J1710

OIL PRICE–OUTPUT NEXUS: A COMPARISON OF INDONESIA AND MALAYSIA

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A research project submitted in partial fulfillment of the requirement for the degree of

BACHELOR OF ECONOMICS (HONS) FINANCIAL ECONOMICS

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF BUSINESS AND FINANCE
DEPARTMENT OF ECONOMICS

AUGUST 2017

DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is **22,748** words.

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ACKNOWLEDGMENT

First and foremost, we feel grateful to God for blessing us with good health and well-being that are necessary to complete this research. Aside that, we would like to grab this opportunity to express countless thanks to our supervisor, Mr Arunnan Balasubramaniam for the provision of expertise, moral encouragement, technical support and also his willingness to sacrifice his time in giving advices and direction to accomplish this project. Without his superior knowledge, assistance and experiences, we wouldn't be able to achieve this outcome. We are also grateful to Mr Keh Chia Guan and Ms Tang Siew Eng, our second examiner and reviewer, in the Department of Economics. We are extremely thankful and indebted to them for sharing expertise, and sincere and valuable guidance and encouragement extended to us. We would like to take this opportunity to express gratitude to all of the department faculty members for their help and support. We also thank our parents for the unceasing encouragement and support. We also place on record, our sense of gratitude to one and all, who directly or indirectly, have lent their hand in this exciting research.

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LIST OF ABBREVIATION

9MP	Ninth Malaysia Plan
ADF	Augmented Dickey-Fuller
AIC	Akaike's Information Criterions
ASEAN	Association Southeast Asian Nation
CPI	Consumer Price Index
ECT	Error Correction Term
ExpF test	Exponential Average Wald Test
FPE	Final Prediction Error
GDP	Gross Domestic Product
HQIC	Hannan-Quinn's Information Criterion
I(0)	Integration Order of Zero
I(1)	Integration Order of One
IIP	Index of Industrial Production
ISIC	International Standard Industrial Classification
ISIC A-B	International Standard Industrial Classification on Agriculture and Fishing Sectoral Output
ISIC C,E	International Standard Industrial Classification on Mining and Electricity Sectoral Output
ISIC D	International Standard Industrial Classification on Manufacturing Sectoral Output
ISIC F	International Standard Industrial Classification on Construction Sectoral Output
ISIC G-H	International Standard Industrial Classification on Wholesales, Hotel and Restaurant Sectoral Output

ISIC I	International Standard Industrial Classification on Transportation Sectoral Output
ISIC J-P	Outputs which consist of Financial Intermediation, Real Estate, Renting and Business Activities, Public Administration and Defense, Education, Health and Social Work, Community, Social and Personal Service Activities as well as Activities of Private Households.
KPSS	Kwiatkowski-Philips-Schmidt-Shin
LA-VAR	Lag-Augmented Vector Autoregressive Model
LIARGI	Natural Logarithm of Indonesia's Agriculture Sector Output
LICONS	Natural Logarithm of Indonesia's Construction Sector Output
LIMANU	Natural Logarithm of Indonesia's Manufacturing Sector Output
LIMIN	Natural Logarithm of Indonesia's Mining Sector Output
LINOP	Natural Logarithm of Indonesia's Nominal Oil Price
LIOTHER	Natural Logarithm of Indonesia's Other Sectors Output
LIROP	Natural Logarithm of Indonesia's Real Oil Price
LITRANS	Natural Logarithms of Indonesia's Transportation Sector Output
LIWHOLE	Natural Logarithms of Indonesia's Wholesales Sector Output
LIY	Natural Logarithms of Indonesia's Gross Domestic Products
LMARGI	Natural Logarithm of Malaysia's Agriculture Sector Output
LMCONS	Natural Logarithm of Malaysia's Construction Sector Output
LMMANU	Natural Logarithm of Malaysia's Manufacturing Sector Output
LMMIN	Natural Logarithm of Malaysia's Mining Sector Output
LMNOP	Natural Logarithm of Malaysia's Nominal Oil Price
LMOTHER	Natural Logarithm of Malaysia's Other Sectors Output
LMROP	Natural Logarithm of Malaysia's Real Oil Price
LMTRANS	Natural Logarithms of Malaysia's Transportation Sector Output

LMWHOLE	Natural Logarithms of Malaysia's Wholesales Sector Output
LMY	Natural Logarithms of Malaysia's Gross Domestic Products
LR	Sequential Modified LR Test Statistic
LWNOP	Natural Logarithms of World Nominal Oil Price
LWROP	Natural Logarithms of World Real Nominal Oil Price
MTOE	Million Tonnes of Oil Equivalent
MWALD	Modified Wald Test Statistic
OPEC	Organization of Petroleum Exporting Countries
PP	Phillips-Perron
SIC	Schwarz's Information Criterions
SME	Small and Medium Enterprise
SupF test	Supremum Wald Test
TVAR	Threshold Vector Auto Regression
US	United Stated
USD	Currency Units (Dollar)
VAR	Vector Auto Regression
VECM	Vector Error Correction Model
WPI	Wholesale Price Indexes
WTI	West Texas Intermediate

LIST OF FIGURES

PREFACE

This study comprises the summary of work we achieved during our final year project. The following study mainly represent the relationship between oil price measurements and sectoral outputs in Malaysia and Indonesia. We begin by introducing the topic we selected and providing the reasons that motivated us to choose this particular subject as our study as well as listing all the necessary background on the topic through an encyclopedic literature on the theoretical and empirical review. Afterwards, we gathered the required data and combined it with relevant econometrics methodologies to acquire our study's empirical results. Finally, we concluded our study by interpreting the following results, suggesting policy implications as well as noting the constraints we faced and how these constraints can be addressed for future studies.

ABSTRACT

This study investigates the oil-output nexus for the case of Malaysia and Indonesia, year spanning from 1982 to 2015. The oil-output relation has been examined in both aggregate and disaggregate levels with oil measure of national and world oil prices, both in real and nominal terms. To examine the relationship, this study employed the Johansen co-integration procedure and LA-VAR based granger non-causality test to observe the long run relationship and pattern of causality among variables under the study. In addition, the commonly used unit root tests (ADF, PP and KPSS) were used to check for stationarity among all variables. The outcomes suggested all variables are non-stationary in level form and stationary in first difference form. The Johansen co-integration test results postulated non-existence of co-movement among all investigated variables. The granger non-causality test results confirmed that oil price positively affects selected outputs in both countries. Specifically, for case of Malaysia, there was a unidirectional causality running from the nominal and real oil price in term to the Malaysian aggregate output (GDP). However, no influence found for the case of Indonesian GDP. From the disaggregate investigation, the empirical results show that oil price influences outputs of manufacturing sectors for both Malaysia and Indonesia. Furthermore, the findings also showed that there is a unidirectional casual effect coming from the nominal and real oil price towards output of transportation sector in Malaysia.

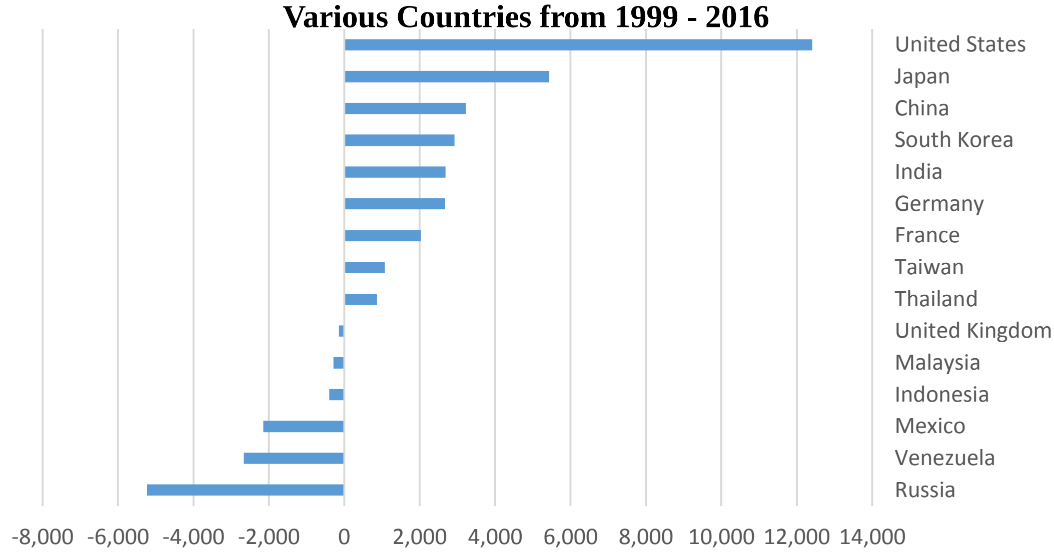
CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

Over the years, oil price fluctuation has been a major concern among countries. Oil is said to be one of the commodity that can influence economic and financial variables across countries. For instance, oil price hikes causes high cost of production and results in a production plunge. A country's productivity may be affected and low productivity could influence economic growth of a nation. Mostly, the oil importing countries are found to be adversely affected to by oil price hikes, and the effects may vary across net oil importing and net oil exporting countries.

Net oil exporting countries are countries that engaged in international trade where those countries have their value of oil exports higher than value of oil imports from another countries. On the other hand, net oil importing countries have their value of oil imports higher than value of oil exports. From **Figure 1**, those countries that have negative value of Mtoe (Million Tonnes of Oil Equivalent) signifies that the dependency in oil imports is generally lower than its oil exporting, which define them as a net oil exporting country, vice versa. Hence, we can observe that United Kingdom, Malaysia, Indonesia, Mexico, Venezuela and Russia are net oil exporting countries. By separating those countries by region, note that Malaysia and Indonesia are the countries from Southeast Asia. Particularly, Indonesia and Malaysia are categorized as narrow net oil exporters in Southeast Asia due to their oil exports is slightly higher than oil imports, which only approximately 200-500 Mtoe more oil exports than its oil imports.

Figure 1: Crude Oil Dependence Profile: Balance of Trade in Various Countries from 1999 - 2016



Notes: Data are expressed in Mtoe. Negative values in Mtoe (Million Tonnes of Oil Equivalent) indicate the balance of a net exporting countries, while positive values in Mtoe (Million Tonnes of Oil Equivalent) indicate the balance of a net importing countries.

Sources: Enerdata's Global Energy Statistical Yearbook 2017

Based on the past research studies, it has been shown that the net oil importing countries experiences a negative effect of oil price changes (Hamilton, 1983). While net oil exporting countries has neutral effect when there is increase in oil price (Brown & Yucel, 2002). Therefore, this current study attempts to investigate the relationship between oil price and output, a comparison of Malaysia and Indonesia. Among the 10 countries of the Association Southeast Asian Nation (ASEAN), Indonesia and Malaysia have been recognized as the largest oil exporting countries. In the last five years, both countries' annual oil exports were at par with the average of 25 Mtoe per year (Yudha and Mahsaru, 2012). Therefore, this research aimed to analyze the impacts of changes in oil price on sectoral output in Malaysia and Indonesia

1.1 Research Background

The price of crude oil plays a crucial role in the global economy as it is one of the major resource for industries. The Organization of Petroleum Exporting Countries (OPEC) act as important cartel of oil supply in the global market. The OPEC countries control oil supply during oil price plunge which consequently affects the global oil market. The effect of increasing oil price in international market cannot be avoided from spreading to the local market, and it may force governments adjust domestic oil price. Oil price changes may cause an increase in the aggregate price level, and affect the economy adversely. In particular, such situation rises inflationary pressure and reduces monetary value and aggregate demand across countries. Moreover, it also cause a decline in production and reduces output. Several past studies have verified that an increase in oil price can cause a slowdown in GDP (refer Husain et al., 2015, for one example).

The oil price hike also affects economic sectors such as manufacturing, agriculture, transportation, construction sectors which all of these sectors uses oil as an important production resource. From this viewpoint, it is clear that the fluctuation of oil price affects economic sectors. At the industrial level, high oil price may raise business expenditures especially for the manufacturing industries and it may affect prices and output in others industries. In this regard, it is crucial to examine the oil price-output nexus at the disaggregate level, which using output by sector because all economic sector contribute differently the aggregate output.

In **Figure 2,** it shows the proportion of seven sectors in both countries of Malaysia and Indonesia[1].The highly contributional sector towards malaysia aggregate GDP is the services sectors (ISIC J-P) which is twenty-four percent compared to Indonesia which is only eighteen percent. The service sector in Malaysia is

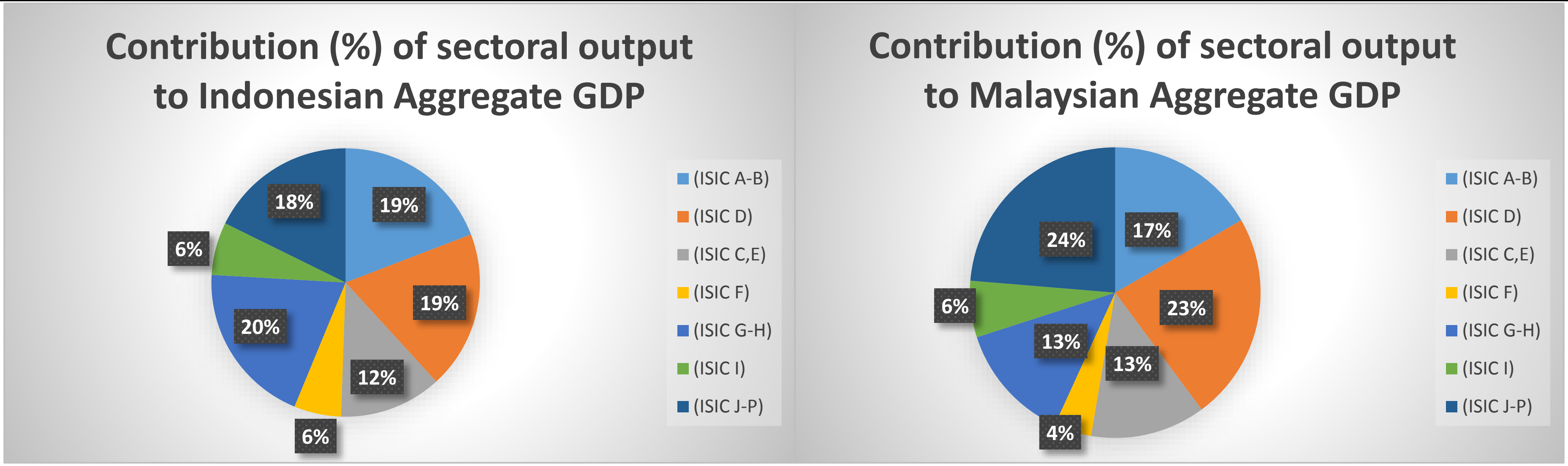
[1] Indonesia which used be an OPEC member country however now it's no longer. Yet, Indonesia including Malaysia are still considered as the largest crude oil exporting countries among Asia-Pacific region. These two oil producing economies have an important role in the oil supply to the global market.

considered to be an important aspect to spur economy development due to the fact that the variety of services available in Malaysia. In contrast, the sectoral output that contributed the most in Indonesia is the wholesale, retail and restaurant sector (ISIC G-H) as the wholesale, retail and restaurant sector contributes about twenty percent to the aggragate output. One reason behind the large contribution is the strive to achieve more Small and Medium entreprise (SMe) by governmment.

Besides that, the manufacturing sector (ISIC D) can be considered as the one of the very important sector in both countries as contribute approxiamately twenty-three percents in Malaysia GDP, while nineteen percent contribution in Indonesia GDP. This indicate that manufacturing sector in Malaysia are more concrete compared to Indonesia. Manufacturing sector in Malaysia is growing at a faster pace because it spurred by impressive domestic demand and export oriented industries support the growh of investment activities and able to get better growth prospect in this sectors.

Nonetheless, nineteen percents of the agriculture and fishing sector sectoral output (ISIC A-B) is allocated in Indonesia GDP, whereas Malaysia which have accounted seventeen percents from its overall GDP. These sector in Indonesia and Malysia is seemingly important as it is one of the major sector that contribute the income sources to the country as it is abundant with fertile land which is ideal for growing a diverse range of crops for both export and domestic consumption.

Figure 2: Contribution (%) of Sectoral Outputs to the Aggregate GDP (Indonesia and Malaysia)



Notes: ISIC A-B denotes as agriculture and fishing sector, ISIC C,E denotes as mining and electricity, gas and water supply sector , ISIC D denotes as manufacturing sector, ISIC F denotes as construction sector, ISIC G-H denotes as wholesales, hotel and restaurant sectors, ISIC I denotes as transportation sector output, and ISIC J-P which include sector of financial intermediation, real estate, renting and business activities, public administration and defence, education, health and social work, community, social and personal service activities as well as activities of private households.

Source: United Nations Statistics Division

1.2 Motivation of the Study

Hamilton (1983) first documented the oil price implication on the United States (US) economy. He stated that the negative correlation between output and oil price does exist. The author further claimed that the oil price changes lead to sluggish output growth in US, also causing inflationary pressure. From other past researchers perspective, Dornbusch et al. (2001) have also stressed that when oil price changes is extremely volatile, it will bring negative repercussions to the country's economic condition, as the oil price's shocks will lead to greater inflationary effect which translate to lesser consumers' demands, causing a contracting effect toward in the level of employment as well as the GDP. In addition, the fluctuation of oil price may lead to reduction in people's purchasing power, which also means that the firms or households would reduce their tendency to invest and consume (Jiranyakul, 2006). On the contrary, Ferderer (1996) argued that volatility and oil price changes have a significant positive impact on economic activities. He stated that oil price increase could benefit the oil exporter countries. This is as the oil price hike become a great opportunity to for oil exporting countries to sell higher price and have positive balance of trade.

Indonesia and Malaysia are known as the narrow net oil exporting countries among the Southeast Asia. The fluctuations of oil price may have an important impact towards their aggregate outputs, however, it can be difficult to identify as the net impact of oil as they are known as the narrow net oil exporters. Likewise Indonesia and Malaysia (refer **Figure 1**), for the case of United Kingdom, Guidi (2009) has concluded that the positive oil price changes result in a reduction in manufacturing sector's outputs. In another study, Hirakata and Sudo (2010) investigated similar issue for the case of the US and Japan at industry level (top oil importing countries). They have found that each shocks effects various industries is different as it depends on the intensiveness of oil usages. It is clear that the impact on the oil price toward the economy is vary across countries, sectors and industries.

Malaysia and Indonesia are known as the two biggest net oil-exporting countries in the Southeast Asia region, but there are not resourceful amount of researches on the oil price and output nexus as the studies are tend to be more popular among the OPEC countries, which will be appealing to investigate the oil price and output nexus in other countries. However, Mehrara and Sarem (2009) has clarified that Indonesia has used diversification of the real sector to eliminate the harmful effects of oil booms and busts where the results showed insignificant effect on output both in the short and long run.

For the case of Malaysia, Shaari, Pei and Rahim (2013) as well as Ee, Gugkang and Husin (2015) has identified that there is long-run relationship between oil price shock and the Malaysia economic sector outputs. Shaari, Pei and Rahim (2013) conducted the test using data from agriculture, construction, manufacturing, and transportation sectors while Ee, Gugkang and Husin (2015) using data from agriculture, manufacturing and service sectors to investigate the impact from the oil price. However, they did not cover other areas such as forestry, hunting and fishing sector, trade of wholesale and retail sector and communication and logistic sector. In this regard, does oil price affect these areas?

Besides, numerous literatures have studied the oil price impact toward the countries' aggregate outputs. It is uncommon for the researchers to conduct much more in-depth analysis toward the relationship between oil price and the output at the disaggregate level. Therefore, this study also examine the oil price impact on disaggregate outputs for two largest Southeast Asia net oil exporting countries. We investigate all the economic sectors in Indonesia and Malaysia and focus on the impact of oil price towards sectoral output of Malaysia and Indonesia by using both oil price measure of nominal and real. In order to attain this goal, we use time-series econometrics analysis such as co-integration and causality testing. The advantage of this study is we have included all of the economic sectors in our analysis for Indonesia and Malaysia. Where, other previous researches only included few of the sectors or only the aggregated output to investigate on the implication of the oil price shocks. This study will assure the identification of effect of oil price on the disaggregated outputs.

1.3 Problem statement

Oil prices fluctuation has been a major concern throughout the global, especially those nations that import or export oil commodities in regular basis will have much bigger impact to the nations' economic performances. Besides, not many studies on this following subject targeted on the ASEAN countries, such as Malaysia and Indonesia. As most of the past researchers have put the center of attention about oil price shocks on the developed countries, like Canada, United Kingdom as well as United Stated. Thus, it is essential to conduct this study to understand the relationship between oil price and economic growth.

Furthermore, the study on the oil price effect on the output in various economic sectors is consider to be rare as most previous studies tend to examine on the relationship between oil price and the aggregate output. It is better to investigate all the economic sectors from the effect of oil price's movement as there are some economic sectors are not significantly affected by the oil price and may require the public sector and the policymakers to focus on. Therefore, this study would be more comprehensive when we can identify the disaggregated outputs in Indonesia and Malaysia from the impact of oil price.

Moreover, the effect of oil price toward the economic growth remains ambiguous. Many people discern that net oil exporting countries' GDP will further improve when positive oil price shock happens which will boost up the price of oil related production. However, not every increase in oil price will be beneficial to all net exporting countries. For example, Olomolo and Adejumo (2006) stated that the economic growth of Nigeria which is a net oil exporting country are insignificant to the positive and negative shocks of oil price. Hence, this study will provide an empirical evidences on oil price influence the sectoral outputs in Indonesia and Malaysia. Particularly, confirmation of the direction relationship among oil price and output can be retrieved in this study. Next, it examines the causal relations between oil price and outputs at the aggregate and disaggregate levels. Finally, we will compare the outcomes of both countries to identify which country has been highly affected by the oil price changes.

1.4 Researches Objectives

1.4.1 General Objectives

To investigate the impact of oil price on the aggregate and disaggregate output in Malaysia and Indonesia

1.4.2 Specific Objectives

1. To detect the direction of the relationship between oil price and outputs in Indonesia and Malaysia.
2. To examine causal pattern of oil price and outputs nexus for Malaysia and Indonesia.
3. To identify which country has been significantly affected by comparing the outcomes of Indonesia and Malaysia.

1.5 Researches Questions

1. What impact does the oil price changes had on the aggregate and disaggregate outputs in Indonesia and Malaysia?
2. Which economic sector has been significantly affected by the oil price changes?
3. Which country has been highly affected by the oil price changes?

1.6 Significance of Study

The outcome of this study may provide a clear information about the reaction of the output by sector when oil price changes. In other words, this study may provide two important findings about the oil price and output relations in two narrow net Asian oil exporting countries which include, the direction of the impact, whereby whether oil price affects outputs positively, negativity or no influence. Next, the findings also could confirm the co-movement and causality between oil price and outputs at the aggregate and disaggregate level. This can provide a clear information whether these variables have a unidirectional or bidirectional causality. Subsequently, this could help the public sector and policy maker to formulate appropriate policy lessons according to the outcomes of this study. In particular, regulators and policymakers could draw policy lessons in order to prevent the deterioration of sectoral outputs from oil price shocks and could develop strategies to spur rapid economic growth. Therefore, this study can be a useful guideline for the policymakers to focus on the economic sectors which will be greatly affected by the movement of oil price, also enable them to set up effective policies to control the stability of the sectoral output from the oil price fluctuation.

1.7 Chapter Layout

In accordance to the structures of our study. Chapter 1 delivers a general reviews on the following study about the relationship between oil price and output. Next, Chapter 2 explores the empirical and theoretical evidence from the previous studies which have been conducted by the past researchers. Subsequently, Chapter 3 discusses on the standard econometric method and statistical data that are employed in our study, following by Chapter 4 which presents a detailed explanation on the empirical results from our study. Chapter 5 is our study's last chapter which provide a conclusion and policy recommendations for future references.

1.8 Conclusion

In this chapter, we brief on how oil price act as one of an important factor toward the economics outputs. Hence, we will continue to Chapter 2 to look into the previous studies on the impact of oil price toward output to have a better understanding on the linkages of oil price and output.

CHAPTER 2: THEORETICAL AND EMPIRICAL REVIEW

2.0 Introduction

This chapter reviews the theoretical and empirical results studied by various authors on the relationship between the oil price and macroeconomics variables in various countries. We intend to analyze the major findings that have been acquired by the previous researchers in order to get the idea of how the oil prices will affect the macroeconomic variables. This section reviews the past journals and analyze the empirical results based on the economic development of the country.

2.1 Theoretical Review

Brown and Yucel (2002) has stated that the activities of economy will be influenced through six different channels which included supply-side shock effect, real balance effect, inflation effect, wealth transfer effect, sector adjustment effect and unexpected effect. The supply-side effect will negatively affect the output and employment rate in the country. This is because when the oil price increases the marginal production costs will also rise which then result in retrenchment in materials, production and human resources.

Real balance effect took place when the money authorities fail to meet the increasing money demand which triggered by rising oil price and result in increasing interest rate and economy recession (Brown & Yucel, 2002). The occurrence of rising oil price is always followed by inflation in the economy. In this case, contractionary monetary policy will be implemented in order to control the inflation. However, the implementation will affects the outputs in the long term due to rise in interest rate that lead to reduction in investments. The wealth transfer effect will seriously affect the trade as the wealth is transferred from oil-importing countries to oil-exporting countries. In the case of sector adjustment effect, oil price shock will influence the labour market by varying the production cost in certain industries. For the unexpected effects, it is explained by the unknown impact brought from the oil price shock.

Numerous past researches regarding the oil price macroeconomics relationship are conducted after the earliest oil embargo which occurred in year 1973. The pioneers on doing these researches are from Hamilton (1983) and Darby (1982) and their researches are based on the economy in United Stated. Different studies on this topic are examined towards developed countries, including Guo and Kliesen (2005), Mork and Olsen (1994), and Gisser and Goodwin (1986). On the other hand, there are also some previous researches conducted which focus on developing countries like Thailand (Rafiq, Salim & Bloch, 2009) and Philippines (Raguindin & Reyes, 2005). The studies conducted by Rafiq, Salim and Bloch (2009) have proved that oil and production process is closely related and the oil price shock had great influence on the macroeconomic fundamentals.

The fluctuation of oil price had a great impact on the economy worldwide and therefore this following issue has noted to be a major issue for the whole nations. It is undeniable that many of the researches had been conducted to study the relationship between oil price and economic activities. One of the study published by Hamilton (1983) and he predicted that the phenomenon of economic downturn in U.S. since the year of 1973 is relative with the soaring oil price and the shortage of the oil resource. Besides, Mork and Hall (1980) also shares the similar opinions with Hamilton, which they have believed that the recession and high inflation rate were caused by the rapid increase in oil price.

Hamilton (1983) have also stated that the real GNP of U.S. has undergone negative growth rate where it falls from 4 percent to 2.4 percent in the period from year 1973 until 1981. Besides, the inflation rate of U.S. has doubled in the time period from year 1973 until 1981 compared to the previous twelve years. The phenomenon stated above was coincides with the rapid escalation of oil price. In the other word, the increase in oil price will potentially give negative impact on real GNP growth rate and increase the inflation rate.

Mork and Hall (1980) have stated a similar viewpoint where the real output will undergoes negative growth rate with the acceleration in oil price. The increase in oil price will result with an increase in price level which will subsequently reduce the money supply. In the contractionary monetary policy, interest rate will rise and thus the investment will be decreased. Therefore, reduction in investment will then negatively affects the aggregate outputs in one nation.

Pierce and Enzler (1974) have discussed the impacts of external shock such as the declining value of dollar, crop failure and the increment of oil price on U.S. economy. In the research, they stated that the domestic price will increase, which is followed by the increase in oil price. The increase in domestic price will consequently expand the money demand and thus increase interest rate. The increase in interest rate will reduce the real consumption expenditure due to declining in the purchasing power. Pierce and Enzler predicted that the measure of raising wages will be taken to deal with the situation. The increase in wages will then spur the growth of GNP. In contrary to the authors above, they believed that the increase in oil price will increase the GNP output.

Eksi, Izgi and Senturk (2011) have clarified that the increase in oil price will negatively affect the GNP growth in OECD countries. Furthermore, the research proposes that the increase in oil price will influence the industrial output of OECD countries except France. There is negative relationship between oil price increase and national output in U.S. (Mork & Olson, 1994). On the other hand, the journal entitled with 'the effect of oil price shocks on the Saudi manufacturing sector' showed that the increment in oil price will not influence the manufacturing sector in short run. The increase in oil price will increase the production cost which then reduces the manufacturing output. The similarity between these two journals is that the increase in oil price did not give significant impact on manufacturing sectors however; some of the sub sectors are being negatively affected.

Shaari, Pei and Rahim (2013) have suggested that the oil price fluctuation will affects the economic sectors of manufacturing, agriculture, construction, and transportation. This is because when the oil price is rising, it will then incur higher transportation fees. Higher transportation fee will lead to higher production cost and lower productivity. Therefore, the rise in oil price will indirectly affects the economic output and growth. Besides that, the rising oil price will give rise to the fare such as buses and railways. As the fares of public transport increase, the consumers' demands will decrease consequently. Furthermore, the increase in oil price will affects the construction sector due to high transportation cost. The suppliers had no choice but to increase the price of raw material to cover the inflated transportation cost. Other than that, the rising oil price affects the manufacturing sector due to higher production cost. As the quantity produced being reduce, the product price will increase, which in turn reduce market demand. The price and quantity of raw material for manufacturing purpose are greatly affected by the increase in oil price as it was used to offset the high shipping cost (Bolaji & Bolaji, 2010). The low performance in these four economic sectors due to fluctuation of oil price will contribute less to Malaysian GDP. In short, the journal suggests that rising oil price will adversely affect Malaysian economy.

Ee, Gugkang and Husin (2015) have suggested that the agricultural, manufacturing and service sectors are vulnerable to the fluctuation of oil price. As the mentioned sectors are main contributors of Malaysian GDP, thus the rising oil price will lead to low industrial outputs and in turn causing low GDP growth. Furthermore, the rising in oil price will lead to the increase of other prices. For instance, it will increase the cost of production as it involved higher transportation cost, therefore the supplier will increase the price of raw materials in order to cover the transportation fee. The escalation of oil price will also influence the service sector mainly from transportation sector. Since transportation sector is highly dependent on the oil supply, therefore an increase in oil price will lead to the increase in transportation cost and consequently reducing transport demand.

Besides, Guidi (2009) proclaimed that the discovery of oil in North Sea had contributed tremendous wealth to the United Kingdom and it also triggered rapid growth rate in UK energy sector. However, there are some predictions that the manufacturing would confront with the difficulty of contraction and then brought negative influence to the country. Similarly, Rose et al. (1984) stated that oil boom in United Kingdom gives negative impact on the manufacturing industry due to the appreciation of British sterling in the periods between 1979 and 1981 had increase the gap of exchange rate between US dollar and UK sterling. The high currency rate in UK also affects the manufacturing industry in the way of reducing industrial output. The workforce in the manufacturing sector was subsequently reduced.

From the journal above, we know that the oil price shock is indeed one of the factors that will influenced the output, either in positive or negative way according to different economist. However, these are only the predictions of the economists which could not be directly used as reference unless it had proved and validated by series of tests or methodologies.

2.2 Reviews on Empirical Evidences

2.2.1 Reviews on Oil Price Changes and Macroeconomic Variables for Developed Economies

Rodriguez and Sanchez (2010) studied on how the changes in oil price will be able to affect the macroeconomics development in Japan. The variables which include industrial production, real oil price, consumer price, real wage and real effective exchange rate with quarterly time series data ranged from year 1976 to 2008. Vector autoregressive model and unit root test by Busetti and Taylor (2003) are being used for the model or methodology for this study. In this study, the authors have found that when there is an unexpected increase in oil price, it will results in causing lower economic activities and increases the inflation rate in Japan.

Abdelhamid and Heba (2016) studied the relationship between impacts of oil price changes towards the manufacturing sector in Saudi Arabia. The data used was during the period of 2002 to 2014. The authors used the variables of manufacturing, oil price, government spending, real exchange rate and export in this study. The unit root test based on the Augmented Dicky-Fuller (ADF) test are implemented in the methodology. In this study, the authors have found that there is an evidence to prove that the positively oil price changes resulted in a consistence contraction in manufacturing output. Next, through the methodology it shows that there is no significant effect between oil price and manufacturing sector.

Hsieh (2008) has studied on the impacts of the oil price changes and macroeconomic condition towards the macroeconomic performances for Korea. The data that are used in this study are the real GDP, nominal interest rate, expected inflation rate, real government spending, real government revenues, real stock price, real exchange rate, real crude oil price per barrel, nominal money supply, price level, core price level and potential output in quarterly time series data ranged from 1978 to 2006. The unit root test are being used by the author as methodology in this study. The author has found that when there is an increase in real oil price, the real GDP of Korea would decrease.

Eksi, Izgi and Senturk (2011) have investigated the results of crude oil prices on the industrial production for the selected OECD countries. The authors have used world oil prices and world index of industrial production as variables with time series monthly data from year 1997 to 2008.The application of the methodologies are unit root tests, Johansen co-integration test, Granger causality test and vector error correction models. The findings of this research have presented a causal relationship existed between price of crude oil and index of industrial production expect for Turkey. Furthermore, the existence of long run linkage between price of crude oil and index of industrial production for US and France.

Herwartz and Plodt (2015) have studied on the shock of oil prices on macroeconomic. The variables used were crude oil production, consumer price index for US and China, real oil prices and US and China real GDP. Time series monthly data for US from 1973 to 2014 and time series quarterly data for China from 1995 to 2014 have been used in this research. With the methodology of VAR model, the results have showed that aggregate demand and oil-specific demand have a strong impact on the real oil price, but only a small effect on oil production. Furthermore, there are a greater reaction of the real oil price to oil specific demand shocks than to oil supply shocks. Generally, the oil price shocks on macroeconomic effects in US is more similar to the euro area than to China.

Dias (2013) has studied the oil price shocks outcomes on gross domestic product, employment and inflation for Portuguese. The variables that are involved are oil prices, consumer price index, gross domestic product deflator, wage index for the private sector, gross domestic product and private sector employment (excluding hospitals and the agricultural sector) with time series quarterly data from the period 1984 to 2012. The methodology which has employ are structural VAR model and the results showed increase in oil prices caused the GDP and employment in private sector decrease in long run. For inflation, the effect only in short run but nil in long run.

Ito (2010) has studied the oil price shock on the macroeconomic variables in Russia. The author has apply inflation rate, real effective exchange rate, real GDP and real oil price as variables with time series quarterly data from the period 1994 to 2009. By using vector autoregressive model, the results shows that rise of oil price cause the exchange rate to decrease in long run and at the end GDP will increase. While, in the short run rise of oil prices cause GDP and exchange rate to decrease, but also cause inflation rate to increase.

Cologni and Manera (2005) have investigate the results of oil price shocks on output and price as well as the responses of monetary variables toward the external shocks. The variables in this study are short term interest rates, monetary aggregate, consumer price index, real gross domestic product, world oil price and exchange rate with the time series quarterly data from the period 1980 to 2003. With the methodology of structural co-integrated vector autoregressive model, the author has found that an impact has occurred for unstable oil price on interest rates and a contractionary monetary policy is needed to overcome inflation.

Donayre and Wilmot (2016) has empirically investigated the impact of oil price shocks on the output of Canada and the price level. The macroeconomic variables has used in the research are oil price, output growth and inflation. By using the methodology of threshold vector auto regression (TVAR), the empirical results show that positive oil price shock trigger stronger impact on the Canadian output and price level when compare to the negative price shocks and the outcome is especially important during the economic downturn. Besides, the reduction in inflation cause by negative oil price shock is greater than the increase in inflation, especially when the output growth is low.

Ferderer (1996) has investigated the relationship between oil price volatility and macroeconomic outputs by using the VAR model. The macroeconomic variables under investigation are industrial production index, non-borrowed reserves plus extended credit, federal funds rate, producer price index for crude petroleum and consumer price index. The findings shows that the oil price volatility is able to forecast the industrial production growth and the Federal funds rate are directly proportional to the fluctuation of oil price which means that the Federal funds rate increase with the increase in oil price.

Gounder and Bartlett (2007) has investigated the impact of world oil price on New Zealand's economic growth in the period between year 1989 and 2006. Crude oil price, consumer price index, nominal wages, nominal GDP, nominal effective exchange rate and US producer's price index are chosen as the variables. The methodologies of Wald and likelihood ratio tests of Granger causality and VAR test are chosen to conduct the research. The major findings shows that linear price change, asymmetric price increase and net oil price variables are significant for the system as a whole, whereas asymmetric price decrease is not.

2.2.2 Reviews on Oil Price Changes and Outputs for Developed Economies

Hanabusa (2009) has studied the connection between oil price fluctuation and economic performance. The study is conducted based on Japan's monthly time series data ranged from the year of 2000 to 2008. The methodology that are employed by the author is supremum Wald test (SupF test), exponential average Wald test (ExpF test), ADF test. Towards the end of the study, the author has found that the impact of the feedback between the economic growth and the oil price changes were reflected through the each causality in mean and variance.

Lee and Ni (2001) has studied the impacts of changes in oil price towards the demand and supply in different industries in Asia region. The variables that are involved in this study are M2 money stock, treasury bill rate, consumer price index, interest rate and the logarithm of industrial production. The data are in time series data from 1959 to 1997 and the methodology used is identified vector autoregressive model. The authors found that between the severity of oil price-triggered output decreases and industries oil intensity, there is a little correlation among them. It is also proven that both demand and supply of industries are affected by oil price shock. Where oil price shock occur, the supply of oil intensive industries and demand of many other industries especially the automobile industries will be reduced.

Rahman and Serletis (2012) have investigated the connection between oil price change and economic activity level. Time series quarterly data from year 1974 to 2010 and variables of real gross domestic product, real oil price, and industrial production index are employed in this study. The methodologies are used bivariate VARMA, GARCH-in-Mean, asymmetric BEKK model, the empirical results shows that the real oil prices change and output growth covariance process is asymmetry and unstable real oil prices is correlated with lower average real economic growth in Canada.

Serletis and Istiak (2013) have investigated the linkage the real oil price and industrial production for the G-7 countries. The variables used were real oil price and domestic industrial production index with time series monthly data from year 1974 to 2011. With the methodologies of unit root test and Johansen co-integration test, the author found out that there were linear relationship between industrial production and the real price of oil for Canada, France, Germany, Italy, Japan, and

the United Kingdom but not United States which had nonlinear relationship.

Papapetrou (2009) has studied the relation of oil prices and economic activity in Greece. Variables used were Greece industrial production and world oil price with time series monthly data from year 1982 to 2008. By using unit root tests, vector error-correction model, Granger causality test , Johansen and Juselius cointegration test, regime-switching model and threshold model, the findings have proved that unstable oil price significantly bring bad outcome on economic activity in Greece.

2.2.3 Reviews on Oil Price Changes and Macroeconomic Variables for Developing Economies

Rafiq and Salim (2014) have studied the effects of oil prices volatility that can affect the six major emerging economies that located in Asia. They have employed a few test in order to obtain the data, namely vector autoregressive model, Granger causality test, variance decomposition test, Augmented Dicky-Fuller (ADF) test, Phillips-Perron (PP) test, Kwiatkowski-Philips-Schmidt-Shin (KPSS) test. In additional to that, the authors adopt quarterly time series data from year 1985 quarter 1 until year 2010 quarter 4. Towards the end of the research, the authors have found that in the case of China, the oil price volatility does has the capability to influence the output growth in the short run. On the other hand, both India's GDP growth and inflation are affected by oil price volatility. Meanwhile for Philippines, oil price volatility affects inflation only. From the results, it shows that all of the countries' economics shows that GDP growth and inflation are closely associated in the short run. Based on the VAR models, the oil price volatility seems to be endogenous for all the examined countries.

Wei and Guo (2016) have studied the connection between changes in oil prices and the China's macroeconomic outputs. The authors has applied the variables of oil price, output, investment, consumption, money supply, export, interest rate and inflation for this study. The data are in quarterly time series data ranged from year 1996 to 2014. Through this study, they have found that oil price shocks will leave positive and negative impacts where the results shows that the oil price shocks have inflicted positive impacts on China's output while negative impacts on China's interest rate. It is found that the oil price are positively correlated with output. The results also have showed that there is a longer and deeper effects on the exports of state-owned enterprises compared to foreign investment enterprises when oil price shocks occur. There is a symmetric responses of the exports towards the oil price shocks.

Rafiq, Salim and Bloch (2008) have studied the effects of oil price instability towards the macroeconomic activities. The study is conducted based on Thailand's quarterly time series data from year 1993 to 2006. Crude oil price, real GDP, investment, interest rate, inflation, unemployment rate and trade balance are the variables for this study. The authors have used vector autoregressive model and Granger causality test as their study's methodologies. In this case, the authors have found that there is a unidirectional causality from oil price volatility towards the macroeconomic outputs of Thailand. This study also indicated that the nature of oil price volatility and Thailand's economic indicators is short term. Aside that, the oil price volatility has significant impact on the macroeconomic outputs of Thailand.

Shaari, Pei and Rahim (2013) have studied the impacts of changes in oil price towards the economic sectors that can affects the economic performance of Malaysia. The variables which include in this study were oil price in Malaysia Ringgit, agricultural sector's GDP, construction sector's GDP, manufacturing sector's GDP and transportation sector's GDP using quarterly time series data from year 2000 to 2011. The methodologies that involve in this study are Augmented Dicky-Fuller (ADF) test, co-integration test and Granger causality test. Towards the end of the study, the authors have found that the construction sector is dependent to oil prices. Aside that, Granger causality test show that oil price does not Granger cause transportation. The performance of the agricultural sector will be affected by the oil price volatility. The study also showed that there is a long-run effects of oil prices on Malaysia's agricultural sectors.

Olomolo and Adejumo (2006) have studied the impact of oil price shock towards the Nigerian output, inflation, real exchange rate and money supply by using the VAR model, unit root test and co-integration test. Real GDP, consumer price index (CPI), real exchange rate, wholesale price indexes (WPI) and real oil price are chosen as the variables. The research findings show that the output and inflation in Nigeria are unaffected by the oil price shock no matter it is in term of positive or negative. However, the real exchange rate in Nigeria is detected to be vulnerable to the oil price shock.

Ejumedia and Ojapinwa (2010) has studied the industrial impact of oil price shocks in Nigeria is investigated. Besides, the impact of oil price shocks on aggregate industrial output in Nigeria is also being investigated. The variables in the research are industrial output and oil price in Nigeria. Augmented dickey fuller, ordinary least square, unit root test and co-integration are chosen to conduct the research. The findings show that the industrial output is most likely influenced by oil price, inflation and exchange rate.

Ari (2010) has studied the linkage among the world crude oil prices and the agricultural commodity prices. The author has used world oil prices and agricultural commodity prices in Turkey as variables. The author has applied symmetric causality test to determine the world oil prices and the prices of maize. In this study, the author has found that the result of the asymmetric causality test shows that the positive and negative cumulative shocks in oil prices lead to the positive and negative cumulative shocks of cotton prices in agricultural sector.

Gokmenoglu, Azin and Tasoinar (2015) have studied the relationship between four variables namely oil price, inflation, GDP and industrial production. The methodologies that are involved in conducting the research are unit root test, co-integration approach and Granger causality test. The findings of the research show the existence of long-run relationship among the variables and it shows the industrial production in Turkey is independent on the oil price changes when the Granger causality test is employed.

Ghosh and Kanjilal (2014) has investigated the impact of oil price shocks in terms of linear and non-linear on macroeconomic variables for India, an oil-importing country. The macroeconomic variables include monthly average price of UK Brent crude, West Texas Intermediate (WTI) and Dubai Crude, in dollar terms, index of Industrial Production (IIP), real Exchange Rate, real Exports, call money rate, real foreign exchange reserve and Wholesales Prices Index (WPI). Unit root tests, Granger causality tests, markov regime-switching VAR and generalized forecast error variance decomposition were chosen as the methodologies. The findings of the research show that increase in oil prices have great significant impact on macroeconomic variables and the inflation and foreign exchange reserve are greatly influenced by the changes in oil prices.

2.2.4 Reviews on Oil Price Changes and Outputs for Developing Economies

Gudarzi, Asghari and Sadr (2012) have studied the linkage between the oil price and economic growth for the case of Iran. The variables which include in this study are real GDP and oil price and those time series data are gathered from year 1980 to 2010. The methodologies that involve in this study are co-integration ARDL-bounds testing procedure, Granger non-causality test and unit root test. The authors have found that through the co-integration ARDL-bonds testing procedure, there is a distinct unidirectional casual flow from oil consumption to oil price. Aside from that, the Granger non-causality test results show that there are a neutral effect of oil price towards the economic growth.

Mohsen (2015) has studied the impacts of trade openness, capital and oil price towards the industrial output. The data used was during the period of 1970 to 2010 in Syria. The inclusion of the variables in this study are oil price, industrial output, trade openness and capital through annually time series data. The author has implemented co-integration test and Granger causality test as methodology. In this case, the author has found that oil price are negatively and significantly related to industrial output. When the oil price increases, it will further boost the cost of industrial production which negatively affects the industrial production in Syria. This lead to a unidirectional causality relationship between oil price to industrial output in both long run and short run.

Ee, Gugkang and Husin (2015) have examined the impact of oil price on Malaysia's economy such as agriculture, service and manufacturing sector. The variables that involve in conducting this research are oil price in Malaysian Ringgit, sectoral output (agriculture sector's GDP, manufacturing sector's GDP and services sector's

GDP). The application of methodologies such as unit root test, Johansen co-integration test, vector error correction model and Granger causality test show the existence of long run effect of oil price toward the Malaysia's economy outputs. The outcomes of the study also show that the increment of oil price will influence the economy sectors.

Mehrara and Sarem (2009) have investigated the influence of oil price shocks towards the industrial production in oil exporting countries which includes Iran, Saudi Arabia and Indonesia. The two variables are used in the research, namely oil price and industrial value added of Iran, Indonesia and Saudi Arabia. The methodologies of unit root tests, Gregory-Hansen co-integration and Granger causality tests were used to obtain the findings. The findings of the research were that Iran and Saudi Arabia are extremely sensitive towards external shock especially when it was negative oil price shock; theory was applicable in both short run and long run. On the other hand, oil price will not cause any influence on Indonesia in terms of long run and short run.

Cross and Nguyen (2016) have conduct a research to study the relationship between global oil market fluctuations and economic growth in China. The involved variables in the research are oil price and GDP. Vector autoregressive model and unit root test are employed as the methodologies to obtain the research findings. The result of the research showed that the occurrences of global oil price shocks are less influential on the output of China and the impact is temporary. Besides, the oil production and oil price movements are insensitive toward the output shock in China based on the historical decomposition.

2.2.5 Related Review on Oil Price Changes and Macroeconomic Variables for Emerging Economies

For the case of Catik and Onder (2013), the authors have analyzed the effect of oil price changes towards the oil importing country – Turkey with the help of different variables including imported oil prices in terms of Turkwash Lira, Turkey's GDP, nominal US/TL exchange rates, Turkey's interbank rate, wholesale price index, federal funds rate and US industrial production index. Catik and Onder have applied varieties of methods in conducting the research namely unit root test, Lee and Strazicich unit root test with two structural breaks, multivariate threshold vector, autoregressive model (TVAR), Johansen co-integration test and forecast error variance decomposition. The findings of the research indicated that the inflation and output will undergo great influence due to oil price instability especially when the rate of fluctuation exceeds the optimal threshold level. Besides, Turkey has lesser tolerance in confronting oil price instability especially when it undergoes increment in oil price.

Saghaian (2010) has investigated whether oil price affect commodity price and which oil prices will caused that. The author has used the monthly data of oil prices and commodity prices from year 1996 to 2008 to set as the variables for his study. With the methodologies of Granger causality tests, Johansen's co-integration tests, Augmented Dickey-Fuller (ADF) test and vector error correction model, the author has found that the increase in new biofuel agribusinesses and oil-ethanol-corn linkages will rise the relationship between agriculture and energy markets.

2.2.6 Reviews on Oil Price Changes and Outputs for Emerging Economies

Yildirm and Oztruk (2014) have investigated whether oil price should be used in empirical analyses as it differs among different oil products. Oil price, economic output, and industrial production with monthly data from year 2003 to 2013 are employed as their variables for this study. Granger causality test which follow the approach of Toda and Yamamoto and unit root test are used as their methodologies for this following study. The findings were oil price should be used in empirical analyses and rising oil price may lower the labour productivity and capital and at the end reduces output.

Kapusuzoglu and Ulusoy (2015) have investigated the short and long-run relationships between the world prices of oil and the prices of agricultural commodity. The investigated variables are agricultural commodity prices and world oil prices with the monthly data from year 1990 to 2014. By using methodologies of unit root test, Johansen and Juselius co-integration test, and Granger causality tests, the authors have found that long run and causality relationship does not exist between each agricultural commodity prices and world oil.

Lardic and Mignon (2005) have investigated whether oil prices and gross domestic product have a stable long run link. The used variables in this study are oil prices and GDP with the employment of time series quarterly data from year 1970 to 2003. With the help of unit root test and Johansen co-integration tests, the authors have found out that the increase in oil price delay the aggregate economic activity more than decreasing oil prices stimulate it. These findings are again be proved in Lardic and Mignon (2006), even though the application of data and methodology is slightly different.

2.2.3 Conclusion

In this chapter, we have gone through the related research and realize that there are various outcome for various countries. Although many different studies have been done but there is only a few papers study about the effect of oil price towards the sectoral output. We intend to find out more information regarding the effect of oil price towards the sectoral output and hence, this study need further investigation.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This study examines the relationship between oil price and sectoral outputs of Malaysia and Indonesia. Hence, this chapter discussed the methodology that used to answer the research objectives of this study. This study employs the Augmented Dickey Fuller (ADF), Philips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests, Johansen cointegration procedure and LA-VAR based granger non-causality test proposed by Toda and Yamamoto (1995) to investigate the research objectives of this study. The reason of using unit root test is to check the order of integration of the series. The Johansen procedure of cointegration test is used to observe the long run relationship between the variables. For the granger non-causality test, it is used to obtain the causal pattern between the integrated variables.

Furthermore, a brief theoretical discussion also include in the chapter. Based on the journals, it revealed that the increase in oil price will give negative impact on the outputs and economic growth in the country. In addition to that, this chapter consists of data description which gathered by using annual time series data, where every output by sector under investigation is labeled according to the International Standard Industrial Classification (ISIC) Revision 3.1.

3.1 Theoretical Discussion

Brown and Yucel (2002) have proposed that economy will be affected by oil price shock through six channels which includes supply-side shock effect, real balance effect, inflation effect, wealth transfer effect, sector adjustment effect and unexpected effect. In brief, the six channels stated will bring negative impact on the economy as well as the output. As a conclusion, the oil price is indeed a factor that negatively influences for the oil importing countries. Shaari, Pei and Rahim (2013) have proposed that the rising oil price will negatively influence the economy due to higher transportation fee and production cost. This scenario will then lead to poor growth rate of Malaysian GDP. It also suggests that the increase in oil price will result in poor performance in the sectors of agriculture, manufacturing and service followed by rising transportation cost.

This study refers to journals that study foreign country as research background such as United Kingdom, United States and OECD countries. Eksi, Izgi and Senturk (2011) have proposed that rising oil price will give negative impact on the GNP growth in OECD countries. Another journal entitled 'the effect of oil price shocks on the Saudi manufacturing sector' suggests that manufacturing sector is unaffected by the escalation of oil price in the aspect of short run. On the other hands, Guidi (2009) proposes that the escalation of oil price will negatively affect the manufacturing sector by reducing the industrial output. Besides, Rafiq, Salim and Bloch (2009) have studied the impact of oil price on Thailand and they successfully proved that oil play important role in production process and macroeconomic fundamentals are greatly influenced by oil price shock.

3.2 Data Description

This study examines the relationship between sectoral output and the oil price in two ASEAN oil-exporting countries (Malaysia and Indonesia). We employ the annual time series data covering the period from 1982 to 2015. The annual average nominal price of West Texas Intermediate (WTI) in terms of Dollar serve as the benchmark crude for our research. The nominal (WTI) world oil price data can be found from the *World Bank Commodity Price Data*, which known as The Pink Sheet and also further transform to real world price. In addition, the nominal and real oil price in terms of the nations' currencies units are obtained by multiplying the world oil price with the estimated market exchange rates for Malaysia and

Indonesia. As for the measurement of the economy activities, we employed the Gross Domestic Product (GDP) as well as each of the sectors' outputs that follows the International Standard Industrial Classification (ISIC) Revision 3.1. The output data for both countries are collected from *United Nations Statistics Division*. Furthermore, each of the time series data employed in this research are transformed to natural logarithmic form.

3.3 Model Specification

Following past studies, the baseline regression model on the relationship between oil price and output in Malaysia and Indonesia is assumed as follows:

$$y_t = \beta_0 + \beta_1 op_t + \varepsilon_t \qquad (1)$$

Where,

β_0 = Intercept or constant term

β_1 = Coefficient of the independent variables

y_t = Output of a nation in natural logarithm form

op_t = Oil price in natural logarithm form

ε_t = error term

First of all, the output which state to be the dependent variables in our functional forms are symbolized to be the nation's GDP in order for us to identify the impact from the oil price. Even if the empirical results have shown insignificance on the oil price toward GDP. We further diversify the overall output of one nation into sectoral output according to the data classification of (ISIC) so that we can have more in-depth research on whichever economic sector will be significant to the changes of the oil price. The output variables in our study are classified as below in **Table 1**:-

Table 1: List of Variables and Description

Variables	**Description**
National GDP	Mainly our indicator to check the nation's economic performances and productivities from the impact of oil prices' changes. This defines as the aggregate output of each economic sectors in the nation.

Outputs by Sector	
Agriculture	Labeled as section A and B in ISIC that cover the production from the usage of animal and vegetal natural resources, such as growing of permanent or temporary crops, farming of poultry, swine and cattle as well as fishing for commercial purposes.
Mining	Coverage of section C and E in ISIC, which represent the extraction of mineral resources such as crude petroleum, coal or natural gas, as well as the production of gas, electricity and hot water supply.
Manufacturing	For ISIC in section D which is about manufacturing that define the chemical or physical transformation of raw materials with the utilization of machinery to produce new products. Production such as refined petroleum products, basic metal for general hardware or equipment, consumable goods and many more are listed as outputs in manufacturing sectors
Wholesales	Following the standards of ISIC in section G and H which comprised of trade of wholesale and retail, plus the services of hotels and restaurant.
Construction	Categorized in the section F of ISIC, which include in the activities of building completion and installation, site preparation as well as renting on the equipment for construction or demolition purposes.
Transport	Under the classification of ISIC in section I, which include the transportation in land, water and air, also the logistics services.
Other sectors	The accumulation of the output which compromise of financial, insurance, business, private household and social work activities, also the involvement in health and education that label in section J to P of ISIC.
Source: United Nation Statistical Division	

Oil price variables are served as a proxy for the measurement of one nation's outputs in our study. We also distinguish the oil price variables into two various independent variables to understand the impact in a nation's outputs, which is the world oil price and the nation oil price. Not only that, these two variables also denoted in nominal and real term in order to consider whether the effect of the oil price that attributable to the change in inflation or consumer price index of the nation are notable. The oil price variables which represent as our independent variables are important to our study as it can illustrate on any significance impact toward the economic sectors in Malaysia and Indonesia.

3.4 Testing Procedures

3.4.1 Pearson Product Moment Correlation Testing Procedure

The practice of this statistical methodology which is created by Pearson (1896) is to determine the directional hypothesis on the relationship among the oil price and outputs. Besides, the strength of either positive or negative relationship on the variables we are interested to study also can be detected via correlation analysis.

Pearson Product Moment Correlation Estimate:

$$\rho_{x,y} = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{n(\sum x^2 - (\sum x)^2][n(\sum y^2 - (\sum y)^2]}} \tag{2}$$

Where, n is the total number of pairwise correlations between variables, $\sum x$ and $\sum y$ are expressed as the summation of sample x indexed and sample y indexed respectively. $\sum xy$ is the summation of pairwise samples indexed.

3.4.2 Unit Root Hypothesis Testing Procedures

When conducting time series analysis, it is a standard procedure to identify the dynamic relationship between the time series variables. Augmented Dickey and Fuller (1981) (ADF) test as well as Phillips and Perron (1988) (PP) test are carried out to check whether there is any unit root in the time series. Moreover, the Kwiatkowski, Phillips, Schmidt, and Shin (1992) (KPSS) test act as a robustness checking in the unit root tests results.

i) Augmented Dickey-Fuller (ADF) model:

$$\Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{k} a_i \Delta y_{t-i} + u_t \tag{3}$$

$$\Delta y_t = \mu + \beta t + \delta y_{t-1} + \sum_{i=1}^{k} a_i \Delta y_{t-i} + u_t \tag{4}$$

where, μ is a drift, β is the time trend's coefficient, t expressed as the time index, δ is the presenting process root's coefficient, u_t is an error term which follow the white noise process, y_t is the time series variable that are interested to be studied. The test's objective is to know whether the coefficient value δ equals to zero, thus forming the null hypothesis, H_0: $\delta = 0$ which indicate the time series process to be non-stationary, against the alternative hypothesis, $H_1 : \delta < 0$, which means a stationary time series process. Noteworthy, Equation (3) represents the ADF model which excludes the linear trend, while Equation (4) include both constant and linear trend into the respective model. Including irrelevant explanatory variables into the regression model may cause loss in degree of freedom, hence expressing the regression accurately either adding both intercept and linear trend or only intercept is crucial. If the time series plot has deterministic trends and does not begin from the origin, the regression model should include the drift and linear trend which show in Equation (4). However, if the trend is not obvious then it is a model with drift and without linear trend as in Equation (3).

ii) Phillips-Perron (PP) regression model:

$$\Delta y_t = \mu + \beta\left(t - \frac{n}{2}\right) + \delta y_{t-1} + u_t \quad (5)$$

Similarly to ADF regression model, where μ is a drift, β is the time trend's coefficient, t expressed as the time index, δ is the presenting process root's coefficient, u_t is an error term which follow the white noise process and also taken account of the autocorrelation problem with the inclusion of first differentiation on the y_t lags, y_t is the time series variable that are interested to be studied. The test's objective is to know whether the coefficient value δ equals to zero, thus forming the null hypothesis, H_0: $\delta = 0$ which indicate the time series process to be non-stationary, against the alternative hypothesis, H_1 : $\delta < 0$, which means a stationary time series process. The advantages of using the PP test is it applies the correction of standard deviations with Newey-West method that bypasses the problem of heteroskedasticity and autocorrelation as the test is non-parametric.

iii) Kwiatkowski, Phillips, Schmidt, and Shin (1992) KPSS regression model:

:

$$\Delta y_t = \mu + \beta t + a\sum_{i=1}^{t} \gamma_i + u_t \quad (6)$$

where, μ is a drift, β is the time trend's coefficient, t expressed as the time index, a is the presenting process root's coefficient, u_t is an error term which follow the white noise process, γ_i has variance equal to 1 and expected value which equal to zero, y_t is the time series variable that are interested to be studied. Null hypothesis is formed as H_0: $a = 0$, which means a stationary series and alternative hypothesis H_1: $a \neq 0$, indicating a non-stationary series. Three tests should jointly applied to retrieve a robust conclusion. Kwiatkowski et al. (1992) mentioned that testing both the unit root hypothesis and the stationarity hypothesis, not only we are able to differentiate between series that do not contain unit root or series that appear to be stationary, also series which the data are insufficiently informative hold a conclusion on its stationarity.

3.4.3 Lag Length Selection

One of the essential element in specifying the VAR models is to verify the appropriate lag lengths, but it is difficult to determine correctly. When the lag length is shorter than the appropriate standard, there will be autocorrelation problem between the error terms which will provide the estimators to be biased and inefficient, also a wider lag length lead to loss of degrees of freedom due to the increase on the parameters, indicating larger standard errors and therefore the results of hypothesis testing will be misleading. Thus, these tests which include sequential modified LR test statistic, final prediction error (FPE) , Akaike's information criterions (AIC), Schwarz's information criterions (SIC) and Hannan-Quinn's information criterions (HQIC) are used to search for the VAR models' optimal lag length. If the conflicting results are obtained then we choose a lag length suggested by majority of criterion tests.

3.4.4 Johansen Co-integration Testing Procedure

Cointegration is used to identify co-movement among the time series variables that are interested to be studied, also it is the definition of long run relationship which exist between the variables. Cointegration test is ideal and important to find out whether the oil prices and sectoral output have long-term relationship since it is mandatory check for robustness in the results.

The application of Johansen test is one of the most popular method which used to search for cointegrating properties between series. This test overcome the limitation the Engle-Granger test that allows only one cointegrating vector and testable with exact two time series variables. Johansen test permits for more than one cointegrating vector and able to test with more than two time series variables and so it is more suitable to be employed for our research method. Let takes VAR(p) model from equation (3), subtracting z_{t-1} on the both sides of the equation:

$$\Delta z_t = \mu + \delta z_{t-1} + \sum_{i=1}^{k-1} \delta_i \Delta z_{t-i} + u_t \quad (7)$$

Where $\delta = -(1 - \sum_{i=1}^{k} \delta_i)$ and $\delta_i = -\sum_{j=i+1}^{k} \delta_j)$. Greasly and Oxley (2010) proclaimed that the cointegrating rank of the system is stated to be the number cointegrating vectors that is linearly dependent in the system. By examining the characteristic of root on δ, we can check what cointregrating rank is it in the following system. Commonly, there are $\delta < (n-1)$ cointegrating vectors in the system in most case, which indicate a reduced rank. If $\delta = n$, which refers as full rank, imply that the coefficient matrix δ is stated to be linearly independent columns. However, if δ = 0, then there is no cointregration between the selected time series variables, which imply no rank. It is essential to investigate cointegration and if state to be appeared, vector error correction model (VECM) is employed rather than using framework of unrestricted VAR to account on the non-stationary time series.

There are two test statistics which proposed by Johansen (1992) for cointegration.

Firstly, trace test:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln(1 - \lambda_i) \quad (8)$$

Secondly, maximum eigenvalues test:

$$\lambda_{max}(r, r+1) = -T\,(\ln(1 - \lambda_{r+1})) \quad (9)$$

Where, the coefficient matrix δ are denoted as $\lambda_1 > \lambda_2 > \cdots > \lambda_n$, Trace test's null hypothesis is whether the number of distinct eigenvalues is $\leq r$, while maximum eigenvalues tests' null hypothesis is the cointegration vector of r against the alternative hypothesis $r + 1$. If both test show different results, we follow the maximum eigenvalues test statistic as the alternative hypothesis is much more informative and straightforward than trace test statistic.

3.4.5 Granger Non-Causality Testing Procedure

The Granger Causality test that proposed by Granger (1969) is being one of the most popular methodology to investigate the causal relationship among variables. This test has been applied in diverse empirical researches since its being uncomplicated and simplicity in estimation.

However, the causality test was subject to caveats, where specification bias is possible due to Granger-Causality test between two selected time series variables does not contemplate other variables' effects. Gujarati (2006) mentioned that it is difficult to determine the best lag length as causality test is very sensitive toward model specification. Thus, the Granger-Causality test consider to be weak because the empirical results that is provided is not sufficiently robust.

Furthermore, the conventional granger-causality tests' assumptions in an unrestricted VAR model has to be integrated at I(0), which means the selected time series variable have to be stationary. Gujarati (2006) also clarified that when the underlying variables are integrated equal and above one, the χ^2 (Wald) test procedure can become invalid, as the test statistics is not the form of normal distribution due to the nature of non-stationarity in time series, and also the violation in VAR stability condition will arise due to spurious regression problem. Toda and Yamamoto (1995) (T-Y) presented a procedure which is not complex and easy to use which only need an augmented level VAR for estimation that undertakes the χ^2(Wald) test statistics in asymptotic distribution to obviate the flaws associated from Granger (1969) causality test.

Clarke and Mirza (2006) stated that the T-Y procedure of Granger non-causality does not require pretest of system cointegrating properties that help on the removal of the bias that is potentially linked from the testing of cointegration and unit roots. Besides, the causality testing are involved in level form that permits long-run information which fit for standard VAR modelling. Hence, the information loss due to the requirement of first differencing will not happen. In addition, Toda and

Yamamoto (1995) proclaimed that the modified Wald test statistic (MWALD) is feasible provided that $k > d_{max}$.

The initiate action involves is the identification of optimal lag order k, which can be verified by results from the information criterion that majorities has recommended. Secondly, the conduction of unit root test are also important for this procedure as it allow one to distinguish the variables' maximal order of integration d_{max} in following system. These two following steps are necessary to formulate bivariate VAR ($k + d_{max}$) model in order to carry out the Granger non-causality test. In our case, the VAR(p) model for oil price and aggregate output (y_t) nexus for Malaysia and Indonesia can be written as below:

National nominal oil price ($nnop_t$) and aggregate output (y_t) nexus:-

$$\begin{pmatrix} y_t \\ nnop_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} \theta_{11,1} & \theta_{12,1} \\ \theta_{21,1} & \theta_{22,1} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ nnop_{t-1} \end{pmatrix} + \cdots +$$
$$\begin{pmatrix} \theta_{11,k} & \theta_{12,k} \\ \theta_{21,k} & \theta_{22,k} \end{pmatrix} \begin{pmatrix} y_{t-k} \\ nnop_{t-k} \end{pmatrix} + \begin{pmatrix} \theta_{11,p} & \theta_{12,p} \\ \theta_{21,p} & \theta_{22,p} \end{pmatrix} \begin{pmatrix} y_{t-p} \\ nnop_{t-p} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \tag{10}$$

National real oil price ($nrop_t$) and aggregate output (y_t) nexus:-

$$\begin{pmatrix} y_t \\ nrop_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} \infty_{11,1} & \infty_{12,1} \\ \infty_{21,1} & \infty_{22,1} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ nrop_{t-1} \end{pmatrix} + \cdots +$$
$$\begin{pmatrix} \infty_{11,k} & \infty_{12,k} \\ \infty_{21,k} & \infty_{22,k} \end{pmatrix} \begin{pmatrix} y_{t-k} \\ nrop_{t-k} \end{pmatrix} + \begin{pmatrix} \infty_{11,p} & \infty_{12,p} \\ \infty_{21,p} & \infty_{22,p} \end{pmatrix} \begin{pmatrix} y_{t-p} \\ nrop_{t-p} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \tag{11}$$

World nominal oil price ($wnop_t$) and aggregate output (y_t) nexus:-

$$\begin{pmatrix} y_t \\ wnop_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} \omega_{11,1} & \omega_{12,1} \\ \omega_{21,1} & \omega_{22,1} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ wnop_{t-1} \end{pmatrix} + \cdots +$$
$$\begin{pmatrix} \omega_{11,k} & \omega_{12,k} \\ \omega_{21,k} & \omega_{22,k} \end{pmatrix} \begin{pmatrix} y_{t-k} \\ wnop_{t-k} \end{pmatrix} + \begin{pmatrix} \omega_{11,p} & \omega_{12,p} \\ \omega_{21,p} & \omega_{22,p} \end{pmatrix} \begin{pmatrix} y_{t-p} \\ wnop_{t-p} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \tag{12}$$

World real oil price ($wrop_t$) and aggregate output (y_t) nexus:-

$$\begin{pmatrix} y_t \\ wrop_t \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \end{pmatrix} + \begin{pmatrix} \emptyset_{11,1} & \emptyset_{12,1} \\ \emptyset_{21,1} & \emptyset_{22,1} \end{pmatrix} \begin{pmatrix} y_{t-1} \\ wrop_{t-1} \end{pmatrix} + \cdots +$$
$$\begin{pmatrix} \emptyset_{11,k} & \emptyset_{12,k} \\ \emptyset_{21,k} & \emptyset_{22,k} \end{pmatrix} \begin{pmatrix} y_{t-k} \\ wrop_{t-k} \end{pmatrix} + \begin{pmatrix} \emptyset_{11,p} & \emptyset_{12,p} \\ \emptyset_{21,p} & \emptyset_{22,p} \end{pmatrix} \begin{pmatrix} y_{t-p} \\ wrop_{t-p} \end{pmatrix} + \begin{pmatrix} \varepsilon_1 \\ \varepsilon_2 \end{pmatrix} \tag{13}$$

The above equations (10, 11, 12 & 13) are the specification of LA-VAR models of oil price and aggregate output using four different measure of oil price variable. The symbols $\emptyset, \omega, \infty, \theta,$ are vectors of the each bivariate autoregressive. The term y_t denotes aggregate output (GDP) of the countries under study (Malaysia and Indonesia) and $nnop_t$, $nnrop_t$, $wnop_t$ and $wrop_t$ denote measures of oil price which in both national and international oil price measure of nominal and real. The order of p indicates as the lag order of $(k + d_{max})$. The significant findings of directional causality of the variables that we are interested to study can be identified by establishing the rejection of null hypothesis of the Granger Non-Causality via checking the significance test statistic of MWALD on the coefficient matrix of the lagged independent variables. For instance,

- H_{01}: $\theta_{12,1} = \theta_{12,2} \ldots = \theta_{12,k} = 0$, indicates $nnop$ does not Granger Cause y
- H_{02}: $\theta_{21,1} = \theta_{21,2} = \cdots = \theta_{21,k} = 0$, indicates y does not Granger Cause $nnop$.

Similar to aggregate output (gross domestic product) examination for both countries of Indonesia and Malaysia, this study will re-estimate the above VAR specifications for all output by sectors using 4 different oil measures of national currency as well as world oil price at nominal and real terms to investigate their impact for all outputs by sectors of Malaysia and Indonesia which include agriculture($agri_t$), manufacturing($manu_t$), mining(min_t), transportation($trans_t$), wholesales($whole_t$), construction($cons_t$) and others ($other_t$, financial intermediation, education and health).

3.5 Conclusion

From this chapter, it has presented an introductory of the data set we have retrieved and the testing procedure that is needed to generate the empirical results for our study. When the desired results are gathered, we can understand and interpret the implication of the oil price toward sectoral output in two ASEAN countries (Malaysia and Indonesia).

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter presents the data analysis of method specified in the previous chapter. The results include of correlation analysis to inspect the degree of relationships, followed by the ADF, PP and KPSS unit root tests to observe the integration order of all variables that have been employed in this study. Subsequently, this study stimulated Johansen cointegration procedure to investigate co-movement evidence among series. Finally, we estimate LA-VAR based granger non-causality test proposed by Toda and Yamamoto (1995) to identify the pattern of causality between variables.

4.1 Data projection

This section presents the data projection of all variables under this study. The first part presents an overview of Indonesian sectoral outputs. The subsequent section presents Malaysian sectoral outputs. The last part of the data projection, projects the variables of various oil price measures.

4.1.1 Indonesian Outputs by Sectors

Based on **Figure 3**, it shows the graph of sectoral output in Indonesia. Firstly, output of agriculture sector shows an increasing trend between the years 1982 and 2015. This can be caused by land expansion in Java and Madura especially on the relatively scarce populated islands of Sulawesi, Kalimantan and Sumatra that lead to the yield per hectare of crop land increase (Fuglie, 2003). Therefore, when the crop land expand, the agriculture labours increase continuously and output per agricultural worker increase. Next, the construction sector has always been an important role in the share of economy developments. The Indonesian construction output has been increasing steadily for the past of 32 years. One reason probably is construction industry known as the integral part of the national output, accounting for a substantial proportion of GDP in both developing and developed nations (Wibowo & Mawdesley, 2003).

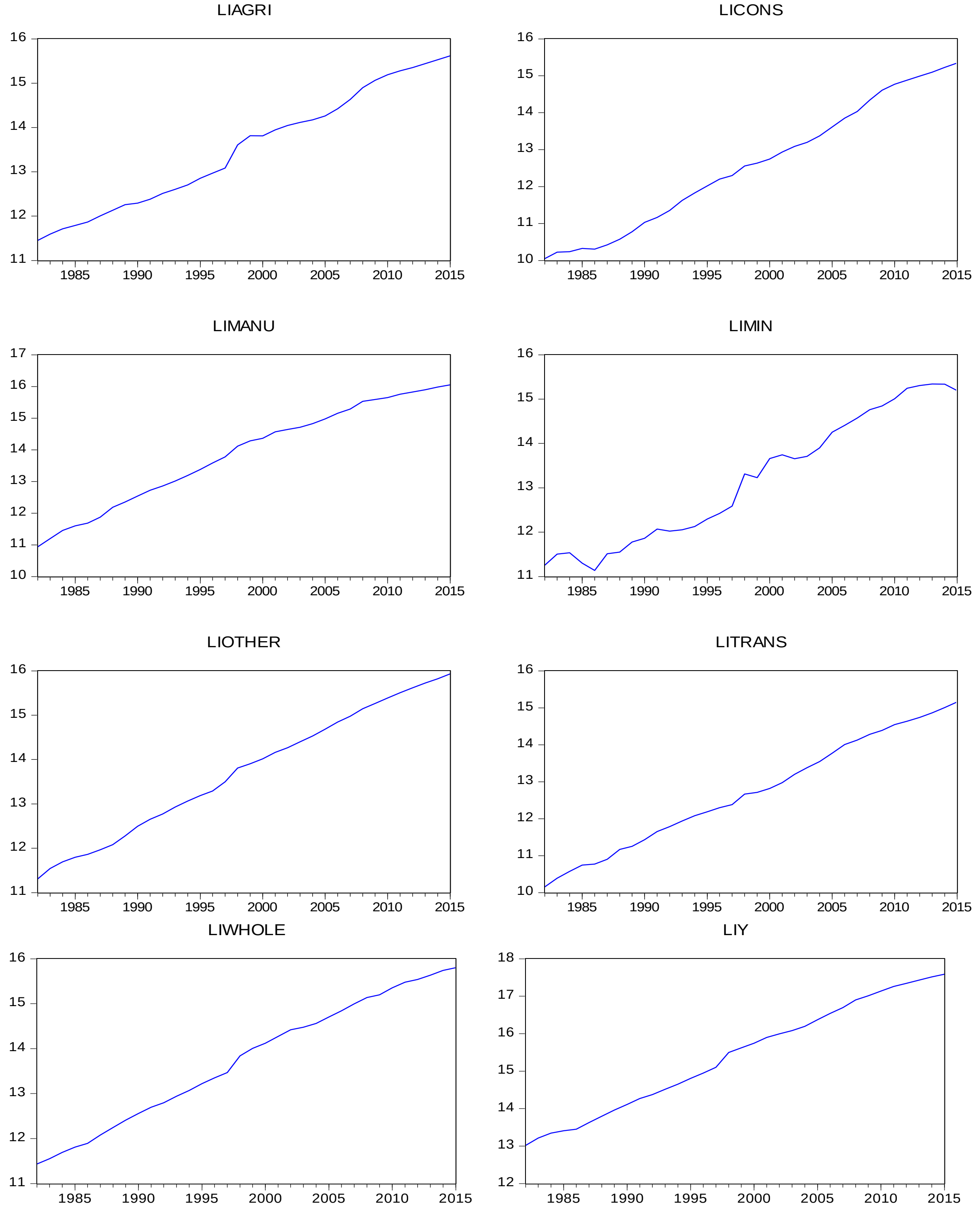
Indonesia has been recognized to be a newly industrialized economies in South East Asia. The output of manufacturing sector had increased from an average of 19.96 percent per year over the period between 1986 and 1990 to 27.82 percent per year in the period between 2000 and 2005 (Khaliq & Noy, 2007), which explain on the constant upward trend of manufacturing sector in Indonesia.

For the mining industries in Indonesia, the output have been increasing throughout the examined period. During the 80s, the implementation of government's policy that welcome foreign direct investment to the coal industry and permit the coal transportation vehicles to utilize public roads, the mining activities expand rapidly which modernize the mining industries in Indonesia since twenty-first century (Fatah, 2007). About the transportation sector, the output shows an increasing trend during the year 1982 to 2015. It is because growth in cars vehicle ownership and use is often seen as an inevitable outcome of increasing GDP and incomes. Thus, when people spend more income on vehicles it directly as well as indirectly affect the growth of Indonesia economy.

For the output of wholesales sector, it portrays a positive trend during the investigation period of the 32 years. Normally, the wholesale sectors are cover with Small Medium Enterprise (SME) businesses. Historically, SMEs have been a major player in contributing the economy to grow in Indonesia due to the fact that it greatly increase the opportunities on being employed. Thus, it has become one of the primary or secondary sources of income for the Indonesian (Tambunan, 2011). With respect to output growth, the performance of SMEs is relatively good and its enable to contribute the Indonesia GDP which able to enhance the country economy. Furthermore, the other sectors in Indonesia which involves the services sector to final consumers and other business. Those services includes retail and distribution services from producer to consumers. In the period of 1999 to 2003, private consumption expenditure provide about 70% of the Indonesia GDP as the business of supermarket have develop significantly. Hence, illustrating the outputs from other sector increase as time go by.

Lastly, the overall output from the Indonesia industry sector has rise steadily throughout the investigated years, which summarize the outlook of the GDP where it present an upward trend. Noteworthy, the increased oil exportation in Indonesia towards other countries are also emphasis in economy contribution. For example, Australia was the biggest trade partner with Indonesia, 2.7% of imports are come from Indonesia somehow petroleum accounts for almost half of all Australian are imports from Indonesia. Therefore it cause the output of Indonesia to grow rapidly.

Figure 3: Graph of Indonesia Sectoral Outputs, from 1982 to 2015



Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE and LIY denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia respectively.

4.1.2 Malaysian Outputs by Sectors

In **Figure 4**, it presents the graph of sectoral output in Malaysia. In 1980s, the outputs of agriculture sector as always increase but also show volatility throughout the following years that mostly because of the implementation of policies such as the New Economic Policy and Third Malaysia Plan which provide supports to agricultural development to drive economic growth. During the 80s to 90s, Malaysia is a rubber dominant country and land are used for plantation of rubber trees. In the late 90s, the output of agriculture sector decline severely due to the invention of synthetic rubber, which the price of natural rubber reduce drastically and lead to the significant decrease in plantation of rubber due to the discouragement in investing rubber field expansion (Sekhar, 2000). When Ninth Malaysia Plan (9MP) is implemented during the earlier years of 2000, the agriculture sector outputs has been increase sharply due to the program has highlighted on biotechnology innovation, enhancement of workforce skills, entrepreneurial farmers' participation and commercial farming in huge scale to make sure the agriculture sector will be revitalized to become one of the important economic growths' factor in Malaysia. However, the share of agriculture sector in Malaysia economy is declining after the years 2010 due to the heavy reliance on foreign labour. More than 750,000 registered foreign labours are employed in 2012 which contribute to an increase in wages. The second factor is the increase the price of agricultural inputs, driving up the agriculture sector production costs. Hence, this is the reason why the graph show a slight decrease in the agriculture outputs after the year of 2010.

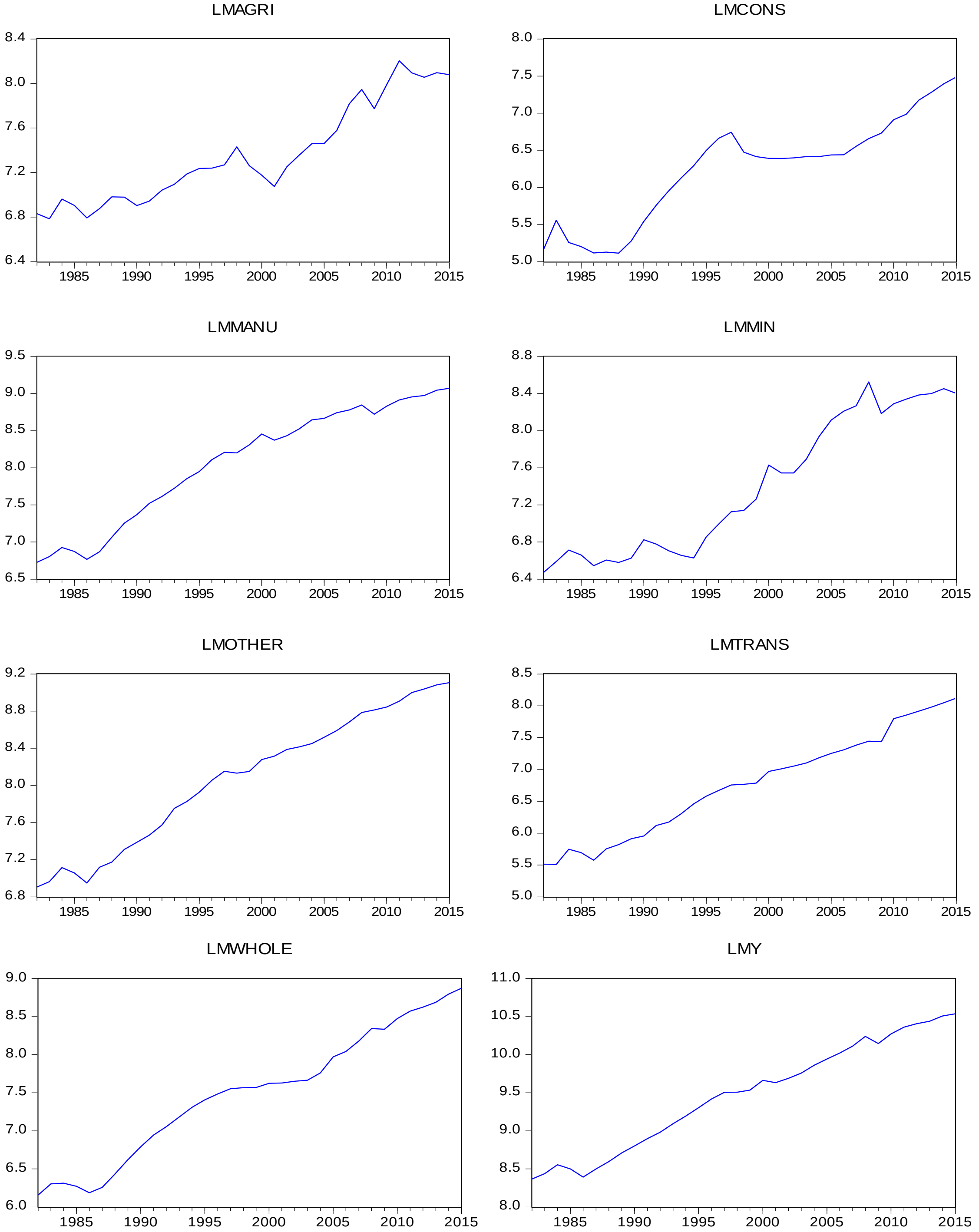
The national GDP growth of Malaysia are strongly influence by the performance of construction GDP growth. Malaysian Construction Industry has an outstanding performance since the years of 1988 and 1994 and the output on this sector has shown an upward trend. The construction sector was never grown less than 11% since the years of 1988 and 1994 (Khalid, 1995). During the year 1996 to 2006, the output of construction sector shows declination and remain constant over the time. Part of the reason are the heavy dependency of foreign workers as well as the hit of economic crisis. For instance, Asian financial crisis in year 1997 or subprime mortgage crisis during the year 2008. From the year 2010 onwards, the outputs of construction sector have grown steadily which is explained by the improvement in civil engineering and the efforts from the government to upgrade the network of railway and roads plus increase the outputs of gas and oil as well as the enhancement in electricity generation (Olanrewaju & Abdul-Aziz, 2015).

Moreover, the graph of output in manufacturing sector has presented an increasing trend during year 1982 to 2015. That because the risen of global demand for electrical and electronic product which provide advantages to produce more as Malaysia are notable to have strong performance in these manufactured products (Lai, 2016). Thus, the manufacturing sector develop at fast pace that lead to the output to grow profoundly. In the earlier years of 1982, the output of mining industry in Malaysia has low performance due to the global tin market has collapsed. Furthermore, at that time Malaysia are more focused on industrialization, oil palm and gas petroleum. In the 90s, after the governments have adopted a new national mineral policy in years 1994 and we can observe that the output for this particular sector increase sharply from year 1994 to year 2009 onwards. Overall, the graph of mining sector outputs illustrate an increasing trend with slight volatility during those years.

Transportation sector is one of the major components of globalization and important in the contribution toward economy of Malaysia. The motor vehicle ownership in Malaysia has increased significantly every year and reached double of the number for every 10 years, which explain the constant increase of the transportation sector's output in the graph. For the output of wholesale sector that present a declination from year 1982 to 1985. The factors this occurrence are Malaysia has inadequate resources and insufficient knowledge to compete with International market as well as the failure of heavy industrialization. After that, the output grow steadily because of trade liberalization during 2000s which allows local retailers to search for foreign countries market to drive economy growth.

Besides, the variable about the contribution from restaurant, hotel and services are labelled as the output of other sector. As Malaysia moves towards to become a developed country, the development of the services sector to serve as the engine of growth should be prioritize in order to achieve sustainability in economy growth. Especially in the Eleventh Malaysia Plan will emphasize on the services sector will continue to be the primary driver of the economic growth. Thus, the output on this sector has been showing a steady upward trend during the investigated 32 years. From the graph illustration about the Malaysia's GDP, with the exception when Malaysia promote heavy industrialization which has announced to be abortive during the year 1981 to 1985, that clarify the decrease outputs during that time. Other than that, it shows an increasing trend after the year 1985 to 2015, which pinpoint on the succession on the growth of different industrial sector.

Figure 4: Graph of Malaysia Sectoral Outputs, from 1982 to 2015



Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE and LMY denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output and total gross domestic products in Malaysia respectively.

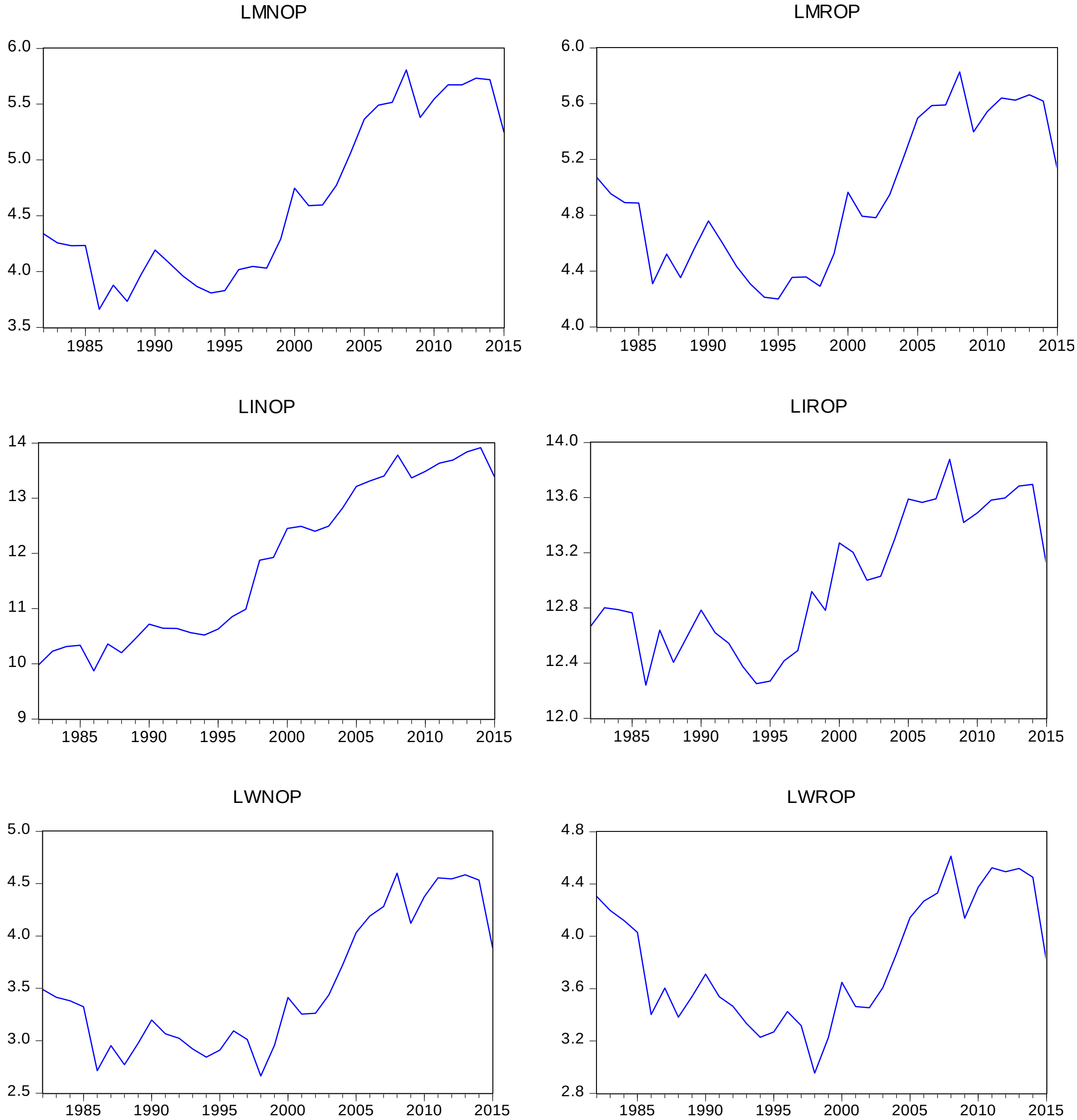
4.1.3 Measure of Oil Price Variables

The graph of various measure of oil prices have been illustrated in **Figure 5**. From the graph of the Malaysia real oil price and nominal oil price, it have similar pattern in year 1990, which the oil price spiked during that time. The reason behind is from the advancement in production technique and drilling technology in worldwide. Especially when Asian financial crisis has occurred between year 1997 to 1998 that consequently affect the oil price to in Malaysia it caused Malaysia currencies slumping, stock markets collapsing and other asset prices declining, and an increase in private debt (Olowe & Ayodeji, 2010). However, after the crisis the oil price having back a positive path most of the reason was there was a globalization are popularized during that period, making an oil price increase a partial result of the economic boom, particularly in Asia. In the year 2008, the oil price drops again in both real and nominal oil price due to the effect of Global financial crisis that lead Lehman Brothers and several other financial institutions shut down in the United States. The financial crisis created risks to the Malaysia economy which made central banks cut interest rates and various governments implement economic policy to stimulate economic growth and try to recover back the confidence in the financial markets. Hence, the financial crisis it has affected the uncertainty in the demand for oil, which cause the oil price to fluctuate.

In Indonesia, during the year 1997 to 1998 the crude price drop precipitated by the Asian financial crisis which has slowdown oil and gas development plans in Indonesia. Hitting by the crisis causes the investment drop out from the country and consequently leading the oil price decrease during the period. When global financial crisis has happened, the nominal and real oil price in term of Rupiah keep on increase rather than the phenomenon of oil price plummeted. That because the negative impact from the crisis toward Indonesia is relatively limited as Indonesia have a sound macroeconomic management. For example, the government of Indonesia implementation of fuel subsidy policy which is subsidized by the state budget and its policy aimed are supporting the poorer segments of Indonesian society.

Moreover, from year 1982 to 1985, the world real and nominal oil price show deep decline due to the global markets are oversupplied with crude oil as the members of OPEC has attempted to lower quota of oil production but face repeated failures. Thus, the oil price fluctuate and fail to recover during the year 1986 to 1996. Furthermore, an explicit drop in oil price has happened during Asian financial crisis due to the deterioration in the world economic growth which lessen the consumer demand. However, the oil price has rocketed dramatically due to the 2000s energy where the world suffer from scarce amount of petroleum reserves and significant decline in the value of Dollar, even the impact from global financial crisis in year 2008 which only temporary decrease the oil price as it put insignificant pressure toward the continuous oil price escalation (Tambunan, 2011). After the year 2014, the oil prices decline again as the demand is low due to weak economic activities in China and all over the world. In conclusion, oil price are much volatile in nature and require many procedures to stabilize the oil price.

Figure 5: Graph of Various Measure of Oil Prices, from 1982 to 2015



Notes: LMNOP, LMROP, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of nominal and real oil price in term of Ringgit, nominal and real oil price in term of Rupiah and nominal and real oil price in term of Dollar respectively.

4.2 Preliminary Analysis

Before proceed on the search for the relationship between oil price and sectoral outputs with VAR estimation, this study conducts a preliminary analysis of descriptive statistics and correlation analyses.

4.2.1 Descriptive Statistics

Tables 2 and 3 present the descriptive statistics of Indonesia and Malaysia. Based on the summary statistics, the GDP in both countries have the highest positive mean value of 15.39 in Indonesia and the value of 9.46 in Malaysia compared to all the other variables. This indicates that GDP increases slightly larger than other variables when there is changes in the oil price. Median data can be found through the middle value position in data set. Based on the summary statistics, we can see that the median and mean value were slightly close to each other. This indicates that the data set has a symmetrical distribution. It is normally distributed and has central tendency.

The Jarque-Bera Test is used to test the normality of the data. The significance level of the test was 5% in this test. When a variables has a probability results that exceed the significance level 5%, it indicates that the variables is not normally distributed. Based on the summary statistics, we can see the probability values of each variables does not exceed the significance level. From here, we can say that all the variables were normally distributed. Standard deviation was calculated with the purpose of measuring the variability of the data. Based on the summary statistics, the construction sector has the highest standard deviation (1.72) among all the sectors in Indonesia. It indicates that the construction sector is more volatile than other sector and might be easily influenced by the fluctuation of oil price. Other than that, the wholesale sector has the highest standard deviation (0.84) among all the sectors in Malaysia, which indicate that the Malaysia wholesale sector is more volatile in nature and might have large impact toward the alternation of oil price. The skewness is used to measure the asymmetric of a probability distribution of a real-valued random variable about its mean. Generally, the skewness will equal to 0 when it has normal distribution. From the summary statistics, we can see that the manufacturing sectors, wholesale sector and other sectors as well as GDP in both countries have negative skewness. This indicates that those sectors' skews slightly to the left. Meanwhile, other variables that have positive skewness indicates that they will have skewness to the right.

Kurtosis is a measurement on whether the data distributions are peaked or flat relative to a normal distribution. A kurtosis's value is 3. If the value exceed 3, it indicates leptokurtosis. Based on the summary statistics, the kurtosis results for all the outputs for both countries are less than 3. This indicates that all the variables have distribution that were less peaked and thinner tails than normal distributions.

Table 2: Descriptive Statistic (Indonesia)

	LIAGRI	**LICONS**	**LIMANU**	**LIMIN**	**LINOP**	**LIOTHER**	**LIROP**	**LITRANS**	**LIWHOLE**	**LIY**	**LWNOP**	**LWROP**
$\bar{\boldsymbol{\sigma}}$	13.51	12.58	13.86	13.19	11.84	13.71	12.98	12.72	13.74	15.39	3.51	3.81
M	13.70	12.59	14.19	13.27	11.90	13.85	12.85	12.68	13.92	15.56	3.35	3.67
Max	15.61	15.34	16.04	15.34	13.91	15.93	13.87	15.15	15.80	17.58	4.60	4.61
Min	11.45	10.04	10.93	11.13	9.87	11.30	12.24	10.15	11.43	13.01	2.66	2.95
$\boldsymbol{\sigma}$	1.33	1.72	1.59	1.45	1.42	1.43	0.49	1.51	1.39	1.46	0.63	0.47
Skew	0.07	0.084	-0.274	0.13	0.10	-0.06	0.16	0.001	-0.11	-0.05	0.51	0.17
Kurto	1.65	1.71	1.77	1.53	1.35	1.71	1.72	1.76	1.68	1.66	1.84	1.70
JB	2.61	2.36	2.55	3.16	3.89	2.35	2.47	2.15	2.51	2.53	3.41	2.55
JB (p)	0.27	0.30	0.278	0.20	0.14	0.30	0.28	0.34	0.28	0.28	0.18	0.27

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia, nominal & real oil price in term of Rupiah and in term of Dollar respectively. In sequences, $\bar{\boldsymbol{\sigma}}$**, M,** $\boldsymbol{\sigma}$**, Skew, Kurto, JB** and **JB (p)** represent mean, median, standard deviation, skewness, kurtosis, Jarque-Bera test statistic and probability.

Table 3: Descriptive Statistic (Malaysia)

	LMAGRI	**LMCONS**	**LMMANU**	**LMMIN**	**LMNOP**	**LMOTHER**	**LMROP**	**LMTRANS**	**LMWHOLE**	**LMY**	**LWNOP**	**LWROP**
$\bar{\boldsymbol{\sigma}}$	7.35	6.24	8.06	7.40	4.62	8.06	4.92	6.76	7.48	9.46	3.51	3.81
M	7.24	6.41	8.25	7.20	4.31	8.15	4.88	6.77	7.56	9.52	3.35	3.67
Max	8.20	7.48	9.07	8.52	5.80	9.10	5.82	8.11	8.87	10.53	4.60	4.61
Min	6.78	5.11	6.72	6.47	3.66	6.90	4.20	5.50	6.15	8.36	2.66	2.95
$\boldsymbol{\sigma}$	0.44	0.70	0.78	0.74	0.72	0.71	0.51	0.81	0.84	0.70	0.63	0.47
Skew	0.56	-0.25	-0.43	0.23	0.37	-0.20	0.22	0.01	-0.09	-0.10	0.51	0.17
Kurto	1.98	2.09	1.77	1.40	1.57	1.72	1.66	1.81	1.90	1.70	1.84	1.70
JB	3.27	1.51	3.22	3.92	3.66	2.53	2.78	1.99	1.73	2.43	3.41	2.55
JB (p)	0.19	0.46	0.19	0.14	0.15	0.28	0.24	0.36	0.41	0.29	0.18	0.27

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY, LMNOP, LMROP AND LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Malaysia, nominal & real oil price in term of Ringgit and in term of Dollar respectively. In sequences, $\bar{\boldsymbol{\sigma}}$**, M,** $\boldsymbol{\sigma}$**, Skew, Kurto, JB** and **JB (p)** represent mean, median, standard deviation, skewness, kurtosis, Jarque-Bera test statistic and probability.

4.3.2 Correlation analysis

Table 4 shows that all the variables are positively correlated among each other. The independent variable of LWNOP has strong positive correlation with all the variables. This is due to the changes in nominal oil price affects all the sectors in Indonesia. On the other hand, LWROP has weak positive correlation with LIAGRI, LICONS, LIMANU, LIOTHER, LITRANS, LIWHOLE and LIY which signifies that the changes in world real oil price doesn't affect much the respective sectors in Indonesia.

Based on **Table 5**, we can see that all the variables are positively correlated among one another. We also found that the dependent variables which is the oil price are positively correlated with the independent variables, all the sector. This signifies that the independent variables positively affects the dependent variables. Majority of the variables have strong positive correlation with other variables except for LWROP because it has weak positive correlation with LMCONS, LMMANU, LMOTHER, LMTRANS, LMWHOLE and LMY. This is due to the following mentioned sectors did not affected much by the changes of the world real oil price in Malaysia during the time period.

Table 4: Correlation Analysis (Indonesia)

Sample: 1982 2015
Included observations: 34

Correlation Probability	LIAGRI	LICONS	LIMANU	LIMIN	LINOP	LIOTHER	LIROP	LITRANS	LIWHOLE	LIY	LWNOP	LWROP
LIAGRI	1.000											

LICONS	0.995***	1.000										
	(0.000)	-----										
LIMANU	0.989***	0.987***	1.000									
	(0.000)	(0.000)	-----									
LIMIN	0.993***	0.989***	0.976***	1.000								
	(0.000)	(0.000)	(0.000)	-----								
LINOP	0.975***	0.965***	0.958***	0.990***	1.000							
	(0.000)	(0.000)	(0.000)	0.0000	-----							
LIOTHER	0.996***	0.997***	0.996***	0.987***	0.968***	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----						
LIROP	0.828***	0.811***	0.786***	0.879***	0.926***	0.807***	1.000					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----					
LITRANS	0.994***	0.997***	0.992***	0.985***	0.964***	0.998***	0.806***	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----				
LIWHOLE	0.996***	0.994***	0.998***	0.986***	0.967***	0.999***	0.807***	0.996***	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----			
LIY	0.998***	0.997***	0.996***	0.990***	0.972***	0.999***	0.817***	0.997***	0.999***	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----		
LWNOP	0.785***	0.795***	0.724***	0.833***	0.851***	0.766***	0.917***	0.780***	0.756***	0.772***	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----	
LWROP	0.476***	0.487***	0.385**	0.548***	0.586***	0.443***	0.778***	0.463***	0.430**	0.453***	0.915***	1.000
	(0.004)	(0.003)	(0.024)	(0.001)	(0.000)	(0.009)	(0.000)	(0.006)	(0.011)	(0.007)	(0.000)	-----

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia, nominal & real oil price in term of Rupiah and in term of Dollar respectively.(*) indicate the null hypothesis is rejected in the significance level, 5%. Value between 0.0 – 0.4 indicate weak correlation, value between 0.4 – 0.7 indicate moderate correlation, and value between 0.7 – 1.0 indicate strong correlation

Table 5: Correlation Analysis (Malaysia)

Sample: 1982 2015
Included observations: 34

Correlation Probability	LMAGRI	LMCONS	LMMANU	LMMIN	LMNOP	LMOTHER	LMROP	LMTRANS	LMWHOLE	LMY	LWNOP	LWROP
LMAGRI	1.000											

LMCONS	0.878***	1.000										
	(0.000)	-----										
LMMANU	0.890***	0.942***	1.000									
	(0.000)	(0.000)	-----									
LMMIN	0.925***	0.830***	0.925***	1.000								
	(0.000)	(0.000)	(0.000)	-----								
LMNOP	0.876***	0.706***	0.807***	0.958***	1.000							
	(0.000)	(0.000)	(0.000)	(0.000)	-----							
LMOTHER	0.928***	0.950***	0.992***	0.944***	0.838***	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----						
LMROP	0.745***	0.503***	0.620***	0.849***	0.962***	0.659***	1.000					
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	-----					
LMTRANS	0.946***	0.946***	0.979***	0.950***	0.853***	0.994***	0.681***	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----				
LMWHOLE	0.946***	0.963***	0.981***	0.932***	0.833***	0.993***	0.655***	0.992***	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----			
LMY	0.942***	0.946***	0.989***	0.956***	0.860***	0.998***	0.690	0.996	0.994	1.000		
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----		
LWNOP	0.842***	0.628***	0.695***	0.884***	0.973***	0.742***	0.975***	0.766***	0.751***	0.770***	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	-----	
LWROP	0.589***	0.295*	0.351**	0.635***	0.820***	0.411**	0.929***	0.448***	0.426**	0.451***	0.915***	1.000
	(0.000)	(0.090)	(0.042)	(0.000)	(0.000)	(0.016)	(0.000)	(0.008)	(0.012)	(0.008)	(0.000)	-----

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY, LMNOP, LMROP AND LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Malaysia, nominal & real oil price in term of Ringgit and in term of Dollar respectively.(*) indicate the null hypothesis is rejected in the significance level, 5%. Value between 0.0 – 0.4 indicate weak correlation, value between 0.4 – 0.7 indicate moderate correlation, and value between 0.7 – 1.0 indicate strong correlation

4.3 Stationarity (Unit Root Test)

In ADF test and PP test, the null hypothesis is rejected when the p-value of the variables are smaller than the significance level. When the null hypothesis is not being rejected, it indicates that the null hypothesis is non stationary and the test shall proceed with first difference form to obtain the integrated order of the variable. From **Table 6** to **Table 9,** it is observed that the empirical results from ADF and PP have detected that investigated time series variables are all found to be non-stationary in level from. This is due to their p-value are larger than the significance level, not able to reject the null hypothesis. The test is then continued by first difference form and it is found that both the intercept without trend and intercept have the same result where all the variables' null hypothesis are rejected at significance level 0.05 which signifies the time series variables are stationary and integrated order of one, I(1).

Beside KPSS test have been employed as "confirmatory analysis" to check whether the provided results of ADF test and PP test is robust. When the null hypothesis for this test is rejected, the test shall be continued in first difference form. Based on what **Table 6** to **Table 9** show, we have verified that the empirical results of ADF test and PP test demonstrate consistency on what the KPSS test results have shown.

In summary, all the investigated variables are non-stationary and integrated order of one, I(1) at level form. After first differencing process, all the investigated variables achieves stationarity. By jointly test the ADF and PP with KPSS, we can confirm and gather robust stationarity results.

Table 6: Unit Root Test in level form (Indonesia)					
	ADF Test		**PP Test**		**KPSS Test**
	t-Statistic	p-value	t-Statistic	p-value	LM-Statistic
Intercept without trend					
LIARGI	-0.039	0.948	-0.039	0.948	0.675**
LICONS	0.800	0.992	0.524	0.985	0.672**
LIMANU	-2.507	0.123	-2.597	0.112	0.675**
LIMIN	-0.277	0.917	-0.265	0.919	0.658**
LIOTHER	-1.326	0.605	-1.737	0.403	0.679**
LITRANS	-0.794	0.807	-0.820	0.800	0.681**
LIWHOLE	-1.479	0.531	-1.483	0.529	0.677**
LIY	-1.013	0.736	-0.959	0.755	0.676**
LINOP	-0.798	0.806	-0.778	0.812	0.640**
LIROP	-1.490	0.526	-1.384	0.577	0.527**
LWNOP	-1.077	0.712	-1.054	0.721	0.488**
LWROP	-1.725	0.409	-1.729	0.407	0.334
Intercept with trend					
LIARGI	-2.117	0.517	-2.117	0.517	0.0991
LICONS	-2.601	0.282	-2.681	0.250	0.099
LIMANU	-0.040	0.993	-0.059	0.993	0.200**
LIMIN	-2.321	0.411	-2.319	0.412	0.135*
LIOTHER	-1.303	0.869	-1.679	0.737	0.151**
LITRANS	-2.446	0.350	-2.548	0.304	0.063
LIWHOLE	-0.441	0.981	-0.503	0.978	0.158**
LIY	-0.998	0.930	-1.377	0.848	0.121*
LINOP	-1.776	0.692	-1.815	0.674	0.110
LIROP	-2.354	0.394	-2.235	0.455	0.128*
LWNOP	-2.340	0.401	-2.340	0.401	0.169**
LWROP	-2.336	0.404	-2.336	0.404	0.175**

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia, nominal & real oil price in term of Rupiah and in term of Dollar. In level form, if the variables is not found stationary, the progression of unit root test will continues until first-differences form. Asterisks (*) & (**) indicate the null hypothesis is rejected in the significance level, 10%, 5%.

Table 7: Unit Root Test in first-differences form (Indonesia)					
	ADF Test		**PP Test**		**KPSS Test**
	t-Statistic	p-value	t-Statistic	p-value	LM-Statistic
Intercept without trend					
D(LIARGI)	-4.354	0.002**	-4.386	0.002**	0.0880
D(LICONS)	-3.735	0.008**	-3.845	0.006**	0.146
D(LIMANU)	-3.812	0.007**	-3.806	0.007**	0.624**
D(LIMIN)	-5.686	0.000**	-5.687	0.000**	0.120
D(LIOTHER)	-4.567	0.000**	-4.543	0.001**	0.271
D(LITRANS)	-6.130	0.000**	-6.149	0.000**	0.092
D(LIWHOLE)	-4.756	0.001**	-4.726	0.000**	0.296
D(LIY)	-4.583	0.001**	-4.586	0.001**	0.176
D(LINOP)	-6.039	0.000**	-6.051	0.000**	0.144
D(LIROP)	-6.661	0.000**	-6.662	0.000**	0.191
D(LWNOP)	-5.353	0.000**	-5.353	0.000**	0.164
D(LWROP)	-5.341	0.000**	-5.337	0.000**	-
Intercept with trend					
D(LIARGI)	-4.28	0.010**	-4.318	0.009**	-
D(LICONS)	-3.77	0.031**	-3.925	0.022**	-
D(LIMANU)	-4.84	0.002**	-4.850	0.002**	0.064
D(LIMIN)	-5.61	0.000**	-5.611	0.000**	0.114
D(LIOTHER)	-4.51	0.006**	-4.455	0.006**	0.155**
D(LITRANS)	-6.03	0.000**	-6.045	0.000**	-
D(LIWHOLE)	-5.05	0.001**	-5.050	0.002**	0.110
D(LIY)	-4.57	0.005**	-4.582	0.004**	0.110
D(LINOP)	-5.92	0.000**	-5.938	0.000**	-
D(LIROP)	-6.52	0.000**	-6.522	0.0000**	0.116
D(LWNOP)	-5.22	0.001**	-5.226	0.000**	0.120**
D(LWROP)	-5.25	0.001**	-5.250	0.000**	0.095

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia, nominal & real oil price in term of Rupiah and in term of Dollar. [D(…)] represent the first differentiation of a variable. Asterisks (*) & (**) indicate the null hypothesis is rejected in the significance level, 10%, 5%.

Table 8: Unit Root Test in level form (Malaysia)					
	ADF Test		**PP Test**		**KPSS Test**
	t-Statistic	p-value	t-Statistic	p-value	LM-Statistic
Intercept without trend					
LMARGI	-0.271	0.918	-0.079	0.943	0.628**
LMCONS	0.239	0.970	-0.452	0.888	0.608**
LMMANU	-1.289	0.621	-1.465	0.538	0.654**
LMMIN	-0.379	0.901	-0.359	0.904	0.637**
LMOTHER	-0.800	0.805	-0.822	0.799	0.668**
LMTRANS	0.065	0.958	0.328	0.976	0.676**
LMWHOLE	-0.074	0.942	-0.133	0.937	0.666**
LMY	-0.359	0.904	-0.379	0.901	0.670**
LMNOP	-0.699	0.833	-0.699	0.833	0.553**
LMROP	-1.196	0.664	-1.223	0.652	0.433*
LWNOP	-1.078	0.712	-1.054	0.721	0.488**
LWROP	-1.725	0.409	-1.729	0.407	0.334
Intercept with trend					
LMARGI	-2.394	0.375	-2.343	0.400	0.143*
LMCONS	-2.125	0.512	-1.852	0.655	0.085
LMMANU	-0.771	0.958	-0.900	0.944	0.181**
LMMIN	-1.927	0.617	-1.927	0.617	0.129*
LMOTHER	-1.566	0.784	-1.654	0.748	0.141**
LMTRANS	-3.372	0.072	-3.372	0.072	0.064
LMWHOLE	-2.960	0.159	-2.091	0.531	0.074
LMY	-2.186	0.481	-2.285	0.430	0.101
LMNOP	-2.302	0.421	-2.302	0.421	0.155**
LMROP	-2.265	0.439	-2.265	0.439	0.157**
LWNOP	-2.340	0.401	-2.340	0.401	0.169**
LWROP	-2.336	0.404	-2.336	0.404	0.175**

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY, LMNOP, LMROP AND LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Malaysia, nominal & real oil price in term of Ringgit and in term of Dollar as well. In level form, if the variables is not found stationary, the progression of unit root test will continues until first-differences form. Asterisks (*) & (**) indicate the null hypothesis is rejected in the significance level, 10%, 5%.

Table 9: Unit Root Test in first-differences form (Malaysia)

	ADF Test		**PP Test**		**KPSS Test**
	t-Statistic	p-value	t-Statistic	p-value	LM-Statistic
Intercept without trend					
D(LMARGI)	-5.667	0.000**	-6.170	0.000**	0.145
D(LMCONS)	-4.679	0.000**	-4.906	0.000**	0.080
D(LMMANU)	-4.651	0.01**	-4.620	0.000**	0.306
D(LMMIN)	-5.837	0.000**	-5.838	0.000**	0.130
D(LMOTHER)	-5.408	0.000**	-5.401	0.000**	0.137
D(LMTRANS)	-7.293	0.000**	-8.120	0.000**	0.088
D(LMWHOLE)	-3.498	0.015**	-3.586	0.012**	0.065
D(LMY)	-5.509	0.000**	-5.507	0.000**	0.084
D(LMNOP)	-5.425	0.000**	-5.424	0.000**	0.189
D(LMROP)	-5.410	0.000**	-5.410	0.000**	0.191
D(LWNOP)	-5.353	0.000**	-5.353	0.000**	0.164
D(LWROP)	-5.341	0.000**	-5.337	0.000**	-
Intercept with trend					
D(LMARGI)	-5.580	0.000**	-6.405	0.000**	0.142*
D(LMCONS)	-4.764	0.003**	-4.972	0.002**	-
D(LMMANU)	-4.175	0.013**	-4.762	0.003**	0.093
D(LMMIN)	-5.757	0.000**	-5.758	0.000**	0.123*
D(LMOTHER)	-5.393	0.000**	-5.399	0.000**	0.083
D(LMTRANS)	-7.170	0.000**	-7.989	0.000**	-
D(LMWHOLE)	-3.469	0.060**	-3.565	0.050**	-
D(LMY)	-5.417	0.000**	-5.411	0.001**	-
D(LMNOP)	-5.301	0.000**	-5.301	0.001**	0.143*
D(LMROP)	-5.287	0.000**	-5.287	0.001**	0.153**
D(LWNOP)	-5.226	0.000**	-5.226	0.001**	0.120*
D(LWROP)	-5.249	0.000**	-5.249	0.001**	0.095

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY, LMNOP, LMROP AND LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Malaysia, nominal & real oil price in term of Ringgit and in term of Dollar as well. [D(…)] represent the first differentiation of a variable. Asterisks (*) & (**) indicate the null hypothesis is rejected in the significance level, 10%, 5%.

4.4 Johansen Cointegration

Table 10 and **Table 11** illustrates the outcomes of Johansen cointegration test. This is to observe whether there is any existence of co-movement or long run equilibrium among the selected time series variables. Before proceed to testing for cointegration, it is relevant to identify the optimal lag length to predict the VAR model. This study identifies the optimum lag length using the commonly used LR, FPE, AIC, SIC and HQIC. For instance, the VAR model with the time series variable of nominal oil price in term of Rupiah and construction sector output in Indonesia, it show the appropriate lag length of 3 which mean that when we construct the VAR model it is crucial to include the lagged variable until the lag order of three. Hence, each of the appropriate lag order will be vary between each of the different VAR model that we form and it is displayed in **Table 10** and **Table 11.**

After we have identified the optimal number of lags for each set of data, we have conducted the Johansen cointegration test for the model. We have set the null hypothesis as there is no co-movement between the selected time series variables while the alternative hypothesis as there is co-movement between the selected time series variables. When there is any contradictory results from the trace and maximum eigen test results, we choose the maximum eigenvalues test statistic as the alternative hypothesis is more direct and easier to comprehend than trace test statistic. From the Johansen cointegration test result which postulate there is non-existence of co-movement between the investigated time series variables. It is not necessary for us to further include the coefficient of Error Correction Term (ECT) since it is insignificant toward the long run dynamics. Therefore, we proceed using the unrestricted VAR model to perform Granger non Causality Test rather than using VECM (Vector Error Correction Model).

Table 10 : Johansen Co-integration Test (Indonesia)					
Dependent Variables	Hypothesized No. of CE(s)	**Trace Statistic**	**Max Eigen Statistic**	**Prob.****	
				Trace	**Max Eigen**
Panel A: Johansen Cointegration Test using World Nominal Oil Price (LWNOP)					
LIAGRI [1]	r=0	6.170	6.157	0.675	0.593
	r ≤ 1	0.011	0.011	0.914	0.914
LICONS [1]	r=0	6.187	6.175	0.673	0.590
	r ≤ 1	0.011	0.011	0.915	0.915
LIMANU [1]	r=0	15.088	8.886	0.057	0.295
	r ≤ 1	6.201	6.201	0.013*	0.013*
LIMIN [1]	r=0	8.514	8.287	0.412	0.350
	r ≤ 1	0.227	0.227	0.633	0.633
LIOTHER [1]	r=0	8.273	7.242	0.436	0.460
	r ≤ 1	1.030	1.030	0.309	0.310
LITRANS [1]	r=0	6.969	6.452	0.581	0.555
	r ≤ 1	0.516	0.516	0.472	0.472
LIWHOLE [1]	r=0	10.206	7.811	0.265	0.398
	r ≤ 1	2.394	2.394	0.121	0.121
LIY [1]	r=0	8.896	7.827	0.375	0.396
	r ≤ 1	1.068	1.068	0.301	0.301
Panel B: Johansen Cointegration Test using World Real Oil Price (LWROP)					
LIAGRI [1]	r=0	6.481	6.478	0.638	0.552
	r ≤ 1	0.003	0.003	0.952	0.952
LICONS [1]	r=0	6.883	6.881	0.591	0.503
	r ≤ 1	0.002	0.002	0.957	0.957
LIMANU [1]	r=0	15.408	9.080	0.051	0.279
	r ≤ 1	6.328	6.328	0.012*	0.012*
LIMIN [1]	r=0	8.989	8.517	0.366	0.328
	r ≤ 1	0.471	0.471	0.492	0.492
LIOTHER [1]	r=0	8.787	7.516	0.385	0.430
	r ≤ 1	1.270	1.270	0.259	0.259
LITRANS [1]	r=0	7.034	6.476	0.573	0.552
	r ≤ 1	0.558	0.558	0.454	0.455
LIWHOLE [1]	r=0	10.475	7.819	0.245	0.397
	r ≤ 1	2.656	2.656	0.103	0.103
LIY [1]	r=0	9.395	8.050	0.330	0.373
	r ≤ 1	1.345	1.345	0.246	0.246

Table 10: Johansen Co-integration Test (Indonesia) Cont.

Panel C: Johansen Cointegration Test using Nominal Oil Price of Indonesia (LINOP)					
LIAGRI [1]	r=0	3.553	3.548	0.936	0.903
	r ≤ 1	0.005	0.005	0.942	0.942
LICONS [3]	r=0	4.308	3.667	0.877	0.892
	r ≤ 1	0.641	0.641	0.423	0.423
LIMANU [2]	r=0	16.100*	9.685	0.040*	0.233
	r ≤ 1	6.414*	6.414*	0.011*	0.011*
LIMIN [1]	r=0	2.713	2.701	0.978	0.964
	r ≤ 1	0.011	0.011	0.912	0.912
LIOTHER [1]	r=0	5.178	4.740	0.789	0.774
	r ≤ 1	0.438	0.438	0.507	0.507
LITRANS [1]	r=0	4.200	3.805	0.886	0.880
	r ≤ 1	0.394	0.394	0.529	0.530
LIWHOLE [1]	r=0	9.234	5.789	0.344	0.640
	r ≤ 1	3.444	3.444	0.063	0.063
LIY [1]	r=0	5.894	5.202	0.708	0.716
	r ≤ 1	0.691	0.691	0.405	0.405
Panel D: Johansen Cointegration Test using Real Oil Price of Indonesia (LIROP)					
LIAGRI [1]	r=0	5.433	5.410	0.761	0.690
	r ≤ 1	0.022	0.023	0.880	0.879
LICONS [3]	r=0	4.378	3.915	0.870	0.868
	r ≤ 1	0.463	0.464	0.495	0.495
LIMANU [2]	r=0	16.803*	10.476	0.031*	0.182
	r ≤ 1	6.326*	6.326*	0.012*	0.012*
LIMIN [1]	r=0	5.927	5.872	0.704	0.629
	r ≤ 1	0.055	0.055	0.814	0.814
LIOTHER [1]	r=0	6.761	6.150	0.605	0.594
	r ≤ 1	0.612	0.612	0.434	0.434
LITRANS [1]	r=0	4.912	4.533	0.818	0.799
	r ≤ 1	0.380	0.379	0.538	0.538
LIWHOLE [1]	r=0	9.857	6.834	0.292	0.508
	r ≤ 1	3.023	3.023	0.082	0.082
LIY [1]	r=0	7.850	6.973	0.481	0.492
	r ≤ 1	0.877	0.877	0.349	0.349

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY, LINOP, LIROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Indonesia, nominal & real oil price in term of Rupiah and in term of Dollar as well.

[] represent the suggested lag lengths by the majority criterion (LR, FPE, AIC, SIC & HQIC)

LR - sequential modified LR test statistic FPE - Final prediction error

AIC - Akaike information criterion SIC – Schwarz information criterion

HQIC – Hannan-Quinn information criterion

(*) indicate the null hypothesis is rejected in the significance level, 5%. **MacKinnon-Haug-Michelis (1999) p-values.

Table 11: Johansen Co-integration Test (Malaysia)					
Dependent Variables	Hypothesized No. of CE(s)	Trace Statistic	Max Eigen Statistic	Prob.**	
				Trace	Max Eigen
Panel E: Johansen Cointegration Test using World Nominal Oil Price (LWNOP)					
LMAGRI [1]	r=0	9.527	9.454	0.318	0.250
	r ≤ 1	0.072	0.072	0.787	0.787
LMCONS [2]	r=0	10.311	10.050	0.257	0.208
	r ≤ 1	0.260	0.260	0.609	0.610
LMMANU [1]	r=0	7.384	5.230	0.533	0.712
	r ≤ 1	2.154	2.154	0.142	0.142
LMMIN [1]	r=0	9.488	8.890	0.322	0.295
	r ≤ 1	0.598	0.598	0.439	0.439
LMOTHER [1]	r=0	6.173	5.116	0.675	0.727
	r ≤ 1	1.057	1.057	0.303	0.303
LMTRANS [1]	r=0	5.027	4.951	0.805	0.747
	r ≤ 1	0.075	0.075	0.783	0.783
LMWHOLE [2]	r=0	5.004	4.999	0.808	0.741
	r ≤ 1	0.004	0.004	0.945	0.945
LMY [1]	r=0	5.031	4.941	0.805	0.749
	r ≤ 1	0.090	0.090	0.763	0.763
Panel F: Johansen Cointegration Test using World Real Oil Price (LWROP)					
LMAGRI [1]	r=0	7.400	7.364	0.531	0.446
	r ≤ 1	0.036	0.036	0.850	0.849
LMCONS [2]	r=0	11.578	11.092	0.178	0.149
	r ≤ 1	0.486	0.486	0.485	0.485
LMMANU [1]	r=0	8.609	5.978	0.402	0.616
	r ≤ 1	2.631	2.631	0.104	0.104
LMMIN [1]	r=0	9.297	8.118	0.338	0.366
	r ≤ 1	1.179	1.179	0.277	0.277
LMOTHER [1]	r=0	6.948	5.688	0.583	0.653
	r ≤ 1	1.260	1.260	0.261	0.261
LMTRANS [1]	r=0	5.607	5.550	0.741	0.671
	r ≤ 1	0.056	0.056	0.811	0.811
LMWHOLE [2]	r=0	5.943	5.936	0.702	0.621
	r ≤ 1	0.006	0.006	0.935	0.935
LMY [1]	r=0	5.806	5.603	0.718	0.664
	r ≤ 1	0.203	0.203	0.651	0.651

Table 11: Johansen Co-integration Test (Malaysia) Cont.

Panel G: Johansen Cointegration Test using Nominal Oil Price of Malaysia (LMNOP)					
LMAGRI [1]	r=0	8.608	8.565	0.402	0.324
	r ≤ 1	0.043	0.043	0.834	0.834
LMCONS [2]	r=0	10.165	10.000	0.268	0.211
	r ≤ 1	0.164	0.165	0.684	0.684
LMMANU [1]	r=0	8.056	5.630	0.459	0.660
	r ≤ 1	2.425	2.425	0.119	0.119
LMMIN [1]	r=0	9.335	8.732	0.335	0.309
	r ≤ 1	0.602	0.602	0.437	0.437
LMOTHER [1]	r=0	5.912	5.283	0.705	0.705
	r ≤ 1	0.629	0.630	0.427	0.427
LMTRANS [1]	r=0	4.604	4.450	0.849	0.810
	r ≤ 1	0.155	0.155	0.693	0.693
LMWHOLE [2]	r=0	4.532	4.529	0.856	0.800
	r ≤ 1	0.004	0.004	0.948	0.948
LMY [2]	r=0	6.480	6.440	0.638	0.557
	r ≤ 1	0.040	0.040	0.842	0.842
Panel H: Johansen Cointegration Test using Real Oil Price of Malaysia (LMROP)					
LMAGRI [1]	r=0	6.972	6.930	0.580	0.497
	r ≤ 1	0.042	0.042	0.836	0.836
LMCONS [2]	r=0	10.474	10.197	0.246	0.199
	r ≤ 1	0.277	0.277	0.598	0.598
LMMANU [1]	r=0	7.953	5.451	0.470	0.684
	r ≤ 1	2.502	2.502	0.113	0.113
LMMIN [1]	r=0	7.671	6.889	0.501	0.502
	r ≤ 1	0.782	0.781	0.376	0.376
LMOTHER [1]	r=0	5.745	5.145	0.725	0.723
	r ≤ 1	0.600	0.600	0.438	0.438
LMTRANS [1]	r=0	4.691	4.550	0.840	0.797
	r ≤ 1	0.142	0.142	0.706	0.706
LMWHOLE [2]	r=0	4.684	4.673	0.841	0.782
	r ≤ 1	0.011	0.011	0.915	0.915
LMY [2]	r=0	6.430	6.398	0.644	0.562
	r ≤ 1	0.032	0.032	0.856	0.856

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY, LMNOP, LMROP, LWNOP and LWROP denote as the natural logarithms of agriculture sector outputs, construction sector outputs, manufacturing sector output, mining sector output, others sectors output, transportation sector output, wholesales sector output, total gross domestic products in Malaysia, nominal & real oil price in term of Ringgit and in term of Dollar as well.

[] represent the suggested lag lengths by the majority criterion (LR, FPE, AIC, SIC & HQIC)

LR - sequential modified LR test statistic FPE - Final prediction error
AIC - Akaike information criterion SIC – Schwarz information criterion
HQIC – Hannan-Quinn information criterion

(*) indicate the null hypothesis is rejected in the significance level, 5%. **MacKinnon-Haug-Michelis (1999) p-values

4.5 Toda and Yamamoto (1995) Granger Non-Causality

The approach from T-Y to investigate the casual relationship among the time series variables requires the employment of augmented VAR $(k + d_{max})$ model. From our examination, the optimal lag length is ascertained in accordance to the result that is gathered from the information criterion test (LR, FPE, AIC, SIC and HQIC). Each regressor have different optimal lag length correspond toward the regressand, which shown inhomogeneous of lag order to form the bivariate VAR model. Thus, the order of $(k + d_{max})$ will be vary for each VAR model to estimate the directional effect between variables. Additionally, d_{max} is equal to 1 as all variables need to go through first difference stationary process to achieve stationarity. The directional relationship can be identified by summing up the coefficient of the VAR models.

From **Table 12** to **Table 15,** it represents the usage of T-Y procedure to investigate the bidirectional relationship among oil price and sectoral output in Malaysia and Indonesia. Firstly, it is found that the changes of oil prices will positively affect the outputs in both countries. From the null hypothesis of non-causality, it shows that Malaysia have unidirectional causality running from the nominal and real oil price in term to the aggregated output, whereas the various of oil price measure has neutral effect toward the GDP in Indonesia. From the finding of the linkage between oil price and disaggregated outputs, it is suggested that the nominal and real oil price to the output from manufacturing sector in Malaysia are stated to be rejected. Similarly, the rejection of null hypothesis "nominal and real oil price do not Granger Cause the Indonesia's manufacturing sector output" are identified, implying that the changes of oil price bring significant impact toward the manufactured output, also shown consistency in the theoretical underpinning. The findings also hypothesized that there is a unidirectional casual effect coming from the nominal and real oil price toward the output of transportation sector in Malaysia. Interestingly, Indonesia's construction sector outputs Granger cause the nominal and real oil price in term of Rupiah.

Table 12: T-Y Granger Non-causality Test (Indonesia) $X \rightarrow Y$				
Dependent Variables	**Forcing variables**	**Modified WALD**	**k**	**Prob**
LIAGRI	LWNOP (+)	0.285	1	0.593
	LWROP (+)	0.461	1	0.497
	LINOP (+)	0.008	1	0.927
	LIROP (+)	0.013	1	0.906
LICONS	LWNOP (+)	0.352	1	0.553
	LWROP (+)	0.247	1	0.618
	LINOP (+)	0.932	3	0.817
	LIROP (+)	1.362	3	0.714
LIMANU	LWNOP (+)	0.505	1	0.477
	LWROP (+)	0.530	1	0.467
	LINOP (+)	8.487	2	0.014**
	LIROP (+)	11.112	2	0.004***
LIMIN	LWNOP (+)	0.073	1	0.786
	LWROP (+)	0.052	1	0.818
	LINOP (+)	1.136	1	0.286
	LIROP (+)	1.943	1	0.163
LIOTHER	LWNOP (+)	0.282	1	0.594
	LWROP (+)	0.263	1	0.608
	LINOP (+)	1.090	1	0.296
	LIROP (+)	0.290	1	0.590
LITRANS	LWNOP (+)	1.033	1	0.309
	LWROP (+)	1.011	1	0.314
	LINOP (+)	1.313	1	0.251
	LIROP (+)	2.121	1	0.145
LIWHOLE	LWNOP (+)	2.562	1	0.109
	LWROP (+)	2.580	1	0.108
	LINOP (+)	0.130	1	0.718
	LIROP (+)	0.240	1	0.623
LIY	LWNOP (+)	0.136	1	0.711
	LWROP (+)	0.142	1	0.706
	LINOP (+)	0.535	1	0.464
	LIROP (+)	0.285	1	0.593

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY denote as the natural logarithms of output in agriculture sector, construction sector, manufacturing sector, mining sector, others sectors, transportation sector, wholesales sector, total gross domestic products in Indonesia respectively.
LINOP, LIROP, LWNOP and LWROP denotes the nominal & real oil price in term of Rupiah and the nominal & real oil price in term of Dollar.
(*), (**), (***) indicate the null hypothesis is rejected in the significance level of 10%, 5% and 1% respectively.
(+) represent the positive directional relationship and (-) represent the negative directional relationship

Table 13: T-Y Granger Non-causality Test (Indonesia) $Y \rightarrow X$				
Dependent Variables	**Forcing variables**	**Modified WALD**	**k**	**Prob**
LWNOP	LIAGRI (-)	0.592	1	0.441
	LICONS (+)	0.005	1	0.944
	LIMANU (+)	0.054	1	0.815
	LIMIN (+)	0.648	1	0.420
	LIOTHER (+)	0.020	1	0.886
	LITRANS (+)	0.172	1	0.678
	LIWHOLE (+)	0.080	1	0.777
	LIY (-)	0.155	1	0.693
LWROP	LIAGRI (+)	0.584	1	0.444
	LICONS (+)	0.002	1	0.958
	LIMANU (+)	0.056	1	0.812
	LIMIN (+)	0.452	1	0.501
	LIOTHER (+)	0.009	1	0.922
	LITRANS (+)	0.127	1	0.720
	LIWHOLE (+)	0.088	1	0.765
	LIY (+)	0.142	1	0.706
LINOP	LIAGRI (+)	0.346	1	0.556
	LICONS (+)	10.092	3	0.018**
	LIMANU (+)	5.022	2	0.101
	LIMIN (+)	2.988	1	0.183
	LIOTHER (+)	1.090	1	0.296
	LITRANS (+)	1.095	1	0.295
	LIWHOLE (+)	0.003	1	0.952
	LIY (+)	0.281	1	0.596
LIROP	LIAGRI (+)	9.70E	1	0.992
	LICONS (+)	13.212	3	0.004***
	LIMANU (+)	4.136	2	0.126
	LIMIN (+)	1.320	1	0.250
	LIOTHER (+)	0.105	1	0.745
	LITRANS (+)	1.126	1	0.288
	LIWHOLE (+)	0.260	1	0.609
	LIY (+)	0.003	1	0.953

Notes: LIARGI, LICONS, LIMANU, LIMIN, LIOTHER, LITRANS, LIWHOLE, LIY denote as the natural logarithms of output in agriculture sector, construction sector, manufacturing sector, mining sector, others sectors, transportation sector, wholesales sector, total gross domestic products in Indonesia respectively.

LINOP, LIROP, LWNOP and LWROP denotes the nominal & real oil price in term of Rupiah and the nominal & real oil price in term of Dollar.

(*), (**), (***) indicate the null hypothesis is rejected in the significance level of 10%, 5% and 1% respectively.

(+) represent the positive directional relationship and (-) represent the negative directional relationship

Table 14: T-Y Granger Non-causality Test (Malaysia) $X \rightarrow Y$				
Dependent Variables (Y)	**Forcing variables (X)**	**Modified WALD**	**k**	**Prob**
LMAGRI	LWNOP (+)	0.078	1	0.780
	LWROP (+)	0.300	1	0.583
	LMNOP (+)	1.253	1	0.262
	LMROP (+)	1.474	1	0.224
LMCONS	LWNOP (+)	0.762	2	0.683
	LWROP (+)	0.724	2	0.696
	LMNOP (+)	0.970	2	0.615
	LMROP (+)	1.044	2	0.593
LMMANU	LWNOP (+)	3.200	1	0.073*
	LWROP (+)	3.073	1	0.080*
	LMNOP (+)	4.572	1	0.032**
	LMROP (+)	4.275	1	0.038**
LMMIN	LWNOP (+)	0.052	1	0.820
	LWROP (+)	8.21E	1	0.993
	LMNOP (+)	0.131	1	0.717
	LMROP (+)	0.014	1	0.904
LMOTHER	LWNOP (+)	0.163	1	0.686
	LWROP (+)	0.213	1	0.644
	LMNOP (+)	1.474	1	0.224
	LMROP (+)	1.737	1	0.187
LMTRANS	LWNOP (+)	1.590	1	0.207
	LWROP (+)	1.601	1	0.205
	LMNOP (+)	3.540	1	0.060*
	LMROP (+)	3.631	1	0.057*
LMWHOLE	LWNOP (+)	1.288	2	0.525
	LWROP (+)	1.368	2	0.504
	LMNOP (+)	2.391	2	0.302
	LMROP (+)	2.060	2	0.357
LMY	LWNOP (+)	1.655	1	0.198
	LWROP (+)	1.610	1	0.204
	LMNOP (+)	5.360	2	0.068*
	LMROP (+)	5.040	2	0.080*

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY denote as the natural logarithms of output in agriculture sector, construction sector, manufacturing sector, mining sector, others sectors, transportation sector, wholesales sector, total gross domestic products in Malaysia respectively.
LMNOP, LMROP, LWNOP and LWROP denotes the nominal & real oil price in term of Ringgit and the nominal & real oil price in term of Dollar.
(*), (**), (***) indicate the null hypothesis is rejected in the significance level of 10%, 5% and 1% respectively.
(+) represent the positive directional relationship and (-) represent the negative directional relationship

Table 15: T-Y Granger Non-causality Test (Malaysia) $Y \rightarrow X$				
Dependent Variables (Y)	**Forcing variables (X)**	**Modified WALD**	**k**	**Prob**
LWNOP	LMAGRI (-)	0.772	1	0.379
	LMCONS (+)	0.300	2	0.860
	LMMANU (+)	0.046	1	0.829
	LMMIN (-)	0.053	1	0.817
	LMOTHER (+)	0.505	1	0.477
	LMTRANS (+)	0.032	1	0.857
	LMWHOLE (+)	0.091	2	0.955
	LMY (-)	0.127	1	0.720
LWROP	LMAGRI (+)	0.555	1	0.455
	LMCONS (+)	0.395	2	0.820
	LMMANU (+)	0.005	1	0.942
	LMMIN (+)	0.126	1	0.722
	LMOTHER (+)	0.668	1	0.413
	LMTRANS (+)	0.006	1	0.935
	LMWHOLE (+)	0.052	2	0.974
	LMY (+)	0.233	1	0.629
LMNOP	LMAGRI (+)	0.511	1	0.474
	LMCONS (+)	0.522	2	0.770
	LMMANU (+)	0.451	1	0.501
	LMMIN (-)	0.933	1	0.334
	LMOTHER (+)	0.320	1	0.572
	LMTRANS (+)	0.002	1	0.968
	LMWHOLE (+)	0.240	2	0.887
	LMY (-)	1.040	2	0.595
LMROP	LMAGRI (+)	0.450	1	0.502
	LMCONS (+)	0.990	2	0.609
	LMMANU (+)	0.180	1	0.670
	LMMIN (+)	0.238	1	0.625
	LMOTHER (+)	0.545	1	0.460
	LMTRANS (+)	0.016	1	0.890
	LMWHOLE (+)	0.255	2	0.880
	LMY (+)	1.321	2	0.516

Notes: LMARGI, LMCONS, LMMANU, LMMIN, LMOTHER, LMTRANS, LMWHOLE, LMY denote as the natural logarithms of output in agriculture sector, construction sector, manufacturing sector, mining sector, others sectors, transportation sector, wholesales sector, total gross domestic products in Malaysia respectively.
LMNOP, LMROP, LWNOP and LWROP denotes the nominal & real oil price in term of Ringgit and the nominal & real oil price in term of Dollar.
(*), (**), (***) indicate the null hypothesis is rejected in the significance level of 10%, 5% and 1% respectively.
(+) represent the positive directional relationship and (-) represent the negative directional relationship.

4.6 Conclusion

By using the selected methodologies, the outcome of the results have greatly assist us toward the investigation on how the various oil price affect the sectoral output in Malaysia and Indonesia. In short, we have accomplished the data testing and analysis in this chapter to ensure that our model is robust and provide us accurate and sufficient results, which we can proceed to the last chapter, where we discuss in details on the policy implementation, the research limitation that we have faced and the any recommendation for future study.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

In this final chapter, the empirical results from our study will be reported and summarized for better insight on the relationship between oil price and outputs in Indonesia and Malaysia. In addition, major discussion and policy implication are provided. Before our study draws to an end, limitations on our study are stated and recommendations are suggested for future research.

5.1 Summary of the Statistical Analysis

To achieve the objective of our study, the causality test are carried out. By comparing the effect of oil price changes to the biggest net oil exporting country in ASEAN, it reports to us that Malaysia's GDP is significantly and positively affected to the oil price changes. Similar to the past studies by Pierce and Enzler (1974), Rodriguez and Sanchez (2005) as well as Ito (2010) as oil price increase will be beneficial for the domestic oil producer to export with greater price, thus earning greater profit for current expenditure and even for future consumption. On the contrary, Indonesia, which is similarly one of the largest net oil exporting country in ASEAN, the result shows the GDP has neutral effects toward all proxies of the oil prices. Mehrara and Sarem (2009) has similar findings where they have stated that the country's output has been less prone to the changes of oil prices. The insignificant impact of oil shock-induced instability in Indonesia is due to the efficiency in deployment of natural resource rents in order to drive growth as well as foster diversification in its economy (Eifert et al., 2002).

After the investigation on the impact toward the aggregate output on both countries, we further consider effect of the oil prices changes to the output of each various economic sector. Firstly, the results show that there is positive causal relationship exist in the nominal and real oil price in toward the output from transportation sector. It is different from the results from Shaari, Pei and Rahim (2013) where it shown the non-existence of the impact of oil price toward the Malaysia transportation sector. However, there is no causality running from oil price toward the output in Indonesia's transportation sectors. Malaysia is consider one of the biggest manufacturer of motor vehicles in the world, every year it accompany sales about half of million, also putting in the ranking of third in largest car manufacturer in ASEAN (Lai, 2016). Specifically, when oil prices increases, supply of oil increase and oil exports will boost more production in logistics services and transportation for more oil and other commodities export. Throughout the years, the usage of solar energy, fuel cell and biofuels as alternative fuels has increased to minimize the non-renewable energy such as oil for transportation purposes. However, the reliance of oil in Malaysia has not diminished due to the challenge of the transportation energy supply system to be revamped as well as advanced technologies are required for those renewable energy resources (Hoed R, 2007; Lim & Lee, 2012). Besides, the increasing trend in purchasing hybrid vehicles in Malaysia is also related to the significant effect in oil price fluctuation toward the transportation sector's output. This is due to the tendency of customers try to avoid bearing the risk of unpredictable oil prices changes (mainly higher oil prices) in the future when driving conventional vehicles, which generate more profit in the transportation sector with sales racking up to 8334 units of hybrid vehicles during the year 2011 (Razak et al., 2014).

Furthermore, we can conclude that the nominal and real oil price significantly and positively affect the manufacturing sector output in both Malaysia and Indonesia in term of their own currencies. Theoretically speaking, net oil exporting are vulnerable to the falling of oil price and have more advantages in increase of oil price. The previous studies of Ee, Gugkang and Husin (2015) also Shaari, Pei and Rahim (2013) display a consistency on the theoretical aspect of the production from the manufacturing sector will be significantly affected by the oil price. In Malaysia, which take account of roughly 23% of petroleum refinery products in export, whereas in Indonesia, which largely support for approximately 26% of the GDP in the processing of the production in refined petroleum (Lai, 2016; Wacaster, 2014). Since both of the countries have large contribution (refer **Figure 2**, approximately 20% in their production in overall economic sectors) to the GDP, with more productivity happened, expansion in skill enhancement opportunities as well as raise in job employment and higher disposable income for more spending activities to circulate economic growth.

Additionally, for the economic sectors such as agriculture, construction, mining, wholesales and others show insignificant impact from the oil price changes. One of the particular factor behind is the recent increasing substitution of the fossil fuels to biofuels in both country as the necessity to look for a renewable and alternative fuel resources to generate the outputs of sector (Hassan & Kalam, 2013). Another reason the dependency in oil is not as crucial as in manufacturing sector in both countries or transportation sector in Malaysia as the oil is not directly related in these sectors' production.

Lastly, a unidirectional causality is identified where the construction sector outputs in Indonesia have positive relationship with the nominal and real oil price in term of Rupiah. This is due to the changes of aggregate demand in Indonesia's construction sector. Favoino & Zachmann (2016) found out that the increased aggregate demand caused the oil prices to rise and at the end higher GDP incurred and vice versa. In Indonesia, the rapid urbanization and huge government spending in infrastructure is happening, therefore the construction sector in Indonesia tend to grow rapidly to achieve the market demand. The increased production output have push the demand of oil price as oil is needed in the process of construction. Thus, the increased oil demand have raised the oil price.

5.2 Discussion on Major Findings

This study is conducted with the purpose of solving a two questions. Firstly, we aim to identify the impacts of changes in oil price towards the aggregated output in

Indonesia and Malaysia. Secondly, we strive to know which economic sector output is significantly affected by the oil price changes.

Based on the literature review, we expected that the changes in oil price will have positive impact toward the sectoral output. By referring to the **Table 4** and **5**, it turns out that the suspected theories are proportional to the results in Malaysia produced in our study, which means the increase in oil price will drive the output of Malaysia to expand. However, that not for the case of Indonesia, as the oil price has insignificant impact toward the Indonesia GDP, which induce us to proceed in searching for the oil price implication toward the output of different economic sectors.

So, the empirical results concluded that the nominal and real oil price significantly and positively affect the manufacturing sector for both Indonesia and Malaysia. Based on the literature review, we have noticed that there are quite a numbers of countries also have similar effect on the oil price. In this study, the outcome tell us that manufacturing sector which is the largest sector for Malaysia can be easily be affected by the changes of oil. Aside that, in the case of construction sector there is a unidirectional effect is identified where construction sector outputs in Indonesia significantly affects the nominal and real oil price. The construction sector expand rapidly to fulfill the market demand. This causes the demand of oil price increase and results in raising the oil price.

After going through the literature review, we expected that the fluctuation of oil price does not cause any harmful or negative effects to the sectoral outputs. This expectation is consistent with the study as the **Table 12** to **15** in this paper shows that the oil price does not negatively affect the sectoral outputs in both countries. The correlation table shows not a single negative sign in the table. The outcome of the results proves that oil price positively affect the sectoral outputs. The results also signifies that all oil price changes lead to positive impact towards the sectoral outputs in Indonesia and Malaysia.

5.3 Policy Implications

It is undeniable that crude oil plays an important role to run the economy. Many economy sectors are highly dependent on crude oil to produce outputs. Therefore, the oil price fluctuation will give great impact to the economic growth. In order to minimize dependency on crude oil and the impact of oil price, the government authorities should implement some policies to deal with the oil price issue.

As the increase in oil price will encourage sectoral output in Malaysia, it is important for government to increase the budget in various sector so that it will efficiently increase the outputs. For example, the increase in budget enables the manufacturing sectors to undergo modernization in the aspect of machines which helps to boost the productivity. The more advanced the technology, the less time it consume as well as the more outputs it could produce. In other word, innovative technology require less workforce. The operating cost will reduce as the workforce reduce and that money can be allocated in other aspect to improve the overall performance. For example, it can be used to improve the workers welfare by conducting some recreation activities such as company trip. In this way, workers will feel rewarded and will put in more effort in increasing the outputs.

Besides, the sectors are able to employ more trained specialist worker with the increase in budget allocated. Workers with related qualification will helps to improve the workforce quality and facilitate the flow of operation smoothly. For instance, employing an expert in managing the operation is more cost efficient compare to employ a worker without qualification. Specialists are manage to improve the outputs with their experience and professional knowledge. To sum it up, increasing budget will increase the effectiveness in generating outputs in the aspects of improving the technology and employing productive human resources.

Another policy recommended is the use of oil substitutes. The common oil substitutes being introduced in Malaysia is biodiesel. Biodiesel is a renewable diesel derived from vegetable oils or animal fats. Combustion of biodiesel helps to improve air quality by reducing air pollutants. Besides, biodiesel helps to relieve global warming issue by reducing carbon dioxide emission. Other than biodiesel, hydrogen gas is an alternative to replace petroleum. Since hydrogen is abundant in the environment, where it is store in variable form such as water. Thus, it is easily accessible to be utilized as the oil substitutes. The use of hydrogen will helps to conserve the environment as it will not produce any air pollutants but only produce water and warm air as emissions. In short, it is crucial for Malaysia government to take aggressive approaches in preventing the high dependency of sectorial output on oil price so that economic growth will be enhanced.

5.4 Limitations

There are some ways that can be implemented to further enhance the quality of this study. However, there are some limitations that bounded to us, preventing this study to have a better results. The following are the limitations.

5.4.1 Low Frequency Data

First and foremost, the data used in this study are 30 years long and involves 2 countries which are Malaysia and Indonesia. Due to the massive duration of data is being used in this study, the data are picked based on annually time series data. This signifies that the data used in this study is low frequency data. A data is categorized as low frequency data when the data taken consist of semi-annual and annually data. When low frequency data is being used in a study, the results obtained towards the end of the study might not be accurate. This is due to the low frequency data are the sum of all the monthly, weekly or even monthly data into annual data. The true impact might not be detected when low frequency data is being used in a study. Since the data used in this study is 30 years duration, it would be complicated if this study uses a high frequency data as this will results in encountering massive amount of data. This could bring difficulties to us especially when it comes to running test for empirical analysis.

5.4.2 Nonappearance of Short Run Effects and Speed of Adjustment

Next, most of the study usually have their results consist of long run and short run effect through VECM test. However in this study, the results obtained shows that there is long run effect but not for short run effect. The co-integration test and T-Y causality used to test the existence of long run relationship between variables because variables in level form. This study is also unable to determine how long the duration of the effect is in the short run and its adjustment to the long run equilibrium.

5.4.3 Non-Linear Model

A study that uses linear and non-linear model can be said able to generate a better results. Most of the literature stated that there are possibility of asymmetric impact of oil price shocks towards the macroeconomic variables. Furthermore, many said that the relationship between changes in oil price and macroeconomic is non-linear. There are few non-linear transformation of oil price can be used to find out the asymmetric impact and differentiate the difference between the positive and negative changes of real oil price. In our study, we does not include non-linear model. This signifies that the results generated in this study is not the best results.

5.5 Recommendation for Future Research

5.5.1 High Frequency Data

For a better research result in future, there are some recommendations for future researcher. The first one is the future researcher are advised to use the high frequency data for any economic related research to have a more accurate result for the effect of shock. High frequency data is the data with its frequency of monthly, weekly, daily, hourly, minutely, or second. As the frequency of data is very high and detail, so it enables the researchers to easily identify the impact of timed shocks for examples stock price shock and oil price shock. The shock identified is more accurate and precise compared to the lower frequency data result. This is because the high frequency data involves many data and those data are helping the researcher to have a clear picture of timed shock effect. For instance, when a monthly data is use for a forecasting process, the result obtained is more informative and the prediction done by using the result is more accurate compared to the annually data result. Therefore, to have a more accurate and precise result in future, the researcher should use the high frequency data.

5.5.2 Ensure study consist of long run and short run effects

Second recommendation is the future researchers are advised to make sure their results are consist of both the short run and long run effects. The existence of the both short run and long run effects allow the researchers to have a clear image on the duration of the shock effect lasting. When the actual duration of the shock have been identified, it allows us to have a targeted solution for the problem. For example, if we can identify the time of oil price shock, we are able to gain benefit on the shock and avoid loss on it. when the duration are able to identify, the policy implemented will be more effective and capable to meet the ideal economic situation.

5.5.3 Applications of Non-Linear Models

The third recommendation is the future researchers are advised to include both linear and non-linear model in their incoming research. By included both types of model, it provides the researchers a wider and clearer picture on the impact of oil price shock. This is because the non-linear model can be used to find out the asymmetric impact of shock which the linear model are unable to show. Furthermore, the non-linear mode can differentiate the difference between the positive and negative changes of real oil price. By using both linear and non-linear model in the research, the results obtained will be more informative and accurate. For instance, when two models are using in the research, the researcher can have more information by explaining and comparing both model results. Therefore, the future researcher are suggested to involve linear and non-linear model in their study.

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APPENDICES

Appendix 4.1: Granger Non-Causality Test between Nominal Oil Price in USD and Sectoral Outputs in Indonesia

Date: 04/11/17 Time: 18:12
Sample: 1979 2015
Included observations: 32

Dependent variable: LIAGRI

Excluded	Chi-sq	df	Prob.
LWNOP	0.285130	1	0.5934
All	0.285130	1	0.5934

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIAGRI	0.592547	1	0.4414
All	0.592547	1	0.4414

Date: 04/11/17 Time: 18:14
Sample: 1979 2015
Included observations: 32

Dependent variable: LICONS

Excluded	Chi-sq	df	Prob.
LWNOP	0.352261	1	0.5528
All	0.352261	1	0.5528

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LICONS	0.004911	1	0.9441
All	0.004911	1	0.9441

Date: 04/11/17 Time: 18:15
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMANU

Excluded	Chi-sq	df	Prob.
LWNOP	0.505661	1	0.4770
All	0.505661	1	0.4770

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIMANU	0.054572	1	0.8153
All	0.054572	1	0.8153

Date: 04/11/17 Time: 18:16
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMIN

Excluded	Chi-sq	df	Prob.
LWNOP	0.073619	1	0.7861
All	0.073619	1	0.7861

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIMIN	0.648417	1	0.4207
All	0.648417	1	0.4207

Date: 04/11/17 Time: 18:17
Sample: 1979 2015
Included observations: 32

Dependent variable: LIOTHER

Excluded	Chi-sq	df	Prob.
LWNOP	0.282727	1	0.5949
All	0.282727	1	0.5949

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIOTHER	0.020547	1	0.8860
All	0.020547	1	0.8860

Date: 04/11/17 Time: 18:18
Sample: 1979 2015
Included observations: 32

Dependent variable: LITRANS

Excluded	Chi-sq	df	Prob.
LWNOP	1.033798	1	0.3093
All	1.033798	1	0.3093

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LITRANS	0.172333	1	0.6780
All	0.172333	1	0.6780

Date: 04/11/17 Time: 18:19
Sample: 1979 2015
Included observations: 32

Dependent variable: LIWHOLE

Excluded	Chi-sq	df	Prob.
LWNOP	2.562290	1	0.1094
All	2.562290	1	0.1094

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIWHOLE	0.080128	1	0.7771
All	0.080128	1	0.7771

Date: 04/11/17 Time: 18:21
Sample: 1979 2015
Included observations: 32

Dependent variable: LIY

Excluded	Chi-sq	df	Prob.
LWNOP	0.136967	1	0.7113
All	0.136967	1	0.7113

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LIY	0.155215	1	0.6936
All	0.155215	1	0.6936

Appendix 4.2: Granger Non-Causality Test between Real Oil Price in USD and Sectoral Outputs in Indonesia

Date: 04/11/17 Time: 18:23
Sample: 1979 2015
Included observations: 32

Dependent variable: LIAGRI

Excluded	Chi-sq	df	Prob.
LWROP	0.461306	1	0.4970
All	0.461306	1	0.4970

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIAGRI	0.584557	1	0.4445
All	0.584557	1	0.4445

Date: 04/11/17 Time: 20:42
Sample: 1979 2015
Included observations: 32

Dependent variable: LICONS

Excluded	Chi-sq	df	Prob.
LWROP	0.247790	1	0.6186
All	0.247790	1	0.6186

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LICONS	0.002755	1	0.9581
All	0.002755	1	0.9581

Date: 04/11/17 Time: 20:43
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMANU

Excluded	Chi-sq	df	Prob.
LWROP	0.529331	1	0.4669
All	0.529331	1	0.4669

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIMANU	0.056475	1	0.8122
All	0.056475	1	0.8122

Date: 04/11/17 Time: 20:44
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMIN

Excluded	Chi-sq	df	Prob.
LWROP	0.052502	1	0.8188
All	0.052502	1	0.8188

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIMIN	0.451889	1	0.5014
All	0.451889	1	0.5014

Date: 04/11/17 Time: 20:45
Sample: 1979 2015

Included observations: 32

Dependent variable: LIOTHER

Excluded	Chi-sq	df	Prob.
LWROP	0.263023	1	0.6081
All	0.263023	1	0.6081

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIOTHER	0.009426	1	0.9227
All	0.009426	1	0.9227

Date: 04/11/17 Time: 20:46
Sample: 1979 2015
Included observations: 32

Dependent variable: LITRANS

Excluded	Chi-sq	df	Prob.
LWROP	1.011787	1	0.3145
All	1.011787	1	0.3145

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LITRANS	0.127635	1	0.7209
All	0.127635	1	0.7209

Date: 04/11/17 Time: 20:47
Sample: 1979 2015
Included observations: 32

Dependent variable: LIWHOLE

Excluded	Chi-sq	df	Prob.
LWROP	2.578192	1	0.1083
All	2.578192	1	0.1083

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIWHOLE	0.088715	1	0.7658
All	0.088715	1	0.7658

Date: 04/11/17 Time: 20:50
Sample: 1979 2015
Included observations: 32

Dependent variable: LIY

Excluded	Chi-sq	df	Prob.
LWROP	0.142336	1	0.7060
All	0.142336	1	0.7060

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LIY	0.142193	1	0.7061
All	0.142193	1	0.7061

Appendix 4.3: Granger Non-Causality Test between Real Oil Price in Nation Currency Units and Sectoral Outputs in Indonesia

Date: 04/11/17 Time: 20:51
Sample: 1979 2015
Included observations: 32

Dependent variable: LIAGRI

Excluded	Chi-sq	df	Prob.
LIROP	0.013881	1	0.9062
All	0.013881	1	0.9062

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIAGRI	9.70E-05	1	0.9921
All	9.70E-05	1	0.9921

Date: 04/11/17 Time: 20:52
Sample: 1979 2015
Included observations: 30

Dependent variable: LICONS

Excluded	Chi-sq	df	Prob.
LIROP	1.362773	3	0.7143
All	1.362773	3	0.7143

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LICONS	13.21235	3	0.0042
All	13.21235	3	0.0042

Date: 04/11/17 Time: 20:53
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMANU

Excluded	Chi-sq	df	Prob.
LIROP	11.11296	2	0.0039
All	11.11296	2	0.0039

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIMANU	4.136027	2	0.1264
All	4.136027	2	0.1264

Date: 04/11/17 Time: 20:54
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMIN

Excluded	Chi-sq	df	Prob.
LIROP	1.943592	1	0.1633
All	1.943592	1	0.1633

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIMIN	1.320550	1	0.2505
All	1.320550	1	0.2505

Date: 04/11/17 Time: 20:55
Sample: 1979 2015
Included observations: 32

Dependent variable: LIOTHER

Excluded	Chi-sq	df	Prob.
LIROP	0.289713	1	0.5904
All	0.289713	1	0.5904

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIOTHER	0.105725	1	0.7451
All	0.105725	1	0.7451

Date: 04/11/17 Time: 20:56
Sample: 1979 2015
Included observations: 32

Dependent variable: LITRANS

Excluded	Chi-sq	df	Prob.
LIROP	2.121888	1	0.1452
All	2.121888	1	0.1452

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LITRANS	1.126767	1	0.2885
All	1.126767	1	0.2885

Date: 04/11/17 Time: 20:57
Sample: 1979 2015
Included observations: 32

Dependent variable: LIWHOLE

Excluded	Chi-sq	df	Prob.
LIROP	0.240554	1	0.6238
All	0.240554	1	0.6238

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIWHOLE	0.260604	1	0.6097
All	0.260604	1	0.6097

Date: 04/11/17 Time: 20:58
Sample: 1979 2015
Included observations: 32

Dependent variable: LIY

Excluded	Chi-sq	df	Prob.
LIROP	0.285354	1	0.5932
All	0.285354	1	0.5932

Dependent variable: LIROP

Excluded	Chi-sq	df	Prob.
LIY	0.003457	1	0.9531
All	0.003457	1	0.9531

Appendix 4.4: Granger Non-Causality Test between Nominal Oil Price in Nation Currency Units and Sectoral Outputs in Indonesia

Date: 04/11/17 Time: 20:59
Sample: 1979 2015
Included observations: 32

Dependent variable: LIAGRI

Excluded	Chi-sq	df	Prob.
LINOP	0.008249	1	0.9276
All	0.008249	1	0.9276

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIAGRI	0.346679	1	0.5560
All	0.346679	1	0.5560

Date: 04/11/17 Time: 21:00
Sample: 1979 2015
Included observations: 31

Dependent variable: LICONS

Excluded	Chi-sq	df	Prob.
LINOP	0.932561	3	0.8176
All	0.932561	3	0.8176

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LICONS	10.09225	3	0.0178
All	10.09225	3	0.0178

Date: 04/11/17 Time: 21:01
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMANU

Excluded	Chi-sq	df	Prob.
LINOP	8.487328	2	0.0144
All	8.487328	2	0.0144

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIMANU	5.021850	2	0.1012
All	5.021850	2	0.1012

Date: 04/11/17 Time: 21:02
Sample: 1979 2015
Included observations: 32

Dependent variable: LIMIN

Excluded	Chi-sq	df	Prob.
LINOP	1.136531	1	0.2864
All	1.136531	1	0.2864

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIMIN	2.988337	1	0.1839
All	2.988337	1	0.1839

Date: 04/11/17 Time: 21:03
Sample: 1979 2015
Included observations: 32

Dependent variable: LIOTHER

Excluded	Chi-sq	df	Prob.
LINOP	1.069313	1	0.3011
All	1.069313	1	0.3011

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIOTHER	1.090227	1	0.2964
All	1.090227	1	0.2964

Date: 04/11/17 Time: 21:04
Sample: 1979 2015
Included observations: 32

Dependent variable: LITRANS

Excluded	Chi-sq	df	Prob.
LINOP	1.313542	1	0.2518
All	1.313542	1	0.2518

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LITRANS	1.095712	1	0.2952
All	1.095712	1	0.2952

Date: 04/11/17 Time: 21:05
Sample: 1979 2015
Included observations: 32

Dependent variable: LIWHOLE

Excluded	Chi-sq	df	Prob.
LINOP	0.129712	1	0.7187
All	0.129712	1	0.7187

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIWHOLE	0.003579	1	0.9523
All	0.003579	1	0.9523

Date: 04/11/17 Time: 21:06
Sample: 1979 2015
Included observations: 32

Dependent variable: LIY

Excluded	Chi-sq	df	Prob.
LINOP	0.535544	1	0.4643
All	0.535544	1	0.4643

Dependent variable: LINOP

Excluded	Chi-sq	df	Prob.
LIY	0.280982	1	0.5961
All	0.280982	1	0.5961

Appendix 4.5: Granger Non-Causality Test between Nominal Oil Price in USD and Sectoral Outputs in Malaysia

Date: 04/12/17 Time: 21:31
Sample: 1982 2015
Included observations: 32

Dependent variable: LMAGRI

Excluded	Chi-sq	df	Prob.
LWNOP	0.078045	1	0.7800
All	0.078045	1	0.7800

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMAGRI	0.772501	1	0.3794
All	0.772501	1	0.3794

Date: 04/12/17 Time: 21:32
Sample: 1982 2015
Included observations: 31

Dependent variable: LMCONS

Excluded	Chi-sq	df	Prob.
LWNOP	0.762592	2	0.6830
All	0.762592	2	0.6830

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMCONS	0.300394	2	0.8605
All	0.300394	2	0.8605

Date: 04/12/17 Time: 21:36
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMANU

Excluded	Chi-sq	df	Prob.
LWNOP	3.199866	1	0.0736
All	3.199866	1	0.0736

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMMANU	0.046556	1	0.8292
All	0.046556	1	0.8292

Date: 04/12/17 Time: 21:37
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMIN

Excluded	Chi-sq	df	Prob.
LWNOP	0.052363	1	0.8190
All	0.052363	1	0.8190

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMMIN	0.053531	1	0.8170
All	0.053531	1	0.8170

Date: 04/12/17 Time: 21:47
Sample: 1982 2015
Included observations: 32

Dependent variable: LMOTHER

Excluded	Chi-sq	df	Prob.
LWNOP	0.163495	1	0.6860
All	0.163495	1	0.6860

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMOTHER	0.505603	1	0.4770
All	0.505603	1	0.4770

Date: 04/12/17 Time: 21:51
Sample: 1982 2015
Included observations: 32

Dependent variable: LMTRANS

Excluded	Chi-sq	df	Prob.
LWNOP	1.590393	1	0.2073
All	1.590393	1	0.2073

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMTRANS	0.032251	1	0.8575
All	0.032251	1	0.8575

Date: 04/12/17 Time: 21:53
Sample: 1982 2015
Included observations: 31

Dependent variable: LMWHOLE

Excluded	Chi-sq	df	Prob.
LWNOP	1.288387	2	0.5251
All	1.288387	2	0.5251

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMWHOLE	0.091404	2	0.9553
All	0.091404	2	0.9553

Date: 04/12/17 Time: 21:56
Sample: 1982 2015
Included observations: 32

Dependent variable: LMY

Excluded	Chi-sq	df	Prob.
LWNOP	1.655659	1	0.1982
All	1.655659	1	0.1982

Dependent variable: LWNOP

Excluded	Chi-sq	df	Prob.
LMY	0.127642	1	0.7209
All	0.127642	1	0.7209

Appendix 4.6: Granger Non-Causality Test between Real Oil Price in USD and Sectoral Outputs in Malaysia

Date: 04/12/17 Time: 21:58
Sample: 1982 2015
Included observations: 32

Dependent variable: LMAGRI

Excluded	Chi-sq	df	Prob.
LWROP	0.300337	1	0.5837
All	0.300337	1	0.5837

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMAGRI	0.555896	1	0.4559
All	0.555896	1	0.4559

Date: 04/12/17 Time: 22:00
Sample: 1982 2015
Included observations: 31

Dependent variable: LMCONS

Excluded	Chi-sq	df	Prob.
LWROP	0.724011	2	0.6963
All	0.724011	2	0.6963

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMCONS	0.395042	2	0.8208
All	0.395042	2	0.8208

Date: 04/12/17 Time: 22:01
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMANU

Excluded	Chi-sq	df	Prob.
LWROP	3.073330	1	0.0796
All	3.073330	1	0.0796

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMMANU	0.005220	1	0.9424
All	0.005220	1	0.9424

Date: 04/12/17 Time: 22:02
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMIN

Excluded	Chi-sq	df	Prob.
LWROP	8.21E-05	1	0.9928
All	8.21E-05	1	0.9928

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMMIN	0.126261	1	0.7223
All	0.126261	1	0.7223

Date: 04/12/17 Time: 22:07
Sample: 1982 2015
Included observations: 32

Dependent variable: LMOTHER

Excluded	Chi-sq	df	Prob.
LWROP	0.213557	1	0.6440
All	0.213557	1	0.6440

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMOTHER	0.668813	1	0.4135
All	0.668813	1	0.4135

Date: 04/12/17 Time: 22:09
Sample: 1982 2015
Included observations: 32

Dependent variable: LMTRANS

Excluded	Chi-sq	df	Prob.
LWROP	1.601571	1	0.2057
All	1.601571	1	0.2057

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMTRANS	0.006466	1	0.9359
All	0.006466	1	0.9359

Date: 04/12/17 Time: 22:10
Sample: 1982 2015
Included observations: 31

Dependent variable: LMWHOLE

Excluded	Chi-sq	df	Prob.
LWROP	1.368674	2	0.5044
All	1.368674	2	0.5044

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMWHOLE	0.052634	2	0.9740
All	0.052634	2	0.9740

Date: 04/12/17 Time: 22:10
Sample: 1982 2015
Included observations: 32

Dependent variable: LMY

Excluded	Chi-sq	df	Prob.
LWROP	1.609145	1	0.2046
All	1.609145	1	0.2046

Dependent variable: LWROP

Excluded	Chi-sq	df	Prob.
LMY	0.233549	1	0.6289
All	0.233549	1	0.6289

Appendix 4.7: Granger Non-Causality Test between Nominal Oil Price in Nation Currency Units and Sectoral Outputs in Malaysia

Date: 04/12/17 Time: 22:25
Sample: 1982 2015
Included observations: 32

Dependent variable: LMAGRI

Excluded	Chi-sq	df	Prob.
LMNOP	1.253982	1	0.2628
All	1.253982	1	0.2628

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMAGRI	0.511171	1	0.4746
All	0.511171	1	0.4746

Date: 04/12/17 Time: 22:25
Sample: 1982 2015
Included observations: 31

Dependent variable: LMCONS

Excluded	Chi-sq	df	Prob.
LMNOP	0.970556	2	0.6155
All	0.970556	2	0.6155

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMCONS	0.521894	2	0.7703
All	0.521894	2	0.7703

Date: 04/12/17 Time: 22:26
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMANU

Excluded	Chi-sq	df	Prob.
LMNOP	4.572856	1	0.0325
All	4.572856	1	0.0325

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMMANU	0.451447	1	0.5016
All	0.451447	1	0.5016

Date: 04/12/17 Time: 22:29
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMIN

Excluded	Chi-sq	df	Prob.
LMNOP	0.131111	1	0.7173
All	0.131111	1	0.7173

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMMIN	0.933082	1	0.3341
All	0.933082	1	0.3341

Date: 04/12/17 Time: 22:31
Sample: 1982 2015
Included observations: 32

Dependent variable: LMOTHER

Excluded	Chi-sq	df	Prob.
LMNOP	1.474043	1	0.2247
All	1.474043	1	0.2247

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMOTHER	0.319006	1	0.5722
All	0.319006	1	0.5722

Date: 04/12/17 Time: 22:33
Sample: 1982 2015
Included observations: 32

Dependent variable: LMTRANS

Excluded	Chi-sq	df	Prob.
LMNOP	3.540707	1	0.0599
All	3.540707	1	0.0599

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMTRANS	0.001568	1	0.9684
All	0.001568	1	0.9684

Date: 04/12/17 Time: 22:35
Sample: 1982 2015
Included observations: 31

Dependent variable: LMWHOLE

Excluded	Chi-sq	df	Prob.
LMNOP	2.391638	2	0.3025
All	2.391638	2	0.3025

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMWHOLE	0.240504	2	0.8867
All	0.240504	2	0.8867

Date: 04/12/17 Time: 22:35
Sample: 1982 2015
Included observations: 31

Dependent variable: LMY

Excluded	Chi-sq	df	Prob.
LMNOP	5.360514	2	0.0685
All	5.360514	2	0.0685

Dependent variable: LMNOP

Excluded	Chi-sq	df	Prob.
LMY	1.039119	2	0.5948
All	1.039119	2	0.5948

Appendix 4.8: Granger Non-Causality Test between Real Oil Price in Nation Currency Units and Sectoral Outputs in Malaysia

Date: 04/12/17 Time: 22:41
Sample: 1982 2015
Included observations: 32

Dependent variable: LMAGRI

Excluded	Chi-sq	df	Prob.
LMROP	1.129589	1	0.2879
All	1.129589	1	0.2879

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMAGRI	0.450942	1	0.5019
All	0.450942	1	0.5019

Date: 04/12/17 Time: 22:42
Sample: 1982 2015
Included observations: 31

Dependent variable: LMCONS

Excluded	Chi-sq	df	Prob.
LMROP	1.044868	2	0.5931
All	1.044868	2	0.5931

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMCONS	0.989191	2	0.6098
All	0.989191	2	0.6098

Date: 04/12/17 Time: 22:45
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMANU

Excluded	Chi-sq	df	Prob.
LMROP	4.275699	1	0.0387
All	4.275699	1	0.0387

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMMANU	0.180764	1	0.6707
All	0.180764	1	0.6707

Date: 04/12/17 Time: 22:46
Sample: 1982 2015
Included observations: 32

Dependent variable: LMMIN

Excluded	Chi-sq	df	Prob.
LMROP	0.014538	1	0.9040
All	0.014538	1	0.9040

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMMIN	0.238102	1	0.6256
All	0.238102	1	0.6256

Date: 04/12/17 Time: 22:47
Sample: 1982 2015
Included observations: 32

Dependent variable: LMOTHER

Excluded	Chi-sq	df	Prob.
LMROP	1.737495	1	0.1875
All	1.737495	1	0.1875

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMOTHER	0.545286	1	0.4603
All	0.545286	1	0.4603

Date: 04/12/17 Time: 22:48
Sample: 1982 2015
Included observations: 32

Dependent variable: LMTRANS

Excluded	Chi-sq	df	Prob.
LMROP	3.631109	1	0.0567
All	3.631109	1	0.0567

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMTRANS	0.016164	1	0.8988
All	0.016164	1	0.8988

Date: 04/12/17 Time: 22:49
Sample: 1982 2015
Included observations: 31

Dependent variable: LMWHOLE

Excluded	Chi-sq	df	Prob.
LMROP	2.059587	2	0.3571
All	2.059587	2	0.3571

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMWHOLE	0.255899	2	0.8799
All	0.255899	2	0.8799

Date: 04/12/17 Time: 22:49
Sample: 1982 2015
Included observations: 31

Dependent variable: LMY

Excluded	Chi-sq	df	Prob.
LMROP	5.040276	2	0.0804
All	5.040276	2	0.0804

Dependent variable: LMROP

Excluded	Chi-sq	df	Prob.
LMY	1.321951	2	0.5163
All	1.321951	2	0.5163