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EFFECTS OF ENERGY PRICES ON ECONOMIC GROWTH IN THE ECOWAS SUBREGION: INVESTIGATING THE CHANNELS USING PANEL DATA

A THESIS SUBMITTED TO THE DEPARTMENT OF ECONOMICS, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF SCIENCE DEGREE IN ECONOMICS

BY

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DECLARATION

I declare that, I have personally, under supervision, undertaken the study herein submitted. I declare that this submission is my own work towards the award of MSc Economics and to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of this University, except where due acknowledgement has been made in the text.

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DEDICATION

This work is dedicated to my mother for her support and love.

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ABSTRACT

The study empirically examines the effect of energy prices on economic growth within the ECOWAS sub-region. Acknowledging that the effect of energy prices on growth is quintessentially indirect and hence can be tracked through some channels, the study thus investigates this using the System Generalized Methods of Moments (GMM) estimation technique for the period spanning 2000 to 2015. The results indicate that the overall effect of energy prices on economic growth is significantly negative. This effect propagates mainly through government consumption expenditure and investment, albeit its effect through real interest rate is positive. In other words, energy price drives real interest rate down which promotes growth. However, its negative effects on government consumption, investment and exchange rate significantly overwhelm the positive effect from real interest rate. Thus policies geared towards finding alternative energy sources and domestic energy use would be beneficial because of the region's quest to achieve a long term sustainable growth.

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CHAPTER ONE

INTRODUCTION

1.0. Background of the Study

Energy is an essential commodity that every nation thrives on. As a matter of fact, the wellbeing and success of nations largely depends on effective management of the energy sector. The recent overwhelming growth chalked by China and India can be largely be attributed to the increasing consumption of energy. Sachs (2012) outlined this trend and concluded that the rapid growth experienced by China has led to an enormous and unparalleled demand for energy. This finding suggests that there could be some bidirectional causality of economic growth and energy consumption. Other studies (see Chaitanya, 2007) corroborate the feedback effect of energy consumption and economic growth as the findings suggest that higher energy consumption is as a result of rapid economic growth. Given that economic growth relies significantly on energy use, it is imperative for countries to map up strategies and frameworks to enable the energy sector to thrive to enhance economic performance.

Pricing of energy in most countries is exogenously determined. Also energy prices are volatile since they are susceptible to shocks. Thus, being able to predict the prices of energy could be beneficial to successful implementation of energy policies in most countries. Further economic growth could be boosted when energy prices are relatively stable. On the other hand, unstable and hiked energy prices could be devastating. Malik (2007) explains that increase in energy prices lead to increase in domestic price level while foreign exchange reserves decreases. At the same time, it is expected to have a damaging effect on the value of the domestic currency (i.e., depreciation). Depreciation causes energy imports to be much

expensive and consequently increases the cost of production and hence productivity is adversely affected (Lescaroux and Mignon, 2008).

Another harmful effect of increased energy prices is the possible lessening of the availability of fundamental inputs to production which negatively affects potential output (Brown and Yucel, 2002). The real wage rate is also adversely affected due to the decreased productivity and consequently leads to increased unemployment. Decrease in the real wage and increase in unemployment will accelerate inflation which also reduces consumption and real wealth (Cunado and Gracia, 2005; Hsing, 2007). Moreover, increased energy prices can lead to reduction in government spending which negatively affects the economy.

From the foregoing, it appears the effect of energy prices on the economy is propagated through some channels which are worth identifying.

1.1. Problem Statement

The importance of energy has been widely recognized in relation to the traditional factors of production. With modernization, production processes have become heavily dependent on energy, and sustainable economic growth cannot be achieved without sufficient and uninterrupted supply of energy. Therefore, it is imperative for developing countries to unequivocally admit the importance of energy in pursuit of sustainable growth.

Energy price (especially crude oil) and its attendant consequence on economic output still remains an important issue confronting a growing number of world economies. The relationship between energy prices and the level of economic activity has been the subject of much attention for some time as there has been extensive empirical literature on the energy price-GDP relationship, covering the last three decades. Derby (1982) and Hamilton (1983)

were among the early studies and they conclude that most economic recessions were preceded by a sharp rise in the price of oil.

The industrial sector of a country is an engine of economic growth. A sustained and uninterrupted supply of energy is an important determinant of industrial sector performance, which further contributes to better growth of economic indicators. It is therefore intuitive that energy prices would affect economic growth in a seemingly indirect manner rather than direct. Stated alternately, the effect of energy prices on economic growth does not seem to be particularly direct, possibly due to its effect through other determinants of growth. Yet, a plethora of studies have sought to examine the direct effect of energy prices on the economic performance of countries, regions etc. Essentially, energy prices would very much first affect the direct determinants of economic growth such as investment, inflation, interest rate, exchange rate, consumption and consequently through these channel variables affect economic growth. Hence, the novelty of this research is to contribute to the existing body of knowledge by constructing a macro econometric model to be used as a barometer to examine the indirect effect of energy prices on economic performance of the Economic Community of West African States (ECOWAS) and additionally exploiting a more robust panel data estimator (Generalised Method of Moments estimator) for this purpose. The choice of the ECOWAS sub-region is as a consequence of the sub-region's uniqueness in terms of economic performance, social and economic integrability, and the individual countries quest to achieve a unique economic goal. For instance, virtually all the countries that constitute the economic union are net importers of oil and hence are more susceptible to oil price shocks and its consequent effects on their economic performance. Furthermore, no research has been conducted in this manner within the sub-region. Pursuant to the above, the present study seeks to examine the effects of energy prices on economic growth, by particularly

investigating the channels through which such effects are propagated in the ECOWAS sub-region.

1.2. Research Objectives

The general objective of the study is to assess the impact of energy prices on economic growth in the ECOWAS Sub-region. The study specifically seeks to achieve the following:

i. To investigate the effects of energy prices on the channel variables (i.e., government consumption, investment, real interest rate and exchange rate).
ii. To examine the effects of the channel variables on economic growth.
iii. To determine the indirect effects of energy prices on economic growth.

1.3. Research Questions

The study seeks to answer the following empirical questions:

i. How does energy price affect government consumption, real interest rate, investment and exchange rate?
ii. What is the effect of the channel variables on economic growth?
iii. What is the effect of energy price on economic growth through the channel variables?

1.4. Justification of the Study

The study of the impact of energy prices on economic growth particularly in the ECOWAS sub-region is relevant considering the importance of energy to the region's development through production. Also, for the fact that most of the countries within the region are net importers of energy resources, this study seeks to inform policymakers on which channels to focus in the event of frequent energy price changes particularly in the upward direction.

Further, this study seeks to contribute to both policy and academic debate on the influence of energy prices on the economic performance of countries.

1.5. Scope of the Study

Studying the impact of energy prices on economic growth is a broad concept in an academic research and for that matter we seek to investigate the impact of energy prices on the economies in the ECOWAS sub-region. Additionally, we limit the period of the analysis to be between 2000 and 2015. The choice of the study period is as a consequence of the availability of data on all the variables used in the study for all the countries. We deem it relevant to include every member in the ECOWAS community and hence justify our choice of the study period for which data is readily available.

1.6. Organisation of the Study

The rest of the study is organised as follows: Chapter two reviews the relevant literature both theoretically and empirically on the relationship between energy prices and economic growth. Chapter three presents the research methodology while Chapter four presents the empirical results and analysis. Chapter five summarizes the key findings, suggests appropriate recommendations for policy considerations and concludes.

The scope of the study would be the economic situations of the 15 member countries in the sub-region as a result of the impact of energy prices through the following channels: consumption, investment, real interest rate and exchange rate.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

As pointed out in Chapter one, a country's economic growth depends hugely on energy consumption and consequently an increase in the price of energy would affect an economy, mostly indirectly. To clarify this point, this chapter seeks to investigate the theoretical and empirical studies on the energy prices and economic growth.

2.1. Relationship existing between Energy Prices and Economic Growth

There exists broad empirical writing concerning oil (herein after energy) price and its association with GDP. Among the early studies that considered the relationship between energy prices and economic growth include Darby (1982) and Hamilton (1983). These authors assume that numerous recessions that happened within a few economies were trailed by a quick ascent in prices of crude oil. However, this idea over the years has faded as observational studies on utilizing information past the 1980s show oil costs having much lesser impact on economic output.

Later studies after the seminal work of Hamilton (1983) have found oil prices to Granger-cause economic growth in the US economy. Jimenez-Rodriguez and Sanchez (2004) found a comparative result for the UK, Norway, France, Canada and Germany. Aside the aforementioned studies that considered short term interactions between oil prices and economic growth, other few studies have examined the long term relationship between the two. Among those studies, Hooker (2002) has investigated the US economy and assessed a cointegrating relationship that exists between oil prices, unemployment and interest rate over

a long stretch while Lordic and Mignon (2006) demonstrated confirmation of co-incorporation between costs of oil and GDP in the United States.

The literature on oil prices – GDP relationship considers also the part of reactions from unpredictable fluctuations in the cost of oil contending that the impact of oil prices on economic output depends on the symmetry of the model – that is, whether or not a model is symmetric. By symmetry in response to oil prices, we mean output reaction to a fall in oil prices which ends up being a genuine impression of the reaction of a rise in the prices of oil of the same magnitude. Contrarily, asymmetry in response to oil prices suggests that output reaction to an increase in oil prices varies to that of a fall in oil prices of the same magnitude. Interestingly, both specifications generally have been applied in examining the direction of causality between output and oil prices. However because of various difficulties, there has not been any study which applies the asymmetric specification of the oil price – GDP relationship within a panel context.

As indicated by Jimenez-Rodriguez and Sanchez (2004), the result of oil price changes ought to shift among oil trading and also oil importing countries. The ramification of this is, an increase in oil price should reflect as uplifting news in the previous and the other way around in the latter. It is in this manner from earlier works that an increase in oil prices positively affects nations that export oil and adversely impacts nations that import oil.

2.2. Effects of Oil Price Shocks on Economic Growth

The link between oil price and economic output has been given much hypothetical and observational consideration over the years. However, much of the concentration has been to a great extent on the USA and other great economies of the world. Earlier hypothetical studies took a shot at the relationship concerning raw petroleum prices and economic growth (e.g.,

Rasche and Tatom, 1977; Bernanke, 1983). More recent hypothetical studies include Finn (2000) and Hamilton (2009).

Rasche and Tatom (1977) contended that oil price fluctuations can be a vital marker of a change of the supply-side that reduces the growth of the economy. Along these lines an increase in the price of unrefined petroleum shows an increase in the shortage of energy, which is a fundamental resource of production. In this manner, regardless of the possibility that all resources in an economy are completely utilized and effectively utilized, the possibility to deliver is diminished on the grounds that in economic terms, crude oil has gotten to be scarcer. The development of yield and efficiency are hence lessened.

Bernanke (1983) explained on the capital gear usage speculation. He exhibited in a fractional harmony display that oil price shocks would have a tendency to decrease value added, in light of the fact that organizations will concede irreversible venture choices as they attempt to see if the expansion in oil cost is short lived or enduring. Therefore, makers will think that it is more important to reschedule lasting choices relating to venture once they are misty about up and coming raw petroleum price changes. Such choice is likewise liable to contrarily influence the growth of GDP of an economy.

Finn (2000) additionally detailed a model with superbly focused markets, however incorporated energy as a vital contribution for the usage of capital. The model considers contrasts that happen amid utilization rates for capital that is beneficial as utility of utilization of energy. This makes a roundabout channel (that works through capital stock) and the standard direct creation capacity channel, for diverting the effect of changes in energy utilization to the economy. Changes inside crude oil prices results in a quick, simultaneous decrease in utilization of energy and additionally usage of capital. Diminishment in the

utilization of vitality capacities straightforwardly through the illustrative generation capacity of firms; this causes a lessening in output and work's minimal productivity.

Taking into account a review of literature, Hamilton (2009) keeps up that a key system through which oil price shocks affects an economy is through disturbance in the use of purchasers and firms on non-oil products and administrations. Nonetheless, on the off chance that this interruption does not happen, the effect of an oil price climb to the economy will be represented by the variable offer contention.

Different channels through which changes in the price of crude oil influence the growth of an economy have been recognized in studies on crude oil and economic growth. Diverts distinguished in the different studies incorporate the supply and reaction, inflation impact, and the real balance effect (Brown and Yücel, 2002: Jiménez-Rodríguez and Sánchez, 2005: Chuku *et al*., 2010 and Bhanumurthy *et al*., 2012). Figure 1 shows the channels of transmission from oil cost increment to development of GDP.

Accepting that the interest for crude oil is inelastic to changes in the value level, an increase in the universal price of oil for instance thus means higher import bill for net oil importing economies, ceteris paribus. This circumstance will bring about a higher exchange deficiency and therefore cause a weakening of the nation's present record equalization. This will in the end result in lower financial development rates. This channel (Import Channel) is shown in Figure 1 by the connection from global oil cost to the present record equalization to GDP.

The second channel through which an expansion in the universal cost of oil can influence an economy is through an expansion in the local cost of the product (the Price Channel). For most oil producing nations, not all the increase in the global cost of crude oil is passed on to residential shoppers of the item. The administration as fuel subsidy more often than not

retains part of the cost increment. This is shown in Figure 1 by connection between oil subsidy and pass-through proportion.

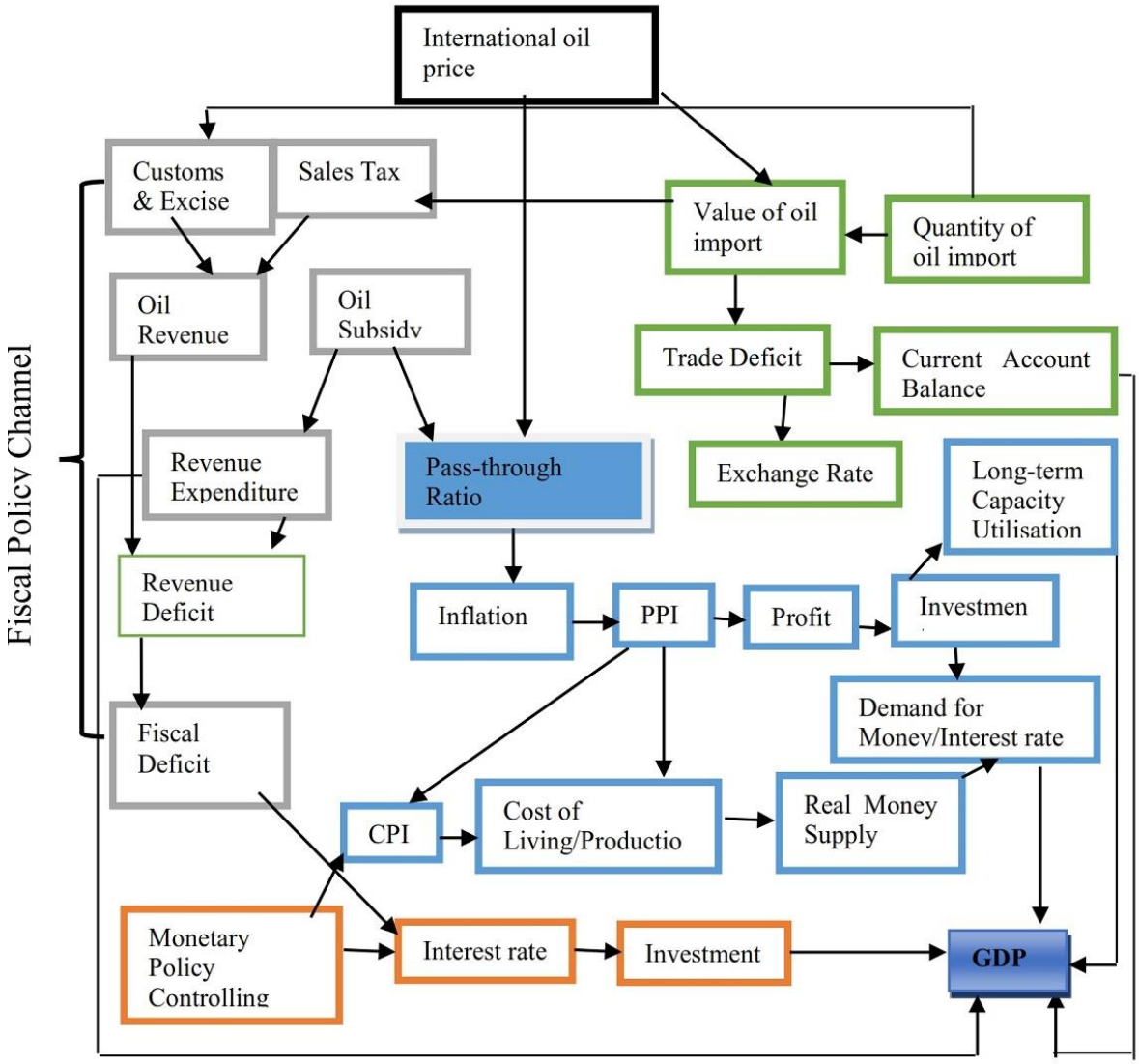


Figure 1: Transmission Mechanism

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

Thus, because of changes in the terms of exchange that is liable to happen because of an increase in oil price, the nation's conversion standard will be influenced and this is liable to influence the costs of items in the household market. This likewise demonstrated by the connection between the conversion scale and pass-through proportion. This infers just a segment of the cost expand (Pass-Through Ratio) will be passed onto the residential business

sector. The extent that is passed onto the local business sector will bring about an ascent in the level of swelling and along these lines lead to an ascent in the expense of creation. This leads to a reduction in benefit levels and therefore prompts a lessening in speculation and business and GDP development. In Figure 1, this is shown by the connection from worldwide oil price to inflation, maker value record (PPI), speculation to long run limit use and intrigue and afterward to GDP.

On the interest side, high oil price causes costs of consumer products to increase. Real money supply falls as interest for cash likewise increases. This prompts an increase in loan fees. Money related powers may likewise react to the increase in value levels by fixing fiscal approach (raising loan fees). High loan fees dishearten venture and this tends to influence GDP as demonstrated in Figure 1.

2.3. Cross-Country Evidence

In spite of the fact that, various studies look into the relationship concerning crude oil prices and economic growth, the vast majority of such studies have to a great extent centred on developed economies. Chuku *et al*. (2010) examined the relationship between crude oil prices and economic growth changes taking into account sectoral structure of a country, structures of foundation, and also macroeconomic data among others.

Research pointing to developed nations (for instance (Hamilton, 1983: 1996: 2010; Lee et al., 1995; Jimenez-Rodrigues and Sanchez, 2005; Filis and Chatziantoniou, 2013) have found that, an increase in crude oil price prompts an antagonistic impact on real output and economic growth. All things considered, every one of these specialists settled on the way that there has not been a steady relationship for these countries after some time. The precarious affiliation saw in the past studies was affirmed in a study by Blanchard and Gali (2007) who

made an examination between the present response of the normal increment in prices of GDP and productivity to oil price shocks in a class of developed nations to that of the 1970s. Blanchard and Gali (2007) set up that a more flexible work business sector and upgrades in money related arrangement where the key purpose for the frail responses of economies as of late is smaller energy force. On the other side, inquires on the crude oil prices-economic growth relationship for oil producing nations have built up changed results. Chang and Wong (2003) analyzed the effects of oil price changes on the economy of Singapore and set up an irrelevant aberrant relationship concerning oil price variations and the GDP. Despite what might be expected, the study by Farzanegan and Markwardt (2009) on the economy of Iran demonstrates a solid direct relationship concerning oil price variances and the yield development of commercial ventures. Additionally, while works by Olomola (2006), Akpan (2009) and Oriakhi and Osaze (2013) have all distinguished a positive relationship concerning the increase in oil price and economic growth in Nigeria (perhaps in light of the fact that Nigeria sends out crude oil), Wakeford (2006), and Bouzid (2012) have all found an aberrant relationship concerning oil cost and the development of economies of South Africa and Tunisia separately.

Concentrating on studies on Ghana, Jumah and Pastuszyn (2007) explored the relationship between changes in oil prices and Ghana's economic growth between the times of 1965 and 2004. The point of the examination was to observe the relationship concerning the worldwide oil price and Ghana's total interest through the channel of loan cost by means of cointegration investigation. The study did not distinguish a direct critical relationship amongst economic growth and crude oil price changes; nonetheless, the study found that the universal cost of crude oil specifically influenced the value level which tends to contrarily influence real productivity. The results moreover demonstrated that money related strategy is basically

stilled in response to an increase in the cost of oil keeping in mind the end goal to reduce any impacts on development however to the detriment of average increase in prices.

Essentially Tweneboah and Adam (2008) researched the long run and short run linkages between world crude oil price and economic growth related strategy in Ghana for the period 1970:1 to 2006:4 by utilizing a vector mistake redress model. The discoveries of the exploration showed a long run affiliation concerning oil value, Ghana's residential value level, her GDP, conversion scale and financing cost in which oil cost straightforwardly influences the value level where as in a roundabout way influencing productivity. The concentrate additionally uncovered that an unforeseen oil value variance is gone before by an increase in the rate of normal cost of industrial and decay in productivity in Ghana. Tweneboah and Adam (2008) contended on the response of loan fee to an increase in the price of oil that, monetary policy arrangement has in the past been with the motivation behind decreasing any development worries of oil price changes however at the expense of more prominent normal increment in price of goods.

The issue with these two studies is that, both neglected to control for the impact of monetary strategy reaction to varieties in the cost of raw petroleum in Ghana. Financial strategy reaction have however been recognized by Bhanumurthy *et al*., (2012) as a noteworthy direct effect through which changes in the worldwide cost of unrefined petroleum affects the development of most developing nations. In Ghana, government spends a total of US$432 million a year on fuel appropriations; this is liable to significantly affect the relationship between oil price and development of Ghana's economy. All the more thus, these two studies used the global cost of crude oil in their estimation, in any case, Mork and Olsen (1994) battles that, if taxes, endowments, value controls or swapping scale variances put wedges between the dollar rough price and the cost paid or got by local customers and makers, despite the fact that this cost might be a decent marker of world business sector interruptions,

on the off chance that it bears critical shortcomings as a measure of local expenses and incomes. In Ghana, the structures of value control, the high and fluctuating charges on petroleum items, and the awful varieties in return rates subsequent to the 1970s are all critical occasions of such wedges. Furthermore, these two studies utilized the VAR structure as a part of their estimations, Kilian and Vigfusson (2011) exhibited that oil value VAR models are in a general sense and this renders the parameter gauges conflicting and deduction invalid. Thus, the present study varies from existing studies by means of its utilization of the System GMM to deal with co-integration, recognizing how financial approach impact the relationship concerning oil price and development of the economy and changing over worldwide cost of crude oil into the nearby cash.

Non-African Countries

In Juncal *et al*. (2012), the impact of fast diesel oil prices on sustenance area costs in Pakistan is analyzed. The nourishment included rice, maize, wheat, chicken and cooking oil which were the needed variables in the study. The free variable was fast diesel. The study guessed that there was a noteworthy relationship and a beneficial outcome of oil costs on food inflation. Taking period arrangement information of 10 years i.e. 2001 to 2010, the outcomes that they got bolstered the speculation and it was reasoned that there was an exceedingly critical impact of oil costs on nourishments expansion.

Bhattacharya and Bhattacharya (2001) endeavoured to study the transmission component of an expansion in crude oil prices on the costs of different products and output in India. The paper gets proof of bi-directional causality amongst oil and non-oil inflation in India. The paper stated that in spite of the fact that the weight of the cost increment at the worldwide business sector was not completely passed onto residential customers in India, the joined oil pool shortage applied weight on government accounts, influencing the macroeconomic

viewpoint and expansion in the resulting year. Again the authors expressed that in the Indian setting, the conceivable effect of petroleum value treks which are managed regularly produces banter among people in general. The deferment of alterations in directed costs may postpone the development of expansion weights in the short run yet therefore gets interpreted into an invariably bigger shock. Any hike in such prices, aside from direct effect indirectly affects the costs of those items which use them as inputs and can prompt a compensation value winding. Utilizing month to month information from April 1994 to December 2000, the paper determines a four-condition VAR model to ponder the connection of inflation in oil with non-oil expansion and growth in money and output. The scientific structure embraced in the paper was utilized to look at the drive of a shock in expansion and yield, and, recognize the slacks through which oil prices influence the costs of different products. The outcomes uncovered that a 20 percentage point shock on oil prices lead to 1.3 percentage point increment in inflation in different goods as it peaks, which regularly happened five to seven months after the shock. The effect on prices endures for around two years, however amid the period it decreases extensively in extent.

In Juncal *et al*. (2004), the study examined the oil costs large scale economy relationship by studying the effect of oil price shocks on both economic activity and customer cost records for six Asian nations over the period 1975Q1-2002Q2. The outcomes recommend that oil prices significantly affect both economic activity and cost lists in spite of the fact that the effect is constrained to the short-run and more noteworthy when oil price shocks are characterized in local currencies. Fourth, and to the extent where the expansion rates are concerned, we find that oil price shocks communicated in local currencies forms significantly affect inflation in all examined nations. As some time recently, the oil prices consumer relationship seems, by all accounts, to be restricted to the short-run and more critical when oil price shocks are characterized in nearby coinage. Fifth, the study confirms asymmetries in the

oil prices changes-expansion rate relationship for the instances of Japan, Thailand, South Korea and Malaysia, and just for the instance of South Korea when the oil price changes-economic growth rate relationship is examined.

Arshad *et al*. (2015) empirically examined the impact of energy prices on economic output in Pakistan by investigating it through some channels. They constructed a macroeconometric model using system GMM estimation technique for the period 1991 to 2011. They found that energy prices have negative effect on economic growth.

African Countries

In Akpan (2009), the author examines the dynamic relationship between oil price shocks and major economic variables in Nigeria by applying the VAR approach. The study calls attention to the unbalanced impacts of oil price shocks including the way that positive and in addition negative oil price shocks essentially affects inflation. In the wake of characterizing oil price shocks the author expresses that Nigeria has encountered four oil shocks each of which had associations with some development in key macroeconomic variables and particularly for inflation. Case in point, the author brings up, the 1973-74, 1979-80 and 2003-2006 periods were connected with cost increments while the oil market breakdown of 1986 of a scene of value decline. Likewise significant is the way that in spite of the apparent advantage of oil prices change (increment in the cost of oil in the previous specified periods considering the nation that exports oil) for Nigeria, which so profited the nation that the estimation of Nigeria's export measured in US dollars increased by around 600 for every penny with the terms of exchange ascending from 18.9 in 1982 to 65.3 by 1974 and government income which remained at 8 for every penny of GDP in 1972 rose to around 20 for every penny in 1975, swelling was generally twofold digit in Nigeria. The study received quarterly perceptions for the period 1970 to 2007 catching the first and second oil blast times

of the 70s and mid-2000s individually. To explore the reaction of macroeconomic variables to unbalanced and advancements in oil costs, an unhindered Vector Autoregressive model (VAR) was received. The author's outcomes were that the inflationary impacts of oil price shocks on the Nigerian economy could be clarified through the AD-AS model saying expanding oil incomes add to larger amounts of government expenditure, plus, given that net outside stores of the national bank would build, the money supply will increase. The expanded money supply and government consumptions will move the interest bend upward. Strangely, output changes represent the biggest offer of shocks in inflation rate, while oil price shocks clarified relatively little. Yield changes contributed around 45 for every penny to changes in commodity price level in the primary quarter, declining through 35 for every penny in the tenth quarter. Real exchange rate contributed around 10 for each penny to changes in expansion rate in the main quarter, increasing through 15 for every penny in the final quarter to around 20 for every penny in the tenth quarter. Nonetheless, oil cost clarified just 0.3 for every penny of changes in expansion rate in the principal quarter, ascending to around 6 for each penny in the eighth quarter and 10 for every 21 penny in the tenth quarter. The paper reasons that oil cost may not be essentially inflationary in spite of discoveries by Barsky and Kilian (2004) and Rotemberg and Woodford (1996).

In Bobai (2012), the study inspected the effect of expansion of petroleum costs in the Nigerian economy utilizing a various relapse model as the fundamental apparatus of examination and OLS methods to look at the relationship between petroleum costs and swelling in Nigeria from 1990-2011, where the variables utilized for investigation were inflation rate and petroleum costs in Nigeria, the outcomes demonstrated a positive relationship exists between PMS, AGO and inflation. PMS had more impact on swelling, while negative relationship exists amongst expansion and DPK. In this paper, in spite of the

discoveries of Akpan (2009) the conclusion was that the general impact indicated increment in petroleum item cost expands the rate of expansion in Nigeria.

2.4. Summary of the Literature

A large body of the literature have considered the effect of energy prices on economic growth. Mainly the literature has considered a time series analysis of the issue for countries across the world. Again, these literatures have failed to consider the indirect effect of energy prices on economic growth. Further, when the indirect effect is considered, the study is limited to only one country. The present study overcomes these problems of the previous studies on methodological and conceptual basis. First, the study employs the panel data econometric technique to control for unobserved country specific effects. Also it acknowledges the indirect effect of energy prices on economic growth and consequently considers that by investigating the channels through which it affects economic growth.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0. Introduction

This chapter is sectioned mainly into two parts – description of the data and the variables used in the analysis and the empirical strategy. The estimator choice is presented under the empirical strategy to provide a sound justification for the appropriate technique employed. Additionally, we present the theoretical or conceptual framework of the channels through which energy prices affect economic performance of countries.

3.1. Data Sources and Description of Variables

3.1.1. Data Sources

The study uses dataset consisting of a panel of observations for the 15 ECOWAS member countries for the period covering 2000 to 2015. Data on real GDP per capita, exchange rate, real interest rate, inflation, broad money stock, government consumption expenditure and gross fixed capital formation are gleaned from World Bank's World Development Indicators and IMF's International Financial Statistics. Data on crude oil price used as a proxy for energy price is obtained from the British Petroleum database.

3.2. Conceptual Framework

As indicated earlier, energy prices do affect economic growth through some channels. Such transmission mechanism is presented in Figure 2 to provide a brief conceptual background upon which this study is built. Following Arshad *et al*. (2016), we settle on a number of channel variables including investment, government consumption, real interest rate and

exchange rate due primarily to data availability. Other potential variables that could have been considered if data were available and have been considered in the literature include stock prices and unemployment.[1]

Real interest rate by definition is the difference between nominal interest rate and inflation. Theoretically, there are two effects for which energy prices can affect economic growth through real interest rate – inflation effect and the interest rate effect. According to the former, higher energy prices increases inflation which consequently reduces the real interest rate. With respect to the latter, increased energy prices increases the demand for money which in turn increases the supply of money, given that monetary authorities cannot accommodate the increased demand for money. The resulting effect is the increase in the nominal interest rate. The net effect therefore is dependent on which of the two effects is stronger. Incidentally, higher real interest rate discourages investment and consequently thwarts economic growth.

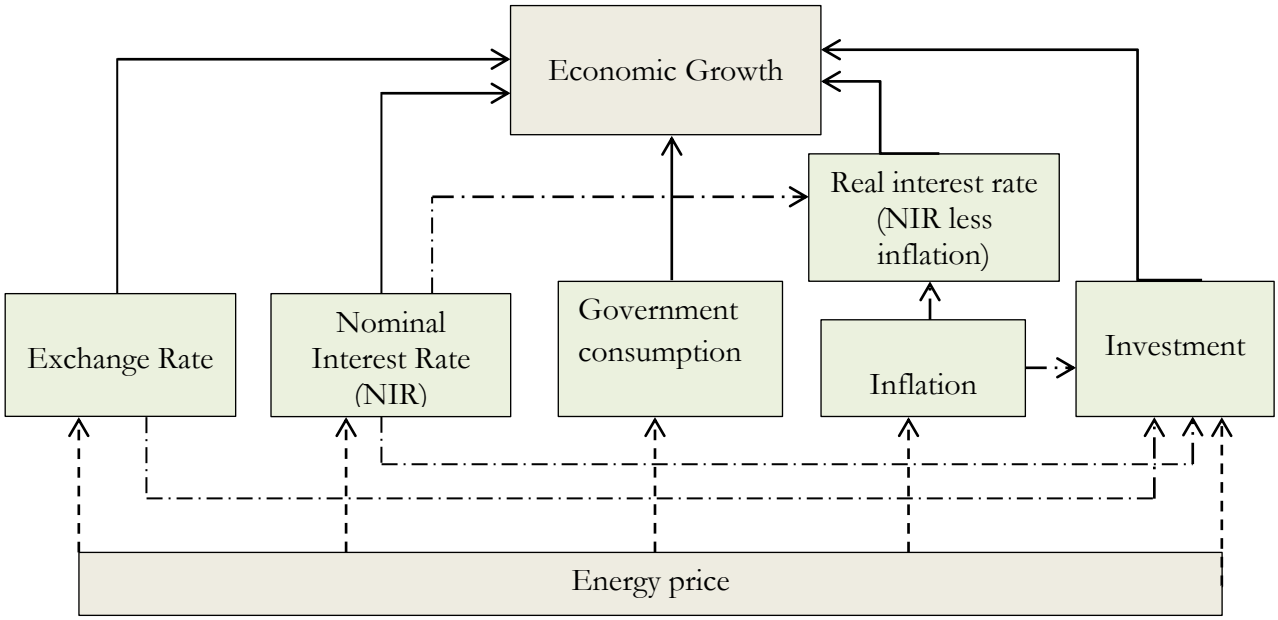
Energy price also affects economic growth through its effects on exchange rate. Intuitively, high energy prices lead to the depreciation of a country's currency particularly if the country is a net importer of energy resources. This leads to the worsening of the importing country's trade balance which consequently contracts the economy in question.

Another channel through which energy prices can affect economic growth is government consumption expenditure. An increase in energy price directly raises the price level which also implies that real government expenditure decreases. To maintain the same level of expenditure, government nominally raises its expenditure as a consequence of the increase in

[1] Unemployment data in particular is virtually absent from all the available sources and thus dropped from the analysis. Also, since the stock markets in most developing countries are still in their creeping stages, data on stock prices for almost all the countries seem exiguous.

energy prices. Thus, energy price has a procyclical effect on government consumption expenditure. Increase in government expenditure would, however, have an ambiguous effect on economic growth depending on whether the expenditure is tilted towards productive activities or take away resources that could otherwise yield a significant rate of return in the private sector.

Figure 2: Conceptual Framework of the Transmission Channels



Source: *Author's construction*

Investment is affected when energy prices change. Intuitively, high energy prices increase cost of production which deleteriously affects investment. Again, high inflation as a consequence of high energy prices decreases real savings and hence the value of investment returns and finally decreases investment. Further, high inflation due to high energy prices increases the nominal interest rate and hence decreases bond prices which reduce investment since investors experience capital loss on bonds.

3.3. Empirical Strategy

A plethora of studies have investigated the determinants of economic growth using cross sectional data.[2] Essentially, cross-sectional studies average the variables (both dependent and independent) over a period of time to capture the relationship existing between them. A corollary is that cross-sectional studies fail to account for the time series variations in the data which could possibly increase efficiency. Again, cross-sectional studies are fraught with endogeneity problems since it is generally difficult to identify many country-specific effects which lead to omitted variable bias. To circumvent these problems, we employ dynamic panel data estimation technique in this study in an attempt to predict the growth of countries within the ECOWAS sub-region using energy prices.

3.3.1. Specification of the Empirical Model

Indexing countries and time by i and t respectively, the panel growth regression equation to be estimated is:

$$y_{it} = \alpha + \delta y_{it-1} + \beta' X_{it} + \lambda' Q_{it} + \eta_i + \varepsilon_{it} \qquad (1)$$

where y_{it} is the per capita real GDP for country i at time t, y_{it-1} is the per capita real GDP at the start of each period which captures the conditional convergence of income across countries, X_{it} is a vector of channel variables over the period including investment, real interest rate, real exchange rate and government consumption expenditure, Q_{it} is a set of conditioning variables, η_i is an unobserved country-specific fixed effect, and ε_{it} is the white noise error term. To capture the group growth rate, we can express equation (1) equivalently as:

$$\Delta y_{it} = \alpha + (\delta - 1) y_{it-1} + \beta' X_{it} + \lambda' Q_{it} + \eta_i + \varepsilon_{it} \qquad (2)$$

[2] Earlier growth studies including Mankiw *et al.* (1992) and Barro and Sala-i-Martin (1992, 1995) have used cross-sectional analysis to explain factors that account for differences in income per capita of countries.

where Δy_{it} is the log difference of real GDP per capita which captures the growth rate. Since energy prices affect economic growth through their effects on the channel variables, it follows that, the set of channel variables are functions of energy prices compactly specified as:

$$X_{it} = \phi + \theta X_{it-1} + \lambda ep_{it} + \gamma' Z_{it} + \eta_i + u_{it} \qquad (3)$$

where ep_{it}[3] is the energy price for country i at time t, Z_{it} is a vector of control variables affecting the channel variables and u_{it} is the error term. To examine the effect of energy price on economic growth is therefore to estimate the indirect effect.[4] Table 1 summarizes the effect of energy prices on economic growth.

Table 1: Effects of energy prices on economic growth

Channel Variables	Effect of energy price on channel variable	Effect of channel variable on economic growth	Effect of energy price on economic growth
Physical Investment	−	+	−
G. Consumption	+	+	+
Exchange rate	+	−	−
Real interest rate	±	−	±

3.3.2. Estimation Technique

In this study, we estimate the growth equation in equation (2) using the System Generalized Method of Moments (System-GMM) technique *à la* Blundell and Bond (1998). Due to the dynamic structure of the growth model, the variables are rendered endogenous and consequently the use of Ordinary Least Squares (OLS) and Fixed Effects estimators renders the parameters biased and inconsistent. Stated alternately, to address the issue of endogeneity

[3] Since almost all the countries used in the study are net-importers of energy, we assumed homogeneity in the import price of energy from the world market. The difference in the effect of the energy price on output growth therefore would come from the former's effect on the channel variables.

[4] For instance, given $y = f(x(z))$, the effect of z on y is given by using chain rule $\frac{\partial y}{\partial z} = \frac{\partial y}{\partial x}.\frac{\partial x}{\partial z}$. Thus, the effect of energy price on economic growth is the product of the effect of the channel variables on economic growth and the effect of energy price on the channel variables.

and unobserved country-specific characteristics, we use the System GMM dynamic panel data estimation technique. The use of the System GMM is justified on an account of the existence of weak instruments which renders that the variance of the coefficients increases asymptotically and thus in small samples they can be biased.

System GMM is an extension of the Differenced-GMM due to Arellano and Bond (1991) and Arellano and Bover (1995). We begin by estimating the following difference equation:

$$y_{it} - y_{it-1} = \delta\left(y_{it-1} - y_{it-2}\right) + \beta'\left(X_{it} - X_{it-1}\right) + \left(\varepsilon_{it} - \varepsilon_{it-1}\right) \qquad (4)$$

which gets rid of all time-invariant regressors and considers past values lagged more than two periods as valid instruments.[5] To reduce potential biases and inaccuracies often associated with Difference GMM, Blundell and Bond (1998) developed a system of regressions specified in differences and levels. For the regression in differences, the lagged levels of the explanatory variables are used as instruments. Also the regression in levels uses the lagged differences of the explanatory variables as instrument.

The consistency of the System GMM estimator is assessed using two specification tests – the Sargan and Hansen tests for over-identification restriction and the test for serially correlated error term. The tests of over-identifying restrictions test the validity of the instrument sets. A rejection of the null hypothesis means the instruments are not valid and hence do not support the model. The contrary is true for a non-rejection of the null hypothesis. The other test examines the null hypothesis that the error term is serially uncorrelated. A non-rejection of the null hypothesis gives support to the model.

[5] Similar specifications are done for the channel variable equations.

3.4. Definition of Variables

The variable definitions are taken mainly from the sources which they are taken from as indicated in the preceding section and also other relevant sources.

- **GDP, PPP (constant 2011 international $)**

PPP GDP is gross domestic product converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2011 international dollars.

- **Energy Price (US $)**

We proxy energy prices with Crude oil prices which measure the spot price of various barrels of oil, most commonly either the West Texas Intermediate or the Brent Blend. The OPEC basket price and the NMEX futures price are also sometimes quoted.

- **Health expenditure per capita, PPP (constant 2011 international $)**

Total health expenditure is the sum of public and private health expenditures as a ratio of total population. It covers the provision of health services (preventive and curative), family planning activities, nutrition activities, and emergency aid designated for health but does not include provision of water and sanitation. Data are in international dollars converted using 2011 purchasing power parity (PPP) rates.

- **Current account balance (BoP, current US$)**

Current account balance is the sum of net exports of goods and services, net primary income and net secondary income. Data are in current U.S. dollars.

- **Foreign Debt**

Principal repayments are actual amounts of principal (amortization) paid by the borrower in currency, goods, or services in the year specified. This item includes principal repayments on long-term debt and IMF repurchases. Long-term external debt is defined as debt that has an original or extended maturity of more than one year and that is owed to nonresidents by residents of an economy and repayable in currency, goods, or services. IMF repurchases are total repayments of outstanding drawings from the General Resources Account during the year specified, excluding repayments due in the reserve tranche. To maintain comparability between data on transactions with the IMF and data on long-term debt, use of IMF credit outstanding at the end of year (stock) is converted to dollars at the SDR exchange rate in effect at the end of year. Repurchases (flows) are converted at the average SDR exchange rate for the year in which transactions take place. Data are in current U.S. dollars.

- **Broad money (current LCU)**

Broad money is the sum of currency outside banks; demand deposits other than those of the central government; the time, savings, and foreign currency deposits of resident sectors other than the central government; bank and traveller's checks; and other securities such as certificates of deposit and commercial paper.

- **Inflation, Consumer Prices**

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be

fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used.

- **GDP (constant 2010 US$)**

GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. Dollar figures for GDP are converted from domestic currencies using 2010 official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used.

- **General government final consumption expenditure (constant 2010 US$)**

General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation. Data are in constant 2010 U.S. dollars.

- **Real Effective Exchange Rate Index** (2010 = 100)

Real effective exchange rate is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

- **Real Private investment (**$US million; 2011 constant prices**)**

The series for real private investment is derived from the difference between the total gross capital accumulation and total gross investment by the government (i.e. public sector

investment). Foreign Direct Investment (FDI) was subtracted from private investment to get domestic private investment. The data was normalized by expressing them as a percentage of real GDP.

- **Foreign Direct Investment**

Foreign direct investment are the net inflows of investment to acquire a lasting management interest (10 percent or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) in the reporting economy from foreign investors, and is divided by GDP.

- **Institutions**

Institutions are proxied using Political Stability and Absence of Violence/Terrorism (PV) which represents the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. Data was gleaned from Kaufman *et al*. (2010)

CHAPTER FOUR

EMPIRICAL RESULTS AND ANALYSIS

4.0. Introduction

This chapter presents and discusses the estimation results of the various models specified in the preceding chapter. The main focus of the empirical analysis concerns estimating the indirect effect of energy prices on economic growth in the ECOWAS sub-region through some identifiable channel variables. The chapter first presents the summary statistics of the data used in the regressions which provides first-hand information about the structure and characteristics of the data. Further, a graphical illustration of the relationship between energy prices and economic growth is presented. The subsequent sections concentrate on the main empirical results and the discussions thereof.

4.1. Preliminary Analysis of the Data

Table 2 presents the descriptive statistics of the key variables used in the estimation of the various models. The standard deviation which shows the extent of variation in the data from their mean values indicates that, there is little variation in the variables across the units used in the analysis. This further corroborates the choice of these units in the analysis as seemingly similar in characteristics. The use of the logarithms of the variables is justified for two reasons: 1) it aids in the interpretation of the coefficients as elasticities. In other words, since the variables are presented in different units, to ensure comparability, presenting them in logarithms makes it possible to relate them; 2) it reduces the scale of the variables from a ten-fold to a two-fold thus potentially reducing heteroskedasticity.

Table 2: Summary Statistics of the Variables

Variable	Obs	Mean	Std. Dev.	Minimum	Maximum
Per capita income growth	225	0.018	0.051	-0.376	0.265
Log Gov't consumption	240	20.366	1.556	16.222	24.238
Log investment	240	20.741	1.621	17.754	24.976
Log interest rate	240	1.579	0.545	1.058	3.429
Log exchange rate	240	4.222	0.788	0	4.970
Log energy price	240	4.041	0.524	3.193	4.654

Note: Obs is the total number of observation. Observation on per capita income growth is 15 observations less than the remaining variables because of the lag effect. By definition, per capita income growth is first difference of the log of that same variable.

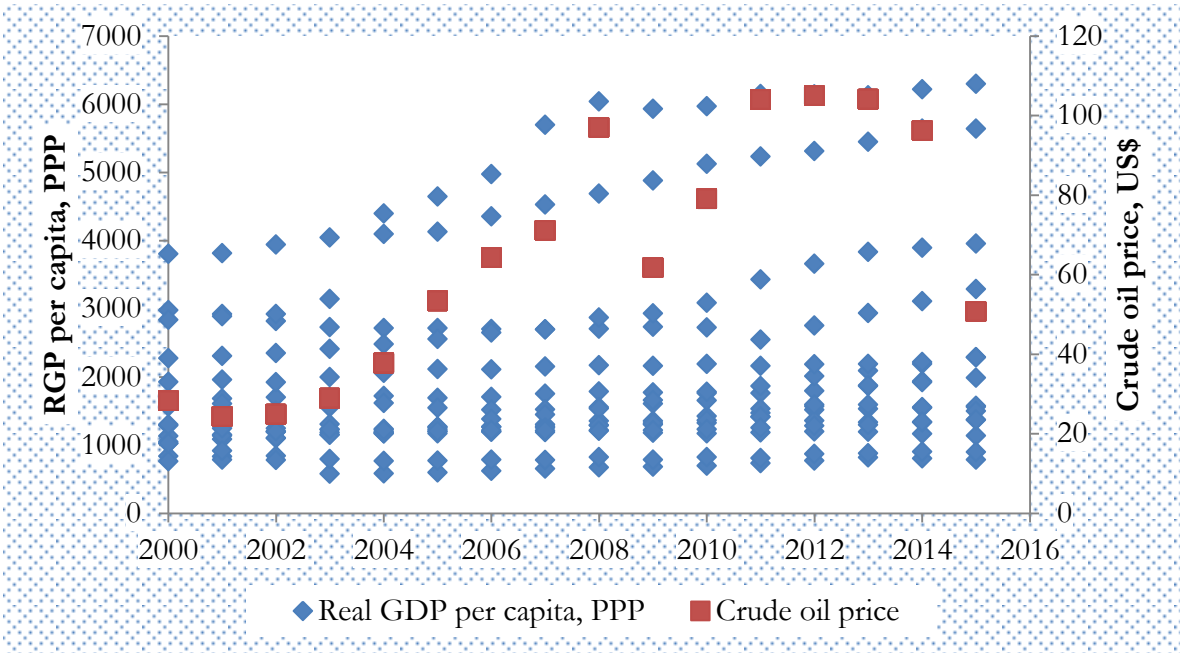


Figure 3: Scattergram of Real GDP per capita and Energy prices. Source: Author's construct

Figure 3 also presents the plot of the two key variables in this study using their respective proxies. The plot shows the time series as well as cross sectional variation of economic performance and energy prices. It shows a seemingly positive relationship between the two variables as periods with low energy prices are associated with low levels of economic performance across the ECOWAS countries on average. Contrarily, high energy prices are associated with high growth on average across the units, albeit a significant number of

countries are clustered around $2000 per capita income. As explained in the preceding chapter, interpreting the direct relationship between energy prices and economic performance could be illusive since the former affects the latter through some channels. However, this plot sought to provide a fortuitous relationship between these two key variables. In other words, the two series presented in the graph should not be interpreted to mean one is causing the other. Consequently we proceed to examine the real/actual effect of energy prices on economic performance through a chain of variables in the next section.

4.2. Estimation Results and Analysis

The parameters of the main equation as well as the subsidiary equations are presented in Table 3.[6] All the equations indicate the absence of autocorrelation as shown by the Arellano-Bond autocorrelation test statistics. The p-values of the Hansen test also indicate the validity of the instruments in all the specifications. The results of each equation are hence explained in turn.

Column (1) presents the parameters from the growth equation. The results show a high degree of persistence (or convergence) in real GDP per capita. Specifically, the coefficient on the lagged real GDP per capita (autoregressive parameter δ) is approximately -0.79 and it is statistically significant. The findings as far as the other parameters are concerned are consistent with the empirical growth literature (see Barro, 1991; Barro and Sala-i-Martin, 2004).

The estimated coefficient on real interest rate is statistically negative and indicates that a one percent increase in its value is associated with a 0.012 percent decrease in economic growth, ceteris paribus. Exchange rate has a deleterious effect on output growth. The estimated value

[6] The main equation is the growth equation whiles the channel equations are the subsidiary.

of the coefficient on exchange rate indicates that a one percent depreciation of the domestic currency leads to a negligibly 0.001 percent reduction in economic growth. A possible explanation could be that, the depreciation of domestic currency makes imported capital goods expensive which increase the cost of production and consequently on economic growth. Since most imports are consumer goods, the effect of the depreciation through capital goods imports would have a negligible effect on economic growth. The growth results also indicate that government consumption significantly reduces economic growth. Specifically, a one percent increase in government consumption results in 0.004 percent reduction in economic performance, all else constant. As anticipated, physical capital has a positive and significant effect on economic performance. The results indicate that an increase in physical investment by one percent is associated with a 0.013 percent increase in economic growth in the ECOWAS countries on average, ceteris paribus. This result reiterates the need for more physical investment in the region which has been identified to boost economic performance. Further, human capital and good institutions[7] positively and significantly affect economic growth. One percentage point increase in human capital and institutions is associated with a 0.033 and 0.009 percent increase in economic growth respectively.

The results of the channel variable equations are presented in columns (2) to (5) in Table 3. The interpretation of each equation is given in turn as they appear in the table. The results of the real interest rate equation suggest that increase in energy price significantly reduces real interest rate. Thus, a one percentage point increase in energy price significantly decreases real interest rate by 0.028 percent. Intuitively, higher energy prices increase inflation and consequently reduce real interest rate. Other determinants of real interest rate appear to have no statistical influence except real income which exerts a positive impact.

[7] Institutions are measured as political stability. This variable was taken from World Governance Indicators. Within the ECOWAS sub-region, over the period under consideration, there has been a relatively stable political climate and thus its effect on economic performance is well anticipated.

Table 3: System GMM Estimation Results

		Channel Variables			
	Growth	Real Interest rate	Exchange rate	Gov't consumption	Investment
	(1)	(2)	(3)	(4)	(5)
Constant	-0.276*				
	(-2.06)				
Log initial GDP per capita	-0.789***				
	(142.47)				
Log energy price		-0.028*	0.247**	0.395***	-0.094*
		(-1.86)	(2.24)	(3.73)	(1.92)
Log real interest rate	-0.012*				-0.042
	(-1.80)				(-0.65)
Log exchange rate	-0.001***				0.01
	(-2.88)				(0.16)
Log government consumption	-0.004*				
	(-1.84)				
Log investment	0.013**	-0.005		0.068	
	(2.34)	(-0.77)		(1.10)	
Log money supply		-0.002			
		(-0.88)			
Log human capital	0.033**				
	(2.20)				
Log foreign debt	-0.000		-0.023		
	(1.00)		(-0.63)		
Current account balance			-0.005**		
			(-2.61)		
Net foreign reserves			0.006		
			(1.07)		
Inflation				0.004	
				(0.89)	
Foreign investment				-0.0005***	
				(-3.35)	
Log real GDP		0.014*		0.252***	0.172***
		(1.93)		(6.56)	(3.58)
Institution	0.009**				
	(2.58)				
Specification tests					
Observation	225	225	225	225	225
Arellano-Bond test for AR(2)	-0.44	-1.05	0.77	-0.24	1.02
	[0.659]	[0.259]	[0.440]	[0.812]	[0.306]
Hansen test	0.00	1.63	0.00	0.00	0.00
	[1.000]	[1.000]	[1.000]	[1.000]	[1.000]

Notes: Dependent variables are given in the second row while the independent variables are in the first column. *,**,*** represent significance levels at the 10%, 5% and 1% respectively. Values in ( ) and [ ] are t-statistics and p-values respectively. All specifications include time dummies. Number of groups is 15 and number of observations per group is 15.

Energy price has a significant positive effect on the average domestic exchange rate. The results indicate that increase in energy prices leads to real depreciation of the domestic currencies of the countries on average. Since most of the countries in the sample are net importers of energy resources, increase in energy prices induces real depreciation of the importing countries' currencies. The coefficient indicates that one percent increase in energy price will depreciate in real terms the domestic currencies by 0.247 percent, ceteris paribus. The determinants of real exchange rate do not significantly induce exchange rate except current account balance which negatively and statistically influences it.

Turning to the government consumption equation, the results show that energy price significantly influences government consumption. An increase in energy price by one percentage point increase government consumption by 0.395 percent. The signs of the other determinants of government consumption expenditure are consistent with theory except foreign investment. Government consumption increases with real income, domestic investment and inflation, albeit real income in the only significant variable. Unexpectedly, an increase in foreign investment dampens government consumption in the region. The coefficient indicates a 0.0005 percent reduction in government consumption for a percentage point increase in foreign investment.

Concerning the investment equation, the results suggest a negative and significant relationship between energy price and investment. One percentage point increase in energy price is associated with 0.094 percentage reduction in investment. This is in alignment with theoretical literature which postulates an inverse relationship between energy price and investment (see Lardic and Mignon, 2008). The other significant determinant of investment is real income, which induces 0.172 percentage increase in the former for a percentage point increase in the latter.

4.3. Effect of Energy Prices on Economic Growth

The effect of energy prices on economy growth can be pervasive. In order to concretize the effects, we examine it through some channels. Table 4 presents the channel effects of energy prices on output growth. Column (1) reports the effect of energy prices on the channel variables while column (2) reports the effect of the channel variables on economic growth. Column (3) is the product of Columns (1) and (2) which illustrates the indirect effect of energy prices on economic growth. The results reveal that energy price has mixed effects on economic growth through its influence on the channel variables. According to the results, energy prices positively affect growth through real interest rate channel. Energy prices, on the other hand, affect growth negatively through the remaining channels – exchange rate, government consumption and investment. Thus the aggregate negative effect of energy prices on economic growth outweighs the aggregate positive effect. The aggregate net effect therefore suggests that, a percentage point increase in energy prices results in 0.00271 percentage decrease in the economic performance. Put differently, doubling energy prices induces 0.271 percent reduction in output growth within the ECOWAS sub-region. The energy price elasticity of real GDP in the region under study appears to be very low. Further, the results are consistent with theoretical expectation on the coefficient and corroborate the empirical literature. For instance, Arshad *et al*. (2016) estimated the net energy price elasticity of Pakistan's real GDP as -1.072 and Kilian (2008) estimated for the United States as -0.45 with error bounds of -0.27 and -0.66 respectively. Although the estimate in the present study appears to be smaller than that of the literature, it is reasonably acceptable considering the fact that prior studies mostly concentrated on country specifics. This study has, however, pooled a number of countries together and controlled for the inherent heterogeneity that could potentially influence the high response of economic growth to changes in energy prices.

Table 4: Effects of Energy Prices on Economic Growth

Channel Variables	Effect of energy prices on the channel variables	Effect of channel variable on economic growth	Effect of energy prices on economic growth
	(1)	(2)	(3)
Real interest rate	-0.028	-0.012	0.00034
Exchange rate	0.247	-0.001	-0.00025
Gov't consumption	0.395	-0.004	-0.0016
Investment	-0.094	0.013	-0.0012
Total Negative Effect			-0.00305
Total Positive Effect			0.00034
Total Net Effect			-0.00271

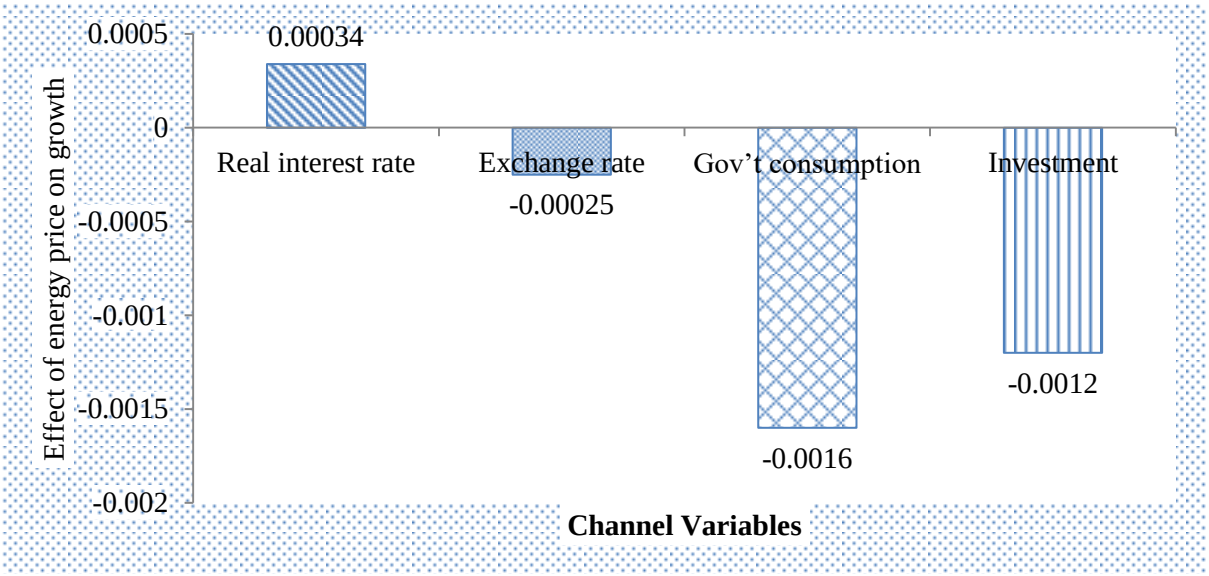


Figure 4: Contribution of the Channel Variables on Economic Growth. Source: Author's construct

To further appreciate the contribution of each channel variable on the effect of energy prices on economic growth, a graphical illustration is useful. Figure 3 thus presents the effect of energy prices on economic growth through these channels. Apparently the figure reveals that most of the effect is captured by government consumption and investment. In turn the effects through interest rate and exchange rate are minimal. The immediate corollary of this result is that, energy price shocks have the tendency to strongly affect government consumption and investment which consequently affect economic growth. Since the strong negative effects

through government consumption and investment overwhelm the weak positive effect through real interest rate, the net aggregate effect is negative as illustrated in Figure 5.

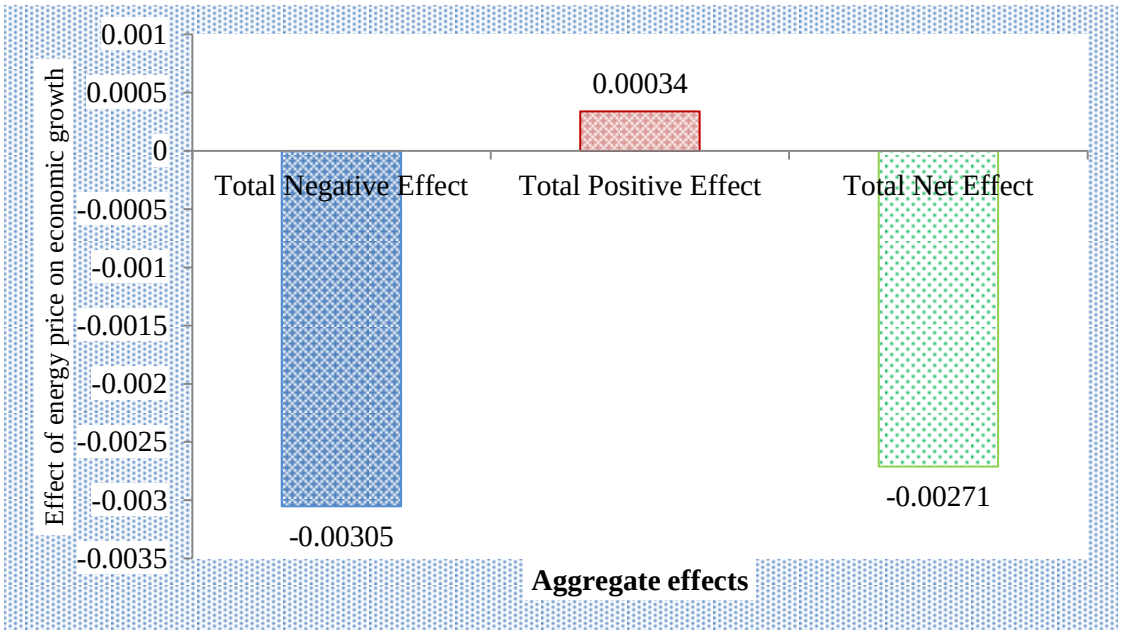


Figure 5: Aggregate Channel Effect of Energy Prices. Source: Author's construct

CHAPTER FIVE

SUMMARY OF FINDINGS, RECOMMENDATIONS AND CONCLUSION

5.0. Introduction

The chapter is sectioned into three: the first is the presentation of the key findings from the study; the second section presents the policy implications and recommendations based on the findings from the research and the third section concludes the study.

5.1. Summary of Empirical Findings

Empirical findings analysed in the preceding chapter are as follows:

The growth results indicate a high degree of persistence in the per capita real GDP of ECOWAS countries. Further real interest rate, exchange rate and government consumption significantly dampen economic performance of the region. On the converse, human and physical capital investment and good institutions promote growth in the region.

Another key finding is that energy price negatively affects real interest rate, exchange rate and physical investment whiles it leads to increased government spending.Thus energy price affects the channel variables in a mixed fashion.

Moreover, the indirect effect of energy prices on economic growth is found to be positive through the real interest rate channel and negative through exchange rate, government consumption and investment channels.

In terms of magnitudes, the contributions of government consumption and investment appear to be huge compared to the other channel variables.

Overall, the net effect of energy prices on economic growth is found to be negative, albeit the elasticity is low.

5.2. Policy Implication and Recommendations

The empirical results provide invaluable information regarding policy formulation and implementation. The key results from the estimation suggest that the overall impact of energy prices on economic growth is significantly negative and low, thus output responds less than proportionately to changes in energy prices within the ECOWAS sub-region. One immediate implication of this result is that, although the effect on average seems small, policies geared towards finding alternatives and domestic energy resource use would be appropriate. Since one of the key objectives of the economic union is to promote economic growth in the long term, the use of renewable energy resources such as solar energy, wind energy etc. is appropriate. Aside meeting the needs of these countries, these energy resources are essentially cheap and seemingly reliable, albeit their initial capital requirements are huge.

5.3. Conclusion

The study empirically examines the effect of energy prices on economic growth within the ECOWAS sub-region. Acknowledging that the effect of energy prices on growth is quintessentially indirect and hence can be tracked through some channels, the study thus investigates this using the System Generalized Methods of Moments (GMM) estimation technique for the period spanning 2000 to 2015. The results indicate that the overall effect of energy prices on economic growth is significantly negative. This effect propagates mainly

through government consumption expenditure and investment, albeit its effect through real interest rate is positive. In other words, energy price drives real interest rate down which promotes growth. However, its negative effects on government consumption, investment and exchange rate significantly overwhelm the positive effect from real interest rate.

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APPENDIX A: LIST OF ECOWAS COUNTRIES

1. Benin
2. Burkina Faso
3. Cabo Verde
4. Cote d'Ivoire
5. Gambia
6. Ghana
7. Guinea
8. Guinea Bissau
9. Liberia
10. Mali
11. Niger
12. Nigeria
13. Senegal
14. Sierra Leone
15. Togo