



The Impact of Natural Resource Rent on Economic Growth of Ghana

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Authors' contributions

This work was carried out in collaboration among all authors. Author OA designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author EB managed the analyses of the study. Author GAY managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

This study examines the effect of oil and gas resource rent on economic growth of Ghana for the period of 2007 to 2019. The study uses the bounds test approach to cointegration within the framework of autoregressive distributed lags model as the estimation strategy. The results from the study revealed that oil resource rent had a negative and significant relationship with economic growth of Ghana. However, gas resource rent had a positive impact on economic growth of Ghana. Furthermore, the study also found that foreign direct investment and exchange rate had significant positive relation with economic growth of Ghana respectively. For government expenditure, it exerts a negative impact on economic growth of Ghana. Based on the negative and significant relationship with oil resource rent and economic growth of Ghana, it is recommended that the government should reduce taxes on oil industries to help increase the production of oil and gas in Ghana. Furthermore, the study recommends Government and private partnership to ensure effective management of exchange rate fluctuations in Ghana.

Keywords: Economic growth; natural resource parametric analysis; GDP; exchange rate; foreign direct investment; net inter-company loans; ARDL model.

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1. INTRODUCTION

1.1 Background of the Study

Oil and Gas are natural resources that contribute immensely to economic growth and development across different countries (Peach and Starbuck, 2014). These resources are highly valuable because of their enormous impacts on the economy in the form of employment, revenue contribution, social contribution and poverty reduction (Bazilian et al.,2015).However, the impacts can either be positive or negative to the economy Manu, [1]. Some countries have been able to take advantage of these natural resources and have generated large revenues from it to achieve sustainable growth whiles with other countries, oil and gas remained a resource curse unto them, thus causing more harm than good Manu, [1]. Proponents of “resource curse” theory reveals that the inhabitants of countries that significantly depend on natural resources are extremely poor, illiterates and unemployed UNDP, [2].

In African, countries such as Democratic Republic of Congo, Gabon, Egypt, Equatorial Guinea, Libya, Algeria and Angola among others are all countries that produce oil and gas. However, revenues generated from their oil and gas sectors have not been of great contribution to improving in the quality of life of their citizens (Peprah, 2009).Unlike these African countries, in Russian, the oil and gas play a significant role in the growth and development of their economy. The budget of the Russian economy is mainly hooked on extraction taxes and revenue from the export of oil and gas which in turn boosts the economic growth of Russia Dubinina, [3]. Similarly, Norway has experienced extraordinary growth and development after twenty years of oil discovery. Malaysia and Mexico cannot be left out either as they have also experience a steady growth and developments after the discovery of natural oil and gas Plänitz&Kuzu, [4].

Ghana is on the threshold of becoming a significant oil producer Asafu-Adjaye, [5]. Ghana has an a very extensive historical memories of the oil and production tracing from the 1970s when oil was first discovered in western coast of the country Plänitz&Kuzu, [4]. When production started, Ghana extracted oils in commercial quantities which played an intensive part of the structural transformation of the Ghanaian economy in the year 2007.The Jubilee fields which is Ghana’s largest oil producing site

commenced with a daily regular production of 80,000 barrels per day and has currently increased production levels to 110,000 barrels per day Plänitz & Kuzu, [4].Ghana has received enormous contributions to the economy from the oil and gas production. It is required by law that a percentage of oil revenues be given to the government to fund the annual budget and deposited in the consolidated account Plänitz&Kuzu, [4].

In Ghana, oil and gas revenues are disbursed into areas of the economy such as; “Expenditure and Amortization of Loans for Oil and Gas Infrastructure; Road and Other Infrastructure; Agricultural Modernization; and Capacity Building. The sector approximately generates revenues of about 581million US dollars per year Reuters, [6].This shows how the oil sector contribute to significant proportion of Ghana’s total revenue generated. However, the problem is that the huge amount of revenues accumulated has failed to translate into enhancing economic growth and developments in the country Hermas, [7]. In addition, the oil sector has also affected the environment and individuals living in coastal areas of Ghana. This has contributed immensely to loss of livelihoods especially in fishing industry. Others macroeconomic challenges include high rates of unemployment in oil producing regions due to high rates immigrants in search for jobs, inflations on accommodations, and food, crime and health implications from pollution Plänitz &Kuzu, [4].This leaves a mind-boggling question as to whether oil and gas production rather causes more harm than good. This has called for further empirical studies to be conducted to ascertain the impacts of oil and gas production on economy’s growth and development of the Ghanaian economy.

For instance, in other countries, Peach and Starbuck [8] conducted a study to investigate the impacts of oil and gas production and economic development in New Mexico.The findings showed that oil and gas extraction in New Mexico Counties has had minor but encouraging effect on income, employment and population. Also, Boahen and Peprah (2011) conducted a study to access the livelihood of women in a community around the oil exploration region. The study revealed women had the challenge of getting employments in the oils sector since they lack the required skills. In Nigeria, a study conducted by Olusegun [9] revealed that oil and gas activities caused incomes to rise which

resulted in breeding prostitution. Another study conducted in Russia revealed that the industry contributed positively to creating economic profits for the populace Dubinina, [3]. However little is known in Ghana on how production of oil affect economic growth of Ghana and this study will help to bridge this gap in literature.

1.2 Problem Statement

Oil and gas are natural resources that have significantly contributed to the growth and development of both developing and developed countries. Natural resources form the significant part of wealth of a nation. Their contribution to growth is in the form of revenue generation, income and poverty reduction (OECD, 2011). Sectors involved in extraction of natural resources provide employment opportunity and livelihood in poor communities. Poor individuals living in rural areas depend directly on natural resources for survival. Therefore policies that ensure effective management of natural resources can have short and long run impact on economic growth (OECD, 2008). Natural resources also contribute to income and revenue generation through contribution of tax payment by firms involve in natural resources extraction. Employees working in sectors engage in natural resource extraction also make income out of the natural resource extraction. Revenue generated from natural resource are used by government for infrastructure development. Incomes earned by individuals working in the natural resource centers also help improve their standard of living (WB, 2006). In Ghana, natural resources contribute about 40% of total revenue generated (GSS, 2019). Thus more than half the revenue is earned from the exportation of these natural resources. This contributes to export driven growth in Ghana since higher proportion of the revenue is earned from exporting the natural resources. For instance in South America natural resources like oil, gas, agricultural, energy and other resources sector have provided the region with export driven growth. Ecuador and Argentina are also major oil exporters Apergi and Payne, [10]. However, in Africa many of the oil production countries have not been able to achieve growth and development because the revenue generated from the oil and gas sector has not been able to translate to growth and development. In Ghana, although the oil sector contribute to about 581 million US dollars to revenue per year and also provides employment Reuters, [6], however, it impact on economic growth is not well known in Ghana. Accessing

the impact of natural resource rent on economic growth is somehow complicated due to the significant impact of macroeconomic variables on economic growth This has drawn the attention of researchers to empirically ascertain whether natural resources affect economic growth in Africa especially Ghana. For instance, in Nigeria, oil extraction has damaged the subsistent farming and fishing activities, especially among the women and this does not promote economic growth Plänitz &Kuzu, [4]. Contrary, Akinlo and Apanisile [11] also found out that oil price volatility has a significant positive impact on economic growth. Thus high oil price promotes economic growth in Nigeria.

Despite the significant contributions the oil and gas sectors make to revenue generation of the economy, it is also characterized with side effects such as increase in prices of basic commodities in Ghana. In addition, the oil and gas production areas in Ghana have been hit with overpopulation Asafu-Adjaye, [5]. Thus, people are moving in from other parts of the country in search for jobs in oil and gas extraction areas. This leads to increasing unemployment rates in the region. Also, inflation and increase in prices of items such as housing, food, corruption and health implications from pollution is experienced in the country Plänitz&Kuzu, [4]. et al., (2012) also did provide empirical evidence that the oil exploration and production have an adverse effect on the ecosystem of Ghana. These studies have paid much attention to the negative impact of oil production in Ghana. However, what is missing in empirical literature in Ghana is to also pay attention to the positive aspect of oil production in Ghana. Thus there is scanty literature on how oil and gas production affect growth of Ghana. This study will add to literature in Africa and other developing countries by employing recent data to empirically examine the relation between oil and gas production in Ghana. Much more need to be learned in this area especially in Ghana. This work has become necessary to fill the knowledge gab in literature.

1.3 Research Objectives

The general objective seeks to investigate the impacts of oil and gas production on the economic growth of Ghana from the year 2012-2017. Specifically, the study seeksto investigate:

- The impact of Gas Rent on economic growth in Ghana

- The impact of Oil Rent on economic growth in Ghana

1.4 Research Questions

- What is the impact of Gas Rent on economic growth in Ghana?
- What is the impact of Oil Rent on economic growth in Ghana?

1.5 Significance of the Study

There has been a constant discussion by policy analysts and researchers on the contributions the oil and gas industry bring to the economy. Some come out with the positive impacts unto the economy while others are of the view that the sector rather causes more harm than good. In view of these varying perceptions, this study seeks to censoriously examine the actual impacts of the oil and gas production on the economic growth of the country. This study will serve as a reference source for future researchers who will conduct similar studies. It will also provide additional knowledge to the various stakeholders in charge of managing Ghana's natural resources. The recommendations will then draw better policies that will enhance effective and efficient utilization of our oil and gas.

1.6 Delimitations

The study is centered solely on the impact of the oil and gas sector on the economic growth of Ghana for a speculated time. Thus, the study is confined to year 2012-2017. However, there is the need to expand the time period to cover recent data. This is our minor problem

1.7 Organization of the Study

The study comprises of five sections with each chapter having sub sections. Section one presents the introduction of the study where the background is discussed, problem statement, the research objectives, question and scope of the study. Section two defines key concepts, theoretical framework and reviews of past studies in connection with the objectives. Sections three expatiates on the methodology that was used to gather and evaluate the data. Also, the section four presents the analysis and interpretation of the data. The fifth section outlines the summary, conclusions and recommendations for the study.

2. LITERATURE REVIEW

This sections is aim at proving a detailed review of both theoretical and empirical literatures that serves as a guide in developing chapters four to helps bring a particular methodology out that will be employed in this study. Specifically, this chapter begins with overview of oil and gas production in Ghana, followed by theoretical review and the last section will give detailed review of existing empirical studies in developing and developed countries.

2.1 Overview of Oil and Gas Production in Ghana

Oil and gas production started in Ghana after a discovery by Kosmos Energy and Tullow oil in July 2007 in the Western Region. However, the location was named jubilee field based on historical facts and the sudden discovery of oil Kuzu and Kastning, [12]. Development towards jubilee field officially begun in December 2010 and was launched as a place of oil. Aside the jubilee field, other locations were also discovered such as the Tweneboa field in the Western Region Annan, [13]. The jubilee field is located 60 km off the Coast of Ghana sharing border with the cote d' Ivories. On the other hand, Tweneboa field is also 6 km off Jubilee Field and was observed produced a reasonable big amount of oil. Jubilee Field produces an average 1 and 2 billion barrels of crude oil Annan, [13]. A barrel is 158, 987 litres while Tweneboa field produces about 1.4 billion barrels of oil. These two fields are the major source of Ghana's oil and gas production. In relation to the quality, jubilee field produces light and sweet oil indicating its quality hence draws foreign direct investment into the country Hermas, [7]. Ghana currently operator one oil refinery that is the state owned Tema oil refinery which refined oil with a capacity of around 45.000 barrel per day (Kastning, 2010). Within the first quarter of production, government was able to secure about Ghc445 million equivalent to US\$ 316 million Manu, [1].

2.2 Definition of Concepts and Key Terms

It is very important that we define the two main key terms that are used in this study. First of all, economic rent of a natural resource rent is defined the value of capital services flows rendered by the natural resource or the value of it extraction (OECD, 2005). Oil rent is also

defined as difference between the value of crude oil production at world prices and total costs of production (WDI, 2019). This is measured as a percentage of its contribution to GDP. Natural gas rents are also defined as the value of natural gas production at world prices and total cost of production (WDI, 2019).

2.3 Theoretical Review

In this subsection we will present theories on growth to support these empirical studies. Theoretical reviews are crucial in the determination of particular theory which would be needed to deal with the research problems. Growth theories are widely used in economics for empirical studies. Different empirical studies on growth have adopted different theories on growth which include the new growth theory, Todaro and Smith theory (2012), the Romer model and endogenous growth. This section therefore reviews the various theoretical explanations to economic growth as well as the main assumptions underpinning such theories.

2.3.1 Todaro and Smith (2012) of growth and natural resource production

As postulated by (Todaro and Smith, 2012), there are 3 key components of economic growth which are of prime importance. These include; capital accumulation including new investment in land, physical, equipment and human resources through improvement in health, education and job skills, population growth and hence eventual growth in the labour force and technological progress- new ways of accomplishing task. This means that any policy aimed at attaining growth should have either of the aforementioned components in it. The Main component through which natural resource production can affect economic growth is through capital acquisition and advancement in technology. Extraction of natural resources helps increase revenue generated by the firms. Increase revenue generated by firm will also increase the accumulation of capital since firms can reinvest the revenue or profit generated from production. Thus extraction of natural resource can generate revenue to acquire new capital. The extraction of natural resources also involved the use of highly advanced technology for their extraction and production. Engaging in natural resource production also comes with the use of advance technology to extract the raw materials from their natural state. The use of advance technology promotes economic growth since it increases

productivity (Smith, 2011). Hence Natural resource production can affect economic growth through investment and technology.

2.3.2 Rent seeking and social capital

Huge natural resource rents, especially in conjunction with ill-defined property rights, imperfect or missing markets, and lax legal structures in many developing countries and emerging market economies, may lead to rampant rent-seeking behavior on the part of producers, thus diverting resources away from more socially fruitful economic activity (Auty, 2001; Gelb, 1988). The combination of abundant natural resources, missing markets, and lax legal structures may have quite destructive consequences. In extreme cases, civil wars break out – such as Africa’s diamond wars – which not only divert factors of production from socially productive uses but also destroy societal institutions and the rule of law. In other, less extreme cases, the struggle for huge resource rents may lead to a concentration of economic and political power in the hands of elites that, once in power, use the rent to placate their political supporters and thus secure their hold on power, with stunted or weakened democracy and slow growth as a result (Karl, 1997). Moreover, an abundance of natural resources may tempt foreign governments to invade with destructive consequences and the possibility of such an event may prompt the domestic authorities to spend vast resources on national defense. Large military expenditures tend to inhibit growth through their adverse effects on capital formation and resource allocation (Knight, Loayza, and Villaneuva, 1996). Rent seeking can also take other, more subtle forms. For example, governments may be tempted to thwart markets by granting favored enterprises or individuals privileged access to common-property natural resources, as, for example, in Russia, or they may offer tariff protection or other favors to producers at public expense, creating competition for such favors among the rent seekers. Extensive rent seeking – i.e., seeking to make money from market distortions – can breed corruption in business and government, thus distorting the allocation of resources and reducing both economic efficiency and social equity. Empirical evidence and economic theory suggest that import protection (which is often extended to foreign capital as well as goods and services), cronyism, and corruption all tend to impede economic efficiency and growth (Bardhan, 1997; Mauro, 1995).

2.4 Review of Empirical Studies

This section review empirical works that are related to this work. Acquah-Andoh et al., [14] did investigate the oil and gas production and the growth of Ghana's economy using ordinary least squares (OLS) regression. The paper paid much attention to the sustainability of petroleum production in the light of the medium term policy structure, the Ghana Shared Growth and Development Agenda (GSGDA). Their results reveal that current production of petroleum is not a significant contributor to Ghana's GDP. Furthermore, the study found out that the consistent appreciation of Ghana's real effective exchange rate between 2010 and 2013 led to a deterioration of the competitiveness of the non-oil sector and declining contribution of the agricultural sector to GDP.

Uwakonye et al. [15] also did a related work on the impact of oil and gas production on the Nigerian economy. This research work paid much attention to the contribution of the oil and gas production to the growth of rural areas of Nigeria using an econometric model. The study found out that despite the large revenues being brought in from oil exports, the Nigerian government still holds a large unemployment rate and a high poverty rate, especially in rural areas of Nigeria.

Using fixed effect, random effect and pooled ordinary least regression technique, Eder et al. [16] examine the exploration and production of oil and gas as a factor of economic development of the Arctic resource regions, resource curse. The results from the study reveal that production of energy resources in the Arctic regions directly affects the level of socio-economic development of the Arctic regions.

Cantah [17] also did a similar work on crude oil price and economic growth in Ghana. The study used annual time series data spanning from 1967 to 2011 and was source from World Bank Development. The results of the study reveal 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.

Using fixed effect model as an estimation strategy, Wang [18] also examine An Economic

Impact Analysis of Oil and Natural Gas on the development in the Permian Basin. The data used was a panel data spanning 1998-2016 covering 62 countries. The results from the study revealed that revenue generated by the oil and natural gas industries has been consistently exceeding one billion dollars per year. In addition, the study also revealed that per job annual income and the number of jobs has both experienced significant growth in the last two decades of active oil and natural gas development in the region.

Other researchers have also paid attention to how natural resources affect growth both developing and developed country. For instance Akinlo and Apanisile (2014) also investigate the impact of oil price volatility on economic growth in Sub-Sahara Africa. He employed three different estimation strategies and this include the Panel pooled OLS, Fixed effect model and Generalized Method of Moment. The type of data employed in this study was a panel data spanning from 1986 to 2012. Their results reveal that volatility of oil price has a positive and significant effect on economic growth for oil exporting countries. However, oil price has a positive and insignificant effect on economic growth for non oil producing countries.

Employing the granger causality test as estimation, Hosseini et al. [19] also examine the effect of oil and non oil export on economic growth of Iran. The study used annual data which covered the period of 1970 to 2008. The data for the study was obtained from International Financial Statistics (IFS), World Development Indicators (WDI) and the Central Bank of Iran Republic (CBI). The results from the study reveal uni-directional causality from oil and non-oil exports to economic growth. This implies that export-led growth hypothesis is valid in Iran.

Planitz and Kuzu [4] investigated the benefits associated with oil and gas production in Ghana. Findings of the study revealed enhances government's revenue, infrastructure development, and fiscal expansion, enhance foreign exchange and creates more jobs in the Ghana. The study used qualitative research design and interview guide for data collection. The study sampled thirty (30) oil and gas industries in Ghana.

In a related work by Oduro [20], he examines the nexuses of oil consumption, oil price volatility and economic growth. He used annual time series

data spanning from 1980 to 2013 and source it from World Banks Development Indicators. He also employed an ADF test and it proved that all the variables were cointegrated. He employed the vector error correction model and the GARCH model as an estimation technique and found out that crude oil price has a negative significant relation with economic growth in the short-run. However, in the long-run this relationship was found to be positive.

Stern [21] also did empirical studies on energy and economic growth in USA. Data used in these studies was a time series data spanning from 1947 to 1990. He carried out VAR estimation and a granger causality test and found out there was no evidence there gross energy uses granger cause economic growth. In addition, he also found out that consumption granger cause GDP growth.

Manu [1] examined the benefits of oil and gas production in Cape Three Points using correlation analysis and descriptive statistics. The study results revealed oil and gas production creates jobs, improves the living standard of people, increase revenues and improve in the distribution of electricity in the country. The study used qualitative method and interview guide for the data collection. The study used purposive sampling technique to sample 25 households.

Apergis and Payne [10] also did a related work on energy consumption and growth in South America. They used nine South American countries making the data a panel data spanning from 1980 to 2005. The result from the Error correction model estimates reveals that there is a long run equilibrium relationship between real GDP, energy consumption, labour force and real gross fixed capital formation.

Annan (2011) assessed the benefits related to the oil and gas production in Ghana using ARDL as estimation strategy. Findings of the study identified increment in Gross Domestic Product, availability of foreign exchange, expansion in fiscal, employment creation and customer spending to be the benefits are positively related to the oil and gas production in Ghana. The study made use of various literature related works.

Ekperiware and Olomu [22] also employed the VAR to examine the effect of oil and agriculture on economic growth in Nigeria. The study focused on the effect of oil and gas production on the agriculture sector. Findings of the study

revealed that there are a positive and significant relationship between oil and gas production and economic growth in Nigeria.

From the above empirical review on how natural resource rent affect economic growth is scanty in existing literature especially, in Ghana. Most of the empirical works paid attention to how macroeconomic variables and oil production affected growth in Ghana. Much more need to be learned on how natural resource rent affects economic growth in Ghana. Thus this work included gas rent which has been overlooked in empirical research work. This work has become necessary to fill this gap in literature.

3. METHODOLOGY

3.1 Introduction

This chapter focuses on the methodology employed in this study. The first we will describe the source and the type of data used. This is then followed by the model specification. The next section delves into describing the variables and how they are measured. Then we move on selection an appropriate estimation technique for this study. Finally, we conclude by throwing light on the diagnostic test to aid achieve the objectives of the study.

3.2 Research Design

The study used a quantitative research approach to examine the relationship between natural resource rent and economy growth in the economy of Ghana. Quantitative method makes use of numerical data which is applied in statistical techniques. The employed time series data in the analysis. The study also involve a parametric analysis.

3.3 Sources and Type of Data

The data employed in this study is monthly time series data from 2010 to 2019. Data on gross domestic product, foreign direct investment, gas resource rent, oil resource rent, government expenditure and exchange rate were obtained from the 2019 world Bank's development indicators (WDI). This sample selection criterion is very crucial because study takes 2010 as a starting point because that is the period Ghana started the production of oil.

3.4 Model Specification

The study will follow previous empirical studies by Annan, 2011 and Ekperiware and Olomu, [22]

and specify the empirical model to ascertain the empirical relationship between growth and oil as well as gas rent. Since we expect growth to depend on oil and gas rent as well as other variables, we proceed with the following general function

$$GDP_t = f(OR, GR, FDI, GE, EXR) \quad (1)$$

Where GDP is gross domestic product, OR is oil rent, GR is gas rent, FDI is foreign direct investment, GE is government expenditure and EXR is exchange rate.

We adopt the Cob-Douglas production log linear model to be able to transform equation (1) in a linear form. This is shown below

$$GDP_t = \beta_0 (OR_t)^{\beta_1} (GR_t)^{\beta_2} (FDI_t)^{\beta_3} (GE_t)^{\beta_4} (EXR_t)^{\beta_5} (e_t)^{\mu_t} \quad (2)$$

To make equation (2) linear and estimable, we take a natural log of it.

The general form is transform to obtain an empirical form below;

$$\ln GDP_t = \beta_0 + \beta_1 \ln OR_t + \beta_2 \ln GR_t + \beta_3 \ln FDI_t + \beta_4 \ln GE_t + \beta_5 \ln EXR_t + \mu_t \quad (3)$$

From equation (2) above, we will estimate the all the β_i in the model. Once we have taken a natural log of all the variables, the β_i becomes elasticities hence the coefficient could be interpreted as their long-run elasticities. For example β_2 , a coefficient of $\ln GR_t$ becomes the elasticity GDP_t of with respect to GR_t . In particular, it measures the degree of responsiveness of GDP to changes in GR_t ceteris paribus. β_1 , β_3 , β_4 and β_5 represent their respective coefficient and elasticities and thus also show the same behaviour as β_2 .

Through deduction from theoretical and empirical literature, we hypothesize the following signs for our coefficients;

$$\beta_1 > 0, \beta_2 > 0, \beta_3 > 0, \beta_4 < 0, \beta_5 > 0, \beta_6 < 0$$

3.4.1 Dependent variable

3.4.1.1 Economic growth

The most common measure of output and growth in any economy is the GDP. GDP can be defined

as the total amount of goods and services produced in an economy during a given period of time, usually a year. The GDP of any economy comprises of consumer spending, investments, expenditure by the government and exports less imports. Real GDP on the other hand can be define as total goods and services produced in an economy at a given period of time which adjust for inflation. Thus it a GDP adjusted for inflation. The study makes use of real GDP as a measure of economic growth following studies such as Nketiah-Amponsah (2009) Romp and de Haan (2005).

3.4.2 Independent variables

3.4.2.1 Exchange rate

Exchange rate is the rate at which one country's currency can be traded for another country's currency (Colander, 1994). It is the price of one currency in terms of another. When there is a depreciation of currency, the import of raw materials and other machinery for production become expensive (see for Annan, 2011 and Cantah, [17]. Hence the depreciation of a currency does not provide a healthy macroeconomic environment to promote economic growth. However, when the country's currency appreciation it reduces cost of importation. Importing raw material and other equipment for production become very cheap and this increases economic growth Planitz and Kuzu, [4]. The exchange rate of the Ghana cedis for a unit of US dollar is used and is represented in the model as EXR.

3.4.2.2 Foreign direct investment

This variable is also defined as a category of cross border investment made by non-resident in the economy. It can also be defined as investment made by a firm or individual into business interests in another country. Foreign direct investment includes the sum total of value of reinvested earnings, value of affiliated equity and net inter-company loans Alfaro and Chauvin, [23]. The study expects a positive relationship between foreign direct investment and economic growth. Inflow foreign direct invest results in the expansion of the scale of production which increases output produced. Thus inflow of foreign direct investment promotes economic growth.

3.4.2.3 Government expenditure

This variable includes the total local and central government spending in the economy. This also

refers to the purchase of goods and services by government. It is composed of public consumption, private consumption and capital expenditure. Although there are other source of government expenditure but the main source of government spending is taxation (Dohner, 1989). An increase in government expenditure increases infrastructure and expansion of other domestic firms. An increase in government expenditure also increases individuals income especially, government workers. This will increase the demand for goods and services in the country. Firm's response to this by increasing the production and this promote economic growth of a country.

3.4.2.4 Gas rent

Gas rent is also defined as difference between the value of crude oil production at world prices and total costs of production (WDI, 2019). An increase in gas rent is expected to increase production since it implies the firms in making profit out of production. This increases firms investment and expands the scale of production. This helps promote economic growth of a country Dah and Sulemana, [24]. In this regard, the study expects a positive relationship between gas rent and economic growth of Ghana.

3.4.2.5 Oil rent

Oil rent is also defined as difference between the value of crude oil production at world prices and total costs of production (WDI, 2019). Thus oil rent is understood to be the production oil the deduction of cost of paying worker, hiring or purchasing machine and other cost the revenue earn on the world market. Deducting cost of production from revenue gain from selling it on the world market give oil rent. Increase in oil rent increases promote economic growth because firms can reinvest profit made from production to expand the scale of production. Hence oil rent and economic growth have a positive relationship Uwakonye et al., [15]. The study expects a positive relationship between oil rent and economic growth of Ghana.

3.4.3 Estimation strategy

This section provides detailed account of the estimation strategy. Firstly, the study present the method used for the stationarity test. Followed by the ARDL model and the diagnostic test.

3.4.3.1 Stationarity/ unit root test

To be able to do the estimation with the ARDL, the study carried out to test for stationarity among all the variables. We then employed the Augmented Dickey-fuller (ADF) test and the Phillips- Perron (PP) proposed by Dickey and Fuller (1979) and, Phillips and Perron (1988) respectively to test for stationarity. This served as guide to study the patterns and trends of the observation. This will aid in determining whether the observations are stationary or non-stationary (have unit roots). The bounds test is based on the assumption that the variables are either I (0) or I (1) series. The ADF assumes that assumes the errors are statistically independent and have a constant variance.

In addition to this method, a more robust approach was the PP test which highly tested for heteroscedasticity and serial correlation present in the error term. In analysis, if the paper fails to reject the null hypothesis of a unit root at level or non-stationarity, first difference of the series taken to ensure stationarity This conclusion does not rule out the fact that some series will have an Integral order of zero I (0). For the series that are non-stationary, the first difference is evaluated. The null hypothesis is then rejected if the series is considered stationary. This implies that the series is integrated of order one I(1).

3.4.3.2 The Autoregressive Distributed Lag (ARDL) model

The ARDL estimation technique is applied to estimate the six parameters .The ARDL estimation technique is adopted in this study for its simplicity as compared to the others model and the test is also more efficient even with small sample size and also able to account for endogeneity among the variables. (Ghatak & Siddiki, 2001) explained that the ARDL cointegration approach is superior in small samples compared to other single and multivariate cointegration techniques and is able to produce much more reliable results as compared to the other models.

The ARDL bound test specifies the functional relationships between Economic growth (GDP), Oil rent (OR), Gas rent (GR), Government expenditure (GE), Foreign direct investment (FDI) and Exchange rate (EXR) is shown below:

$$\begin{aligned} \Delta \ln GDP_t = & \alpha_0 \\ & + \sum_{t=1}^p \beta_1 \Delta \ln GDP_{t-1} \\ & + \sum_{t=1}^p \pi_1 \Delta \ln EXR_{t-1} \\ & + \sum_{t=1}^p \eta_1 \Delta \ln FDI_{t-1} \\ & + \sum_{t=1}^p \gamma_1 \Delta GDP_{t-1} \\ & + \sum_{t=1}^p \lambda_1 \Delta \ln GE \\ & + \sum_{t=1}^p \tau_1 \Delta \ln GR_{t-1} \\ & + \delta_1 \ln GDP_{t-1} \\ & + \delta_2 \ln EXR_{t-1} \\ & + \delta_3 \ln FDI_{t-1} + \delta_4 \ln OR_{t-1} \\ & + \delta_5 \ln GE_{t-1} \\ & + \delta_6 \ln GR_{t-1} + \varepsilon_t \end{aligned}$$

In the ARDL equations the Δ is the first difference operator of the models. The parameters $\beta, \pi, \eta, \lambda$ and τ in the ARDL model represent the dynamic coefficient in the short-run while the long-run multipliers are denoted by δ_1 to δ_6 , the number of lags is denoted by p while ε_t is white noise error which is independent and identically distributed.

The ARDL cointegration test is testing the following hypotheses:

H0 = $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0$; (there is no cointegration. Thus, no long run relationship between the variables).

H1 = $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0$ (there is cointegration or long run relationship between the variables).

The above hypothesis is tested using the F-statistic. It primarily tests for the hypothesis of no long-run relationship using the ARDL methodology. If the calculated F-stats is more than the upper critical value, the null hypothesis of no long-run relationship is rejected otherwise it is accepted. However, if the F-statistic lies between the lower and the upper bound, the result is not concluded.

The error correction model is then used to estimate the speed of adjustment. The error

correction model helps aim at reconciling the economic variables under consideration when there is a deviation from the short-run and long-run equilibrium. It simply measures the degree of deviation of the independent variables from equilibrium. The model is generated as;

$$\begin{aligned} \Delta Y_t = & a_0 + \sum_{i=1}^p \beta_i \Delta Y_{t-i} \\ & + \sum_{i=1}^q \gamma_i \Delta X_{t-i} + \delta ECM_{t-i} \\ & + \varepsilon_t \end{aligned}$$

The Y in the model represents the dependent variable with its lags and X represents a list of independent variables with their lags, Δ denotes the first difference operator, while β and γ are the short run dynamic coefficients of the model. The ECM_{t-i} is the error correction term and represent the long run which must have a negative sign and must be statistically significant with δ being its parameter indicating the speed of adjustment to long run equilibrium after a shock.

Finally, the study carried out a diagnostic test to ensure that the ARDL model is free from statistical problem. The diagnostic test includes normality, serial correlation, heteroskedasticity, functional form, cumulative sum (CUSUM), and cumulative sum of squares (CUSUMQ).

4. RESULTS AND DISCUSSION

This section presents the data and discussion of the results. First of all, the study presented the summary statistics and trend analysis on growth and gas rent. The study then performed stationarity test using augmented Dickey-Fuller test and Phillips and Perron test. Furthermore, the study used bound test for cointegration to test the existence of cointegration among the variables. This is followed by the long and short run estimates of the ARDL model. Lastly, the study did the diagnostic test to examine the fitness of the ADRL model.

4.1 Descriptive Statistics

This section presents the descriptive of all the variables used in the study.

Table 1 below presents the descriptive statistics of the secondary data gathered on the six

variables. The series have 28 observations representing the yearly time series from 1990 to 2017. While the mean shows the average of the series, the standard deviation indicates the deviation of the series from their mean values. Majority of the series show a little variation or deviation from the individual means. The extent to which gross domestic product, oil rent, gas rent, foreign direct investment and exchange rate deviate from the individual means are not substantial except government expenditure. Gross domestic product recorded an average of 5.3457 over the period of 1990 to 2017, while oil rent recorded an average of 1.9529. The

maximum value that gross domestic product can attain is 14.0471 and its minimum value is 0.0128, while the maximum value of oil rent is 5.6721 and the minimum value is 1.0128. Furthermore, gas rent also recorded an average of 1.0042 within the period 1990 to 2017, while foreign direct investment also had an average of 4.2182 within the same period. Government expenditure was found to have a maximum of 15.3081 and a minimum of 7.0694 while government expenditure had a maximum of 15.3081 and a minimum of 7.0694. The results for exchange rate have the same interpretations.

Table 1. Descriptive statistics of the variables

Variable	Observation	Mean	Std. Dev.	Min.	Max
LnGDP	108	5.3417	2.5683	0.0128	14.0471
LnOR	108	1.9529	1.8990	1.0128	5.6721
LnGR	108	1.0042	0.0123	1.9637	4.0853
LnFDI	108	4.2182	3.2269	0.2513	9.5170
LnGE	108	10.6339	2.0620	7.0694	15.3081
LnEXR	108	1.1366	1.2193	0.0326	4.3507

4.2 Trend and Patterns of Time Series

4.2.1 Graphical Representation

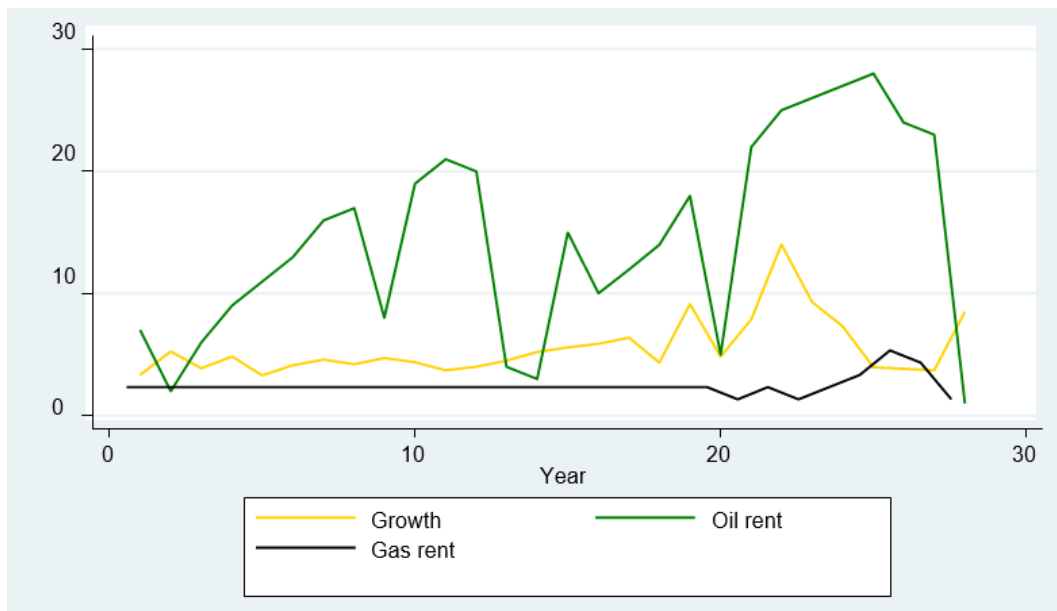


Fig. 1. The graph above shows the trends and patterns of the observations on the variables of the study. From the graph economic growth, oil rent and gas rent exhibit fairly regular trends but the other variables exhibit irregular trends and pattern. We conclude that economic growth, oil rent and gas rent

Table 2. Unit root test results using both the ADF and PP test

Variables	ADF				PP			
	Levels		1st difference		Levels		1st difference	
	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend	Constant	Constant with trend
lnGDP	-3.095**	-4.0766**	-6.816***	-6.574***	-3.138**	-3.611*	-6.803***	-6.562***
lnOR	-1.681	1.687	-4.181***	-4.117**	-1.914	-2.155	-4.254***	-4.185**
lnGR	-2.177*	-1.606**	-2.648**	-3.005***	-4.631	-5.111*	-7.022***	-2.423***
lnFDI	-2.313	-2.648	-4.288***	-4.342***	-2.325	-2.581	-4.239**	-4.315**
lnGE	-3.160**	-3.717**	-4.466***	-4.349**	-3.215**	-3.586**	-7.638***	-7.301***
lnEXR	-1.942	-1.484	-3.645**	-3.990**	-1.828	-1.556	-3.624**	-3.943**

Source: Authors

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

Table 3. ARDL bounds test estimates

F-statistic	K	Lower bound critical value	Upper bound critical value
39.74839***	5	2.39	3.38

Source: Authors

From Table 4, K denotes the number of regressors in the equation, *** represent rejection of the null hypothesis at 1% significance level

4.3 Unit Root and Cointegration Test Results

4.3.1 Unit root test result

From the unit root test results in Table 1, gross domestic product, gas rent and government expenditure attained stationarity at levels while oil rent, foreign direct investment and exchange rate attain stationarity at first difference. Thus gross domestic product, gas rent and government expenditure were integrated of order zero I (0) and oil rent, foreign direct investment and exchange rate were integrated of order one (1). This confirms that we can use ARDL to estimate the parameters since all the variables are integrated of order zero (0) or order one (1).

4.3.2 Cointegration test results

This section presents cointegration test using the ARDL bounds test to ascertain the long run relationship for the dependent and independent variable. These are reported in Table 3.

From the results in Table 3, the F-statistic value which is 39.74839 exceeds the upper bound critical value of 3.38. Thus, based on the bound test, it is concluded that gross domestic product, exchange rate, oil rent, gas rent, foreign direct investment and government expenditure are cointegrated. Thus there is a long-run relationship between gross domestic product and exchange

rate, gas rent, oil rent, government expenditure as well as foreign direct investment.

4.3.3 Long-run results from the ARDL estimation

Table 4 shows the long-run empirical results between gross domestic product and oil rent and other relevant variables. The result reveals that there is a positive significant relationship between gross domestic product and oil rent at 1% level of significance. Specifically, the results show that 1% increase in oil rent will result in an increase in gross domestic product by 5.23 % in the long-run holding all other things constant. When oil rent increases it implies that the cost of producing oil is less than the price sold on the world market and this will increase the total revenue or profit made in oil sector in the long-run. The oil sectors contribution to gross domestic product will increase because the gains from oil production are reinvested into the oil producing firms to help expand their scale of production thereby increasing output in Ghana. In addition, when firms make much profit out of oil production, employees incomes increases and they also hire new workers as well as acquire new capital to increase output produce. These increments significantly contribute to economic growth. This result is similar to that of Kperiware and Olomu (2015).

Table 4. Long-run results

Regressor	Coefficient	Standard Error	T-Statistic
lnOR	5.2339***	0.1397	2.0255
lnGR	-25.2600	27.6627	-0.9131
lnGE	-0.2428**	0.1119	-2.1697
lnFDI	0.2857***	0.0865	3.3017
lnEXR	1.5470***	0.2956	5.2339
Constant	6.8422***	1.4472	4.7278

*** represent significant levels 1% and ** represent 5% level of significance

Table 5. Short-run estimations using the ARDL

Regressor	Coefficient	Standard Error	T-Statistic
Δ lnOR	1.0175***	0.1205	8.4421
Δ lnOR(-1)	0.3925	0.1238	3.1706
Δ lnGR	106.762***	15.1553	7.0445
Δ lnFDI	0.1272**	0.0742	1.7140
Δ lnEXR	-7.8376***	0.5845	-13.4077
Δ lnGE	-0.0868	0.0546	-1.5892
Δ lnGE(-1)	0.3666***	0.0513	7.1431
ECM(-1)	-0.4943***	0.0708	-21.099
R-square	0.9767		
Adjusted R-square	0.9636		
Durbin-Waston test	1.9983		
F-statistic	2.2114		
Prob (F-statistics)	0.000		

*** represent significant levels 1% and ** represent 5% level of significance.

Table 6. Diagnostic test results

Diagnostic test	Test Statistics	Prob. Value
Normality	0.1330	0.9356
Serial correlation	1.0394	0.3969
Heteroskedasticity	1.7095	0.1950
Functional form	0.666	0.119
CUSUM	Stable	
CUSUMQ	Stable	

Gas rent was insignificant but had a negative relationship with gross domestic product. The results reveal that 1% increase in gas rent will result in 25.26% decrease in gross domestic product in Ghana. This results shows that gain made from gas rent are not invested in important areas of the economy to promote growth. For government expenditure, it also had a negative and significant relationship with gross domestic product at 5% level of significance. Specifically, 1% increase government expenditure will result in 0.24% decrease in gross domestic product holding all other variables constant. In developing countries like Ghana, government higher percent of government expenses goes into payment of salary of government workers. Government hardly spends on productive areas like extension of electricity to rural areas,

manufacturing firms and roads construction. Furthermore, foreign direct investment and gross domestic product has a positive relationship such that when foreign direct investment increases gross domestic product also increases. Thus 1 percent increase in foreign direct investment will increase gross domestic product by 0.08% holding all other variables constant. Increase in foreign direct investment means expansion in local firms and building of multinational firm in an economy and this will expand the scale of production thereby increasing total output. Lastly, exchange rate had a positive and significant relationship with gross domestic product at 1 percent level of significant. Specifically, 1 percent increase in exchange rate will result in 1.547 increases in gross domestic product holding all other variables constant. This implies that higher

exchange rate increases cost of import finished and unfinished by manufacturing firm for production. Increase in cost of import of raw materials will limit the output produced since they cannot import same amount of raw materials as before the increment in the exchange rate.

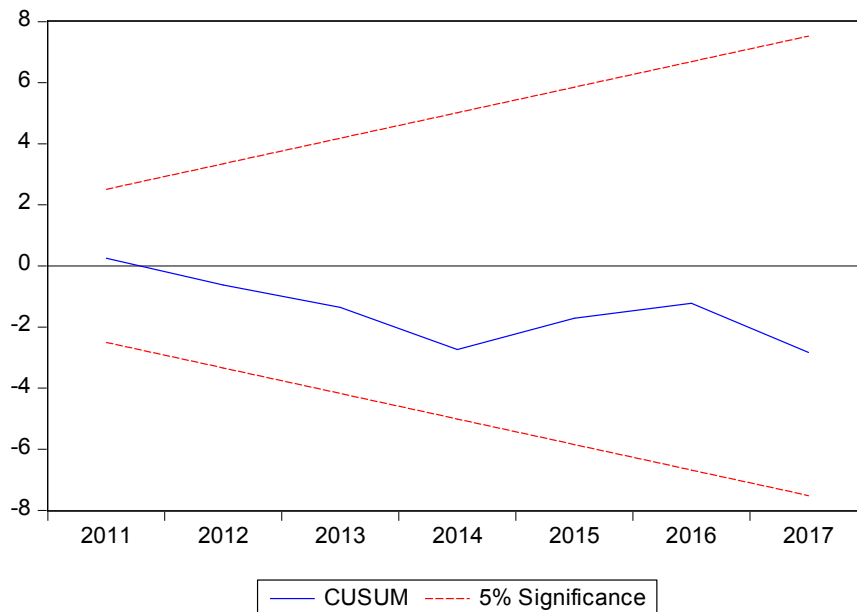
4.3.4 Short-run results from the ARDL estimation

Table 5 also present the short run effect of the explanatory variables on gross domestic product. The variable of interest (oil rent) was significant and had positive relationship with gross domestic product. The coefficient of the oil rent portrays that 1% increase in oil rent will lead to a 1.01% increase in gross domestic product. Gas rent also exhibited a positive sign suggesting that it is positively related to gross domestic product in Ghana. Gas rent was significant with the capacity to increase gross domestic product by 0.39% for 1% increase in oi rent in Ghana. Foreign direct investment also had a positive and significant association with gross domestic product at 5% significance level. An increase in foreign direct investment by 1% will result in an increase in gross domestic product by 0.12 in the short run. This implies that foreign direct investment has a positive impact on gross domestic product. Exchange rate was also once again consistent with prior expectation and economic theory in the

short run in the case of Ghana. The coefficient been negative implies that means there is a negative association between exchange rate and gross domestic product. All things being equal, 1% increase in exchange rate will lead to 7.83% decrease in gross domestic product in Ghana in the short run. This implies that exchange rate has a negative significant effect on gross domestic product at 5% significance level in the short run.

The study also exhibited that, in the short run, government expenditure was found to have a significant negative impact on gross domestic product. All things being equal, 1% increase in government expenditure will lead to a 0.05% decrease in gross domestic product in Ghana in the short run.

The results from the error correction term shows that it is negative and significant which confirms the long run relationship between: oil rent, gas rent, government expenditure, exchange rate foreign direct investment and gross domestic product as well as a restoration to a long run equilibrium when there is a short run shock in any of the independent variables. Specifically, the error correction term, ECM (-1) of -0.44281 shows that equilibrium in the long run is restored at a speed of approximately 44 percent after shock.



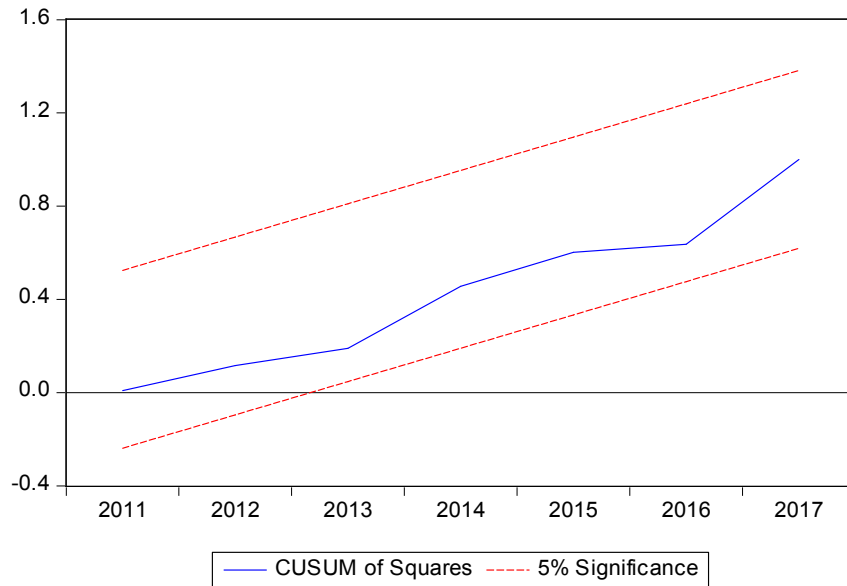


Fig. 2. plots of CUSUM and CUSUMQ
Source: Authors estimation

4.4 Diagnostic Test Results

Table 6 presents a diagnostic test results to ensure that our ADRL model is free from econometric problems like normality, serial correlation, heteroskedasticity, functional form, cumulative sum (CUSUM), and cumulative sum of squares (CUSUMQ).

From Table 6, it shows that the estimated model is free from econometric problems since the probability values are greater than 0.05. Also the CUSUM and CUSUMQ graph in Fig. 1 in the appendix reveals that foreign gross domestic product over the sample period is stable. This is because the plots of the Cumulative sum and Cumulative sum of square (CUSUM and CUSUMQ) lie within the 5 percent critical bound.

The normality and serial correlation test was conducted using the Jarque-Bera test and the Breusch- Godfrey LM test respectively. Heteroskedasticity and functional test was done using Breusch-Pagan-Godfrey test and Ramsey reset test respectively. Finally, the stability of the model over the sample period is ascertained from the plots of CUSUM and CUSUMSQ.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This section presents a summary and conclusion on the impact of oil and gas rent production on the economic growth of Ghana. The conclusion is based on the results of the study. In addition,

this chapter makes recommendations for policymakers and further research.

5.1 Summary

The aim of the study was to investigate the impact of oil and gas rent production on the economic growth of Ghana from the Year 2012-2017. Based on the objective of the study, the study used yearly time series data spanning from 1990-2017 from the world development indicator (WDI) database. The study employed trend analysis and ADRL model as estimation strategy to ascertain both the short run and the long run relationship between resource rent and economic growth in Ghana. Specifically, the study examines the empirical relationship between oil rent and economic growth as well as gas rent and economic growth in Ghana. The data obtained was passed through a stationarity test using the Augmented Dickey-fuller (ADF) and Phillips- Perron (PP) test. The results from the stationarity test reveals that all the variables are integrated of order zero and one.

From the study, it was revealed that there is a positive and a significant relationship between oil rent and economic growth in both the long-run and short-run in Ghana. Thus oil rent exerts positive impact on economic growth in Ghana. The study also revealed that there was a significant relationship between gas rent and economic growth in the short-run in Ghana.

However, in the long-run, the relationship was not significant in Ghana. Furthermore, there was a significant and positive relationship between foreign direct investment and economic growth in both short-run and long-run in Ghana. Thus foreign direct investment had a positive influence on economic growth in Ghana. Lastly, exchange rate has positive impact on economic growth in the long-run in Ghana. However, in the short-run, the relationship was negative in Ghana.

5.2 Conclusion

The major objective of the study was to examine the impact of oil and gas rent on the economic growth of Ghana from the Year 2012-2017. In doing so, the study employed the ARDL model as an estimation technique to examine both the long-run and the short-run relationship between oil rent and economic growth as well as gas rent and economic growth.

The study found out that oil rent had a positive impact on economic growth in both the long-run and short-run in Ghana. The study also reveals that gas rent exert positive and significant on economic growth in the short-run. However, in the long-run, the study shown that gas rent had a negative impact on economic growth in Ghana.

5.3 Recommendations

The following recommendations were made based on the findings of the study:

From the study, it was reveals that oil rent and gas rent had a positive relationship with economic growth. The study recommends that the government should provide financial support through subsidy to oil and gas production industries to help increase oil production in Ghana. Increase in oil production will help increase oil rent to promote growth in Ghana. In addition, the government should reduce taxes on oil production industries to help increase the production oil and gas production in Ghana. This will help promote growth in Ghana.

The study also reveals that foreign direct investment had a positive relationship with economic growth in Ghana. The study recommend that, the monetary authority should be able stabilize the macroeconomic indicators like inflation and exchange rate to help attract foreign investment in Ghana. Thus Government and private partnership should ensure effective management of the exchange rate fluctuations in Ghana.

Furthermore, the study reveals that exchange rate had a positive impact on economic growth in the long-run in Ghana. The study recommend private and government partnership to help stabilize the local currency. This will help increase economic growth in Ghana.

The study also revealed that oil rent has an effect on the economic growth. Therefore the study recommends that stakeholders must be willing to engage in activities that improve the production of oil in order to boost the economy. Also, since the study was conducted using secondary data, this would mean that the documents or information gathered may not be representative of, or reflect the wider population, especially when older reports between the periods of 2012-2017 were used. The study recommends future studies should to consider the opinions of experts in the related field and Ghanaians in general. Thus, future studies can either adopt quantitative where questionnaires will be administered in collecting data or qualitative study design where interview sessions can be conducted.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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