Journal of Islamic Finance, Vol. 5 No. 2 (2016) 016 – 027
IIUM Institute of Islamic Banking and Finance
ISSN 2289-2117 (O) / 2289-2109 (P)

Effect of Crude Oil Spot and Futures Price Volatility on South East Asia Islamic Equity Market

Mahmud Oluwaseyi QUADRY[a], Abideen Adeyemi ADEWALE[a], Haruna Babatunde JAIYEOBA[a], Rafat Motunrayo ALLI[b]

[a]*Institute of Islamic Banking and Finance, International Islamic University Malaysia*
[b]*Kulliyah of Economics and Management Sciences, International Islamic University Malaysia*

Abstract

This paper examines the effect of crude oil price volatility on Southeast Asia Islamic equity market index. The paper focuses on the long run and short run effect of both the spot and futures price of crude oil on the Islamic equity market index in south East Asia. Daily data from September 2007 to June 2015 obtained from Bloomberg database is used in the paper. The analysis based on time series techniques within the co-integrating framework. The vector error correction model is used in this study complimented with Impulse Response Factor IRF to examine out of sample causality. The major finding of this study is that crude oil spot and futures prices have positive impact on the Islamic equity index in Malaysia, Singapore and Thailand. Though based on the short run relationship, there is remarkable difference in the speed of adjustment back to equilibrium among the Southeast Asia Islamic equity indices. Given the ongoing price volatility of crude oil prices and the market expectation that it may not abate anytime soon, this paper promotes the viability of the Southeast Asia Islamic equity market as investment safe haven to mitigate the impact of such volatility in crude oil prices.

Keywords: Islamic equity market indices, *shari'ah* compliance, crude oil, spot prices, futures prices, volatility

1. Introduction

It is incontrovertible that crude oil is a valuable economic resource that contributes to the growth and development of a country's economy. Such contributions are usually in the form of attracting foreign direct investments with its associated foreign exchange earnings, technology transfer, job creation, infrastructural development etc. Although in some instances, it has proven to make countries endowed with it to be afflicted with issues such as environmental degradation and 'resource curse' manifest in corruption and rent-seeking, in some other countries it has been such a wonderful economic blessing (Auty, 2004). Interestingly, since about the last quarter of 2014 till present crude oil is also arguably the most susceptible economic commodity to price volatility[1]. Such volatility that manifests in both the spot price and the future price of crude oil obviously has huge implication for asset prices, equity market returns, and foreign exchange market Masih, Peter and De Mello (2011) and Onour (2012).

Without prejudice to the implication of price shocks of crude oil on commodity prices, real and financial investments, and numerous other macroeconomic fundamentals, Jones (2004) noted that it is the equity market that is often the worst hit. Jones (2004), Masih, Peter and De Mello (2011) for instance, found that equity market return in an efficient market tends to increase during oil price boom due to the positive impact on cash flow and market value of a corporation. An otherwise implication was also noted in the work of Park et al (2008), Kilian et al (2009), Narayan (2010) and Saiti, Bacha and Masih (2014) that concluded that the 2007/2008 global economic crises although had its roots in the subprime mortgage in the US nonetheless may be linked to the oil price volatility and with notable negative implication for stock market returns.

[1] Volatility may be viewed as the level of risk inherent in the change in price or value of a commodity over a period of time.

Consequently, and quite apparently too, researches focusing on the study of crude oil price changes on conventional equity market is on the increase. This is however, in stark contrast to similar studies focusing on the Islamic equity market. This market is considered important because, during the financial crisis of 2007/2008, it was reported that the impact of the crisis on the Islamic financial market was minimal (Salami and Adewale, 2015). This was based on the fact that its activities are practiced on the principle of Islamic principle and doctrine (Alexakis, Pappas, and Tsikouras, 2015; and Saiti, Bacha, and Masih, 2016).

Furthermore, Islamic equity markets in addition to being the fulcrum of economic development also serve as suitable financial platforms for risk averse investors seeking to aviod inflation threat (Mohd Hussin et al, 2009). This perhaps explains the proliferation of the Islamic equity markets indexes in Muslim-dominated countries and Islamic finance hub such as Malaysia and Bahrain. Non-Muslim Asia-pacific countries such as New-Zealand, Philippines, Japan, Australia, Taiwan, India, China, Korea, Hong-Kong, Sri Lanka and countries like Singapore and Thailand in the South East Asia context had also become safe haven for investors that have low preference for risk due to availability of *Shari'ah* compliant stocks. These equity markets have witnessed phenomenal growth in recent times. Presently, the Islamic equity markets comprise 1,425 listed firms with a combined market value worth of $5255.3 billion US dollars out of which about 56 percent are traded as *Shari'ah* compliant stocks.[2]

The present paper thus attempts to contribute to the extant literature on the Islamic equity market indexes focusing on three ASEAN economies vis. Malaysia, Singapore, and Thailand. This is by investigating both the long-run and the short-run relationships between Islamic equity market index and crude oil spot and future prices. In addition, the speed of adjustments back to equilibrium in the long run is also assessed. This is with the intent of unraveling possible evidences that advertises the diversification benefits and risk mitigation potentials of the Islamic equity indexes especially as the price volatility in crude oil prices seems persistent and its effect pervasive. The choice of the three countries is predicated on the fact that empirical evidences suggest that crude oil net-importing economies are highly susceptible to price swings on commodities especially crude oil (Kang, Ratti and Yoon, 2015). While Malaysia is Muslim dominated and has robust Islamic finance architecture, it also used to be a net oil exporting country until 2013. It has since become net-oil importing economy with expectations that it will remain so in future. Singapore and Thailand are Muslim minority countries and also net-importers of crude oil. While they both have arguably notable equity markets, they are not known as hub for Islamic finance relative to Malaysia. More importantly, Singapore is very prominent in the production of jack-up rigs used for drilling oil in shallow ocean waters. The continuous drop in the price crude oil have resulted in job cuts and declining profits even among giants like Keppel Corp and Sembcorp Marine even as analysts predict a wave of default as most bonds in the industry matures in 2017. Although Thailand is making frantic efforts towards reducing its oil imports by extensive research in ethanol production, it nonetheless remains a net oil-importer. Its drive to reinvigorate its economy via agriculture and industrialization has over the years increased its demand for crude oil. The diversity that the countries selected present and their varying relative exposure to crude oil price volatility may provide interesting insights into how these Islamic equity market index returns respond.

The remainder of this paper is structured as follows. Immediately following this brief introduction is the Section 2 which reviews related extant literature. While section 3 describes the methodology and data used in the study, Section 4 presents the results of the analysis and section 5 provides some concluding remarks.

2. Theoretical Framework

From a theoretical point of view, the relationship between oil price shocks and the Islamic equity market index can be explained by the Discounted Cash Flows model. The model holds that the price of a stock reflects the discounted value of the expected future cash flows to be generated by that same stock.

---

[2] Dow Jones Islamic Market World Index ^{SM} fact Sheet
http://www.djindexes.com/mdsidx/downloads/fact_info/Dow_Jones_Islamic_Market_World_Index_Fact_She et.pdf [22 Dec. 15]

Two components in the model are the required return or weighted average cost of capital on the one hand as well as the future values of cash flows including dividends and implied terminal price of the stock on the other. Both components are susceptible to volatility in crude oil price for a number of reasons. Against the backdrop of the fact that oil is a crucial input for most companies, an increase in crude oil price results in higher production costs especially for a firm that is a net consumer. In the event that this company hedges against oil price shocks, a firm that is a net producer of crude oil would also be negatively affected given lost revenues. In either case, market watchers and analysts would come up with various predictions and the consequential implication for future cash flows generation. Similarly, from a macro perspective, declining oil prices have negative implication for the foreign exchange earnings of a net-exporting country thus weakening the value of the local currency and inducing inflation. Theoretically, a positive relationship exists between inflation and high interest rates and by extension stock returns due to low level of corporate investment. On the other hand, a net-importing country should benefit from oil price decline assuming all things are equal. However, as indicated in the case of Singapore, though a net-importing economy, a crucial contributor to its foreign exchange earnings jack-up rigs production has a strong positive correlation with oil price movement.

3. Literature Review

Hamilton (1983) is arguably one of the pioneer studies on crude oil price changes effect on the United States of America (USA) equity market. Afterwards, numerous studies have been carried out across the globe to understand and investigate the reaction of equity market to volatility in the commodity market including that of the crude oil. Using daily data, Onour (2012) addressed two problems in his study. First, focusing on the oil exporting countries of Kuwait, Saudi Arabia, and UAE, he investigated if crude oil price had effect on shaping the dynamic nature of the stock markets in these countries. Second, the study also examined if cyclical relationship exists between stock price and oil price. Onour (2012) found cyclical relationship between oil price and equity market in the countries sampled and concluded that except for Kuwait, there is a positive and significant effect of movement in the crude oil prices on equity market return albeit at different price levels. While a positive relationship was noted when the price is less than US$40 per barrel, such relationship is attenuated when crude oil price rises to USD$72 per barrel.

El-Hedi (2012) investigated the problem of long run relationship between oil price and equity market among the Gulf Cooperation Council (GCC) countries. The study was based on the monthly data elicited from Arab Monetary Fund (AMF) database covering a period of 10 years between 1996 and 2007. The study adopted the Organization of the Petroleum Exporting Countries (OPEC) spot price as proxy for oil price and regressed it on the GCC equity market indices. Using a panel co-integration analysis based on bootstrapping estimates, and seeming unrelated regression (SUR) methods, the study indicated that except for Saudi Arabia, the other five GCC states vis. Kuwait, Bahrain, Qatar, UAE, and Oman witnessed a positive impact on their stock markets due to movement in oil price increases. The panel co-integration test based on bootstrapping estimates also indicated that the positive relationship observed using the Seemingly Unrelated Regression (SUR) also exist in the long run thus contradicting the findings of Onour (2012) and Ravichandran (2010).

Zhang (2008), Lardic et al., (2006) both conducted a study on the developed economies of the United States, G7 countries, Europe and Euro area economies using quarterly data collected from the International Financial Statistic (IFS) between 1957Q1 to 2006Q4, 1970Q1 to 2004Q3. Lardic et al (2006) used asymmetric co integration model and found no statistically significant relationship exists between movement in oil price and equity markets in these developed nations. In a related study by Zhang (2008) using the Hamilton (2003) model and in this case focusing on Japan, a non-linear association was found to exist between oil price movement and economic growth proxy for by gross domestic products (GDP).

Ciner (2013) investigated the effect of price movements on the equity market in the USA. The study also considered time variation due to the fact that likelihood of shock varies. Monthly data from January 1986 to December 2010 was used. West Texas intermediate (WTI) as spot price proxy for crude oil price and Standard & Poor's (S&P 500), NASDAQ composite index were the parameters used as proxy for the US equity market. Frequency domain model as invented by Ashley (2008) was adopted. Ciner (2013) reported that significant time variation exists between equity market and oil prices. For instance, the study

noted that equity returns respond negatively to oil price movement in the short run, that is, less than 12 months shocks. While shocks for the medium term that is, 12 to 36 months' effect on equity market is positive, oil price shocks in the long run, that is, greater than 36 months impact equity market negatively.

Narayan (2010) probed the relationship between changes in oil prices and the Vietnamese equity market index between 2000 and 2008 using daily data on two equity markets namely Hanoi securities trading Centre (HASTC), and Ho Chi Minh city Securities Trading Centre (HSTC) nominal exchange rates as proxy for stock market index. The West Texas Intermediate spot price index obtained from Bloomberg was used as proxy for the crude oil prices. The study reported that oil price, equity price and exchange rates have long run relationship. It also found oil price and exchange rates have a statistical and significant positive impact on equity market in the long run. However, in the short run estimate, it was discovered that neither oil price nor exchange rate affect equity return.

Fayyad (2011) empirically examined the long run relationship between the stock market return and oil price in the GCC countries (Kuwait, Oman, UAE, Bahrain, and Qatar). The study also included developed economies like the UK and USA for comparison purposes. Weighted equity market index using MSCI as proxy for equity market index and daily data Brent oil spot price as proxy for crude oil was used for the analysis. The data was obtained from energy information administration covering September 2005 to February 2010. Vector auto-regression (VAR) was used and the result indicated that no significant relationship exist between the commodities in the first period. However, in the second period a statistically significant relationship was found to exist between the stock market indexes and oil price movement in all the GCC countries except for UAE and Bahrain. Conversely, a statistically significant relationship was observed for other countries vis. Oman Qatar, Oman, USA, UK, Qatar equity markets.

Arouri et al. (2011) studied volatility spillover and return between oil price in the GCC and equity market by using daily data between 2005 and 2010. A vector autoregressive generalized autoregressive conditional heteroscedasticity (VAR GARCH) model was used in the study. The VAR GARCH model allows for joint conditional returns, volatility and correlation between oil price and equity market. The results obtained indicate there is a significant spillover effect across the GCC countries in the relationship between oil price swings and equity market returns. In their various studies, Ling et al., (2003), Chan (2005) and Hammoudeh (2009) adopted a similar model in their research on tourism demand variation and equity market. The results indicated that three countries - Bahrain, Qatar, Oman - out of the six studied were significantly affected by lagged oil return on their equity market.

Papapetrou (2001) in his study on Greece adopted a vector error correction model (VECM). The intent of the study was to assess the impact of oil price movement on the Greek stock market return by adopting monthly data between 1989 and 1996. The findings which corroborated those of a US study by Sadorsky (1999) and Jones (1996) revealed that a negative relationship exist between oil price changes and the Greek equity market return in both the short and long run.

Toraman (2011) conducted a study on Istanbul exchange market by investigating how oil price shock affects market return on four different indexes vis. ISE100 composite index, technology index, industrial index and service index. In the study, daily data for the period 2009 to 2011 was used in relation to Brent oil price as well as the market return from the respective indexes. Johanssen (1988) co-integration test, as well as Vector Error Correction Model (VECM) was used to assess both long run and short run relationships respectively. The report indicated that there is a statistically significant effect of the movement in oil prices on the return reported in the Istanbul equity market particularly ISE 100 index. Saiti et al. (2013) found that there was relatively low and even at times negative dynamic conditional correlation between FTSE *Shari'ah* China index and FTSE *Shari'ah* USA index. Additionally, Abdullah et al. (2016) their analysis based on the application of the recent wavelet technique MODWT, indicates that the Singapore Islamic index is leading the other Islamic indices and the commodities.

The various studies reviewed above demonstrate that a commendable number of empirical studies investigating the relationship between the equity market indexes and commodity prices exist. However, this is in stark contrast to the dearth of empirical studies assessing such relationship in the context of the Islamic equity market index especially in the South East Asian region. The relatively strong presence and growth of Islamic finance in the region and the dwindling prices of crude oil advertises the need for investigating the risk diversification benefits of the Islamic equity market. This is more so against the

backdrop of the fact that the Islamic equity market seems to be more resilient in the event of financial turbulence often manifested in the volatility of a major world commodity such as crude oil.

4. Data and Econometric Methodology

The data used in this study were obtained from the Bloomberg Database and comprises daily data between September 2007 and June 2015. The rationale for the use of daily data is in line with the submission in Arouri et al (2011) that it allows for capturing the apparently rapid and intense relationship that exist between stock prices and crude oil price swings. The Morgan Stanley Composite Index (MSCI) was considered as the benchmark used to measure the Islamic equity market index for large capitalization company for Malaysia, Singapore and Thailand; while West Texas Intermediate (WTI) was the proxy for crude oil spot and futures prices. These proxies are quite commonly used for similar purpose in the extant literature and are easily available. This study further considered two sub-periods by dividing the whole data into two period samples. That is, the period of financial crisis between 2007 till 2010 and post financial crisis period between 2010-2015. The essence of comparing the two periods of study was to contribute to the notion that institutions that adopt Islamic principles are relatively not so much, if at all affected by the global financial crisis. Therefore, this called for examining the relative performance of the Islamic equity market during the financial crisis and post financial crisis. In the results section of the paper, SP is reported as the closing price of the respective Islamic equity market index price, COILSP and COILFP are reported as the crude oil spot and futures price for West Texas composite intermediate respectively.

The data so obtained were subjected to various relevant econometric analyses including the unit root test, Johanssen co-integration test, vector error correction model, and the Granger causality test. Afterwards, the impulse response function is used to assess the speed of transmission of external shock in this case of volatility in crude oil prices to Islamic equity index performance.

4. Model Specification and Empirical Results

4.1 Unit Root Test

A necessary standard precondition for the subsequent application of a vector autoregession modeling is for the variables to be used in the model to be integrated of the same order. In this regard, there is the need to test for unit root. Two methods often used in the standard literature are the Augmented Dickey Fuller and Phillips-Peron tests. In the former, lagged difference (y) is adopted to ensure disturbance term is a white noise; while optimum lags selection is based on Akaike Information Criterion (AIC) which is recommended and supported by Engle (1987). The Null hypothesis (H_0: $\phi = 1$) should not be rejected if time series data possesses unit root in the Augmented Dickey Fuller (ADF) result. That is, if the ADF test statistics is more negative than the ADF critical value, we do not reject the null hypothesis of the presence of a unit root. Also, it is important to ensure that the error term is uncorrelated and variance is constant. In the latter, Phillips-Perron (PP) test allowance is made for a more generalized view for ADF test methods based on less-restrictive assumptions for distribution of error.

Table 1 presents result of the unit root test performed and based on the DF and PP tests. It can be concluded that the series data are difference stationary and in integration of order one, i.e I (1).

Table 1: Augmented Dickey Fuller and Philips-Peron Unit Root Analysis

Full Sample (All periods)

	LEVEL				FIRST DIFFERENCE			
VARIABLE	ADF INTERCEPT	ADF INTERCEPT & TREND	PP INTERCEPT	PP INTERCEPT & TREND	ADF INTERCEPT	ADF INTERCEPT & TREND	PP INTERCEPT	PP INTERCEPT & TREND
MIMYLC	-0.6772	-1.8861	-0.6039	-1.8543	-42.2902[a]	-42.2820[a]	-42.2797[a]	-42.2712[a]
MITHLC	-1.9224	-2.4512	-1.8643	-2.3884	-44.7271[a]	-44.7192[a]	-44.7740[a]	-44.7669[a]
MISGLC	-1.9754	-2.3955	-1.8723	-2.3038	-47.8564[a]	-47.8644[a]	-47.9244[a]	-47.9500[a]
WTIFU	-1.7128	-1.7163	-1.7537	-1.7544	-47.6145[a]	-47.6227[a]	-47.6159[a]	-47.6278[a]
WTIPX	-1.8859	-1.8867	-1.8095	-1.8081	-46.6357[a]	-46.6430[a]	-46.6308[a]	-46.6400[a]

Subsample Period 1 (Crisis)								
MIMYLC	-0.8753	-2.3283	-0.9019	-2.3283	-20.6828[a]	-20.6872[a]	-20.6739[a]	-20.6763[a]
MITHLC	-0.8908	-1.5846	-0.9382	-1.7122	-21.1462[a]	-21.1260[a]	-21.1646[a]	-21.1446[a]
MISGLC	-0.8973	-1.6364	-0.8361	-1.5005	-23.3116[a]	-23.2918[a]	-23.3964[a]	-23.3771[a]
WTIFU	-0.9393	-1.6697	-0.8658	-1.6196	-23.6760[a]	-23.6832[a]	-23.7161[a]	-23.7323[a]
WTIPX	-0.9019	-1.7175	-0.8447	-1.6819	-23.4629[a]	-23.4794[a]	-23.4505[a]	-23.4698[a]
Subsample Period 2 (Post financial crisis)								
MIMYLC	-1.0933	-2.4189	-1.1358	-2.3366	-36.5713[a]	-36.5650[a]	-36.4949[a]	-36.4875[a]
MITHLC	-2.6153	-3.2958	-2.4786	-3.1131	-39.6417[a]	-39.6372[a]	-39.8367[a]	-39.8397[a]
MISGLC	-2.4912	-4.0697	-2.4484	-4.1293	-41.4663[a]	-41.4660[a]	-41.4690[a]	-41.4701[a]
WTIFU	-1.6144	-1.6484	-1.5342	-1.5610	-40.9199[a]	-40.9731[a]	-40.8964[a]	-40.9637[a]
WTIPX	-1.6365	-1.6697	-1.6134	-1.6471	-39.4960[a]	-39.5394[a]	-39.4935[a]	-39.5400[a]

1% of Mackinnon critical values for the acceptance of alternative hypothesis of the unit root are provided in the parenthesis 'a' indicates significance at 1% level

Based on the Table 1, at level all the series for the Islamic equity market index and crude oil spot and futures prices contained unit root as indicated by ADF test and supported by PP test. This necessitated that the first difference of the series is obtained. The subsequent result obtained indicated that the series data no longer contained unit root and are integrated of order I(1) as confirmed by ADF and PP test.

4.2 Johanssen Juselius Co-integration Test.

Johansen co-integration test was also conducted for long run relationship investigation. A precondition is that time series data should be stationary or stable over time. According to Seiler (2004), two series are said to be co-integrated if they are of the same order and a stationary linear combination exists between them. According to Niarchos and Alexakis (1998), even if individual series or both are non-stationary, co-integrated relationship can still be established if the two series do not deviate from each other in the long run. The resulting stationary series could be used in subsequent analysis to produce unbiased results (Seiler, 2004:296). As stated in Alexakis et al (2015:7), for two series X_t, (Crude oil prices COILSP and COILFP) and Y_t, (closing selling prices of stock - SP) a co-integrating relationship can be established if:

$X_t, Y_t \sim I(1)$

$Z_t = X_t, - \alpha Y_t$

$Z_t \sim I(0)$

Where α is the co-integrating parameter whose magnitude indicates the co-integrating speed.

The Null (H0) hypothesis of Johansen Juselius test in this study posited that there is no relationship between crude oil spot and futures price (COILSP and COILFP) and Islamic equity market index (SP) for both the Trace Statistic and Max-Eigen value test. Asteriou (2011) documented that violation of co-integration (i.e no long run relationship) in series data will results in spurious regression which renders econometrics work unproductive. Table 2 displays results obtained that indicated there is a long run relationship between series data based on Max-Eigen and Trace Statistic value test albeit at different level of significance. This implied that since long run relationship exist between the data, an increase in crude oil spot and future price would lead to an increase in the performance of Islamic Equity market index and vice versa.

From the Table 2, it can be deduced that a long run relationship exists between crude oil spot and future price and Islamic equity market index for all selected countries. Since the variables are related, it is expected that they move together in similar direction. This implies that when crude oil market booms, it is expected that Islamic equity market will perform better and when there is decline in performance in the crude oil market, the equity market will experience similar shock.

Table 2: Johansen Co-integration Test Result

CRUDE OIL SPOT AND FUTURE PRICE					
	NULL	**TRACE**		**MAX ENG**	
Full Sample **VARIABLE**	**HYPOTHESIS**	**T-STA**	**C.V**	**T-STA**	**C.V**
	None	382.8882[a]	29.7971	377.1328[a]	21.1316
MIMYLC	At most 1	5.7554	15.4947	5.1848	14.2646
	At most 2	0.5705	3.8415	0.5705	3.8415
	None	385.1610[a]	29.7971	376.6923[a]	21.1316
MITHLC	At most 1	8.4687	15.4947	5.7012	14.2646
	At most 2	2.7675	3.8415	2.7675	3.8415
	None	385.6982[a]	29.7971	377.7870[a]	21.1316
MISGLC	At most 1	7.9112	15.4947	5.2645	14.2646
	At most 2	2.6466	3.8415	2.6466	3.8415
Subsample Period 1 (Crisis Period)					
	None	136.1083[a]	29.7971	122.1349[a]	21.1316
MIMYLC	At most 1	13.9733	15.4947	11.3590	14.2646
	At most 2	2.6144	3.8415	2.6144	3.8415
	None	133.8064[a]	29.7971	124.0298[a]	21.1316
MITHLC	At most 1	9.7766	15.4947	8.0932	14.2646
	At most 2	1.6835	3.8415	1.6835	3.8415
	None	131.9541[a]	29.7971	125.3882[a]	21.1316
MISGLC	At most 1	6.5658	15.4947	5.5151	14.2646
	At most 2	1.0508	3.8415	1.0508	3.8415
Subsample Period 2 (Post financial crisis period)					
	None	241.3670[a]	29.7971	235.2815[a]	21.1316
MIMYLC	At most 1	6.0854	15.4947	6.0579	14.2646
	At most 2	0.0275	3.8415	0.0275	3.8415
	None	249.1563[a]	29.7971	233.9950[a]	21.1316
MITHLC	At most 1	15.1612	15.4947	12.1892	14.2646
	At most 2	2.9720	3.8415	2.9720	3.8415
	None	249.4134[a]	29.7971	235.9420[a]	21.1316
MISGLC	At most 1	13.4715	15.4947	10.9192	14.2646
	At most 2	2.5523	3.8415	2.5523	3.8415

Note: Trace & Max Eng represents Trace & Max Engen Statistic, both test recognize the presence of co-integration among the equation. Superscript a, b and c represent significance at 1, 5 and 10 % level respectively

4.3 Vector Error Correction Model (VECM)

Once a group of series is said to be co-integrated, the Granger Representation Theorem of Engle and Granger (1987) posits that an Error Correction Model exists. According to Seiler (2004), following the invention of Vector Auto Regression (VAR) model, years later, VECM was invented which provides more restricted version of VAR with the introduction of new error correction elements, and also designed for

use with integrated non-stationary series that are co-integrated. The correction of the existing disequilibrium that occurs from unexpected shocks in the analysis is the major idea of the error correction term. VECM allows for deviations which are gradually corrected in the long run through a series of adjustments reflected in the co-integrating term. The equation 1 below represents VECM equation:

$$SP_{ij,t} = \beta_0 + \sum_{q=0}^{m} \eta_q COILSP_{i,t-q-1} + \sum_{q=0}^{m} \Theta_q COILFP_{t-q} + \delta\varepsilon_{t-1} + \mu_t \ldots\ldots\ldots\ldots\ldots \quad (1)$$

From the above equation 1, ε_{t-1} represent a period lagged error correction term and 'm' indicates the lag length whose selection is based on Akaike Information criterion (AIC). The importance of this model is to enhance detection of long and short run relationships between the Islamic equity market index and crude oil spot and futures prices. As mentioned earlier, SP capture the closing price of the respective Islamic equity market index price, COILSP and COILFP captures the crude oil spot and futures price for West Texas composite intermediate.

Following the analysis as contained in Table 3, it is discernible that negative sign before each statistically significant coefficient denote the Islamic equity markets sampled are trending back to equilibrium in the long run. In absolute value, it is noted that Singapore Islamic equity market index return faster to equilibrium in the long run due to shock emanating from the crude oil spot and futures market. The Singaporean Islamic equity market is followed by Thailand Islamic equity market index while Malaysia Islamic equity market index responds slower compared to the other two Islamic equity markets. A plausible reason could be attributed to heavy demand for and the dependent of the nation on crude oil for production activities relative to Singapore and Thailand. During the financial crisis period, Singapore Islamic equity market index failed to return to equilibrium contrary to those of Malaysia and Thailand Islamic equity market. In this regard, however, the Thailand equity market performed better than the Malaysia Islamic equity market during this period by adjusting faster to equilibrium in the long run. In the post financial crisis period, Singapore Islamic equity market outperformed other Islamic equity markets while Malaysia Islamic equity market performed the least by adjusting relatively slower to equilibrium in the long run. The implication of this slow adjustment on investment decision is that risk-averse investors should not consider adding Malaysia Islamic equity market to their portfolio or may do so as the last resort during recession. Although, this may not necessarily mean that the Malaysia market is not investable, rather it implies that only investors with high risk preference may invest in the market regardless of whether there is financial crisis or not.

Table 3: Error Correction Term (ECT) From VECM Output Model

	MIMYLC	**MITHLC**	**MISGLC**
ECT	-0.0001	-0.00016	-0.00031

Subsample Period 1(Crisis Period) Subsample

	MIMYLC	**MITHLC**
ECT	**-0.00039**	**-0.00044**

Period 2 (Post crisis period)

	MIMYLC	**MITHLC**	**MISGLC**
ECT	-1.62E-06	-0.00012	-0.00024

4.4 Granger Causality

Analysis can be continued under co-integration framework in so far at least one co-integrating vector occurs between variables. Traditional Granger causality test invented from VAR framework and satisfaction of stationary condition must therefore be ascertained. In a situation where no stationarity exists, χ^2 Wald test cannot be examined under the Granger causality test. The equation 2 shown below represents granger causality test:

$$\Delta X_t = \alpha_0 + \sum_{i=1}^{p} \beta_{xi}\Delta X_{t-1} + \sum_{i=1}^{p} \beta_{yi}\Delta Y_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Δ in the model represents the first difference, ΔX and ΔY indicates their respective time series value for SP on the one hand and COILSP and COILFP on the other respectively. The null hypothesis is formulated as Crude Oil price shock does not Granger cause Islamic Equity Market Index return, while the alternate hypothesis is formulate otherwise. The alternate (H1) will be accepted if the coefficient of β_{yi} are jointly significant based on the F test. Therefore, such acceptance will result when ΔX is replaced with ΔY as the dependent variable on left hand side.

From Table 4 above, it can be deduced that at the 1 percent significance level, past price of crude oil spot and future prices influence the performance of the Singapore Islamic equity market. As for Malaysia and Thailand Islamic equity market indexes, only the past spot price of crude oil influences future performance of the market while past futures price does not. Similarly, during the financial crisis period, the past spot and futures prices of crude oil influence the future performance of Malaysia and Thailand Islamic equity market respectively. However, during the post financial crisis, only past futures and spot price of crude oil respectively influence the Thai and Singaporean Islamic equity market index.

Table 4: VECM Pairwise Garnger Causality Test Results

VARIABLES		F- STAT	PROB
Full Sample			
MIMYLC	WTIPX	1.5144	0.0368[b]
	WTIFU	1.1639	0.2480
MITHLC	WTIPX	1.3811	0.0823[c]
	WTIFU	1.3029	0.1263
MISGLC	WTIPX	1.8547	0.0033[a]
	WTIFU	1.8492	0.0035[a]
Subsample Period 1 (Crisis Period)			
MIMYLC	WTIPX	1.6280	0.0431[b]
	WTIFU	1.8777	0.0126[b]
MITHLC	WTIPX	1.8480	0.0084[a]
	WTIFU	1.5443	0.0472[b]
Subsample period 2 (Post crisis period)			
MIMYLC	WTIPX	1.07209	0.3515
	WTIFU	0.73279	0.8912
MITHLC	WTIPX	1.33908	0.2039
	WTIFU	1.60992	0.0981[c]
MISGLC	WTIPX	1.75128	0.0731[c]
	WTIFU	1.40047	0.1825

Note: a, b and c represent significance at 1, 5 and 10 % level respectively. SP is represented by MIMYLC, MITHLC, and MISGLC for Malaysia, Thailand and Singapore respectively, while WTIPX and WTIFU are represented by WTIPX and WTIFU for crude oil spot and futures prices respectively.

4.5 Impulse Response Function

For a more robust result, impulse response function (IRF) test was used to enhance the result of VECM model so that response of the Islamic equity markets index to shock from the error term can be traced out (Gujarati et al, 2009). In this case, the IRF is used to illustrate how the error of each of the VAR equation responds to a unit shock. The results obtained suggest that although stock prices are influenced by movements in oil prices, there is a variation in such response among the three Islamic equity index sampled in this study. The speed of transmission of external shocks to variables depicted by impulse response is contained in the Figures below from 1 to 8.

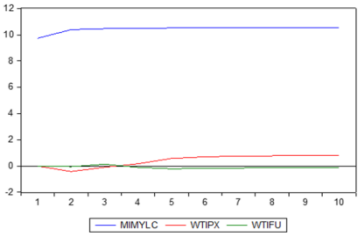

Fig. 1: Impulse Response Shock of MIMYLC Index to Crude Oil

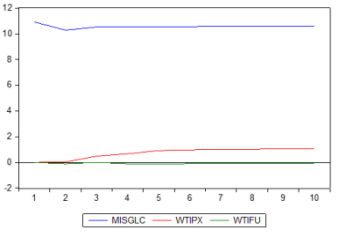

Fig. 2: Impulse Response Shock of MISGLC Index to Crude Oil

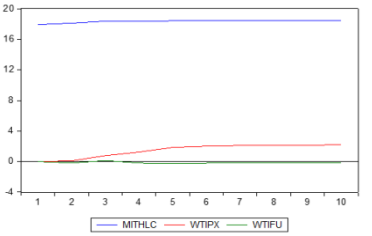

Fig. 3: Impulse Response Shock of MITHLC Index to Crude Oil

Subsample Period 1 (Crisis Period)

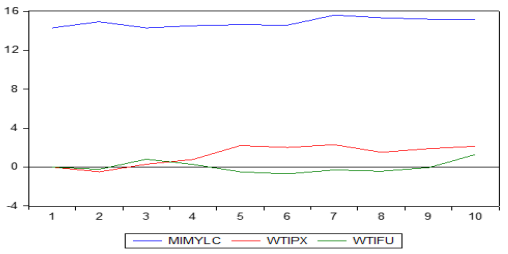

Fig. 4 Impulse Response Shock of MIMYLC Index to Crude Oil

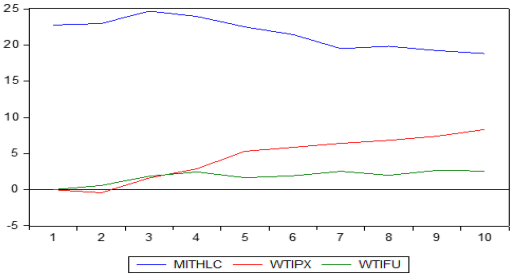

Fig. 5 Impulse Response Shock of MITHLC Index to Crude Oil

Subsample Period 2 (Post financial crisis period)

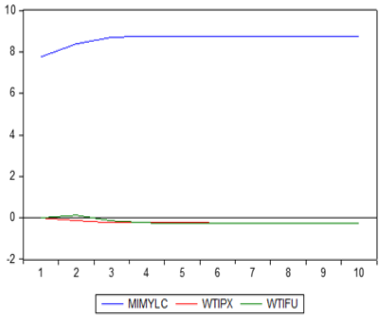

Fig. 6: Impulse Response Shock of MIMYLC Index to Crude Oil

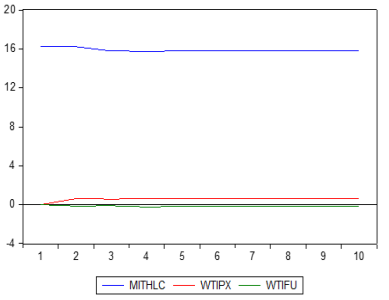

Fig. 7: Impulse Response Shock of MITHLC Index to Crude Oil

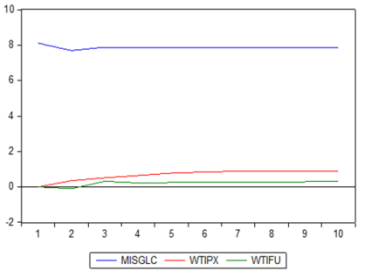

Fig. 8: Impulse Response Shock of MISGLC Index to Crude Oil

Using ten (10) days period to examine the volatility of crude oil spot and futures price on Islamic equity market for Malaysia, Thailand and Singapore, it was discovered that one unit standard deviation shock in spot and futures prices crude oil affect respective equity market positively. However, cognizance is taken of the fact that variation exists in days in which shock become constant till end of 10 days forecast for the whole sample period. Similarly, during the financial and post financial crisis sub-periods, Islamic equity market for three countries: Malaysia, Thailand and Singapore experienced positive shock from changes in crude oil spot and futures prices except for Singapore Islamic equity market. Generally, while the results show that a positive response is noted in the various markets, the implication may be that the Islamic capital market is not immune from the effects of commodity prices in this instance crude oil.

5. Conclusion

The study takes cognizance that commodity markets over the time have proven to be susceptible to the macroeconomic conditions. Nonetheless, a lacuna in the extant literature relates to how the Islamic equity indexes relate to the shock in commodity prices especially, crude oil. Based on the discounting model theory, this paper focuses on the relationship between oil price swings and Islamic capital market index in

Malaysia, Singapore, and Thailand. The investigation used daily data to conduct various econometric analyses. The objective of this study was to probe the effect of crude oil spot and futures prices on Islamic equity market in the South East Asia region. This paper further considers its investigation by dividing the period under study into two sub-periods: financial crisis period of 2007/2008 and post financial crisis. The objective of this study was accomplished by adopting vector error correction model and impulse response function.

Based on the findings, long run relationship between crude oil and Islamic equity market exist. This implies increase in crude oil price subsequently leads to increase in Islamic equity market index in Malaysia, Thailand and Singapore market respectively. Our findings supports previous studies on conventional equity market reported by Narayan et al., (2012). Not limited to this, the Islamic equity market index for respective countries adjusts relatively back to equilibrium from shock emanating from crude oil market. Similarly, during the sub-periods all except for Singapore Islamic equity market deviate from equilibrium. Based on the analysis, investors, as well as market regulators can predict the future performance of the Islamic equity market especially in the sampled markets when crude oil price exhibit instability in both the spot and futures market.

In addition to this finding, past spot and futures price of crude oil influences the future performance of Malaysia, Thailand and Singapore Islamic equity market. More so, based on the impulse response function, one unit shock in crude oil spot and futures price have positive effect on the Islamic equity markets of the countries sampled. This finding contradicts previous study on conventional equity market as reported by Papapetrou (2001), Taraman et al., (2011). It however, supported the notion by Alexakis et al (2015) that Islamic financial market are not affected by the 2007/2008 financial crisis because its operation are based on the principle of shariah and Islamic doctrine which prohibits speculation as compared to the conventional equity market which allows speculative activities.

The implication of this study for portfolio managers, fund managers, potential investors, academics researchers, market regulators specifically in South East Asia is that they should afterwards understand how respective Islamic equity market responds to crude oil shock. Also, it provides investors with speculative ability based on long run relationship that exists between crude oil and respective countries Islamic equity market index. More so, it allows international diversification possibility for potential investors by adding different countries equity into their portfolios. However, cognizance should be taken of the fact that the relationship between oil price swings and stock returns may vary across sectoral divides. As such, for investors to make the right decisions in their portfolio creation and management may require that such sectorial moderation of the hypothesized relationships tested in this study is considered in the future.

References

Abdullah, A. M., et al. (2016). The impact of crude oil price on Islamic stock indices of South East Asian countries: Evidence from MGARCH-DCC and wavelet approaches, *Borsa Istanbul Review* (2016), http://dx.doi.org/10.1016/j.bir.2015.12.002

Alexakis, C., Pappas, V. and Tsikouras, A. (2015) Long Run asymmetric relationships between Islamic and conventional equity indices; Economics Working Paper Series 2015/002

Arouri, M. L. (2011). Return and Volatility Transimission between world oil prices and stock markets of the GCC countries. *Economic Modelling*, 28(4), 1815 - 1825.

Asteriou, D. a. (2011). *Applied Econometrics Second edition* . Palgrave: Macmillan.

Auty, R. (2004). Natural resources and civil strife: a two-stage process. *Geopolitics*, 9(1), 29-49.

Bloomberg. (2015, July 1). www.bloomberg.com

Chan, F. L. (2005). Modelling Multivariate nternational tourism demand and volatility. *Tourism Management*, (26), 459-471.

Ciner, C. (2013). Oil and stock returns: Frequency domain evidence. *Journal of International Financial Markets, Institution and money*, 1-11.

Arouri, M. E. H., & Rault, C. (2012). Oil prices and stock markets in GCC countries: empirical evidence from panel analysis. *International Journal of Finance & Economics*, 17(3), 242-253.

Engle, R.F., and C.W.J. Granger, 1987, Co-integration and Error Correction: Representation, Estimation and Testing, *Econometrica*, 55(2), 251-276.

Fayyad, A. and Daly, K. (2011). The Impact of Oil Price shocks on stock market returns: comparing GCC countries with the UK and USA. *Emerging market review*, 12(1), 61-78.

Hamilton, J.D., 2003. What is an Oil Shock?. *Journal of Econometrics*, 113, 363-98.

Hamilton, D. J. (1983). Oil and the macroeconomy since World War II. *The Journal of Political Economy*, 9, 228-248.

Hammoudeh, S. Y. (2009). Shock and volatility spillover among equity sector of the gulf arab stock markets. *Quarterly review of Economics and Finance*, (49), 829-842.

Johansen, S. (1988). Statistical analysis of Co-integration vectors. *Journal of Economic Dynamic Control*, (12), 231-254.

Jones, C.M., and G. Kaul, (1996), "Oil and the Stock Markets," *Journal of Finance*, 51(2), 463-491.

Jones, C. K. (2004). Oil and the Stock Market. *Journal of Finance,* (81), 883-986.

Kilian, L. & Cheolbeom, P. (2009). "The Impact of Oil Price Shocks on The U.S. Stock Market",. *International Economic Review,* 50 (4), 1267-1287.

Masih, R., Peters, S., & De Mello, L. (2011). Oil price volatility and stock price fluctuations in an emerging market: Evidence from South Korea. *Energy Economics*, 33(5), 975–986

Mignon, V. (2006). "The Impact of Oil Price on GDP in European Countries: An emprical investigation based on asymetric cointegration". *Energy Policy*, 34(18), 3910 - 3915.

Ling S., M. M. (2003). Asymtotic theory for a vector ARMA-GARCH model. *Economic Theory,* (19), 278-308.

Mohd Hussin, M. Y. (2009 Vol. 17 No. 3,). Analisis Perkembangan Pasaran Saham Islam di Malaysia. *Journal Syariah*, pp. 431-456.

Narayan, P. & Narayan, K. (2010). "Modelling the impact of oil prices on Vietnam's Stock Price. *Applied Energy* , 87, 356-361.

Onour, I. (2012). Crude Oil Price and Stock Market in major oil-exporting Countries: evidence of decoupling feature. *International Journal of Monetary Economicsand Finance*, 5(1).

Park, J. and Ratti, R.A. (2008). "Oil Price Shock Markets in the U.S. and 13 European Countries,". *Energy Economics*, 30, 2587-2608.

Papapetrou, E. (2001). Oil Price Shocks, Stock market, economic activity and employment in Greece. *Energy Economics,* (23), 511-532.

Phillips, P.C.B., and Perron, P. (1988), Testing for Unit Root in a Time Series Regression, *Biometrika*, 75, 335-346.

Saiti, B., Bacha, O. I., & Masih, M. (2013). Estimation of Dynamic Conditional Correlations of *Shariah*-Compliant Stock Indices through the Application of Multivariate GARCH Approach. *Australian Journal of Basic and Applied Sciences,* 7(7): 259-267.

Saiti, B., Bacha, O. I., & Masih, M. (2014). The diversification benefits from Islamic investment during the financial turmoil: The case for the US-based equity investors. *Borsa Istanbul Review*, 14(4), 196-211.

Saiti, B., Bacha, O. I., & Masih, M. (2016). Testing the conventional and Islamic financial market contagion: evidence from wavelet analysis. *Emerging Markets Finance and Trade*, 52(8), 1832-1849.

Salami, O. L., & Adewale, A. A. (2015). Malaysian Islamic Banks' Efficiency: An Intra-Bank Comparative Analysis of Islamic Windows and Full-Fledged Subsidiaries. *International Journal of Business and Society*, 16(1), 19-38.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics,* 21, 449-469.

Seiler, M.J. (2004), *Performing Financial Studies: A Methodological Cookbook*. Saddle River, NJ : Prentice Hall.

Toraman, C., Basarir, C., & Bayramoglu, M. F. (2016). Effects of crude oil price changes on sector indices of Istanbul Stock Exchange. *European Journal of Economic and Political Studies*, 4(2), 111-126.

Zhang, D. (2008). "Oil Shock and economic growth in Japan: A nonlinear approach". *Energy Economics*, 30(5), 2374-2390.