Nexus between Oil Price and Stock Performance of Power Industry in Malaysia

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Abstract

This paper examines the reaction of KLCI and five major power sector stocks listed on Bursa Malaysia to the changes in the world spot oil price using cointegration technique and impulse response analysis. Results indicate the existence of a long run positive relationship of world spot oil price with the stock returns of KLCI, TENAGA, TANJONG and YTLP. The impulse response analysis further shows that, in most of the cases, the oil price shock has only an impact on the short time horizon. As Malaysia is a net oil exporting country practicing oil and gas subsidization, the oil price shocks lead to the wealth transfer effect from oil importing to oil exporting countries, thus, confer a positive impact on the stock market.

***Keywords*:** Stock market, Power industry, Oil price

JEL Classification: G12, Q43

1. Introduction

Energy plays a pivotal role in the rapid growth of a country's economy. It is inevitable that a country economic growth will generally be accompanied by growth in energy demand. As Malaysia progresses towards becoming a developed nation, energy consumption will undoubtedly increase. In the past 10 years, Malaysia's energy demand has grown rapidly at an annual growth rate of 5.3% in line with the growth of its economy (Energy Commission, 2007). However, the increasing energy demand and the dwindling indigenous fossil fuel supply have raised concerns of energy scarcity and insecurity of energy supply for the future, especially with the high escalating prices of fossil fuels such as coal, natural gas and, in particular, oil in the global market.

Energy commodity prices have been rising at an unprecedented pace over the last five years with the oil prices experienced a strong run-up from beginning of 2007 to July 2008 with the spot price of West Texas Intermediate (WTI) barreling from US$58 per barrel in Jan 2007 and hit a record high of US$145 per barrel in July 2008. Opposing to that of the fuel prices, entering year 2008 Malaysia's stock market, which has long been plagued by low turnover, has continued to be under pressure in a bearish pattern. Kuala Lumpur Composite Index (KLCI) has lost more than 39 percent of its value in 2008 alone where it started with a high of 1435.18 on 2 January 2008 and closed at 869.62 at the end of December 2008. Although some believed that this is mainly due to the domestic political woes after the government's unprecedented loss in March 2008 general election, others argued that the rocketed fuels price is one of the reasons for the recent market depression.

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The relation between the fuels price and market performance of stocks has continued to be the interest of many researchers. Since Hamilton's 1983 work, the existence of a negative relationship between oil prices and macroeconomic activities has become widely accepted. Every time fossil fuel prices rise, economic activities such as people's income and the value of their assets, decline by some measures. Changes in the fuel prices have been considered an important factor for understanding fluctuations in stock prices. Thus, there is now a growing body of literature focusing on the impact of oil price changes on the stock market at country, industry, and also individual company levels.

At country level, to name some, the US stock market has been examined by Kling (1985), Jones and Kaul (1996), and Sadorsky (1999); Greece by Papapetrou (2001), and the developing economies by Maghyereh (2004). Whereas, Fama and French (1992), Al-Mudhaf and Goodwin (1993), Faff and Brailsford (1999), Kilian (2007), and Scholtens and Wang (2008) studied the impact of oil price changes on various industries and individual company's market performance. While most of the studies at company level concentrate on the oil and gas companies, see for example, Al-Mudhaf and Goodwin (1993), Lanza *et al*. (2003), Boyer and Filion (2007), and Scholten and Wang (2008), only few examine the relationship of oil price on public utilities and power generating companies which deal with the final users of energy, especially in the context of a developing country like Malaysia. As a developing country practicing direct oil subsidy with a regulated power industry, it would be interesting to find out if the changes in fuel price have an important impact on the stock market in Malaysia. Therefore, the main purpose of this study is to examine the relationship between the world spot oil price and the Malaysian stock market returns which include KLCI and the power companies' stock returns using a vector autoregression (VAR) analysis model.

The remainder of this paper is organized as follows. Section 2 gives an overview of the Malaysia energy sector. Section 3 provides a brief literature review. Section 4 discusses the methodology and data used in the analysis. Empirical results will be presented and discussed in section 5. Finally, conclusion remark will be given in the last section.

2. An Overview of Malaysia Energy Sector[1]

Energy is a strategic resource for Malaysia, and its importance in the industrialization process of the country is well recognized. It is appropriate to emphasize that energy has a crucial influence on economic growth, competitiveness and the position of the economy in the global market. As of year 2007, Malaysia holds proven oil reserves of 4.316 billion barrels. Malaysia's crude oil production registered a marginal decrease of 1.2 percent from 2006 to 33,967 kilo tonnes of oil equivalent (ktoe) in 2007 reflecting shutdowns for major maintenance and repair works in its several oil fields. Despite the long-term trend toward declining oil reserves and the slight decrease in the oil production, Malaysia is still a net exporter of crude oil. For year 2007, Malaysia has exported 6,804 ktoe of crude oil to Japan, Thailand, South Korea and Singapore.

The trends of energy use in Malaysia resemble the trends found in many developing countries. Oil has been an important source of energy for Malaysia. In an effort to offset declining domestic oil reserves, the national oil and gas company, Petroliam Nasional Berhad (Petronas), has been involved most actively in exploring offshore areas, especially in deepwater zones that pose high operating costs and require substantial technical expertise. Petronas has also initiated several overseas exploration and production projects through its subsidiary company called Petronas Carigali.

In order to ensure energy security and longevity, Malaysia is trying to diversify its energy sources by decreasing dependence on oil. Besides crude oil, Malaysia has an abundance of natural gas and coal located in specific reserves throughout its 13 states. The Malaysia National Energy Balance 2007 reported that as of January 2007, it contains 88.9 trillion standard cubic feet (Tscf) of proven natural gas reserves and 1,843 million tonnes of coal reserves. Natural gas production has been rising steadily in recent years, reaching 6,746 million standard cubic feet (MMscf) per day in 2007, whereas, the total production of coal was barely 1,074,935 metric tonnes for year 2007.

The Malaysian economy strengthened in 2007 with real GDP expanding by 6.3 percent compared to year 2006. In line with the increase in GDP, the final energy consumption (excluding input for power generation) has also increased by 9.8 percent to register at 44,268 ktoe compared to year 2006 (see Table 1 for the Malaysia key energy statistics in 2007). Petroleum products constituted about 56.1 percent of total final energy demand for year 2007, followed by natural gas at 23.4 percent, 17.4 percent for electricity and 3.1 percent for coal and coke. Energy in Malaysia is consumed mainly in the transportation and industrial sectors, registered at 35.5 percent and 43.2 percent respectively, followed by commercial and residential sectors combined at 14.0 percent, and the agricultural sector which consumes 0.6 percent of the energy. The remaining 6.7 percent is for non-energy use[2].

Malaysia's oil demand has been growing at a much slower rate than its economic output due to the conservation efforts and the conversion of oil-fired power plants to natural gas. Table 1 shows that the total energy input in power stations in 2007 amounting to 21,910 ktoe (about 35 percent of the Malaysia total commercial energy supply of 63,296 ktoe), where natural gas with a share of 56.6 percent as the main fuel source for electricity generation, followed by coal at 34.2 percent, hydropower at 6.9 percent, diesel at 1.4 percent, and fuel oil at 0.9 percent.

Since the beginning of 2002, the price of crude oil has increased substantially in the world market. The price of oil and petroleum products are determined by the international market based on supply and demand. If there is a large increase in oil prices in the world market, it will affect the price of fuel in the country as the price mechanism is linked to international market prices. The actual product price is determined after taking into consideration prevailing international prices, operating costs such as distribution and marketing costs and finally, sales taxes. In Malaysia, fuel is sold much cheaper than other countries because the government provides subsidies and sales tax exemptions. Natural gas supplied to the power sector has also been subsidized by Petronas at RM6.40 per mmbtu since 1997, and revised to RM14.31 per mmbtu, which is about 124 percent increase, in July 2008. However, at RM14.31, the government would still be subsidizing gas, which trades at RM39.00 per mmtbu in the market.

Table 1: Malaysia Key Energy Statistics Year 2007

	Kilo Tonnes (ktoe) of Oil Equivalent	Percentage
Malaysia Total Commercial Energy Supply Type of Fuels		
Crude Oil	26,571	41.98%
Petroleum Product and Other	(995)	(1.57%)
Natural Gas	27,362	43.23%
Hydro Power	8,848	13.98%
Coal and Coke	1,510	2.39%
	63,296	
Final Demand of Commercial Energy by Type of Fuels		
Petroleum Product	24,853	56.14%
Natural Gas	10,370	23.43%
Electricity	7,684	17.36%
Coal and Coke	1,361	3.07%
	44,268	
Final Energy Use by Sectors		
Transportation	15,717	35.50%
Industrial	19,116	43.18%
Commercial and Residential	6,212	14.03%
Agricultural	265	0.60%
Non-Energy	2,958	6.68%
	44,268	
Energy Input in Power Stations (excluding co-generation and private licensed plants)		
Natural Gas	12,401	56.60%
Coal	7,486	34.17%
Hydropower	1,510	6.89%
Diesel	314	1.43%
Fuel Oil	199	0.91%
	21,910	

Source: National Energy Balance 2007, Malaysia Energy Centre.

2.1 Malaysia Power Industry

Electric power development in Asia until recently has been a monopoly of the state, with the power sector's planning, finance, construction and management being a part of government activity. The surge in demand for power, as well as external pressures, induced Asian governments to allow private sector participation in electric power generation. In Malaysia, the government divested Tenaga Nasional Berhad (TNB) in 1992 and awarded independent power producers (IPPs) licenses to build and sell electricity to TNB for transmission and distribution. The power supply industry in Malaysia is principally dominated by three integrated utilities, namely Tenaga Nasional Berhad (TNB), Sabah Electricity Sendirian Berhad (SESB), and Syarikat SESCO Berhad (SSB). TNB and SESB fall under the jurisdiction of the Energy Commission (EC), whilst SSB is under the jurisdiction of the Sarawak State Government. TNB is the main electricity supplier for Peninsular Malaysia while East Malaysia is covered by SESB (Sabah) and SSB (Sarawak). These utility companies are complemented firstly by IPPs, and to a lesser extent, by dedicated power producers and co-generators. Before the generation side of the electricity business was opened to competition, the power supply industry operated as a vertically integrated monopoly.

The market was opened to IPPs in 1992 to relieve the state-owned electric utilities' burden of new power plant financing. There were 26 IPP projects which had been licensed for the whole of Malaysia in 2006, though not all of the projects have been built. To attract private investments into the power generation sector, the government had, through the state-owned utilities, entered into long-term power purchase agreements (PPAs) with the IPPs, many of which are on take-or-pay basis[3]. As of year 2007, the total installed generation capacity is 21,398MW where Peninsular Malaysia, Sabah and Sarawak stood at 19,723MW, 708MW and 967MW respectively serving the maximum demand recorded of 13,620MW for Peninsular Malaysia, 625MW for Sabah and 834MW for Sarawak (Energy Commission, 2007).

In the light of the experiences of other deregulated utility systems, notably the Californian power crisis, the Government's earlier plan to implement the power pooling model under which power plants would have had to sell electricity to power grids has been stalled. Instead, TNB has been allowed to retain a major role in generation. The alternative market structure adopted by the government aims to transform the IPP market into a more transparent and competitive system via the implementation of an open bidding system for setting up new generation capacity. The authorities believe that the managed market model will encourage lower-cost power production, thus ensuring competitive power prices for consumers.

Among the largest IPP players in Malaysia are YTL Power Generation Sdn Bhd, Genting Sanyen Power Sdn Bhd, Tanjung Bin Power Sdn Bhd, Malakoff Berhad, Port Dickson Power Berhad, Powertek Berhad, Segari Energy Ventures Sdn Bhd, ARL Tenaga Sdn Bhd, Ranhill Powertron Sdn Bhd, and TNB Generation Sdn Bhd. Most of the IPP players are owned by public listed companies or their subsidiaries. The companies listed on Bursa Malaysia that involved in power generation business either directly or through its subsidiaries are tabulated in the Table 2. All the seven companies are listed on the main board of Bursa Malaysia. Among them, five of the companies are KLCI's components as of 2008. For this study, these five power companies are selected, namely Tenaga Nasional Berhad (TENAGA), Sarawak Energy Berhad (SARAWAK), Tanjong Public Limited Company (TANJONG), YTL Power International Berhad (YTLP), and Genting Berhad (GENTING). They are among the favorite stocks traded on Bursa Malaysia as indicated by their high trading volume in year 2007 (see Table 3).

These companies are selected due to their high market capitalization and some preliminary thoughts about any possible reaction to the oil prices. In contrast to their massive market capitalization and weighting of nearly 13% on the KLCI and 9% on the Bursa Malaysia for at year ended 2007[4], the direct GDP contribution of Malaysia's power sector is not very substantial. The value-added for the utility accounted for a mere 3.0% of nominal GDP in year 2007[5]. While the proportion is not very high, the power sector's impact on the economy is certainly of far greater significance, given its essential service and hence strategic role in economic development. Nearly 80% of the country's electricity demand comes from the critical industrial and commercial user groups (Energy Commission, 2007).

Table 2: The Bursa Malaysia Listed Companies Involve in Power Generation

	Company	Business Activities	Generation Installed Capacity in Malaysia	Power Station/ Company owned
1.	Tenaga Nasional Berhad TNB (5347) Trading/Services (KLCI components)	Power Utility	**11,200MW** Gas 40.4%, Coal 32.8%, Hydro 17.5%, Oil 9.3%	TNB Generation, TNB Generation Sdn Bhd, TNB Janamanjung Sdn Bhd, TNB Hidro Sdn Bhd, Sabah Electricity Sdn Bhd
2.	Sarawak Energy Berhad Sarawak (2356) Trading/Services (KLCI components)	Power Utility	**967MW** Gas 49.7%, Coal 21.7%, Oil 18.1%, Hydro 10.4%	Syarikat SESCO Bhd, Sejingkat Power Generation I & II, Sarawak Power Generation
3.	Tanjong Public Limited Company Tanjong (2267) Trading/Services (KLCI components)	Power Generation, Gaming, Leisure & Property Investment	**1,490MW** Gas 100%	Powertek Berhad, Pahlawan Power Sdn Bhd, Panglima Power Sdn Bhd, Power Plant in Middle East
4.	YTL Power International YTLP (6742) Infrastructure	Energy & Utility	**1,212MW** Gas 100%	Paka & Pasir Gudang Power Station, Power Plant in Jawa
5.	Genting Berhad Genting (3182) Trading/Services (KLCI components)	Leisure, Power Generation, Plantation, Properties	**720MW** Gas 100%	58.6% of Genting Sanyen Power Sdn Bhd, Power Plant in China & India
6.	MMC Corporation Berhad MMCCorp (2194) Trading/Services (KLCI components)	Transport & Logistics, Energy & Utility, Engineering & Construction	**6,813MW** Gas 36.9% Coal 54.3% Oil 8.8%	51% of Malakoff Corporate Berhad (2007) which owned Segari Energy Venture Sdn Bhd, GB3, Tanjung Bin Power Sdn Bhd, Kapar Energy Venture Sdn Bhd, Prai Power Sdn Bhd
7.	Ranhill Utilities Berhad Ranhill (5030) Construction	Infrastructure, Oil & Gas, Power, Water	**190MW** Gas 63.2% Oil 36.8%	Ranhill Power Generation, Ranhill Powertron

Source: Bursa Malaysia Berhad (2007), companies' annual reports.

Table 3: Selected Power Companies' Stock Information in 2007

	Volume (million units)	Total Transaction of Main Board (%)	Share Issued (million shares)	2007 Market Capitalization (RM billion)	Total Market Capitalization of Bursa Malaysia (%)
TENAGA	2,123	0.78%	4,334.6	41.61	3.8%
SARAWAK	353	0.13%	1,526.11	3.66	0.3%
YTLP	745	0.27%	5,715.26	7.46	0.7%
TANJONG	138	0.05%	403.26	14.29	1.3%
GENTING	1,579	0.58%	3,703.78	29.45	2.7%

Source: Bursa Malaysia Berhad (2007).

Although MMC Corporation Berhad owned 51% of Malakoff Corporation Berhad which is the largest IPP in Malaysia, MMC Corporation Berhad only started its involvement in power generation business with the acquisition of Malakoff in year 2006. Its history in power sector is too short to see the impact of oil price on the stock price, thus, it will not be included in this study. Another stock that will not be included in the study is the Ranhill Utilities Berhad which owned only 190MW (less than 1 percent of the total installed capacity in Malaysia as of year 2007) of power generation capacity. The market perception on the company is more of an infrastructure company rather than a power sector company.

3. Related Literature Review

There have been numerous studies related to the interaction among oil prices and the overall economy. While many have studied on the effect of fuel prices on economic activities, studies relating fuel prices and stock prices have also received much attention from researchers. It is expected that a rise in fuel prices would suggest a lower stock market return and a drop in fuel prices infers a rise in stock prices. Fossil fuels such as oil, coal and natural gas as the primary resource in the industrialization process has a crucial influence on a company financial performance. A higher fuel price would mean higher operational expenses and thus affecting the revenues. An efficient stock market will react with an immediate decline in stock prices. Thus, individual oil price shocks depress real stock returns.

Pioneered by Hamilton (1983), there are many studies which advocate a linkage between economic variables and oil prices. An increase in oil prices have some effects on the economy through various channels as rise in the cost of production, decrease in corporate profit, impact on inflation and transfer of wealth from oil consumer countries to oil producer ones. As assets prices are the present value of the future net earnings of the firms, it is reasonable to expect a significant relation between oil price shocks and stock market returns. As studies have shown that oil plays an important role in an economy, one would expect changes in oil price to be correlated with changes in stock prices. The studies on the direction and impact of oil price changes on stock market have been examined by Kling (1985), Jones and Kaul (1996), Huang *et al*. (1996), Sadorsky (1999), Papapetrou (2001), Maghyereh (2004), Kilian (2007), Scholtens and Wang (2008), and many others.

Kling (1985) investigates relationship between crude oil price changes and stock market activity for the sample period of 1973-1982 in the US and finds that crude oil price changes affect the future stock prices in the industries which use oil as input. Jones and Kaul (1996) test on the rationality of stock prices as to whether they reflect the impact of news on current and future real cash flows, thereby finding that oil price increases in the post war period have a significant detrimental effect on the US, Canadian, Japanese, and the UK stock markets. They also conclude that the different oil price sensitivities depend on different concentration of resources and industries.

Sadorsky (1999) studies the dynamic interaction between oil price and other economic variables including stock returns using an unrestricted VAR model with US data from January 1947 to April 1996. He uses variance decomposition and impulse response functions to analyze the dynamic effect of oil price shocks. He finds that oil price changes and oil price volatility have significantly negative impact on real stock returns. In post-1986 period, oil price changes and oil price volatility have a larger impact on the economy than in the pre-1986 period, as in 1986 the oil price declined significantly and the oil price has been more volatile since 1986. His study also discovers that the response of the stock market to oil price shocks is asymmetric such that an oil price increase has a greater influence than an oil price decrease.

Maghyereh (2004) examines the nexus between oil price shocks and stock market returns for 22 emerging economies, namely Argentina, Brazil, Chile, China, Czech Republic, Egypt, Greece, India, Indonesia, Jordan, Korea, Malaysia, Mexico, Morocco, Hungary, Pakistan, Philippines, Poland, South Africa, Taiwan, Thailand, and Turkey for the period of January 1998 to April 2004. Results from the variance decomposition analysis show that there is weak evidence that oil price shocks can affect stock market returns in these emerging economies. Only in 4 countries (Turkey, Malaysia, South Africa and Korea) do oil price shocks explain more than 2% of the forecast errors variance, while in 15 countries oil price shocks explain less than 1% after 15 days. He concludes that, inconsistent with previous empirical studies in developed economies, stock markets in emerging economies are inefficient in the transmission of new information of the oil market, and stock market returns in these countries do not rationally signal changes in crude oil price. After finding negative impact of oil price shock on the aggregate stock return in his works, many researchers have expanded their study to examine the impact of oil shocks in individual sectors as well as firm levels. Interestingly, in contrast to the negative impact of oil price shock on aggregate stock return, some of them find that oil price shock has a positive impact on the oil and natural gas industries.

For example, using a VAR approach, Huang *et al*. (1996) find that oil futures returns do influence some US individual oil company stock returns, but oil futures returns do not have much impact on broad based market indices like the S&P 500. On the other hand, Faff and Brailsford (1999) explore the sensitivity of Australian industry equity returns to an oil price shock also find there is a positive and significant impact of oil price changes on the oil and gas, and diversified resources industries. In relation to the impact of oil shocks on the stock return, Jones *et al*. (2004) comment that, ideally stock values reflect the market's best estimate of the future profitability of firms, so the effect of oil price shocks on the stock market is a meaningful and useful measure of their economic impact. Since asset prices are the present value of the future net earnings of the firms, both current and expected future impacts of an oil price shock

should be absorbed fairly quickly into stock prices and returns without having to wait for those impacts to actually occur. The direction of the impact on stock market return may be different depending on whether oil is an input or an output for an industry. Some industries might be in position to pass on higher fuel costs to their customers, thus minimizing the negative impact of higher oil prices on their profitability.

Yurtsever and Zahor (2007) test the impact of oil price shocks to the various industries and companies in the Netherlands. They apply the methodology used by Nandha and Faff (2007) for testing the exposure and symmetry of oil price shocks of the different industries and some individual firms' stocks in AEX (Amsterdam Stock Exchange). Empirical results indicate that there is a positive relationship between oil price increase and oil and gas industry's stock prices which is consistent with their expectation as oil is the main output of the oil and gas industry. The analysis also demonstrates that oil price increases and decreases have an asymmetry impact on the equity market.

Kilian and Park (2007) states that responses of real US stock returns to oil price shocks differ substantially depending on the underlying causes of the oil price increase. They find that shares in the petroleum and natural gas industry as well as gold and silver mining will appreciate in response to a positive oil-market specific demand shock as these industries are believed to have direct relation with the increase in demand of oil. In contrast, automobile and retail industries are deemed to have negative impact on the price shock. For public utilities which deal with the final users of energy, their responses to crude oil market instability are more muted since public utilities tend to be regulated.

Al-Mudhaf and Goodwin (1993) examine the return of 29 US oil companies in a period surrounding the oil shock of 1973 using a multi-factor APT model and find that oil price shock drove up return for oil firm. This is then followed by Boyer and Filion (2007) who also employ the APT model to study the determinants of stock returns of Canadian oil and gas companies. Their results reveal a significant relationship between oil price changes and stock return. In addition, Scholtens and Wang (2008) assess the oil price sensitivities and oil risk premiums of NYSE listed oil and gas firms' returns by a two-step regression analysis under two different arbitrage pricing models. They discover that the return of oil stocks is positively associated with the return of the market.

While many studies conclude that there is a significant relationship between crude oil price changes and the stock returns at the country, industry and individual firm levels, some researchers argue that the impact of crude oil prices on equity return is ambiguous. For example, Chen *et al*. (1986) concluded that oil price changes have no effect on asset pricing. Huang *et al*. (1996) also found no relationship between stock returns and changes in the price of oil futures. Therefore, empirical study needs to be conducted to gauge the relationship between oil price changes and stock market return in a country/industry/firm as the finding may vary depending on whether the country under study is a net oil importing or exporting nation, and also some industry specific factors may affect the outcome of the results.

4. Methodology and Data

The testing methodology consists of three steps. The first step is to apply the Augmented Dickey-Fuller (ADF) (1981) unit root test to examine the stationarity characteristics of the data and to verify the order of integration of them. The unit root test is essential as cointegration is less valid if the tested variables are with different order of integration. The second step involves testing for cointegration using the Johansen-Juselius (1990) procedure and normalizing the obtained equation by means of vector error correction estimates. In the third step, we utilize the impulse response functions to study the dynamic response of the stock returns towards the shocks of world oil price over time. As the ADF unit root test and the Johansen and Juselius cointegration test are now commonly applied in empirical researches, to conserve space, we would not explain them here.

4.1 Impulse Response Function

The impulse response functions (IFRs) shows the dynamic responses of time series to a one-period standard deviation shock to the innovations of the system and indicate the direction of the response to each of the shocks (Sims, 1980). It can also provide a rough analysis of how long it takes for the variable to go back to the equilibrium after the long run relationship has been shocked. In this study, IRFs will be used to trace out the time path of stock return with respect to one unit oil price shock. Suppose that a 2-variables VAR(1) is specified as follow:

$$\begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} y_{1t+1} \\ y_{2t+1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{1t} \\ \varepsilon_{2t} \end{bmatrix} \tag{1}$$

A perturbation in ε_{it} has an immediate and one for one effect on y_{1t}. In period t+1, that perturbation in y_{1t} affects y_{1t+1} through the first equation and also affects y_{2t+1} through the second equation. These effects work through to period t+2, and so on. Thus, a random shock in one innovation in the VAR sets up a chain reaction over time in all variables in the VAR. Impulse response functions calculates these chain reactions (see Park, 2007, pp. 32).

4.2 Source of Data

The sample contains weekly KLCI and stock returns of the five power sector companies of Bursa Malaysia which covering the sample period from January 2002 to December 2008. The period was chosen because only after January 2002 a steadily increase in the world oil price was witnessed over the next few years. The KLCI serves as a proxy for the market portfolio returns and the five major power sectors stock will be symbolized as TENAGA, SARAWAK, TANJONG, YTLP and GENTING. The weekly stock closing prices and the KLCI were compiled from Bursa Malaysia. Globally, there are many oil price indices. In general, the prices of three types of oil (Brent, West Texas Intermediate and Dubai) serve as benchmarks for other types of crude oil. The price of West Texas Intermediate (WTI) is generally higher than Brent oil as it is sweeter and lighter than Brent oil. In this study, WTI spot oil price index will be used as the proxy for world oil price seeing that it is one of the most widely traded spot oil prices in the world and is used as a benchmark to set other oil product related prices.

5. Empirical Results

In this study, the empirical analysis was carried out using log-transformed time series data on the WTI spot oil price (LWTIS), stock returns of KLCI (LKLCI), TENAGA (LTNB), SARAWAK (LSEB), TANJONG (LTANJ), YTLP (LYTLP) and GENTING (LGENT) over the period of January 2002 to December 2008.

5.1 ADF Unit Root Test Results

Firstly, the properties of individual time series data were investigated and the order of integration were determined using the ADF unit root test. The outcomes of the unit root tests are presented in Table 4. The results show that the null hypothesis cannot be rejected in each series in level where the series contain a unit root. Therefore, all variables appear to be non-stationary in the level. By testing through first difference, the results clearly indicate that the null hypothesis of non-stationary can be rejected. This means that all variables become stationary and do not contain unit root after first differencing. Hence, the variables are said to be integrated of order one. According to Engle and Granger (1987), variables having the same order of integration can be tested for cointegration. In this way, the result of unit root test facilitates us to proceed to the cointegration test for the variables under study.

Table 4: Results of Unit Root Test

	Level (Trend and Intercept)		First difference (Intercept)	
Variables	*t*-statistic	Lag Length	*t*-statistic	Lag Length
LWTIS	1.164	(1)	-14.554***	(0)
LKLCI	0.046	(0)	-17.581***	(0)
LTNB	-1.193	(0)	-19.723***	(0)
LSEB	-2.550	(0)	-20.092***	(0)
LTANJ	-2.491	(0)	-20.133***	(0)
LYTLP	-2.052	(0)	-18.810***	(0)
LGENT	-0.488	(0)	-20.781***	(0)

Notes: LWITS, LKLCI, LTNB, LSEB, LTANJ, LYTLP and LGENT are the natural log of WTI spot oil price, and KLCI, TENAGA, SARAWAK, TANJONG, YTLP and GENTING stock prices respectively. Asterisks (***) denote rejection of the null hypothesis at the 1% significant level. Numbers of lag intervals are selected based on Schwartz Information Criterion (SIC).

5.2 Johansen-Juselius Cointegration Test Results

The purpose of the cointegration test is to detect the existence of a long run relationship between the oil price with KLCI and the power sector stocks' returns. The maximum likelihood procedure is applied to scrutinize the number of cointegrating vector(s) between these variables. Table 5 presents the results of the trace and the maximum-eigenvalue tests from the cointegration analysis. Results show that the null hypothesis of no cointegration between WTI spot oil price with KLCI, TANJONG, TENAGA and YTLP are rejected at least at 10% level of significance as the computed values for both trace and maximum-eigenvalue tests are larger than the corresponding critical values. However, no cointegration is found for the stock return of GENTING and SARAWAK with the WTI spot oil price. These results implying that there is a single cointegrating vector in the models for KLCI, TANJONG, YTLP and TENAGA with the WTI spot oil price, and hence, a stable long run equilibrium relationship exists among these variables in the system over the sample period.

5.3 Normalized Cointegrating Vector

In this section, the independent variable of WTI spot oil price is normalized with respect to the dependent variable of KLCI and power sector stocks return that consist of TANJONG, YTLP and TENAGA. This will give us more insights on the long run relation between the world spot oil price and the stock returns in Malaysia. Since GENTING and SARAWAK have no cointegration relation with the WTI spot oil price, these two stocks are excluded from the vector error correction estimates. Given that the estimation values are obtained by normalizing the independent variable with respect to the dependent variable, they therefore reflect the long run elasticity measures of the variables. Table 6 reports the results of the normalized cointegrating vector. The results show that the Malaysian stock market in general and the power sector stocks return in particular are positively related to the WTI spot oil price. The relationships are statistically significant as indicated by the high *t*-statistic values.

Table 5: Johansen and Juselius Cointegration Test Results

Ho	Eigenvalue	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value
Variables: LKLCI & LWTIS					
None	0.039	16.360**	15.495	14.527**	14.265
At most 1	0.005	1.834	3.842	1.834	3.842
Variables: LTNB & LWTIS					
None	0.038	15.800**	15.495	14.136*	14.265
At most 1	0.005	1.664	3.842	1.664	3.842
Variables: LTANJ & LWTIS					
None	0.046	19.343**	15.495	16.806**	14.265
At most 1	0.007	2.537	3.842	2.537	3.842
Variables: LYTLP & LWTIS					
None	0.075	29.541**	15.495	27.269**	14.265
At most 1	0.006	2.272	3.842	2.272	3.842
Variables: LGENT & LWTIS					
None	0.032	12.630	15.495	10.967	14.265
At most 1	0.005	1.663	3.842	1.663	3.842
Variables: LSEB & LWTIS					
None	0.025	10.505	15.495	8.417	14.265
At most 1	0.006	2.089	3.842	2.089	3.842

Note: Asterisks (*, **) denote rejection of the null hypothesis at the 10% and 5% significant levels, respectively.

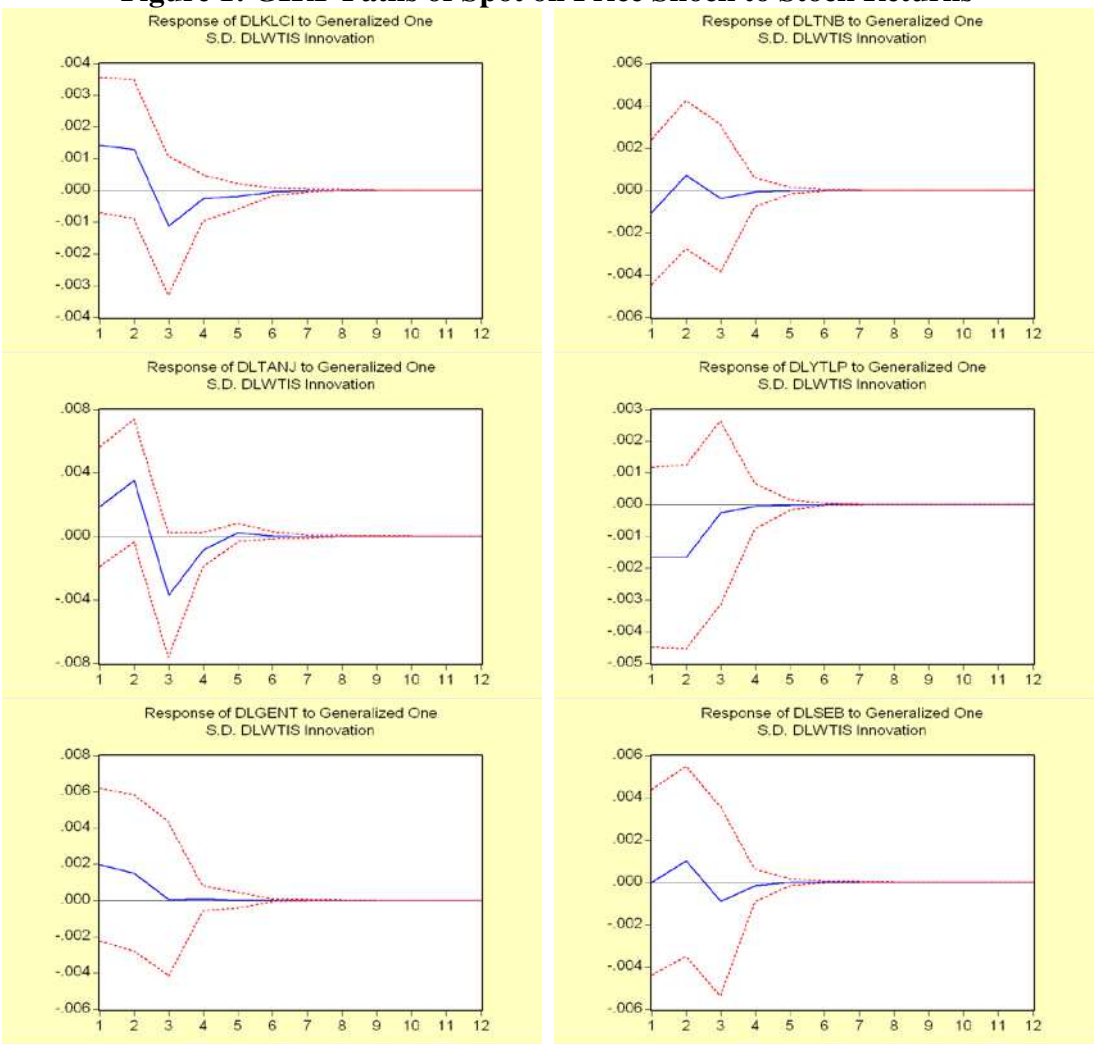
Table 6: Normalized Cointegrating Vector Test Results

	Constant	LWTIS	[*t*-statistics]
LKLCI	3.232	0.688	[6.730]
LTNB	0.529	0.307	[2.992]
LTANJ	-0.524	0.588	[7.512]
LYTLP	-2.880	0.649	[12.900]

5.4 Impulse Response Function Analysis Results

Impulse response functions (IRFs) are dynamic simulations showing the response of an endogenous variable over time to a given shock. In this study, the generalized impulse response function (GIRF) analysis is applied. The aim of this analysis is to examine the impact of world oil price shock on the Malaysian stock market. The results of the impulse responses of the variables are presented in Figure 1. In general, the responses of the variables take about 5-6 weeks to return to the equilibrium level. Most of the variables seem to act positively and instantly after the shocks of oil prices, except for TENAGA and YTLP which responded negatively. Overall, from Figure 1, we notice that the responses are insignificant and the short run equilibrium adjustment process is quite fast. In most of the cases, the oil price shock has its impact on the shorter time horizon and the highest impact would happen to TANJONG and less to SARAWAK. TANJONG reacted positively immediately after the oil price shock and continue to increase for a week. It is then reverts back in the negative territory in the following week and back to the equilibrium on the fifth week.

Figure 1: GIRF Paths of Spot oil Price Shock to Stock Returns



Notes: The horizontal axis refers to weeks after the shock. The vertical axis refers to standard deviations. Charts provide GIRFs or reactionary profiles for the response of all the variables when WTI spot oil price is shocked.

6.0 Conclusion

There were many studies which supported a linkage between economic variables and oil price fluctuations started from Hamilton (1983). Thus, it is logical to expect a significant relation between oil price shocks and stock market returns as well, because the assets prices are the present value of the future net earnings of a firm. Since Malaysia is a developing country practicing direct oil subsidy with a regulated power industry, it is interesting to find out from this study that the change in fuel price has an impact on the stock market in Malaysia and the power sector companies listed on Bursa Malaysia.

Using Johansen and Juselius (1990) cointegration test, a single cointegrating vector was detected among the variables for LKLCI, LTNB, LTANJ and LYTLP with the oil price but no cointegration vector was found for LGENT and LSEB. Thus, it is concluded that a long run relationship can be found between the stock returns of KLCI, TENAGA, TANJONG and YTLP with the world spot oil price, but not for the cases of GENTING and SARAWAK. Results of the normalized cointegration vector indicating the existence of long run positive relationship of world spot oil price with the KLCI, TENAGA, TANJONG and YTLP. However, the findings imply that the positive impact is relatively small. Furthermore, empirical analysis from the impulse response functions show that, in most of the cases, the oil price shock has an impact on the shorter time horizon, with the highest impact on the TANJONG. By and large, the responses are insignificant and the short-run equilibrium adjustment process is rather fast.

As oil and other substitutes of oil, such as natural gas and coal, are the main inputs of the power industry in Malaysia, it is reasonable to expect a negative relation between oil price increase and the power sector stock prices. However, the results of this study have shown otherwise. This could be mainly due to the fact that Malaysia not only is a net oil exporting country practicing oil subsidies, but also it has abundance of the natural gas and coal resources. Most importantly, natural gas supplied to the power sector by the national oil and gas company, Petronas, is at a subsidized rate which is much lower compare to the market price.

This study indicates that world oil spot price has a positive long run impact towards Malaysian stock market during the period under study from January 2002 to December 2008. This finding is supported by Greene *et al*. (1997), Abeysinghe (2001), International Energy Agency (2007), and Park (2007) which evoke that the oil price shocks lead to the wealth transfer effect from oil importing to oil exporting countries. Consequently, oil price hike heads a positive impact on oil exporting nations. Yet, the positive effect from oil price hike on the power sector stock is relatively small in the context of Malaysia. Besides having the privilege of enjoying the subsidized natural gas price from Petronas, the power sector in Malaysia is still highly regulated. In addition, all the independent power producers (IPPs) have a secured long-term power purchase agreements (PPAs) with the state-owned utility companies. Study by Kilian and Park (2007) in the US stock market also found that for the public utilities which tend to be regulated, their responses to crude oil market disturbances are more muted although they are dealing with the final users of energy.

Our findings also show that the non-existence of long run cointegration relation between the stock returns of GENTING and SARAWAK with the world spot oil price. This could most probably due to the fact that the power division of GENTING is not as prominent as its leisure business, and investors do not perceive GENTING as a power sector stock. In fact, GENTING power division only makes up to about 17% (RM1,491 million) of the total GENTING group's revenue (RM8,483.8 million) whereas, their leisure and hospitality business contribute to nearly 70% (RM 5,892.3 million) (see Genting Berhad Annual Report 2007). Whereas, in the case of SARAWAK, it has only become the main power player in the state of Sarawak after the acquisition of Syarikat SESCO Berhad, the power utility company in Sarawak, in July 2005. Currently, the major shareholder in SARAWAK is the Sarawak State Government, who holds 65% equity interest in the Company since September 2004. Thus, SARAWAK with the short history of involvement in power sector and fully controlled by the state government, it is not surprising that the stock is less affected by the movement of the international oil prices.

By knowing the influence of oil prices on stock market activity and power stocks' returns, investor can then act accordingly with the oil price movement. According to the results, investors and business administrators of the relevant firms could find that it is interesting as the oil exposure for power industry in Malaysia is quite low. A well diversified portfolio can be achieved by considering oil price shocks and consisting of some stocks, such as the power sector stocks, which have a positive reaction to these shocks.

To conclude, the international oil price volatility has less impact on the Malaysia's power sector stock mainly due to the government subsidization on the oil and gas which are the main fuel for the power generation in Malaysia. In response to the sharp increase in the global oil prices as well as the subsidized gas price in mid 2008, TENAGA has announced a 24% increase in the average tariff, with effect from 1 July 2008, in order to compensate for the increase in fuel costs. And thus, the effect of reducing the gas subsidy to the power sector has then been indirectly transferred to the consumers of the electricity. As electricity plays a pivotal role in economic activities, inevitably the economic performance of the country will be impacted with the tariff increase. From there it can be seen that the government's oil and gas subsidization policy not only lessening the adverse effect of oil price volatility on the power sector stocks in Malaysia but also plays a significant role in improving economic performance. Thus, the policy makers should take these consequences into consideration when handling the government policy of oil and gas subsidy to power sector.

Endnotes:

1. We refer to National Energy Balance 2007 published by Malaysia Energy Centre for most of the information used in this section.
2. Non-energy use refers to use of products resulting from the transformation process for non-energy purpose (i.e. bitumen/lubricants, asphalt/greases) and use of energy products (such as natural gas) as industrial feedstock.
3. In case the utility is unable to accept all the power according to the despatch schedule and if the fuel procured by the IPP remains unused, the utility will be required to either pay liquidated damages or pay the cost of the fuel not utilized for purposes of generation.

4. At year ended 2007, the total Bursa Malaysia market capitalization was around RM1.10 trillion where total KLCI market capitalization was about RM750 billion which made up to about 70% of the total Bursa Malaysia market capitalization.
5. See Economic Report 2008/2009 by Ministry of Finance Malaysia.

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