeks cycle), over the period 2010–2015, the coherence is not persistent but in case of co-movement, the Islamic stock market is leading the foreign exchange. Over the long-run (64 weeks cycle), all cases exhibit coherence with Islamic stocks leading the exchange market except for the case Malaysia and Singapore where the is no coherence at that period. However, both markets are in anti-phase most of the medium and long-run.

The above result of the continuous wavelets transformations (CWT) is to establish the simple dynamic relationship between our Islamic stock and foreign exchange markets which is consistent with literature on the non-Islamic stock markets. The following section shows more interesting findings on the dynamic link between the two markets in a regime switching environment are presented in the next sub-sections.

5.2 Regime shifts in the Islamic stock markets

Following Chkili & Nguyen, (2014b), in examining the relationships between stock and exchange markets in a regime-switching environment, the first step in our empirical investigation consists of verifying whether stock returns of sample markets exhibit regime-switching behaviour. For this purpose, we proceed to test the null hypothesis of no regime shifts (i.e., the dynamics of stock returns is better reproduced by a linear autoregressive model) against the alternative of regime switching model which corresponds to a MS-AR model. Formally, the likelihood ratio test (LR) developed by Perron, (2007) is used to make final choice of suitable modelling approaches. This test is computed as follows

$$LR = 2 \times |lnL_{MS-AR} - lnL_{AR}$$

where lnL is the log likelihood of the competing models. The best-suited model is selected on the basis of Davies (1987) critical values. As shown in Table 2, the LR test statistics are significant in all cases at the 1% level. These results lead us to reject the null hypothesis of no regime shifts for the stock markets in the ASEAN countries, which means that the time-varying behaviour of these markets is better described by the nonlinear MS-AR model. Previous studies, (Chkili & Nguyen, 2014a; Kanas, 2008; Walid et al., 2011; Wang & Lee, 2010) found similar results for other emerging markets. From a theoretical point of view, this behaviour is expected and can be explained by the changing economic structure in these markets owing to structural economic reform policies (financial liberalization, tax system adjustments, competition policy) as well as the occurrence of successive economic and financial crises at both regional and international levels.

LR test statistic results

	lnL (AR)	*lnL (MS-AR)*	*LR*
Malaysia	909.1769	937.2637	56.1736***
Indonesia	681.2424	716.3986	70.3124***
Philippines	760.7075	782.7316	44.0482***
Thailand	736.2662	754.2956	36.0588***
Singapore	702.8674	733.9293	62.1238***

Notes: *** denote the null hypothesis of no regime shift is rejected at the 1% significance level.

Table 2: LR test statistic results

The MS-AR models are then estimated for each of the sample stock markets and the estimation results are reported in Table 3. A close look at the standard deviations shows that they are highly significant for all markets and that their values clearly indicate the existence of two different regimes. The first regime, referred to as regime 1, is characterized by a high volatility level and the second regime (regime 2) displays a low volatility level. For all cases, the volatility of regime 1 is at least two times higher than that of regime 2. Among the ASEAN Islamic stock markets, Indonesia and Thailand have the highest volatility in both the low and high volatility regimes. Table 3 also indicates that the probability of being in regime 1 is higher than the probability of staying in regime 2, regardless of the markets. Indeed, the probability of being in the high volatility regime (turmoil) 1 ranges from 0.809 (Thailand) to 0.938 (Indonesia), while the probability of being in low volatility regime is comprised between 0.805 (Indonesia) and 0.9927 (Singapore). The magnitude of these probabilities (P11 and P22) suggests that the high volatility (turmoil) regime is more persistent than the low volatility one, or in other words, the Islamic stock markets of ASEAN giant countries stay longer in regime 1 than in regime 2. This finding is fully confirmed by the average duration in weeks for each regime (d1 and d2). The results show that the high volatility regime lasts, on average, between 16.21weeks in Indonesia and 5.23 weeks in Thailand. On the other hand, the average duration of the low volatility regime is 13.66 weeks in Singapore, followed by 8.79 weeks in Thailand, 6 weeks in Philippines and 5 weeks in both Indonesia and Malaysia.

Estimation results for the MS-AR model

	EMAS Shariah (Malaysia)	Jakarta Islamic (Indonesia)	PSE (Philippines)	FTSE SET Shariah (Thailand)	FTSE SGX Shariah (Singapore)
Const(1)	0.002103*(0.0011)	0.003505*(0.0014)	0.005956**(0.0013)	0.007258**(0.0018)	-0.004758*(-0.0035)
Const(2)	-0.00097(0.00289)	-0.921 (0.773)	-0.220 (0.266)	0.358 (0.297)	0.00311(0.001063)**
AR1	0.010791(0.293726)	-0.218426(0.062095)	-0.10109(0.0599)	-0.121551(0.063972)	-0.013 (0.037)
L(S1)	-4.680353**(0.0927)	-0.004782(0.00464)	-0.0045(0.00392)	-0.002746(0.002481)	-3.481473*(0.1001)**
L(S2)	-3.869148(0.1170)	-3.165148(0.14184)	-3.448(0.1044)	-3.537059(0.067964)	-4.329956(0.08165)
P11	0.907	0.938	0.910	0.809	0.838
P22	0.815	0.805	0.825	0.886	0.927
d1	10.77227	16.21161	11.08712	5.233877	6.172314
d2	5.418655	5.131721	5.716511	8.798678	13.66818
logL	937.2637	716.3986	782.7315972	754.2956	733.9293

Notes: standard deviations are reported in parentheses. *d1* and *d2* are the average durations for the stock market to be in regime 1 and in regime 2, respectively. ***, **, * indicate that the estimated coefficients are significant at the 1%, 5% and 10% levels, respectively. p-values are given in brackets.

Table 3: Estimation results for the MS-AR model

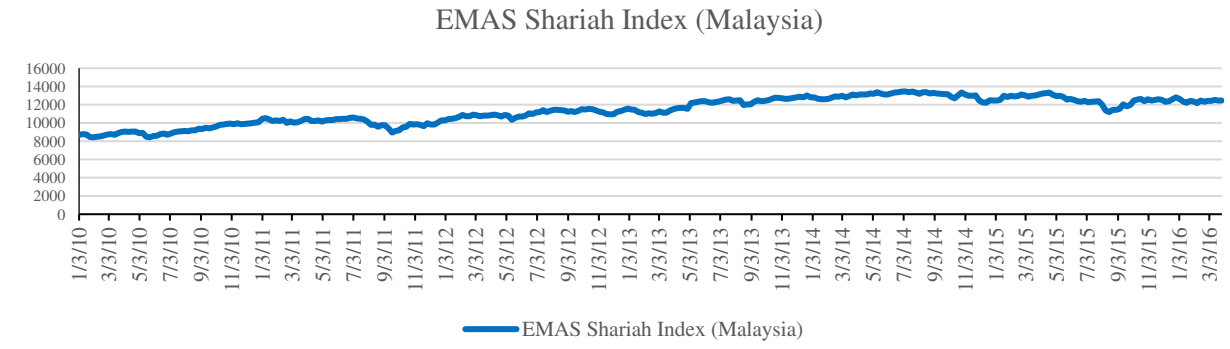
Figure 1 displays the stock market index, stock market returns and the smoothed probability of being in regime 2 for the five countries under consideration. The upper graphs show that the stock markets in the five major ASEAN countries share several points in common. It can be noticed that they experienced a lower level n the wake of 2010 and might not be attractive for both domestic and foreign investors. With a critical look at the historical data, an upward trend is then observed to have been maintained in all countries until late 2011 and early 2012 which coincides with the Greek debt crises. These stock markets with the exception of the Malaysian EMAS, experienced a slight fall in 2014, owing to the cumulative impact of the US subprime market and the subsequent global financial crisis.

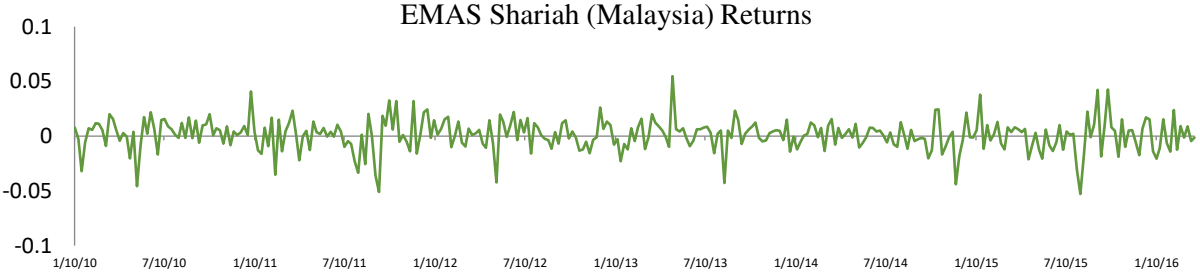
Overall, the time-variations in market indices suggest that the ASEAN Islamic markets have not been decoupled from major external economic and financial shocks, and they tend to fluctuate strongly in response to these shocks.

The smoothed probability of staying in regime 1 (high volatility state), which is displayed in the middle graphs, shows several high volatility periods that are common to all markets. These periods cover particularly the Greek crises in 2011-2012 and the recent oil price plunge.

The ASEAN-5 individual Islamic stocks market movement and their respective regime switching behaviour are shown in the figures below.

a. Malaysia





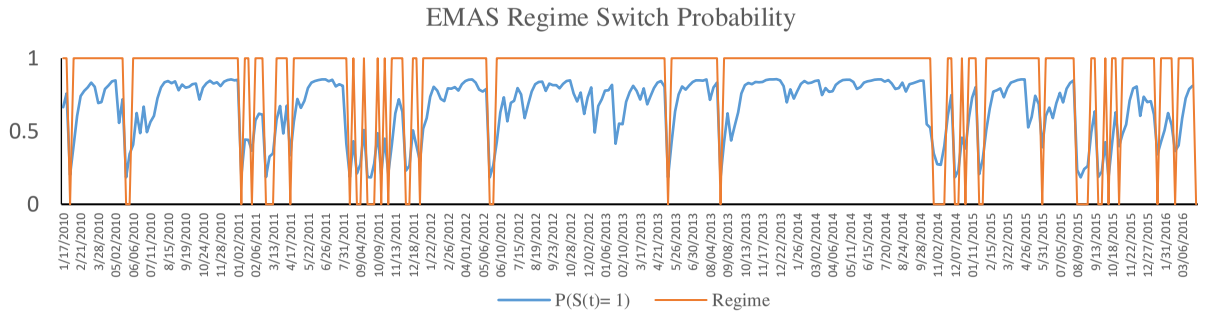
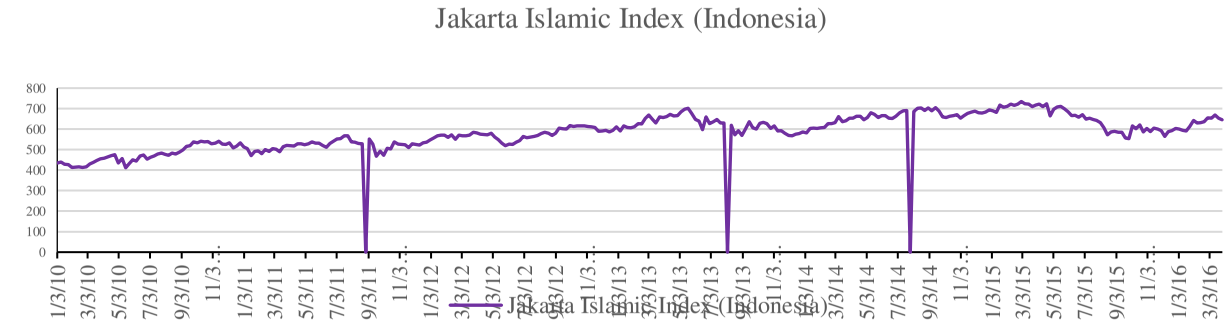


Figure 2:Stock market indices, stock market returns, and smoothed probability for high volatility regime for Malaysia

b. Indonesia



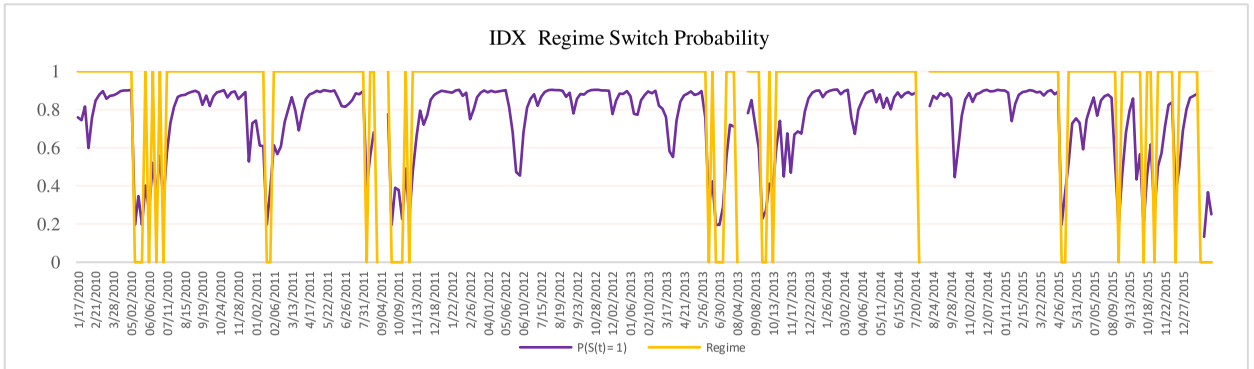


Figure 3:Stock market indices, stock market returns, and smoothed probability for high volatility regime for Indonesia

c. Philippines

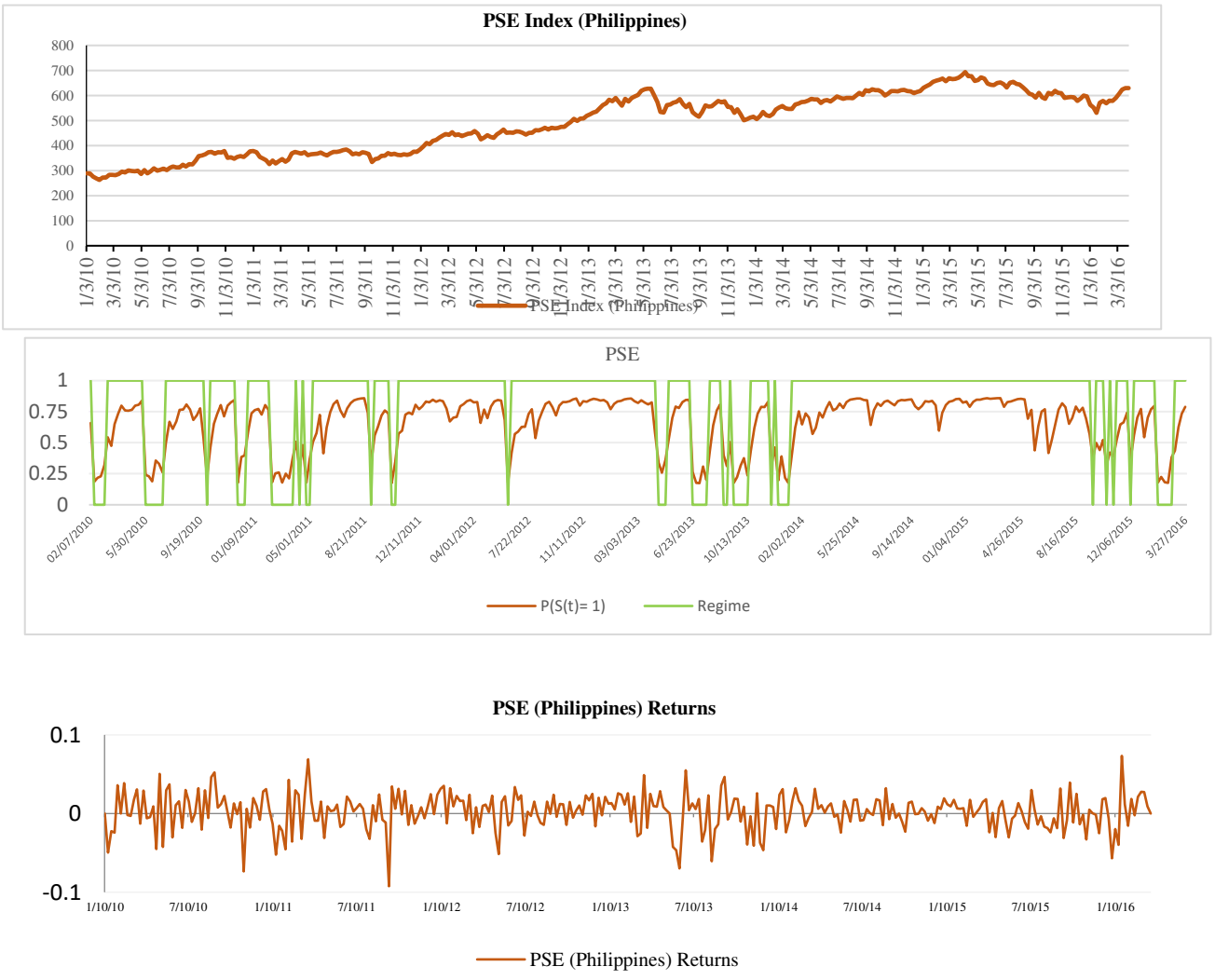
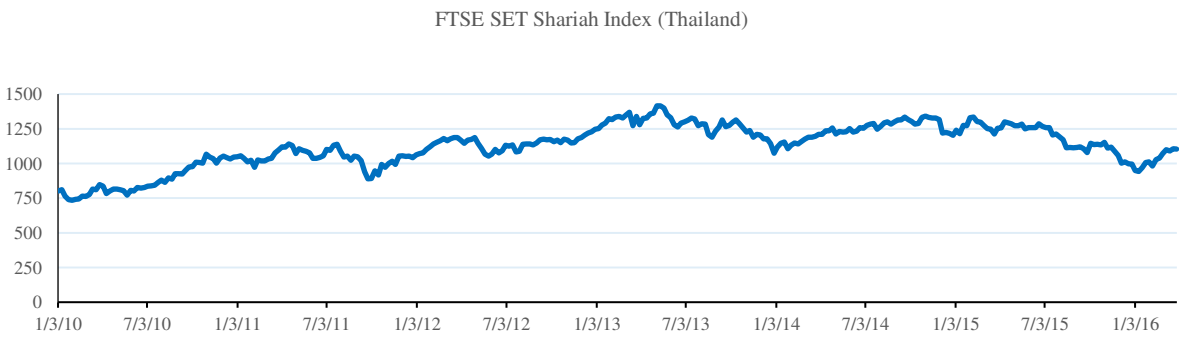


Figure 4:Stock market indices, stock market returns, and smoothed probability for high volatility regime for Philippines

d. Thailand



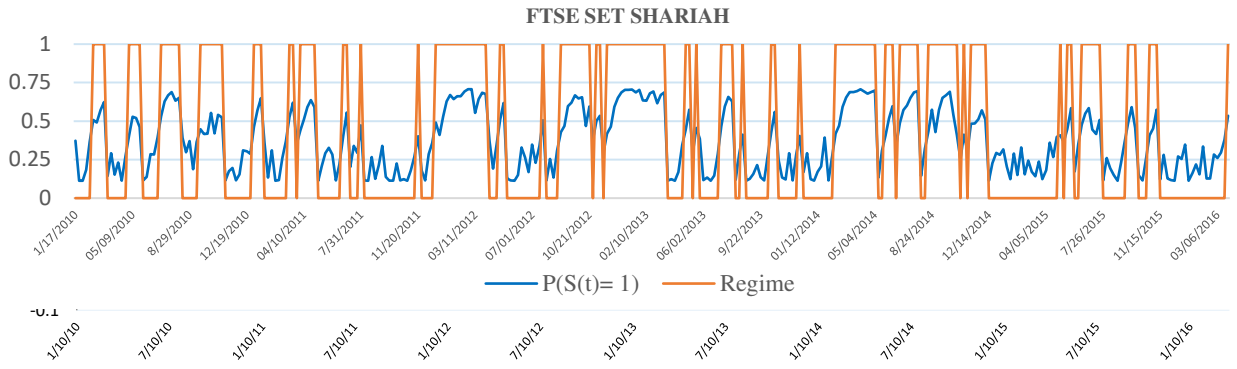
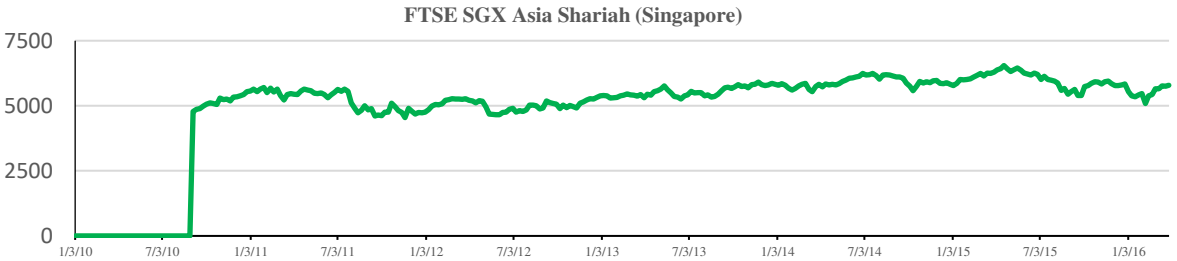
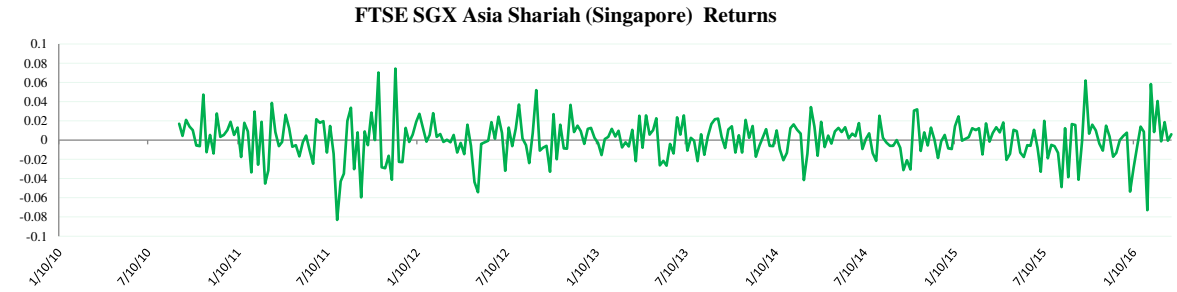


Figure 5:Stock market indices, stock market returns, and smoothed probability for high volatility regime for Thailand

e. Singapore





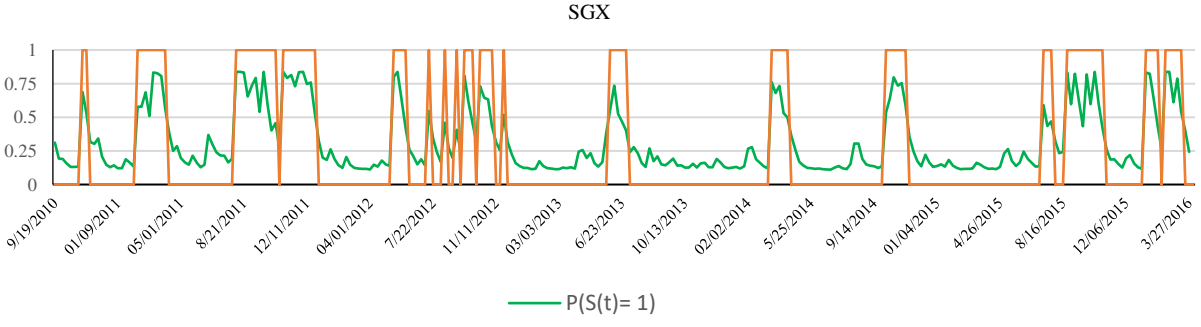


Figure 6: Stock market indices, stock market returns, and smoothed probability for high volatility regime for Singapore

With the exception of Singapore and Thailand, Malaysia, Indonesia, and Philippines indicates a quite similar pattern in the regime shifts for all Islamic markets since they experience market turmoil more often than not over the last six years characterized with the high volatility regime. The smoothed probability plots for regime 2 also detect few other episodes of high volatility across all markets, which we see to coincide with the 2011-2012 Greece's public debt crisis.

For Thailand and Singapore, the estimated smoothed probability of being in regime 2 indicates that these markets frequently get in and out of the high volatility regime. Singapore, however appears to be in the quiet regime of low volatility most of the time across the study period. Other peaks of high volatility can be reasonably attributed to country-specific events and risk factors as stock returns are closely linked to the country's macroeconomic variables and business cycle.

On the broad view, all market exhibit similar characteristics in volatility transmission. This is not surprising as they are all exposed to the dynamics of the ASEAN regional market.

5.3 Exchange rate volatility

In this section, we examines the volatility of the US dollar exchange rates for our sample countries during the recent period marked by high economic and political uncertainty similar to Chkili & Nguyen, (2014b). Several studies suggest that the volatility of exchange rates in emerging countries is more pronounced during times of crises. For example, Coudert et al. (2011) investigate the impact of the recent global financial turmoil on the exchange rate volatility in emerging markets by analyzing its relation- ships to a global financial stress measure. After controlling for the potential of nonlinearities, they find that exchange rate volatility increases more than proportionally with the global financial stress, for most countries in their sample of 21 emerging countries over the period from January 1994 to September 2009. More importantly, these authors also provide evidence of contagious effects from one emerging currency to other currencies in the neighbouring area. The empirical evidence documented by Coudert et al. (2011) (cited in Chkili & Nguyen, 2014b) thus suggests that the US dollar exchange rates we consider may exhibit different behaviour before and after major crises. We examine the returns and and volatility of exchange rates over the study period of 3rd January 2010 to 27th March 2016 for comparison in both tranquil and turmoil periods . We use the squared weekly returns of exchange rates as proxy of their volatility. Figure 6 and Figure 7 foreign exchange returns and volatility in the ASEAN five over the our study period.

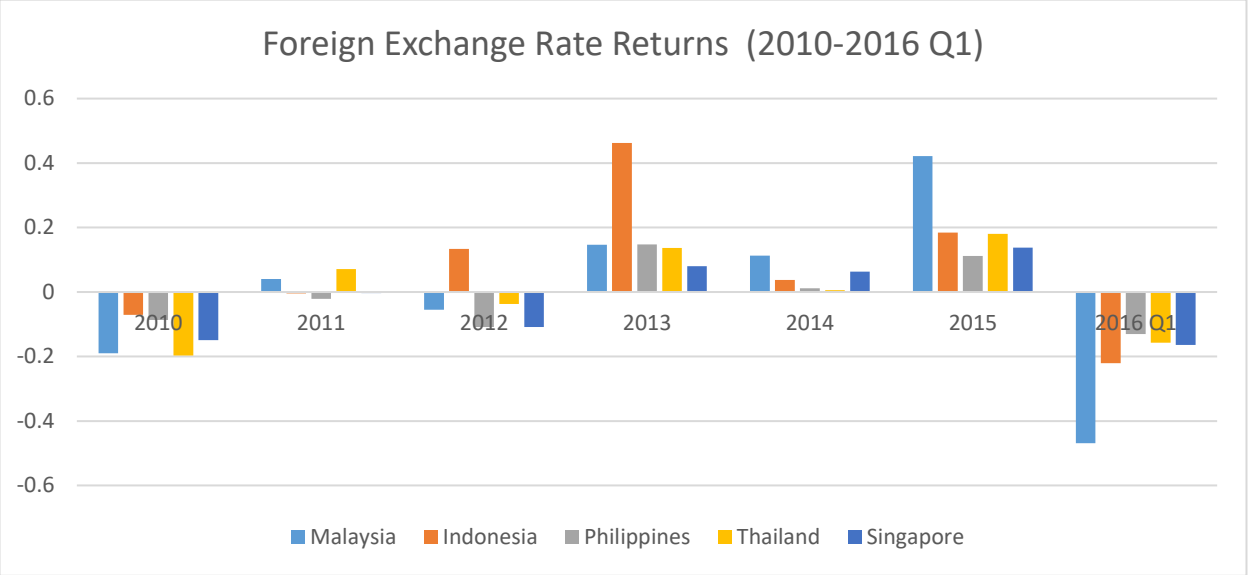


Figure 7: Exchange rate return (%) from beginning of 2010 to the 1st quarter of 2016

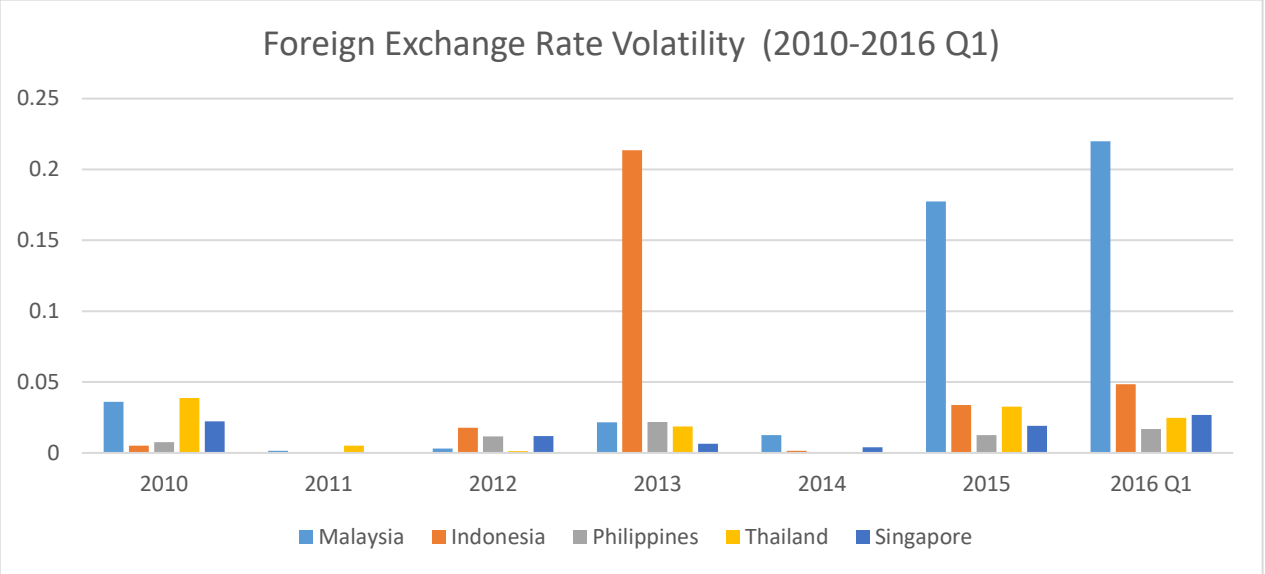


Figure 8:Exchange rate volatility (%) from beginning of 2010 to the 1st quarter of 2016

Figure 1 & 2 above shows that the exchange rate volatility for the ASEAN currencies are less volatile from year 2011 to 2014 with the exception of Indonesia in the year 2013 with a higher exchange rate volatility. From year 2015 however, the volatility in the ASEAN countries under study heightened with Malaysia being the most volatile followed by Indonesia. However, the exchange rate return remains positive until the first quarter of 2016. This may be attributed to the global oil price plunge in the wake of 2015 as its effect is transmitted across all currencies.

5.4 Dynamic relationships between stock and foreign exchange markets

In this section we report the estimation results for the MS-VAR model where the interactions between US dollar exchange rates and stock market returns in ASEAN countries are explicitly analysed. We begin with testing whether regime-switching behaviour exists in the linkages of these markets, using the likelihood ratio (LR) tests. Result from the LR test would signify if our

estimation of dynamic linkage can be based on a MS-VAR model or not. The LR tests assumes a Null Hypothesis that there is no regime switching relationship between our variables. If the Null is rejected, then we can say there is regime switching relationship between stock market and exchange rate returns otherwise none. This implies the suitability of a MS-VAR model for reproducing the joint dynamics of these markets under the effects of regime shift.

Estimation results for the MS-VAR model

	EMAS Shariah (Malaysia)	Jakarta Islamic (Indonesia)	PSE (Philippines)	FTSE SET Shariah (Thailand)	FTSE SGX Shariah (Singapore)
α_1	0.00.. (0.00..)	0.00.. (0.00..)	0.00.. (0.00..)	0.00.. *** (0.00..)	0.00..* (0.00..)
α_{11}	0.00.. (0.00..)	0.00.. (0.00..)	0.00* (0.00)	-0.00.. (0.00..)	0.00..* (0.00..)
α_{21}	-0.04 (0.10)	0.00.. (0.00..)	0.13 (0.11)	0.13 (0.11)	-0.12 (INF)
α_{22}	0.01 (0.26)	0.00.. (0.00..)	-0.04 (0.07)	-0.24 (0.07)	0.01 (0.04)
α_{31}	-0.24 (0.40)	0.09 (0.25)	0.16 (0.15)	0.08 (0.55)	-0.07 (0.27)
α_{32}	-0.20 (0.52)	-0.08 (0.50)	-0.03 (0.06)	0.01 (INF)	0.02 (0.20)
β_1	0.00.. (0.00..)	0.00.. (0.00..)	0.00..(0.00..)	0.00.. (0.00..)	0.00.. (0.00..)
β_{11}	0.00.. (0.00..)	0.00.. (0.00..)	0.00.. (0.00..)	0.00.. (0.00..)	0.00.. (0.00..)
β_{21}	-0.13*** (0.02)	-0.09*** (0.02)	-0.56 (0.99)	-0.07)*** (0.01)	0.32* (0.18)
β_{22}	-0.13*** (0.04)	-0.15*** (0.04)	-0.19*** (0.05)	-0.17*** (0.08)	0.01 (INF)
β_{31}	0.07 (0.09)	0.01 (0.08)	0.05 (0.10)	0.22)*** (0.10)	-O.17 (0.14)
β_{32}	0.02 (0.18)	-0.03 (0.12)	0.09 (0.08)	-0.07 (0.08)	-0.00.. (0.00..)
P_{11}	0.9	0.92	0.79	0.94	0.84
P_{22}	0.77	0.81	0.92	0.95	0.66
Average Duration					
Regime 1	9.87	13.06	4.69	15.5	1.52
Regime 2	4.38	5.26	12.31	18.29	1.19
Standard Devation of Stock Markets					
Regime 1	0.0143	0.0281	0.0228	0.0247	0.0211
Regime 2	0.0144	0.0286	0.0230	0.0248	0.0208
Standard Devation of Foreign Exchange Markets					
Regime 1	0.01131	0.00972	0.00710	0.00681	0.00791
Regime 2	0.01128	0.00980	0.00718	0.00685	0.00788

logL	2218.44	2258.35	2275.78	2151.31	2151.31

Notes: standard deviations are reported in parentheses. *d1* and *d2* are the average durations for the stock market to be in regime 1 and in regime 2, respectively. ***, **, * indicate that the estimated coefficients are significant at the 1%, 5% and 10% levels, respectively. p-values are given in brackets.

Regarding the estimation results of the MS-VAR model in Panel B, we can easily identify two regimes – a low volatility regime (regime 1) and a high volatility regime (regime 2) – with the former being more persistent than the latter. Indeed, the average duration of being in regime 1 is higher than in regime 2 for most of our sample countries with the exception of Philippines and Thailand whose case may be attributed to the incessant political power tussle, especially in Thailand. This result is somewhat consistent with the findings of Kanas (2005), Chan et al. (2011) and more recently, Chkili & Nguyen, (2014b). For instance, Kanas (2005) provides evidence of two regimes for the relationship between the Mexican exchange rate and the stock market returns of some emerging countries. Moreover, the results obtained by Kanas (2005) suggest that the low volatility regime is more persistent than the high volatility regime. Chan et al. (2011) reach the same conclusions when examining the return relationships across three different asset classes.

The results in Panel B also indicate that the estimated coefficients capturing the impact of exchange rate movements (α_{31} and α_{32}) on the stock market returns are not significant in all cases. This finding, which corroborate the result of previous studies (e.g., Kanas, 2000; Yang and Doong, 2004; Aloui, 2007; Chikli et al, 2014), suggests that fluctuations in the US dollar exchange rates did not have strong effects on the dynamics of Islamic stock market returns in the ASEAN-5 under study. Yang and Doong (2004), for example, find similar results for the G7 countries as they show that stock price movements significantly affect future exchange rate movements, but changes in exchange rates have less direct impacts on future changes of stock prices. Also Kanas (2000), examines the volatility spillover between exchange rates and stock markets for some developed countries, and documents that the volatility transmission from the foreign exchange markets to the stock markets is insignificant for all sample countries. The weak impact of exchange rate fluctuations on Islamic stock market returns may be explained by the effective available Islamic alternative currency risk hedging instruments common in the ASEAN region such as Islamic Profit Rate Swaps (IPRS), exposure netting among others. Also, the prohibition of speculative activities in the Islamic transactions and strong tie with the real sector activities makes the Islamic stocks formidable against exchange rate fluctuations. Grant and Marshall (1997) suggest that the resort to financial hedging by multinational firms reduce the impact of exchange rate fluctuations on stock returns, given that the sensitivity of stock markets to exchange rate depends greatly on the exchange rate exposure of listed firms.

On the other hand, the effects of Islamic stock returns on exchange rate movements are captured by the coefficients β_{31} *and* β_{32}. They all show no considerable significance except for the case of Thailand among other ASEAN countries. This finding to a reasonable degree supports the theoretical prediction of the stock-oriented models. This insignificant relationship might be due to the developing status and size of the Islamic stocks market and by extension Islamic finance in the region relative to the conventional market. This result shows no significant relationship in both high and low volatility regimes for all except for Thailand, where a positive relationship suggest that an increase in stock market returns leads to the appreciation of the THB exchange rates (i.e., the appreciation of the US dollar against the local currency). This result is quite different from the findings of Granger et al (2000), Hatemi-J and Roca (2005), Phylaktis and Ravazzolo (2005), and Pan et al (2007). Pan et al (2007) also examine the dynamic linkages between stock and foreign exchange markets for some Asian countries (Hong Kong, South Korea, and Singapore). Their results indicate that movements in exchange rates before the 1997 Asian financial crisis are, to some extent, driven by changes in stock prices.

6.0 Conclusions

Past studies find evidence of interactions between stock and foreign exchange markets, but no attempt has been done on the Islamic stock market to the best of our knowledge. In this article, we examine this intriguing issue for the ASEAN countries in a regime-switching environment.

We first use wavelet coherence in the continuous form to decompose the series. Result shows that, in all cases, the variables exhibit less coherence(an increase/decrease of the Islamic stock and Foreign markets) in the short run (first four weeks) and more coherence in the long run. In general, for the entire analysed period, the colour code shows that the co-movements between series are more persistent in the long-run (32-64 weeks cycles). In the short-run, the contagion is weak and the direction cannot be identified. This is good news for ASEAN currency hedgers as the Islamic stocks are not strongly exposed to short run foreign exchange fluctuations as the result suggest.

Next we applied the Markov switching autoregressive mode (MS AR) to detect regime-shift behaviour in the Islamic stock returns of the ASEAN markets, and find evidence to support the existence of two distinct regimes for all markets, a quiet regime of low volatility and a turmoil regime of high volatility. Secondly, by considering the exchange rate volatility over the recent times while considering the economic issues and political turmoil in various part of the world. We find that the US dollar exchange rates of the ASEAN countries react in line with major events like the Greek crises in 2012 to 2015 in which all with the exception of Indonesia being mostly insensitive to the movements of the US dollar value.

Finally, the extension of our empirical investigation to the dynamic linkages between stock and exchange rate returns via a MS-VAR model shows that exchange rate changes do not affect Islamic stock market returns of the ASEAN countries, regardless of the regimes. However, contrary to expectations, this study did not find a significant impact from Islamic stock market returns to exchange rates for all countries, except Thailand, and it is more pronounced during the period of the high volatility.

Summing up, this study has been able to demonstrate that Islamic stocks behave differently compared to the conventional stocks with regards to foreign exchange returns in a regime switching environment on the basis of our result. Our findings also have several economic and financial management implications. Firstly, investors, fund and portfolio managers, and policymakers, especially in Thailand should thus give heed to these regime-specific interactions when they make capital budgeting decisions and implement regulation policies. Specifically, they may be better able to adopt appropriate hedging strategies to better guard against currency risk during future crises that may occur in the emerging countries. Secondly, such results may be helpful for the policy makers from a financial stability perspective, providing governments and central banks with insights into volatility spill overs and risk transmission between FX markets and stock markets. Finally, results may also allow one to assess the level of Islamic stock market informational efficiency

One source of weakness in this study is the data limitation for Islamic stocks, which shortens the scope of our study. Further investigation into this dynamic link is strongly recommended for other regions and the comparisons be made with the conventional stocks. This will depict differences and similarities of both markets.

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