

Nexus between Financial Development and Energy Consumption: Experience from Bangladesh

Rajib Mahmood¹ and Sakib Bin Amin²

Energy can be considered as the backbone of the economy and financial progress is the legs upon which it is standing. Bangladesh being one of the most overpopulated country in the world has managed to maintain an approximate 6% growth rate over the past decade. This has been made possible through a combined effort of providing sufficient resources to the people. This paper analyses the relationship between two of the most important variable in sustaining growth and development, financial development and energy consumption in Bangladesh. Lack of study to show the relationship between these sectors in Bangladesh had caused some restriction in understand the sectors congruously. Domestic credit provided to the finance sector and energy use has been used as the indicators for financial development and energy consumption respectively in this paper. Augmented Dickey Fuller (ADF) for unit root test have been orchestrated in this analysis. Furthermore, ARDL cointegration test have been performed. Finally, the granger causality has been applied in order to accomplish the outcomes of this paper. The results showed a bi-directional causality between the two variables taken into account. Financial development leads to an increase in the energy use and increasing energy consumption also led to increasing financial growth. However, the causality ran only in the short run and no relationship in the long run. This was the case for both direction of causality. Policy implication for Bangladesh at the conclusion of this research paper would be for the government to provide flexible economic policies to encourage further investments in both financial sector and energy sector.

Field of Research: Economics

1. Introduction

The study of the relationship between financial development and energy consumption has obtained the attention of researchers in recent times since in today's fast growing world energy is considered to be the wheel for progress in an economy with continuous upsurge in population leading to significant impact in the energy demand. Economies have been growing faster than anticipated with energy playing a very significant role in the development and growth process in the world. The population of Bangladesh confronted the same sudden upsurge of population. Some researchers (Ali et al.) had predicted that after the financial crisis of 2007/2008 and 2009 global recession, energy demand will be affected negatively, however, the level of energy consumption was unaffected. For tiger economies in Asia like India and China, the energy demand is continuously increasing. In developed and developing nations, the energy demand has been increasing by many folds to

¹ BS in Economics and Corresponding Author, Department of Economics, North South University, Dhaka, Bangladesh, Email:rajib.mahmood8@gmail.com

² Assistant Professor, School of Business and Economics, North South University, Dhaka, Bangladesh, Email: sakib.amin@northsouth.edu

maintain the standard of living. Several empirical evidences suggested that the development of financial sector can lead to increasing energy efficiency resulting in reduced amount of energy consumption. Financial development is now being considered as one of the most crucial factor in economic growth but there have been some significant blows in this sector through some of the financial crisis' in the past 2 decades. However, the upsurge has been continuous even after the crisis. The interest in the study of energy consumption have gained the attention of researchers after the findings of Kraft and Kraft (1978) who had discovered a unidirectional causal relationship between United States GNP to energy consumption.

A number of researchers have participated in studying the effect of financial development on economic growth along with energy consumption but none have been done from Bangladesh's perspective. This research has been inspired by the importance energy sector to enhance the financial development of the economy with no indicative research done to evaluate this correlation in Bangladesh.

This research paper is likely to show the impact of development of financial sector on energy consumption in Bangladesh. Energy such as electricity, gas, coal etc. are some of the major resources of energy for industrial and agriculture sector in Bangladesh. As per Bangladesh Power Development Board (BPDB) approximately 45% of electricity produced in the entire economy was consumed by these two sectors (1995-2010). During the course of this research paper it was highlighted that electricity has played a very vital role in enhancing the development process. To reinstate the financial reforms of the government World Bank had officially started its development project in 2000 (ADB, 2009) to accelerate industrial growth which ultimately had some influence over the energy sector. There have not been many studies on various effects of correlation between energy consumption and other factors in Bangladesh. The study of energy sector is still a new topic in Bangladesh since, the development of new energy sources such renewable energy is still on the verge of initiation. There has been very few research conducted on the relationship between financial development and energy sector in Bangladesh and hence this research paper was motivated to show the effect of such relationship. This paper should help better understand some important issues which has not been discussed in earlier studies because of the long span of time considered, 1980-2015, which will increase the reliability of the research paper. Existing literature reviews shows a common trend of showing a positive relationship between financial development and energy but there were exceptions as well. However, the research findings for this research paper were different from the existing studies observed in the Bangladesh, for e.g. there were variance in relation to the short run or long run effect.

The paper will consist of other sections beginning with an introduction. Section 2 contains literature review followed by a sectoral overview of both energy and finance sector of Bangladesh. Section 3 deals with methodology and section 4 focuses on findings, section 5 provides conclusion.

2. Literature Review

The significant role of energy in economic development has been observed in many available literature of energy economics.

Oh and Lee (2004) had executed a research paper on the relationship between economic growth and energy consumption using the Granger-causality and vector error correction model (VECM) approach. They had considered the period 1981-2004 in Korea and the outcomes had shown no causality in the short-run among the variable considered but there was a unidirectional causality from economic growth to energy consumption. However, this does not significantly answer the research question for this in relation to financial development.

Another research paper pursued by Ali et al. (2015) in finding out the relationship between financial development and energy consumption in Nigeria. They had analyzed using the Dickey-Fuller and Phillips-Perron unit root test and considered coal, oil, petroleum, natural gas as proxy for energy consumption. The results of the analysis had shown that the variables have relationship in the long-run and the short-run outcomes had identified financial development and economic growth have less significant impact on the level of energy consumption. However, in the long-run the advancement in the financial sector had very little or no harmful effect on the energy consumption but on the other hand economic growth had noteworthy negative influence on Nigeria's energy consumption level. This paper had greatly influenced the study of this paper in relation to the variables considered but proper outcome could be generated from this study regarding the research question.

Kakar et al. (2011) in their research paper had studied the correlation between financial development and energy consumption in Pakistan. There had been some significant outcomes for different variables considered in this research paper such as total energy consumption, real GDP, domestic credit to private sector and broad money (M2). The results showed no short-run relationship between financial development and energy consumption but in the long-run there exists a correlation between financial development and energy consumption and economic growth. Granger causality test was indicating to a unidirectional causality among money supply and energy consumption and a bi-directional causality existing between energy consumption and domestic credit. This study by Kakar et al. had provided some significant input but the research gap identified in this paper relating to this study has not be identified considering multiple variables have been considered, rather than bi-variate impact of the study.

Salman and Atya (2014) had considered a number of countries from North Africa to find the role of financial development and energy consumption on economic growth. The variables considered were energy consumption measured by kg of oil equivalent per capita, real GDP per capita, domestic credit provided banking sector as a percentage of GDP and Foreign Direct Investment (FDI). The results of the Granger causality test and Augmented Dickey-Fuller (ADF) approach provided a positive but insignificant relationship between economic growth and energy consumption while financial development had provided a positive significant relation in Algeria. But the results of this study does not answer the question of the relationship between only energy consumption & financial development.

Shahbaz and Sbia (2013) had argued that economic growth will increase the energy demand and financial development will enhance the energy consumption. Empirical analysis had provided a bidirectional causal relationship between financial development and energy consumption in Lebanon.

Shahbaz (2015) in his research of impact of financial development on energy sector for Pakistan show that an increase in the stock market capitalization and capital stocks would increase the demand for energy in Pakistan. Considering the other macroeconomic variables, an increase in economic growth and population also led to an increase in the energy demand. He used the ARDL bounding test approach and the de-trended GLS tailored statistics to quantify the correlation between financial development and energy consumption using total energy consumption (kt of oil equivalent), real GDP, real gross fixed capital formation and population as the proxy variables. This study was created in combination of two or more sectors in an economy with multiple variables working together the gap identified here is that no specific mentioning of two variables affecting each other.

Rahman (2004) studied nexus between financial development and economic growth in Bangladesh. He used the Blanchard-Quah (1989) Structural Vector Auto Regression (SVAR) for the period of 1976-2005. The proxy considered for the outcomes consisted of domestic credit to the private sector as a percentage of GDP, gross fixed capital formation as a percent of GDP, per capita GDP at current USD and real lending rates. The SVAR model indicate that financial development has a long-run positive impact both on investment and GDP ratio and per capita income. A one percent positive shock to financial development resulted in a 0.15 percent of upsurge in investment-GDP ratio. On the other hand, financial development did have a direct impact direct impact as well as a long-run indirect impact on per capita income. This research methodology is one of the rare studies done in Bangladesh relating to the sectors but however this study did not answer the question relating to this paper regarding the relationship between energy consumption and financial development.

The newly industrialized countries had both positive and negative shocks in the correlation in between energy consumption and financial development (Zerren and Koc, 2014). Malaysia and Mexico were some of the countries that had both positive and negative shocks whereas Philippines only had negative shocks. Turkey however, were experiencing a two-way causality between energy consumption and financial development. The continuous negative shocks in Thailand of energy consumption have been adversely affecting financial sector.

Chtioui (2012) showed whether there is an impact on energy consumption in Tunisia due to economic growth and financial development showing some impressive outcomes. The results showed that there was bi-directional causality between economic growth and energy consumption in the long run but not in the short run.

Rashid and Yousaf (2015) on showing the linkages between financial development and electricity growth in India and Pakistan, the outcomes showed positive relationship between the two. However, the strength of the relationship varies between the two countries because of different economic infrastructure and policies between the two nations. They have also complemented the financial structure of both economies since they were not that much affected by the financial crisis (2008) and have suggested that further reform is not required for the time being rather new investment in encouraged.

The three studies above do not specifically answer the research question but somewhat relates to the study of the variables but not the in relation to the economic

state for a country like Bangladesh. In most cases, the research gap was in line consideration of the factors considered in this paper and after reviewing such literature no such conclusion could be derived rather a new hypothesis was born whether the to accept the correlation or reject the correlation between energy consumption and financial development in Bangladesh as no such study was performed anywhere in the world about Bangladesh.

The research question for this study to identify whether there exists a correlation between financial development and energy consumption was derived from the study of these papers and did not specifically mention the particular variable in any of the study to similar context for a country like Bangladesh but an almost similar outcome was determined in one of the past studies but no answers were available with any relevance to Bangladesh and hence the research outcome of this paper has helped to determine and provide a greater understanding of the sectoral correlations.

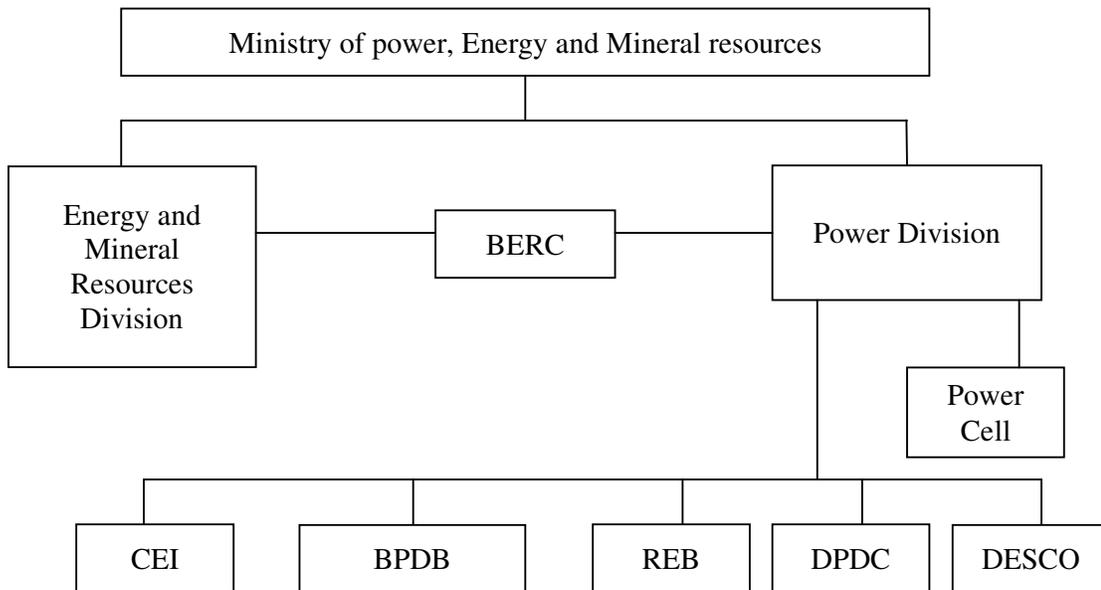
2.1 Sectoral Overview of Bangladesh

Both energy sector and financial sector in the following sections of the chapter.

2.1.1 Energy sector of Bangladesh

Bangladesh has had a persistent economic growth of 6% (BPDB) for the past decade. This has been substantially effecting the energy consumption level of Bangladesh. Bangladesh Power Development Board has been working in a continuous effort to increase the supply of energy such as electricity and gas to cope up with the demand. The current structure of power sector can be illustrated as followed,

Figure 1: Structure of Energy Distribution Channel in Bangladesh



Source: Bangladesh Power Development Board (2013).

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One problem that has been affecting the people of Bangladesh is the power outages. The outcomes of this unfortunate incidents have had severe adverse effect on the production capacity of the economy. The government of Bangladesh has taken several initiatives in order to fight this problem. Government has signed several new temporary rental production contracts based on diesel and liquid fuel power generation plants. In 2010, the fiscal budget was passed considering their new Perspective Plan of "Power for All" by 2021. The steps taken have been quite effective in increasing the production of electricity. The additional electricity generation plan provided that 2166 MW of electricity will be produced by the end of the fiscal year 2011, 3176 MW by fiscal year 2014 and 2410 MW by fiscal year 2015 in both private and public sectors. The generation and proper transmission of the additional energy resulted in an estimated investment of BDT 208.82 Billion. In order to fill up the investments in the energy sector, the government has been quick to take actions and get involved in Public Private Partnership (PPP) agreements and started to encourage foreign direct investments (FDI).

Other sources of energy are also on the verge of progressive usage for productive work. Biogas and Biomass are expected to have a very high capability in progressive usage specially in the rural areas. Different NGO's in the country have continuously provided training and held sessions in order to encourage more use of biogas. They have set up more than 10000 domestic biomass plants in the different skirts of the country.

Currently, an approximate 90% of the energy produced in the economy uses gas as their main source of input. Alternative sources of energy include imported oil and coal. However, this frequent usage of gas over the past decade has resulted in fast depletion of gas reserves in the economy. 12 of the 23 onshore and off shore gas fields are being actively used for extraction. One of the major disadvantage for Bangladesh, is the lack of technologies to continue the extraction process in a consequential manner. It can be clearly said that Bangladesh is very rich in gas but it is not being used up completely.

The economy is also rich in coal reserves. Five major coal fields have been discovered in Bangladesh at the moment. However, there are no proper coal policies in order to use them up to a greater extent for energy production. There is only one coal-fired plant to produce electricity but it is not being used to its full potential and only producing half of its capacity at 250 MW. New coal power plants are being set up under PPP and one of which is the Rampal power plant. The four projected plants are likely to cost around US \$3 billion (Ministry of foreign affairs of Denmark) and their main source of resource for production, will be imported coal and in between domestic coal extraction will be initiated.

Hydro-electricity, solar-panels, and wind energy are some of the potential renewable energy sources that are slowly gaining momentum in Bangladesh for production purposes. Wind is being used to produce 1 MW (2008) of energy, solar energy is used to produce 18 MW of energy and hydro was helping to produce 1 TWH of energy (2008) in the economy.

2.2.2 Financial Sector

The money related area in Bangladesh includes four classifications of planned banks, Non-Bank Budgetary Organizations (NBFIs), Microfinance Foundations (MFIs), different co-agent banks, insurance agencies and two stock trades. While Bangladesh Bank has administrative and supervisory control over the whole managing an account division and additionally the NBFIs, the Securities and Exchange Commission (SEC) practices comparable activities for the Stock Exchanges and the dealer banks. Most parts of the budgetary division are described by a combination of open and private proprietorship. In the last three decades, population of Bangladesh has experienced a progress in access to the banking sector to an unimaginable extent. In 1972 population per branch was 57,700 which had a dramatic decrease to 19,800 in 1991. However, in the early 2000's the number slightly increase to 21,300 per branch because progressive increase in the population growth rate (Japan Bangla Business Center, Corporation). The services provided by the banks have become very diverse in the past decades. People in the rural areas have been able to obtain loans to make a living by starting up their businesses specially with the help microfinancing. This had positive influence on the per capita income of the economy as a result Bangladesh has experienced a sustainable 6% (World Bank, 2006) economic growth in the past decade. Until December 2012 63.97% state owned commercial banks had branches in different rural areas of Bangladesh (Bangladesh Economic Review, 2013).

Broad money (M2) to GDP ratio has increased significantly from 12% in 1980 to 57% 2012, which shows how much the depth of the financial sector has increased. In Bangladesh, foreign direct investment always played a significant in the aggravation of the growth and acceleration. Since 1996, the energy sector of Bangladesh start attracting foreign investments due to the reformed foreign investment policies by the government (Rahman, 2012). Foreign direct investment flow in Bangladesh on the other have shown positive signs in the last decades. FDI has increased by almost \$1834 US in 2015. The average flow of FDI from the period 2002 to 2015 is an extravagant amount of 930 million dollars. However, in 2004 the flow had reached a record low amount of 276 million dollars which had experience an upsurge in the upcoming years (Policy Research Institute).

3. Econometric Methodology

Leading the relapse investigation for this relationship between financial development and energy utilization the software utilized was Microfit 4.0. In any case, there are different choices accessible for such investigation, for example, E-views, however Microfit 4.0 was utilized to decide the impact of the time series information utilized both as a part of the long run and short run. Domestic credit provided by financial sector as a percentage of gross domestic product (DDC) was utilized as proxy for financial development and energy use as kg of per proportionate capita (EU) was utilized as the intermediary for energy consumption.

Time series is stationary and were viewed as steady when relapse investigation is worked based on the time series data. In actuality, many time series information is non-stationary where the reasoning's are not normal. The OLS assessments will bring about a beguiling outcome if the factors considered in the model are non-

stationary and both t and F-test will be considered as non-standard and to legitimize the stationarity of the time arrangement information unit root test needs to be organized.

The research paper considered a time-series period of 29 years, 1985-2013, which has been considered as a sufficient sample size to provide the required outcomes in response to the data available for the relevant variables. However, there will always be a scope of better outcomes as more numbers of years will be considered in the relevant study conducted.

3.1 Unit Root Test

The Dickey-Fuller (DF) test and the Augmented Dickey Fuller (ADF) test was considered as the most feasible test among several ways of finding out the existence of unit root. The Dickey Fuller test will be performing the null hypothesis of a time series considered to be containing a unit root (non-stationary) against the alternate hypothesis of being stationary. On the other hand, the ADF test will be pursued based on the equation provided involving the process of augmenting the previous DF equation using lagged values of the dependent variable.

$$\Delta Y_t = \alpha + (\beta - 1)Y_{t-1} + \psi T + e_t \dots\dots\dots (1)$$

$$\Delta Y_t = \alpha + (\beta - 1)Y_{t-1} + \delta \Delta Y_{t-1} + \psi T + e_t \dots\dots\dots (2)$$

Both DF and ADF has used the following hypothesis,

$H_o: \beta - 1 = 0$ [i.e. the Y_t is non-stationary]

$H_a: \beta - 1 \neq 0$ [i.e. the Y_t is stationary]

It is essential to include the time trend in the unit root test when the observations are showing increasing or decreasing trend cycle. This test also has non-normal asymptotic distributions and non-standard distributions which are becomes disrupted when certain fixed terms such constant, time trend and others.

Reliance on t-statistic is discouraged because the time series data used for both dependent and independent variable can be non-stationary; hence we will be required to use McKinnon τ (tau) statistics values. If the resulted value of τ is absolutely greater than the critical DF value, then we will be able to reject the null hypothesis of non-stationarity and accept the alternate hypothesis at α level of significance if not then we do not reject. Another important issue to be considered in performing unit root test is the selection of proper lag length. A typical approach is to include a relatively long lag length as per the model selected by the usual t-test. However, if the value of t-statistic is insignificant at some mentioned critical value then the regression should be progressed further using a lag length of p-1 until the lag becomes significantly alternate to 0.

3.2 The ARDL Approach

In today's world of econometric research, the autoregressive distributed lag (ARDL) approach for cointegration is being used more often than the traditional cointegration methods such as Johansel and Jusilas (1980). The ARDL approach was first

introduced Pesaran et al (1996) and Pesaran and Shin (1995). The investigation turns out to be more confused when the factors are difference-stationary, or incorporated of order 1 (I (1) for short). The late writing on cointegration is worried with the investigation of the long run relations between I (1) factors, and its essential start is, at any rate verifiably, that within the sight of I (1) factors the customary ARDL approach is no more extended pertinent. One of the advantages of this approach is that it will ignore all the problems associated with pre-testing correlated with the standard cointegration analysis. The ARDL approach will also be able to provide a more vigorous outcome for a small sample size and hence the ARDL approach tries to dodge the ADF unit root test. However, some researcher has also reported that the incorporation of unit root test in the ARDL approach would still be a compulsion if the variable is assimilated of order 2 or more.

The ARDL approaches first step towards the cointegration involves determining whether there is any long run relationship between any variables by working out the F-statistics to analyze the significance of the lagged levels in the error correction form. Two groups of quantities have been assumed, one consisting of I(1) and another with I (0) and also to determine does the ARDL approach comprises of an intercept and/or trend. The outcomes calculated from the F-statistics will provide us with conclusion of whether we will be rejecting our null hypothesis or not. If the calculated result is above the upper critical value, the we can reject the null hypothesis which is assumed to no long run relationship and this won't require for us to know the orders of integration for the time series and the hypothesis cannot be rejected if the F-statistics value fall below the lower critical value. However, if the value falls in between the lower critical value and upper critical value then the outcome will be reported as inconclusive. The second step is approximate the coefficients of the long run and the short run and the inferences if there is a long run relationship between the variables.

The ARDL model will portray the following form.

$$\Delta Y_t = \beta_0 + \Sigma \beta_1 \Delta Y_{t-i} + \Sigma \beta_2 \Delta X_{t-i} + \Sigma \beta_3 \Delta Y_{t-1} + \Sigma \beta_4 \Delta X_{t-1} + \epsilon_t \dots \dots \dots (3)$$

One of the most significant decision in ARDL approach is choosing the right order of the lag function and the inclusion of trend in the model and hence for the ease this complication we have used the software Microfit because this will automatically choose the appropriate lag length and check the level of significance with trend included. In this research time trend, has been included to test whether the cointegration test becomes sensitive to trend or not.

3.3 Causality Test

As indicated by cointegration examination, when two factors are cointegrated then there is at any rate on heading of causality. Some late research has shown that the presence of non-stationary arrangement series can give deceiving conclusions in the Granger causality test. It is just conceivable to construe a causal long run relationship between non-stationary (Engle and Granger, 1987) time arrangement when the factors are cointegrated. For the Granger test to provide correct causal relationship information it is required to include error correction term in the testing procedure which will ultimately help to represent separately the long and short run causality between the variables. The granger causality without the error correction

will pursue the F-test and on the other hand inclusive of the error correction the causality test will pursue the t-test. As Razzaque and Ahmad, had mentioned in their research paper, the lagged change will show the short run effect and significance level of error correction will provide the long-term effect.

Assuming that U and W are the variables that we are testing the causality. The Granger causality test figures out if past estimations of W add to the clarification of current estimations of U as gave data in past estimations of U itself. On the off chance that past changes in W does not clarify current changes in U, then W does not Granger Cause U. Correspondingly, we can examine whether U Granger causes W by exchanging them and rehashing the procedure.

There can be four possible outcomes in the Granger causality test. Firstly, neither of the variables will have a Granger causality; secondly, U causes W but not the other way; thirdly, W causes U but not the other way and finally U and W will both Granger cause each other in both directions.

Before conducting the causality for this research paper, we had created the residual (RES) value required to give a sustained level of significance. After creating the residual value, we conducted the causality test between our two variables EU and DDC. For these, two types of equation will be created to find every possible causality between the two variables, the equation is provided below

$$\Delta EU_t = \alpha_1 + \beta_1 RES_{t-1} + \Sigma\alpha_{11}\Delta EU_{t-1} + \Sigma\alpha_{12}\Delta DDC_{t-1} + \mu_t \dots \dots \dots (4)$$

$$\Delta DDC_t = \alpha_2 + \beta_2 RES_{t-1} + \Sigma\alpha_{21}\Delta DDC_{t-1} + \Sigma\alpha_{22}\Delta EU_{t-1} + \mu_t \dots \dots \dots (5)$$

The error term has been included in order to administer other ways to find cointegrations.

4. Findings of Study

4.1 Unit Root Test: Results

Each of the variables were put through unit root test to find the data series' order of integration. The following tables shows the ADF statistics and the critical values of the variables in their first differenced forms.

Table 1: Augmented Dickey Fuller (ADF) Unit Root Test for the Variables

Group 1: Levels			
	ADF Statistics (Only Constant)	ADF Statistics (Constant and Trend)	Decision Considering Trend
DDC	0.16883	-1.9356	Non-Stationary
EU	3.1911	0.073456	Non-Stationary
Group 2: Differences			
	ADF Statistics (Only Constant)	ADF Statistics (Constant and Trend)	Decision
DDC	-4.0829	-4.2064	Stationary
EU	N. A	-4.6057	Stationary

Table 2: 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%	-3.5547	-4.1348	-4.1383	-3.5572
5%	-2.9157	3.4935	-3.4952	-2.9167
10%	-2.5953	-3.1753	-3.1762	-2.5958

In table 1, we can clearly state that we will be rejecting the null hypothesis at 5% level of significance since the calculated value of t-test is greater than the critical value of t-test. This means that there is a presence of unit root in the initial data series and it is non-stationary for both the variables. In order to make the data stationary we had to create the first differences of the data series other the outcomes would be vague unless the variables are cointegrated. Hence these outcomes have made us progress to next stage of testing for cointegration.

4.2 ARDL Cointegration Test: Results

The computed F-test statistics for the chosen lag is given in table provided below:

Table 3: ARDL Cointegration Test (F Test)

Order of lag	F statistics without Trend
3	F (2,21) = 5.2327

The order of lags in this research paper has been research paper been determined by performing by continuous testing. In the first step lag 2 was considered since we cannot start with lag 1 because of the rule of thumb which was that we have to use more than one lag for the annual data. In the lag 2 the outcomes had been inconclusive since F statistics value was between the lower limit and the upper limit (critical value band). This led us to go the next value lag 3, at this level the variables had become cointegrated because the value of 5.2327 is above the upper limit. This resulted cointegration allows us move to next step of causality test. Although lag 4 shows a cointegral relationships, we have chosen to ignore because the outcomes are similar to lag 3 in terms of short run and long relationship.

4.3 Causality Test: Results

The Granger causality constructed for this research paper has provided us with the outcomes for both short run and long run. Looking at **table 4(a)** we can determine whether any causality runs from DDC to DEU. The null hypothesis considered was that DDC does not cause DEU and if we reject null then we can clearly state financial development does cause energy use to increase, where EU is the dependent variable and DDC is the independent variable. As per table 4(a) it can be stated that there is short run causality running from DDC to DEU, because the coefficient of DDC is significant and thus rejecting null.

Table 4(a): Granger Causality Test Statistics

Dependent Variable: DEU		
Null: DDC DOES NOT CAUSE DEU		
Regressor	Coefficient	T-Ratio
INT	2.5843	2.8216
DDC	0.72894	2.8157
DEU (-1)	-0.0020939	-0.012707
RES (-1)	-0.077096	-0.92344

Table 4(b): Granger Causality Test Statistics

Dependent Variable: DDC		
Null: DEU DOES NOT CAUSE DDC		
Regressor	Coefficient	T-Ratio
INT	0.037100	0.061573
DEU	0.30150	2.8276
DDC (-1)	0.13369	0.75833
RES (-1)	0.060789	1.0999

There is no long-term relationship because the coefficient of the error correction term (RES (-1)) is highly insignificant (t-ratio is -0.92344).

In **table 4(b)**, the null in this approach stated that DEU does not cause DDC hence concluding that causality will only run one way if it is not rejected. The outcome of the Granger causality test showed that the coefficient of DEU is also significant when DDC is considered as the dependent variable. Hence rejecting the null hypothesis, it can be identified that a short run causality also runs from DEU to DDC but not in the long run since coefficient error correction term is insignificant at 1.0999 (less than 2).

Hence, the hypotheses of there being an existing correlation between financial development and energy consumption was accepted and having no correlation was rejected based on the result of the test. The outcomes of the granger causality test has answered the research to proof that a causality exists between financial development and energy consumption in Bangladesh, a new finding in this field of study with statistical reference; which has not been identified in any earlier research studies in Bangladesh and answering the **research question** stated in introductory section of the paper hence reducing the knowledge to some extent relating to this field.

5. Conclusion

The literature on financial development-energy consumption enlightened us on the crucial role of progressive financial sector and enhanced energy requirement as a result of growth. Bangladesh having a free market system enables the entrepreneurs to initiate their operations through finance resulting in more energy usage; such investments have also increased in the energy sector due greater privatization.

The research paper investigated the effect of financial development on energy consumption in Bangladesh using the time series data for the period 1985-2013. Empirical evidence analyzed that there is a relationship between financial development and energy consumption in Bangladesh as theory suggests. In Bangladesh, the relationship showed positive influence of financial development on energy consumption. Energy Use also had a significant effect in improving the financial sector in the country. Like Algeria (Salman and Atya, 2014), Bangladesh provides a bidirectional causality between energy consumption and financial development, hence supporting the evidence provided by Sadorsky(2011). The research paper showed that this does not have any long-term relationship but sustaining such short run positive influence might lead to a long-term effect as well. Government should be taking steps in order to develop both the sectors by implementing long term policies. Encouraging more investment will also lead to more energy consumption hence leading to economic growth, considering the population growth rate is to be sustained.

The outcome of this research paper has discovered some knowledge which was not available earlier in any studies conducted in Bangladesh or any other studies relating to Bangladesh, which might help other studies to get inspiration or gather knowledge regarding two of the most important variables operating in the economy.

This study should have some implication on economic policies of the country relating to the financial investments and energy sector in Bangladesh since the study in itself has put in some knowledge to prosper the economy as a whole. In an attempt to increase the financial flow, one other important aspect to influence investors would be to make the market lean toward environmental friendly projects because of the outburst of climate change. Such initiative will not only help reduce threat to the environment but also help to increase economic prosperity. Since both finance and energy influence each other positively, two things should be considered. First of which is ensure the amplexness of financing to accommodate adequate to meet social and monetary ventures, and the sufficiency of long haul financing to permit economies to develop and achieve to their maximum capacity.

Conducting this research had many limitations in itself. The very first issue that the research paper had to deal with was short sample size of 29 years (1985-2013). Such a short sample causes various problems in determining the long run effect of the variables. Many other significant variables have been excluded in conducting this research paper such as the domestic credit provided by local banks, foreign direct investments (FDI), electricity consumption, fossil fuel energy consumption and others which might lead to some other significant research studies. The econometric results might be different than the outcome gathered if variables were included or excluded in the model. This research focuses for the most part on ARDL approach in deciding

the cointegration relationship between the factors. Likewise, it just considers the ADF test to direct the unit root tests. Other than this, the research paper additionally has a few constraints in regards to the typical time arrangement issues about managing the basic changes and serial relationship.

There is further scope or high recommendation for research relating to energy consumption and financial development in Bangladesh in consideration of the economic prosperity of the country and to gather more knowledge about such particular field of study.

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