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CRUDE OIL PRICE AND GROWTH OF OUTPUT

THE CASE OF GHANA

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Abstract

Crude oil has become an integral part of the Ghanaian economy. This makes the growth of the Ghanaian economy vulnerable to fluctuations in the world price of crude oil, especially when the country still depends largely on imported crude oil to meet her crude oil needs. This study therefore employed the ARDL approach to cointegration to examine the relationship between crude oil price and Ghana's economic growth using annual data set from 1967 to 2012. Unlike previous studies on crude oil price economic growth relationship for Ghana, this study controlled for the effect of fiscal policy in the relationship. This study adopts the neoclassical growth model of Solow. The results of the study indicated the existence of a long run relationship between crude oil price and economic growth in Ghana. Also, the study revealed that oil price increases had a negative impact on economic growth in both the short run and long run and this was reinforced by increases in government expenditure in response to the oil price in the form of fuel subsidies. The policy implications of the study are that fuel subsidies should be removed and the country should consider alternative sources of energy which are cheaper relative to crude oil price.

Keywords: Crude oil Price, Economic Growth, Output, Ghana

INTRODUCTION

Energy is a vital ingredient in achieving sustained growth of every nation and Ghana is not an exception. Sources of energy in Ghana comprise 69.5% biofuels and waste (predominantly used by rural households for cooking), 24.1% crude oil and 6.4% Hydro (International Energy Agency, 2012). Crude oil is the main source of energy for the productive sectors of the Ghanaian economy. It accounts for about 89%, 39% and 99.7% of energy consumption in the agricultural sector, industrial sector and transport sector respectively (Energy Commission, 2006).Consequently, changes in the price and availability of crude oil can have significant impact on the economic growth of the Ghanaian economy. Despite the important role crude oil a play in the Ghanaian economy coupled with rising consumption of the product, the country depends largely on imported crude oil to meet domestic demand for petroleum products. This makes the country very vulnerable to changes in the international price of crude oil. The effect of crude oil price fluctuations on the growth of an economy is transmitted through both supply and demand channels (Jimenez-Rodriguez & Sanchez, 2005). In Ghana, increases in the world price of crude oil is transmitted into the domestic economy through increases in the domestic prices of petroleum products in the country. As a major source of input for the productive sectors of the economy, such increases tend to have serious repercussions on the country's economic growth.

Ghana has experienced poor growth rates in the past during periods of crude oil price hikes. For example, between 1973 and 1983 Ghana experienced an average decline in per-capita GDP of more than 3% a year (Fosu & Aryeetey, 2008). The crude oil price shocks of 1974 and 1979/81 was partly blamed for this economic misfortune (Aryeetey & Harrigan, 2000). Crude oil price during this period, quadrupled from the 1972 price of $2.48 to $11.58 per barrel by 1974. The price of crude oil further increased to $36.83 per barrel by 1980 (British Petrochemical, 2012). It is however difficult to completely attribute the downturns in economic activity during this period to the volatile nature of oil prices. This because the period of poor economic performance in Ghana also coincided with political instability, high levels of corruption as well as high levels of economic mismanagement. This period of economic misfortunes and crude oil price shocks was followed by economic reforms in the country and relatively low crude oil prices. This development ensured that the country enjoyed stable uninterrupted growth with the GDP growth rate averaging 5% year since the inception of democracy in 1993 (Killick, 2010).

This stable trend in economic growth was however disrupted in 2000 and 2008 following high crude oil prices during these periods. With crude oil prices averaging $28.3 per barrel in 2000, domestic prices of crude oil products rose by more than 20%; budget deficit also

increased by 87.7% and economic growth fell from 4.4% in 1999 to 3.7% in 2000 with inflation rising to 40.8%. The nominal exchange rate between the Ghana Cedi and the US dollar depreciated from GH¢0. 35 per dollar in January 2000 to GH¢0. 63 per dollar by December 2000 (World Bank, 2012). Similarly, the country's stable growth trend was also disrupted again in 2008 after the global rise in food and crude oil prices, with crude oil price reaching about $147 per barrel in July 2008. Government's efforts to insulate domestic consumers, at least to some extent, resulted in fiscal deficit. Inflation rate accelerated from 10.9% in 2006 to 12.8%, 18.45%, and 20.75% in 2007, 2008, and 2009 respectively. The exchange rate also depreciated by about 50% against the US dollar between 2008 and the first half of 2009 (Mhango, 2010). On the other hand, crude oil serves as a source of tax revenue and input into domestic production of goods and services. Crude oil therefore contribute to and thereby influence the Gross Domestic Product of the country as a source of energy. Hence, an assessment of the effect of crude oil price on the Ghanaian economy is critical to estimating the growth path of the economy.

Interestingly, related studies on the relationship between crude oil price and economic growth in sub-Saharan African countries especially Ghana are very few (e.g. Olomola & Adejumo, 2006; Akpan, 2009). Studies by Jumah and Pastuszyn (2007) and Tweneboah and Adam (2008) appear to be the only two known studies on Ghana. Moreover, most of these studies did not capture the effects of fiscal policy on the relationship between crude oil price and the growth of the Ghanaian economy. Fiscal policy has been identified as a major channel through which oil price fluctuations affect the growth of developing countries (Bhanumurthy, Das, & Bose, 2012). Also, these studies employed the VAR framework in their analysis. However, Kilian and Vigfusson (2011) demonstrated that oil price VAR models are fundamentally misspecified and this renders the parameter estimates inconsistent and inference invalid. It is against this background that this study seeks to investigate the relationship between crude oil price and economic growth in Ghana employing the newly developed autoregressive distributed lag (ARDL) approach to cointegration.

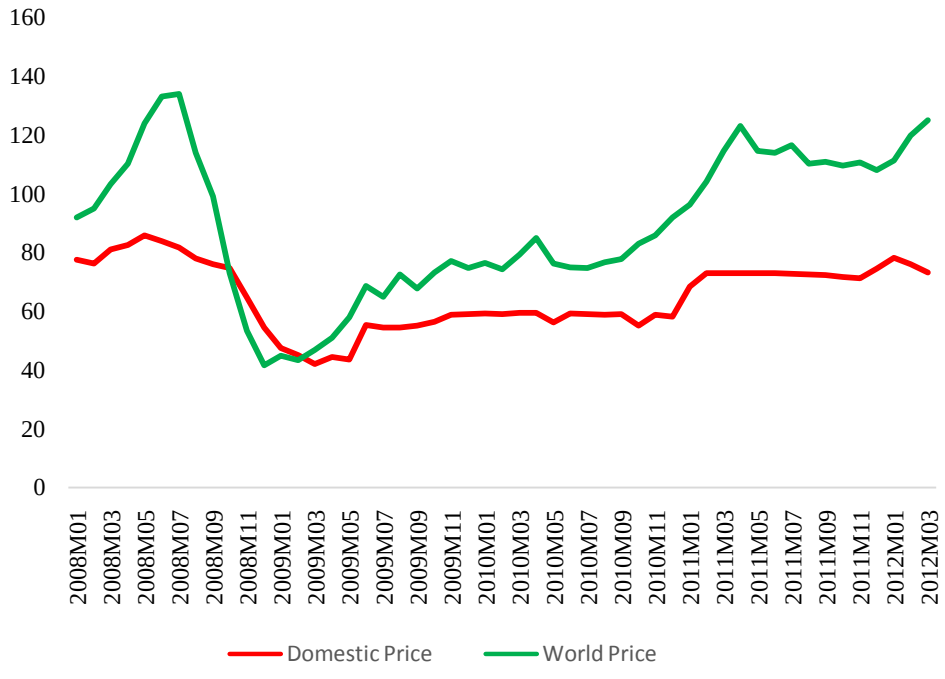
The rest of the paper is organised as follows. Section 2 explores the relationship between crude oil price and the Ghanaian economy with specific emphasis on fuel subsidies. In section 3 we examine the theoretical and empirical literature on oil price and economic growth. Section 4 goes further to present the sources of data and methodology used for the study. Section 5 discusses the results and presents summery and conclusions of the study while section 6 presents the recommendations and policy implications of this study.

CRUDE OIL PRICE AND THE GHANAIAN ECONOMY

Ghana's macroeconomic performance has been associated with high and low points over the years. The period between 1973 and 1983 can be described as the dark years of the Ghanaian economy. The country within this period experienced a downward spiral in economic growth,high rates of inflation, shortage of goods and services among others. Industrial output during this period fell by 12.5%, budget deficit increased by 44.94%, total money supply climbed to over 500% cumulatively with inflation rate reaching 117% by 1977 (Hutchful, 2002; Fosu and Aryeetey, 2008). This period as indicated earlier coincided with the first two oil price shocks experienced by the world economy as well as periods of political instability and economic mismanagement in Ghana.

Huge budget deficits in the past have been attributed to the provision of fuel subsidies by the government and this tend to have some negative effect on the Ghanaian economy. Periods of poor economic growth in the country was usually preceded by increases in the price of crude oil and huge fiscal deficits in the economy. Ocran (2007) maintains that, a major cause for the huge fiscal deficits can be attributed to failure of the government to adjust domestic price of petroleum products to reflect the increase in the world price of crude oil.

Figure 1 Domestic Price of Oil and World Price



Source: National Petroleum Agency and Global Economic Monitor (GEM) Commodities (2014)

Similarly, a report by the Centre for Policy Analysis (CEPA) (2007) indicated that the public expenditure and currency crises of 2000 which continued into 2001 and 2002 was as a result of the continual increase in the international price of crude oil and the failure of government to pass it on to the consumer. Thus, the decision by the government to absorb increases in crude oil prices through subsidies rather than allowing for automatic price adjustments meant that the government expenditure exceeded its targets in those years. The cost of crude oil subsidies rose to about 2% of GDP by 2002. In January 2003, the government introduced a pricing formula that linked domestic prices to world prices in order to reduce the burden on the government in terms of subsidies. However for political expediency, the automatic adjustment was deserted and further increases in the world price of crude oil were not passed on to consumers but rather absorbed by the government through its expenditure. Despite high world oil prices that rose above $50.00 in 2004, the government maintained the low price and ended up subsidizing crude oil products to the tune of $200 million, representing 2.5% of GDP (Ocran, 2007). The government spends an average of $432 million annually on the subsidization of petroleum products in the country. Utility and fuel subsidies cost the government an amount of GH¢809.0 million in 2012, with an additional amount of GH¢955.8 million due to be paid in 2013 (Ministry of Finance and Economic Planning, 2013). Figure 1 below gives a graphical view of the variations in the world price of crude oil and the price that is paid by domestic consumers in Ghana. As indicated in Figure 1, the prices paid by Ghanaians with regards to oil is far below the world price and this gives an indication of the amount that is paid by the government in the form of oil price subsidies.

It is important to mention that, the option to raise the subsidy, although politically popular, could also have adverse effects on the growth prospects of the economy. Large subsidies on domestic petroleum price may redirect public expenditure away from more productive expenditures or can contribute to unsustainable budget deficits. A rise in a subsidy is obviously an increase in government spending. If, as a reaction to higher government expenditure, taxes are not raised or other government expenses cut down to balance the actual trend, the government will have to face a higher budget deficit.

Generally, governments of developing countries are faced with three possibilities to finance their expenditure. These are, to print additional currency, to issue public debt or borrow from domestic financial institutions and through foreign borrowing. The Government of Ghana has in the past financed subsidies through borrowing from the domestic financial marketor through the printing of money. Borrowing from the domestic financial market may result in the crowding out of private investment and may adversely affect growth of the economy. Also the printing of additional currency may increase inflationary pressures on the economy. Akçay et al.

(2002) argue that, even when a central bank does not monetise the deficit, adjustments in the private sector to higher deficit policies may very well lead to inflation. According to the Bank of Ghana (2004), the predicament of an oil price surge for central banks is that it is often problematic from a stabilisation policy viewpoint, in the sense that higher oil prices not only push up inflation (thus calling for a rise in interest rates), but also dampen growth (necessitating rates to be lower than otherwise). Hence there is the need to examine the relationship between crude oil price increases and the growth of the Ghanaian economy given the level of subsidies on the product in terms of for the effect of fiscal policy response.

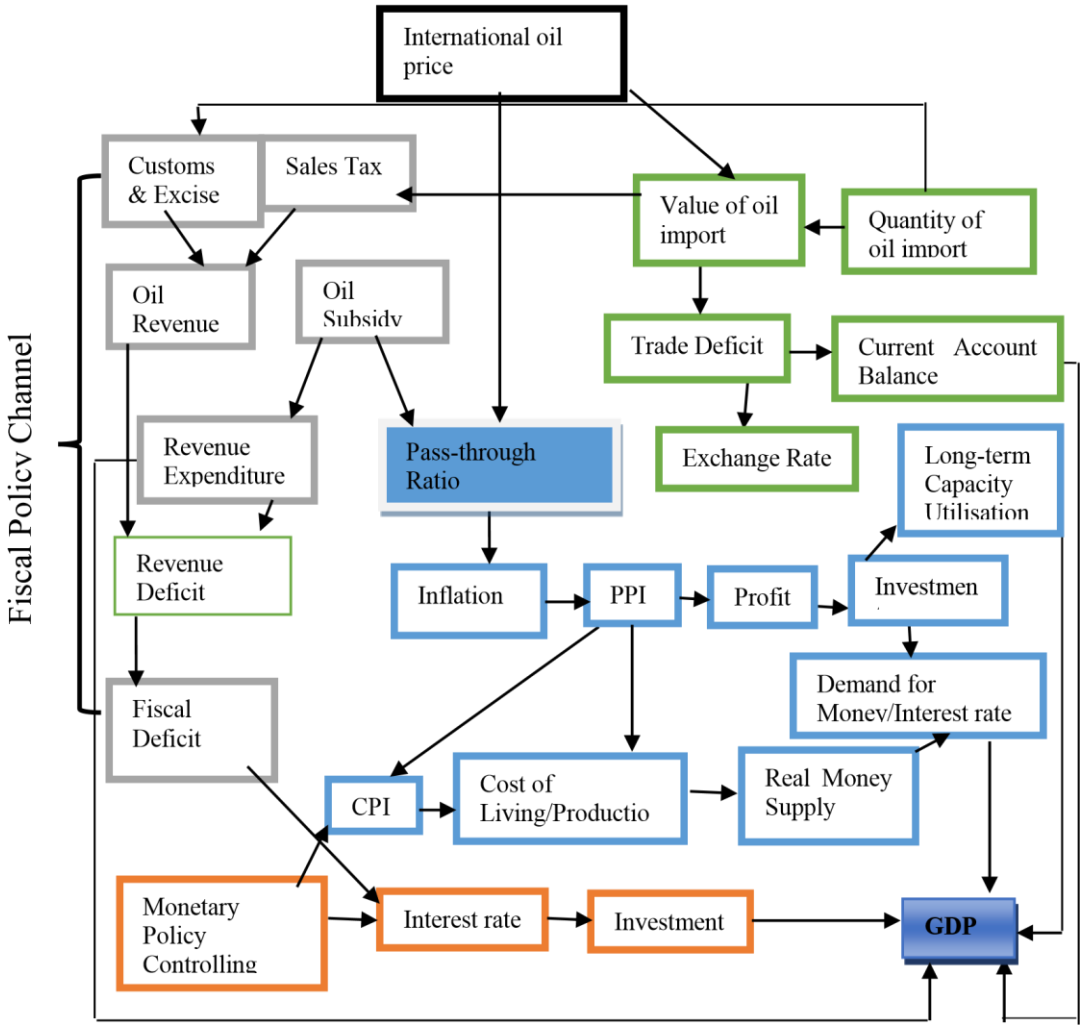
REVIEW OF RELATED LITERATURE

The relationship between oil price and economic growth has received a plethora of theoretical and empirical research over the past decades but have however focused largely on the on USA and other developed economies of the world. Earliest theoretical works on the relationship between crude oil price and economic growth includes works done by Rasche and Tatom (1977), Bernanke (1983) Finn (2000) and more recently Hamilton (2009).

Rasche and Tatom (1977) argued that oil price fluctuations can be an important indicator of a supply-side shock that reduces the potential output of an economy. Thus a rise in the price of crude oil indicates an increase in the scarcity of energy, which is a basic input of production. Consequently, even if all resources in an economy are fully employed and efficiently used, the potential to produce is reduced because in economic terms, crude oil has become scarcer. The growth of output and productivity are therefore reduced. Bernanke (1983) elaborated on the capital equipment utilisation hypothesis. Bernanke (1983) demonstrated in a partial equilibrium model that oil price shocks would tend to reduce value added, because firms will defer irreversible investment decisions as they endeavour to find out whether the increase in oil price is transitory or lasting. Thus, producers will find it more and more desirable to postpone permanent investment decisions when they are uncertain about future crude oil price changes. Such decisions is also likely to negatively affect the growth of output of an economy. Finn (2000) also formulated a model with perfectly competitive markets, but integrated energy as an essential input for the utilization of capital. The model considers variations in the utilisation rates for productive capital as a function of energy use. This creates an indirect channel (that works through capital stock) and the usual direct production function channel, for channelling the impact of fluctuations in energy usage to the economy. Crude oil price increase or shock causes sharp, simultaneous declines in energy use and capital utilisation. The reduction in the use of energy works through the representative firm's production function directly; this causes a reduction in output and labour's marginal productivity. Based on a survey of literature, Hamilton

(2009) maintains that a key mechanism through which oil price shocks affects an economy is through disruption in the expenditure of consumers and firms on non-oil goods and services. However, if this disruption does not occur, the effects of an oil price hike on the economy will be governed by the factor share argument.

Figure 2: Transmission channels of oil price changes



Source: Adapted from Chuku et al. (2010) and Bhanumurthy et al. (2012)

Various channels through which changes in the price of crude affects the growth of an economy have been identified in the literature on crude oil and economic growth. Channels identified in the literature includes the supply and side effect, inflation effect, and the real balance effect (Brown & Yücel, 2002: Jiménez-Rodríguez & Sánchez, 2005: Chuku ,Effiong, & Sam, 2010 and Bhanumurthy, Das, & Bose, 2012). Figure 2 illustrates the channels of transmission from oil price increase to growth of GDP.

Assuming that the demand for crude oil is inelastic to changes in the price level, an increase in the international price of oil for example, will translate to higher import bill for net oil importing economies, ceteris paribus. This situation will result in a higher trade deficit and consequently cause a deterioration of the country's current account balance. This will eventually result in lower economic growth rates. This channel (Import Channel) is indicated in Figure 2 by the link from international oil price to the current account balance to GDP.

The second channel through which an increase in the international price of oil can affect an economy is through an increase in the domestic price of the commodity (the Price Channel). For most developing countries, not all the increase in the international price of crude oil is passed on to domestic consumers of the commodity. The government in the form of fuel subsidy usually absorbs part of the price increase. This is indicated in Figure 2 by link between oil subsidy and pass-through ratio. Similarly, due to changes in the terms of trade that is likely to occur as a result of the oil price increase, the country's exchange rate will be affected and this is likely to affect the prices of commodities in the domestic market. This is also indicated by the link between the exchange rate and pass-through ratio. This implies that only a portion of the price increase (Pass-Through Ratio) will be passed onto the domestic market. The proportion that is passed onto the domestic market will cause a rise in the level of inflation and subsequently lead to a rise in the cost of production. This results in a reduction in profit levels and consequently, lead to a reduction in investment and employment and GDP growth. In Figure 2, this is indicated by the link from international oil price to inflation, producer price index (PPI), investment to long-term capacity utilization and interest and then to GDP.

On the demand side, high oil price causes prices of consumer goods to increase. Real money supply falls as demand for money also increases. This leads to a rise in interest rates. Monetary authorities may also respond to the increase in price levels by tightening monetary policy (raising interest rates). High interest rates discourage investment and this tends to affect GDP as indicated in Figure 2.

In the absence of complete pass through (which is the case for most African countries as indicated by African Development Bank (2009)), an oil price increase will raise subsidy on oil and for that matter, on government expenditure. It is important to mention, however that, most oil price increases are not predictable, hence oil price subsidies may result in budget deficits. If the deficit is financed from domestic sources (through borrowing from the domestic financial market), then it is likely that, it leads to the crowding out effect. This situation is indicated by the link between fiscal deficit and interest rates. Thus, government borrowing from domestic sources to finance the fuel subsidy will lead to high interest rate and consequently cause investment levels to fall.

Empirical Literature

Although, a number of empirical studies on the relationship between crude oil price and economic growth exist, most of such studies have largely focused developed economies. Very little empirical literature exist on net oil importing economies in sub-Sahara Africa. More so, very little exist on an emerging oil exporting countries like Ghana in the literature. The relationship between crude oil price and economic growth varies depending on a country's sectorial composition, institutional structures, and macroeconomic policies among others (Chuku *et al.* 2010).

Studies focusing on developed economies (see for e.g.Hamilton J. D., 1983: 1996: 2010; Lee, Ni and Ratti 1995; Hooker 1996; Jimenez-Rodrigues and Sanchez 2005; Schmidst and Zimmermann, 2007; Filis and Chatziantoniou 2013) have revealed that, crude oil price increases tends to have adverse effect on industrial output and economic growth. Nevertheless, they all concluded that this relationship has not been stable for these countries over time. The unsteady relationship that had been perceived in the literature was confirmed in a study by Blanchard and Gali (2007) who compared the present response of inflation and output to oil price shocks in a group of developed economies to those in the 1970s. Blanchard and Gali (2007) concluded that the main cause behind the weak responses of economies in recent years is smaller energy intensity, a more flexible labour market and improvements in monetary policy.

On the other hand, studies on the crude oil price economic growth relationship for developing economies have reported varied results. Chang and Wong (2003) examined the effects of oil price fluctuations on the Singaporean economy and found an insignificant negative relationship between oil price shocks and Singapore's gross domestic output, inflation and unemployment rate. On the contrary, studies by Olomola (2006), Akpan (2009) and Oriakhi and Osaze (2013) have all found a positive relationship between oil price increases and growth of output in Nigeria (possibly because Nigeria is a net exporter of crude oil), studies by Wakeford (2006), and Bouzid (2012) have all found a negative relationship between oil price and economic growth for South Africa and Tunisia respectively.

Focusing on studies on Ghana, Jumah and Pastuszyn (2007) investigated the relationship between oil price shocks and monetary policy in Ghana for the period 1965 to 2004. The objective of the study was to examine the relationship between the world price of crude oil and aggregate demand in Ghana via the interest rate channel by means of cointegration analysis. The study did not identify a direct significant relationship between output and crude oil price changes, however, the study found that the international price of crude directly affected the price level which tends to negatively affect real output. The results also indicated that monetary policy is initially stilled in response to an increase in the price of oil in order to lessen

any growth effects but at the cost of higher inflation. The resultant higher inflation, however stimulates a further tightening of monetary policy. In addition, the output does not revert quickly to its initial level after an oil price shock, but declines over an extended period.

Similarly Tweneboah and Adam (2008) estimated a vector error correction model to explore the long run and short run linkages between world crude oil price and monetary policy in Ghana for the period 1970:1 to 2006:4. The results of the study indicated that there is a long run relationship between oil price, domestic price level, GDP, exchange rate and interest rate in Ghana in which oil price positively impact the price level while negatively impacting output. The study also revealed that an unexpected oil price shock is followed by an increase in inflation rate and a decline in output in Ghana. On the response of interest rate to a rise in the price of oil, Tweneboah and Adam argued that monetary policy has in the past been with the purpose of reducing any growth consequences of oil price shocks but at the cost of higher inflation.

The problem with these two studies is that, both failed to examine the intervening effect of fiscal policy on the relationship between oil price and the growth of output in Ghana. Fiscal policy response have however been identified by Bhanumurthy, *et al.*(2012) as a major channel through which changes in the international price of crude oil affects the growth of most developing countries. In Ghana, government spends an average of US$432 million year on fuel subsidies only, this is likely to have a significant impact on the relationship between oil price and economic growth in Ghana. In addition, these two studies used the VAR framework in their estimations, Kilian and Vigfusson (2011) demonstrated that oil price VAR models are fundamentally misspecified and this renders the parameter estimates inconsistent and inference invalid. The contribution of this study to the existing literature on the relationship between oil price and the growth of output is that, it examine this relationship in the face of fuel subsidies and also uses the ARDL approach to cointegration, identifying how fiscal policy influence the relationship between oil price and economic growth and converting international price of crude oil into the domestic currency.

METHODOLOGY

Sources of Data

The study employed annual dataset from 1967-2012 to investigate the existence of long run relationship between crude oil price and economic growth as well the short-run dynamics in the case of Ghana.Data on the main variable of interest (GDP, Consumer Price Index, Money Supply, Labour force, Investment, Government expenditure and Exchange rate) was obtained from the World Development Indicators 2013 edition of the World Bank. Data on international crude oil prices was obtained from the BP statistical review 2013.

Variables of choice

The following set of potential determinants of economic growth are derived from a survey of existing theory and empirical literature and used in our study: International crude oil price, Government expenditure, an interaction between oil price and government expenditure, consumer price index, money supply, exchange rate, labour supply and investment. Their definitions and measurements are discussed in turns.

International Price of Crude oil

From the literature crude oil price is usually hypothesized to affect economic growth as a basic input of production (Jiménez-Rodríguez & Sánchez, 2005). In order to capture the effect of oil price on the growth of the Ghanaian economy, the study used Brent Crude oil prices provided by the BP statistical review. Since the increase in crude oil prices as indicated in the literature adversely affects investment and output, a negative relationship between oil price and economic growth is expected to be negative.

Government Expenditure

Government expenditure refers to general government spending at any level. Government expenditure is used in this study as a policy variable and also as a major determinant of GDP. Following the works of Easterly and Rebelo (1993); Doh-Nani (2011) and Ayibor (2012), the ratio of government expenditure to GDP is used in the study. The Keynesian proposition suggests that government expenditure will result in a rise in economic growth. Government expenditure could however; result in a reduction in economic growth because of the crowding out effect on private investment and the inflationary pressures it can lead to (Allen & Ndikumana, 2000).

Interaction between oil price and government expenditure

For the purpose of this study and to control for the effect of fiscal policy response to changes in the price of crude oil, the study interacted crude oil price with government expenditure. This variable is included in the study to account for the fiscal policy channel through which oil price fluctuations affect economic growth. The idea is that the impact of oil price fluctuations on the Ghanaian economy may be influenced by government expenditure. West African Monetary Agency (2008) and Bhanumurthy *et al.* (2012) noted that, high oil price results in higher government spending in most developing countries due huge subsidies on petroleum products. In Ghana for example, crude oil related products such as petrol, kerosene, liquefied petroleum gas (LPG) and diesel are usually subsidized by government in order to reduce the possible

effect of the high crude oil price on the poor. Due to the volatile nature of oil prices in the world market, it becomes very difficult for the government to adequately plan its subsidies for the commodity. For this reason the government may resort to domestic borrowing and this may adversely affect the growth of the economy through high interest rates and crowding out of investment.

Consumer Price Index

Consumer Price Index (*CPI*) is a measure that captures the changes in the price level of a market basket of consumer goods and services purchased by the household. In this study, the CPI is employed to control for the effect of high oil price on domestic goods and services. High oil price may result in a rise in the general price level and this may be detrimental to economic growth. Rapid increases in the general price level of the economy may result in uncertainty about the future profitability of investment projects. This is because, higher prices of consumer goods and services may dampen demand for goods and services in the economy and for this reason, investors may resort to more conservative investment strategies than would otherwise be the case, eventually leading to lower levels of investment and economic growth.

Money Supply

Money Supply is the total amount of monetary assets available in an economy at a specific time. These comprise the sum of currency outside banks, demand deposits other than those of the central government, as well as savings and other time deposits (World Bank, 2012). Following Bernanke's *et al.* (1997) influential paper, the present study includes money supply to capture the influence of the monetary policy in response to changes in the price of crude oil. This is because the central bank may respond proactively or reactively to fluctuations in oil price, which in turn may affect the growth of the economy.

Exchange Rate

Demand for crude oil is relatively inelastic, hence the increase in oil prices increases expenditure on imports by the oil importing country. This may result in an increase in the supply in the local currency, thus weakening the currency relative to foreign currencies. The weakened currency will increase the burden of payments and lead to balance of payment problems and reduction in other imports, which will ultimately affect economic growth. Hence the inclusion of exchange rate in the model. This study uses official exchange between the Ghana and the US dollar as a measure of the exchange rate as was used by (Jiménez-Rodríguez & Sánchez, 2005). Exchange rate depreciation may lead to increase in the export of goods and services

since goods produced in the economy become relatively cheap. This will have a positive impact on economic growth. Depreciation of the domestic currency may also result in the reduction of imports. However, the impact of exchange rate depreciation on the economy may depend on the balance of payment position of the country.

Investment

The study follows the work of Fosu and Aryeetey (2008) and uses Gross fixed capital formation as a proxy for investment in this study. Gross fixed capital formation is defined as the total value of additions to fixed assets by domestic enterprises, *less disposals* of fixed assets during the year, *Plus* additions to the value of non-produced assets such as discoveries of mineral deposits, plants, machinery, and equipment purchases; and the construction of infrastructure and commercial and industrial buildings (Baafi, 2010). Investment is included in the model because, fluctuations in crude oil prices lead to a rise in the level of uncertainty which subsequently results in the deferral of irreversible investment which in turn affect real GDP growth. It is important to note however that high rate of investment results in high economic growth (Barro & Sala-I-Martin, 1992).

Labour

Labour force (*L*) consists of the proportion of the population that is economically active. In this study, the proportion of the total population aged between fifteen (15) years and sixty-five (65) years who are active and productive is used as a proxy for the labour force. Jayaraman and Singh (2007) argued that, there can be no growth without the involvement of labour. Solow (1956) and Swan (1956) also recommended that labour force should be incorporated in the growth model because of its impact on the work force, hence the inclusion of labour force in the study. All things being equal, the higher the labour force the higher the supply of labour and hence output.

Economic Reform

Economic Reform Dummy is used in the study to capture the possible influence of economic reforms on economic growth in Ghana. It takes the value of zero (0) for the pre-economic reform period and one (1) for periods after the economic reforms. (.I.e. Zero for the period 1970 to 1982 and one for the period 1983 to 2012). Since the purpose of economic reforms in Ghana was to reduce Ghana's debts and to improve its trading position in the global economy as well as restoring economic productivity at minimum cost to the government, this variable is expected to have a positive impact on the growth of real GDP.

Theoretical Model Specification

Since the objective of these study is to examine the relationship between growth of output and oil price, following Rasche and Tatom (1977), the study adopts the Solow growth model as specified below.

$$Y_t = f(K_t, A_t L_t, \ell) \quad (1)$$

Where *Y* is output per capital, *A* is the total factor productivity or the Solow Residual, *K* is capital stock,*L*is labour force and ℓ is the naperian "e"Applying the Cobb-Douglas production function, Solow stated the equation

$$Y_t = K_t^{\alpha_t}, (A_t L_t)^{\beta_t} \ell^{\varepsilon_t} \quad (2)$$

It is important to note that *A* is not fixed, but varies with different production functions based on the factors being studied. This production function is widely used in literature; including Rasche and Tatom (1977a); Ram and Ramsey (1989);Fosu (1990), and Fosu and Aryeetey (2008). Apart from the traditional input of production, the model also assumes other conventional inputs.

Empirical Model

This section presents the empirical model to be estimated. From existing theory and empirical literature, the following are the general working hypotheses*: International oil price increases has a negative effect on the growth of output, however this effect is reduce by expansionary fiscal policy in response to the increase in the price of crude oil.* Thus an increase in the price of crude oil is likely to cause output levels in the economy to fall due to its effect on the cost of production. However the study hypothesise that an increase in government expenditure in response to the increase in the price of crude oil price will help reduce the negative impact of oil price increases on the growth of output.

This study adopts the neoclassical growth model of Solow, which is specified in equation (2) above. It is important to mention that, literature on economic growth indicates that, there are multitudes of potential variables that can affect the TFP (*A*) in equation (2). However, owing to the availability of data and following Rasche and Tatom (1977a), Ram and Ramsey (1989), the study examined the following variables of interest resulting in:

$$A_t = f(O_t, G_t, EXC_t, CPI_t, MS_t, OG_t, DR_t) \quad (3)$$

This implies that :

$$A_t = O_t^{\beta_1}, G_t^{\beta_2}, EXC_t^{\beta_3}, CPI_t^{\beta_4}, MS_t^{\beta_5}, OG_t^{\beta_7}, DR_t^{\beta_8} \quad (4)$$

Where *O* is real crude oil price, *G* is government expenditure, *EXC* is bilateral exchange rate between the Ghana cedi and the US dollar, *CPI* is consumer price index, *MS* is the money supply, *OG* is the interaction between oil price and government expenditure, and DR is dummy for economic reforms. Ghana under took an economic reform programme in 1983 which resulted in some changes in the structure of the economy and hence we try to control for this changes in the economy. By substituting equation (4) into (2) and by specifying an extended Cobb-Douglas production function to represent the production of technology of an economy, the study obtains;

$$Y_t = \eta K_t^{\alpha}, O_t^{\beta_1}, G_t^{\beta_2}, EXC_t^{\beta_3}, CPI_t^{\beta_4}, MS_t^{\beta_5}, L_t^{\beta_6}, OG_t^{\beta_7}, DR_t^{\beta_8} \ell^{\varepsilon_t} \quad (5)$$

By taking the logarithm of the variables involved in the equation (5):

$$lnY_t = \ln\eta + \alpha lnK_t + \beta_1 lnO_t + \beta_2 lnG_t + \beta_3 \ln EXC_t + \beta_4 lnCPI_t + \beta_5 lnMS_t + \beta_6 L_t + \beta_7 lnOG_t + \beta_8 DR_t + \varepsilon_t ln\ell \quad (6)$$

Let $\ln\eta = \beta_0$ and $ln\ell = 1$, equation (6) can therefore be written as:

$$lnY_t = \beta_0 + \alpha lnK_t + \beta_1 lnO_t + \beta_2 lnG_t + \beta_3 \ln EXC_t + \beta_4 lnCPI_t + \beta_5 lnMS_t + \beta_6 L_t + \beta_7 lnOG_t + \beta_8 DR_t + \varepsilon_t \quad (7)$$

The coefficients $\boldsymbol{\alpha, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, and\ \beta_8}$ are the elasticities of the respective variables, $\boldsymbol{\beta_0}$ is the drift component, *t* denotes time and ε is the error term.

Since the emphasis of this study is to examine the relationship between crude oil price and economic growth, the suitable technique to adopt is a cointegration analysis and error correction modeling. Consequently, the study employed the Autoregressive Distributed Lag (ARDL) approach by Pesaran and Pesaran (1997), Pesaran and Shin (1999) and Pesaran, Shin, and Smith (2001). This approach has some econometric advantages over the other cointegration techniques. First, the ARDL technique does not require pre-testing of the series to ascertain their order of integration since the test can be conducted irrespective of the other of integration. In addition, ARDL modeling incorporates adequate number of lags to capture the data generating process from general to specific modeling framework (Laurenceson and Chai, 2003

as cited in Shrestha and Chowdhury, 2005). Furthermore, the bounds test approach to cointegration gives more robust results in small samples than the Johasen approach. Thus, the ARDL approach to cointegration is more efficient in finite samples compared with the Johansen approach that requires large data samples for one to get a valid result (Pesaran & Shin, 1999). Also, the problem of endogeneity is addressed in this technique. Pesaran and Shin (1999), argued that modeling the ARDL with the appropriate lags will adjust for both serial correlation and endogeneity problems. Jalil, Ma, and Naveed, (2011) contend that endogeneity is less of a problem if the estimated ARDL model is free of serial correlation. The problem of endogeneity is primarily important since the causal relationship between financial development and economic growth cannot be ascertained beforehand. The use of the ARDL approach is further justified by the relatively small sample size of our dataset covering annual dataset from 1967 to 2012. The ARDL approach is therefore, considered to be very suitable for analysing the underlying relationship. Hence, we specify the ARDL representation of equation (3) as:

$$\Delta lnY_t = \beta_0 + \lambda lnY_{t-1} + \alpha lnK_t + \beta_1 lnO_t + \beta_2 lnG_t + \beta_3 lnEXC_t + \beta_4 lnCPI_t + \beta_5 lnMS_t$$
$$+\beta_6 L_t + \beta_7 lnOG_t + \sum_{i=1}^{P} \gamma \Delta lnY_{t-i} + \sum_{i=1}^{P} \varphi \Delta lnK_{t-i} + \sum_{i=1}^{P} \phi_{1i} \Delta lnO_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta lnG_{t-i}$$
$$+ \sum_{i=1}^{P} \phi_{3i} \Delta lnEXC_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta lnCPI_{t-i} + \sum_{i=1}^{P} \phi_{5i} \Delta lnMS_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta L_{t-i-}$$
$$+ \sum_{i=1}^{P} \phi_{7i} \Delta lnOG_{t-i} + \upsilon_t \qquad (8)$$

Where Δ denotes the first difference operator, *P* is the lag order selected by the Schwarz Bayesian Criterion (SBC), $\beta_0$is the drift parameter while υ_t is the error term which is$N(0, \delta^2)$. The parameters γ, φ and ϕ_{ij} are short-run parameters and $\lambda, \alpha \; and \; \beta_{ij}$ are the long-run multipliers. All the variables are defined as before. The study estimated equation (4) with the bounds test by employing the OLS method, which is normally the first procedure in the ARDL model. The F-test was used to test for the presence of long-run relationship among the variables in equations (8). The null hypotheses of no long-run relationship among the variables in equations (8) is tested against the alternative hypotheses of a long- run relationship as follows:

$H_0: \alpha = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$
$H_1: \alpha \neq \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 = 0$

The existence of cointegration among the variables under consideration is tested based on the F-statistic. Given that, the asymptotic distribution of the F-statistic is non-standard without considering the independent variables being I (0) or I (1), Pesaran and Pesaran (1997) have provided two sets of critical values for the different numbers of regressors (k), and whether the ARDL model contains an intercept and/or trend. Therefore, the calculated F-statistic is compared with these sets of critical values developed on the basis that the independent variables are I(d) (where $0 \leq d \leq 1$). The lower critical bound assumes that all the variables are I (0), meaning that there is no cointegration among the variables, while the upper bound assumes that all the variables are I (1). So if the calculated F- statistic falls outside the upper critical value, then a null hypothesis of no cointegration will be rejected regardless of whether the variables are I (0) or I (1) implying a long- run relationship among the variables. Provided that cointegration has been established from the ARDL model, the long run and error correction estimates of the ARDL and their asymptotic standard errors are then obtained.

$$\ln Y_t = \mu + \sum_{i=1}^{P} \lambda lnY_{t-i} + \sum_{i=1}^{P} \alpha lnK_{t-i} \sum_{i=1}^{P} \beta_1 lnO_{t-i} + \sum_{i=1}^{P} \beta_2 lnG_{t-i} + \sum_{i=1}^{P} \beta_3 lnEXC_{t-i} + \sum_{i=1}^{P} \beta_4 lnCPI_{t-1} + \sum_{i=1}^{P} \beta_5 lnMS_{t-i} + \sum_{i=1}^{P} \beta_6 L_{t-1} + \sum_{i=1}^{P} \beta_5 lnOG_{t-i} + \beta_8 DR_t + \upsilon_t \quad (9)$$

The ARDL error correction representation of the series is also estimated as

$$\Delta lnY_t = \phi_0 + \sum_{i=1}^{P} \gamma lnY_{t-i} + \sum_{i=1}^{P} \varphi \Delta lnK_{t-i} + \sum_{i=1}^{P} \phi_{1i} \Delta lnO_{t-i} + \sum_{i=1}^{P} \phi_{2i} \Delta lnG_{t-i} + \sum_{i=1}^{P} \phi_{3i} \Delta lnEXC_{t-i} + \sum_{i=1}^{P} \phi_{4i} \Delta lnCPI_{t-i} + \sum_{i=1}^{P} \phi_{5i} \Delta lnMS_{t-i} + \sum_{i=1}^{P} \phi_{6i} \Delta L_{t-i} + \sum_{i=1}^{P} \phi_{7i} \Delta lnOG_{t-i} + \phi_8 DR_t + \xi ECT_{t-1} + \epsilon_t \quad (10)$$

Where ξ is the speed of adjustment of the parameter to long-run equilibrium following a shock to the system and ECT_{t-1} is the residuals obtained from equations (9). The coefficient of the lagged error correction term ξ is expected to be negative and statistically significant to further confirm the existence of a cointegrating relationship among the variables in the model.

EMPIRICAL RESULTS AND DISCUSSIONS

Unit roots test results

Before carrying out the ARDL or Bounds test to cointegration, and the Granger-causality test, unit roots test was first conducted in order to examine the stationarity properties of the variables in the study. While the ARDL approach to cointegration does not necessitate the pretesting of the variable for unit roots, it is imperative to perform unit roots test to verify whether the variables are not integrated of an order higher than one, to avoid spurious results. This is necessary, because the computed F-statistics provided by Pesaran *et al.* (2001) are not valid in the presences of *I* (2) variables. The results from the unit roots test indicates that all the variables of interest are integrated of order one (*I*(1)).

Table 1: Test for order of Integration (using Eviews)

	ADF-Test Statistic (with Intercept)		PP-Test Statistic (with Intercept)	
Variable	Levels	First Difference	Levels	First Difference
LY	3.4048	-3.8728***	3.2281	-3.8902***
LO	-2.1238	-6.2498***	-2.1286	-6.2198***
LCPI	-1.5035	-3.7692***	-1.1113	-3.8212***
LREER	3.1227	-4.0142***	-1.3314	-3.6420***
LMS	0.1587	-5.6186***	0.1451	-5.5939***
LG	-0.4633	-4.9087***	-0.6089	-4.7527***
LOG	-0.9269	-5.3184***	-0.9367	-5.3525***
LL	-1.5039	-5.0169***	-1.7346	-3.6706***
LK	-0.2445	-6.2163***	-0.1536	-6.2277***

Bounds Test

The study then proceeded to estimate equation (8) in order to examine the long-run relationships among the variables. Due to the fact that the sample size for the study is small and given that the study employed annual data, a lag length of two (2) is used in the bounds test. Pesaran and Shin (1999) proposed that, a maximum lag length of two (2) for annual data should be used in the bounds testing approach to cointegration. After the determination of the lag length, the F-statistic that is computed within the framework of the Unrestricted Error Correction Model (UECM) was compared with the lower and upper critical values in Pesaran and Pesaran (2009). Table 2 reports the bounds test results for Real GDP (LY). From Table 2, the F-statistic for the model with Real GDP (*LY*) as the dependent variable is$F_{LY}(.)$ = 3.1651. It exceeds the upper critical bound at ten percent significance level. This means that the null hypothesis of no cointegration among the variables in equation (8) is rejected. This suggests the existence of a long-run relationship between economic growth and its explanatory variables.

Table 2: Bounds test for the existence of cointegration

Critical Value Bounds Intercept with no trend	90% Level		95% Level		99% Level	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
K=8	**1.956**	**3.085**	2.272	3.447	2.848	4.126
Dependent Variable						**F-Statistic**
F(LY) = F(LY | LO, LCPI, LEXC, LMS, LG, LOG, LLF, LK)						**3.1651**

Note: K is the number of regressors.

Estimated from WDI (2012) and BP Statistical Review data using Microfit 4.1 package; the critical values are obtained from Appendix B Case II, statistical tables of Pesaran and Pesaran (2009).

Long run estimates

Since the results of the cointegration analysis indicate the existence of a long run relationship between economic growth and the explanatory variables in the study, the study proceeded to estimate the long run impact of the explanatory variables on economic growth using the ARDL framework. Long run estimates of the ARDL model in Table 3 reveal that, crude oil price, consumer price index and the interaction term (oil price and government expenditure) have a negative impact on the growth of output at ten (10), one (1) and five (5) percent significance level respectively. This result is in line with the expectations of the study.

Table 3: Long Run Model

Variables	Coefficient	Standard Error
LO	-0.0390*	0.0211
LG	0.2782**	0.1069
LREER	0.0344*	0.0170
LCPI	-0.0044***	0.0009
LMS	0.0030	0.0499
LOG	-0.0648**	0.0270
LK	0.0537**	0.0229
L	0.0359**	0.0142
DR	-0.0104	0.0678
C	19.6846***	2.2921

*Note: ***, ** and * denotes significance at 1%, 5% and 10% respectively*
Estimated from WDI (2012) and BP Statistical Review data using Microfit 4.0 package

On the other hand, government expenditure, bilateral exchange rate, labour force and capital stock, had a positive impact on the growth of output as expected. However, the long run estimate of the money supply was insignificant, though positive as expected. It is important to note that Table 3 presents a regression with an interacting term as postulated by Wooldridge (2009). Wooldridge (2009) argues that a regression equation that involves an interaction term must be interpreted with extreme care. This is because the marginal effects of the interacted

variables must not be considered in isolation. The marginal effect of oil price on real GDP, for example, must be interpreted by taking into account the effect of government expenditure as well. The long-run estimates indicate a negative relationship between crude oil price and growth of output. The coefficient of crude oil price (*LO*) in Table 3 is negative and statistically significant at ten percent. From Table 3, the effect of oil price on growth of output is given by,

$$\frac{dLY}{dLO} = -0.039046 - 0.064818LG \qquad (11)$$

To get the actual effect of oil price increases on the growth of output, the study follows Wooldridge (2009) and plugs in the mean value of government expenditure, as indicated in appendix 1, into equation (11).

$$\frac{dLY}{dLO} = -0.039046 - 0.064818(20.83210) = -1.3893 \qquad (12)$$

This means that, one percent increase in the price of crude oil will cause real GDP to fall by 1.3893 standard deviations from the mean value of real GDP. This implies that government efforts to reduce the impact of high oil prices on the consumers through increased subsidies reinforces the negative impact of oil price increases on the growth of output. This implies that, the study fails to accept the null hypothesis that increases in government expenditure in response to oil price increasing has a reducing effect on the negative effect of oil price increase on the growth of output in the Ghanaian economy. One possible reason for this is that, large subsidies (via increase in government expenditure) on domestic petroleum price may redirect public expenditure away from more productive expenditures which may have adverse effect on the growth of the economy. In addition oil price changes cannot be easily predicted due to its volatile nature, hence it becomes difficult for the government to adequately plan for the subsidy to pay in a particular year. This situation may compel government to shift resources from other sectors of the economy to help finance the differences in subsidies that may occur and as such it tend to have adverse effect on these sectors of the economy which ultimately affect the growth of the Ghanaian economy. This result is consistent with theoretical exposition put forward by Bernanke (1983) and Finn (2000). According to economic theory, an increase in crude oil price tends to reduce capital utilization and this causes output to fall. In Ghana, crude oil serve as a major source of energy for the country's productive sectors (Armah, 2003), hence the result obtained in this study suggests that, high crude oil prices adversely affect the

country's output level. The result is also consistent with previous empirical studies on the relationship between crude oil price and output. Bouzid (2012) found a statistically significant negative relationship between crude oil price and economic growth in Tunisia. Also, Kiani (2011), in a study of the impact of high oil prices on the growth of the Pakistani economy found that crude oil price increases adversely affected output of the economy.

Government expenditure (LG) which was used as policy variable, was statistically significant and exerted a positive impact on output. To identify the actual effect of government expenditure on the growth output, the study estimated equation (13) derived from table 3,

$$\frac{dLY}{dLG} = 0.27816 - 0.064818LO \qquad (13)$$

From Appendix 1, the study substituted the mean value of oil price into equation (13)

$$\frac{dLY}{dLG} = 0.27816 - 0.064818(3.623787) = 0.0433 \qquad (14)$$

This implies that, a percentage increase in government expenditure will cause Real GDP to increase by 0.0433 standard deviations from the mean value of Real GDP. This result indicates that government expenditure is an important channel through which the economy can achieve increased output. The result also implies that the involvement of the government in the domestic determination of crude oil prices reduces the positive effect of government expenditure on the growth of output. This result is consistent with the Keynesian proposition. The result is also in line with the findings of several empirical studies. Bhanumurthy, Das, and

Bose (2012) found a positive relationship between government expenditure and output for India. Swaray (2011) and Ayibor (2012) all found a positive relationship between output and government expenditure for Sierra Leone and Ghana respectively. The long run estimates also indicates that labour force capital stock are important channels through which the country can achieve growth of GDP. However, the study shows that high price level in the country is inimical to the growth of GDP.

Short run dynamics

Once the long-run relationship among the variables has been established within the framework of the ARDL approach to cointegration, the study further estimates the short run relationships. From Table 4, the coefficient of the lagged error correction term (ECM_{t-1}) is negative and

significant at one percent significance level. This actually confirms the existence of a cointegrating relationship among the variables in the model. The ECM represents the rate of adjustment to restore equilibrium in the dynamic model after a disturbance. The coefficient of the error correction term is -0.46296. This implies that, about 46 percent of the deviations from the long-term growth of output caused by previous year's shocks converges back to the long run equilibrium in the current year. The result shows that, the speed of adjustment is relatively low in the model.

The short run coefficient of crude oil price is positive and significant at 5% significance level. This is consistent with the argument of Kliesen (2008), who indicated that the price elasticity of demand for crude oil is low in the short-term as such firms and consumers are unable to change their production or consumption patterns instantaneously after price changes have occurred. However, considering the fact that oil price increases over the past decades has been accompanied by increases in government spending in the form of fuel subsidies, it is important to identify the net effect of oil price increase on the growth of output, given the level of government spending. The study follows the same procedure as indicated in the explanation of the long-run effect. Hence the effect of oil price increase on economic growth in the short-run is given by; 0.049737-0.030008 (20.83210) = -0.5754. This means that, an increase in the price of crude oil will result in a reduction in economic growth by 0.5754 standard deviation from the mean value of economic growth. The result implies that in the short-run, the increasing effect of oil price increases on the growth of output in the Ghanaian economy declines as the government increases its spending in response to the increases in the price of crude oil. This result is consistent with results obtained by Gounder and Bartleet (2007).

Table 4: Error Correction Model

Variables	Coefficient	Standard Error
dLOt	0.0497**	0.0201
dLGt	0.1288**	0.0468
dLREERt	0.0159*	0.0077
dLCPIt	-0.0020***	0.0004
dLMSt	0.0014*	0.0007
dLOGt	-0.0300**	0.0110
dLKt	0.0249**	0.0095
dLt	0.0166**	0.0074
DR	-0.0048	0.0311
C	9.1133***	1.5946
ECMt-1	-0.4630***	0.0910

*Note: ***, ** and * denotes significance at 1%, 5% and 10% respectively*

Estimated from WDI (2012) and BP Statistical Review data using Microfit 4.0 package

Government expenditure on the other hand exerted a positive effect on economic growth. The short-run effect of government expenditure on economic growth is given by 0.12878-0.030008(3.623787) = 0.0200.

Thus, a percentage increase in government expenditure will cause economic growth to increase by 0.02 standard deviation from the mean of economic growth. Both the long and short run results confirms the key role fiscal policy plays in promoting economic growth as indicated by John Maynard Keynes' The General Theory of Employment, Interest, and Money. Inflation was negative and money supply was significant in the short run, however, its impact (0.0014) on economic growth was relatively small.

Model diagnostics and stability tests

Hansen (1992) cautioned that estimated parameters of a time series data could differ over time. Consequently, it is critical to conduct parameter tests in order to check for model misspecification that may arise as a result of unstable parameters and subsequently lead to bias estimates. Table 5 below shows the results for the model diagnostics and goodness of fit. The results in Table 5, indicate an R-squared value of 0.70959, suggesting that about 71% of the total variations in economic growth is explained by variations in crude oil price and the other explanatory variables in the model. Table 3 also shows that the overall regression is significant at one percent (F-Stat (10, 32) = 7.5745[0.000]). This implies that the explanatory variables in the model are good predictors of economic growth. Furthermore, the results in Table 5 show that there is no evidence of spurious regression as the Durbin-Watson (DW) is greater than the adjusted R-squared. (R-Bar-squared). This result is confirmed by the test for serial correlation. Also, table 5 indicates that the errors are normally distributed and the model passes the Ramsey's RESET for correct specification of the model as well as the white heteroscedasticity test.

Finally, to check the stability of the coefficients of the model, the study employed the CUSUM and CUSUMSQ of recursive residuals stability tests as suggested by Pesaran and Pesaran (1997). According to Bahmani-Oskooee (2004), the null hypothesis for this test is that the coefficient vector is the same in every period. The plot of the CUSUM and CUSUMSQ of recursive residual stability test in the Appendix 2 indicates that all the coefficients of the estimated model are stable over the study period since they are within the 5 percent critical bounds.

Table 5: Model Diagnostics

Diagnostics		Diagnostics	
R-Squared (R^2)	0.70959	R-Bar-Squared	0.60654
S.E. of Regression	0.029467	F-Stat (10, 32)	7.5745[0.000]
Mean of Dependent Variable	0.035396	S.D. of Dependent Variable	0.046978
Residual Sum of Squares	0.026918	Equation Log-likelihood	97.5729
Akaike Info. Criterion	85.5729	Schwarz Bayesian Criterion	75.0057
DW-statistic	2.1161		
Diagnostics		**LM-Version**	**F-Version**
Serial Correlation	χ^2_{Auto}	0.48688[0.485]	F(1,30)= 0.34358[0.562]
Functional Form	$\chi^2_{RESET}(1)$	0.69466[0.405]	F(1,30)= 0.49260[0.488]
Normality	$\chi^2_{Norm}(2)$	0.47037[0.790]	Not Applicable
Heteroscedasticity	$\chi^2_{White}(1)$	0.25367[0.614]	F(1,41)= .2433[0.624]

Estimated from WDI (2012) and BP Statistical Review data using Microfit 4.0 package

SUMMERY AND CONCLUSIONS

In this study we have estimated an ARDL model to explore the long run and short run relationship between world crude oil price and Ghana's economic growth for the period 1967 to 2011. The estimates of the ARDL model revealed that crude oil price, government expenditure, real effective exchange rate, consumer price index, oil price-government expenditure, capital stock and labour force have a significant effect on real GDP in the long run with oil price, CPI and fiscal policy response having a negative effect on real GDP. The error correction term, was negative and significant. This means that the economy will be able to recover from the previous year's shock. More specifically, the error correction term implied that, about 46.3 percent of the previous year's disequilibrium was adjusted in the current period.

Based on the results obtained in the study, the study concludes that increases in the international price of crude oil are detrimental to the growth of the Ghanaian economy. The effect of oil price increase on output in the long-run is however greater than the short run effect. The results also implies the negative effect of oil price increases on the Ghanaian economy is not reduced by increases in government spending in response to the oil price increases. This means that fuel price subsidies does not really eliminate the negative impact of oil price hikes on economic growth. Also, fiscal policy response to oil price increases has an adverse effect on the economy.

RECOMMENDATIONS AND POLICY IMPLICATIONS

Given the fact that increases in government expenditure over the years in response to oil price increases has only resulted in reinforcing the negative effect of oil price on the Ghanaian economy, the present study recommends the complete elimination of fuel subsidies in the Ghanaian economy. The study however, recommends that taxes on the commodity should be reduced and if possible completely removed. This is because removal of taxes will go a long to reduce the cost of production of producers. More so, the removal of the oil price subsidy is likely to reduce government borrowing, especially from domestic sources and this will reduce the crowding out effect of government expenditure that is likely to cause a reduction in private investment. Also, removal of subsidies will help reduce the allocative and productive inefficiency.

Also given the fact energy is an important element to the growth of the Ghanaian economy, searching for an alternative source of energy that is cheaper than crude oil could go a long way to reduce the negative effect of oil price on the growth of the Ghanaian economy.

DIRECTION FOR FUTURE RESEARCH

The main aim of this study was to examine the relationship between crude oil price and economic growth in Ghana. The study did not however consider specifically, the possible effect of oil price fluctuations on the various sectors of the economy. Hence, it will be interesting for future research to be focused on disaggregating the impact of crude oil on the economy by considering the impact of such fluctuations on the main productive sectors of the economy namely: industrial, agricultural and the services sectors. In other words looking at the impact of oil prices on the various sectors of the economy separately would be worthwhile. This will help in identifying the main channels (by sectors) through oil price fluctuations affects Ghana's economic growth.

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APPENDICES

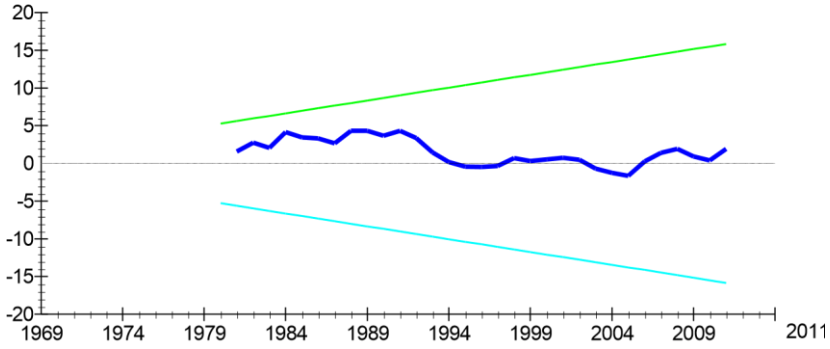
1: Summary statistics

	LY	LK	LO	LG	LREER	LCPI	LMS	LL	LOG
Mean 23.04	21.00	3.62	20.83	5.23	0.34	21.50	53.60	16.36	
Median 22.89	20.86	3.60	20.68	4.98	1.09	21.32	52.79	17.40	
Maximum	24.05	22.52	4.71	21.71	7.58	5.33	22.87	57.73	27.29
Minimum	22.52	19.26	2.34	19.72	4.43	-5.73	20.38	51.18	5.19
Std. Dev.	0.43	0.94	0.66	0.48	0.82	3.80	0.65	2.23	7.50
Skewness	0.73	-0.01	-0.29	0.04	1.39	-0.35	0.46	0.55	-0.13
Kurtosis	2.32	1.75	2.23	2.61	4.11	1.71	2.10	1.82	1.62
Jarque-Bera	4.83	2.95	1.72	0.30	16.75	4.05	3.11	4.93	3.70
Probability	0.10	0.23	0.42	0.86	0.00	0.13	0.21	0.19	0.16
Sum	1036.64	945.12	163.07	937.45	235.35	15.36	967.41	2412.18	736.16

Source: Estimated from WDI (2012) and BP Statistical Review data using Eviews 7
Note: Std. Dev. represents Standard Deviation while Sum Sq. Dev. represents Sum of Squared Deviation

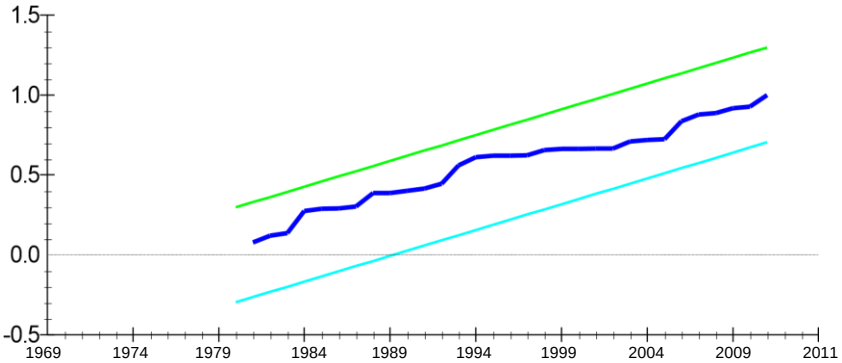
2: Plot of cumulative sum and cumulative sum of squares of recursive residuals stability tests

Plot of Cumulative Sum of Recursive Residuals (using Microfit 4.1)



The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals (using Microfit 4.1)



The straight lines represent critical bounds at 5% significance level