THE IMPACT OF OIL PRICE SHOCKS ON STOCK MARKET RETURNS IN MALAYSIA: THE ARDL APPROACH

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Abstract - This study analyses the impact of oil price shocks on Malaysia stock market using daily time series data for the period of 1987-2017. The Autoregressive Distributed Lag (ARDL) approach and Toda Yamamoto (1995) causality test are used to aid in the analyses of the study. Through the ARDL approach, the bound test results indicate the existence of a long-run relationship between crude oil and stock market returns. This study has discovered that oil price shocks have significant positive impact on the Malaysia stock market both in the long-run and short-run. On the other hand, the causality test reveals a unidirectional causality running from oil return to stock return. These results have important implications for the decision-making by policymakers.

Keywords - Oil price shocks, Stock market return, Autoregressive Distributed Lag, Toda-Yamamoto

I. INTRODUCTION

Oil price shocks can be defined as the increases in oil price and decreases in oil price (Mork,1989). According to Hamilton (1996), he proposed that for an increase in oil prices to be defined as a shock. Oil price shocks have become a major concern for the world economy. Seen from an economy perspective, crude oil is a real resource and essential input in the production process. Through this way, the changes in oil price will certainly have an impact on the costs of doing business and production. Therefore, future oil prices affect the expected cash flows, and this is reflected by stock price. The theoretical findings were consistent with theory of Huang *et al.* (1996) and Jones *et al.* (2004), which demonstrated that oil price influences the stock price through the expected cash flows.

Malaysia is the second largest oil and natural gas producer in Southeast Asia after Indonesia. Almost all the Malaysia's source of crude oil is from the offshore fields, with most of the reserves located in the Malay basin (International Monetary Fund, Asia and Pacific Department, 2015). Malaysia is considered as an oil exporter country but also a country that imports oil from other countries. The country's oil exports value exceeds the oil imports value; thus, Malaysia is a net oil exporting country. Based on the ASEAN Statistical Yearbook 2014, it's clearly stated that Malaysia is an oil exporter country from year 2004 to 2014.

In the middle of 1980s, Malaysia had been transformed from an agriculture-based economy to an economy less reliant on agriculture but towards the manufacturing sector. Since the year 1980, the manufacturing sector had led the economic growth of Malaysia. As the manufacturing sector has long been recognized as a catalyst of growth in the development process of Malaysia, it is considered to have played a key role in the country's economic development. The rapid growth of the manufacturing sector has led to the high demand for crude oil in developing countries. For instance, the Malaysia's crude oil consumption soared during all years as shown in Figure 1.

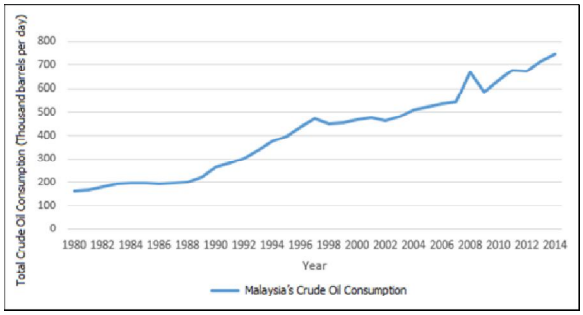

Figure 1: Malaysia's crude oil consumption, 1980-2014 (Thousand barrels per day)
Source: Data are retrieved on 7 May 2017, from The Global Economy, http://www.theglobaleconomy.com/Malaysia/oil_consumption/

Besides that, Malaysia's crude oil prices are set by the government and the oil price is subsidized by the government since 1970s. Large changes in oil price could have tremendous impacts on the economy of Malaysia. To households, an increase in oil price will lead to a rise in gasoline price, which in turn causing reduction in the household income, as households spend a part of their incomes on gasoline expenses. A large increase in oil price is also an issue for business units of both domestic and foreign business entities, because it can reduce a company's profits and may lead to lower equity prices of oil-related companies. Therefore, oil price shocks are considered as an important factor to causing fluctuations in the stock market.

In addition, crude oil price can influence financial markets via several channels, that is, by affecting economic activity, inflation, corporate earnings, and monetary policy which have implications for asset prices and financial markets (Mussa, 2000). As indicated by Mussa, an increase in oil price will raise

the cost of economy, resulting in an increase in the relative price of energy inputs and putting pressure on profit margins. This in turn will impact on price level which may lead to inflation. The magnitude of the impact on price level will depend on the degree of monetary tightening and the extent to which consumers seek to offset the decline in their real incomes through higher wage increases, while producers seek to restore profit margins. Further, this will affect the extent to which central banks raise interest rates to offset inflationary pressures and therefore the impact of oil price increase on the real economic activity. Finally, oil price increase will affect the equity and bond valuations, and currency exchange rates, depending on the situations whether a company or a country is benefiting or hit by the increase in oil price.

There are previous studies on how crude oil return influences the international stock markets for different countries particularly in developed countries such as, the United States (U.S.), United Kingdom (U.K), and European countries. Several past studies had looked into the issue in the case of Malaysia. However, this present study seeks to provide analysis using a long-time span of updated data from 1987-2017 and on daily basis differing from most current studies that use monthly data, and we apply the methods of Autoregressive Distributed Lag (ARDL) and Toda and Yamamoto causality test. The examples of previous studies are such as, Huang *et al.* (1996), Papapetrou (2001), Basher and Sadorsky (2006), Mohanty, Nandha and Bota (2010), Dhaoui and Khraief (2014), and Dogan *et al.* (2016). Our in interest is to empirically verifying whether oil price shocks can significantly influence the stock market in Malaysia. This study will provide insights to aid policymakers in the decision-making process dealing with crude oil price and local stock market.

The remainder of this paper is organized as follows. Section 2 reviews the relevant empirical studies on oil price shocks and stock returns. Section 3 discusses the methods and data used in this present study in examining the relationship between crude oil and stock market returns in Malaysia. This is mainly to find out the influence of oil price shocks on stock market in Malaysia. Our empirical results will be presented and discussed in Section 4. Finally, the conclusion remark will be given in Section 5.

II. LITERATURE REVIEW

Huang *et al.* (1996) investigated the link of crude oil futures return and stock returns in the U.S. during the 1980s. The VAR approach was applied to investigate the relationship between both variables and it was concluded that crude oil futures led the stock prices of oil companies. However, the authors indicated that oil futures returns were not correlated with stock returns. In a similar study, Sadorsky (1999) carried out an unrestricted VAR model for the case of U.S. The study focused on the dynamic relationship between oil price and stock returns by using the monthly data for the period of 1947-1996. The findings showed that oil price played an important role in affecting stock returns.

Papapetrou (2001) used monthly data to probe the relationship between oil price and stock return in Greece from 1989 to 1999. The author employed multivariate vector autoregression (VAR) for the analysis. The findings suggested that a positive oil price shocks can depress stock return, which mean that oil price can have a negative impact on stock return. Basher and Sadorsky (2006) used international multi-factor model to study the effect of oil price on stock return for 21 emerging markets using both weekly and monthly data. It was found a significant relationship between oil price change and stock market return. Abdul Hadi, *et al.* (2009) investigated the impact of oil price changes on stock market in Malaysia and Indonesia. They used monthly time series data for Kuala Lumpur Composite Index (KLCI) and Jakarta Composite Index (JCI) from the period 1986 to 2006. The results indicated that a significant long-term relationship between oil prices and stock markets in both countries. There also exists a positive relationship among the variables.

Mohanty, Nandha and Bota (2010) analysed the relationship between oil price and stock market returns for six Eastern European emerging stock markets including Czech Republic, Hungary, Poland, Romania, and Slovenia. They applied monthly data from 1998 to 2010. The estimated regression model showed no significant relationship between oil price and stock market returns. Cunado and Perez de Gracia (2014) applied Vector Autoregressive (VAR) and Vector Error Correction Models (VECM) to examine the relationship between oil price shocks and stock market returns. They analysed the cases of 12 European oil-importing countries over the period of 1973-2011. In the study, they found that oil price shocks had positive and significant impact on stock market returns in most of the countries.

Dhaoui and Khraief (2014) studied the linkage between oil price shocks and stock market returns, for the period 1991 to 2013. They analysed the cases of eight developed countries: U.S., Swiss, France, Canada, U.K., Australia, Japan and Singapore. This study applied monthly data and the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. It was found a strong negative interaction between oil price and stock return in the seven developed countries, except Singapore. Jain & Biswal (2016) examined the dynamic linkages among oil price, exchange rate, gold price and stock market in India for the period 2006 to 2015. Based on the Dynamic Conditional Correlation (DCC GARCH) models, the results showed the fall in gold price and oil price will decrease the value of currency and the benchmark stock index.

Dogan *et al.* (2016) studied the response of stock market returns to the changes of oil price using panel data. The study focused on Egypt, Israel, Jordan, Kuwait, Morocco, Oman, Qatar, Saudi Arabia, Tunisia and Turkey, and utilized the generalized method of moments-system approach. The study reported that oil price impacted on real stock returns positively for all countries. Another recent study, Najaf (2016), reported a significant association between oil price and stock markets in both Malaysia and Turkey. The author employed time series data of twenty years for the period 1990 to 2010.

III. Methodology

To carry out this study, time series data from 1987 until 2017 are collected. The analysis is conducted at a uniform daily frequency with a total of 7636 observations for each variable. The data of Brent crude oil and Malaysia stock market return are extracted from Datastream. This study examines the impact of oil price shocks, on Malaysia stock market using FTSE Bursa Malaysia KLCI Index (FBMKLCI) return as the dependent variable and Brent crude oil return as the independent variable. The model is as below:

$$LNKLCI_t = \alpha + \beta_1 LNBRENT_t + \varepsilon_t \qquad (1)$$

In the above equations: α represents the intercept and β_1 is the coefficient. $LNKLCI$ is the natural log of the Malaysia aggregate stock market return at year t. $LNBRENT$ is the natural log of Brent crude oil return (US dollars per barrel) at year t. The ε_t is error term.

3.1. Stationarity Tests

Unit root tests are used to check for the stationarity of the time series data of Brent crude oil return and Malaysia stock market return. The Augmented Dickey-Fuller (ADF) (1979) and Phillips-Perron (PP) (1989) unit root tests will be applied in this study.

3.2. Autoregressive Distributed Lag (ARDL)

Autoregressive Distributed Lag (ARDL) was introduced by Pesaran and Shin (1999) and it was developed by Pesaran *et al.* (2001). In this study, we apply ARDL in order to achieve the study's objective, that is, to investigate the impact of oil price shocks on Malaysia stock market return. The ARDL models have myriad advantages such as it can capture both the long-run and short-run relations of the cointegrated variables. Besides that, ARDL model is applicable irrespective of whether the regressor in the model is *I*(0) or *I*(1), as long as they are not *I*(2) for the application of ARDL bound test for cointegration (Narayan, 2005; Al-Mulali *et al*., 2016). The ARDL bounds test for cointegration is estimated in the following equation:

$$\Delta x_t = \alpha + \sum_{i=1}^{p} \beta_0 \Delta x_{t-i} + \sum_{i=1}^{q} \beta_1 \Delta y_{0_{t-i}} + \beta_2 x_{t-i} + \beta_3 y_{0_{t-i}} + \varepsilon_t \qquad (2)$$

Based on the equation (2), the null hypothesis is no cointegration represented as $H_0: \beta_2 = \beta_3 = 0$. The alternative hypothesis is cointegration exists represented as $H_1: \beta_2 \neq \beta_3 \neq 0$ in equation. The next step is to calculate the *F*-statistic with critical value. The null hypothesis H_0 is rejected if the *F*-statistic is more than the upper critical values. Moreover, we reject the alternative hypothesis if the calculated *F*-test is less than the critical values, which mean that there is no cointegration between the variables. Further, if the calculated *F*-statistic value falls within the bounds, then the decision is inconclusive. Once cointegration is established, the next step is to estimate the long-run and short-run coefficients between the variables. The models for long-run and short-run equations are as below:

$$\Delta x_t = \alpha + \sum_{i=1}^{p} \beta_0 \Delta x_{t-i} + \sum_{i=1}^{q_1} \beta_1 \Delta y_{0_{t-i}} + \varepsilon_t \qquad (3)$$

$$\Delta x_t = \alpha + \sum_{i=1}^{p} \beta_0 \Delta x_{t-i} + \sum_{i=1}^{q_1} \beta_1 \Delta y_{0_{t-i}} + \beta_2 ECT_{t-1} + \varepsilon_t \qquad (4)$$

3.3. Toda-Yamamoto

To infer the relationship between the variables, the causality test is applied by utilizing the Toda and Yamamoto (1995) model. The general Toda and Yamamoto causality test between any two variables, Y_t and X_t, can be applied using the following VAR model:

$$Y_t = \gamma + \sum_{i=1}^{m} \delta_{1i} Y_{t-i} + \sum_{i=m+1}^{k} \delta_{2i} Y_{t-i} + \sum_{i=1}^{m} \theta_{1i} X_{t-i} + \sum_{i=m+1}^{k} \theta_{2i} X_{t-i} + \epsilon_{1t} \qquad (5)$$

$$X_t = \tau + \sum_{i=1}^{m} \vartheta_{1i} X_{t-i} + \sum_{i=m+1}^{k} \vartheta_{2i} X_{t-i} + \sum_{i=1}^{m} \eta_{1i} Y_{t-i} + \sum_{i=m+1}^{k} \eta_{2i} Y_{t-i} + \epsilon_{2t} \qquad (6)$$

Where the null hypothesis of non-causality from X_t to Y_t in (5) can be expressed as: $H_0: \theta_{1i} = 0$, for $\forall_i$, and the null of non-causality from Y_t to X_t in (6) is: $H_0: \eta_{1i} = 0$, for $\forall_i$.

IV. EMPIRICAL RESULTS

4.1. Unit Root Test

The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests are reported in Table 1. As shown in the table, the results indicate that all

variables have unit roots in levels. However, in the first difference, all variables become stationary or are integrated of order one, *I*(1).

Table 1: Results of unit root tests

	Test Statistics	
	ADF	PP
A: Level		
Model Specification: Intercept		
LNBRENT	-1.426	-1.442
LNKLCI	-2.407	-2.241
Model Specification: Trend and Intercept		
LNBRENT	-2.500	-2.541
LNKLCI	-2.943	-2.771
B: First Difference		
Model Specification: Intercept		
ΔLNBRENT	-84.631*	-84.588*
ΔLNKLCI	-38.099*	-80.565*
Model Specification: Trend and Intercept		
ΔLNBRENT	-84.626*	-84.583*
ΔLNKLCI	-38.111*	-80.565*

Notes: Δ denotes the first difference operator. Asterisks * denotes the statistically significant at 1% significance level.

4.2. Lag Order Selection

Prior to the cointegration and causality tests, the number of lags to be used in the VAR model is determined. The lag order selection is reported in Table 2. All the criteria are confirmed with 2 lags to be used in the next analysis.

Table 2: Lag order selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-10321.8	NA	0.051249	2.704686	2.706504	2.70531
1	40535.8	101675.1	8.39E-08	-10.61823	-10.61277	-10.61636
2	40567.9	64.23009*	8.33e-08*	-10.62560*	-10.61651*	-10.62248*

Notes: * imply selected lag order by the criterion LR sequential modified LR test statistic (5% level at each test), LR sequential modified LR test statistic (5% level at each test), FPE final prediction error, AIC Akaike information criterion, SC Schwarz information criterion, HQ Hannan-Quinn information criterion.

4.3. ARDL

After all the variables are confirmed to be stationary at first difference, then the ARDL bound test is used to test for the long-run relationship among the variables based on the F-test. The results are reported in Table 3 which shows that there is evidence of cointegration when LNKLCI is taken as dependent variable while LNBRENT is the independent variable. This is supported by the computed F-statistics which is found to be statistically significant at 10% level of significance, as the computed values are higher than the critical values. Therefore, we strongly reject the null hypothesis of no long-run relationship between the variables. The optimal lag length for this test is 2 which have been chosen based on Akaike Information Criteria (AIC).

Table 3: Results of the ARDL bounds test analysis

Dependent Variable	*F*-statistic value	Optimal lag length
LNKLCI	3.593***	2
Bound critical values by Pesaran *et al.* (2001).		
	I(0)	I(1)
1%	4.94	5.58
5%	3.62	4.16
10%	2.72	3.21

Notes: The optimal lag structure based on Akaike Information Criterion (AIC). * implies a rejection of no cointegration null hypothesis at 10% significance level.**

Thus far, we have confirmed the existence of cointegration among the variables based on the results of ARDL bounds test. The next step is to estimate the long-run and short-run impacts of crude oil return on Malaysia stock market return. In Table 4, the results indicate that oil return has a positive impact on the stock market return which is significant at the 10% level. A 1% increase in oil return leads to a 32.71% increase in stock return. The final step of the ARDL model is the error correction to estimate the short-run parameter with the speed of adjustment. The short-run analysis results are reported in Table 5. The results indicate that ECM_{t-1} coefficient is negative and highly significant at the 1% level. The coefficient suggests an adjustment of approximately 0.12% towards the long-run equilibrium after a shock. In other words, the short-run disequilibrium is corrected in the long-run equilibrium at a rate of 0.12% in the following period with stock return (LNKLCI) as the dependent variable. The overall ARDL analysis suggests that, oil price shocks have a positive impact on Malaysia stock market in both the long-run and short-run.

Table 4: Results of the ARDL long-run estimation

	Coefficient	St. Error	t-Statistic	Prob.
Dependent Var: LNKLCI				
LNBRENT	***0.3271	0.1745	1.8742	0.0609

Table 5: Results of ARDL short-run estimation

	Coefficient	St. Error	t-Statistic	Prob.
Dependent Var: LNKLCI				
LNBRENT	**0.0128	0.0062	2.0550	0.0399
ECM_{t-1}	*-0.0012	0.0004	-3.2840	0.0010

Note: Asterisk *, **, and * denotes significant level at 1%, 5%, and 10% respectively.**

4.3. Toda-Yamamoto causality test

As a cointegration exists in the ARDL model, we proceed with the Toda-Yamamoto causality test. The purpose of using the Toda-Yamamoto causality test is to provide robust results on the dynamic relationship between the variables. Based on the Toda-Yamamoto causality test results as shown in Table 6, the MWALD statistics of 7.172 is significant at 5% level indicating that there is strong evidence of causality

running from crude oil return (LNBRENT) to stock market return (LNKLCI). However, the results do not reveal any causality running from stock market return (LNKLCI) to oil return (LNBRENT). This finding clearly indicates a unidirectional causal relationship running from oil return to stock market return, in other words, oil return impacts on Malaysia stock market return.

Table 6: Results of Toda-Yamamoto test

Null Hypothesis	MWALD	p-value	Conclusion
LNBRENT does not Granger cause LNKLCI	**7.172	0.0277	Reject H_0
LNKLCI does not Granger cause LNBRENT	5.807	0.1214	Do not reject H_0

Notes: ** denotes the rejection of the null hypothesis of no causality at 5% significance level. All the variables are in the form of natural logarithm.

CONCLUSION

This paper aims to examine the impact of oil price shocks on Malaysia stock market. Unit root tests are employed and the findings indicate that all the variables are not stationary in levels, but after first difference, thus the variables are stationary at first difference and integrated of order one *I*(1). In both the long-run and short-run, we find that the Malaysia stock market responds positively to oil price shocks. The obtained results are consistent with theory of Huang *et al.* (1996) and Jones *et al.* (2004). Besides, this finding is similar to the findings of Cunado and Perez de Gracia (2014) and Dogan *et al.* (2016) in which the oil prices impacted on stock returns positively. In addition, this result is also similar to the finding of Abdul Hadi, *et al.* (2009) and Najaf (2016), which the studies concerning on Malaysia country. This implies that oil price can improve the forecasting of stock market return in Malaysia for long-run and short-run. Apart from that, this study found a unidirectional causality that runs from oil price to stock market return, but the inverse causation is not validated.

Therefore, policymakers should be mindful of the trend in crude oil prices as regards the formulation of policies having impact on the Malaysia stock market. First and foremost, we suggest Malaysia's policymaker to control the price level of crude oil as well as implementing the subsidy which is an important tool to stabilize oil price shocks. Since increase in oil price will induce the inflation and it will influence the households and business units. Besides, Malaysia had turned into a net importer of crude oil since 2014. As reported by Cecilia (2015), Malaysia's net exports of crude oil have been on a declining trend in the last 10 years, the production had reduced from 60,000 barrels per day (bpd) in 2005 to 48,000 bpd in 2014. However, Malaysia still an oil export country. Thus, in order to benefit from oil price shocks, policymaker should manage oil production and enable them to contribute to the economy. Furthermore, as the finding indicate that there is a positive influence of oil price shocks on the stock market in Malaysia, it may indicate that oil-related companies especially may benefit from oil price shocks. Therefore, policymaker should formulate policies on oil price in order to mitigate risk. Moreover, the oil-related companies can diversify the portfolio by investing in various economy activities and reduce its dependence on crude oil, therefore, in the case of oil price shocks, this will not affect the entire economy.

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