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Asymmetric Impacts of Oil Price Shocks on Malaysian Economic Growth: Nonlinear Autoregressive Distributed Lag Approach

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Abstract

This empirical study intends to examine the behavior of oil prices on Malaysian economic growth whether nonlinearity implies. The dynamic models of Linear and Nonlinear Autoregressive Distribution Lags (ARDL and NARDL) are used to estimate the models. The study used annual data from 1975 to 2015. The study used the real Malaysian spot oil price (Miri) as oil price unlike. The results from the linear model revealed that oil prices positively increase economic growth both in the short-run and the long-run. To achieve our objective, the NARDL estimator was used to detect the impact of positive and negative changes in oil prices. The results reveal that there is nonlinear relation among the variables in the long-run relationship as the evidence of cointegration was found. Increases in oil price boost economic growth positively while a decrease in oil price is not as indicate insignificantly. The error correction term confirms the results to indicate negative, significant, and less than 1 percent. That is the speed of adjustment after the oil price shock. The results have important policy implications, exposed that the impacts of oil price changes (positive and negative) are not necessarily equal.

Keywords: Oil Price, Economic Growth, Malaysia, Nonlinear, ARDL.
JEL Classifications: F43, O11, O40, Q43.

1. Introduction

For the past decades, energy markets noticed persistence increases in

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prices in energy products while in the mid of 2014 oil prices drastically dropped. These unexpected changes in energy prices had affected world economic growth. Specifically, increases in oil price turn to benefit the oil-producing countries while is unfavorable to oil-importing countries. This raises the attention of researchers to explore whether there is a possibility of non-linear or asymmetric adjustment when oil price changes. The impact of oil price shock influences the whole economic activities of developing countries. Especially the countries that heavily rely on oil revenue and are weak to control external shock (Barsky and Kilian, 2004). Increasing oil price is a way of shifting the term of trade to oil-producing nations. While it is an adverse impact on oil-importing nations (Backus and Crucini, 2000). Dropping of oil prices will decrease the revenue earning from exporting crude oil in oil-exporting countries. This will increases the demand for oil due to lower prices by oil-importing countries (Shudhasattwa et al., 2016). There is evidenced that economic activity responds asymmetrically when oil price changes. More precisely, oil price increases slow the overall economic activities more than falling of oil price to accelerate it (Lardic and Mignon, 2006). The research on oil price changes and economic growth is a vital issue to explore in the energy economics literature. Looking at how oil and its price influence the oil-producing country's economy and the world economy in general. Any changes in demand and supply increase the price or decrease the price of crude oil and will affect economic growth. Since from the oil boom 1970s, many researchers attempt to examine the relationship between oil price and economic growth (Hamilton, 1983; Mork, 1989; Lee et al., 1995; Doroodian and Boyd, 2003; Jiménez-Rodriguez and Sánchez, 2005; Guo and Kliesen, 2005; Du et al., 2010; Beirne et al., 2013; Anandan et al., 2013; Kumar et al., 2014; Herrera et al., 2015; Rafiq et al., 2016). The countries in South-East Asia experience appreciation in their rates of growth in the 1980s and early 1990s, an average of 8 percent annually. Conversely, the remarkable growth had affectedly changed by external factors such as the Asian financial crisis Gan and Li, 2008; Hooi and Smyth, 2010; Chin et al., 2009). The rate of growth of East Asia and Pacific (EAP) was slowed in 2015 to 6.4 percent from 6.8 percent in 2014 (World Bank, 2015). In 2015, the average economic performance of the oil-exporting economies was dropped, as they are affected significantly by the falling of crude oil prices. The contribution from those countries to the world growth become weak, especially those who are more disturbed. In general, the estimated growth of more than 50 percent of developing countries was continued declining (World Bank Group report, 2016). The commodity-exporting countries are among the major contributors to slowing the rate of growth. Observing the bar chart in Figure 1 Vietnam and the Philippines are gradually improved from the second and the third quarter. Indonesia and Thailand are considered average in the second and third quarter follows by China. The Malaysian economy in the second and third quarter accounted the decline in the rate of growth, which can be associated with the falling oil price.

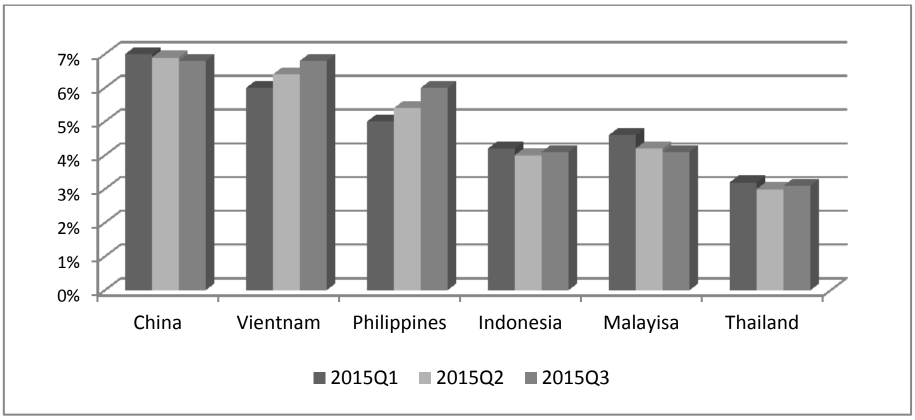

Figure1: East Asia Quarterly Growth in 2015
Source: World Bank (2016).

The structure of the Malaysian economy is quite an open economy which is a vibrant emerging economy. The economy is concentrated in rich resources products such as energy, services and commodities for its industrial development. In development, the Malaysia primary commodities maintain among the top exporter’s example palm oil, rubber, tin and among the top ten liquefied natural gas exporters (Ahmed and Wadud, 2011). Malaysian GDP worth 296.22 billion US dollars in 2015, from 1960 to 2015 the GDP averagely recorded 79.67 billion US dollars. The lowest recorded 2.42 billion US dollars was in 1961, the highest recorded 338.10 billion US dollars was in 2014

(World Bank). Figure (2) shows the composition of Malaysian gross domestic products' contribution while Figure (3) shows the Malaysian exports composition in 2013.

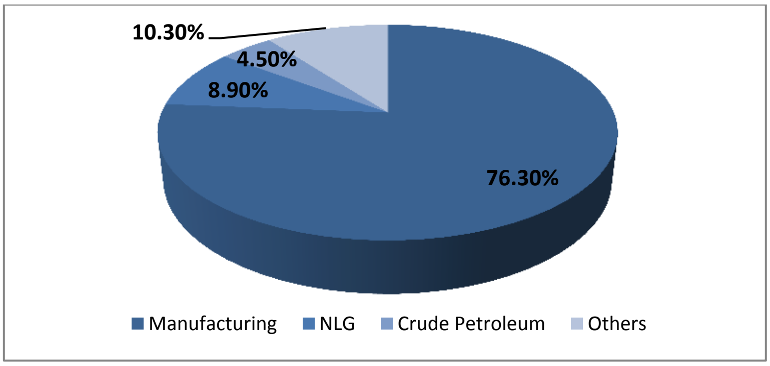

Figure2: Malaysia GDP Composition2013
Source: CEIC Data Co. Ltd.

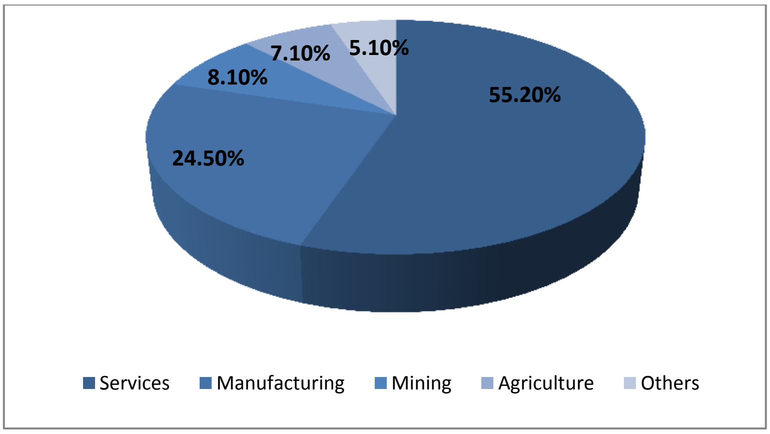

Figure3: Malaysia Exports Composition2013
Source: CEIC Data Co. Ltd.

Crude oil production in Malaysia averagely is 669.65 barrels a day from 1994 to 2015, the production was occasionally declined, in September of 2015 was produced 652 barrels dropped in October 2015 to 619 barrels. The maximum crude oil production in Malaysia was in October 2004 produced 791 barrels and the lowest production was in May 2011 produced 489 barrels (EIA, 2015). Commodity exporters including Malaysia were affected by the oil price drop, declining in reserves, and strong pressure on the Malaysian Ringgit these contributed a lot by depreciating about 25 percent. Despite revenue losses from lower commodity prices, several countries made efforts to reduce fiscal deficits, including Malaysia by reforming the grant of subsidy in some products and introduce goods and services tax (World Bank, 2015). In 2015, Malaysian economy adjusts to lower oil prices are anticipated to have a growth rate of 4.7 percent, which is the lowest in recent time. Figure (4) shows the import and export of crude oil, while Figure (5) shows the import and export comparison.

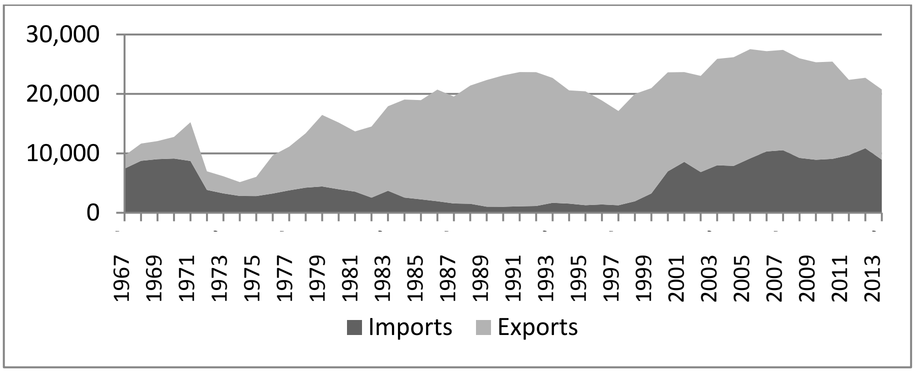

Figure4: Imports and Exports of Malaysian Crude Petroleum
Source: Malaysia Economic Statistics Time Series, 2015.

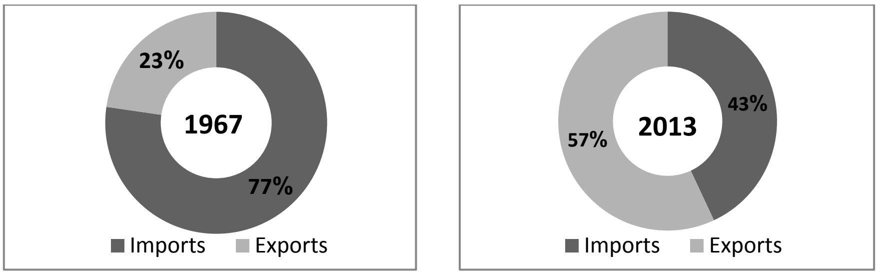

Figure5: Comparison of Imports and Exports of Crude Petroleum
Source: Malaysia Economic Statistics Time Series, 2015.

In Figure (6), the scatter plots of the relationship between oil price and the Malaysian GDP are plotted with a five-year interval to detect the possibility of the non-linear or asymmetric behavior of oil price. It can be observed from the trend pattern of these graphs that some of them signify the positive correlation while others have indicated the negative ones. Based on this evidence the study attempts to explore the relationship in non-linearity connections. If the possibility of nonlinear were found, the research would further investigate the asymmetric speed of adjustment in oil price changes.

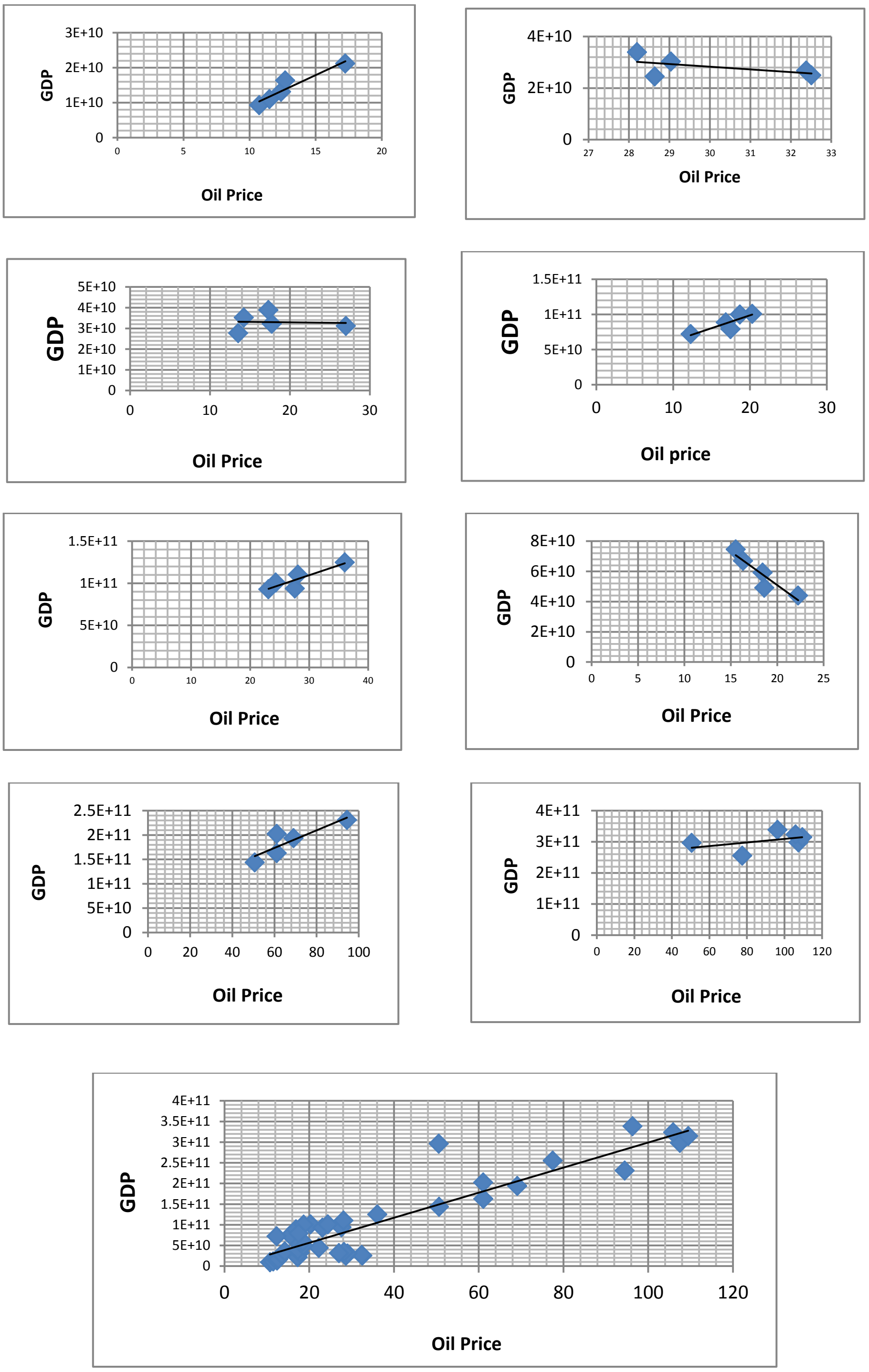

Figure6: Scatter Plots of the relationship between oil price and the Malaysian GDP, 1975 to 2015

Figure (7) illustrates that the trend relationship of changes in the oil price and the response in Malaysian GDP considering the period of our study 1975 to 2015. Malaysian GDP had continued rising during the sample period as it benefited from the increases in oil price, the only interruptions occurred was when the oil price dropped. Most of the negative changes within a year are disappearing and GDP moves back to the normal trend. We manage to identify five major negative responses of GDP when the oil price dropped. From 1985 to 1986, 1997 to 1998, 2000 to 2001, 2008 to 2009, and 2014 to 2015 while other negative changes absorbed by other means.

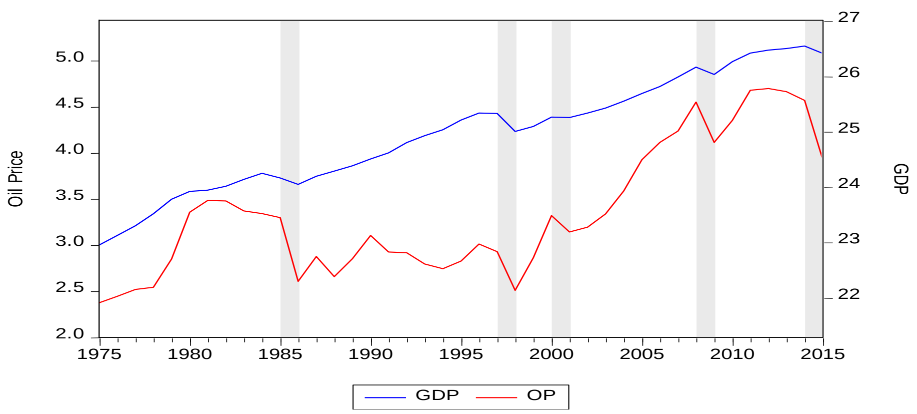

Figure7: Oil Price and Malaysian GDP

Source: World Bank.

2. Literature Review

Some studies examine the impacts of oil price involved Malaysian economies such as Abeysinghe (2001), Xuan and Chin (2015), and Maji et al. (2017). Abeysinghe (2001) uses quarterly data from 1982:1 to 2000:2 estimated through the structural VAR model. Found that Indonesia and Malaysia as oil producers are affected by the negative impacts of higher oil prices. Xuan and Chin (2015) found that oil prices affect consumer prices in Malaysia. Maji et al. (2017) examined the economy-wide impacts of oil price shocks on the Malaysian economy. Employing the input-output technique, the results revealed that the decline in oil prices from 2015 to 2016 reduces tax revenues by 10.5%, lower GDP by 1.9% and increases the unemployment rate by 0.3%. Cunado and Gracia (2005) use quarterly sample period data 1975:1–

2002:2 by applying asymmetric cointegration in six Asian countries. Found that economic activity and price indexes are influenced by the oil price. Another study by Rafiq et al. (2009) employ vector auto-regression (VAR) over the period 1993:Q1 to 2006:Q4 on Thailand economy found that macroeconomic indicators are affected by oil price volatility. Similarly, Razmi et al. (2015) also found that oil prices affected the economy of Thailand. Jayaraman and Choong (2009) study Pacific Island countries (PICs) throughout 1980–2007 estimated the data by ARDL framework. The main results suggest that the models in all four PICs countries are cointegrated in the long-run relationship. Ahmed and Wadud (2011) employ a structural VAR model on monthly data within the period 1986 to 2009. Found that after the internal fluctuation of industrial production, the oil price volatility is another greatest significant reason to explain its changes. Abdul Rahim and Liwan (2012) studies Malaysian oil and gas trends and implications found that oil and gas will be exhausted soon, while we want to extend the study by examining it in a nonlinear relationship. Subsequently, Basnet and Upadhyaya (2015) study ASEAN-5 economies by applying the Structural VAR model based on quarterly data from 1970Q1 to 2010Q2. The results indicate that in the long-run oil price shock is insignificant in the ASEAN-5 economies since the effects are disappearing within a short period. Recently, Badeeb et al. (2016) employ the ARDL framework over the Malaysian annual data 1970–2013 found there are symptoms of an oil curse.

Archanskaïa et al. (2012) found that the supply-driven oil price shock has a negative effect on macroeconomic activity. Blanchard and Gal (2010) and Kilian and Lewis (2011) have found that the increases in oil prices driven by world demand shocks did not have any significant negative impact on macroeconomic activity. Sek (2017) and Sek et al. (2017) empirically studies the relationship between oil price changes and inflation in Malaysia. The study reveals the indirect impact of oil prices on consumer prices through the transmission from production costs and import prices. The second study is based on two categories of countries the high oil-dependent and low oil-dependent countries. The results show that changes in oil prices in low oil dependency countries have a direct impact on domestic inflation but in the high oil dependency countries, the impact of oil price is indirect on domestic inflation through changes in the exporter's production cost. Bala et al. (2017) and Bala and Chin (2018) found that oil price changes have a significant impact on economic growth and inflation in African OPEC members. Bass (2019) examined the impact of institutional quality and world oil prices on the performance of the Russian manufacturing sector. Results of the Granger causality test show unidirectional causality running from oil prices and institutional quality to economic growth. Khan et al. (2018) study the asymmetric effects of oil price shocks on economic activity in 13 selected Asian economics. Employing nonlinear ARDL, the study found evidence of real GDP responds symmetrically to positive and negative oil price changes in China, South Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka and Thailand in the short run, while it behaves asymmetrically to oil price shocks in Bangladesh, Hong Kong, India, Indonesia and Japan. However, no long-run asymmetry in oil price changes and economic activity was detected in all the countries. Eyden et al. (2019) analyzed the impact of real oil price volatility on the growth in real GDP for 17 OECD countries. The main finding of the study is that oil price volatility has a negative and statistically significant impact on economic growth. There are also studies that found that oil price has no effect on the growth. For example, Awunyo-Vitor et al. (2018) found that the effect of oil price change on economic growth is statistically insignificant in Ghana.

3. Methodology

The relationship between oil price and economic growth in the literature is usually examined by applying various techniques that would arrive at linear cointegration, error correction model, and Granger causality. Therefore, those techniques have low power to detect the possibility of nonlinearities in economic growth dynamics. In recent, Shin et al. (2014); Greenwood-nimmo (2013) advanced the well-known ARDL model of Pesaran and Shin (1999) and Pesaran et al. (2001) to nonlinear ARDL cointegration approach (NARDL) has nonlinearity properties to detect asymmetries in both short-run and long-run among the variables. We adopt this methodology for this study. Many studies applied ARDL in similar investigations (see Hassan and Zaman, 2012; Khac and Bao, 2014; Bahmani-Oskooee and Fariditavana, 2015). We adopt a model of the symmetric long-run relationship between oil price and economic activities by Jbir and Zouari-Ghorbel, 2009 and Trung and Vinh, 2011.

$$LY = f(lreer, lp, loil) \tag{1}$$

Where: lY is the log form for the industrial production index as a proxy of economic activity. $lreer$ is the log form for the real effective exchange rate, lp represents the log form for consumer price index and $loil$ is the log form for oil price based on WTI oil price. We adapt the model by partitioning the oil price into positive and negative changes to capture the nonlinear impact of oil price on economic growth. That is necessary to formulate the long-run equation in line with the nonlinearity approach.

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + \mu_t, \tag{2}$$

Where y_t and x_t are scalar I(1) variables, and x_t is decomposed as $x_t = x_0 + x_t^+ + x_t^-$, where x_t^+ and x_t^- are partial sum processes of positive and negative changes in x_t.variable Constructions:

$$lY_t = \alpha_0 + \beta_1 lreer_t + \beta_2 cpi_t + \beta_3 lop_t + \varepsilon_t \tag{3}$$

$$lY_t = \alpha_0 + \beta_1 lreer_t + \beta_2 cpi_t + \beta_3 lop_t^+ + \beta_4 lop_t^- + \mu_t \tag{4}$$

Where: lY is the log of GDP, $lreer_t$ is the log of the real effective exchange rate, cpi_t is the log of the consumer price index and lop_t is the log of the oil price while $lop_t^+ and\ lop_t^-$ are partial sums of positive and negative changes in oil price respectively, and $\alpha = (\alpha_0, \beta_{1,}, \beta_2, \beta_3, \beta_4)$ is a cointegrating vector or a vector of long-run parameters to be estimated. $\beta_{1,}$ is expected to be positive or negative depending on the degree of response, while $\beta_2, \beta_3, \beta_4$ is expected to be positive, although β_4 is expected to be less than β_3 since it captures a reduction in oil price.

$$op_t^+ = \sum_{j=1}^{t} \Delta op_j^+ = \sum_{j=1}^{t} \max(\Delta op_j, 0) \tag{5}$$

$$op_t^- = \sum_{j=1}^{t} \Delta op_j^- = \sum_{j=1}^{t} \min(\Delta op_j, 0) \quad (6)$$

This simple approach to modeling asymmetric cointegration based on partial sum decompositions has been applied by Schorderet (2001) in the context of the nonlinear relationship. The NARDL estimation framework was presented in Shin et al. (2014) follows the Pesaran and Shin (1999) and Pesaran et al. (2001) in ARDL modeling as:

$$\begin{aligned} \Delta lY_t = {} & \alpha_0 + \beta_1 lY_{t-1} + \beta_2 lreer_t + \beta_3 lcpi_t + \beta_4 lop_t^+ + \beta_5 lop_t^- \\ & + \sum_{i=1}^{p} \pi_i \Delta\, lY_{t-i} + \sum_{i=1}^{p} \emptyset_i \Delta\, lY_{t-i} + \sum_{i=0}^{q} p_i \Delta\, lreer_{t-i} \\ & + \sum_{i=0}^{q} p_i \Delta\, lcpi_{t-i} + \sum_{i=0}^{q} (\propto_i^+ \Delta lop_{t-i}^+ + \propto_i^- \Delta lop_{t-i}^-) \\ & + \mu_t \end{aligned} \quad (7)$$

The variables are as defined above, p and q are lag orders and $\beta_3 = -\beta_3/\alpha_0$ and $\beta_4 = -\beta_4/\alpha_0$, the above-mentioned long-run impacts of respectively oil price increase, and oil price reduction on economic growth. $\sum_{i=0}^{q}(\propto_i^+$ is measures the short-run influences of oil price increases on economic growth. While $\sum_{i=0}^{q}(\propto_i^-$ the short-run influences of oil price reduction on GDP. Hence, in this setting, in addition to the asymmetric long-run relation and the asymmetric short-run influences, economic growth through oil price changes are also captured.

3.1 Data

The study employed annual statistical secondary data on oil price, real GDP per capita, real effective exchange rates, and consumer price index. For the oil price data, we used real Malaysian oil price (Miri) corresponding spot components prices ($/b). The GDP per capita is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies in real term divide by the total number of population. The real effective exchange rate is an index of (2010 = 100) measure of the value of a currency against a weighted average of several foreign currencies divided by a price deflator. All the data are obtained from the websites of the World

Bank Database except oil price from OPEC Annual Statistical Bulletin, 2016. The study periods 1975 to 2015 was determined best on the availability of the data. All variables are expressed in the natural logarithm.

4. Empirical Results

The ARDL cointegration approach has strengths over some methodologies that require a unit root test. It does not necessarily need a stationary test, although it will not validly be for I(2) variable, as it is beyond and violates the properties of using the Pesaran et al. (2001) bounds testing. The study has to abide by the rules of ARDL since it accommodates variables in the series be they stationary at I(0), I(1), or a mixture of both. The results in Table 1 show the pre-testing of the stationarity of the data in the models. Firstly, we conducted the prominent unit root tests using Augmented Dickey-Fuller (ADF), and secondly, the Phillips-Perron (PP) test was used for robustness. The evidence of the unit root test shows that GDP, exchange rate, and oil price were stationary at the first difference that is, appropriate for ARDL, NARDL, and Asymmetric estimation.

Table 1: ADF and PP Unit Root Results

	Level				**First-difference**			
	ADF		**PP**		**ADF**		**PP**	
Variable	**Constant**	**&Trend**	**Constant**	**&Trend**	**Constant**	**&Trend**	**Constant**	**& Trend**
lY	-1.7449	-2.7828	-1.6700	-2.7828	-4.7589a	-4.8491a	-4.6736a	-4.7778a
$lreer$	-1.3972	-1.8847	-1.4128	-2.1116	-4.8839a	-4.7890a	-4.7228a	-4.5789a
$lcpi$	-2.3200	-1.9089	-2.2681	-2.0428	-3.4281b	-3.9368b	-3.5271b	-4.0358b
lop	-1.4786	-1.8174	-1.5039	-1.9073	-5.4847a	-5.3929a	-5.4848a	-5.3934a

Note: & trend is constant with the trend; SIC is used to select the optimal lag order in ADF and PP test, and **a** and **b** denote significance level at 1 percent and 5 percent.

Table 2: Descriptive Statistics

	LGDP	**LREER**	**LCPI**	**LOP**
Mean	24.95148	4.792231	4.192883	3.341860
Median	25.03377	4.774719	4.233541	3.192942
Maximum	26.54662	5.204967	4.725690	4.695468

	LGDP	LREER	LCPI	LOP
Minimum	22.95315	4.520363	3.502056	2.373044
Std. Dev.	1.004058	0.231877	0.356656	0.698018
Skewness	-0.089819	0.480061	-0.309156	0.636841
Kurtosis	2.058649	1.750668	2.006059	2.221462
Jarque – Bera	1.568955	4.241216	2.340807	3.806830
Observations	41	41	41	41

Note: All variables are in logarithms.

4.1 ARDL and NARDL Models

Figure 8 shows how the models select the optimal lag lengths the results are automatically displayed in different combinations. The Akaike Information Criteria (AIC) were used to determine the statistical procedure. The best model in ARDL is two lags for GDP and no lags for the real effective exchange rate, consumer price index, and oil price (2,0,0,0). For NARDL maintain the two lags for GDP, no lags for the real effective exchange rate, consumer price index, and the positive and negative changes in oil (2,0,0,0,0).

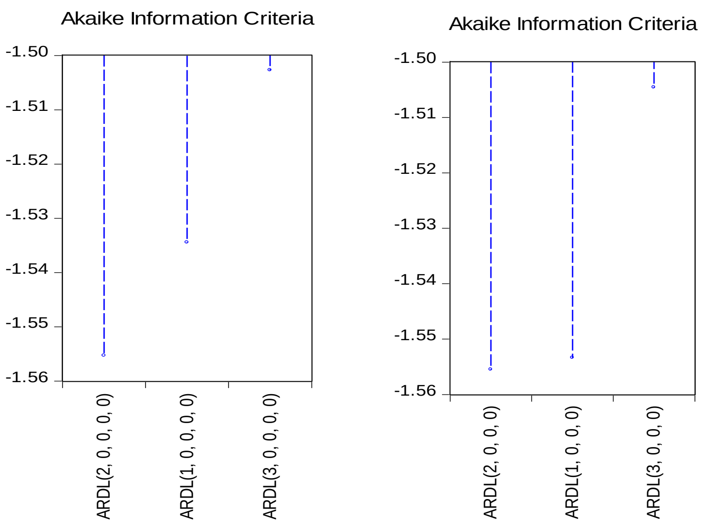

Figure 8: Optimal Lags Selection for ARDL and NARDL

To find out the long-run relationship between the two models (cointegration) among the variables GDP, real effective exchange rate, consumer price index, oil price, and oil price changes. A restricted error correction model was applied to generate the F-statistics value.

We can reject the null hypothesis only if the value of the calculated F-statistic is above the upper bound value at a 5 percent level of significance. We found that both the calculated F-statistics in the two models were above the upper bound presented in Table 3. That suggests that the variables are cointegrated i.e. they are moving in the same direction, they have a long-run association. The empirical results established based on F-statistics calculated from the study from the two models and compared with the tabulated value F-statistics. We conducted both ARDL and NARDL tests discovered that the variables are cointegrated in both models. In the linear model, the calculated F-statistics is 4.6363 with is greater than the tabulated F-statistics at 5 percent while in the nonlinear model, the calculated F-statistics is 4.6905 with is also greater than the tabulated F-statistics at 5 percent.

Table 3: ARDL Linear and Nonlinear Cointegration Test

Bounds test result	F-statistics	Lag	Level of significance	Unrestricted intercept and no trend	
			1%	4.310	5.544
$lY_t = f(lreer_t, lcpi_t, lop_t)$	4.6363	2	5%	3.100	4.088
			10%	2.592	3.454
			1%	3.967	5.455
$lY_t = f(lreer_t, lcpi_t, lop_t^{+}, lop_t^{-})$	4.6905	2	5%	2.893	4.000
			10%	2.427	3.395

Note: F-statistics is greater than the upper bound at the 5% level, which indicates the existence of the long-run relationship. Also, lag 2 was selected as the optimal lag length after testing different lags length suggested by the Akaike information criterion (AIC).

The validation of the long-run association allowed us to further the estimation to investigate the short and the long-run impacts in the two models as reported in Tables 4 and 5. In the symmetric model, the short-run impacts of oil prices on economic growth are positive and significant as we are expecting, since the Malaysian GDP benefited from higher prices as an oil exporter. The nonlinear model revealed that when oil price increase, economic growth benefits more than oil price dropped in the short-run by 0.0047 percent and 0.0038 percent respectively. This result is consistent with the theoretical evidence that when the oil price drops the economy will less benefit since it still exporting but not like when oil price increase. The error correction term in both models confirms the previous cointegration with the significant negative signs -0.2024 and -0.3026 respectively.

The long-run results, in the linear model it reveals that the oil price remains a positive sign and significant in 10 percent. Moving to the asymmetric model indicates the evidence of nonlinear relationships among the variables oil price changes and GDP. The oil price increase is influencing GDP positively and significantly while the oil price decrease is not significant. 1 percent increase in the oil price is related to 0.0069 percent increments in GDP while falling in oil price is insignificantly related to GDP. The two control variables reveal that the real effective exchange rate is insignificant to influence GDP while the consumer price index is positively and significantly affecting GDP in both models. These findings signify that the Malaysian economy benefited during higher oil price while lower oil price it absorbs the negative shock through government's policy. These results are related to the other findings on nonlinearity models, with are suggested that the oil price pass-through is incomplete (Delatte and López-Villavicencio, 2012; Ibrahim and Chancharoenchai, 2014).

Table 4: Linear and Nonlinear ARDL Short-run Results

	Linear		Nonlinear	
Ind. Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**
$ect(-1$	-0.2012	0.0124	-0.3026	0.0028
$D(lY(-1))$	0.1945	0.1049	0.2139	0.0953
$D(lreer)$	0.4502	0.0691	0.6957	0.0057
$D(lcpi)$	1.1015	0.0419	1.2966	0.0203
$D(lop)$	0.2395	0.0001	-	-
$D(lop+)$	-	-	0.0047	0.0137
$D(lop-)$	-	-	0.0038	0.0143
R^2	0.9894	-	0.9900	-
BPG		(0.0719)		(0.0183)
LM		(0.0944)		(0.3385)

Note: Breusch-Pagan-Godfrey Heteroskedasticity test and Breusch-Godfrey Serial Correlation LM test, bracket consist the probability, **a** denote significance at 1% level, **b** denote significance at 5% level.

Table 5: Linear and Nonlinear ARDL Long-run Results

	Linear		Nonlinear	
Ind. Variables	**Coefficient**	**P-value**	**Coefficient**	**P-value**
$lreer$	-0.4775	0.4967	-0.2819	0.5936
$lcpi$	1.8730	0.0120	2.1327	0.0001
lop	0.3435	0.0528	-	-
$lop+$	-	-	0.0069	0.0274
$lop-$	-	-	0.0075	0.1818
c	18.3336	0.0033	17.2600	0.0004

Regularly, the study conducted a stability test CUSUM and CUSUM Square as designated in the ARDL framework to check the stability of the models. These results are presented in Figures 9 and 10. The figures illustrated that residuals were within the critical bound at the 5 percent significance level. This signifies that the ARDL and NARDL estimations are stable, reliable, and consistent.

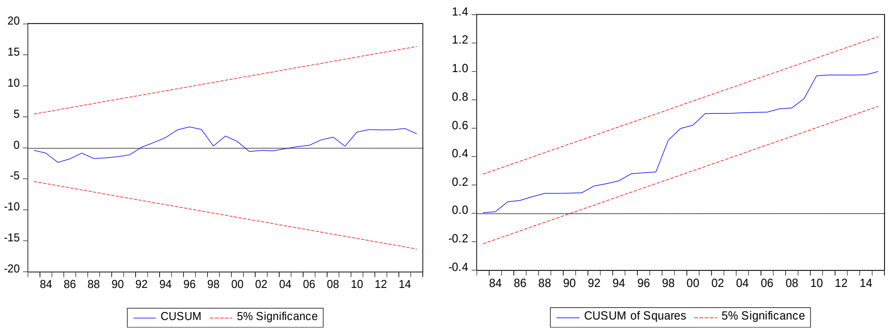

Figure 9: CUSUM and CUSUMSQ for ARDL Model

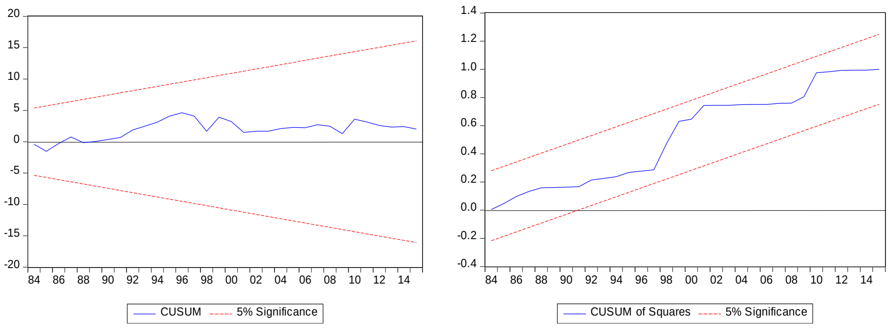

Figure 10: CUSUM and CUSUMSQ for NARDL Model

5. Conclusion

The empirical analysis intends to examine the nonlinearity behavior of oil prices on Malaysian economic growth. The study used annual data from 1975 to 2015. Linear and Nonlinear Autoregressive Distribution Lags (ARDL and NARDL) have been used to estimate the models. From the linear model, the results revealed that oil prices positively boost economic growth both in the short-run and the long-run. Meanwhile, the linear estimator does not have the properties to discover the nonlinearities. To aim our objective, the NARDL estimator was used to detect the impact of positive and negative changes in oil prices. The results reveal that there is a nonlinear relationship among the variables in the long-run relationship as the evidence of cointegration was found in the model. Oil price increase boosts economic growth positively while oil price decrease is not as indicate insignificantly. The error correction term confirms the results to indicate negative, significant, and less than 1 percent. That is to show the speeds of adjustment after the oil price shock. The results have important policy implications, exposed that the impacts of oil price changes (positive and negative) are not necessarily equal.

This recommends that it is essential to the decision-makers to consider separate response when oil price changes. Even though, the results revealed that Malaysia's economic growth was constantly benefiting when oil price increases and temporarily affected when the oil price dropped. This shows that the negative aspects of oil prices were absorbed by the non-oil counterpart or from the government policy. This assertion is also a reference to other economies that are oil-producing countries to empirically explore how effectiveness is policies and how to manage the negative shock.

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