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THE EFFECT OF ENERGY CONSUMPTION ON ECONOMIC GROWTH IN CAMEROON

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ABSTRACT

This study was carried out to determine the Effect of Energy Consumption on Economic Growth in Cameroon from the period of 1980 to 2014. The energy sources used to test for this relationship were Petroleum and electricity. The study made used of secondary time-series data. Using the Generalised Method of Moments technique, the results obtained shows that Gross Domestic Product (GDP), population growth rate and petroleum prices, have a positive relationship with petroleum consumption. Also, there was an established positive relationship between Gross Domestic Product (GDP), population growth rate, electricity prices and electricity consumption. Again, the study found a positive and significant relationship between petroleum consumption, electricity consumption, Gross domestic investment (GDI) and population growth rate and economic growth. Furthermore, the empirical result revealed that the rate of inflation and economic growth are positively related. Based on the findings of this study, it is recommended that the government should expand current sources and exploit the other sources of energy such as solar energy, wind energy, thermal energy so as to increase the production and consumption of energy which increases economic growth.

Keywords: Energy consumption, Electricity consumption, Petroleum consumption, Gross domestic product, Generalized method of moments.

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Contribution/ Originality

This study contributes in providing more literature on the energy sector in Cameroon. The paper's primary contribution is the finding that is the finding that both petroleum and electricity consumption have a positive and significant role in the economic growth of Cameroon.

1. INTRODUCTION

Energy is a fundamental resource in the economy. Any activity requires energy in some form. Consequently, economic growth is directly related to energy consumption. As Alam (2006) puts it, "energy is the indispensable force driving all economic activities." According to Ojinnaka (2008) energy consumption runs hand in hand with the national product. His study revealed that energy consumption per capita is an important indicator of economic growth. Energy is one of the most important resources used in all production processes and this has increased the

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foreign earnings of countries that export energy products. Most countries especially the less developed countries have benefited from transfer of technology in the process of exploration, production and marketing. The energy industries have also provided jobs to a good number of people who were unemployed. There have been improvements in infrastructure and socioeconomic activities of communities in the process of energy resource exploitation. Base on the above arguments, consistence supply of energy, thus becomes central to economic and infrastructural transformation of the nation's economy.

The relationships between energy consumption and economic growth have been investigated over time but there is still need for continuous research and development. Many studies are based on whether the economic growth leads to energy consumption or vice-versa. The findings of many empirical studies show that there is a strong correlation between electricity use and economic development. For example, using Pearson correlation coefficient, Morimoto and Hope (2004) have discovered that economic growth and energy consumption in Sri Lanka are highly correlated. This result is oppose to that of Stern (1993) who examined the relationship between the USA energy consumption and GDP with a multivariate cointegration model but could not find any relationship the two variables. The relationship between energy consumption and the growth of gross domestic product has been a discipline for greater research and development (Jobert and Karanfil, 2007; Akinlo, 2008; Erdal *et al.*, 2008; Yoo and Ku, 2009).

Data from the International Energy Agency for 1990 to 2008 reveals that the average energy use per person in the world increased by 10%. In 2008, total worldwide energy consumption was 474 exajoules (132,000 TWh). Regionally, energy consumption grew from 1990 to 2008. For example, energy consumption increased by 170% in the Middle East, by 146%, by 146% in China, by 91% in India, by 70% in Africa, by 66% in Latin America, by 20% in the USA, by 7% in the EU-27 block, and world overall grew by 39% International Energy Agency (2010). Moreover, although 14.1% of the people living in the world today are from Africa, the continent consumes only 4.2 percent of world produce energy for industrial uses in 2007 (IEA, 2010). In 2010, energy consumption in Cameroon represented 5747 thousand ton of oil equivalent to kilowatt hours, of which 70% was consumed by households, 16% by transport and 6% by the industrial sector. Cameroon's oil production increased from 7.9 million tonnes in 1990 to 7.34 million in 2000. Out of the 26.6 million (representing 73,094 barrel per day) barrels produced in 2009, Cameroon consumed 24,500 bpd and exported 50,167 bpd. Cameroon oil production was down by 1.6% in 2008 and 13.1% in 2009. Output dropped to 30.8 million barrels in 2008 and in 2009, its dropped further to 26.6 million barrel. Various reasons were advanced to explain this drastic reduction including: the depletion of the main oil wells, reduction in the price of a barrel of oil and the 2009 international financial crisis. Other reasons included the failure to implement various development projects, whose execution has been postponed indefinitely.

Cameroon's net electricity generation was estimated at 5 billion kilowatthour in 2006 and its rose to 5.6 billion kilowatthours in 2007. Net consumption stood at 4.37 billion kilowatthour and 4.8 billion kilowatthours in 2006 and 2007 respectively. According to Diskiene *et al.* (2008) energy is an important factor which promotes the quality of life and provides economic and social improvements. However, increasing energy prices, global warming and climate change, increase in world energy demand, dependence on fossil fuels being consumed away rapidly and low level of development in new energy sources to commercially meet the increasing energy demand are major challenges that makes countries uncertain about energy supply security (Šliogerienė *et al.*, 2009). It has been observed that in Cameroon, the exploitation and use of energy has taken on a new dimension that can be explained by the growing population (which increases energy requirements) and also by the government policy of Cameroon becoming an emerging country by 2035.

The main problem facing the petroleum sector in Cameroon is that of supply shortages and disruptions that contributes to rising prices. Also, the electricity sector suffers from power brownouts, blackouts and low voltages which is extremely frequent, especially during the "dry" season, when there is no rain. The electricity service quality

deteriorated so much that the country's productivity decreased (a report from the French Development Agency estimates that the electricity crisis reduced economic growth by 1%, World Bank 2004). All these have affected economic activities in Cameroon. The government built diesel thermal power plants in Kribi in order to meet up with the electricity shortages and the Lom Pangar Hydropower Project is still in progress. Despite all the above measures taken, these problems still exist.

On the basis of the above problem, this study intends to provide answers to the following research question; what factors determine energy consumption? How do petroleum and electricity consumptions affect economic growth in Cameroon? The study had as main objective to investigate the effect of energy consumption on Economic growth in Cameroon. Specifically, this study intended to identify the factors that determine energy consumption and to find out the extent to which its affects economic growth in Cameroon

The rest of this research paper is structured as follows; Section two reviewed relevant literature on energy consumption. The paper moves further to present the analytical techniques in section three presents. Results are presented and discussed in the fourth Section. The fifth section summarizes, recommends and draws an adequate conclusion from the study.

2. LITERATURE REVIEW

Many studies have been carried out on energy consumption and economic growth for developed countries as well as developing countries over different periods of time. However, the results obtained after the usage of an econometric tool show diverse views on the direction of causation between energy consumption and growth. This discrepancy in results is due largely to the use of different econometric methods and time periods, besides country specific heterogeneity in climatic conditions, developmental policies, energy production and consumption levels. Some of this related studies selected for this study are examined as follows:

Using the energy consumption and gross national product (GNP) of the United States over the period from 1947 to 1974 and employing the bivariate Sims causality test, Kraft and Kraft (1978) argues that the direction of causality is from GNP to energy consumption. Going by their results, the US economy has a low level of dependence on its energy which enables energy conservation policies which does not affect income. This pioneer work in this area intensified the interest of researchers in the relationship between income and energy consumption.

Ansgar *et al.* (2010) set out to determine the long-run relationship between energy consumption and real GDP, including energy prices, for 25 OECD countries from 1981 to 2007. They used principal component analysis to show how development both at an international level and national level account for the long-run relationship energy consumption and economic growth. Based on their results, international developments account most for the long-run relationship between energy consumption and real GDP. Their results also show that energy consumption is price-inelastic. Furthermore, they concluded that there is a bi-directional causal relationship between energy consumption and economic growth.

Mahendra (1998) carried out a research aimed at determining the relationship between energy consumption and economic activity in Fiji. With the use of ordinary least square estimates for the period 1970-1987, the analysis showed that total energy use in the commercial sector in Fiji had expanded. The net result however contained a negative structural effect and a very substantial (negative) conservation effect. This study therefore concluded that, if efforts are not made either to increase conservation efficiency of use or to move towards greater use of renewable energy sources, increased demand for imported energy product will divert an increasing proportion of export earnings towards meeting the import bill.

Gbadebo *et al.* (2009) investigated the relationship between energy consumption and economic growth in the Nigerian economy from the period of 1970 to 2005. They examined three different sources of energy which are crude

oil, electricity and coal. By applying the cointegration technique, the results derived inferred that, there exists a long-run positive relationship between current period energy consumption and real GDP. The study revealed a negative relationship for lagged values of crude oil, electricity consumption and real GDP. The study observes that, energy consumption is a strong determinant of economic growth having an implicit effect in lagged periods and both an implicit and explicit effect on the present economy of Nigeria. The study recommended that this sector should be given more relevance even by the opportunities laden in the sector to increase economic growth

Ayodele (2004) carried out a research on improving and sustaining power (electricity) supply for socio economic development in Nigeria. His results obtained shows that electricity consumption is positively related to economic growth. He concluded that electricity consumption have diverse impact in a range of socio economic activities and also on the living standards of Nigerians.

Aqeel and Butt (2001) researched on energy and its relationship with economic growth in Pakistan. He made use of cointegration and Hsiao's version of Granger causality. The empirical results revealed that economic growth causes total energy consumption which is quite different from the findings of other researchers. The results show no bidirectional relationship between economic growth and gas consumption. On the other hand, the study also found a bidirectional relationship between economic growth and electricity consumption. The study concluded that energy conservation policy on petroleum consumption would not lead to any side-effects on economic growth in Pakistan.

Ongono (2009) carried a study on Energy consumption and economic performance in Cameroon. The results of this study show that there is no Granger causality between electricity consumption and economic performance (GDP) at the national level and primary sector. The result also revealed that in the secondary sector, production Granger causes electricity consumption. Furthermore, in the tertiary sector, the causality runs from electricity consumption to production. He recommended that any policy aimed at strengthening growth and reduce poverty must pay special attention on energy production.

This paper is different from previous contributions in several aspects. The sample adopted for the dataset is wider and current than other contributions. This analysis is carried out on two energy sector and providing enough literature on the petroleum and electricity sectors in Cameroon. Also, the study goes deeper to examine the factors that influences petroleum consumption and electricity consumption and their effect on economic growth which no study has done so for Cameroon. Again, the present study make use of the Generalized Methods of Moments technique as oppose to other studies which make use of cointegration and ordinary least square techniques.

3. METHODOLOGY

This study covers a time scope of 34 years (1980-2014 inclusive). This is because of the availability of data within this time period and also given the fact that the period is long enough to take care of any reforms that have been taken in the petroleum and electricity sectors in Cameroon. The study made use of secondary data. Petroleum consumption and electricity consumption data was gotten from IEA (International Energy Agency and the American Energy information Administration) statistics and index Mundi while Cameroon real GDP, population growth rate, inflation rate and gross domestic investment data came from African statistical yearbook and African development indicators.

The empirical model used for this study was designed to investigate the effect of energy consumption on economic growth in Cameroon between 1980-2014 inclusive. Making use of the methodology of similar empirical studies and the exogenous growth model, a model was drawn up to determine economic growth in the Cameroonian context. Take note that a simple linear specification of the model will not provide consistent results. Therefore, to cover this problem, the natural log of the variables were taken. The variables population growth rate and inflation rate

are not logged because they are already express in percentages and we do not log variables in percentages. The three equations were specified as follows;

$$l(PCON) = a_0 + a_1\, l(RGDP) + a_2\, l(PP) + a_3 POP + U \ldots\ldots\ldots\ldots\ldots\ldots \quad 3.1$$

$$l(ECON) = \beta_0 + \beta_1\, l(RGDP) + \beta_2\, l(EP) + \beta_3 POP + \pi \ldots\ldots\ldots\ldots\ldots\ldots\ldots \ldots\ldots 3.2$$

$$l(GDP) = \varsigma_0 + \varsigma_1\, l(PCON) + \varsigma_2\, l(ECON) + \varsigma_3 INF + \varsigma_4 l(GDI) + \varsigma_5 POP + \lambda \ldots\ldots\ldots\ldots\ldots 3.3$$

A priori $\mathbf{a_0>0, a_1>0, a_2<0, a_3>0,}$

β_0**>0,** β_1**>0,** β_2**<0,** β_3**>0,**

ς_0**>0,** ς_1**>0,** ς_2**<0,** ς_3**<0,** ς_4**>0,** ς_5**>0**

These *a priori* are coefficients of variables which were estimated and their signs were derived from economic theory.

PCON = Petroleum Consumption: Petroleum consumption refers to consumption of petroleum energy, and it is equivalent to domestic production plus imports and stock variations, less exports and the consumption of fuel used for international sea and air transport. It was measured in thousands per barrel per day.

PP = Petroleum price: This is the spot price per barrel (159litres) as traded on the domestic market. This price dependents on both the grade of the petroleum which is determined by factors such as specific gravity, sulphur content and the place where the petrol comes from. In this study, petroleum price was measured in US Dollas

EP= Electricity Prices: This is the average real price of home, commercial and industrial electricity measured in Franc CFA per kilowatt hour. Electricity prices under AES-SONEL are distinguish between three main types of consumers: low voltage consumers (households, small businesses (pay 50frs per unit) and street lighting (pay 40frs per unit), medium voltage consumers (larger businesses) and high voltage consumers like industries (pay from 50frs to 90frs depending on the unit consumed).

ECON = Electricity Consumption: This consists of total electricity used by households, businesses, institution and industries within a given period of time. It is measured in kilowatt-hours.

GDP = Gross domestic product: This is the total money value of all goods and services produced in a country within a given period of time which is usually one year. It was measure in million US Dollas

INF = Inflation rate: This is the rate of change of prices of goods and services measured annually. It was measured in percentages

GDI = Gross domestic investment: This is the addition to the capital stock of both the public and private sector located within the country. It was measured in million US Dollas

POP = Population growth rate: This is the rate of change in the population of the country over time. In this study, population growth was measured in percentages**.**

Equation 3.1 above reveals that petroleum consumption depends on Real Gross Domestic Product, Petroleum price and population growth rate. Also, Equation 3.2 shows that petroleum consumption is determined by Real Gross Domestic Product, Petroleum price and population growth rate. Again, Equation 3.3 reveals that Real Gross Domestic Product depends on Real Petroleum consumption, Electricity consumption, inflation rate, Gross Domestic Investment and population growth rate.

This study made use of the Generalized Method of Moments in analysing the time series data. Generalized Method of Moments estimator has been used in this study because they have large sample properties which are easy

to characterize so as to facilitate comparison. A family of such estimators can be studied *a priori*in ways that make asymptotic efficiency comparisons easy. The method also provides a natural way to construct tests which take account of both sampling and estimation error. Also the Generalized Method of Moments was used because its estimators can be computed without specifying the full data generating process.

Before delving in to GMM analyses, the J-statistic was used to test the validity of overidentifying restrictions. This test was conducted under the assumption that the overidentifying restrictions are satisfied. This means that the models specified above are valid. The computed J-statistic was multiplied by the number of regression observations. The resultant value was then used to determine if the model is appropriate or not

The economic or *a priori* test was the first validation test that was carried out to verify if the signs of the estimated coefficients are supported by economic theory. Statistical (1^{st} order) test made used of statistical measures such as multiple coefficient of determination (adjusted R^2), probability value and F-ratio test to find out the extent to which the results of the study could be use for policy recommendation. The adjusted R^2 was used to show the extent to which changes in the dependent variable are cause by joined variations in the independent variables. In this study, computed probability values were used to test the statistical significance of the estimated coefficients.

4. PRESENTATION AND DISCUSSION OF RESULTS

Table-1. Pair-wise correlation

	lpcon	**lecon**	**Lrgdp**	**Lgdi**	**lpopgr**	**Lprice**	**leprice**	**linfl**
Lpcon	1.0000							
Lecon	0.8592* (0.0000)	1.0000						
Lrgdp	0.7456* (0.0000)	0.8716* (0.0000)	1.0000					
Lgdi	0.0952 (0.6043)	0.3487 (0.0504)	0.5464* (0.0012)	1.0000				
Lpopgr	-0.6679 (0.0000)	-0.7512* (0.0000)	-0.6904* (0.0000)	-0.0030 (0.9868)	1.0000			
Lprice	-0.0519 (0.7744)	0.1816 (0.3119)	0.1021 (0.5783)	0.5485* (0.0012)	-0.0438 (0.8086)	1.0000		
Leprice	0.6319* (0.0001)	0.7715 (0.7715)	0.8351* (0.0000)	0.3880 (0.0282)	-0.8171* (0.0000)	0.2886 (0.1033)	1.0000	
Linfl	-0.4041 (0.0268)	-0.4070 (0.0256)	-0.3583 (0.0563)	0.4601 (0.0105)	0.3652 (0.0472)	0.1433 (0.4501)	-0.3264 (0.0783)	1.0000

*= significant at 1% .Figures in brackets ( ) represent probability-values of the correlation coefficient which is use to determine if the coefficients are significant or not.

From the results of the pairwise correlations presented on Table 1 (table computed using STATA 11), it can be observed that the correlation coefficients between the independent variables are below the threshold value of 0.8. This means that multicollinearity is absent between the explanatory variables in the model

Table-2. GMM estimation results for petroleum equation (equation 3.1)

Variable	**Coefficient**	**Standard Error**	**P-value**
D_lrgdp	0.5094788 ***	0.1077998	0.000
D_lpp	-0.0010907	0.0007804	0.162
D_pop	0. 2478218 ***	0.1087108	0.023
b0 (cons)	0.005006***	2.601109	0.003
R-Square	0.6137		
Adj R-squared	0.5723		
Durbin-Watson	1.905604		
J - Statistics	0.004531		
Obs	34		

Note: All variables in natural log except population growth rate (D pop)

*** denote 1% level of significant

From the table above, the computed J-statistic is 0.004531. This value was multiplied by the number of observations to obtained the calculated J-statistics. That is $J = 34 \times 0.004531 = 0.154054$. The value for the calculated J-statistics is small and less than zero. We therefore do not reject the null hypothesis that the instruments are valid. This means that the model is valid and the coefficients were interpreted as found on the proceeding paragraphs. The result in table 2 indicates that the constant term is 0.005. This represents the average autonomous petroleum consumption in Cameroon. In other words, this is the quantity of petroleum that is consumed when all other determinants of petroleum consumption are held constant. The result that there is relationship between Real Gross Domestic Product (RGDP) and petroleum consumption. This means that as the growth rate of Cameroon increases, so too does the standard of living of the population leading to an increase in the demand of automobiles, generators and other equipment or machineries that use petroleum and thus an increase in petroleum consumption. Precisely a 1% increase in RGDP will lead to a 0.5095% increase in petroleum consumption. The statistical test of hypothesis reveals that the result is statistically significant at 1%. We therefore reject our null hypothesis and accept the alternative implying that RGDP is a significant determinant of petroleum consumption in Cameroon within our period of study and so should be given adequate attention when setting growth strategies.

Petroleum prices have a negative coefficient of -0.0011. This implies that as prices of petrol reduces, the quantity demanded will increases. Precisely, when the price of petrol reduces by 1%, the quantity that is demanded will increase by 0.0011%. This value is not statistically significant at 1%. We therefore fail to reject our null hypothesis implying that petroleum prices are not a significant determinant of petroleum consumption in Cameroon within our period of study. Examining the influence of population growth rate on petroleum consumption reveals that the coefficient of population growth rate is positive (0.2478218). This is in agreement with a priori expectation. This implies that, as population increases, the demand of petrol will also increase. A 1% increase in population will result in 0.2478% increase in petroleum consumption. This result is statistically significant at 1%. This means that population growth rate is an important determinant of petroleum consumption in Cameroon and should be consider in energy policy making. The coefficient of multiple determination of the petroleum consumption equation shows a good fit. The Adjusted R^2 is 0.5723. This shows that variation in the level of petroleum consumption (PCON) is more than 57% accounted for by variations in Gross Domestic Product, population growth rate and Petroleum Prices, with less than 43% accounted for by the stochastic error term (U) (that is, variables not included in the model). This implies that our regression captures more than 57% of total variation in petroleum consumption explained by the variations in the explanatory variables with less than 43% accounted for by the stochastic error term.

The study also tested for the incidence of autocorrelation using the Durbin-watson (DW) statistics. The calculated D.W is 1.9056 which is greater than 1.7, shows that the results do not suffer from autocorrelation. In other words there is the absence of serial correlation in the study and thus are said to be reliable and could be use for forecasting and policy recommendation.

Table-3. GMM estimation results for Electricity equation (equation 3.2)

Variable	Coefficient	Standard Error	P-value
D_lrgdp	0.339299***	0.2275255	0.000
D_lep	-0.5752858	0.6873364	0.403
D_pop	0.133161 ***	0.5385518	0.002
b0 (cons)	0.012006***	4.007072	0.000
R-Square	0.7995		
Adj R-squared	0.7700		
Durbin-Watson	2.251145		
J - Statistics	0.005598		
Obs	34		

Note: All variables in natural log except population growth rate (D pop)

*** denote 1% level of significant

Table 3 above presents a computed J-statistic of 0.005598. This value was multiplied by the number of observations to obtain the calculated J-statistics. That is $J = 34 \times 0.005598 = 0.190332$. The value for the J-statistics is small which indicates that the model is correctly specified. We therefore do not reject the null hypothesis that the instruments are valid. This means that the model is valid and the coefficients were interpreted as below;

The constant term is 0.012. This shows the amount of electricity that is consume when all other factors that determines the quantity of electricity consumption are held constant. That is, the amount of electricity that is consumed when the other determinants of electricity consumption are not taken into consideration. The value of Real Gross Domestic Product (RGDP) is positive (0.339299) and this is in conformity with the a priori expectation. This means that as RGDP increases, the amount of electricity that is consume will also increase. Precisely a 1% increase in RGDP will lead to a 0.34% increase in electricity consumption. The statistical test of hypothesis reveals that the result is statistically significant at 1%. We therefore reject the null hypothesis and accept the alternative implying that RGDP is a significant determinant of electricity consumption in Cameroon within our period of study and so should be given adequate attention when setting growth strategies. The empirical results show that the coefficient for the price for electricity is -0.5753. This means that the prices of electricity and electricity consumption are negatively correlated. This implies that as prices of electricity reduce, the amount of electricity that will be consumed will increases. Precisely, when the price of electricity reduces by 1%, the amount of electricity consume will increase by 0.5753%. The statistical test of hypothesis reveals that the result is statistically significant at 1%. We therefore fail to reject our null hypothesis implying that electricity prices are not a significant determinant of electricity consumption in Cameroon within our period of study. Examining the influence of population growth rate on electricity consumption reveals a positive coefficient of 0.133161. This is in agreement with a priori expectation. This implies that, as population increases, the demand of electricity will also increase. A 1% increase in population will result in 0.1331% increase in electricity consumption. This result is statistically significant at 1%. This means that population growth rate is an important determinant of electricity consumption in Cameroon and should be consider in energy policy making. The above result reveals that the coefficient of multiple determination of the petroleum consumption equation has a good fit. The adjusted R^2 is 0.7700. This shows that variation in the level of electricity consumption (ECON) is more than 77% accounted for by variations in Gross Domestic Product, population growth rate and electricity Prices, with less than 23% accounted for by the stochastic error term (U) (that is, variables not included in the model). This implies that our regression captures more than 77% of total variation in electricity consumption explained by the variations in the explanatory variables with less than 23% accounted for by the stochastic error term. The test for autocorrelation using the Durbin-watson (DW) statistics shows a value of 2.2511. This means that the results do not suffer from autocorrelation. In other words there is the absence of serial correlation in the study and thus are said to be reliable and could be use for forecasting and policy recommendation.

Table-4. GMM estimation results for Economic Growth equation (equation 3.3)

Variable	Coefficient	Standard Error	P-value
D_lpcon	0.2389914 ***	0.0675559	0.000
D_lecon	0.0388531	0.0007451	0.0045
D_infl	-0.0001644	0.0621778	0.532
D_linv~t	0.0823549 ***	1.006048	0.000
D_Pop	0.306403***	0.0386823	0.033
b0 (cons)	0.010790***	0.0105166	0.0025
R-Square	0.6230		
Adj R-squared	0.5477		
Durbin-Watson	1.990492		
J - Statistics	0.013765		
Obs	34		

Note: All variables in natural log except population growth rate (D pop) and inflation (D infl)

*** denote 1% level of significant

The computed J-statistic for the Economic growth equation is 0.013765. This value was multiplied by the number of observations to obtain the calculated J-statistics. That is $J = 34 \times 0.013765 = 0.46801$. The value for the calculated J-statistics is small (<0) we therefore do not reject the null hypothesis that the instruments are valid. This means that the model is valid and the coefficients were interpreted as below;

Petroleum consumption has a positive coefficient of 0.2390. This is in conformity with our economic a priori expectation. This implies that petroleum consumption has a positive influence on economic growth. An increase in petroleum consumption will lead to an increase in RGDP. Precisely a 1% increase in petroleum consumption will lead to a 0. 2390% increase in RGDP. The statistical test of hypothesis reveals that the result is statistically significant at 1%. We therefore reject our null hypothesis and accept the alternative implying that petroleum consumption is a significant determinant of economic growth in Cameroon within the period of study

The results revealed that electricity consumption has a positive coefficient of 0.0389. This result is supported by the economic a priori expectation. This implies that electricity consumption has a positive relationship with economic growth. An increase in electricity consumption will lead to an increase in RGDP. Precisely a 1% increase in electricity consumption will lead to a 0.0389% increase in RGDP. The statistical test of hypothesis reveals that the result is not statistically significant even at 10%. We therefore fail to reject our null hypothesis.

The above result shows a negative relationship between the rate of inflation and real GDP. This means that as the rate of inflation or general price level increases, the real disposable incomes of consumers' fall leading to a fall in aggregate demand and investment as a whole which will eventually lead to a fall in RGDP through the multiplier effect. Precisely an increase in the general price level by 1% will lead to a fall in growth rates by 0.0001%. This result is not statistically significant even at 10%. We therefore fail to reject the null hypothesis which states that inflation has no significant influence on economic growth.

Examining the influence of Gross domestic investment on RGDP reveals that the coefficient of Gross domestic investment (0.0824) is positive. This is in agreement with the a priori expectation. This implies that, as Gross domestic investment increases, RGDP also increases. If the Gross domestic investment increases by 10%, real GDP will also increase by 0.0824%. This coefficient is statistically significant at 1% level of significance. The null hypothesis was rejected and the alternative accepted meaning that Gross domestic investment is a significant contributor to economic growth and should be taken into consideration when designing growth policies.

The empirical findings show that population growth rate has a positive (0.306403) coefficient which agrees with the a priori expectation. Precisely, a 1% increase in population growth rate, will lead to a 0.3064% increase in real GDP. This result is also statistically significant at 1% level of significance. Therefore, the null hypothesis was rejected and the alternative accepted. hence population growth rate is a significant determinant of economic growth in Cameroon.

The results in table 4, indicates that the constant term is 0.0283. This represents the average growth rate in Cameroon independent of the other variables. That is, the growth rate that occurs despite the above mentioned determinants of growth.

These results are supported by the Economic a Priori Expectations. The results of this research are in line with the the findings of other researchers such as Gbadebo *et al.* (2009) who carried out a study to investigate the relationship between energy consumption and economic growth in the Nigerian economy from the period of 1970 to 2005. By applying the cointegration technique, the results derived inferred that, there exists a long-run positive relationship between current period energy consumption and economic growth. The study observes that, energy consumption is a strong determinant of economic growth. This results contradict similar studies of other researchers such as Kamogawa and Shirota (2007) who incorporated carbon dioxide emissions in order to investigate the relationship between energy consumption, economic growth and carbon dioxide emission. Based on the application

of the Ramsey-Cass-Koopmans model, the results inferred that economic growth and flow of pollutants are positively correlated. Reducing petroleum consumption will reduce carbon di-oxide emission which will consequently increase economic growth and Yu and Jin (1992) who concluded that energy conservation policies will not have a negative effect on economic growth.

5. POLICY SUGGESTIONS AND CONCLUSION

This study examines the Effect of Energy Consumption on Economic Growth in Cameroon using Generalised Method of Moments technique. The findings of this study reveal the existence of a positive and significant relationship between energy consumption and economic growth. This study therefore recommends that companies in charge of oil refining and transportation should increase petroleum supply around the country by connecting the major towns with petroleum pipelines**.** But cleaner sources of energy should be used so as to curb the effects of climate change which results from the consumption of fossil fuels. Energy infrastructures should be Sustain and enhance. This does not only involve good maintenance practices of existing energy infrastructure but it also deals with ensuring that there is increase in such infrastructure through the issuance of licenses to the private sector for operation of such facilities and by reducing regulatory barriers even to long term capacity contracting. Also, natural gas infrastructures should be constructed and installed throughout the country. Availability of such facilities will increase the gas production and consumption and possibly growth.

The state should encourage research and development in the energy Sector in order to fully exploit other energy sources. There is need to increase research and development in the energy sector so that innovation can be fostered. Research and development into renewable sources of energy could be fostered and this could enhance economic growth. Lastly, the government should increase the budgetary allocation to the sector and make the release of funds as fast as possible without delays. It is certain that the energy sector is capital intensive and would require huge amount of investments. Based on the findings, it can be concluded that energy consumption has a significant role to play on the economic growth of Cameroon.

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