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THE IMPACT OF OIL AND LIQUEFIED NATURAL GAS (LNG) PRICES ON ECONOMIC SECTORS IN MALAYSIA

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ABSTRACT

The aim of this paper is to examine the impact of oil and LNG (Liquefied Natural Gas) prices fluctuation to economy sectors in Malaysia. We investigates four economics sectors in Malaysia namely industry, manufacturing, agriculture and services sector. Annual time series data were collected from 1985 to 2015.Econometrics methods like unit root, co-integration, VECM and causality test were tested to identify a long run relationship and causality from energy prices to economic sector. Data for economic sectors and energy prices were extracted from World Bank and Energy Information Administration (EIA).The empirical results found that all series are associated and move together in a long run but there is no short-run dynamics exist. Pairwise Granger causality test suggested that oil and LNG prices affect industrial and manufacturing sectors in Malaysia.

Keywords*:* Oil price; GDP economic sectors; LNG; cointegration; causality; VECM

1 INTRODUCTION

The research inspired by previous researcher who has done the empirical investigation on the impact of oil price shock to the economy. In recent years, crude oil prices are fluctuated and always become interesting topics to discuss. The rise in energy price caused other prices to increases as oil will determine the other price of goods. Increase in energy price will reduce the household's income and increase spending on energy goods and services (Office, 2006). This paper emphasize on economic sector because we want to investigate which sector is the most affected with oil price fluctuation. Hence the results are helpful for government to allocate budget or subsidies to on specific sector.

Generally previous research paper analyzed the relationship between oil price relationship with the macroeconomics especially in United State case and OPEC country. Nevertheless, this paper aims to explore the crude oil price and LNG[1] on economic sector in Malaysia. An accurate forecast of oil price is necessary to provides information that are useful for policy maker, investor, international organizations, Central Banks, government and various range of industries including manufacturers. The information on the oil price and energy forecast are useful for decision making and policy settings. The dependency to oil price in the selected sector will indicate that Malaysia government need formulating policies on oil and gas prices. International Energy Agency (IEA) has predicted that Malaysia will become a net oil importer in 2017 prior to increasing demand by domestic market. Malaysia

[1] LNG stands for Liquefied Natural gas and is a natural gas (predominantly methane, CH4, with some mixture of ethane C2H6) that has been converted to liquid form for ease and safety of non-pressurized storage or transport. It takes up about 1/600th the volume of natural gas in the gaseous state (at standard conditions for temperature and pressure). It is odorless, colorless, non-toxic and non-corrosive.

also the third highest oil reserves in Southeast Asia but its net oil exports are very tight due to small gap between domestic product and demand. Malaysia is one of the developing country that successfully utilized its factor of endowments in achieving GDP growth in a short run.

Malaysia GDP recorded a significant ranking compared to other Southeast Asia countries after Thailand and Indonesia. Malaysia five main economic sectors that contribute to Malaysia GDP are agriculture, mining and quarrying, construction, manufacturing and services. However in this paper, data for mining and quarrying and construction are combined and were categories under industry. Recent data mentioned that five main states in Malaysia that contribute to Malaysia GDP are Selangor, Federal territory, Sarawak, Johor and Sabah (Department of statistic, 2015). Agriculture sector show a decrease value from the past 30 year, from 32% in 1970 to 8% in 2015 while industry, services, and manufacturing is in increasing trend. GDP which is known as gross domestics product was first introduced by Adam Smith. He introduce this term because he belief that the wealth of the nation should be measure by production and commerce. This is to replace the evaluation of the country by gold and silver deposits. The nation prosperity evaluated based on metric called GDP.

We are motivated to explore the relationship between oil and LNG price fluctuation with macroeconomic variables because Malaysia is net exporter for oil and gas. Based on latest world LNG report, Malaysia (10.2%) is the 3rd biggest exporter for LNG (IGU, 2016) while Malaysia investment development authority (MIDA) identified that oil and gas industry in Malaysia will become prominent in the future because presently this oil and gas contribute 20% for Malaysia GDP. The first two biggest LNG exporters are Qatar (31.8%) and Australia (12%), (EIA 2016). Any changes in price, supply and demand will give an impact to Malaysia GDP performance. In Malaysia we have over 3500 oil and gas businesses that comprise international oil companies, independents and services and manufacturing that support oil and gas industry supply chain. Malaysian oil and gas companies are focused on key strategic segments such as marine, drilling, engineering, fabrication, offshore installation and operations and maintenance (O&M).Malaysia is committed to ensure the Oil and gas in Malaysia is successful trough pro-business policy. Hence this study can contribute indication on how oil and gas prices reflect with economic sectors in Malaysia.

Graph in Figure 1 shows that service sector contributes the highest with a healthy growth of from 30% in 1970 to 50% in 2012 (Department of statistic, 2015). However since 2014, the growth is in decreasing trend. We belief that this value was influenced by global oil price reduction which has been started since 2014. Figure 1 shows a contribution for each sector to Malaysia's GDP. The graph shows that service sectors contribute the highest since 2007 and followed by industrial, manufacturing and the lowest is agriculture sector. The pattern of the GDP growth in each sector are less steeper compare to oil and LNG prices but the pattern are similar. LNG prices pattern mimic the oil price pattern except in 2009 where oil price hits the second lowest in history after 2015.

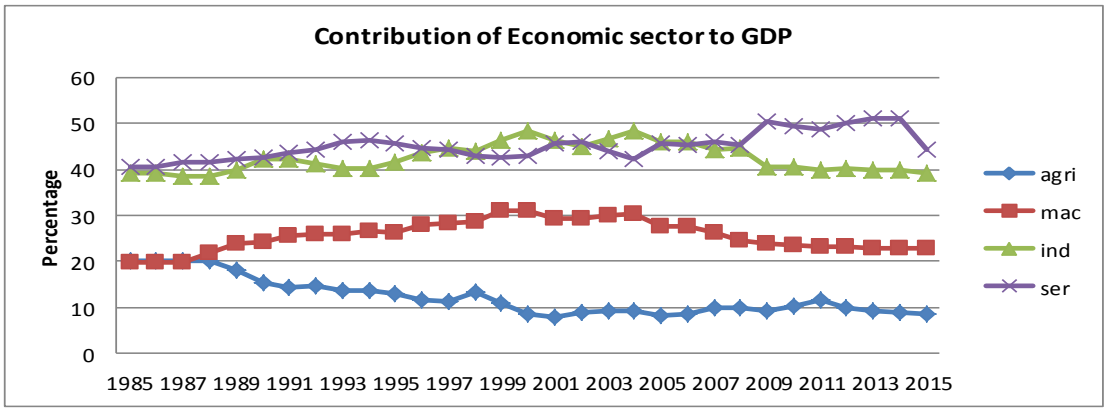

Figure 1: Percentage of value added economic sector to GDP

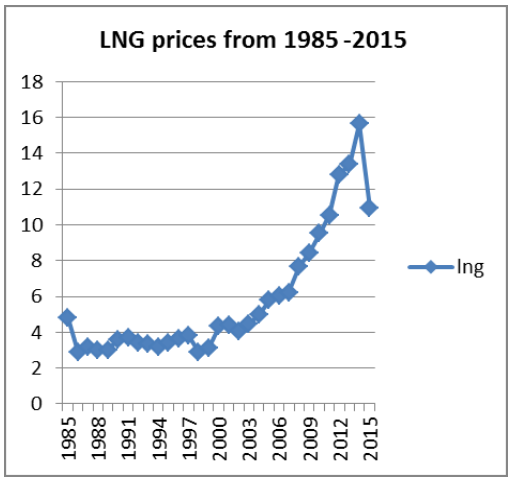

Figure 2: Price of Liquefied US natural gas price export Dollar per thousand cubic feet

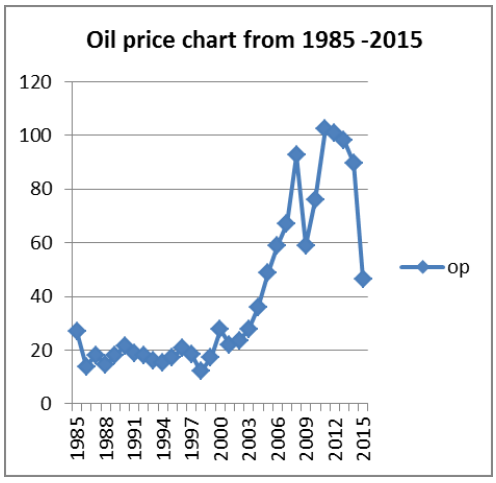

Figure 3: Annual import crude oil per Dollar

2 LITERATURE REVIEW

Energy is essential to almost all economic sectors, and become one of the most strategic commodities for the global economy. Sharp increase in oil market has become one of the biggest economist's concerns since Hamilton, (1983) who concludes the impact of oil price on the U.S economy inconsequence from the 2nd World War. Moreover, crude oil has been playing a key role in all economic activities although the nature of this relationship may have changed over time (Eggoh et al, 2011). Any changes in oil price can lead to a change in macroeconomic policies as well as microeconomic decisions. The importance of oil as a moving engine in economic growth has attracted researcher to explore the relationship between oil and various economic variables like GDP, interest rate, CPI, unemployment, current account , output, stock prices etc. The results of the related studies vary depending on different methodologies, theory, modeling, data, frequency and time span.

Theoretically, previous researchers relate oil prices to various transmissions in macroeconomics activity. The classical supply-side effect suggests that increase value of oil price will affect in increasing value of input of production. Thus there will a reduced input of production and lead to reduce in overall potential output (Abel and Bernake, 2001).The theory indicated that when the price of input increase the production and productivity

growth of a product will decline. Prasad et al, (2007) did a study on the relationship of oil price and GDP for Fijian economy. The empirical results indicated that GDP and oil prices have a positive relationship. Fiji is a good example for Malaysia because this country is categorized under developing and agriculture sectors contribute the most for the Fijian economy.

Iqbal et al, (2012) also found that Indonesia GDP are declined when oil price increased. This effect can be seen when Indonesia is a net importer for oil. Pei, (2013) did a study for Malaysia and found that construction, manufacturing, agriculture and transportation have a long run relationship with oil price and the Granger causality test indicated that all oil granger to all variables except the transportation sector. Jaafar et al, (2008) investigated the oil price impact on Malaysian economy by applying computable general equilibrium analysis. The empirical results indicated that Malaysia GDP's and fixed capital investment reduced by 0.35% and 8% when oil price increase by 5%

3. METHODOLOGY

Previous literature experimented various methods in order to study the effect of oil price to macroeconomics. Earlier study on VECM model has been applied by (Jiménez-Rodriguez and Sánchez, 2004). He did a study on Granger causality over energy prices, energy consumptions and economic growth in Nigeria. ECM method was applied when the model are cointegrated at level. Yusma et al, (2013), Shaari et al, (2012) applied causality test over Malaysia macroeconomics on oil price fluctuations. Cointegration and VECM causality test of Granger were employed to test the dependency of macroeconomics variables to oil price. This paper inspired by Gokmenoglu et al, (2015) where Phillip-perron, Johnsen cointegration and pairwise Ganger causality test were applied. However present study added VECM test to explore a short-run dynamic on long-run equilibrium (Iqbal et al, 2012). (Ee, 2015) did a study on the impact of oil price fluctuation on three economic sector namely manufacturing, agriculture and service sectors. The methods applied are ADF test, Phillips-Perron for stationary, Johansen cointegration and VECM test. (Yusma et al, 2013) applied ARDL bound testing approach to study the long run and short term relationship of Malaysia energy demand an economic growth (GDP). ARDL were applied when the unit root test is not stationary at 1st differences.

3.1 Data

This paper covers Malaysia economic sectors namely industry, manufacturing, agriculture and service from 1985 to 2015. Oil price data were obtain from Energy Information Administration while economic sector GDP contributor were taken from World Bank Development indicator in percentage at USD constant 2010.The rational taking data from 1985 is because Malaysia started exporting LNG since 1985 (Malaysia energy, 2015).

Variables

LROP
Annual nominal average imported crude oil price per USD times with US CPI and divide by Malaysia CPI.

LRLNG

Price of Liquefied U.S. Natural Gas Exports Dollars per Thousand Cubic Feet times with US CPI and divide by Malaysia CPI.

LRRI
Industry sector data includes value added to GDP for mining, construction, electricity, water and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

LRRM
Manufacturing sector value added to GDP is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

LRA
Agriculture includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

LRS
Services include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs.

3.2 Unit root test

Present study explores the long run relationship between oil prices over four economic sectors in Malaysia. In order to achieve the objectives of the study, we employ Philips Perron 1988 to check the unit root for the variables. This approach is nonparametric with respect to nuisance parameters and allows a broad class of weakly dependent and possibly heterogeneously distributed data which is different with (Dickey and Fuller, 1981).

This approach allow model with fitted drift and time trend that it can be used to discriminate a deterministic trend for stationary and non-stationary data. The limiting distributions of the statistics are obtained from unit root null and sequence of local alternatives. Unlike Dickey Fuller test, Phillip-Perron does not require lag length. This is the main advantage compare to Augmented Dickey Fuller procedure. The null hypothesis of the test is unit root in the series. If the result is statistically significant, the null hypothesis can be rejected which means that data is stationary at level, I(0) or to be integrated of order zero.

The hypotheses under the PP unit root test are:
H0: = 0 (Series contains unit root and Yt is non-stationary)
H1: *= 1 (Series contains no unit root and Yt is stationary)*

3.3 Johansen Cointegration test

Long-run relationship of the variables was tested using Johansen cointegration. This approach assume all the variables are in the same order and aims to identify if two or more series are converging to form a long-run relationship.

Rejection of the null hypothesis happens when trace statistic is greater than critical values at 1% or 5% and it means that at least one of the coefficient is statistically significant (not equal to zero). Once a co-integrating vector is estimated, there is a long-run relationship among the variables. The second likehood ratio test statistic is the Maximal Eigenvalue test, which evaluates the null hypothesis.

3.4 Vector Error Correction Model

When data are identified to be cointegrated , it indicated that that is long-run relationship exist among the variables. In order to find a short-run dynamics on the long-run equilibrium, we applied a vector error correction model (VECM). (Granger 1998) argued that a proper Vector Autoregression framework must include Error Correction Model to analyze the dynamic relationship between the variables. Co-integration is a property of long-run equilibrium; meanwhile Granger causality is a short run phenomenon. A co-integrated variable contains the error term for the assessment on how the variables are adjusted, in response to short run disruptions, to re-establish equilibrium in the long run. According to (Guo 2008) a negative sign with significant result of a short-run analysis of VECM indicated that long run equilibrium condition holds and that the economy responds to deviations from equilibrium in a balancing manner.

3.5 Test

In forecasting the causality direction of the variables, we apply a Granger causality test based on Pairwise Granger causality test Awe and Supply, (2008), and Pei, (2013) apply pairwise Granger causality test for their empirical model.

4. FINDINGS AND DISCUSSION

Table 1: Unit root test

Variables		T-Test	1%	5%	10%
Level	LROP	-1.083720	-3.670170	-2.96397	-2.62100
	LRLNG	-0.344154*	-3.670170	-2.9639	-2.62100
	LRA	-2.4575*	-3.67017	-0.9639	-2.6210
	LRM	-0.26043	-3.67017	-2.96397	-2.62100
	LRI	-1.51660*	-3.670170	-2.96397	-2.62100
	LRS	-0.681275	-3.670170	-2.963972	-2.62100
1st differences	LROP	-5.70750***	-3.679322	-2.96776	-2.62298
	LRLNG	-7.36767***	-3.679322	-2.96776	2.62298
	LRA	-4.876020***	-3.67932	-2.96776	-2.62298
	LRM	-7.36767***	-3.67993	-2.96776	2.62298
	LRI	-4.6806***	-3.679322	-2.96776	-2.62298
	LRS	-4.553284***	-3.679322	-2.96776	-2.62298

Table 1 Phillip-Perron unit root test results indicated that all variables are non-stationary at levels. The data contains unit –root and cannot support to reject null-hypothesis at level. The rejection of null hypotheses can be seen at first differences.

Table 2: Johansen cointegration test

REAL OIL PRICE					
H_0	**H_1**	**Trace**	**5%C.V.**	**Max-Eigen**	**5% C.V.**
r = 0	r = 1	110.4386***	69.81889	9.72033***	33.8768
r≤1	r = 2	50.71822**	47.8561	23.97777	27.5843
r≤2	r = 3	26.7404	29.7970	16.77902	21.1316
r≤3	r = 4	9.961420	15.4947	9.95574	14.2646
r≤3	r=5	0.005647	3.84146	0.05647	3.84146
REAL LNG					
H_0	**H_1**	**Trace**	**5% C.V.**	**Max-Eigen**	**5% C.V.**
r = 0	r = 1	95.06385***	69.8189	53.4962***	33.8768
r≤1	r = 2	41.5712	47.85613	21.70836	27.5843
r≤2	r = 3	19.86289	29.79707	13.70881	21.1316
r≤3	r = 4	6.154071	15.49471	5.505757	14.2646
r≤3	r = 4	0.648314	3.841466	0.648314	3.84146

Table 2 shows both trace test and maximum eigenvalue test for oil price on economic sectors (agriculture, industry, manufacturing and service sectors).The results for LNG and oil price indicated that there is one cointegrating equation at 5 per cent significant level. Both results are supported by trace test and maximum eigenvalue test respectively.

Table 3: Vector Error Correction Method (VECM)

REAL OIL PRICE			
VECM	Coefficient	Standard Error	t- statistics
Cointegrating Eq.(EC(-1))	1.59379	0.12954	1.226425
D(LROP(-1))	-0.19964	0.4383	-0.45540
D(LRA(-1))	1.92526**	0.81565	2.360397
D(LRI(-1))	5.94927*	3.128690	1.90152
D(LRM(-1))	-1.90552**	1.786639	-1.0665
D(LRS(-1))	5.659852**	2.215727	2.55433
C	0.226419	0.174203	1.299745
REAL LNG			
VECM	Coefficient	Standard Error	t- statistics
Cointegrating Eq.(EC(-1))	0.371802***	0.09044	4.11072
D(LRLNG(-1))	-1.073216***	0.25265	- 4.24757
D(LRA(-1))	0.291022	0.33149	0.86318
D(LRI(-1))	5.03130***	1.02514	4.91161
D(LRM(-1))	-2.64660***	0.55593	-4.76351
D(LRS(-1))	4.71279***	0.93323	5.04997
C	0.057061	0.01705	3.34638

Johansen cointegration test suggested the presence cointegrating relationship of the variables in oil prices on economic sector and LNG prices on economic sector. This suggests that error correction model exist and combines the long-run relationship with short-run dynamics of the model. This result demonstrates that the long run equilibrium conditions holds and that the economy responds to deviations from equilibrium in a balancing manner. The lag length in the model has been determined according to Akaike's Information Criterion (AIC). The lag length that minimizes the AIC is 2.

The VECM result in table 3 suggests that both oil prices and LNG prices have no short-run dynamic over long-run equilibrium. Coefficient values for both dependent variables are positive. This suggests that long-run equilibrium condition does not influences short-run dynamics of economic sectors. There is no speed of adjustment towards a long-run equilibrium. Hence we cannot reject the null hypotheses of no short-run dynamic over long-run equilibrium. The VECM results also suggest that no long-run causality exist from oil and LNG price on economic sectors.

Table 4: Pairwise Granger causality test

Null Hypothesis	Obs	F-Statistic	Prob.
LRLNG does not Granger Cause LROP	29	3.63155	0.0419
LROP does not Granger Cause LRLNG		9.62531	0.0009***
LRA does not Granger Cause LROP	29	2.14166	0.1394
LROP does not Granger Cause LRA		0.54396	0.5874
LRI does not Granger Cause LROP	29	0.42153	0.6608
LROP does not Granger Cause LRI		6.97499	0.0041***
LRM does not Granger Cause LROP	29	0.81143	0.4560
LROP does not Granger Cause LRM		4.49133	0.0220
LRS does not Granger Cause LROP	29	1.13134	0.3392
LRSP does not Granger Cause LROP		0.51841	0.6020
LRA does not Granger Cause LRLNG	29	0.48416	0.6221
LRLNG does not Granger Cause LRA		0.05486	0.9467
LRI does not Granger Cause LRLNG	29	1.58988	0.2247
LRLNG does not Granger Cause LRI		6.62111	0.0051***
LRM does not Granger Cause LRLNG	29	1.81120	0.1851
LRLNG does not Granger Cause LRM		4.09118	0.0296
LRS does not Granger Cause LRLNG	29	1.51258	0.2406
LRLNG does not Granger Cause LRS		0.64898	0.5315
LRI does not Granger Cause LRA	29	1.60098	0.2225
LRA does not Granger Cause LRI		1.06645	0.3600
LRM does not Granger Cause LRA	29	0.47790	0.6259
LRA does not Granger Cause LRM		1.81618	0.1843
LRS does not Granger Cause LRA	29	9.38458	0.0010***
LRA does not Granger Cause LRS		2.95632	0.0712
LRM does not Granger Cause LRI	29	0.56583	0.5753
LRI does not Granger Cause LRM		4.79636	0.0177***
LRS does not Granger Cause LRI	29	0.65272	0.5296
LRI does not Granger Cause LRS		1.89287	0.1725

5.0 CONCLUSION

The main results of this paper confirmed that long-run relationship between oil price and LNG prices on economic sectors namely agriculture, industrial, manufacturing and services however there is no short-run dynamics exist on these two energy source. Long-run relationship implies that all series are associated and move together in a long run and these are supported by previous literature that confirmed most of energy prices in developing countries and economic growth have long-run relationships. Net oil exporter countries have a long-run association between oil prices and GDP. See (Iqbal et al, 2012 and Jiménez-Rodriguez, 2004).

Most of the previous literature indicated that developing countries has no short-run dynamics on the energy prices. Prasad et al, (2007) found that increase in oil price has a positive relationship on real GDP for Fiji. Long run Causality test on VECM also suggest that there is no long-run causality running from economic sector to energy prices in Malaysia. The findings on Granger causality suggested that oil price causes industrial sector and oil price causes manufacturing sector. While LNG prices causes industrial sector and LNG prices causes manufacturing sector. The direction of causality is unidirectional for oil price and LNG price. The unidirectional meant only one direction exist and no reverse causality. Granger causality indicated that oil and LNG prices affect the industrial and manufacturing sectors in Malaysia. In contrast, the industrial sector and manufacturing sector does not affect oil price and LNG price in Malaysia. The result found similar with Pei, (2013) where the oil price granger manufacturing sector but the direction is bidirectional. Granger causality indicated that oil and LNG prices affect the industrial and manufacturing sectors in Malaysia. This result has important implications for Malaysia government in order to allocate oil and gas subsidies or oil and gas policies in specific economic sector. This paper suggests that oil and LNG prices are significant in promoting the growth of GDP for industrial and manufacturing sector.

Oil subsidies are expected to help the growth of targeted sector as oil price is notably volatile in nature. The encouragement of the alternatives energy like LNG should be continue as Malaysia have natural gas reserved and we are the 3rd biggest exporter for this energy. The application of this energy in industrial sector is expected to contribute a cleaner environment as LNG emits 50% less carbon dioxide than coal when you burn it. The continuity on the exploration and research and development for crude oil, and LNG is essential as these two energy source is significant in contributing GDP's growth for Malaysia.

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