



THE NEXUS BETWEEN URBANIZATION, ENERGY DEMAND AND HEALTHCARE IN BANGLADESH

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ABSTRACT

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Urbanization leads to increase in energy usage as it aggravates the demand of housing, land usage, commutation and many more. Economic theory postulates that urbanization is a demographic activity where a big share of any country's people migrates in urban settlements (Arouri *et al.*, 2014). The energy demand will keep on increasing in the upcoming years as targets for development and economic growth aggravates. Bangladesh aims to become a middle-income nation by 2021. As more and more workers will migrate to the urban city for job, they will use more and more healthcare facilities available in the city, which in turn will increase the demand for energy. Healthcare industry is termed as a vital sector for any country, as health is wealth for any nation. Furthermore, patients' health and quality of life is important to perform economic activities or to be an active citizen of the country for growth of the economy, as a healthy economy is the key to a successful nation. Good governance is important in this aspect as the country has set a target to gain universal health coverage by 2023 to pay 70% of the medical expenses. However, healthcare industry needs to utilize renewable energy and smart technology for the sustained economic growth.

Contribution/Originality: This study uses new methods of ARDL Bound Testing Approach to investigate the link among urbanization, energy and healthcare.

1. INTRODUCTION

Economic theory states that urbanization can be considered to be a demographic activity in which a big portion of any country's population lives in urban settlements (Arouri *et al.*, 2014). It is a transition of rural labor force from agricultural sector to industrial sector, mainly situated in urban regions of the cities, as it's the hub for eminent professions and social networks. This transitional shift influences energy demand in a number of ways. During the industrial revolution, only a small number of the global population lived in urban cities. Urban areas are magnets for young people and entrepreneurs, as they provide a range of opportunities, mainly benefitting the growing middle class. Urbanization is considered as the engine for economic growth, as 80% of the economic output originates in the urban regions. This economic growth has put a profound affect on the healthcare industry as people who migrate to the city, seek health care within the facilities of the city hospitals. This simultaneously causes hospitals and medical institutions to employ more workers and staffs, along with increased demand for energy. Economic theory postulates that economic growth and social modernization lead to urbanization, where energy has played a vital role (Shahbaz *et al.*, 2016). Urbanization leads to increase in energy usage by aggravating the demand

on housing, hospitals, medical institutions, land usage, public utilities, food, electric appliances, and nonetheless transportation.

Bangladesh has shown decrease in the mortality rates and increase in life expectancy. The total healthcare stands to 3.7% of the economy's GDP. The major share of the total health expenditure was spend on drug retail services, curative care service and prevention, and public health services. Bangladesh ranks the 3rd from the bottom in total healthcare expenditure as percentage of GDP index for the South East Asia region, but the economy also ranks among the top 5 nations for its public expenditure as a percentage of total healthcare expenditure (Light Castle Partners, 2016).

Bangladesh, having a GDP rate of 7.86% has improved remarkably in terms of GDP and health indicators since its independence in 1971. Despite some drawbacks in insufficient health financing, the economy has achieved Millennium Development Goal 4 and 5 on child mortality rate and maternal mortality. Recently, Bangladesh has let its target to achieve Sustainable Development Goals (SDGs) with universal health coverage. The increasing economic growth, improved socio-economic conditions, higher income levels, and education have led people to gain better health care system. In 2015, the total health expenditure in Bangladesh was 2.9% of GDP, which was one of the lowest allocations around the globe. On the other hand, out-of-pocket expenditure was 67% of the total health expenditure, which was of the highest proportions around the globe. Annually, on average, 4% of the households are pushed towards impoverishment due to high out-of-pocket health expenditures. According to the Health Economics Unit of Ministry of Health and Family Welfare (MOHFW), a target have been established to decrease the out-of-pocket expenditures on health by 32% and has identified some health financing reforms to the country forwards towards universal health coverage.

In emerging countries like Bangladesh, few studies are conducted on the link between health and economic growth of the country, especially considering the patients satisfaction with services. There is little means of defining such health services. On the other hand, the efforts of the government, NGOs and private sector to ensure quality health service in the recent years have been rewarded. More than 73% children of the country is fully immunized and child mortality rate has declined to almost 88 per 1000, compared to 153 in the 1970s (Andaleeb *et al.*, 2007). Furthermore, patients' health and quality of life is important to perform economic activities or be an active citizen of the country for growth of the economy, as a healthy economy is the key to a successful nation.

To the best of the knowledge, no studies have been done focusing on the nexus between energy demand, urbanization, and healthcare scenario in Bangladesh. This paper has used standard econometric tools such as ARDL Bound test approach, ADF Unit Root Test, and ARDL cointegration test, by using urbanization, energy use, electricity consumption in domestic sector, electricity consumption in commercial sector, consumption of electricity in industrial sector, total electricity consumption, and population growth as control variables in a multivariate framework. Through tests conducted in this research paper, we have found bidirectional relation in long run as well as in short run between urbanization and energy use. It is safe to say that as more and more workers will migrate to the urban city for job, they will use more and more healthcare facilities available in the city, which in turn will increase the demand for energy.

Section 2 gives a review of the literature and Section 3 provides an overview of the urbanization, energy sector and healthcare in Bangladesh. Section 4 describes the econometric methodology used in this research paper, followed by the results in Section 5 and conclusion in section 6.

2. LITERATURE REVIEW

Yazdi and Khanalizadeh (2017) examined the role of environmental quality and economic growth in the determination of health expenditure for the Middle East and North Africa region (MENA) from the year 1995 to 2014 using Auto regressive Distributed Lag (ARDL) approach. The results showed that economic growth and environmental quality impacts health expenditure, while CO₂ emission have statistically significant positive effect

on health expenditure. In light of that, Topcu and Girgin (2016) examined the impact of urbanization on energy demand for a panel of 11 Middle Eastern countries over the period 1990-2012. Panel cointegration and causality approaches were used. The panel cointegration results showed a co-movement of the variables in the long run and the cointegrating regression results indicated that 1% increase in urbanization leads to 0.49% increase in energy demand in the long run. In terms of causality, results differed from short term through the long term. Their findings showed that causality ran from energy demand to urbanization in the short run, but the direction turns out to run from urbanization to energy demand in the long run. Energy conservation policies were recommended to decrease region's global gas emissions. Similarly, Luo (2014) tested the dynamic relationship of electricity consumption and economic growth in urbanization in China during 1980-2009. The multivariate analysis framework incorporated gross fixed capital formation and the employment level. He used VECM and Impulse Response and Variance Decomposition techniques to analyze the internal relationship between electricity consumption and economic growth under urbanization. The results showed that short-term fluctuation of economic growth puts it 78.2% down to electrical input, investment and labor input, urbanization and adjustment by itself. He recommended policies towards the expansion of electricity infrastructure to meet the increasing demand exerted by the country's strong growth and rapid urbanization.

Thoa *et al.* (2013) discussed about the impact of economic growth has on health care utilization in rural Vietnam. The paper concluded to reduce inequalities in healthcare as people with economic growth were better off in comparison to household without economic growth. Elmi and Sadeghi (2012) studied the causality and co-integration relationship in health care and economic growth in developing countries for the period between 1990-2009. The paper used panel cointegration and causality in VECM framework, where the findings revealed that there is a short-run causality from GDP to healthcare expenditure and a bilateral causality and long-run relationship between economic growth and health expenditure. The findings revealed that income plays a significant role across developing countries for the growth of health care expenditure for the long-run.

3. OVERVIEW OF ECONOMY, ENERGY SECTOR, URBANIZATION AND HEALTHCARE OF BANGLADESH

The country secured an economic growth rate of 7.24% over the last decade, which is well above the global economic growth and prediction by The World Bank of 6.4%-6.8. This was possible because of higher growth of the industrial sector as well as the service sector, accompanied by increasing demand for energy. On the bright side, Bangladesh also shifted up from a low-income country to a lower middle-income country and plans to become a middle-income nation by 2021.

Bangladesh is aiming to promote 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. It is suggested that a 0.23% of GDP growth can be achieved by 1% increase in per capita energy consumption. Although energy consumption by Bangladesh has experienced one of the highest percent increase within the Asian countries, by 4.5% since 1990 till 2012, yet per capita, energy consumption is yet stagnant, as compared to other countries. Table 1 represents electricity sector in Bangladesh at a glance.

Table-1. Comparative Data of Bangladesh Electricity Scenario.

Subject	2009	2010	2011	2012	2013	2014	2015	2016
Installed Generation Capacity	5719	5823	7264	8716	9151	10416	11534	12365
Derated Generation Capacity	5166	5271	6639	8100	8537	9821	7817	12921
Generation (MW)	3589	3883	3962	4805	5010	5320	7817	9036
Highest Generation	4162	4606	4890	6066	6434	7356	6389	8091
Electricity Demand (peak demand)	6066	6454	6765	7518	8349	9268	10283	11405
Access to Electricity	47	48.5	49	53	62	69	72	80
Per Capita Electricity Generation	183.26	200.32	211.86	231.65	248.89	270.83	251.68	-

Source: Power Division Bangladesh, GOB, 2016.

Among the total natural gas consumption, power plants use 41%, the industry and captive power use 17% and 16% respectively, leaving 12% for domestic sector and 8% to fertilizer sector, followed by 6% in the transport sector (CNG). The dependency for natural gas has increased to 300% from 1992 to 2012, mainly due to urbanization.

Healthcare industry is termed as one of the salient fields for any country, as health is wealth. Medication is considered as a basic need for living, which has a growing demand. As growth in living standards (due to urbanization and increase in income) and aging population ensures a healthy economy. But depending on the form of health service patients need, the level of health care is divided into 3 major categories [Table 2](#).

Table-2. Classification of health services.

Classification	Description
Primary	Basic/general healthcare. Given through doctors, who are trained in: family practice, pediatrics, internal medicine, and gynecology
Secondary	Medical care given by physicians, who are consultants and work as per call of the primary physician
Tertiary	Specialized consultative care, usually on referral from primary or secondary medical care personnel, by specialists working in a center which has personnel and facilities for special investigation and treatment

Source: LCP (2016)

Bangladesh has spent on average 37% of the total healthcare expenditure. Public spending on health is financed from non-development or revenue budget and development budget or Annual Development Programme (ADP) in the form of national tax, foreign development tax, etc. Moreover, there are 64,434 registered doctors, 6,034 registered dentists, 30,516 registered nurses and 27,000 midwives (LCP, 2016).

As the country is experiencing an energy transformation, this will not only provide adequate energy supply to the growing urbanization and population of the country as a whole but also provide quality healthcare for the citizens.

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

Panel 1: Levels			
Variables	ADF Statistics (Constant)	ADF Statistics (Constant & Trend)	Decision
Electricity Consumption in the Service Sector	2.587954	0.155831	Non Stationary
Energy Use	2.826289	-0.350563	Non Stationary
Electricity Consumption in the Industry Sector	-0.950167	-3.841821	Stationary
Total Electricity Use	2.611227	0.11930	Non Stationary
Urbanization	-6.978227	-7.540299	Stationary
Electricity Consumption in the Domestic Sector	3.691268	0.794883	Stationary
Panel 2: First Difference			
	ADF Statistics (Constant)	ADF Statistics (Constant & Trend)	Decision
Electricity Consumption in the Service Sector	-5.214089	-4.586648	Stationary
Energy Use	-5.588461	-7.678213	Stationary
Total Electricity Use	-4.895306	-5.939694	Stationary

Note: All regression is estimated with and without trend. Selection of the lag is based upon Schwartz Information Criterion (SIC). Eviews 9 software automatically selects the most significant lag length based on this criterion.

[Table 3](#) shows ADF statistics and corresponding critical values of all the variables in their level and first differenced forms. It is worth noting that unit root tests have non-standard and non-normal asymptotic distributions which is highly affected by the inclusion of deterministic terms. A time trend is considered as an extraneous regressor whose inclusion reduced the power of the test.

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
01%	-3.639407	-4.252879	-3.646342	-4.284580
5%	-2.951125	-3.548490	-2.954021	-3.562882
10%	-2.614300	-3.207094	-2.615817	-3.215267

Note: All values are estimated with and without trend. Eviews 9 software automatically selects the most significant lag length. The critical values automatically comes up at 1%, 5% and 10% respectively.

Table 4: As electricity in commercial services, energy use and total electricity were non-stationary at levels, their first differences were checked and found stationary as the final result.

3.1. ARDL Cointegration Test

The ARDL approach of cointegration can be remarkably applied irrespective of whether the variables are I (0) or I (1) as it avoids the pre testing problems associated with standard cointegration analysis which requires the classification of the variables into I (1) and I (0). In addition, the ARDL approach also gives more robust results when the sample size is small. Thus the ARDL approach of cointegration does not need to employ DF unit root tests and autocorrelation function tests for testing the order of integration.

At the first stage, the long run relationship between the variables under investigation is tested by computing the F-statistics for testing the significance of the lagged levels of the variables in the error correction form of the underlying ARDL model. They have tabulated two sets of values for a different number of regressors (k) and whether the ARDL model contains an intercept and/or trend. One set assumes that all the variables in the ARDL model are I (1), whereas another assumes all the variables are I (0). If the computed F-statistics falls above the upper critical value, the null hypothesis of no long run relationship can be rejected without needing to know the orders of integration for the time series. Conversely, if the computed F value is below the lower critical value, the null hypothesis cannot be rejected. Finally, if the computed statistics falls within the critical value band, the result is inconclusive. The second step of the ARDL procedure is to estimate the long run and the short run coefficients and their inferences provided that we have already established the long run relationship between the variables.

The ARDL Framework Takes the Following Form:

$$\Delta Y_t = \beta_0 + \sum \beta_1 \Delta Y_{t-i} + \sum \beta_2 \Delta X_{t-i} + \beta_3 Y_{t-1} + \beta_4 X_{t-1} + \varepsilon_t \tag{1}$$

In Microfit 4.1 software we can have an automatic choice of selecting the appropriate model. Regarding trend, the significance of the trend variable has to be checked. Although in the spirit of the bounds test, a model with a time trend is invalid because for the model to be valid there should be only one long run relationship. If someone includes a time trend in the model one may end up with more than one possible cointegration relationship: one with a time trend and one without a time trend. But in this article time trend has been included just to check whether cointegration test is trend sensitive or not. In addition, a clear indication of the trend is observed from the plotted level variables. Firstly, the order of lags on the first differenced variables was obtained. In this paper, lag 2 is taken as an optimal level. Lag 1 is excluded because as a rule of thumb we should include more than one lag for the annual data. The computed F-test statistics for each order of lag is presented in the following table where F-statistics is highly significant in lag 2.

Table-5. ARDL Cointegration Test (F-Statistic).

Order of Lag	F - Statistic without Trend	F - Statistic with Trend
02	F (6,13) = 9.31	F (6,12) = 8.38

Note: ARDL cointegration test have been conducted both with trend and without trend with the order of lag 2 by the help of Microfit 4.1 software

Table 5 represents the computed F statistics, holding urbanization as the dependent variable. There is a significant change in the level of 99% level.

We have considered ARDL Cointegration both with the trend and without trend. As a rule of thumb, if F statistics lie between upper and lower value, then cointegration is present. The null hypothesis states that no cointegration is present and we reject the null hypothesis and confirm the presence of ARDL cointegration.

Table-6. ARDL ECM Test (Dependent variable is Urbanization).

Regressor	Coefficient	T – Ratio
dURB1	0.152	1.67
dEU	-0.0609	-2.82
dECT	0.1456E-4	0.16
dECT1	0.1066E-3	1.82
dECD	-0.9028E-5	-.068
dECD1	-0.2465E-3	-1.84
dECS	0.0014595	2.98
dECI	0.1672E-5	.025
dC	8.189	4.06
ecm(-1)	-0.827	-9.35

Note: ECM coefficient shows the pace variable return to equilibrium. The dependent variable in urbanization. Microfit 4.1 software has been used for the test.

Table 6 represents the speed of adjustment to restore equilibrium in the model. The ECM should be negative, less than 1 and highly significant, which is the case here. Lag 1 is excluded because as a rule of thumb we should use more than one lag for the annual data.

As ECM value is less than one, it can be stated that there is a short run disequilibrium and auto correction is occurring at a fast rate.

4. CONCLUSION & RECOMMENDATION

Bangladesh is characterized by rapid urbanization, backed by huge population. Bangladesh aims to become an upper middle-income nation by 2021 and a developed nation by 2050. Bangladesh will keep on rising. It is worth noting that millions of people are concentrating in townships every year and the number will keep on spiraling until prominent alternative jobs are created in other regions of the country.

There are 2,983 private hospitals and registered clinics, with a total number of beds provided by the private part, stands to 45,485, as of 2013. As urbanization will take place and increase, more people will flock to the city and will need medical facilities. The challenge remains in the mixed health system and poor governance. The existing structure and management of health organization fails to make the system accountable to its stakeholders. Good governance is important in this aspect as the country aims to achieve universal health coverage by 2023 to pay 70% of the medical expenses.

However, the healthcare industry needs to utilize more and more renewable energy and smart technology for the success. More industries should be built in other divisions of the country. Likewise, as electricity consumption in service sector results in urbanization and vice versa, more attention should be given to this sector. As Bangladesh targets to become a middle-income nation by 2021 and a developed nation by 2050, the government has to invite more international organizations to boost service sector.

However, transparency and accountability regarding funds need to be monitored and evaluated, as well as good governance need to be ensured. For example, facilities are provided based on the bed counts and past funding history, rather than on performance based category or need-based category like population size or bed turnover rates. Hence, it's salient to improve the resource allocation to reflect upon the needs of the populations and facilities. Perhaps sensitization or buy-in of major stakeholders at the national level can reduce the reform based allocations.

Nonetheless, government can then advocate to increase the budget allocation for the health industry, which as a whole will benefit everyone.

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