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The Relationship between Oil Consumption and Economic Growth in Bangladesh: An Empirical Analysis

Saanjaana Rahman[1] , Sakib B. Amin[2], and Farhan Khan[3]

Today, oil is considered as a dynamic factor that helps to sustain modern economic activities as well as wellbeing of a nation. To the best of our knowledge, no study has been done in the context of Bangladesh regarding the causal relationship between oil consumption and economic growth. Hence, the aim of this paper is to empirically analyze the long-run causal relationship between oil consumption and economic growth in Bangladesh by using annual data ranging from 1980 to 2015. Johansen's Cointegration test results reveal that all variables are cointegrated and Granger Causality test results show that a unidirectional causality is running from oil consumption to economic growth, which goes hand to hand with the growth hypothesis. Thus, Bangladesh should adopt appropriate energy policy to curb down the constraints regarding oil consumption and oil products distribution in order to continue the stable economic growth and reach Middle-Income status by 2021.

Field of Research: Economics

1. Introduction

Oil constitutes a critical factor in sustaining the well-being of a nation as well as the nation's economic growth and social modernization (Amin, 2015). Urbanization increases energy usage by aggravating the demand for housing, land use, public utilities, food, electric appliances and nonetheless, transportation. The process of urbanization ultimately results in economic growth (Hasanov *et al.* 2016). Due to the flexibility and universal strength of this energy source, oil has played a dominant part historically, and its consumption is predominantly, the chief source of the economic growth and development (Ghalayini 2011).

Oil is a vital source of energy for both developed and developing countries (Amin, 2015; Fakher & Goldansaz 2015). The oil industry started off more than 5000 years ago, and its importance is likely to keep on escalating, even under the most optimistic assumptions about growth in alternative renewable energy sources. The oil crisis in the 1970s and 2013 reflect a strong necessity of oil by the economies. The oil crisis called for a halt to the global economic growth and hit hard in the development of nations all over the world (Hong *et al.*2011). In 2014, oil provided for 38% of the world's energy needs, and in Bangladesh, it accounted for 112.17 thousand barrels in the 2015 year (British Petroleum 2015). Although Bangladesh is a country blessed with the natural gas reservoir, it is still heavily dependent on oil for economic growth and development. Production and several consumption activities

[1]BS Graduate, Department of Economics, School of Business and Economics, North South University, Bangladesh, Email: saanjaana.rahman@gmail.com
[2]Assistant Professor, Department of Economics, School of Business and Economics, North South University, Bangladesh, Email: sakib.amin@northsouth.edu
[3]BS Graduate, Department of Economics School of Business and Economics, North South University, Bangladesh, Email:farhan.khan008@northsouth.edu

involve oil usage as an essential input, making it a key source for an economic upturn in Bangladesh.

For developing countries, the oil consumption will keep on increasing in the coming years, as development targets and economic growth accelerates (Bhusal 2010). Bangladesh aims to become a middle-income nation by 2021, where energy usage will play an important role. Furthermore, Bangladesh has the potential to be the 28th largest economy in the world by 2050 and has recently been addressed as the 'New Asian Tiger'. Experience regarding development in other countries in the past suggests that oil consumption will rise faster when per capita income reaches between the US$1,000 and the US $10,000; a range that Bangladesh is currently entering. This may lead to economic growth and development (Masuduzzaman 2013). Therefore, checking causal direction between oil consumption and economic growth is important to come up with proper combinations of policies.

A wide range of exhaustive research has been conducted on the nexus between oil consumption with environmental impacts, financial development, poverty alleviation, CO_2 emissions over the past decades in various countries. Whether economic growth leads to oil consumption or oil consumption is the engine of economic growth has to lead an intense debate in the past years, leaving empirical results mixed and incompatible. Terzi and Pata (2016); Ishida (2013); Bekhet and Yusop (2009); Hanabusa (2014) have found that there is a unidirectional causal relationship between oil consumption and economic growth and the causality running from oil consumption to economic growth. On the other hand, Aktaş and Yimaz(2008); Bhusal (2010); Pourhosseingholi (2013) have established that a bidirectional relationship remains between oil consumption and economic growth.

To the best of our knowledge, no studies have been done focusing on the empirical relationship between oil consumption and economic growth in Bangladesh. Hence, the aim of this paper is to investigate the relationships and direction between the two concerned variables in Bangladesh. In doing so, the research question is as follows: What is long run causal relationship between oil consumption and economic growth in Bangladesh?

The rest of the paper is arranged as follows: section 2 provides a review of the literature with section 3 giving an overview of the energy sector in Bangladesh. Moving to section 4 describes the econometric methodology and data set used in the paper, followed by results in section 5 and conclusion in section 6.

2. Review of the Literature

According to Ishida (2013), Japan's economy cannot support the present prosperity without extensive use of several sources of energies. Such as oil. The core objective of this paper was to explore whether the growth of Japan's economy excessively dependent on fossil fuels or not. A time series multivariate model is being applied. Data time period was from1970 to 2010 Fossil fuel energy (oil), non-fossil fuel energy labor, GDP, stock were the variables of interest. Cointegration test result showed that there is a long run relationship among the variables. In the long run a unidirectional causality is running from oil consumption to GDP.

Samiullah (2014) in his paper asserted that due to the oil shock of 1973 and fast increase in oil prices, many oil importing countries faced a downward economic growth as we as high inflation rates. To examine the relationship between energy consumption and economic growth of Pakistan a time series approach is used. Data time period was 1981-2013. ARDL approach revealed that there is a stable relationship between energy consumption and economic growth. The direction runs from energy consumption to economic growth or in simple terms, the relationship between the variables is unidirectional.

Arouri*et al*. (2014) examined the relationship between energy consumption and economic growth using output per capita as a proxy for economic growth. Time series data has been used for the period of 1960 to 2011 to examining the relation through causality test. The result suggested that there is a positive relationship between the variables. Furthermore, the paper explained that energy consumption in some last decades in France enhanced the output level as well as per capita income.

Masuduzzaman (2013) investigated the link between investment, electricity consumption and economic growth in Bangladesh by using time series data. The range of the data set was from 1981-2011. The Johannes's cointegration test revealed that all three variables are cointegrated. Granger causality test showed that there is a unidirectional causality running from electricity consumption and economic growth. High utilization of electricity can enhance the investment process in Bangladesh which ultimately will lead to the economic growth.

According to Terzi and Pata (2016), after the great depression and two oil shocks (1973 &1979) crisis have caused oil-dependent countries dramatically. The effect was also felt by Turkey. In recent time, like many other non- oil producing developing countries, Turkey needs reasonable oil supply for a sustained economic growth. The central objective of this paper was to investigate the link between these two variables by using time series data of 1974 to 2014. Granger Causality test and, Gregory-Hansen Cointegration models are being used. The results showed that there is no long-run relationship between the level of economic growth and oil consumption. However, the UVAR, TYVAR and Hsiao's Granger causality tests in the short term show that a positive one-way causality is going from the oil consumption level to the economic growth rate, and oil consumption level stimulates economic growth rate.

Hanabusa (2014) investigated the dynamics of oil consumption, oil price, and economic activity during the period of 1986 to 2008 in Japan. At first residual-based test for cointegration was applied with structural change. The result found the stable economic relationship among the variables. Moreover, a structural change occurred after the collapse of the bubble economy. In the second phase, the paper found that the price elasticity of oil demand decreased about 0.1 and income elasticity of oil demand decreased by 0.4. The lag augmented-vector autoregressionmethod found that oil consumption does not Granger cause economic progress before the collapse. However, oil consumption Granger causes economic growth from after it. These empirical magnitudes have inferences for the environmental and economic difficulties that Japan will face in the future.

Suleiman (2013) found that there is a co-movement and causality between oil consumption oil price and economic growth of non OPEC countries. Both time series

and panel data are being used depending on whether a country is a net exporter or a net importer. The results showed that there is a long-run cointegrating relationship between oil prices and GDP. Oil price Granger causes the net importing countries growths but not Granger causes the net exporting countries.

According to Bekhet and Yusop. (2009), the economy of Malaysia has been growing at a stable speed over the last few decades. However, to increase the growth rate energy consumption is important. Though the country is blessed with conventional and non-conventional energy sources, oil is a big portion of the total energy. Thus oil price and consumption impact the economy. This paper inspects the long run relationship between oil price, oil consumption, other energy consumption and macroeconomic performance in Malaysia. The sample time series period is from 1980 to 2005. Time series are subjected to various shortcomings such as autocorrelation, multi-collinearity problems and host of other problems. Thus, data were first tested for their residuals. Empirical results revealed a long run relationship among the variables as well as short-run relations among them. The result also showed that change in world oil price leads to changes in the degree of oil consumption and other energy-relatedproduction. These Findings may help the policymakers to correct the present policies so that efficiency can be achieved in the energy sector.

Fakher and Goldansaz (2015) emphasized that not only labor and capital but also energy plays a significant role in production in commodities and services. It is one of the divining force of production activities. Thus, it is an indispensable component for economic growth and development as well. Results showed that indeed there is a positive relationship between oil products consumption and economic growth. The effect which leads to economic growth and development can be seen via two channels. Firstly, due to increase in the consumption of oil products, leads to higher motivation to firm to produce more and use more advanced machinery in the production process. Secondly, high level of production needs an increase in the labor force which will ultimately be followed by improvement in development.

Shahbazi *et al*. (2012) investigated the impact of petroleum products consumption on economic growth. They used panel data for the period of 2001 to 2006 at the province level. The results show that gasoline and gas oil consumption has a positive and significant effect on economic growth. The elasticity of production towards gasoline and gas oil was sequence 0.22 and 0.19. The result revealed that government expenses for construction and the population of provinces have positive and significant effects on economic growth and development. Limiting the consumption of petroleum products can lead to slow economic growth in the country provinces.

Aktaş and Yimaz (2008) asserted that oil is not only a critical factor in sustaining the well-being of Turkey but also plays a vital role in stimulating stable economic growth. Production in industries such as manufacturing, transportation, and electricity generation demands a substantial amount of oil. Thus, supply side of the oil products needs to be examined closely. In Turkey, there is a highly inefficient the consumption of oil products. Improving the efficiency is now a priority. In the paper authors wanted to examine the short run and long-run causality between oil consumption and economic growth using time series data covering a period of 1970-2004. The result indicated that there exists a bidirectional causality between oil consumption and

economic growth in the short and long run. In other means, the relation addresses feedback hypothesis.

Jakovac (2014) examined the relationship between economic growth and energy consumption for Croatia in the time period of 1952-2010. In the data, year break was identified by chow breakpoint test. Break year was 1989. Thus there were two sub-samples. First one was from 1952 to 1989 and the second one was from 1993 to 2010. The year 1990 and 1992 were omitted because during that time Croatia was going through a war. Findings advise that there is a bidirectional response in the short-run and that causality runs from energy consumption to economic growth in the long-run in the first sub-sample. After the structural break, the paper found a unidirectional causality running from economic growth to energy consumption. Here, energy conservation policies together with the formation of competitive energy market may be possible with little or no injurious side effects to economic growth.

Ready (2015) investigated the relations between oil consumption, economic growth, and oil prices and then built a real business cycle model to study oil prices. The model showed that there is a long run productivity risk recursive preferences, and an oil good which is used for both production and final consumption. Which ultimately directly or indirectly affects the economic growth.

According to Pourhosseingholi (2013), there is an appropriate and privileged condition for energy resources in OPEC countries relation to many other countries. Immense amount of different types of energy can be used for economic development as well as economic growth. Among different sources of energy, oil now constitutes a prudential factor in sustaining the well-being the OPEC countries as well as the nation's economic growth. Industrial and other production process demands a sustainable supply of oil. Thus in this paper, the relationship between oil consumption and economic growth is examined for OPEC countries. Panel data from 1980-2011 and cointegration model is being used. ADF unit root test is conducted to checking the presence of unit root in the data of oil consumption and GDP. Granger causality test is also being employed. The overall result showed that there are long run and short run relationship between oil consumption and economic growth. Short run and long run results indicated the causality running from oil consumption to economic growth and vice-versa. It supports the feedback hypothesis. Thus policies which can bring efficiency in consumption will not affect the economic growth adversely.

According to Bhusal (2010), in Nepal, oil is used in many different sectors such as manufacturing, transport, production of electricity and much more. Each sector contributes to economic prosperity. The paper estimated the long run and short run causality between oil consumption and Gross Domestic Product (GDP) for Nepal using annual data covering the period of 1975-2009. Granger causality test was employed to reveal the relationship of the variables with (I (1)) integration order. Results reveal that there is a bidirectional relationship between oil consumption and GDP Growth both in short run and long run which goes hand to hand with feedback hypothesis.

After the wide discussion of different literatures, we can set our hypothesis relevant to our research question. We will consider a set null hypothesis in this paper. These

are as follows, H_1: Oil does not Granger Cause GDP and H_2: GDP does not Granger Cause Oil.

3. Overview of Energy Sector in Bangladesh

Bangladesh is a densely populated country with a per capita income of US $ 751 (FY 2010). However, Bangladesh is experiencing an admiring fast real GDP growth rate of 6% during the past 5 years (Asian Development Bank 2009) and the growth is unsurprisingly accompanied by increasing demand for energy. In 2013, the total primary energy consumption was 1.13 quadrillion Btu, with a change of 4.54% from the previous year. Subsequently, the country aims to grow at 8% by 2020 (U.S EIA). The growth of electricity was 10% in 2010, and power generation capacity of Bangladesh was 5936 MW in January 2011, rose to 10416 MW in 2016. However, the present capacity cannot be realized to its fullest due to the forced outage (Amin, et al. 2012). About one-fourth of the generation plants of the power system in more than 20 years old, causing higher maintenance costs and regular plant outages. A single Buyer System prevails in the power sector making, and a minor portion of electricity produced by small IPPs are directly synchronized to the 33kV distribution line of selected Palli Biddyut Samity(PBS) of Rural Electrification Board (REB). It has been suggested that the pace of electricity sector development has to be accelerated, to enjoy the overall economic development of the country. Nearly 90% of the population is urban and 42% of the rural households have access to grid electricity (BBS 2010). The government of Bangladesh is aiming off-grid renewable energy technologies. Electricity is one of the major reasons for slow GDP growth in this country, and priority is being given to the electricity sector. The following table represents electricity sector in Bangladesh at a glance.

Table 1: Comparative Data of Bangladesh Electricity Scenario

Subject	2009	2010	2011	2012	2013	2014
Installed Generation Capacity	5719	5823	7264	8716	9151	10416
Derated Generation Capacity	5166	5271	6639	8100	8537	9821
Generation (MW)	3589	3883	3962	4805	5010	5320
Highest Generation	4162	4606	4890	6066	6434	7356
Electricity Demand (peak demand)	6066	6454	6765	7518	8349	9268
Access to Electricity	47	48.5	49	53	62	69
Per Capita Electricity Generation	183.26	200.32	211.86	231.65	248.89	270.83

Source: Amin (2015); Power Division Bangladesh GOB (2015)

Petroleum is predominantly used in the transportation, as well as other sectors for economic activities (Alam*et al.* 2011). Diesel is used in the agricultural sector for irrigation pumps. On the other hand, kerosene is used in the rural areas for lighting. In transportation sector petroleum products dominate. Transport sector consumed 44.80% of the total sales in 2014. Around 10% of the total energy in 2010 came from

diesel and furnace oil (BPDB 2011). However, the popularity of petroleum fuels is decreasing due to policies encouraging CNG as a substitute fuel.

An important structural change has been seen in oil sector from the year of 2012. Use of oil has increased in the electricity sector. The total share of oil used in electricity generation rapidly increased from 6-8% in 2011 and 19% in 2012 and after that a huge jump to 28.38% in 2015 (BPC 2015). The share of oil in electricity generation increased due to private rental power plants. These power plants use oil as input and as a result, oil consumption in this sector has increased.

Burning of wood, animal dung, crop residues is still popular in rural parts of the country, affecting both the environment as well as human health negatively. There are many coal reserves in the North-western part of Bangladesh, and the establishment of a coal plant at Rampal, at Sundarbans have aroused debates and controversy globally. The total coal reserve is estimated to be 1.756 Gtonne. Only 5% of total electricity in the FY 2006 and 2007 was contributed by coal.

Renewable energy helps in reducing poverty, and aids in minimizing environmental degradation like desertification, biodiversity depletion, and climate change. Although Bangladesh is receiving both renewable and nonrenewable energy sources, only 1.5% is contributed. The renewable energy sector of Bangladesh requires immense amount of development to become a dominant factor for stimulating economic growth.

Table 2: Consumption of Petroleum Products (In Million Liters)

Products	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
Octane	90.02	78.26	85.54	97.26	107.15	110.85	117.45
Petrol	124.82	115.38	127.25	141.49	158.71	169.71	178.67
Kerosene	405.10	342.70	376.65	397.21	358.44	314.87	289.87
Diesel	2333.6	2301.3	2568.2	3239.3	3240.4	2964.60	3242.55
Furnace Oil	289.60	164.47	194.17	544.62	883.74	1076.42	1202.50
Lube	17.29	15.02	15.92	17.95	17.52	15.90	17.82
Other	366	310	390	430	448	443.65	435.09
Total	3626	3327	3257	4868	5214	5086	5484

Source: Amin (2015); Bangladesh Petroleum Corporation, BPC 2015

While demand for energy, mainly oil is increasing, the supply remains sticky. The energy crisis in Bangladesh also exaggerated due to lack of experience, frequent changes in key policy makers and decision makers, lack of political commitment and trained manpower, and corruption. Following the previous work in Bangladesh, the Government aims to tap all possible sources of energy, adequate supplies of energy to its various uses, commercialization of renewable energy, and improvement in the transmission and distribution system.

4. Methodology and Data Set

To check the stationarity of the variables, the existence of unit root has to be tested. Macroeconomic and financial data are well known because of their non-stationarity. There are several ways to find out the existence of unit root of the variables. For example, Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) test are broadly employed. For our analysis, we have performed the Augmented Dickey-Fuller (ADF) test to test the existence of unit root and found that both of the variables arenon-stationary and thus cannot be regressed without making them stationary. After the ADF test, we performedcointegration test to investigate the possible linear combination of the variables that can be considered stationary. If cointegration is established than we run the causality test to check the possible direction of causality between the variables.

Non-stationary data may lead to false regression in the context of time series analysis unless there is at least one cointegration relationship Amin, 2011; Amin and Rahman, 2011).The Johansen technique is employed to test for cointegration. A unified framework for estimation and testing cointegration relations are provided in the context of Vector Autoregressive (VAR) error correction models. Here one has to estimate Unrestricted Vector of Autocorrelation of the form:

$$\Delta x_t = \alpha + \theta_1 \Delta x_{t-1} + \theta_2 \Delta x_{t-2} + \theta_3 \Delta x_{t-3} + \cdots\cdots + \theta_{k-1} \Delta x_{t-k+1} + \theta_k \Delta x_{t-k} + u_t$$

In the equation above Δ is the difference operator, $x_t \ (n \times 1)$ is a vector of non-stationary variables (in levels) and is also the vector of random errors. The information on the long-run relationship is expressed by the matrix θ_k the variables are not cointegrated if the rank of θ_k =0.However if rank (usually symbolized by r) is equal to one, there exists one cointegrating vector and lastly if, $1 < r < n$ there are multiple cointegrating vectors. Johansen and Juselius (1990) have derived two tests for cointegration, which are trace test and the maximum Eigen value test. The trace statistic assesses the null hypothesis that there are at most r cointegrating vectors while the maximal Eigen value test, estimates the null hypothesis that there are*r* exactly cointegrating vectors in x_t

There is at least one direction of causality if two variables are cointegrated. Granger-causality is one of the essential issues that has been immensely studied in empirical finance of macroeconomics. Granger-causality is introduced by Granger (1969, 1980, 1988). Engle and Granger (1987) asserted that the presence of non-stationary can lead to distorted conclusions in Granger-causality test. In this test, we can only infer the long-run relationship between nonstationary time series when the variables are cointegrated.

If *x* and *y* are variables of interest, then by applying Granger-causality test we can determine whether past value of *y* augment the explanation of present values of *x* given that by information in past values of *x* itself. *y* does not Granger cause *x* if changes past values of *y* does not explain changes in *x* values at present. Likewise, we can probe whether *x* Granger causes *y*. There are four probable outcomes in the Granger causality test:

(1) neither variable Granger cause each other
(2) y causes x but not otherwise
(3) x causes y but not otherwise
(4) both x and y Granger cause each other

In this paper, we will conduct the causality test between Oil consumption and GDP (Economic Growth).

Following two sets of the equation will be estimated:

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \cdots\cdots + \alpha_l x_{t-l} + \beta_1 y_{t-1} + \cdots\cdots + \beta_l y_{t-l} + u_t \qquad (1)$$

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \cdots\cdots + \alpha_l y_{t-l} + \beta_1 x_{t-1} + \cdots\cdots + \beta_l x_{t-l} + v_t \qquad (2)$$

It is for all possible pairs of *(x,y)* series in the group. The stated F-statistics are the Wald statistics for the joint hypothesis $\beta_1 = \beta_2 = \beta_3 = \cdots\cdots = \beta_l = 0$

As mentioned earlier that in this paper that we will investigate the long run relationship and direction of causality between oil consumption and economic growth in Bangladesh. For the sake of simplicity, a simple relationship has been constructed in this analysis. It takes a simple linear relationship in a way that one principal variable, GDP is enough to explain the variation as they both change pastime passes by. The measure of GDP can be considered as the indicator of economic development which has been drawn from the different issues of Economic Trends taken from World Development Indicators (2015). For oil consumption, we have used the data of daily oil consumption average (1000 Barrels per day) of each year. This data is published by British Petroleum and this data is trusted worldwide. It should be mentioned here that since Bangladesh got her independence in 1971, our paper focuses over the period 1980-2015 for which 35 observations are available at most.

5. Results and Discussions

Unit root tests were conducted to determine the order of integration of the data series for each of the variables. Table 3 shows the ADF statistics and corresponding critical values of all the variables in their level and first differenced forms.

Table 3: Augmented Dickey-Fuller Unit Root Test for the Variables

Panel 1: Levels			
	ADF Statistics (Only Constant)	ADF Statistics (Constant & Trend)	Decision
GDP	1.36919	2.492715	Non Stationary
Oil consumption	-0.001379	-2.383572	Non Stationary
Panel 2: First Differences			
	ADF Statistics (Only Constant)	ADF Statistics (Constant & Trend)	Decision
Oil Consumption	-5.561033	-5.567287	Stationary
GDP	-10.36919	-5.492715	Stationary

Note: All regression is estimated with and without trend. Selection of the lag is based on Schwartz Information Criterion (SIC). EViews 5.0 software automatically selects the most significant lag length based on this criterion.

Table 4: Mackinnon Critical Values for Rejection of Hypothesis of a Unit Root

Critical Value	Levels		First Differences	
	No Trend	With Trend	No Trend	With Trend
1%	-3.632900	-4.243644	-3.639407	-4.252879
5%	-2.948404	-3.544284	-2.951125	-3.548490
10%	-2.612874	-3.204699	-2.614300	-3.207094

Unit root tests have non-standard and non-normal asymptotic distribution. These distributions are highly affected by the presence of deterministic terms such as constant, time trend etc. An extraneous regressor whose inclusion reduces the power of the test is called time trend. However, if the true data generating process were trend stationary, failing to include a time trend also results in a reduction in power of the test. Furthermore, this loss of power from exclusive of a time trend when it should be present is more severe than the reduction in power associated with including a time trend when it is extraneous.

Lag length selecting is a major issue in unit root testing. One approach is to include a moderately long lag length and select the model by the usual t-test. If the t-statistics on lag p is insignificant at some stated critical value, the regression should be habitually assessed using a lag length p-1 till the lag is significantly diverse from zero. The stationarity property of the variables has been checked. From the table, it is clear that the variables would yield spurious results if not the variables are cointegrated. These results, however, allow proceeding the next stage of testing for cointegration. The Johansen cointegration test indicates that two series have one cointegrating relationship. Maximal Eigen value test and the trace test point out one cointegrating relationship at 95%. The results are as followed,

Table 5: Johansen Test for Cointegration (Maximum Eigen value Test)

	Null Hypothesis	Alternative Hypothesis	Statistics	95% Critical Value	Conclusion
Oil Consumption and GDP	None	At Most One	19.60 (2.04)	14.25 (3.84)	One Cointegrating Relationship

Table 6: Johansen Test for Cointegration (Trace Test)

	Null Hypothesis	Alternative Hypothesis	Statistics	95% Critical Value	Conclusion
Oil Consumption and GDP	None	At Most One	21.64 (2.04)	15.49 (3.84)	One Cointegrating Relationship

We have performed Granger causality test with lag 2. The result shows that there is a causal relationship running from oil consumption to GDP. The results of the causality test have been shown by the following table:

Table 7: Granger Causality Test

Null Hypothesis	F-Statistics	P-Value	Granger Causality
Oil does not Granger Cause GDP	2.53706	0.0905	Oil consumption causes GDP
GDP does not Granger Cause Oil	1.51240	0.2373	

So far we have seen that non-stationarity among the macroeconomic variables are to some degree expected. The cointegration tests tell us that variables are cointegrated, means oil consumption is correlated with GDP. This effect can be carried on to other tests as well. Results of Granger causality test of Table 5.5 (which is a test of superiority) reveals that first null hypothesis can be rejected which means oil actuallygranger causes economic growth but not vice versa. This result supports growth hypothesis which asserts that an increase in energy consumption (for our case it is oil) will lead to higher GDP in the long run. It answers our research question. However, we cannot reject the second null hypothesis as the probability value is more than the desired level. As Bangladesh is going through a developing process, the nation is engaged with more modern and industrial activities. These activities are heavily depended on oil products. To improve the rateof modernization and industrialization, more oil products will be consumedand the higher rate of such activities will ultimately escalate the economic growth in the long run.

6. Conclusion

The world economy has tripled over the last four decades. After the oil shocks, it was indeed clear to the economists and policymakers that energy somehow influences the economy of a nation. Today Energy is the driving thrust behind all economic activities. The economy can be viewed as a process of energy flows, as an order of energy conversion, which culminates in the production of goods and services. Therefore, it should be noted that economic growth of Bangladesh highly depends on energy consumption. Thus understanding the core idea about how energy consumption stimulates economic growth can help to formulate proper policies for efficiency and sustainability.

Oil is the vital source of energy in Bangladesh, as well as for other nations. In this paper, we have investigated the long run causal relationship between oil consumption and economic growth in Bangladesh with the help of time series data ranging from 1980 to 2015.We have found a unidirectional relation which is running from oil consumption to economic growth that supports the growth hypothesis and it answers our research question. Our result is similar with (Hanabusa 2014 and Ishida 2013) Given that, oil supply in Bangladesh is insufficient to meet the growing demand, a well-designed policy framework can play an effective role in managing the distribution of oil products. In addition to supply-side measures, demand side management measures are also needed.

One of the limitations is lack of data availability. As Bangladesh gained its independence in 1971, no credible data before that was available. It is mentionable here that inclusion (such as control variables or dummy variables) might have some significant effect on the econometric results. However, this paper provides a way forward to the readers and researchers. For instance, there can be a breakdown of oil consumption into fossil fuel consumption and consumption through the renewable

source. Furthermore, it is essential to examine the hypotheses in different developing countries (cross panel) for the generalization.

References

Amin, SB, 2015, 'The Macroeconomics of Energy Price Shocks and Electricity Market Reforms: The Case of Bangladesh', Durham E-thesis, Durham University.

Aktas, C & Yimaz, V 2008, 'Causal relationship between oil consumption and economic Growth in Turkey', *Kocaeli Üniversitesi Sosyal Bilimler Enstitüsü Dergisi, Vol. 6, Pp. 45-55*.

Alam, MJ, Begum, IA, Buysse, J, Rahman, S & Huylenbroeck, GV 2011, 'Dynamic modeling of causal relationship between energy consumption, CO2 emissions and economic growth in India', *Renewable and Sustainable Energy Review, Vol.15, Pp. 3243-3251*.

Amin, SB, 2015, 'The Macroeconomics of Energy Price Shocks and Electricity Market Reforms: The Case of Bangladesh', Durham E-thesis, Durham University.

Amin, SB, 2011, 'Quantity Theory of Money and its Applicability: The Case of Bangladesh', World Review of Business Research, Vol.1, No. 4, Pp.33-43.

Amin, SB, & Rahman, AFM, 2011, 'Energy-Growth Nexus in Bangladesh: An empirical study', *International Review of Business Research Papers*, *Vol.7, No.2, Pp.182-195.*

Arouri, M, Uddin, GH, Kyophilavong, P & Tiwari, A 2014, 'Energy utilization and economic growth in France: Evidence from asymmetric causality Test', Working Paper No. 102, IPAG Business School France.

Asian Development Bank 2009, Asian Development Bank and Bangladesh: Fact Sheet. Philippines: Asian Development board.

Bangladesh Petroleum Corporation (BPC) 2015, Annual Report, GOB

Bangladesh Power Development Board (BPDB) 2011, Bangladesh's Power Supply: Investment Opportunities. London, 1st March 2011.

Bangladesh Bureau of Statistics (BBS) 2010, Statistical yearbook of Bangladesh, Bangladesh Bureau of Statistics, Agargaon.

Bekhet, HA,&Yusop, NYM 2009, 'Assessing the relationship between oil Prices, Energy consumption and macroeconomic performance in Malaysia: Co-integration and Vector Error Correction Model (VECM) approach', *International Business Research, Vol. 2, No.3, Pp. 152-175*

British Petroleum (BP) 2015, Data Bank

Bushal, TP 2010, 'Econometric analysis of oil consumption and economic growth in Nepal', *Economic Journal of Development Issues*, *Vol.11, No.2, Pp. 135-143*

Engle, RF & Granger, CWJ 1987, 'Co-integration and error correction: Representation, estimation and testing', *Econometrica*, *Vol. 55, Pp. 251-76*.

Fakher, H & Goldansaz, SH 2015, 'Investigating the impact of growth of petroleum products consumption on economic development with a systematic dynamics approach in developing countries', *Iran. Econ. Rev*, *Vol.19, No.3, Pp. 279-293*.

Ghalayini, L 2011, 'The Interaction between Oil Price and Economic Growth', *Middle Eastern Finance and Economics,* Vol. 13, Pp. 128-140.

Granger, CWJ 1969, 'Investigating causal relations by econometric models and cross-spectral methods', *Econometrica*, *Vol. 37, Pp. 424-438*.

Granger, CWJ 1980, 'Testing for causality, a personal viewpoint', *Journal of Economic Dynamics and Control*, *Vol. 2, Pp. 329-352*.

Granger, CWJ 1988, 'Some recent developments in a concept of causality', *Journal of Econometrics*, *Vol. 39, Pp. 199-211*.

Hanabusa, K 2014, 'Oil demand and economic activity in Japan', Chukyo Uiversity Institute of Economics Discussion Paper Series, No. 1401.

Hasanov, FJ, Hunt LC & Mikayilov, CI 2016, 'Modelling and forecasting electricity demand in Azrebaizan using cointegration techniques', *Energies, Vol.9, Pp. 1-31.*

Hong TO, Wijeweera & Charles, B 2011, 'Energy consumption and economic growth – The case of Australia', *International Journal of Humanities and Social Science Invention,* vol. 7.

Ishida, H 2013, 'Causal relationship between fossil fuel consumption and economic growth in Japan: A multivariate approach', *International Journal of Energy Economics and Policy, Vol.5, No.2, Pp. 127-136*.

Jakovac, P 2013, 'Empirical Analysis on economic growth and energy consumption relationship in Croatia', *EkonomskaIstraživanja-Economic Research,Vol.26, No.4.Pp. 21-42*

Johansen, S & Juselius, K 1990, 'Maximum likelihood estimation and inference on cointegration – with applications to the demand for money', *Oxford Bulletin of Economics and Statistics*, *Vol.52, Pp. 169-210*.

Masuduzzaman, M 2013, 'Electricity consumption and economic growth in Bangladesh', Research Study Series No. – FDRS 02/2013.

Pourhosseingholi, N 2013, 'Causality between oil consumption and economic growth in OPEC countries: A panel cointegration approach', *Asian Economic and Financial Review,Vol.3, No.12, Pp. 1642-1650*.

Ready, RC 2015, 'Oil consumption, economic growth, and oil Futures: A fundamental alternative to financialization', PhDThesis, The University of Rochester, NY.

Samilullah, M 2014, 'Energy consumption and economic growth: Time series evidence from Pakistan', *Journal of Economics and Sustainable Development, Vol.5, No.27, Pp. 2222-2855*.

Shahbazi, K, Asgahrpoor, H & Moharramzadeh, K 2012, 'The Impact of Petroleum Products Consumption on Economic Growth', *Quarterly Journal of Economic Modelling*, *Vol.1, Pp. 25-44.*

Suleiman, M 2013, 'Oil demand, oil Prices, economic growth and the resource curse: An empirical analysis', PhD Thesis, Surrey Energy Economics Centre (SEEC), University of Surrey, Guildford.

Terzİ, H & Pata, UK 2016, 'The effect of oil consumption and economic growth in Turkey', *Doğuş Üniversitesi Dergisi, Vol.17, No.2, Pp. 225-240*.

World Development Indicators (WDI) 2015.