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Does Access to Improved Water Source and Sanitation Facility Accelerate Economic Growth in Bangladesh?

Sandip SARKER*, Arifuzzaman KHAN**

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ABSTRACT

This paper examines the relationship among access to improved water, sanitation and economic growth in Bangladesh through co-integration and vector error correction model (VECM) over the period 1991 to 2014. Bangladesh has registered remarkable progress in achieving major Millennium Development Goals (MDG). Today nearly 87% of our total population has access to improved water sources and 60% have access to improved sanitation facilities which is contributing significantly towards human development in Bangladesh. Therefore we want to test whether access to improved water and sanitation accelerates economic growth in Bangladesh through a time series analysis. The Johansen co-integration tests indicate that there is long run association among the variables. The vector error correction model indicates that there is a long run causality running from improved sanitation facilities (% of population with access) and improved water source (% of population with access) to gross domestic product in Bangladesh. Similarly in the short run a causal relationship has been found among the variables as well. Further impulse response function and variance decomposition results say that improved sanitation facilities (% of population with access) and improved water source (% of population with access) can explain the major variations in our economic growth. The implication of our findings is that in Bangladesh an increase in improved access to water and sanitation is likely to positively affect our economic growth in the long run. Keeping in mind about Sustainable Development Goals (SDG), policymakers in Bangladesh need to pay special attention to ensure greater access to improved water and sanitation to boost our economic growth & development.

1. Introduction

The establishment of safe drinking water and basic sanitation is among the most critical challenges for achieving sustainable development for the developing countries over the next decade. The provision of water supply and sanitation generates substantial benefits for public health, human capital development, the economy and the environment. Water is essentially interconnected with the Millennium Development Goals (MDG) and basic sanitation was added to the catalogue at the 2002 World Summit on Sustainable Development held in Johannesburg. To halve by 2015 the proportion of people without sustainable access to safe drinking water and basic sanitation was one of the numerical and time-bound targets defined for the MDGs. The provision of safe drinking water and basic sanitation contributes to sustainable improvements in peoples' lives regarding their health and education situation which is the preconditions for productive employment as well as for the eradication of extreme hunger and the empowerment of women.

Population and economic growth are driving pressure on available fresh water resources throughout the world. Uncertain water availability is a challenge that many countries are facing, which can impact economic growth significantly. Water has always played and continues to play a central role in human societies. An adequate and reliable source of water is needed to sustain human life, future economic development, and the integrity of ecosystems. Benefits from the provision of basic water supply and sanitation services that are mentioned in the Millennium Development Goals (MDGs) are massive. For example the achievement of the MDGs for water and sanitation would generate benefits of USD 84 billion per year. Following the MDGs United Nations has developed Sustainable Development Goals (SDG) with a broader aspect of sustainable development throughout the world. At the same time it is well known that poor sanitation has a powerful as well as detrimental impact on the health of the people. Almost 6% of the total global burden of disease are the result of inadequate sanitation, water and hygiene (WHO, 2003). To prevent these diseases improved access to sanitation as well as water is necessary Esrey et al. (1991). According to the World Bank statistics, in 2014 almost 600 million people worldwide were without improved access to water and two billion people were without access to basic sanitation. Thus, the economic benefits from improved access to safe drinking water and sanitation can be considerable. Investment in water supply and

* Independent researcher, Bagladesh, ** Central Banker, Bagladesh, E-mail addresses: sandip0735@gmail.com (Sarker S.), arif.ku.business@gmail.com (Khan A)

sanitation services typically generates a number of economic, environmental and social benefits. Access to clean drinking water and sanitation reduces health risks and frees-up time for education and other productive activities, as well as increases the productivity of the labor force. Many scholars and international organizations have provided strong evidence to the effect that improved water and sanitation can catalyze human development and growth (World Bank, 2004; Briscoe, 2005).

Previous economic studies also identified several economic benefit from improved water and sanitation services (UN-Water 2008; Tearfund, 2008). These includes reducing direct and indirect health costs, increasing the return on investments in education, gaining productivity and so on. Additionally Human Capital theory suggest that there are substantial economic benefit of education. With less time ill and less time spent fetching water, children above all are able to devote more time to learning which further improves their cognitive abilities (Michaelowa, 2000). Further it is also evident that diseases and productivity losses linked to water and sanitation in developing countries amount to 2% of GDP (Sadoff and Grey, 2005). Over the last two decades the importance of sanitation in South Asia's human development has been increasingly recognized, and greater public investments have been made in promoting access to and achieving improvements in sanitation. At the same time Bangladesh has been able to maintain a steady growth of 6% per year in the last five and six years. Moreover Bangladesh also made significant improvement in achieving millennium development goals in terms of improved access to water and sanitation. This has certainly contributed towards the development of human capital in Bangladesh as well. Additionally no prior studies have been found to interpret the relationship among improved access to water, sanitation and economic growth in Bangladesh. Therefore our study has attempted to identify the relationship between improved water and sanitation access and economic growth in Bangladesh from a time series data. The result provides important policy suggestions regarding our health and sanitation issues which are the preconditions for sustainable development.

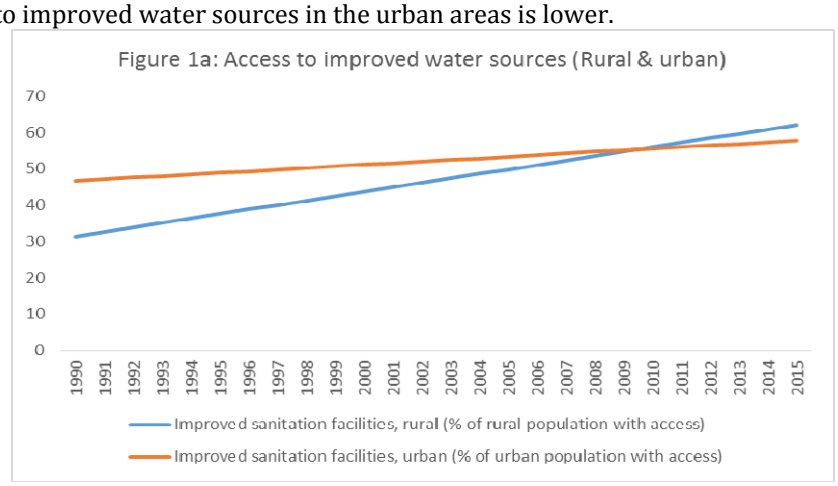
2. Literature Review

Several studies have been found that focused on the relationship among water sanitation and growth. Most of them found strong positive relationship. A study by Warford and Yining (2002) found that 1.5% of all deaths in china can be attributed to water and sanitation related diseases. The total welfare loss from the impact of water pollution on health alone is estimated to $13.4 billion for the late 1990s which is equal to 1.3% of china's GDP. Bloom and Sachs (1998) explored that more than half of Africa's economic growth shortfall relative to high growth countries of East Asia could be explained statistically by water and sanitation problem than by more traditional macro-economic policy variables. Sachs (2001) demonstrated the significance of water and sanitation management on health and education on economic growth and economic welfare. He further argued that countries with a higher access to improved water and sanitation experience a higher economic growth in the long run. Water and sanitation program conducted a study on 'Economic Impacts of Inadequate Sanitation in India' in 2011. It explored that the total annual economic impact of inadequate sanitation in India amounted to a loss of 2.4 trillion ($53.8 billion) in 2006 which was equivalent of about 6.4 percent of India's gross domestic product (GDP) in 2006. Another study by The World Bank's Water and Sanitation Programme recently assessed the annual economic impact of poor sanitation in Cambodia assessed the annual economic impact of poor sanitation and concluded that the costs were equivalent to $448 million which is around 7.2% of the GDP. A comprehensive cost-benefit analysis was conducted by Hutton and Haller (2004) for the WHO and they quantified the benefits of improved water supply and sanitation in South Africa. Results of this analysis show benefits for South Africa that range from 200 South African rand per person per year for access to simple improved water and sanitation facilities to 900 South African rand for access to regular piped water supply and household sewage connection. Manase (2009) in his study on strategic role of water in sustainable economic growth in South Africa found a strong correlation between improved access to water sources and economic growth. He also stressed that that investing in water infrastructure, management and services is absolutely essential and a necessary prerequisite for sustainable economic growth, poverty alleviation and social development for South Africa. However some researcher also identified the impact of improved access to water and sanitation in other ways. Drake et al. (2000) believes that school, sanitation and economic development are interrelated in all the other ways. A lack of adequate sanitation hinders school achievement across genders. Bhargava et al. (2005) in their study on school going children in Tanzania found that water related disease and lack of sanitation impede learning and child development and hence have long term impact on their ability to contribute productivity as working adults. Barro (1997) finds that a 10% increase in life expectancy should spur a 0.4% annual increase in growth rates. (Sachs and Hamoudi, 1999; Barro, 1997; Fogel, 1994) all found that better health and lower mortality encourages greater accumulation of physical and human capital which ultimately affects economic growth of a nation. According to (Vaux, 2004), sanitation, access to safe drinking water and personal and domestic hygiene are arguably necessary conditions for sustained increase in economic welfare. From the analysis of the existing literature it has been found that water and sanitation is critical for sustainable economic growth of a nation. At the same time an increase in improved access to water

and sanitation can also significantly affects the development of human capital of a nation. Our study is expected to contribute to the economic literature by adding a result from a developing country perspective in the area of water and sanitation for economic growth.

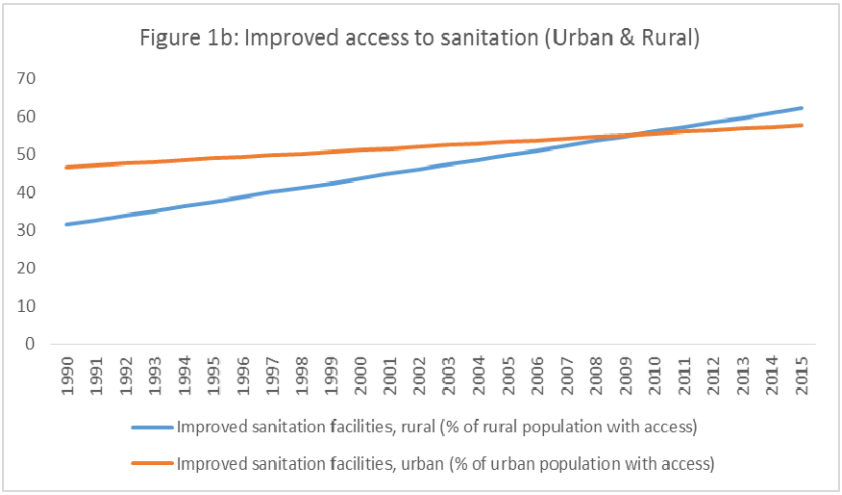
3. Water & Sanitation Scenario in Bangladesh:

With more than 1000 people per square kilometer Bangladesh has one of the highest population densities in the world. 50% of the population is characterized as poor and 20% as hardcore poor. In absolute numbers, therefore, about 71 million people are under the national poverty line. In spite of this serious challenge, the effort to achieve nearly universal water supply coverage has become an example of global best practice. The current urban population of 35 million is increasing at a rate of 3.5% per year and by the year 2050 nearly 50% of the people will reside in urban areas, of which over 30 million will be in the city of Dhaka, likely to be the second largest city in the world. A conservative projection indicates that nearly 30% of urban dwellings will live in slums and shanties. Although urban water and sanitation coverage figures appear impressive at 71%, only about 40% of the population receives intermittent water through piped systems, while the remainder does so through hand-pumps. Figure 1a displays the scenario of access to improved water sources in rural and urban areas. We can see that from 1990 there has been a significant increase of access to improved water resources in the rural areas in Bangladesh. However compared to rural areas, the growth of access to improved water sources in the urban areas is lower.



Source: World development Indicators

At the same time from figure 1b, we can see that improved access to sanitation in the rural areas has made significant progress over the past two decades. However progress in the urban areas also displays a satisfactory result.



Source: World development Indicators

In Bangladesh the ministry of local government, rural development and cooperatives has overall responsibility for monitoring and governing the sector, including policy formulation through its Local Government Division. Rural water through hand-pumps from shallow ground water aquifers, which is based on a service level where one hand pump serves on average 20 people, or roughly about 3 families, is a major success story for Bangladesh. Following the SACOSAN 2003 Ministerial Conference, government of Bangladesh has launched a massive campaign and, as of today, achieved over 70% coverage through pit

latrines. The rate of increase in access has been a remarkable 14% per year. The key challenge is urban water and sanitation service, especially for the growing low income community including the slum dwellers. The problem is more serious in the mega city of Dhaka and the City Corporations areas. Institutional issues are a major challenge, rather than finance and or technical issues. The inclusion of Water and Sanitation as one of the components of the Bangladesh Poverty Reduction Strategy is a significant recognition of the critical importance the Government has assigned to the sector as a means of poverty reduction. This has encouraged the main sector stakeholders and international development organizations to align with the Governments strategy and mobilize technical and financial assistance to support the MDGs for the water and sanitation sector.

4. Objectives

The main objective of our study is to find out the causal relationship between improved access to water and sanitation and economic growth in Bangladesh from a time series data. Over the last five to six years we have achieved a steady growth of 6%. At the same time Bangladesh has also performed well in achieving Millennium Development Goals (MDG) goal in terms of access to improved water and sanitation. Moreover sustainable development goals (SDG) have replaced MDG where the target is to ensure availability and sustainable management of water and sanitation for all. As we have achieved satisfactory growth in MDG's goal, therefore we want to test whether there is any long run as well as short run causal relationship among our variables from a time series modeling.

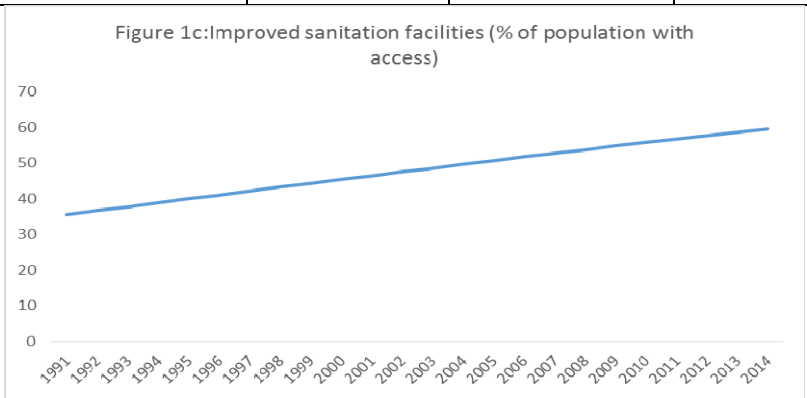
5. Data, Model & Methods

5.1 Data

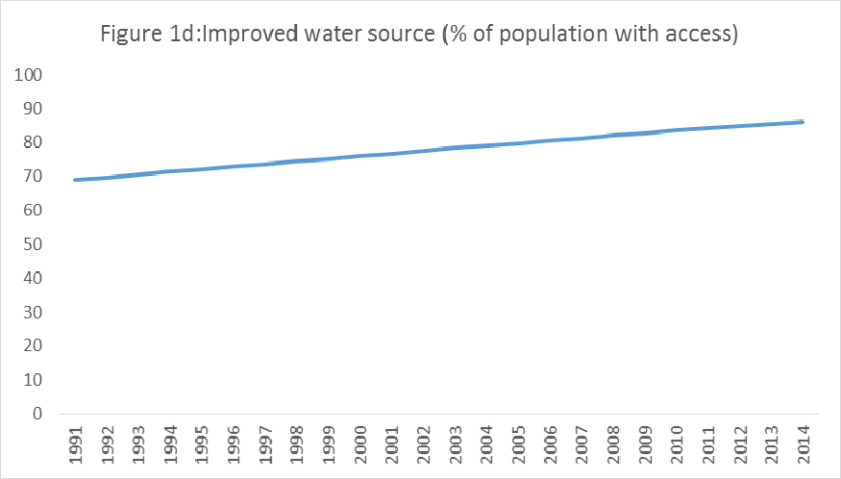
Table 1 presents descriptive statistics for the variables employed in the study. Figure 1 presents the time series of each of the variables in graphical form. In this study our dependent variable is gross domestic product (constant local currency) and independent variables are improved sanitation facilities (% of population with access) and improved water source (% of population with access). Most of the previous studies measured economic growth in terms of GDP. In our study, GDP is measured in terms of the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant local currency (WDI, 2014). Then access to improved sanitation facilities refers to the percentage of the population using improved sanitation facilities. Improved sanitation facilities are likely to ensure hygienic separation of human excreta from human contact. They include flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet (WDI, 2014). Finally access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). Data has been collected from world development indicators of World Bank data sheet from 1991 to 2014.

Table 1 Descriptive Statistics

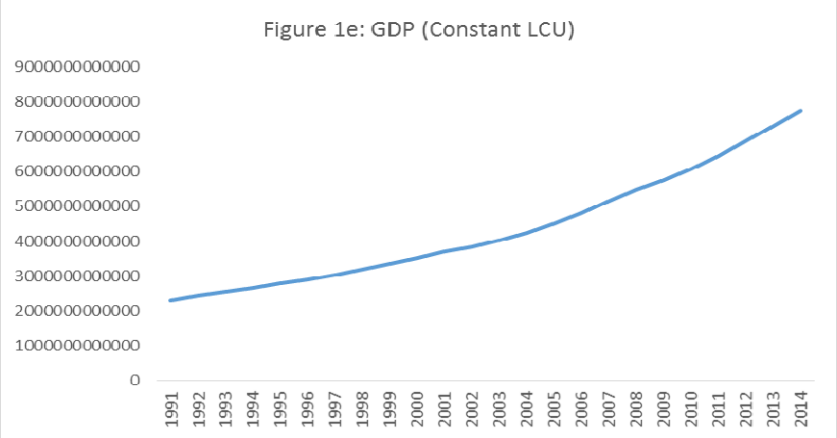
Variables	Mean	Median	Skewness	Kurtosis
Gross Domestic Product (LCU, Constant)	4367189464242	3941726000000	0.6251	-0.7561
Improved sanitation facilities (% of population with access)	47.925	48.1	-0.0620	-1.2142
Improved water source (% of population with access)	77.7833	77.9	-0.0626	-1.21805



Source: World Development Indicators, 2014



Source: World Development Indicators, 2014



Source: World Development Indicators, 2014

5.2 Econometric Modelling:

The econometric modeling strategy proceeds in several steps, consistent with previous studies. The unit root test is carried out to check the stationarity of the variables as financial and macro variables are well known for their non stationarity. The Augmented Dickey Fuller (ADF) test is then carried out to detect the existence of unit root and as a result of which, some of the variables are found to be non-stationary and thus could not be regressed unless made stationary. The null hypothesis for the ADF unit root test is that the variable has a unit root against the alternative of stationarity. We performed the ADF tests based on the following model:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \cdots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t,$$

The cointegration test is run to find out possible linear combinations of the variables which could be considered stationary. To test for cointegration we use the maximum likelihood test developed by Johansen and Juselius (1990). We use the AIC to determine lag length. Johansen and Juselius multivariate cointegration equation is given below:

$$\Delta X_t = \sum \Gamma i \, \Delta X_{t-i} + \prod X_{t-1} + \varepsilon_t$$

Once the variables are found to be cointegrated, then Vector Error Correction model (VECM) can be employed to identify the long run and short run causality running from our variables. The long-run multivariate models are as follows:

$$Y_t = \alpha + \beta_1 ISF_t + \beta_2 \, PIWS_t + u_t$$

Where Y_t = GDP, ISF_t = Improved sanitation facilities (% of population with access), $PIWS_t$ = Improved water source (% of population with access), u_t = error terms

If there is a long run relationship between the series, shocks will result in disequilibrium in the short-run before the series return to their long-run equilibrium. The short run model corresponding is as follows:

$$\Delta \, GDP_t = \sum \beta_i \, \Delta \, GDP_{t-i} + \sum \alpha_i \, \Delta ISF_{t-i} + \sum \alpha_i \, \Delta IWS_{t-I} + \varepsilon_{it}$$

Where, GDP = Gross Domestic Product, ISF = Improved sanitation facilities (% of population with access) & IWS = Improved water source (% of population with access).

Eviews 9 has been used to interpret and analyze the data.

6. Findings & Analysis

Initially, we opted for ADF test to check the datasets and we observed that the datasets were non-stationary at level. In the level, we found both the series become non-stationary (Table 2). However in the first difference we found the series become stationary (Table 2). So it became possible for us to investigate the existence of a long-run relationship within a Johansen cointegration testing framework.

Table 2: Augmented Dickey–Fuller Unit Root Test

Variables	Level	First Difference
	t-statistic	t-statistic
Gross Domestic Product (Constant, LCU)	-3.508647	-5.767541
Improved sanitation facilities (% of population with access)	-5.055165	-7.416936
Improved water source (% of population with access)	-3.869650	-8.280145

In Johansen's method, both the Eigen value statistics and Trace statistics can be used to determine whether variables are cointegrated or not. To trace out the presence of cointegration, we could rely on both Trace statistics and Eigen value. From the Trace statistics (table 3); it was found that all variables have been cointegrated at 5% level where the null hypothesis is rejected indicating long-term association between the variables. Further Maximum Eigenvalue statistics indicates that there is at least one cointegrating equation. It indicates that all the variables move together in the long run. We used Akaike information criterion (AIC) to select the number of lag. The rule is lower the AIC better the model. Therefore we have selected lag 3. As all variables are cointegrated, we can run vector error correction model.

Table 3: Johansen Cointegration Test Result

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.817115	58.90394	29.79707	0.0000
At most 1 *	0.489639	23.22708	15.49471	0.0028
At most 2	0.351708	9.101708	3.841466	0.0626

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.817115	35.67686	21.13162	0.0003
At most 1	0.489639	14.12537	14.26460	0.0526
At most 2 *	0.351708	9.101708	3.841466	0.0026

Table 4 shows the Vector Error Correction Model (VECM) to determine long run causal relationship. Here C (1) represents the speed of the adjustments towards long run equilibrium. We see that our C (1) is negative and is also significant which indicates that there is long run causality running from improved sanitation facilities (% of population with access) and improved water source (% of population with access) to gross domestic product. Further we can say that improved sanitation facilities (% of population with access) and improved water source (% of population with access) have influence on our dependent variable GDP in the long run.

Table 4: VECM Long Run Causality model

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	**-1.227116**	**0.471971**	**-2.599985**	**0.0316**
C(2)	0.549325	0.375461	1.463067	0.1816
C(3)	0.356206	0.301357	1.182006	0.2711
C(4)	0.399524	0.190336	2.099044	0.0690
C(5)	-0.551904	0.190382	-2.898930	0.0199
C(6)	-0.427404	0.179443	-2.381845	0.0444
C(7)	-0.203259	0.156987	-1.294750	0.2315

	Coefficient	Std. Error	t-Statistic	Prob.
C(8)	0.332629	0.143539	2.317338	0.0491
C(9)	0.407095	0.150660	2.702075	0.0270
C(10)	0.364488	0.108886	3.347436	0.0101
C(11)	-0.062025	0.153745	-0.403426	0.6972

R-squared	**0.831582**	Mean dependent var	-0.062298
Adjusted R-squared	0.621059	S.D. dependent var	1.084246
S.E. of regression	0.667442	Akaike info criterion	2.322169
Sum squared resid	3.563830	Schwarz criterion	2.868949
Log likelihood	-11.06060	Hannan-Quinn criter.	2.414706
F-statistic	3.950083	Durbin-Watson stat	2.235030
Prob(F-statistic)	**0.031764**		

Now we want to estimate whether there is any short run causal relationship among our variables. To do this we used wald statistics test result. Table 5 shows short run causality result between improved sanitation facilities (% of population with access) and GDP. Result says that there is a short run causality between improved sanitation facilities (% of population with access) and GDP since chi-square value is less than 5%.

Table 5: Short Run Causality between Improved sanitation facilities and GDP

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	2.872409	(3, 8)	0.1035
Chi-square	8.617228	3	**0.0348**

Table 6 shows short run causality between improved water source (% of population with access) and GDP. Result says that there is also a short run causal relationship between improved water sources (% of population with access) and GDP as chi-square value is less than 5%.

Table 6: Short Run Causality between Improved water source and GDP

Wald Test:

Test Statistic	Value	df	Probability
F-statistic	6.302053	(3, 8)	0.0168
Chi-square	18.90616	3	**0.0003**

Now we want to examine whether our model where GDP is the dependent variable has any statistical error or not. Here our value of R^2 is 83% which is high. Our F statistics is also significant which a good sign of our model. Breusch-Godfrey's LM Test (table 7) indicates that there is no serial-correlation in our model. Further Breusch-Pagan-Godfrey's Heteroskedasticity Test (table 8) indicates that this model does not have Heteroskedasticity problem.

Table 7: Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.261542	Prob. F(2,6)	0.7782
Obs*R-squared	1.523603	Prob. Chi-Square(2)	**0.4668**

Table 8: Heteroskedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.824781	Prob. F(12,6)	0.6357
Obs*R-squared	11.82900	Prob. Chi-Square(12)	**0.4595**
Scaled explained SS	0.768575	Prob. Chi-Square(12)	1.0000

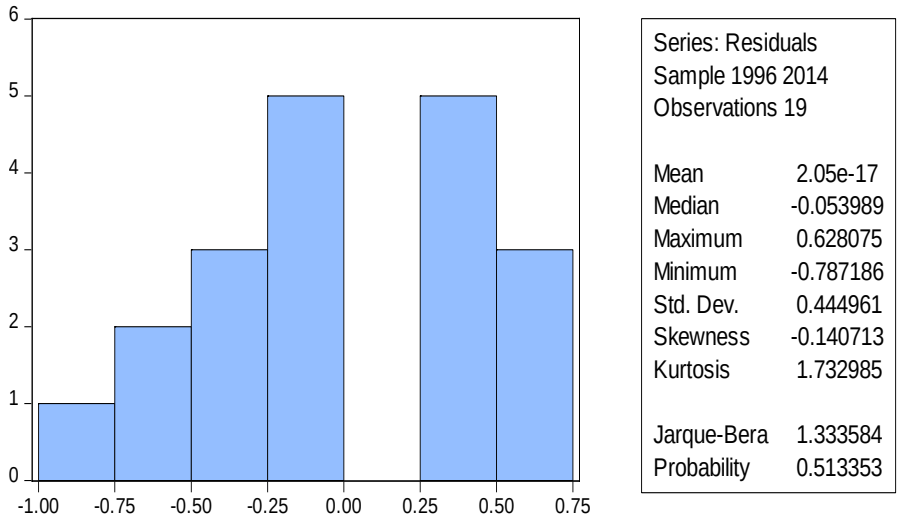


Figure 2: Normality Test

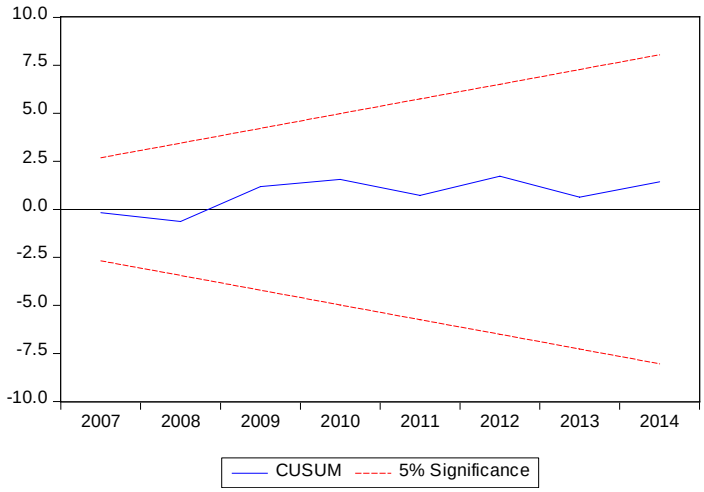
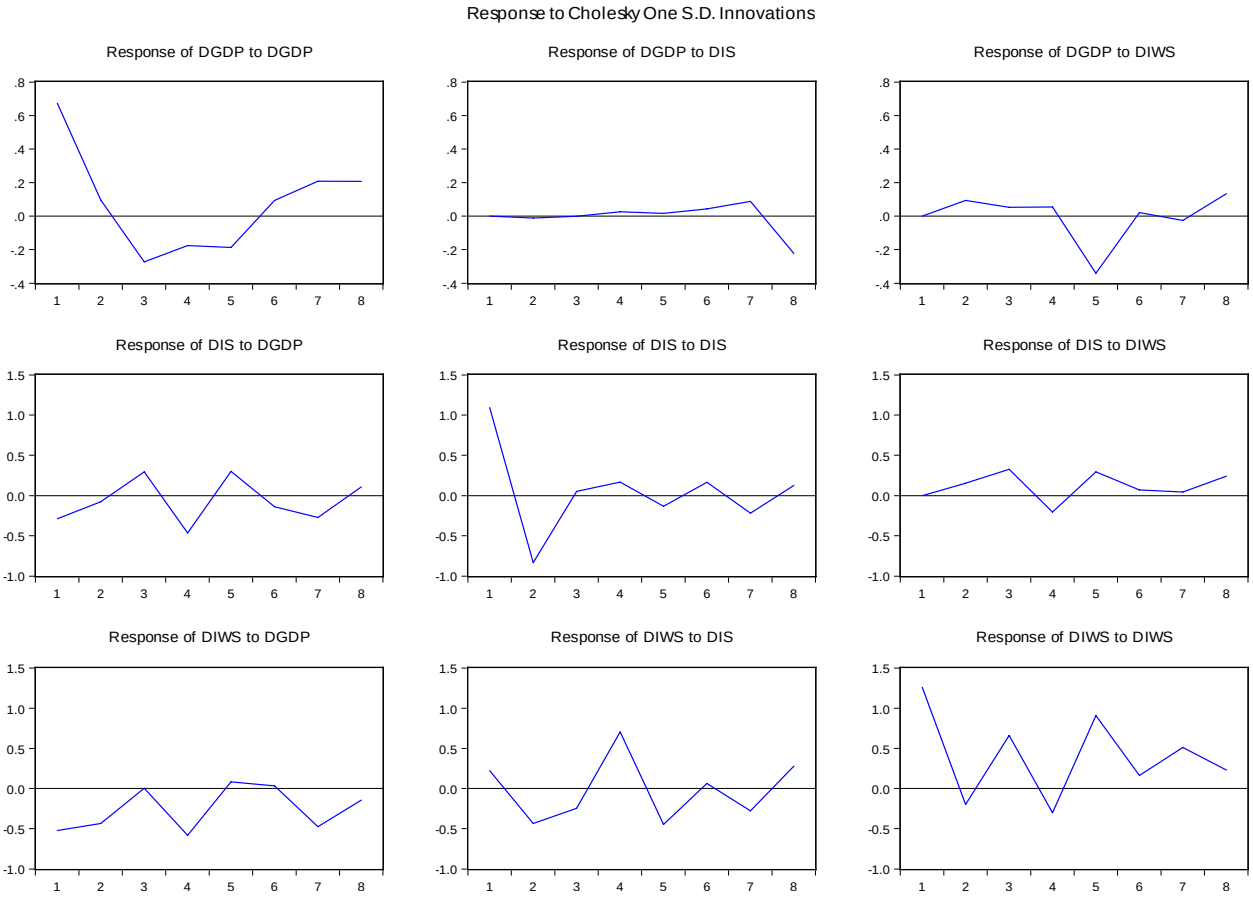


Figure 3: Stability Test

Moreover residuals our model is found to be normally distributed (figure 2). At the same time stability statistics in figure 3 indicates that our model is stable or in other words our dependent variable GDP has stability.

6.1 Impulse Response & Variance Decomposition Results

Graph 4 displays the impulse response for gross domestic product to generalize one standard deviation fundamental innovation. It helps to trace out the responsiveness of the dependent variables in the VECM to shocks to each of the variables. The first figure shows that if we give positive shock of one standard deviation to GDP then GDP will gradually go down and after 2nd year it becomes negative and once again positive after fifth year. Then if we give positive shock of one standard deviation to improved sanitation facilities (% of population with access), then GDP will initially be steady up to 6th period and after seventh year it will become negative. Then finally if we give positive shock of one standard deviation to improved water source (% of population with access), then GDP will initially positive and after fourth year it will become negative and again positive after seventh year.



Graph 4: Impulse Response

As impulse response function does not show the extent of the relationships between variables. Therefore, in order to judge the relative strength of different influences on a given variable, we conducted variance decomposition analysis. Table 9 shows Variance Decomposition of Gross Domestic Product. Here in the short runs (year 3) impulse or innovation or shock to GDP accounts for 97.88% variation of the fluctuation of GDP (own shock). At the same time shock to improved sanitation facilities (% of population with access) can cause 0.02% variation to the fluctuation of GDP in the short run. Finally shock to improved water source (% of population with access) can cause 2.08% variation to the fluctuation of GDP in the short run. However in the long run (year 10) shock to GDP accounts for 77.51% variation of the fluctuation of GDP (own shock). At the same time shock to improved sanitation facilities (% of population with access) can cause 6.69% variation to the fluctuation of GDP. Finally shock to improved water source (% of population with access) can cause 15.79% variation to the fluctuation of GDP in the long run. Therefore among major demographic determinants of GDP, we can conclude that improved sanitation facilities (% of population with access) and improved water source (% of population with access) might explain the major variations along with GDP itself.

Table 9: Variance Decomposition of Gross Domestic Product

Period	Standard Error	GDP	Improved Sanitation	Improved Water Sources
1	0.673904	100.0000	0.000000	0.000000
2	0.687323	98.12252	0.025883	1.851593
3	**0.741372**	**97.88979**	**0.022750**	**2.087457**
4	0.764377	97.38830	0.139843	2.471853
5	0.857799	82.04199	0.146644	17.81137
6	0.864240	81.99798	0.390252	17.61177
7	0.893655	82.12541	1.323965	16.55063
8	0.953346	76.87376	6.624596	16.50164
9	0.954433	76.71054	6.810200	16.47926
10	**0.977491**	**77.51708**	**6.688715**	**15.79421**

7. Concluding Remarks

Our study makes an effort to establish a relationship among Gross Domestic Product, improved sanitation facilities (% of population with access) and improved water source (% of population with access). We found long run as well as short run causal relationship among Gross Domestic Product, improved sanitation facilities (% of population with access) and improved water source (% of population with access). The results are further clarified by the impulse response as well as variance decomposition analysis. According to the MDG Bangladesh Country Report 2015, Bangladesh has made significant strides achieving major Millennium Development Goals (MDGs) targets in poverty alleviation, food security, gender equality, checking infant death, lowering maternal mortality and reining in HIV spread and tuberculosis. Especially in the area of water and sanitation Bangladesh has made remarkable progress. However sustainable development goals (SDG) has replaced MDG and therefore challenges arise further for Bangladesh once again regarding achieving those goals. As in many other countries sanitation as well as access to improved water remain a major challenge for Bangladesh. Government of Bangladesh set its targets of achieving full coverage of water and sanitation by 2013 and 2015 respectively. However we are still behind our target. Establishing and preserving environmental sanitation, safe water supplies and good hygiene in Bangladesh requires a combination of initiatives e.g. effective communication of information that will change behavior, education from primary school stage, support for good management of building and engineering as well as reducing arsenic contamination in the water supply. Different international development organizations like ADB, World Bank are financing several water and sanitation related projects in Bangladesh to improve the situation. Those projects aim to empower communities to respond to the demand for improved conditions through education, strengthening local government and ensuring that they have access to the necessary engineering skills. Good health enhances workers' productivity and healthier people who live longer have stronger motivations to invest in developing their skills, which increases workforce productivity by reducing incapability. Obviously, investment in health as well as overall human capital expenditure has definitely long run impact on economic growth. Therefore our study recommends that Bangladesh government needs to increase its expenditure on health as percentage of total expenditure which was only 7.83% in 2013. Further we also recommends that government needs to be able to develop policies and legislation that can provide local government, particularly the government's Department of Public Health Engineering (DPHE) with the capacity to meet the needs of the users. However our study has conducted with three variables only. Moreover there was unavailability of long time series data as well. Therefore our study recommends that future research should be conducted with more possible alternate variables on human capital development e.g. government expenditure on health, education, sanitation, school enrollment and so on with a longer time series data. At the same time a cross country (e.g. South Asia) analysis using panel data can also help to compare the result among different countries as well.

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