OIL PRICE AND ECONOMIC GROWTH OF OIL-IMPORTING COUNTRIES: A REVIEW OF INTERNATIONAL LITERATURE

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Abstract
This paper reviews the existing literature on the relationship between oil price and economic growth in oil-importing countries for developed, emerging and developing countries. It discusses the theoretical and empirical findings. The study finds that the impact of oil price on economic growth varies from country to country and over the periods of oil volatilities. Moreover, results from studies reviewed depend on methodology employed, the dataset and the country fixed effects. There is, however, a wide support for results of a negative relationship between oil price and economic growth, especially in developed countries. While studies showed a negative relationship during an increase in oil price, a decrease in oil price seems to have an insignificant relationship for developing countries. The causal relationship is also diverse across studies reviewed, ranging from unidirectional to bi-directional and feedback hypothesis. To our knowledge, this may be the first review of existing literature on the relationship between oil price and economic growth for oil-importing countries.

Keywords: oil price, economic growth, developed countries, emerging countries, developing countries

1. Introduction

The relationship between oil price and economic growth has received great attention in macroeconomics and policy modelling. However, the exact relationship is not well defined, especially for oil-importing countries. Results from studies on the direct relationship between oil price and economic growth are not uniform across existing literature. Studies on the subject vary with regard to country and country groups, variables and techniques employed in the analysis. Therefore, empirical results differ and sometimes are even in conflict. Although the theoretical review stressed that a higher oil price negatively affects economic growth for oil-importing countries, empirical literature differs. Some literature (Gbatu *et al*., 2017a; McDonald and van Schoor, 2005; Essama-Nssah *et al.,* 2007) found that oil prices have little or no effect on economic growth. Other studies found that an oil price increase has a negative effect on economic growth, therefore favouring an inverse relationship between both variables (Darby, 1982; Bruno and Sachs, 1985; Hamilton, 1996; Fofana *et al*., 2009; Rafiq *et al*., 2009).

Energy as a source of economic growth seems to be passive in traditional economic growth theories, and most macroeconomic models do not capture constraints associated with energy. There has been heavy reliance on natural resources, particularly oil, in promoting economic growth. This may however, cause a downward trend of economic growth since oil is regarded as an exhaustible resource. Recently, there has been a growing body of

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evidence that energy plays an essential role in the economic growth of economies around the world (Hall and Klitgaard, 2012; Ayres and Warr 2010; Johnson *et al*., 2012). The crude oil price has been volatile especially since 2008, following a decrease from a peak of $147 in 2008 to $57 in 2017. The prices of other commodities, including food, have shown similar volatilities. The period also overlaps with the global financial crisis. In fact, some economists are of the opinion that the sub-prime debt crisis in the United States is the cause of the financial crisis and an aftermath effect of the oil price spike (Cortright, 2008; Hall and Klitgaard, 2012). The oil price hike is believed to have increased other prices, which resulted in defaults in the sub-prime mortgage repayments. There has also been a linkage of the oil price increase to income inequality during this period due to the indirect effect of an increase in housing, food, and energy prices.

This paper aims to review the theoretical and empirical literature on the relationship between oil price and economic growth. The paper is divided further as follows: Section 2 reviews the theoretical literature on the relationship between oil price and economic growth for oil-importing countries. Section 3 discusses the empirical literature on the relationship between oil price and economic growth and section 4 concludes the paper.

2. Economic literature on oil price and economic growth

2.1. Theories on resource price and economic growth

Golub (1983), Darby (1982), and Hooker (1999), among others, have previously documented theories on the nexus between oil prices and growth. They have established that the oil price volatility affects growth for various importing and exporting countries. When oil prices increase, GDP in oil-importing countries decreases through increase in import spending. The exchange rate also depreciates during oil price increase but appreciates when oil prices fall. The opposite is true for oil-exporting countries. Some theories on resource price and economic growth are explained in the Annex: Malthusian, Holeting, Meadows, Keynesian, Sachs and Solow.

2.2. Empirical literature: Causal Relationship of Oil Price and Economic Growth

Understanding the connection between the oil price and macroeconomic performance is critical for countries, mainly oil-importing countries in order to make policies that will forestall the likely consequences of oil price shocks and fluctuations. The vulnerability and impact of oil prices on different economies have been attributed mainly to the significant role of oil globally. Several examples of empirical evidence exist to explain the fluctuations of oil price as well as to assess the macroeconomic consequences of the fluctuations of oil price. The price of oil has attracted a considerable degree of attention for many decades.

Persistent fluctuation in oil price could have severe macroeconomic implications for both oil-exporting and oil-importing countries. Numerous empirical studies have documented the nexus between oil price and economic activities of both developed and developing countries (Darby, 1982; Bruno and Sachs, 1982; Bruno and Sachs, 1985; Hamilton, 1983; Hamilton, 1996; Hickman, Huntington and Sweeney, 1987; Mork and Hall, 1980; Rafiq *et al.*, 2009; Rafiq and Salim, 2011; Gbatu *et al.*, 2017a; Iwayemi and Fowowe, 2011; Balcilar, *et al*., 2017; Tefera *et al.*, 2012). Some empirical studies have shown that oil price volatility has a negative impact on the macro economy and inhibits economic performance.

This section discusses previous empirical literature on oil prices and economic growth. This literature is separated into different strands based on scholarly evidence in developed, emerging and developing countries. Others include those pertaining to global and African experiences. Here we include a reference to studies that analyse causal relationship of oil price and economic growth, and we include more information in the Annex

Causality between oil price and economic growth has been empirically tested in some studies as well, though the results are far from being consistent. Studies on the causal relationship between oil price and economic growth can be divided into four categories. The first category found a unidirectional causal flow from oil prices to economic growth, while the second category found a unidiectional causal flow from economic growth to oil prices. The third category of studies found a bidirectional causalty (two-way causal relationship), while the fourth category is the neutrality hypothesis (where there is no causal relationship). While most studies that exist have been conducted on developed countries, particularly the US, most studies on developing countries have been on Asia and Latin America. Little attention has been given to SSA countries that are usuallly mostly hit by oil price shocks.

Moreover, while a number of studies have examined energy consumption and economic growth nexus, few studies have been conducted on oil prices and economic growth in SSA. Most studies on the causal relationship between energy consumption and economic growth argue that energy consumption Granger-causes economic growth (Odhiambo, 2009a; Narayan and Smyth, 2008; Narayan and Prasad, 2008; Shiu and Lam, 2004; Chang *et al*., 2001; Yang, 2000; Cheng, 1997; Masih and Masih, 1996). Another category of studies favours the economic growth to energy consumption flow of causality. They argued that the real sector determines the demand for energy consumption (Shahbaz *et al*., 2017; Odhiambo, 2016; Narayan and Smyth, 2005; Gosh, 2002; Cheng, 1999; Abosedra and Baghestani, 1989).

Another strand of studies promotes a feedback hypothesis or bidirectional causal relationship. It is argued here that there is causality from energy consumption to economic growth and from economic growth to energy consumption (Saidi *et al*., 2017; Odhiambo, 2009b; Paul and Bhattacharya, 2004; Yang, 2002; Masih and Masih, 1997). Studies that support the neutrality hypothesis are scant. In this strand, it is argued that there is no Granger-causal relationship between energy consumption and economic growth (Rahman and Mamun, 2016; Cheng, 1997; Cheng, 1995; Yu and Hwang, 1984).

Studies on oil prices and economic growth are few in comparison to studies on energy consumption and economic growth. Few studies have examined the nexus between oil prices and economic growth. Some of the studies that have examined oil price and economic growth include: Hooker (1996), Lescaroux and Mignon (2008), Cunado and Perez-de-Gracia (2003), Rafiq *et al.* (2009) and Kumar (2005).

Hooker (1996a) found that oil price does not Granger-causes industrial production for the US using the VAR methodology from 1947 to 1994, however, oil price granger cause unemployment and employment growth rates for data from 1947 to 1973 but not after 1973. Hooker (1996b) also found that oil price does not Granger-cause GDP for the US. Cunado and Perez-de-Gracia (2005) analyzed six Asian countries using VAR and quarterly data

from 1975 to 2002. They also found that oil price does not Granger-cause economic growth for half of the countries in the short run but does granger cause economic growth in South Korea, Japan, and Thailand. Lescaroux and Mignon (2008) examined three-panel groups of oil importing, oil exporting and OPEC countries, and posited that oil price Granger-causes GDP for the oil importers and OPEC countries. However, they do not Granger-cause GDP for other oil exporters. Cunado and Perez-de-Gracia (2003) analysed 14 European countries using quarterly data from 1960 to 1999, and a VAR technique. They observed that oil prices Granger-cause GDP for half of the countries, but do not Granger-cause GDP for the other half.

However, some other studies have found a unidirectional causal flow from oil price to economic growth. Rafiq*et al.* (2009) analysed data from Thailand and found that oil price does Granger-cause and have a significant impact on macroeconomic indicators in the country. Kumar (2005) confirmed similar results for India using linear and nonlinear specifications of multivariate VAR. Evidence showed that oil price does Granger-cause macroeconomic activities. A one percent decrease in growth of industrial production is attributed to a one hundred percent increase in the oil price.

In another research study on the US, Mory (1993), using OLS and annual data from 1952 to 1990, found that oil price Granger-cause GDP. Analyses on the subject from other countries include: Aliyu (2009) on Nigeria, Du and Wei (2010) on China; which establish results that are consistent with the position that oil price Granger-cause GDP and other macroeconomic indicators. Guo (2008) found that oil price Granger-causes GDP for Russia, Japan, and China.

Another different result was found by Hanabusa's (2009) analysis on Japan. Results from this study showed a bidirectional relationship between oil price and GDP. In another study for eight OECD countries, Jiménez-Rodríguez and Sánchez (2005) found a bidirectional relationship for five of the countries, namely: Japan, Canada, Germany, UK, and France. However, a unidirectional relationship (oil price Granger causes GDP) is found for the USA, Italy, and Norway. Previous studies on the causal relationship between oil prices and economic growth tend to suffer from variable omission bias. This bias is because some of the studies on the subject examined the causal relationship using bivariate analysis (Odhiambo, 2008; Odhiambo and Nyasha, 2018). Moreover, panel data analysis for SSA is scant. The panel data allows for the addition of control variables with a large dataset and ability to have robust inferences.

s/n	study	Causal Relationship between	year covered; method	summary of findings
1	Hamilton (1983)	oil price and GDP in the US	Quarterly data from 1949-72; OLS	The direction of the causal relationship is that oil price Granger-causes real GNP. Oil price increases caused reductions in real GNP growth.
2	Hooker (1999)	oil price and GDP in the US	Quarterly data from 1947-74; VAR	The direction of the causal relationship is that real oil price do not predict output. However, it predicts unemployment.

3	Hooker (1996a)	oil price and GDP in the US	Quarterly data from 1947-94; VAR	Oil price does not Granger-cause many macroeconomic indicators, including GDP, in subsequent data after 1973
	Hooker (1996b)	oil price and GDP in the US	Quarterly data from 1947-94; VAR	Oil price granger cause unemployment and employment growth rates for the full sample from 1947 to 1994 but not from 1973 to 1994. However, oil price does not granger cause industrial production for both the full sample and 1973 to 1994 data.
4	Cunado and Perez-de-Gracia (2005)	oil price and GDP in 6 Asian countries, Singapore, Japan, Thailand, Malaysia, Philippines and South Korea	Quarterly data from 1975-2002; VAR	Oil price have significant short run impact on economic activities (proxied by industial production in Japan, manufacturing production in Singapore, and real GDP for the remaining countries) and consumer price indexes. The impact is higher when oil prices are measured in local currencies of the countries investigated. The authors als observed a short run granger causality from oil price to economic growth in half of the countries. However, there is no long run effect berween oil price and economic growth
5	Cunado and Perez-de-Gracia (2003)	oil price and GDP in 14 European countries, Belgium, Austria, France, Luxembourg, Netherlands, Sweden and the UK, Germany, Denmark, Greece, Spain, Finland, Ireland, and Italy	Quarterly data from 1960-99; VAR	Oil price Granger-causes industrial output growth for Belgium, Austria, France, Luxembourg, Netherlands, Sweden and the UK but does not Granger- cause GDP for Germany, Denmark, Greece, Spain, Finland, Ireland and Italy. Moreover, there is no long run relationship between oil price and industrial output growth. Results also depends on whether the world oil price or oil price measured in national currencies are used.
6	Mory (1993)	oil price and GDP in the US	Annual data from 1952-90; OLS	Oil price increases negatively affects economic activities, however, oil price decrease do not have clear effect on economic activities. Oil price Granger-causes GNP and other macroeconomic indicators (total consumption, investment, imports, etc).
7	Guo (2008)	oil price and GDP in 3 Countries, Russia, Japan, and China	Quarterly data from 1999-2007; VAR	Oil price Granger-causes GDP. Increase in the price of oil has a negative impact on economic growth in Japan and China but positive impact in Russia.

8	Lescaroux and Mignon (2008)	oil price and GDP in 3 Panel Groups of oil importers, OPEC, and other oil exporters	Annual data from 1960-2005; VAR	There is a unidirectional causality from oil price and other macroeconomic variables except for Saudi Arabia, UK and Qatar that runs from GDP to oil price. There is also an existence of long run relationship between GDP and oil price.
9	Du and Wei (2010)	oil price and GDP in China	Monthly data from 1995-2008; VAR	Oil price Granger-causes GDP during 2002M1 to 2008M12. There is a positive impact of oil price on economic growth.
10	Aliyu (2009)	oil price and real exchange rate on real GDP in Nigeria	Monthly data from 1980 to 2007; VAR	There is evidence of a unidirectional causal relationship from oil price to real GDP and a bidirectional relationship between real exchange rate and real GDP. The author also found that oil price shocks result in positive impact on economic growth.
11	Hanabusa (2009)	oil price and GDP in Japan	Monthly data from 2000 to 2008; EGARCH	The causal relationship is bidirectional. Oil price Granger-causes GDP and GDP Granger-causes oil price.
12	Jimenez-Rodriguez and Sanches (2004)	oil price and GDP in 8 OECD countries, US, Canada, Japan, Germany, Norway, France, Italy and the UK	Quarterly data from 1960-99; VAR	A unidirectional causality exists from oil price to GDP for Italy, Norway and the US and bi-directional for Canada, Japan, France, Germany and the UK
13	Ghalayini L. (2011).	Oil Price and Economic Growth for G7 group, OPEC countries, Russia, India, China and the world	G7; 2000Q1-2010Q4; Russia; 2003Q1-2010Q3; India; 2000Q1-2010Q1; China & OPEC; annual data 1986-2010; For World-1998Q1-2010Q4; ADF and Granger causality	There is no causal relationship between oil price changes and economic growth for most of the countries except for the G-7 group where there is a unidirectional relationship from oil price to gross domestic product
14	Berument, Ceylan, and Dogan (2010)	The impact of oil price shocks on economic growth in 16 selected MENA countries	1969-2005 differing for each country based on data availability;	Oil price increase has a positive significant effect on GDP of Algeria, Iran, Qatar, Libya, Syria, Kuwait, Iraq, Oman, and the UAE but no significant effect for Djibouti, Israel, Jordan, Morocco, Egypt, Bahrain and Tunisia

			VAR	
15	Ftiti, Guesmi, and Tuelon (2014)	The impact of oil prices on economic growth of 4 major OPEC countries (UAE, Kuwait, Venezuela and Saudi Arabia)	Daily data from 03 Sept 2000 to 03 Dec 2010; Evolutionary co-spectral analysis of Priestley and Tong (1973)	Oil price shocks during fluctuations in a global business cycle such as 2008 global financial crisis have a significant effect on oil price and growth
16	Kumar (2009)	The impact of oil price on economic activities in India	Multivariate VAR (Linear and non-linear specifications)	Oil price Granger-causes macroeconomic activities
17	Rafiq et al (2009)	Impact of oil price on economic activities in Thailand	Quarterly data from 1993Q1 to 2006Q4; VAR	Oil price Granger-causes and has a significant impact on macroeconomic indicators such as unemployment and investment
18	Osigwe A.C. (2015)	It evaluates the effects of exchange rate fluctuations on crude oil prices and economic performance in Nigeria	OLS and Two-stage Least square	The real exchange rate has a positive effect on the economic performance. Also, a 1% increase in the price of oil would positively influence the economic performance by 4%
19	Dibooglu (1996)	It evaluates if international differences in real variables cause Purchasing Power Parity (PPP) deviations.	Quarterly data over the period 1960-1988; Cointegration and ECM	Real shocks, real oil price movements, significantly explain deviations from PPP
20	Benedictow et al. (2013)	Analyse the effects of changes in oil price and fiscal policies in Russia	Quarterly data from 1995Q1 to 2008Q1; General to Specific using OLS	Higher oil price leads to higher economic growth and savings but also stimulates a rupture in the economy
21	Iwayemi and Fowowe (2011)	Assesses the oil and macroeconomy of 4 major oil exporting countries	Annual 1970 to 2006; Granger-causality and six-variable VAR	The impulse response functions show that shocks from oil prices affected macroeconomic variables negatively. Although rising oil prices should increase government revenue through foreign

		(Algeria, Egypt, Libya and Nigerai)		exchange earnings, economic activities have not improved.
22	Adeniyi et al (2011)	Threshold analysis of oil price shocks and economic growth in Nigeria	Quarterly data from 1985 to 2008; VAR	Oil price shocks do not stimulate macroeconomic variables, even after the introduction of threshold effects. This may be due to the weak linkages in the Nigerian economy. The authors recommended productive spending for higher economic growth.
23	Chuku (2012)	Analysed the linear and asymmetric effect of oil price shocks in Nigeria (an oil-importing and oil-exporting country)	Quarterly data from 1970Q1 to 2008Q4; Granger, SVAR	Though Nigeria is a major oil exporter, oil prices are exogenous to the economy and its macroeconomic trends do not determine global oil markets. Recommended that planned expenditure based on revenue from anticipated oil price rise should be avoided
24	Balcilar et al. (2017)	Analysed the impact of oil prce on GDP growth in South Africa	Quarterly data from 1960Q2 to 2013Q3; Bayesian Markov Switching VAR (MS-VAR)	They divided the data span into low and high growth regime. Found that high growth regime is longer on the average, than low growth regime. Using regime-based impulse response functions, they also found that oil price shocks had a tendency to be continuous during low growth regime compared to high growth regimes
25	Abeysinghe (2001)	Measured the direct and indirect effects of oil prices on GDP growth of 12 economies (Indonesia, Malaysia, Philippines, Thailand, Hong Kong, South Korea, Singapore, Taiwan, China, Japan, USA, and the rest of OECD as a group)	Quarterly data from 1982Q1 to 2000Q2; Two-Stage Least Squares, Impulse response function	The direct impact of high oil prices on the net oil exporters (Indonesia and Malaysia) is positive while the indirect impact is negative and contractionary, which was transmitted through their trading partners (trading matrix). The other economies are net oil-importers and the direct and indirect impacts are negative. Their results also show that for a large economy like the US, the transmission effect of oil price on growth may not be significant but very critical for small open economies.
26	Ayadi, O.F (2005)	Analysed oil price fluctua-tions effect on the Nigerian economy	1980-2004; VAR	Oil price fluctuations have an effect on exchange rate and thereby, affect industrial production. Therefore, an increase in oil prices does not result in increase in industrial production.

27	Olomola and Adejumo (2006)	Examined the effect of oil price shock on output, inflation, real exchange rate and money supply	Quarterly data from 1970 to 2003; VAR	Oil price shock has no effect on inflation and output but has significant impact on real exchange rates. Higher real oil prices may exacerbate the wealth effect and appreciate the real exchange rate. This may result in the contraction of the tradable sector and consequently, exposure to the Dutch disease.
28	Behmiri and Manso (2013)	Examined the causal relatinship between oil consumption and economic growth in 23 SSA countries	1988-2011; Multivariate panel Granger-causality framework	In the short run, there exists a bidirectional causality between crude oil consumption and economic growth in oil-importing countries but a unidirectional causality in oil-exporting countries. However, in the long run, their results indicate a bidirectional causality in both oil-importing and oil-exporting countries.

4. Conclusion

The aim of this study is to review existing literature on the relationship between oil price and economic growth with a focus on both the theoretical and empirical evidence. This review is different because it critically evaluates the impact of oil price on economic growth of oil-importing countries. This study found that many studies have focused on oil-exporting countries especially in developing countries. To our knowledge, this may be the first review of existing literature on the relationship between oil price and economic growth for oil-importing countries.

Results from the literature reviewed showed that oil prices generally have a negative impact on GDP growth of oil-importing countries but positively impact oil-exporting GDP growth. Other macroeconomic variables such as interest rate, exchange rate and financial assets are affected through the transmission mechanisms as explained by the theoretical literature section. However, a decrease in oil prices does not generally increase the GDP growth rate of oil-importing countries as explained by the theories covered. It is also observed that studies on developed countries employed the VAR and/or Granger-causality techniques in their analysis for the relationship between oil prices and economic growth. All theoretical and empirical literature emphasised the negative impact of oil prices on economic growth. Results in emerging and developing countries varied because some are oil-exporting countries, so an increase in oil price generally stimulates and increases an oil-exporting country's GDP.

The review of empirical literature of developed, emerging and developing countries showed that many studies on developed countries were on the US economy. While studies on developed countries have been extensively explored, studies on developing countries are still at the developmental stage. Moreover, the few studies that exist on developing and emerging countries have focused on Asia and Latin America. These studies have mostly examined the implication of oil price increase on the economies. In the case of oil-importing SSA countries, literature has been relatively scarce and most studies on developing and emerging countries also employed either the different variants of VAR/VECM or the CGE model. However, there is no single and direct consensus in the literature for developing countries.

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Annex

A1. THE RELATIONSHIP BETWEEN OIL PRICE AND ECONOMIC GROWTH: A THEORETICAL REVIEW

Golub (1983), Darby (1982), and Hooker (1999), among others, have previously documented theories on the nexus between oil prices and growth. They have established that the oil price volatility affects growth for various importing and exporting countries. When oil prices increase, GDP in oil-importing countries decreases through increase in import spending. The exchange rate also depreciates during oil price increase but appreciates when oil prices fall. The opposite is true for oil-exporting countries. Some theories on resource price and economic growth are explained below. In the Annex we include a summary of the following theories: Malthusian, Holeting, Meadows, Keynesian, Sachs and Solow

1) Malthusian theory

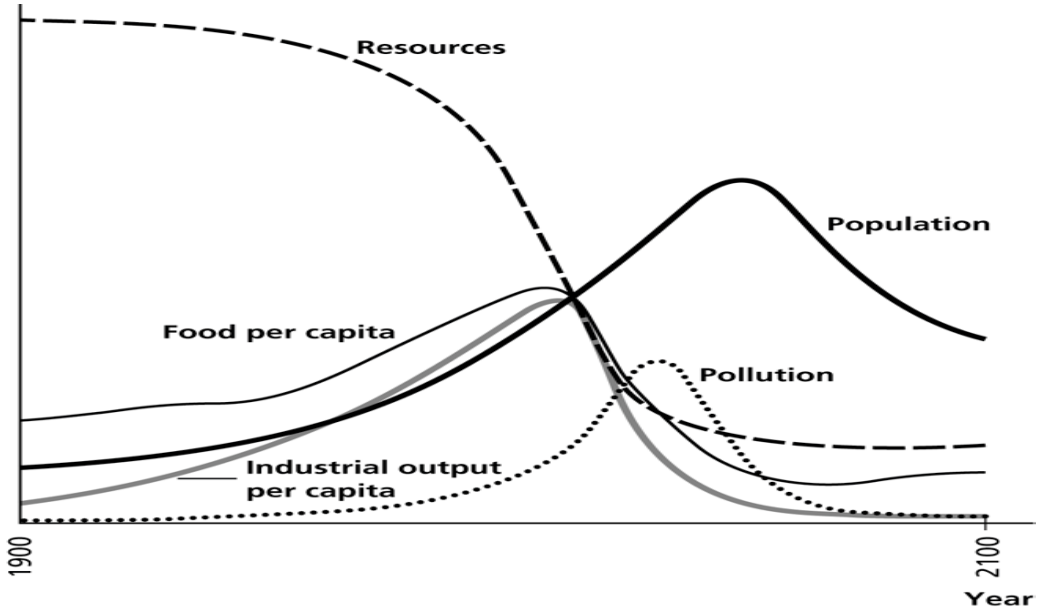
The relationship between natural resources and economic growth was first examined by Malthus (1908) through population growth. He found that a linear increase in food production is not sufficient to provide for an exponential increase in population. Due to limited land availability, food production is also limited and would result in starvation of the citizens in overpopulated regions. Therefore, the scarce natural resource, specifically land, results in a decrease in long-term economic growth. The pre-industrialised period was characterised by dependence on land and renewable resources like water, agricultural products and wind. The industrial revolution aided Western Europe to bolt the Malthusian theory and increasingly rely heavily on exhaustible resources. There was an initial reliance on coal, but oil in recent times, has played a wider role in the global economy. Because oil is a nonrenewable resource, the exhaustion of oil poses a relevant investigation on its effect on economic growth, especially for the future.

2) Hoteling theory

Hoteling (1931) believed that employing nonrenewable resources in production is profitable when there is a direct and positive relationship between the price of the resources and interest rate. Also, the consumption of the resources as production input today must balance with its future consumption. However, empirics have shown that there are other determinants of the price of natural resources. Crude oil, an example of a natural and nonrenewable resource, has fluctuated significantly in recent years. The price of oil is largely determined by political factors and OPEC market control rather than the exhaustible nature of oil. In the last century, OPEC has influenced the price of oil in the short-term through supply cuts (for example, in 2009 and in 2015). However, the increased production of "unconventional oil" has limited OPEC's market power in determining oil prices (Merz, 2016).

2.3 Meadows Model

Meadows *et al*. (1972) projected the trends of resource use and reckon that the world would run out of the major exhaustible resources (oil, gas, iron and copper) within a thirty-year range. Data from 1900 to 1970 was employed for forecasting from 1970 to 2100. The graph below from Meadows *et al*. (1972) shows the trend of resources, pollution, industrial output per capita, food per capita and population.



Source: Meadows *et al*. (1972)

Even though the persistent consumption of resources, particularly oil, may be unsustainable, output growth has been evident as opposed to views held by Meadows *et al.* (1972). Moreover, oil still accounts for 33% of global energy consumption as the world's leading fuel (BP Statistical Review of World Energy, 2017). It is the largest traded commodity in the global market. While Deutsche Bank (2 estimated that 59% of oil reserves have been extracted and consumed, Weil (2013) estimated that the remaining oil reserves will only last 61 years given the current rate of consumption. However, as new oil reserves are being discovered and technological advancement increased, the exhaustion of natural resources, specifically oil, is always being extended.

2.4 Keynesian Model

The Keynesian model of aggregate demand (AD) and aggregate supply (AS), and the neoclassical theory provide a basis for the indirect link between oil prices and economic growth. The Keynesian model illustrates that the AS curve is upward sloping in the short run, rather than vertical. The upward sloping of the AS curve implies that changes in the AD curve will affect both price and output. The vertical AS curve illustrates that the long-term AS would affect prices only. The neoclassical model, as propounded by Solow (1956), explains that capital accumulation, and its uses in an economy, determines the long-term dependence of a country's GDP on global oil prices. Since savings on the "steady-state" path are fully spent on capital amortisation, and the supply of new capital to maintain a constant capital-labour ratio per worker. Therefore, long-term growth is the only determinant of population growth and technological progress, and not savings rate. Change in savings rate will only affect the constant capital-labour ratio and short-term output.

The Solow growth model is also based on the assumption that the economy consists of two sectors, oil and non-oil sector and that there is increasing global oil prices. Therefore, for

exporting countries, this will mean a transfer of funds from oil-importers. This wealth transfer can be utilised to increase consumption or investment component of the GDP. While for importing countries, there will be increased import spending and wealth transfer away from oil-importing countries. A persistent increase in oil price provides increasing funds for investment purposes for an oil-exporting economy; thereby increasing capital accumulation and therefore, positively affecting the output of goods and services. However, increasing oil prices reduces source of investment funding for oil-importing countries; reduction in capital accumulation and negatively affects output and growth.

2.5 Sachs Model

Sachs (1981) explained the theory of optimisation of a temporary or permanent increase in oil price. An optimising oil-importing country should not experience a current account deficit when the price of imported oil rises except if the oil price is temporary. A permanent increase in oil price leads to a decrease in permanent income and consequently a fall in consumption to a sustainable level with no change in the current account. However, if the increase in oil price is temporary, an optimising oil-importing country should use foreign borrowing to smooth out domestic consumption.

Sachs' theory however, neglects cost of adjustment and the uncertainty in the duration of the oil price increase, whether it will be a temporary or a permanent one. In practice, intertemporal utility maximisation adopts a mix of financing and adjustment to a permanent shock when cost of adjustment increases with the speed of adjustment. Moreover, oil price fluctuations due to political disturbances (for example, the Arab-Israeli war in 1973 and the Iranian revolution in 1979) are likely to be temporary. Oil price increases will lead to dissaving and current account deficit only for a period of time for oil-importing countries, and offset surpluses for oil-exporting countries.

2.6 Solow Model

The basic model based on Solow (1956) explains that a constant labour size uses manufactured capital to produce output. The model assumes that there are diminishing returns to capital; capital increases at a decreasing rate. Since a constant amount is assumed to be saved and invested in the capital stock, a constant amount of the capital stock depreciates. The capital stock becomes unchanging in size when savings equal depreciation. The economy reaches a stationary point where there is no economic growth since there is no additional investment in the economy. According to the Neoclassical growth model, however, only technological progress can ensure continued economic growth. The Cobb–Douglas production function acknowledges that some amount of energy and materials are required for the production of goods and services.

$$Y = AF(K, L) \quad (1)$$

where Y is real GDP, K is the quantity of capital, L is the quantity of labour, and A is the index of how efficiently the economy translates capital and labour into real GDP. F is a production function homogenous to degree 1; that is, the production function shows a constant return to scale. This means that production increases in the same proportion as the primary input endowment, in this case, that of oil, increases.

The effect of changes in oil price depends on its demand and supply. If an increase in oil price is due to substantial oil demand by importing countries, demand for oil and other goods and services produced by other importing oil countries will increase, thereby increasing global demand. If the oil price increase is, however, due to lower demand for oil, aggregate demand for goods and services will decrease; therefore, global demand will reduce and, in turn, exports of oil-importing countries will fall. Estrada and Hernandez de Cos (2012) identified three potential ways oil prices may impact on the prospective level of output (GDP) for oil-importing countries. This includes the effect on productivity, secondly, the effect on the optimal capital stock, and the effect on the level of employment.The impact of oil prices on productivity (GDP), assuming the only intermediate consumption is imported oil, can be expressed algebraically as thus:

$$Y = A\ F\ (K, L, O), \tag{2}$$

where O is the oil consumption term.

In endogenous growth models A is constant, and, as capital accumulates, growth can continue indefinitely. Some amount of energy and other input is essential for production. Therefore, resources and capital are reliant on each other in the neoclassical model, the production of capital assets requires using some quantity of resources (Estrada and Hernandez de Cos, 2012; Stein, 2004).

Estrada and Hernandez de Cos (2012) applied the Euler's theorem to equation 1 above, it gives:

$$\Delta \ln Y = \frac{F_K K}{Y}.\Delta \ln K + \frac{F_L L}{Y}.\Delta \ln L + \Delta \ln A \tag{3}$$

where F_k and F_L are the marginal productivity of capital and labour (partial derivatives), and Δ is the difference operator. They also assumed that there is perfect market for the input and production output. Therefore, marginal productivity of capital and labour will be equal to real wage and the real cost of capital respectively. Therefore, in an endogenous growth model, a constant growth rate is achievable and the diminishing returns to manufactured capital are compensated by a technological growth effect (Stern, 2004).

New theories of endogenous growth models of natural resources, explain the institutional arrangement of sustainable economic growth, with an a priori assumption that a technical arrangement is feasible. The elasticity of substitution (ɣ) between capital and inputs from natural resources indicates how much an additional amount from one of the inputs must be employed when the other input is decreased. A unitary (ɣ =1) implies that perfect substitution exists. That is, holding output constant, the same percentage changes the ratio of the two inputs. Substitution, though technically feasible, depends mainly on the level of capital investment to replace depleted natural resources. Moreover, investment depends on the institutional arrangement of the economy. In an economy where ɣ =1 and is only technically feasible, there will not be sustainability. This will ultimately decrease per capita consumption since capital accumulation cannot meet up with depleting natural resources to replace them (Stein, 2004).

Variations in cross-country economic growth rates, and per capita income, seem not to be explained by the neoclassical growth models with assumptions of decreasing capital returns, perfect competition, and exogenous technology. Romer (1989) asserts that countries do not converge to the same level of per capita income as seen in the neoclassical model if they share the same technical arrangement and savings behaviour (Grossman and Helpman, 1993). Therefore, Mankiw, Romer and Weil (1992) argued that cross-country differences in savings rates, which reflect differences in tastes and culture, must be accounted for, and human capital as well as accumulated capital is included. They assume that every country has its Cobb-Douglas production function, population growth and savings rate to account for the cross-country differences (Grossman and Helpman, 1993).

Annex

1) Developed Countries Experience

The empirical relationship between oil prices and growth has inconsistent results. Some studies found a negative impact of oil prices on economic growth, and others found oil price changes to have an insignificant impact on economic growth. In the literature, earlier studies on the oil price-GDP relationship, which include Darby (1982), Bruno and Sachs (1982, 1985), Hamilton (1983, 1996), Hickman, Huntington and Sweeney (1987), and Mork and Hall (1980), have all found an inverse relationship between oil price increases and aggregate economic activities. Most of the earlier studies conducted are on developed economies.

For studies focusing on developed countries, Hamilton (1983, 1996) found an inverse relationship between oil price increases and aggregate economic activities. Using Granger causality test, Hamilton showed that oil price changes are the cause of GNP fluctuations in the US. Hamilton (1983) analysed the decline in the U.S macroeconomic performance; the author observed that the decline would be ascribed to the sudden and sharp increase in oil price. Similarly, Mock and Hall (1980), using a simulated model found that a significant change in the price of oil has a significant adverse effect on the economy. Energy is essential in the production and consumption processes of varying outputs in the different economies.

Burbidge and Harrison (1984) tested the effect of rising oil price using vector autoregression (VAR) on monthly data from January 1961 to June 1982. They compared five countries and found that the effect of oil price on inflation is higher in the US and Canada than in Japan, Germany and England. Cunado and Perez-de-Gracia (2003) analysed 14 European countries using quarterly data from 1960 to 1999, and a VAR technique. They found a direct relationship between oil price and GDP for half of the countries, but no direct relationship for the other half. They explained that choosing either world oil prices or a national real oil price index influences the difference between oil prices and outputs. They also found that only the United Kingdom and Ireland exert long-run relationships between oil prices and outputs. Therefore, the effect of oil price shocks on economic growth is restricted to the short-run.

Most of the earliest research on oil price's relationship with the macroeconomy was theoretical and mainly on the US. Models are developed for an increase in the price of an

intermediate imported good. These models conclude that oil price shocks result in increased wages, increased price levels and reduction in real output (Bruno, 1982; Bruno and Sachs, 1982; Darby, 1982; Gordon, 1975; Phelps, 1978; Solow, 1980; Bruno and Sachs, 1980; Findlay and Rodriguez, 1977). Darby (1982) studied the relationship between oil price and world inflation and recession. The author tested the impact of various oil price indexes on real income in an extended Lucas-Barro equation for the United States, United Kingdom, Canada, France, Germany, Italy, Japan, and the Netherlands. Results showed that a significant oil effect is apparent in five out of the eight countries (i.e. oil price variables in France, Italy and Japan are not statistically significant).

Hamilton (1983) observed that only one of the US recessions after World War II did not precede a substantial increase in oil price. Though oil shocks cannot be stated as the exact cause of these recessions, Hamilton (1983) found that data during 1948 and 1972 are statistically significant that oil prices were instrumental in some of the recessions. The data are found to be nonspurious, which makes the evidence more robust. Therefore, oil price may account for macroeconomic performance of the US within that period. Mork (1989) extended Hamilton's research to include price controls and the downward trend of oil prices. Asymmetric responses to oil price movements are explored for both increase and decrease in the price of oil. The empirical analysis was based on the structural employment theory. Mork (1989) confirmed Hamilton's (1983) results of negative correlation between oil price increases and macroeconomic variables even during periods of price controls. However, the correlation for oil price decreases may not be positive and perhaps zero. Mork and Hall (1980) in an earlier study formulated and simulated a relatively small macroeconomic model of the US. The models were constructed based on capital, labour and energy as production inputs with technological constraints. A money demand function; a permanent income consumption function; rational expectations were also formulated. They concluded that large oil price shocks are disruptive to the economy.

Recent studies have shown that determinants of oil price fluctuations are not entirely from exogenous shocks, such as supply shocks from political conflicts and OPEC policies. Rather, oil price fluctuations can also be determined by global macroeconomic factors such as economic expansion, exchange rate fluctuations, changes in interest rates and inflation (Bernanke, 2004; Kilian 2008; Balke *et al*., 2010). Therefore, real oil price shocks should be considered as endogenous to the macroeconomy.

Guo and Kliesen (2005), in an empirical analysis of the US found a negative impact of oil prices on output and other macroeconomic variables. However, Jime´nez-Rodrı´guez and Sa´nchez (2005) in an empirical analysis for some OECD countries further explained that oil price impacts are non-linear on real GDP. Oil price increases have a larger impact than oil price decreases. In fact, oil price decreases are found to be statistically insignificant in most cases. For oil-importing countries, oil price shocks have a negative impact on economic activities for all countries (US, Euro Area, Canada, France, Italy and Germany) except Japan. For the oil-exporting countries, the UK was negatively impacted by oil price shocks while Norway gained from the oil price shocks during the period examined.

2) Emerging Countries Experience

Persistent high oil prices have affected emerging countries through their impact on inflation, monetary and exchange rate, fiscal balances and external balances. A study by Rafiq, Salim and Bloch (2009) on Thailand, confirmed a negative impact of oil prices on output and other macroeconomic variables. Rafiq and Salim (2011) in another study examined the impact of oil price volatility on six Asian emerging countries including China, Indonesia, Philippines, India, Malaysia and Thailand. The authors employed the VAR analysis for each of the countries. Results for China and Malaysia showed that oil price volatility impacts output growth in the short-run. The Philippines' result showed that oil price impacts only inflation. Oil price volatility impacts both GDP growth and inflation in India and Indonesia. For Indonesia however, the impact was before and after the Asian crisis. For Thailand, oil price volatility impacts GDP growth but seemed to disappear after the Asian crisis.

Khan (2010) examined the relationship between crude oil price and stock market returns and volatility for emerging BRIC (Brazil, Russia, India and China) countries using the VECM-MGARCH technique. The results showed that oil price and stock market returns are co-integrated for all the countries. A long run bidirectional relationship was found for all countries but only Russia showed a short-run relationship which affects the Brent oil prices. The oil market was found to be highly integrated with the BRIC countries' stock markets.

Kumar (2005) estimated the impact of oil price on the growth of industrial output in India using a multivariate VAR. Employing quarterly data from 1975 to 2004, Kumar (2005) found a negative impact of oil prices on output growth. Cunado and Perez-de-Gracia (2005) found a similar result in a panel VAR analysis for six Asian countries including Thailand, Singapore, Japan, Malaysia, Philippines and South Korea. They confirmed a negative relationship between oil prices and economic growth. Another study on an emerging Asian country is by Benedictow *et al*. (2013). The authors examined the effects of oil price fluctuations on fiscal policies in Russia using the general to specific OLS method. They found that higher oil price stimulates economic growth but also causes a rupture in the economy. Ito (2008) investigated the effect of oil price and monetary shocks in Russia using quarterly data and the VECM technique. The author found that a 1 percent increase in oil prices stimulates and raises the real GDP growth by 0.25 percent and increases inflation by 0.36 percent over the next 12 quarters. Monetary shocks confirmed the theoretical literature and were found to cause a real effect on GDP and inflation.

In general, empirical studies suggest that increased oil prices negatively impact oil-importing economies. The structure of the economy, however, determines the extent of the effect on the economy after a price shock. Du *et al*. (2010) examined the crude oil price shock on economic growth in China using the VAR methodology. The authors found that a 100 percent increase in crude oil price increased economic growth of the country by 9 percent and CPI by 2.08 percent when employing a linear model specification. The non-linear model specifications were asymmetric and different transformations were employed. They found that a 100 percent increase in crude oil prices decreased the Chinese GDP growth by 17 percent when employing the Mork (1989) transformation, a 10 percent decrease for Hamilton (1996) transformation and 1 percent decrease for Lee *et al*. (1995)

transformation. The study confirmed a non-linear and asymmetric relationship between oil prices and economic growth as discussed in the theoretical literature.

Berument, Ceylan and Dogan (2010) examined the impact of oil price shocks on economic growth in MENA region covering 1960-2003 using the dynamic vector autoregressive (DVAR) model. The results show a positive impact on Iran, Iraq, Algeria, Jordan, Kuwait, Oman, Syria, Tunisia and United Arab Emirates, while Bahrain, Djibouti, Egypt, Morocco and Yemen show no significant statistical relationship.

Balcilar, van Eyden, Uwilingiye and Gupta (2017) also examined the relationship between oil price and economic growth under two business cycle; low and high growth regime. The impact of oil price shocks on the South African GDP was examined using quarterly data from 1960Q2 to 2013Q3. They adopted the Bayesian Markov-Switching VAR and found that the oil price has an impact on real output growth, especially in low growth regimes, and also confirmed that a non-linear relationship exists between oil prices and GDP. They found that a high growth regime is longer on the average, than the period of a low growth regime. Other studies on the South African economy include: Fofana *et al*. (2009) and Essama-Nssah *et al.* (2007).

Fofana *et al.* (2009) examined the relationship between oil prices and the South African economy. The computable general equilibrium (CGE) model and the Macro-Meso-Micro modelling were employed. The results showed a negative impact of an oil price increase on the macroeconomy with an adverse effect on GDP and the current account. The micro-economy results showed that an increase in the price of oil increases the cost of living and adversely affects the poorer population. The distributional impact of increasing transport costs showed that the median quintile expenditure group was affected the most both in the rural and urban areas.

McDonald and van Schoor (2005) also employed the CGE model to investigate the effect of oil price increase in South Africa. An increase of up to 30 percent in crude oil prices was examined. A 20 percent increase in oil prices results in a 1 percent decrease in GDP. Major impacts were in the petroleum industry but the effect on a "liquid fuel-dependent" sector like transport is not as large as expected. The depreciating currency was found to offset the negative impact of higher petroleum prices especially in exporting areas of the sector. In the long run, there is high mobility of capital and skilled labour which may not be advantageous to the whole economy.

Essama-Nssah *et al.* (2007) examined the economy-wide and distributional impact of oil price shocks on South Africa. The authors employed a CGE macro to micro framework. The CGE model has 43 production activities and categorised these into agriculture, industry and services. A surge in the price of crude oil imports results in a reduction in the quantity of imported crude oil by approximately 1 percent. The micro results showed the welfare impact of the oil price shock on the level of skills of households. The results showed that the poorer segment of the population with low skills was more negatively affected while those with high skills are on the average benefiting from the oil price shock.

3) Developing Countries' Experience

There is still a dearth of research on the impact of oil price volatility on economic growth for developing countries. This may be because the demand for energy and oil in developing countries has been growing only in recent times. Gbatu *et al*. (2017a) examined the impact of oil price shocks on Liberia using the ARDL Bounds test. They found an asymmetric relationship and explained it using Liberia's under developed financial markets and tight monetary controls. Moreover, the impact of oil price shocks on the variables employed is limited to the short-run. They also found that there was no positive impact to GDP growth in the short-run during periods of decreasing oil prices as experienced in developed countries. Unlike traditional studies, falling oil prices do not translate into more production inputs in developing countries. They rather increase savings and opportunities for corruption. However, an increase in oil prices stimulated the Liberian economy during the period examined.

Iwayemi and Fowowe (2011) analysed the effect of oil price shocks on macroeconomic variables in Nigeria using VAR and Granger causality testing techniques. They found that oil price shocks have little effect on GDP. They also found that there is no causal relationship between positive oil shocks and GDP. Other authors on Nigeria include: Adeniyi *et al.* (2011); Chuku (2012) and Ayadi (2005). Adeniyi *et al.* (2011) analysed the threshold of oil price shocks and economic growth in Nigeria using the VAR methodology. The authors found that threshold effects do not stimulate macroeconomic variables because of the weak linkages in the sectors of the Nigerian economy. They concluded that Nigeria's spending should be geared towards productive purposes for economic growth prospects.

Chuku (2012) investigated the linear and asymmetric effect of oil price and economic growth. The author considered Nigeria as both an exporting and an importing country since the bulk of its refined oil is being imported. Chuku (2012) employed the Structural VAR method and found that oil prices are exogenously determined. The macroeconomic trend of the economy does not determine the price of both exported and imported oil in the country. Ayadi (2005) analysed the relationship between oil price fluctuations and the Nigerian economy using the VAR analysis. The author found that the oil price has an effect on industrial production through the exchange rate channel. An increase in the price of oil does not increase the industrial output in the economy.

Gbatu *et al.* (2017b) examined the asymmetric effects of oil price shocks and exchange rate fluctuations on real GDP for a panel of ECOWAS countries. The fixed effects model was employed. The sample was divided into three groups; all the ECOWAS countries, the net oil-exporting countries and the net oil-importing countries. The results showed a linear and asymmetric impact of oil prices on real GDP for the whole sample of ECOWAS countries and the net oil-importing countries. Moreover, exchange rate volatility negatively impacts the sample for the whole of ECOWAS and the net oil-importing country samples.

Tefera *et al*. (2012) examined the implication of oil price shocks and oil subsidies for the Ethiopian economy. The static CGE model was employed. They found that an increase in the oil price depreciates the Ethiopian Birr, thereby causing an increase in exports and decrease in imports. The income and consumption of households were also negatively affected especially in the rural areas. The oil subsidy scheme was found to increase public

expenditure, reduce government savings and hence, total investment. In the short run the oil subsidy improves the welfare of households but leads to lower investment and prospects for economic growth in the long run. In another study on Ethiopia, Fekadu (2005) examined the impact of oil price increases using trend analysis. The author found that oil price negatively affects core inflation but has a minimal effect on general inflation in the short run. The non-food price index was found to be more sensitive to the increase in oil price.

Odhiambo (2009) analysed the energy consumption and economic growth relationship in Tanzania using the ARDL Bounds test method. The results showed there is a long-run relationship between energy consumption and economic growth. The study also confirmed a uni-directional causal relationship between energy consumption and economic growth in Tanzania. Therefore, energy consumption boosts economic growth of Tanzania. In another study, Odhiambo (2010) using a comparative analysis of South Africa, Kenya and the Congo DRC, investigated the relationship between energy consumption, prices and economic growth. The study employed the ARDL-bounds test for a trivariate model of energy consumption, energy prices and real GDP per capita. The findings for Kenya and South Africa are consistent with those established by Odhiambo (2009). Moreover, there exists a unidirectional causal relationship from energy consumption to economic growth while the Congo DRC showed an opposite result from economic growth to energy consumption. Therefore, energy consumption may not considerably impact economic growth. However, the need for energy supply diversification is crucial to augment long-run energy demand and dependency.

Behmiri and Manso (2013) examined the impact of crude oil consumption on economic growth of twenty-three SSA countries. They employed a multivariate panel framework of oil consumption, oil price and economic growth for a sample of net oil-importing and net oil-exporting countries. The study found a bi-directional causal relationship between crude oil consumption and economic growth in oil-importing countries in the short-run and a unidirectional relationship from crude oil consumption to economic growth in oil-exporting countries. The long-run results however, showed a bidirectional relationship for both oil-importing and oil-exporting countries.

A review of the literature on oil price and economic growth relationship shows there is still a dearth of research on developing countries and particularly SSA countries. Much attention has not been given to African countries and there exists mixed results in the research on developing countries. Hence, this thesis and the modelling framework employed add to the existing literature.

4) Other Studies

Other studies such as the European Central Bank (2016); Rasmussen and Roitman (2011), however, found that the impact of oil prices on oil-importing countries is minimal, or insignificant. Rasmussen and Roitman (2011) found that a 25 percent increase in oil prices would only cause a 0.5 percent, or lower, decrease in GDP. The authors used a global dataset in their analysis.

The European Central Bank in one of its economic bulletins (2016), reported that the aggregate demand growth had been limited in oil-importing countries, despite the gains from lower oil prices. Simulation models from the National Institute Global Econometric

Model (NiGEM), the six-mod version of IMF's flexible System of Global Models and a structural VAR model were employed to examine the relationship between oil prices and the world GDP. Therefore, a 10 percent decrease in oil prices that is driven by supply fluctuations, caused an increase of between 0.1 percent and 0.2 percent in the world GDP. However, a 10 percent decline that is driven by demand fluctuations caused a decrease of more than 0.2 percent in the world GDP. However, if the reasons for the oil price decline have been more because of supply shocks than demand shocks, the models suggest that the combined effect of the two shocks on the world GDP would be close to zero or even slightly negative.

Abeysinghe (2001) stated that higher oil prices would affect both the oil-importing and oil-exporting economies through direct and indirect effects. The statement emanates from an analysis including 10 Asian countries, the USA and the rest of the OECD as a group. The indirect effects are from interactions with trading partners. He concluded that even though the oil price effect may not be significant for large economies like the US, it nonetheless plays a critical role in small open economies. Also, even net oil exporters like Indonesia and Malaysia experienced the negative impact of oil prices through a trade matrix.

Bacon (2005) examined the impact of higher crude oil prices for 131 countries. The study found that the impact was more severe for poorer oil-importing countries compared to developed countries. Therefore, a 10 percent increase in the price of crude oil will cause a 4 percent decrease in the economic growth of countries with GDP per capita below 300US$. If the increase in the price of oil is doubled, then the shock was also doubled. However, countries with GDP per capita of over 9000US$ and higher foreign reserves experienced an average 0.4 percent decrease in their economic growth.

Ghassan and AlHajhoj (2016) examined the volatilities in the OPEC and non-OPEC crude oil prices in the long-run. The study employed threshold autoregressive (TAR) and momentum threshold autoregressive (MTAR) methods of adjustment and the CGARCH method. Results showed persistent price volatility for both OPEC and non-OPEC prices. The short-run also showed similar volatility for both OPEC and non-OPEC prices. There is also the presence of an asymmetric response in the prices for both OPEC and non-OPEC categories. In the case of an oil price increase, OPEC prices adjust more slowly to deviations from long run equilibrium than non-OPEC prices due to the compulsory unified reaction strategy and preference for higher oil price. However, in the case of oil price decrease, OPEC and non-OPEC producers react in similar manner, especially when oil prices are very low.

In the light of studies covered above on the relationship between oil price and economic growth, a variation in the magnitude of the impact of the former on the latter is apparent. It is, therefore, difficult to draw a single conclusion on the impact of oil prices on economic growth. Most research on developed countries is consistent on a negative relationship between oil prices and economic growth. Research on developing countries, however, vary in the direction of impacts. Reasons for the variation in results could be differences in model specifications, variables considered, and monetary policies adopted in developing countries. This implies that the effect of oil price on economic growth varies from one country and region to the other.