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PLUNGING OIL PRICES IMPACT MALAYSIA'S AND INDONESIA'S ECONOMY

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Abstract

Oil has a profound impact on the world economy. This study examines the impact of changes (falling) in oil prices on the two oil producing ASEAN countries – Malaysia and Indonesia using quarterly data from 2005:Q1 to 2014:Q4. A cointegration analysis using an autoregressive distributed lag equation (ARDL) is conducted between oil and the Malaysian and Indonesian economy. Next, single equations are estimated on the impact of oil price changes on macroeconomic variables, followed by a VAR formulation to trace the impact of oil price using impulse response function and variance decomposition. The single equation estimates indicate that real oil prices have a significant positive impact on Malaysia/Indonesia GDP, while it is insignificant on inflation rate and real exchange rate. Using an unrestricted VAR model, real oil price growth shocks have positive and negative response on the growth of Malaysia GDP, Indonesia GDP and US GDP. However, the negative response is found more significant for the growth of Indonesia GDP, while the growth of US GDP has a larger influence on Malaysia GDP as compared to Indonesia GDP. Changes in real oil price are less impactful on Malaysia government expenditure and Malaysian Ringgit, compared to inflation rate and net exports.

Keywords: Autoregressive Distributed Lag (ARDL), Stationarity, Cointegration, VAR, Impulse Response Function and Variance Decomposition

JEL classification numbers: O13, Q41, Q43, Q47

1. Introduction

Starting from 18th to 19th century, industrial revolution takes place and nations intensely rely on the machinery. Energy has always been at the core of the economic growth theory after the industrial revolution (Terzi and Celik, 2016). Therefore, crude oil has ended up one of the essential resources that are profoundly demanded. Throughout the years, oil prices have fluctuated. On June 2008, the oil prices hit the highest value of USD 139.39 per barrel. Recently, the oil slump has struck the global market with the low of USD 30 per barrel in January 2016, which was also the 12-years low (Shenk, 2016). In the early 1980s, Malaysia moved into oil production, which subsequently, elevated itself into one of the well-known major net oil exporters in Asia. Hence, the steep plunge in oil price was believed to impact the Malaysia economy with an estimated loss of around RM 40 billion in revenue from oil. Therefore, the Malaysian government has recalibrated Budget 2016 as Malaysia is an oil-revenue reliant country. The concern is that the plunge in oil price may lead to a Dutch Disease.

Dutch Disease demonstrates the circumstance where the payback cost for a negative oil price shocks is greater than what it could be invigorated by an increase in oil prices (Mehrara 2008). Malaysia, which is highly dependent on the oil price revenues, may encounter an intense retard in the economy when oil slumped as shown in Figure 1.



Figure 1. Crude Oil Price

Source: Author's preparation based on data from Datastream

The rest of the paper is constructed as follows. Section 2 is meant to provide some background information on the status of current research in oil prices and a review of existing related literature on impact of oil on the economy. Section 3 describes the data and the methodologies used in the research. The results are presented and discussed in Section 4 while Section 5 concludes the paper.

2. Literature Review

2.1. Oil Price

Based on the empirical researches, oil price can be measured using numerous approaches. In spite of the fact that various approaches had been developed, there is no exact way to measure the oil prices. Different researchers employed different approaches. For instance, Iwayemi and Fowowe (2011), Farzanegan and Markwardt (2009) and Cunado and De Gracia (2005) applied all measurement methods as stated above in order to get a more comprehensive result. However, some researchers (Al-mulali and Sab, 2012; Ito, 2012; Al-mulali and Sab, 2011) still stick with the elementary approach, while the others (Omojolaibi and Egwaikhide, 2014) only measured the oil price by using the GARCH model.

2.2. Gross Domestic Product

Gross domestic product (GDP) is the primary indicator in determining a country's economy situation. Iwayemi and Fowowe (2011) found out the response of output towards the positive oil price shocks were mild for Nigeria, an oil exporter, as oil price increase will reduce the aggregate demand of the trading partners. This condition will indirectly affect the exports of Nigeria which then lead to lower GDP. In contrast to the positive oil price shocks, the negative

oil price shocks showed a more pronounced effect on Nigeria real GDP. This circumstance had also proven the appearance of Dutch Disease in Nigeria economy, which was also supported by Mehrara (2008). For the case of oil importing countries, the Dutch Disease also occurred. However, there was a noticeable difference between the oil exporter and oil importer. For the oil importing country, the oil price increase dominated oil price decline (Jimenez-Rodriguez and Sanchez, 2005). In contrast with Iwayemi and Fowowe's (2011) study, Olomola and Adejumo (2006) mentioned oil price shocks do not have significant impact on Nigeria GDP, while according to Omojolaibi and Egwaikhede (2014), who studied on African oil exporting countries showed the oil price volatility can benefit the country GDP; however, the response is less impactful.

For the case of Russia (oil exporter), the research has shown that there was a strong positive relationship between Russia output growth and the oil price (Rautava, 2004). From the short run view, the changes in oil price will have a direct impact on the GDP; from the long run view, the impact of the oil price fluctuations is stationary. Ito (2012), who studied the Russia economy, and Almulali and Sab (2013), who studied the economy for OPEC, also found out the similar result. In addition, Cunado and De Gracia (2005) examined the relation between the oil price shocks and GDP for both oil exporter (Malaysia) and oil importer (Japan, Philippines, Singapore, Thailand and South Korea). The results indicated that oil price shocks effectively affect the GDP of Japan, Thailand and South Korea while the relationship is less significant for Malaysia. Jimenez-Rodriguez and Sanchez (2005) also mentioned the impact of the negative oil price shocks and the economy was ambiguous for oil exporting country. Nevertheless, Lescaroux and Mignon (2008) argued the oil price fluctuations have a substantial effect on the economy for both oil exporter and oil importer. In short, the relationship between the oil price shocks and a country's economy cannot be generalized.

2.3. Government Expenditure

Government spending is classified into various segments such as social, education, health, military and more. Based on extensive studies, there was a significant relationship between the causal relationship of oil price shocks and government expenditure. From the perspective of Kuwait (oil exporter), Eltony and Al-Awadi (2001) mentioned there was a significant influence of oil price fluctuations on the Kuwait government expenditure. From the perspective of OPEC and other oil exporting countries, Almulali and Sab (2013) and El Anshasy and Bradley (2012) indicated the increase of oil price will stimulate the government expenditures as well. El Anshasy and Bradley (2012) stated the country that highly depended on oil production will have a higher increment of government expenditures when oil price hike. Besides, if the government anticipates a positive oil price shocks in the upcoming future, it will increase the growth of government expenditures (El Anshasy and Bradley, 2012). Furthermore, Dizaji (2014), Farzanegan (2011) and Farzanegan and Markwardt (2009) have investigated the causal relation in Iran. As shown from the outcomes, positive oil price changes increased the government expenditures, while the negative oil price changes decreased the government expenditure as a result of a reduction in government revenue (Dizaji, 2014; Farzanegan and Markwardt, 2009). Other than that, Farzanegan (2011) has determined the government spending into specific sections; the results showed the security and military spending responds positively to the oil prices, however, the other social spending was statistically insignificant.

In addition, Iwayemi and Fowowe (2011) who investigated on Nigeria economy stated the response to oil price shocks toward the government expenditure is mild. On the other hand, Narayan (2005) found different evidence as he stated the relationship is neutral for the case of Asian countries (India, Malaysia, Pakistan and Thailand). For the case of Bahrain, Hamdi and Sbia (2013) showed that oil revenues (oil price increase) did not affect the government expenditure. The result was unusual as Bahrain is highly dependent on oil revenues as part of the government revenues. However, this condition occurred because the portion of the oil revenues have been transferred to the country's Future Generations Reserve Fund in order to preserve the hydrocarbon wealth and strengthen the long-term fiscal management (Hamdi and Sbia, 2013). Therefore, the government expenditure did not depend on the oil price *per se*. In

summary, most of the researchers concluded oil price hike will increase the government expenditure for oil exporting countries.

2.4. Inflation Rate

In general, oil price fluctuations will impact the inflation rate in the country. The research on Iran (oil exporter) indicated that both of the positive oil price shocks and negative oil price shocks drive up the price levels and increase the inflation rate (Farzanegan and Markwardt, 2009). Besides, the Iran government borrowed from the central bank to cover the deficit spending, which will indirectly increase the money supply and base money; that leads to right shift of demand curve (Farzanegan and Markwardt, 2009). As a result, the combination of the shifting of demand and supply curves caused the price increase and thereby the inflation. For the case of OPEC, Almulali and Sab (2013) also stated there is a positive relationship between oil price hike and inflation. This was due to the high domestic spending as the country's revenue increase. In contrast, the findings on Russia stated inflation has a negative response from the rising of oil price (Ito, 2012). Olomola and Adejumo (2006) also stated the oil price shocks do not have a significant impact on the inflation rate in Nigeria.

Iwayemi and Fowowe (2011) showed that the negative oil price shocks have a larger impact on the inflation rate in Nigeria compared to the positive oil price shocks. This condition has indicated the presence of an asymmetric effect. This was due to the fact that Nigerian government has heavily subsidized the refined petroleum products. Thus, there was no significant transmission of the oil price increment into the country's petroleum price to mild inflationary pressure (Iwayemi and Fowowe, 2011). Cunado and De Gracia (2005) stated the presence of asymmetric effect between the oil price fluctuations and inflation in the case of Malaysia, Japan, South Korea and Thailand. Besides, Cunado and De Gracia (2005) claimed that the impact of oil prices on inflation is more general and more substantial compared to other macroeconomic indicators. In general, oil price fluctuations will influence the inflation rate in the country, except for those who have implemented special policy or regulation.

2.5. Exchange Rate

The fluctuations of the domestic currency or foreign currency can hugely affect the country's economy such as terms of trade, as measured by using real exchange rate, which incorporates the purchasing power (Almulali and Sab, 2013; Al-mulali and Sab, 2011; Iwayemi and Fowowe, 2011). It is calculated by deflating the nominal exchange rate with the ratio of consumer price index (Iwayemi and Fowowe, 2011). Moreover, few of the researchers used the real effective exchange rate as the proxy (Ito, 2012; Farzanegan and Markwardt, 2009).

From the perspective of oil exporting countries (Algeria, Bahrain, Egypt, Indonesia, Kuwait, Nigeria, Oman, Qatar, Saudi Arabia, Sudan, United Arab Emirates and Venezuela), oil price increase has a negative relation with real exchange rate, which will result in an appreciation of domestic currency (Al-mulali and Sab, 2012). According to the research on OPEC (Almulali and Sab, 2013) and other African oil exporters (Omojolaibi and Egwaikhide, 2014), a similar result has been found. In addition to that, the researchers claimed the relationship can be found in both short-run and long-run (Omojolaibi and Egwaikhide, 2014; Almulali and Sab, 2013). Additionally, Iwayemi and Fowowe (2011) and Olomola and Adejumo (2006) stated the existence of Dutch Disease. They revealed the fact that negative oil price fluctuations have a more impactful effect on the Nigeria real exchange rate compared to the positive oil price fluctuations (Iwayemi and Fowowe, 2011; Olomola and Adejumo, 2006).

Conversely, different conclusions have been found from other studies. Adeniyi, Oyinlola, and Omisakin (2011) stated there was no significant relationship between the oil price and the macroeconomic movement in Nigeria. Besides, Al-mulali and Sab (2011) point out the oil price rise caused a depreciation of the currency in the United Arab Emirates because the UAE dirham has been pegged to the US dollar, hence, resulted in a money inflow and high inflation which caused the dirham to depreciate. The argument has been supported by Moosa (2005) as he stated the flexible exchange regimes is better than pegged regime as it can be a good shock

absorber, attain smoother external adjustment and increase policy interdependence. In summary, the domestic currency will appreciate when there are positive oil price changes, providing the country adopted a flexible exchange rate regime.

2.6. International Trade (Imports or Exports)

In the era of globalization, international trade is the practice taken by most of the countries. Different researchers used different proxies to measure the country international trade. Iwayemi and Fowowe (2011) used net exports while Farzanegan and Markwardt (2009) used real imports. Other than that, Ju *et al.* (2014) and Chen and Hsu (2012) have included both imports and exports to measure the trade level. However, as compared to other macroeconomic variables, there are relatively few studies focused on the effect of oil price shocks on the country's exports or imports, especially for the oil exporting countries.

According to the study conducted by Iwayemi and Fowowe (2011), he indicated the changes in oil prices hugely affect the net exports of Nigeria because the oil exports contributed more than 90% of the country exports account and the oil exports quota are stipulated according to the oil prices. Other than that, Chen and Hsu (2012) stated the international trade of oil importing countries have a significant reduction when the oil price rises; from the perspective of the oil exporting countries, which including Malaysia, the result is not statistically significant. For the case of China (oil importer), Ou *et al.* (2012) and Faria *et al.* (2009) found a positive relationship between the China's exports and oil price. However, Tang *et al.* (2010) and Fan *et al.* (2007) have an opposite conclusion whereas the oil price shocks have a negative impact on the exports and imports. Additionally, Ju *et al.* (2014) stated the relationship between the oil price and the China's international trade is inconclusive. For other oil importers such as India, the study shown the oil price has a negative impact on the trade balance (Tiwari *et al.* 2014).

On the other hand, different arguments have been voiced by other researchers. Korhonen and Ledyeva (2010) indicated that although the oil exporter will be beneficial from the oil price hike initially, the economy will be hurt indirectly because countries are interdependent in the presence of international trade. From a long term view, the oil importing countries which were hurt by the oil price hike will reduce their import demand, thus, the oil exports volume from oil exporter will decrease (Korhonen and Ledyeva, 2010). From the perspective of oil importing countries, they can gain from the oil price hikes indirectly. As the oil exporting countries increase their oil revenues, they will import more from the other countries (oil importing country) (Korhonen and Ledyeva, 2010). Consequently, oil exporter was hurt and oil importer gained indirectly from the positive oil price shocks. To sum up, the results are various and depend on different countries.

3. Research Variables

3.1. Research Model

Iwayemi and Fowowe (2011) have investigated the impact of oil prices on Nigeria's economy and using this model, we examined the oil price effect on the Malaysian and Indonesian economy. The model will study the impact of the real oil prices (RO) on the country's real gross domestic product (Y), government expenditure (G), real exchange rate (RER), inflation rate (I) and net exports (NX). Data has been acquired from Datastream in order to ensure the reliability and validity of the data. This research employs quarterly time series data, which ranges from the first quarter of 2005 to the fourth quarter of 2014.

3.2. Research Variables

3.2.1 Real Oil Prices (RO)

In this research, Brent crude oil will be used as the proxy and measured in real terms. The unit measurement of measurement is in US Dollar per barrel.

3.2.2 Real Gross Domestic Product (Y_MY and Y_IDR)

Gross domestic product is estimated using expenditure approaches, where the GDP value is determined by summing up all expenditures on the final goods and services that have occurred throughout the year as per Datastream.

3.2.3 Government Expenditure (G)

Government expenditure is measured by summing up the total expenditure which included expenses incurred by general government on both individual consumption goods and services, imputed expenditure and collective consumption services. Its value is measured in million domestic currency, with the constant price of 2005 as reported in Datastream.

3.2.4 Real Exchange Rate (RER)

Real exchange rate is calculated by deflating the market exchange rate of MYR/IDR with the ratio of US consumer price index to Malaysia/Indonesia consumer price index (Iwayemi and Fowowe, 2011).

3.2.5 Inflation Rate (I)

The CPI will reflect the average changes of the price paid for a fixed basket of consumer goods and services; it is measured in the index form of 2010 = 100 as reported in Datastream.

3.2.6 Net Exports (NX)

Net exports are the net value of the total exports and total imports (Iwayemi and Fowowe, 2011). The proxy for the total exports is the exports value of the goods and services, while the proxy for the total imports is the imports value of the goods and services.

3.3. Theoretical Framework

Figure 2 shows the theoretical framework of this research, based on Iwayemi and Fowowe's (2011) study as aforementioned.

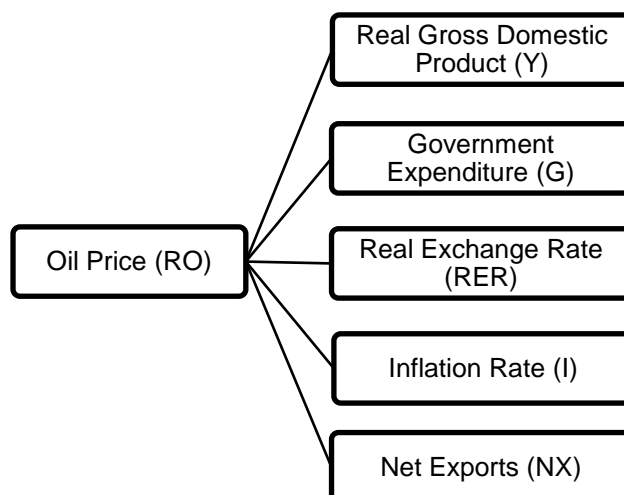


Figure 2. Theoretical Framework

3.4. Test and Analysis

The tests and analyses are computed using EViews. This research paper will use Ordinary Least Squares (OLS) and Auto Regressive Distributed Lag (ARDL) estimators. Besides, unit root tests, granger causality and the unrestricted Vector Autoregression (VAR) analyses will be conducted as well. In order to reduce the outlier effects and provide a meaningful data interpretation, all variables will be transformed to natural logarithms and the difference in the logs is computed to approximate the growth rates.

4. Results and Discussion

4.1. Descriptive Statistics

The descriptive statistics is being computed for the original figure and log figure, which are real oil prices (RO), United States gross domestic product (Y_US), gross domestic product (Y), government expenditure (G), real exchange rate (RER), inflation rate (I) and net exports (NX) for both Malaysia (MY) and Indonesia (ID). The values of the standard deviation from the descriptive statistic showed the data distribution.

Table 1. Descriptive Statistics

	LRO	LY_MY	LY_ID	LY_US	LG_MY	LG_ID	LRER_MY	LRER_ID
Mean	3.641	12.03	13.24	9.61	9.94	10.70	0.42	8.28
Median	3.654	12.02	13.24	9.61	9.91	10.71	0.42	8.24
Maximum	4.028	12.27	13.52	9.69	10.24	11.20	0.54	8.71
Minimum	3.027	11.81	12.96	9.55	9.64	10.20	0.33	7.99
Std. Dev.	0.259	0.13	0.17	0.03	0.19	0.26	0.07	0.19
Skewness	-0.5	0.11	0.01	0.45	0.10	0.19	0.21	0.86
Kurtosis	2.358	1.94	1.78	2.45	1.68	2.44	1.81	2.86
Jarq-Bera	2.345	1.95	2.47	1.86	2.97	0.76	2.66	4.92
	LI_MY	LI_ID	LNx_MY	LNx_ID	DLRO	DLY_MY	DLY_ID	DLY_US
Mean	4.61	4.62	10.03	4.57	0.01	0.01	0.01	0.00
Median	4.61	4.62	10.10	4.56	0.02	0.02	0.02	0.00
Maximum	4.65	4.70	10.41	5.04	0.32	0.03	0.04	0.01
Minimum	4.59	4.60	9.43	3.96	-0.69	-0.04	-0.04	-0.02
Std. Dev.	0.01	0.02	0.30	0.31	0.17	0.01	0.02	0.01
Skewness	1.25	3.03	-0.63	-0.19	-1.74	-2.09	-0.93	-1.73
Kurtosis	10.16	15.34	2.14	1.81	8.27	8.15	2.44	6.68
Jarque-Bera	95.92	314.90	3.89	2.63	64.85	71.65	6.11	41.53

Based on Table 1, due to the dispersion of the variables, the original variables are transformed into natural logarithms form and it shows the standard deviation for all log variables are less than 1. Thus, the log variables are concentrated around its mean and are approximately normally distributed. Besides, coefficients for the log variables in regressions are interpreted as percentage, which allows a more meaningful interpretation. The following variables, RO, Y_MY, Y_ID and Y_US are transformed into difference in log to indicate an economic meaning of growth rate. Since these are quarterly numbers, the annual growth rate is equivalent to 400times the mean.

4.2. Cointegration Analysis Using ARDL and OLS Estimators

A cointegration analysis between oil price and the Malaysian and Indonesian economies are conducted. The impact of oil price on the Malaysian and Indonesian economies is followed up using OLS and ARDL to show the significance of their relationships – statistically and economically.

Table 2a. Cointegration of Oil and Malaysia/ Indonesia Growth

Malaysia			Indonesia		
Dependent Variable: dLY_MY			Dependent Variable: dLY_ID		
Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic
d(LRO)	0.04	4.47***	d(LY_ID(-1))	-0.08	-0.39
C	0.008	3.79***	d(LY_ID(-2))	-0.37	-2.75**
CointEq(-1)	-0.97	-5.54***	d(LY_ID(-3))	-0.67	-9.34***
			d(LRO)	0.01	3.31**
			d(LRO(-1))	-0.01	-1.92*
			C	0.02	4.29***
			CointEq(-1)	-1.21	-4.34***
Cointeq =d LY_MY-(0.05*dLRO+0.0002*@TREND)			Cointeq =d LY_ID-(0.02*dLRO-0.01*@TREND)		

Note: *** 1% significance level, ** 5% significance level, * 10% significance level

The error-correction coefficients are negative (-0.97) for Malaysia and (-1.21) for Indonesia, as required, and are significant in Table 2a. The long-run coefficients from the cointegrating equation are reported, with their standard errors, t-statistics, and p-values. First, there is a long-run equilibrium relationship between the price of crude oil, and Malaysia/Indonesia's GDP. We have coefficient of the ECT(-1) is estimated equal to -0.97 and -1.21, suggesting that deviation from the long-term inflation path is corrected by around 0.97% and 1.21% percent over the following year. This result we can say that the adjustment takes place very quickly. Third, a 10% change in the price of crude oil will result in a long-run change of 0.5% in Malaysia's GDP and 0.2% change in Indonesia's GDP as indicated in Table 2b.

Table 2b. Long-run Coefficients

Malaysia			Indonesia		
Dependent Variable: GDP (dLY_MY)			Dependent Variable: GDP(dLY_ID)		
Variable	Coefficient	t-statistic	Variable	Coefficient	t-statistic
dLRO	0.05	3.91***	dLRO	0.02	2.57**
@TREND	0.0002	0.91	@TREND	0.0001	-0.75
Cointeq = dLY_MY-(0.05*dLRO+0.0002*@TREND)			Cointeq =dLY_ID - (0.02*DLRO -0.001*@TREND)		

It is important that the errors of this model are serially independent - if not, the parameter estimates will not be consistent (because of the lagged values of the dependent variable that appear as regressors in the model). In total, 72 ARDL model specifications were considered. Although an ARDL (1,0) for Malaysia and ARDL (4,2) for Indonesia were finally selected in terms of minimizing the information criteria AIC. We see that the F-statistic for the Bounds Test is 5.8 for Malaysia and 5.8 for Indonesia, and this clearly exceeds even the 1% critical value for the upper bound. Accordingly, we strongly reject the hypothesis of "No Long-Run Relationship" for both countries.

A $\pm 1\%$ change in Oil price is expected to have the following impact on macro-economic variables in Malaysia and Indonesia using single equations.

Table 3. Impact of Oil Price on Malaysia/Indonesia Macroeconomic Variables

	Malaysia	Indonesia
LY_MY/ LY_ID	$\pm 0.35\%$	$\pm 0.41\%$
LG	$\pm 0.48\%$	$\pm 0.37\%$
LRER	$\pm 0.19\%$	$\pm 0.03\%$
LI	$\pm 0.01\%$	$\pm 0.005\%$
LNx	$\pm 0.6\%$	$\pm 0.87\%$

The findings in Table 3 conclude that real oil prices (LRO) have a significant impact on Malaysia and Indonesia (GDP (LY_MY) and GDP (LY_ID)), government expenditure (LG), real exchange rate (LRER), inflation rate (LI) and net exports (LNx), individually using single equation estimates. From an overview, Malaysia/Indonesia GDP and government expenditure have relationships with the real oil prices changes, while the real exchange rate has a negative relationship with real oil prices. For Malaysia, the inflation rate is positively related to oil price while in Indonesia it is negative. Besides, Malaysia's net exports are negatively related to oil price while Indonesia net exports are positively related. Specifically, with every ± 1 percent change in the real oil prices, Malaysia GDP will change by $\pm 0.35\%$ and Indonesia by $\pm 0.41\%$. Besides, with $\pm 1\%$ in real oil prices, Malaysia government expenditure can change by $\pm 0.48\%$ and Indonesia by $\pm 0.37\%$. From the perspective of real exchange rate, with every percent change in the real oil prices, Malaysia real exchange rate will change by $\pm 0.19\%$ and Indonesia by $\pm 0.03\%$. As the real exchange rate fall, it indicates Malaysian Ringgit/Indonesia Rupiah have appreciated. The findings also show that a 1% percent change in real oil prices will cause the inflation rate to change by 0.01% in Malaysia but no impact in Indonesia due to a larger subsidy. Moreover, as the real oil prices change by $\pm 1\%$, Malaysia net exports will change by $\pm 0.60\%$ and Indonesia to change by $\pm 0.87\%$. The difference is Indonesia's net exports are more dependent on larger oil exports than Malaysia's.

Other than investigating how the real oil prices have affected Malaysia and Indonesia macroeconomic indicators, this research also examines the impact of the real oil price growth, government expenditure, real exchange rate, inflation and net exports on the growth of Malaysia/Indonesia GDP as shown in Table 4. However, for Malaysia model, the adjusted R-squared value shows that the data is not highly fitted to the regression line as only 27.34% of the total variation of the growth of Malaysia GDP is explained by the total variation of real oil price growth, government expenditure, real exchange rate, inflation and net exports. Using a multivariable regression, the results indicate that only the real oil price growth is statistically significant in affecting the growth of Malaysia GDP. It stated with every 1% change of the real oil price, the growth of Malaysia GDP will change by 0.04%, holding other variables constant.

Table 4. Cointegration of Malaysia/ Indonesia Growth and Macroeconomic Variables

Malaysia			Indonesia		
DV is LY_MY	OLS	ARDL	DV is LY_ID	OLS	ARDL
C	0.0989 (0.0868)	-3.89** (-2.46)	C	1.1108 (1.4067)	1.36*** (3.85)
dLRO	0.0447*** (3.7398)	-0.04 (-1.44)	dLRO	0.0405** (2.4119)	0.006 (-1.27)
LG	0.0058 (0.3216)	0.03* (2.26)	LG	-0.0644*** (-4.2432)	-0.05*** (-3.60)
LRER	0.0004 (0.0107)	0.11** (3.09)	LRER	0.0112 (0.3763)	-0.005 (-0.61)
LI	-0.0215 (-0.0903)	0.79* (2.37)	LI	-0.1401 (-0.8548)	-0.19*** (-2.95)
LNK	-0.0046 (-0.4359)	-0.01** (-2.50)	LNK	0.0299** (2.3336)	0.03*** (-3.75)
Adjusted R ²	0.2734	0.958239	Adjusted R ²	0.4084	0.76883
Std Error	0.0108	0.003095	Std Error	0.0165	0.01051
F-stat	3.8591	28.86242	F-stat	6.2458	10.9661

Note: *** Significance Level 1% **Significance Level 5% *Significance Level 10%. t-statistics are in parentheses.

As shown in Indonesia model, the adjusted R-squared value shows the data fitted better compared to Malaysia as 40.84% of the total variation of the growth of Indonesia GDP is explained by the total variation of real oil price growth, government expenditure, real exchange rate, inflation and net exports. The results also indicate the real oil price growth, government expenditure and net exports are statistically significant in affecting the growth of Indonesia GDP. Specifically, with every 1% change of the real oil price, the results show a change of 0.04% in the growth of Indonesia GDP, 0.03% in net exports and 0.06% in the government expenditure.

4.3. Unit Root Tests

As shown in Table 5, ADF test and PP test have been run to test the stationarity of the variables. The table clearly illustrated same results have been found in both tests. At the level, inflation rate (I) is the only variables having a p-value which is less than 0.01. Thus, it indicates inflation rate is stationary and genuine at the levels. However, other variables are not stationary at the levels. After running both ADF test and PP test at the first difference and the null hypotheses are rejected. Hence, the findings concluded the variables are integrated of order one. In a simple term, all variables are stationary and the regression is not spurious at the integration order of first difference.

Table 5. Unit Root Tests (Malaysia and Indonesia)

Variables	Levels			First Difference		
	Lag	ADF Statistic	PP Statistic	Lag	ADF Statistic	PP Statistic
RO	2	-2.3160	-2.6558	2	-4.1537***	-5.1569***
Y_MY	2	0.7194	0.8846	2	-3.8660***	-4.1759***
Y_ID	2	1.2237	0.3485	2	-16.513***	-9.5025***
Y_US	2	-0.0387	0.0302	2	-2.5498	-3.8887***
G_MY	2	0.0560	-0.1839	2	-3.2192**	-10.1709***
G_ID	2	-2.5459	-4.8934***	2	-35.1383***	-14.8986***
RER_MY	2	-2.0891	-1.9673	2	-2.6392*	-4.5619***
RER_ID	2	0.9333	0.4039	2	-3.2803**	-4.6676***
I_MY	2	-4.0361***	-5.0219***	2	-5.5026***	-8.2914***
I_ID	2	-3.5120**	-5.7276***	2	-8.3887***	-11.1323***
NX_MY	2	-0.6009	-5.5333***	2	-1.9418	-11.8919***
NX_ID	2	-0.6973	-1.3941	2	-4.5994***	-10.1716***

Note: *** Significance Level 1% **Significance Level 5% *Significance Level 10%

4.4. Granger Causality Test

Table 6 presents the output of the granger causality test. As shown from the findings, the real oil price does granger cause the GDP (Y) of Malaysia but not for Indonesia. Since the price of oil is determined in the world by demand and supply, Malaysia and Indonesia's GDP do granger cause oil price at the 1% level. The real exchange rate (RER) of Malaysia does granger cause the real oil price, while in Indonesia, the real oil price granger cause the real exchange rate of Indonesia. The inflation rate (I) will granger cause real oil price in Malaysia but not in Indonesia. Nevertheless, real oil prices do not granger cause inflation rate (I). On the other hand, the findings show that both variables such as government expenditure (G) and net exports (NX) do not granger cause real oil prices. In the meantime, the real oil prices also do not granger cause the government expenditure (G) and net exports (NX).

Table 6. Granger Causality Test

Sample: 172 Lags: 2	Malaysia			Indonesia		
Null Hypothesis:	Obs	F-Statistic	Prob.	Obs	F-Statistic	Prob.
RO does not granger cause Y.	38	7.1582***	0.0026	38	0.8734	0.4270
Y does not granger cause RO.	38	3.9216**	0.0296	38	1.3704	0.2681
RO does not granger cause G.	38	0.5072	0.6068	38	2.2623	0.1200
G does not granger cause RO.	38	2.2934	0.1168	38	2.2689	0.1193
RO does not granger cause RER.	38	1.5276	0.2320	38	5.5045***	0.0087
RER does not granger cause RO.	38	14.2770***	0.00003	38	0.5550	0.5794
I does not granger cause RO.	38	3.8777**	0.0307	38	0.2173	0.8058
RO does not Granger Cause I	38	1.2867	0.2897	38	0.8391	0.4411
NX does not granger cause RO.	38	1.9109	0.1640	38	0.5629	0.5749
RO does not Granger Cause NX	38	1.1054	0.3430	38	3.2743*	0.0504

Note: *** Significance Level 1% **Significance Level 5% *Significance Level 10%

4.5. Unrestricted Vector Autoregression (VAR) Model

The VAR model is particularly useful in the case of forecasting and analyzing the cyclical behavior of the economy, the generation of stylized facts about the behavior of the elements of the system which can be compared with other existing theories or can be used in formulating

new theories, and testing theories that generate Granger causality implications. We apply Vector Autoregressive (VAR) model to test the validity of the impact of real oil price growth (DLRO), the growth of Malaysia (DLY_MY) and Indonesia gross domestic product (DLY_ID) and the growth of the United States gross domestic product (DLY_US). Two important summary measures, namely, Forecast Error Variance Decompositions (FEVD) and Impulse Response Functions (IRF) are presented from the VAR model. Forecast Error Variance Decompositions will help resolve the issue of relative strength of real oil price growth Malaysia, Indonesia and US GDP growth at different time horizons. Finally, Impulse Response Functions will show the direction of dynamic relationships among these variables.

4.5.1. Impulse Response Function

The impulse response functions are categorized into two sections:

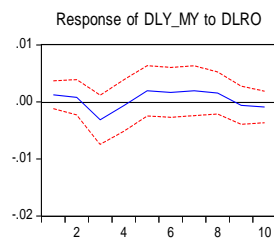
1. The interactions between real oil price growth (DLRO), the growth of Malaysia and Indonesia gross domestic product (DLY_MY/DLY_ID) and the growth of the United States gross domestic product (DLY_US).
2. The interactions between real oil price growth (DLRO), Malaysia/Indonesia government expenditure (G), real exchange rate (RER), inflation (I) and net exports.

Figure 3a shows the interactions between three variables, which include the real oil price growth, the growth of Malaysia GDP and the growth of United States GDP. From the graphs illustrated, it clearly shows that the response of Malaysia GDP growth and United States GDP growth towards the growth of real oil price is similar. It has a positive response initially. However, it declines afterwards. After the fourth period, the response of Malaysia GDP and United States GDP turn positive and remain for a protracted time length. Besides, the response of real oil price growth towards Malaysia GDP growth is larger as it peaks up initially, declines significantly after the 2nd period and becomes positive after the 5th period. Moreover, the GDP growth in the United States can affect the GDP growth in Malaysia to a certain extent.

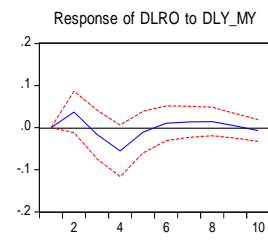
As shown in Figure 3b above, the initial response of Indonesia GDP growth towards the growth of real oil price is positive, however, it turns to decline significantly from 2nd period to 3rd period as well as in 7th period to 8th period. While for the response of United States GDP growth towards the growth of real oil price, the response is mild regardless of a positive response initially. Moreover, the response of real oil price growth towards Indonesia GDP growth is fluctuating. However, the beginning periods have a higher fluctuation compared to the response of later periods. From an overall perspective, the GDP growth in the United States has an insignificant effect on Indonesia GDP growth.

Figure 4a shows the interactions between real oil price growth, Malaysia government expenditure, real exchange rate, inflation, net exports. The response of Malaysia government expenditure towards the real oil price growth is mild. The real exchange rate has a more significant response towards the real oil price growth. The real exchange rate has a positive response first six quarters. Then, it gradually declines. Furthermore, the response of the inflation rate and net exports are more dynamic as compared to other macroeconomic variables. Inflation rate responds positively at the beginning. Yet, it becomes negative after the 2nd period and continues until the 6th period. While from the perspective of the net exports, it has a positive response until the 3rd period, then, the response turns negative for about two periods. After that, it turns to a weaker positive response.

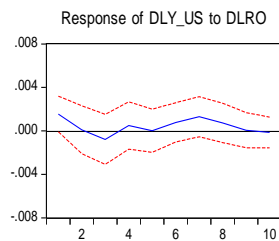
Response to Cholesky One S.D. Innovations ± 2 S.E.



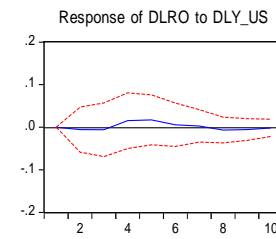
Response to Cholesky One S.D. Innovations ± 2 S.E.



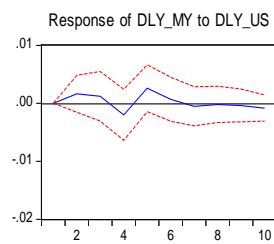
Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.

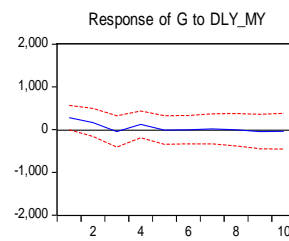


Figure 3a. Impulse Response Function of Malaysia (DLRO, DLY_MY and DL_US)

Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.



Figure 3b. Impulse Response Function of Indonesia (DLRO, DLY_ID and DL_US)

For the response of real oil price growth towards the macroeconomic indicators, the diagram shows the response of real oil price growth towards Malaysia government expenditure and net exports are almost non-existence despite the fact that there is a small initially peak up for the government expenditure. Additionally, the real oil price growth has a significant negative response towards Malaysia real exchange rate and the inflation rate in the first four periods. Afterwards, it becomes a positive response.

Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.

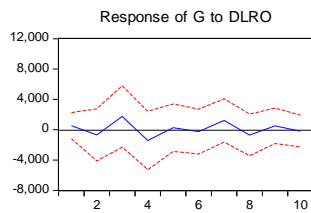


Response to Cholesky One S.D. Innovations ± 2 S.E. Response to Cholesky One S.D. Innovations ± 2 S.E.

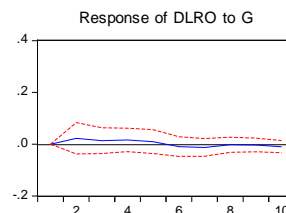


Figure 4a. Impulse Response Function of Malaysia (DLRO, G, RER, I and NX)

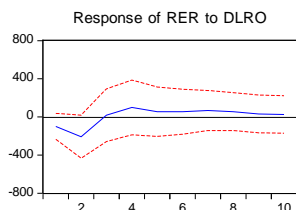
Response to Cholesky One S.D. Innovations ± 2 S.E.



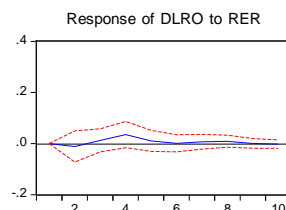
Response to Cholesky One S.D. Innovations ± 2 S.E.



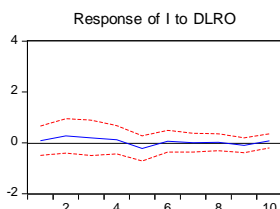
Response to Cholesky One S.D. Innovations ± 2 S.E.



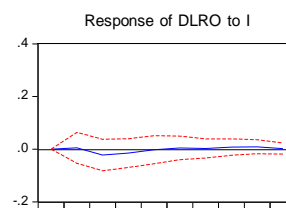
Response to Cholesky One S.D. Innovations ± 2 S.E.



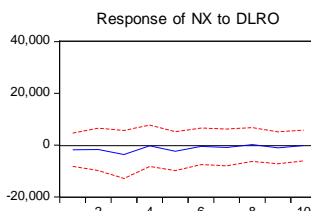
Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.



Response to Cholesky One S.D. Innovations ± 2 S.E.

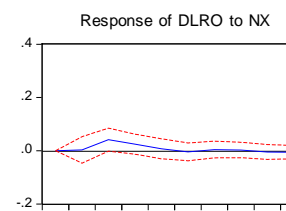


Figure 4b. Impulse Response Function of Indonesia (DLRO, G, RER, I and NX)

Figure 4b shows that the response of Indonesia government expenditure towards the real oil price growth is swinging between positive response and negative response along the periods. For the real exchange rate, it has a significant negative response initially. Nevertheless, it gradually turns to a weaker positive response for a protracted period. Furthermore, the response of inflation rate towards the real oil price growth is mild regardless the weak positive response initially. For Indonesia net exports, it has a consistent negative response in the whole period.

As regard to the response of real oil price growth towards the Indonesia macroeconomic indicators, the figure shows the response of real oil price growth towards the inflation rate and net exports government expenditure is positive initially. After the 5th period, it turns to a negative response. Additionally, real oil price growth has a mild negative response towards Indonesia real exchange rate in the first two periods, then, it peaks up and remains positive. Besides, the response of real oil price growth towards the government expenditure is almost non-existent despite a weak positive response initially. In short, there are greater interactions between oil price and Malaysia macroeconomic indicator as compared to Indonesia.

4.5.2. Variance Decomposition

Since this study primarily focuses on the impact of oil price shocks on macroeconomic indicators, the output of the variance decomposition tabulated in Table 7a and 7b will focus in this area. The findings present in the table include the variation of the growth of gross domestic product (DLY_MY/DLY_ID), the growth of United States gross domestic product (DLY_US), Malaysia government expenditure (G), real exchange rate (RER), inflation rate (I) and net exports (NX) that can be explained by the shocks of real oil price growth (DLRO). There are 10 periods in total. To ease for interpretation, this study will use 3rd period as a benchmark for short run effect while 10th period to represent long run effect.

Table 7a. Variance Decomposition Output of Malaysia

Independent Variable	Period	Dependent Variable					
		DLY_MY	DLY_US	G	RER	I	NX
DLRO	1	2.8132	9.2259	3.4506	10.6492	25.7086	19.5101
	2	2.8117	6.0295	5.3843	10.0952	21.7803	14.6797
	3	6.9780	6.3358	4.7459	9.9304	24.0508	14.6200
	4	6.7229	6.2622	4.2943	9.4095	22.6040	13.6991
	5	7.5797	5.9065	3.8451	8.9351	21.3739	15.1212
	6	7.9454	6.2842	3.6036	8.5613	21.4983	14.1028
	7	8.5084	7.9059	3.3962	8.4130	21.6556	13.9109
	8	9.0147	8.1245	3.2628	8.4018	21.8390	13.3964
	9	9.0639	8.0033	3.2094	8.3973	21.7250	12.7487
	10	9.2668	7.9819	3.3374	8.3903	21.6999	12.4288

According to the results shown in Table 7a, it shows the shock to the real oil price growth can cause 6.97% variation of the fluctuation in Malaysia GDP growth in the short run. The result for United States GDP growth is almost the same as Malaysia GDP growth, which is 6.34%. From the long run view, the shocks of the real oil price growth can contribute 9.27% to Malaysia GDP growth and 7.98% to United States GDP growth. Besides, 4.75% fluctuations in the variance of government expenditure in the short run are caused by the impulse of real oil price growth while for the long run, the fluctuations in the variance of government expenditures are about 3.34%. Moreover, the shock to real oil price growth can affect 9.93% variation of real exchange rate in the short run and 8.39% variation of real exchange rate in the long run. From the view of the inflation rate, the shocks of real oil price growth contribute 24.05% and 21.70% in short run and long run respectively. Other than that, the findings indicate shocks of real oil price growth can cause 14.62% variation of the fluctuation in net exports in the short run. For the long run, it can contribute 12.43%.

Table 7b. Variance Decomposition Output of Indonesia

Independent Variable	Period	Dependent Variable					
		DLY_ID	DLY_US	G	RER	I	NX
DLRO	1	4.8448	22.2465	1.0292	5.6108	0.2165	0.8526
	2	3.5811	16.6235	0.7392	11.9708	2.3828	1.2020
	3	9.5333	12.3171	3.0199	9.1038	3.1030	2.7988
	4	8.6714	11.3372	4.2901	8.2944	3.1047	2.4467
	5	8.2566	10.1435	4.0975	7.4787	4.0240	2.5767
	6	7.7074	10.0361	3.6186	6.9671	3.9599	2.3024
	7	8.4114	9.9202	4.2067	6.6441	3.9221	2.1410
	8	8.3656	9.7730	4.3907	6.2686	3.8329	1.9683
	9	8.2222	9.7646	4.4076	5.8232	3.9779	1.8714
	10	8.0927	9.6582	4.2500	5.3858	4.0573	1.7576

In short, the variation of the government expenditure, real exchange rate, inflation rate and net exports that are explained by the real oil price growth decrease slightly (between 1% to 3%) in the long run as compared to the short run. For the growth of Malaysia GDP and the United States GDP, its variation changes by 2.3% for Malaysia GDP growth and 1.6% for United States GDP growth in the long run. In addition, the findings conclude the shocks of real oil price growth do not contribute much to the growth of Malaysia GDP, the growth of United States GDP, Malaysia government expenditure and real exchange rate as the values are less than 10%. The impulse of real oil price growth is more significant on Malaysia inflation rate and net exports.

As shown in the Table 7b, the findings for Indonesia are tabulated. The shock to the real oil price growth can cause 3.58% variation in the fluctuation of Indonesia GDP growth in the short run and 8.09% in the long run. In contrast, the impulse of real oil price growth causes a higher variation of United States GDP; specifically, 16.62% in the short run and 9.66% in the long run. Additionally, the shock of real oil price growth results in 0.74% variation of Indonesia government expenditure, 1.2% variation of net exports and 2.38% variation of inflation rate in the short run; while for the long run, the impact increases. Specifically, it contributes 4.25% of government expenditure, 1.76% for net exports and 4.06% of the inflation rate. Moreover, the impulse of real oil price growth causes 11.97% to the variation of Indonesia real exchange rate in the short run and reduce to 5.39% in the long run.

In brief, the variation of the Indonesia GDP, government expenditure, inflation rate and net exports that are explained by the real oil price growth increase slightly (between 0.5% to 4.5%) in the long run as compared to the short run. For the real exchange rate, its variation changes by 6.58% in the long run. Although the impulse of oil price growth can affect the variations of Indonesia macroeconomic indicators, the impacts are insignificant.

5. Conclusions and Policy Implications

This study aims to investigate the interactions between the real oil price and Malaysia/Indonesia real GDP, government expenditure, real exchange rate, inflation rate and net exports. Quarterly data is employed with a time span from quarter one of 2005 to quarter 4 of 2014. The data is extracted from Datastream. Albeit previous researchers had investigated similar topic, the impact of oil price on the economy are inconclusive and the relationships cannot be generalized. Moreover, the focus of most researches is on oil importing country instead of oil exporting country. Therefore, this study investigates the relationship among ASEAN oil exporting countries.

The study utilizes several analytical techniques including cointegration analysis using ARDL and ordinary least square (OLS) estimators, unit root tests, granger causality and VAR techniques of impulse response function and variance decomposition. There are a couple of significant findings from this study. According to the single equation estimators, the findings indicate the real oil prices have a significant positive impact on Malaysia/Indonesia GDP. Moreover, the real oil prices have a significant negative impact on Indonesia government expenditure and significant positive impact on Indonesia exports, however, neither of it is significant in Malaysia. For the inflation rate and real exchange rate, it shows that both are insignificant for Malaysia and Indonesia.

The impact of oil price on Malaysia and Indonesia economy are also analyzed by using the unrestricted VAR model. Firstly, the growth of Malaysia GDP, Indonesia GDP and US GDP has positive and negative response towards the growth of real oil price. However, the negative response is found more significant for the growth of Indonesia GDP. In the case for Malaysia, the findings from International Monetary Fund (2015) are more significant. This may be due to the longer period employed by the International Monetary Fund. On the other hand, the growth of US GDP has a larger influence towards Malaysia GDP as compared to Indonesia GDP. This finding is consistent with International Monetary Fund (2015). Next, growth of real oil price is less impactful on Malaysia government expenditure and Malaysian Ringgit. In contrast, Malaysia inflation rate and net exports are highly affected by the growth of real oil price. Thus, the fluctuation of oil prices may have a most noticeable effect on Malaysia inflationary pressure

and current account. The findings are consistent with the findings from Cunado and De Gracia (2005) and Iwayemi and Fowowe (2011), who studied net oil exporting countries. From the perspective of Indonesia, all of its macroeconomic variables (except GDP) have weaker response towards the real oil price as compared to Malaysia.

This study delivers valuable insights for the policy makers. By having a clearer understanding of the impact of oil price changes on the Malaysian and Indonesian economies, the policy makers can cope with the issues by implementing effective strategy and policy. As aforementioned, the analysis shows that Malaysia and Indonesia will confront inflationary/deflationary pressure as oil price shocks occur. Other than deflationary/inflationary impact, policy makers should also take into consideration the response of current account towards the oil price shocks.

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