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# Impact Of Hydrocarbon Fuels On The Economic Growth

**Muhammad Bilal**
MPhil Scholar, Department of Commerce & Finance, GC University, Lahore
Email: bilallgs534jt@gmail.com

**Dr. Waqas Khan** (Corresponding Author)
Deputy Treasurer, GC University, Lahore Email: waqas.khan@gcu.edu.pk

**Dr. Ali Raza Elahi**
Assistant Professor, Department of Commerce & Finance, GC University, Lahore
Email: alirazaelahi@gcu.edu.pk

**Dr. Ali Fayyaz** Munir
Assistant Professor, Department of Commerce & Finance, GC University, Lahore
Email: ali.fayyaz@gcu.edu.pk

## ABSTRACT

The Current study investigates the long run relationship between three hydrocarbon fuels petroleum oil, natural gas, coal and the economic growth from MENA countries (Iran, Egypt, Kuwait, Saudia Arabia and Oman) over the period of 1996-2019 by using Pooled OLS technique. Energy and its impact on economic growth is the most concerned subject among the researchers and policy makers. Results verify the existence of long run relationship between hydrocarbon fuels and GDP. Positive and significant coefficients of hydrocarbon indicators ensures that consumption of Petroleum Oil, Coal and Natural Gas increase economic growth of the countries.

**Keywords:** Hydrocarbon, Pooled OLS, Growth, MENA Region

## Introduction

Hydrocarbon fuel is the mixture of carbon and hydrogen elements. Petroleum oil is the one of the largest source of energy. The raw crude oil and the products which are made from petroleum are the different categories in petroleum oil. The diesel and petrol which are adversely demanded by transportation sector are the distillated forms of petroleum oil. Other that these other forms of petroleum oil is used in manufacturing different product and the industrial sector. Natural gas is the one of the hydrocarbon fuel which is found in form of gas. The extraction process of natural gas is same as petroleum oil. It has many characteristics i.e. it is very cheap as compare to the petroleum oil. Natural gas is an environmental friendly fuel which is less harmful for the natural environment. LPG and the CNG are the forms of natural gas in which it is used. Coal is the solid form of hydrocarbon. Composition of coal is based on the carbon and some other elements i.e. Hydrogen, oxygen and nitrogen. It is found

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inform of black and brown rocks formulated when the dead bodies of animals and plants react with the elements deep in the soil in the presence of specific temperature and pressure. Coal is the cheapest way to generate electricity in the world. It also used in different sector for manufacturing and heating purposes. Hydrocarbon fuels (oil, natural gas and coal) are the vital factors of the economic growth. These are one of the essential inputs for many production and consumption activities. Hydrocarbon fuels drive the productivity and industrial growth of the modern economies high economic growth can be determined by many factors trade, exports, labor and capital but all of these variables are contributed with the help of these hydrocarbon fuels which enhance their productivity. Long run relationship between economic growth and hydrocarbon fuels are examined. The result will explain the efficient use of hydrocarbon fuels will bring economic growth. Many of the past studies focus on this global issue and discover the co-integration relationship among the consumption of energy and the economic growth. Mostly studies used the country specific empirical findings by applying different co-integration techniques. If energy and economic growth infers the causality between them, then the direction of causality supports to relate it with the energy hypothesis. Energy consumption and economic growth are analyzed by many of the studies conducted by researchers in the past. Mostly studies showed that positive relationship is found among energy consumption and economic growth. Petroleum oil, coal and natural gas are commonly used hydrocarbons fuels to generate electricity. The first and foremost sector where these fuels are used as energy resource is the industrial sector and this sector uses more of oil and the natural gas. When these fuels are used in the industries, their production level increases and they produced efficient output by utilizing fewer units of inputs. Hydrocarbon fuels are the important issue of the life these days and it plays a vigorous role to run any economy. It will help to guide the developing countries to manage their fuel resources. It will be a kind of helpful tool for countries to utilize their fuel resources in a manner that boost up their economies. Residential and commercial sectors are the second highest sector where petroleum oil, coal and natural gas are used for different purposes. All these fuels facilitate our living styles and make it easy and convenient. When living standards of the people are become high then it eradicates the poverty and they can participate in the development process of their economies. The third sector where these hydrocarbon fuels are utilized is the transportation sector. These fuels are used by all types of transportation, private vehicles and public transport. These fuels facilitate the economic activities by placing goods and services from one part of the country to another and internationally as well. It will help in foreign exchange earnings and boost up their growth. Energy crisis is becoming the global issue. This study will check the impact of three main hydrocarbon fuels petroleum oil, natural gas and the coal which are the leading source of energy. It will investigate the potential of these hydrocarbon fuels in the progress of the economies. Economies required more of these energy resources to fulfill the increasing demand of growing population. The remaining sections of this paper are planned as follows: the “Literature review” section describes a literature review. The “Data and methodological framework” section explores the data sources and methodological framework. The “Results and discussion” section discusses the empirical outcomes and discussion is provided; also, this section reveals the robustness checks. Finally, the “Conclusion and policy

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suggestion" section discusses the conclusion and policy implications on the basis of the results.

**Problem Statement**

According to the modern theory of the growth labour and capital are not only the production factors but energy resources are the also important participant in the production process. Many developing economies are rich in availability of these resources but due to the lack of infrastructure and the technology they are unable to use them for the growth of their economy.

**Objectives**

To investigate the long term and short term relationship between consumption of hydrocarbon fuels and the national income

**Literature review**

Studies were conducted in the past to examine economic growth and energy consumption. The results showed that there is a positive relationship between them. Kraft and Kraft was the first researcher who found the impact of energy consumption on US growth in 1978. Kraft and Kraft (1978) evaluated the diversity in Gross national product of by including different countries. Soms technique was used during their study. The results found that there is unidirectional relationship between GNP and energy consumption. Masih and Masih (1996) took the sample of around six Arian countries to locate the relationship between energy consumption and economic growth. To determine the direction of cause the dynamic rector error correction model is used. India and Indonesia show unidirectional relationship between economic growth and energy consumption. Only Pakistan bear bidirectional causality connection between energy consumption and national income. Soytas and sari (2003) determined the cause between the consumption of energy and Gross Domestic Product of developing countries. To examine the cointegration the johansen and Juselius maximum likelihood techniques were used by them. Empirical studies found that Argentina has bidirectional relationship. Whereas Italy and Korea showed unidirectional relationship between them. Causality is running from energy corruption to GDP in case of the following countries like Japan, Turkey, Germany and France. Huang et al (2008) inquired the causal relationship among the economic growth and energy consumption. The date of 82 countries are used of different income groups from 1970-2002. The empirical analyses showed that the countries with high income rate their causality is running positively from economic growth he energy consumption. Akinlo (2008) examined the casual relationship between consumption of energy and economic growth of 11 Sub Saharan countries. Data is collected from WDI and IMF (2005). He utilized the ARDL bound test, VECM to test the causality. The result showed that for single, Gambia, and Ghana the causality relationship is bidirectional between energy consumption and economic growth. Jinke et al (2008) analyzed the causal relationship between consumption of coal and GDP. Data of main OECD and non OECD economies are utilized from 1980-2005. It is found that those is unidirectional relationship in Japan and China between consumption of coal and GDP. While India, South Africa and South Korea have no relationship between the

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consumption of coal and GDP. Apergis and Payne (2010) also did analyses of economic growth and energy consumption. They used sample of six central American countries from 1980-2004. The used panel correction model and cointegration model and found that economic growth and energy consumption have the cointegration relationship between them. Thus results proved that energy consumption policies of these six countries have significant impact on their growth. Isik (2010) checked the effect of consumption of gas of Turkey's growth. He used ARDL model and calculated data from 1977-2008 and found that consumption of natural gas has positive impact on Turkish economy in the short run. While in long run if gave negative impact. Rufael (2010) checked the consumption of coal and real GDP of six leading countries which consume coal between 1965-2005. By using modified version of granger causality Test he found that there is unidirectional relationship between consumption of coal and economic growth to consumption of coal to economic growth. While China and South Korea have causality in opposite direction starts from economic growth to consumption of coal. Whereas bidirectional causality was found in South Africa and United States. Fei et al (2011) analysed energy consumption and the economic growth of 30 provinces of china to find cointegration from the data 1985-2007. Relationship is measured by applying panel cointegration and panel-based dynamic OLS. The findings prove that the relationship exist between real GDP per capita and the economic growth in the long run. Kum and Aslan (2012) inspected the causal relationship by by testing the variables of natural gas, capital and economic growth. They used the data of G-7 countries 1970 2008 by applying bootstrap corrected causality to check the relationship. The results showed that natural gas and the economic growth in France, US and Germany have bidirectional Causality. While UK and Italy have unidirectional relationship. Chaudry et al (2012) analyzed the relationship between the energy consumption and economic growth in case of Pakistan. Annual data of the year 1972-2012 was tested. Finally the results showed there is a unidirectional relationship between energy consumption and economic growth. Behmiri and Manso (2013) fount the causality relation between consumption of energy and economic growth of twenty three countries of sub Saharan African region from 1985-2011. They analyzed panel cointegration and panel FMOLS. It is found that by using panel granger causality test Crude oil and economic growth have two way relationships. Farhani et al (2013) explored the consumption of natural gas and trade in the real GDP of Tunisia. to judge the causality relationship among the variables vector in the error correction and auto- regressive distributed lag models are employed. The data has been taken from 1980-2010. According to the findings it showed that there the presence of a relationship among the consumption of natural gas, trade and economic growth. Farhani et al (2014) viewed the relationship between the consumption of natural gas and the economic growth of France from 1970-2010. To analyse the relationship in the long run ARDL Bound testing approach is used. VECM granger approach is utilized to check the causality of economic growth of France which showed a bidirectional causality. Mehmood et al (2014) investigated the energy consumption in accelerating the economic growth of Asian Countries from 1970-2012. Pooled mean group (PMG) and other panel cointegration test were used which showed the presence of relationship among energy consumption and the national income in the long run. Moreover Dynamic OLS and Fully Modified OLS

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proved that energy consumption contributes to the national income in a positive way. Satti et al (2014) checked the relationship among the consumption of coal and economic growth of Pakistan from 1974-2010. VECM granger method was used and result showed that consumption of coal and economic growth has bidirectional causality. Farhani and Rejeb (2015) predicted relationship between energy consumption economic growth from the year 1971-2008. Data of 95 countries were sub-divided into 4 income groups according to the world bank classification. Panel causality test and dynamic ordinary least square for were applied which showed that there is relationship between energy consumption and economic growth in the long run. The direction of causality moves from economic to energy consumption which holds conservation hypothesis for the low income group and high income countries. This academic work is a comprehensive piece of writing which based on prior literature. It shows the relationship between the national income and consumption of energy for the developing countries' economies.

Table No. 1: Summary of Selected Literature and key findings.

| Authors | Countries | Period | Variables | Methods | Findings |
|---|---|---|---|---|---|
| Kraft and Kraft (1978) | USA | 1947-1979 | GNP, energy consumption | SEMS Technique | Unidirectional relation between GNP and energy consumption |
| Masih and Masih (1996) | 6 Asian Countries | 1950-1990 | Economic growth and energy consumption | VECM | India and Indonesia have unidirectional relation between energy and economic growth & Pakistan has bidirectional. The empirical findings show mixed result. |
| Soytas and sari (2003) | 10 emerging markets excluding china and G-7 countries | 1947-1974 | Energy Consumption, GDP | Johansen and juselius maximum likelihood technique and VECM. | Italy and Korea showed unidirectional relation and Argentina has bidirectional. |
| Huang et al (2008) | 82 countries | 1970-2002 | GDP, energy consumption | Panel causality test | Relationship is positive among the energy growth and consumption for the countries belong to the middle income group. The countries which have high incomes, their causality |

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| | | | | | |
|---|---|---|---|---|---|
| | | | | | is running from income growth t o energy consumption positively. |
| Akinlo (2008) | 11 Sub Saharan African countries | 1980-2003 | Energy Consumption, GDP | ARDL bound test and VECM | Bidirectional among the energy consumption and economic growth |
| Jinke et al (2008) | OECD and non OECD economies | 1980-2005 | Consumption of coal and GDP | Panel co integration and causality test. | Japan and china have unidirectional causality between consumption of coal and GDP and there is no relationship exist between consumption of coal and GDP in case of India South Africa and South Korea. |
| Apergis and Payne (2010) | 6 centeral American countries | 1980-2004 | GDP and energy consumption | Panel correction model and error co-integration model | Economic growth and energy consumption have the co-integration relationship among them. |
| Isik (2010) | Turkey | 1977-2008 | Consumption of gas and economic growth | ARDL model | In the short run natural gas has positively related to the growth but in the long run the relationship between them is negatively related. |
| Rufael (2010) | Six leading countries | 1965-2005 | Consumption of coal and RGDP | Modified version of Granger Causality Test | The direction of causality is different for all the countries. |
| Fei et al (2011) | 30 provinces of china | 1985-2007 | Energy consumption and GDP. | Panel unit root test, panel co-integration and panel based dynamic OLS | Long run relationship exist between real GDP per capital and the economic growth. |
| Kum and Aslan (2012) | G-7 countries | 1970-2008 | Natural gas, Capital, GDP | Bootstrap corrected causality | France, US and Germany have Bidirectional causality between gas and GDP |

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| | | | | | |
|---|---|---|---|---|---|
| | | | | | whereas there is unidirectional relationship in Italy and UK. |
| Chaudry et al (2012) | Pakistan | 1972-2012 | Energy consumption and GDP | Granger causality test | Energy consumption and economic growth have unidirectional relationship. |
| Behmiri and Manso (2013) | 23 countries of sub Saharan African region | 1985-2011 | Consumption of crude and economic growth | Panel co-integration ,FMOLS | Crude oil consumption and GDP have two way relationships. |
| Farhani et al (2013) | Tunisia | 1980-2010 | Consumption of natural gas, trade and economic growth | Vector error correction and auto-regressive distributed lag models | Presence of relationship among the consumption of natural gas trade and economic growth. |
| Mehmood et al (2014) | Asian countries | 1970-2012 | Energy consumption and national income. | PMG and other panel co-integration test | Presence of long run relationship among energy consumption and the national income. |
| Satti et al (2014) | Pakistan | 1974-2010 | Consumption of coal and economic growth | VECM granger causality approach | Consumption of coal and economic growth have bidirectional causality. |
| Farhani and Rejeb (2015) | 95 countries | 1971-2008 | Energy consumption and economic growth | Panel causality test, DOLS, FMOLS | There is approval of relationship among energy consumption and economic growth in the long run. |

## Data and Methodological Framework

### Data, Variables and Descriptive Statistic

Data of consumption of petroleum oil, coal, natural gas and growth parameter are used from the period 1996 to 2019. Data of GDP as dependent variable is used as economic growth and it is measured as (constant 2010 US$) taken from (WDI 2020) and the data on the consumption of fossil fuels (Petroleum Oil, Coal and Natural Gas) is taken from BP Statistical Review of the world energy. Data of the variables is used from the period 1996 to 2019 (24 years).

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**Hydrocarbon Fuels**

Hydrocarbon fuels (oil, natural gas and coal) are the essential factors of the economic growth. These fuels are highly demanded energy resources for an economy. According to the Energy Information Administration, world's primary source of energy comprised of 36% share of Petroleum Oil, 27.4% share of Coal and 23% share of Natural Gas. Total share of fuels in primary energy consumption is almost 86.4% which is a huge share. Energy consumption patterns are changing with the rapid changing in the structure of the economies.

**Petroleum Oil**

Petroleum is one of the largest source of energy. It is easily transportable fuel and top traded object of the globe. It was predicted that world will face shortage of oil reserves in upcoming years. Petroleum oil is highly used in industrial sector for manufacturing and petroleum refining. This study has taken the data of petroleum oil from BP Statistical Review.

**Coal**

Coal is the most commonly used solid fuel in energy generation process and found all over the world. Coal is dumped in most of the developing regions. It is the most consistent, harmless and low cost energy type because it is widely available and plays a significant role in transferring energy access. It is environment friendly fuel which enhances the efficiency level and keeps the environment protected. This study has taken the data of coal from BP Statistical Review.

**Natural Gas**

Natural gas is another source of energy that is making significant involvement to the word energy sector. It is also an efficient fuel for the process of electricity generation. The extraction process of natural gas is same as petroleum oil. It is very cheap as compare to the petroleum oil. It is an environmental friendly fuel which is less harmful for the natural environment. LPG and CNG are the forms of natural gas in which it is used. This study has taken the data of natural gas from BP Statistical Review.

**Model**

$$\text{GDP} = \text{f}(\text{oil consumption}, \text{gas consumption}, \text{coal consumption}) \quad (1)$$

Equation 1 shows the functional relationship among the variables included in the study.

$$\text{GDP}_{it} = \beta_0 + \beta_1 \text{oil_con}_{it} + \beta_2 \text{gas_con}_{it} + \beta_3 \text{coal_con}_{it} + \varepsilon_{it} \quad (2)$$

Equation 2 shows the above functional relationship in the form of econometric relational form.

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**Table 2 Description of variables and data source.**

| Variables | Description | Source |
|---|---|---|
| GDP | Gross Domestic Product (constant 2010 US$) | WDI |
| OIL-CON | Oil Consumption in terawatt hour | BP Statistical Review |
| GAS-CON | Gas Consumption in terawatt hour | BP Statistical Review |
| COAL-CON | Coal Consumption in terawatt hour | BP Statistical Review |

**Table 3 Descriptive Statistics**

Descriptive Statistics: of variables are given in table.

| | OIL__CONSUMPTION | GDP | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|---|
| Mean | 594.7351 | 2.16E+11 | 524.4858 | 5.493569 |
| Median | 377.7492 | 1.33E+11 | 372.0047 | 1.189383 |
| Maximum | 2015.342 | 7.93E+11 | 2241.368 | 25.03845 |
| Minimum | 27.59348 | 1.40E+10 | 36.43172 | 4.84E-05 |
| Std. Dev. | 537.7653 | 2.03E+11 | 510.5310 | 6.798598 |
| Skewness | 1.039644 | 1.294725 | 1.540306 | 0.931950 |
| Kurtosis | 3.238099 | 3.746116 | 4.939383 | 2.498286 |
| | | | | |
| Jarque-Bera | 21.90067 | 36.30968 | 66.25692 | 18.62921 |
| Probability | 0.000018 | 0.000000 | 0.000000 | 0.000090 |
| | | | | |
| Sum | 71368.21 | 2.59E+13 | 62938.30 | 659.2282 |
| Sum Sq. Dev. | 34413792 | 4.88E+24 | 31016387 | 5500.292 |
| | | | | |
| Observations | 120 | 120 | 120 | 120 |

**Table 5 Correlation matrix**

| | OIL__CONSUMPTION | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|
| OIL__CONSUMPTION | 1 | 0.71807 | 0.209957 |
| GAS__CONSUMPTION | 0.71807 | 1 | 0.591813 |
| COAL_CONSUMPTION | 0.209957 | 0.591813 | 1 |

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**Table 6 Variance Inflation Matrix**

| | OIL__CONSUMPTION | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|
| OIL__CONSUMPTION | 1 | | |
| GAS__CONSUMPTION | 2.064514 | 1 | |
| COAL_CONSUMPTION | 1.046115 | 1.539037 | 1 |

**Econometric Estimations**

On the basis of stationarity level of data and cointegration level Pooled OLS technique is applied on the selected variables. Normal distribution of data is tested using Jarque-Bera test. Correlation matrix is found to see the correlation among variables. To check the multicollinearity variance inflation factor is found. (See Appendix)

**Results and Discussion**

Results show that coefficient of oil consumption is significant and positive which indicates a positive relationship between GDP and oil consumption which means that an increase in oil consumption will increase GDP. One unit increase in oil consumption brings 0.54 units increase in GDP of the selected economies. Coefficient of coal consumption is significant and positive which indicates a positive relationship between coal consumption and GDP which means that an increase in coal consumption will increase GDP, one unit increase in coal consumption will brings 0.02 units increase in GDP of the economies. Coefficient of Gas consumption is significant and positive which indicates a positive relationship between gas consumption and GDP which means that an increase in gas consumption will increase the GDP, one unit increase in gas consumption brings 7.50 units increase in GDP of the economies. For goodness of fit of data the value of R Square is 0.75 which explains that 75% variation in GDP is explained by oil, coal and natural gas consumption. For overall significance of model F statistics shows that overall model is statistically significant. (see Appendix)

**Conclusion and Policy Suggestion**

The current study seeks to investigate the Impact of Hydrocarbon fuels on the Economic Growth of selected MENA Countries. The empirical findings showed that these hydrocarbon fuels are co-integrated with the GDP. High demand of these hydrocarbon fuels for consumption show the importance of these fuels in an economy. These fuels play vital role to run an economy because of its use in main sectors of the economy. The results are matched with the empirical finding of the literature that these hydrocarbon fuels significantly participate in the GDP of countries. The three variables i.e. petroleum oil, coal and natural gas are co-integrated with the GDP which exhibits that there exist the relationship among them.

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Effects of oil, gas and coal consumption on economic growth is studied by applying different techniques shows that coal, gas and oil consumption coefficients are positive and significant. First, the positive influences of oil consumption on economic growth suggests that more attention should be given towards its use. Policymakers should develop such channels that enhance the use of natural resource specially oil extraction and use. Secondly, economic growth has positive impact on gas consumption and government should pay attention to growth led strategies. Lastly, as coefficient of gas consumption is positive so policymakers should devote more resources toward growth of industrial sector and pay more attention toward sustainable and efficient natural resource extraction and productive use in the country.

**Recommendations**

The recommendations on the basis of empirical and theoretical findings this study is valued for the policy makers. Since the findings reveal a clear positive impact of the consumption of hydrocarbon fuels on the economic growth. Measures should be taken to formulate the energy consumption policies that are supportive to avoid the losses in the transmission process of the energy. In case of many growing economies where the hydrocarbon fuels are in abundant but due to the lack of investment, energy infrastructure and services they are unable to utilize these resources. MENA countries have huge reserves of natural resource like hydrocarbon fuels. Policies should be made to provide them energy infrastructure and services to cope up with their deficiencies in the development process of the country.

**Future Research**

Such work can be extended by performing the comparison of two data sets of developing and developed economies by using same hydrocarbon fuels or some other fuels will be added. With the increase in consumption of energy resources economies are facing the problem of carbon gas emissions. Extensive use of industrial fuel as well as the growing demand of transportation fuels is the big danger for the natural environment and it deteriorates the greenhouse effect. Future studies can relate the impact of consumption of these fuels on the environment and check how much it affects the growth level. Further researches can use the multivariate models by including more variables labor force, capital formation and other growth variables.

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**Appendix**

Method: Panel Least Squares
Date: 08/03/21 Time: 20:31
Sample: 1996 2019
Periods included: 24
Cross-sections included: 5
Total panel (balanced) observations: 120

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| OIL__CONSUMPTION | 0.541474 | 0.059623 | 9.081593 | 0.0000 |
| GAS__CONSUMPTION | 0.019629 | 0.007624 | 2.574752 | 0.0113 |
| COAL_CONSUMPTION | 7.490115 | 4.075720 | 1.837740 | 0.0687 |
| C | 10.66716 | 0.033037 | 322.8807 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.754309 | Mean dependent var | 11.13333 |
| Adjusted R-squared | 0.747955 | S.D. dependent var | 0.448215 |
| S.E. of regression | 0.225022 | Akaike info criterion | -0.112472 |
| Sum squared resid | 5.873649 | Schwarz criterion | -0.019555 |
| Log likelihood | 10.74831 | Hannan-Quinn criter. | -0.074738 |
| F-statistic | 118.7127 | Durbin-Watson stat | 0.127050 |
| Prob(F-statistic) | 0.000000 | | |

Discuss

Descriptive statistics

| | OIL__CONSUMPTION | GDP | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|---|
| Mean | 594.7351 | 2.16E+11 | 524.4858 | 5.493569 |
| Median | 377.7492 | 1.33E+11 | 372.0047 | 1.189383 |
| Maximum | 2015.342 | 7.93E+11 | 2241.368 | 25.03845 |
| Minimum | 27.59348 | 1.40E+10 | 36.43172 | 4.84E-05 |
| Std. Dev. | 537.7653 | 2.03E+11 | 510.5310 | 6.798598 |
| Skewness | 1.039644 | 1.294725 | 1.540306 | 0.931950 |
| Kurtosis | 3.238099 | 3.746116 | 4.939383 | 2.498286 |
| | | | | |
| Jarque-Bera | 21.90067 | 36.30968 | 66.25692 | 18.62921 |
| Probability | 0.000018 | 0.000000 | 0.000000 | 0.000090 |

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| | | | | |
|---|---|---|---|---|
| Sum | 71368.21 | 2.59E+13 | 62938.30 | 659.2282 |
| Sum Sq. Dev. | 34413792 | 4.88E+24 | 31016387 | 5500.292 |
| | | | | |
| Observations | 120 | 120 | 120 | 120 |

Correlation

| | OIL__CONSUMPTION | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|
| OIL__CONSUMPTION | 1 | 0.71807 | 0.209957 |
| GAS__CONSUMPTION | 0.71807 | 1 | 0.591813 |
| COAL_CONSUMPTION | 0.209957 | 0.591813 | 1 |

Vif matrix

| | OIL__CONSUMPTION | GAS__CONSUMPTION | COAL_CONSUMPTION |
|---|---|---|---|
| OIL__CONSUMPTION | 1 | | |
| GAS__CONSUMPTION | 2.064514 | 1 | |
| COAL_CONSUMPTION | 1.046115 | 1.539037 | 1 |

Dependent Variable: GDP
Method: Panel Least Squares
Date: 08/03/21 Time: 20:31
Sample: 1996 2019
Periods included: 24
Cross-sections included: 5
Total panel (balanced) observations: 120

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| OIL__CONSUMPTION | 0.541474 | 0.059623 | 9.081593 | 0.0000 |
| GAS__CONSUMPTION | 0.019629 | 0.007624 | 2.574752 | 0.0113 |
| COAL_CONSUMPTION | 7.490115 | 4.075720 | 1.837740 | 0.0687 |
| C | 10.66716 | 0.033037 | 322.8807 | 0.0000 |
| R-squared | 0.754309 | Mean dependent var | | 11.13333 |

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|---|---|---|---|
| Adjusted R-squared | 0.747955 | S.D. dependent var | 0.448215 |
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| Sum squared resid | 5.873649 | Schwarz criterion | -0.019555 |
| Log likelihood | 10.74831 | Hannan-Quinn criter. | -0.074738 |
| F-statistic | 118.7127 | Durbin-Watson stat | 0.127050 |
| Prob(F-statistic) | 0.000000 | | |