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Impact of Climate Change on the Achievement of Reducing Child Mortality in Bangladesh

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Abstract: *Climate change is considered as one of the prime challenge for the country. Recent published reports have found Bangladesh as one of the most vulnerable countries and would be the worst victim due to climate change. Children are the future of a nation. Considering this issue the country has taken various initiatives in reducing child mortality and had tremendous success record in achieving the goal 4 of MDGs. Relationship between climate change and reduction of child mortality is complex to analyze. ARDL bounds test is carried out to explore the existence of short-run dynamics and long-run equilibrium relationship between climate change and child mortality using secondary time series data in the context of Bangladesh. Empirical findings confirms long-run association-ship among the variables of the study and the model is found stable. Generally climate change worsening the child mortality scenario. Increase in temperature and rainfall reduces child mortality in Bangladesh. Since rainfall is decreasing so ultimately it worsening child mortality scenario. Reasons behind such temperature mortality relationship might temperature not yet exceed its threshold level. In the short-run, unidirectional causality from all choice variables towards dependent variable is identified. The error correction term of the model is 0.9347, found negative and highly significant which confirms overall significance of the model. The findings also ensures stability of the achievement in the long run. The study therefore recommends incorporating the climate resilience policy in formulating national and regional development planning.*

Keywords: *Climate Change, Child Mortality, Bangladesh.*

JEL Classification: *Q54, J13*

Introduction

Climate change is no more an environmental concern it has emerged as one of the biggest development challenge for the most vulnerable Bangladesh (Faroque et al., 2013). Relationship between climate change and sustainable development is multidimensional and complex. Bangladesh is one of the largest deltas in the world which is highly vulnerable to natural disasters because of its geographical location, flat and low-lying landscape, population density, poverty, illiteracy, lack of institutional setup etc. It is recognized in the scientific and negotiating community

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that climate change induced impacts will put additional challenges to many of the Millennium Development Goals and targets in general, and poverty and hunger, and human health in particular (GED, 2014). Different climatic elements might impact different sectors in various scales depending on the geographical areas.

Bangladesh is a developing country with a population of 155.8 million with a per capita income of US$ 1610, Population density is 1015 per square kilometre. Among the total population only 27% lives in the urban area where rest of the people lives in rural Bangladesh. The agriculture, industry and service sectors are contributing sectors to the GDP, where the respective contributions are 16.33, 29.61 and 54.05 percent. Natural resources such as land, water and a rich bio-diversity are the main basis of income and employment (BER, 2014). The country occupies an area of 147,570 sq. km. Geologically it is a part of the Bengal Basin which has been filled by sediments washed down from the highlands on three sides of it, especially from the Himalayas. A network of rivers originated in the Himalayas flow over the country, that carry sediments - the building blocks of the landmass of the delta. The major river systems of the eastern Himalaya - the Ganges, the Brahmaputra, and the Meghna (GBM) - their tributaries and distributaries crisscross the flood plains.

The country enjoys a humid, warm, tropical climate. Its climate is influenced primarily by monsoon and partly by pre-monsoon and post-monsoon circulations. The south-west monsoon originates over the Indian Ocean and carries warm, moist, and unstable air. The monsoon has its onset during the first week of June and withdraws in the first week of October; however, the onset and withdrawal dates vary from year to year. The main rainy period begins with the onset of the moisture-laden south-west trades which are drawn to the Indian sub-continent by the intense heat and consequent low pressure over Punjab (in Pakistan and India) and the Upper Ganges Valley and the filling up of the equatorial lows by air masses from these hot areas. Besides monsoon, the easterly trade winds are also active, providing warm and relatively drier circulation. Bangladesh was prominent for its six distinct seasons (Summer, Rainy, Autumn, Late-autumn, Winter and Spring) with special characteristics and features but nowadays it becomes difficult to isolate one season from another. Now the country is suffering from erratic climate.

Though all sectors and habitats reside in the world are affected by variability and change in climate but the impacts and vulnerability differs from region to region. South Asia is the most vulnerable region of the world to climate change impacts (McCarthy et al., 2001). Though the impacts of climate change are worldwide but Bangladesh are the most vulnerable because of its geographical location, high population density, high levels of poverty and the reliance of many livelihoods on climate-sensitive sectors, such as agriculture, fisheries, etc (Climate Change Cell, 2009). The international community also recognizes that Bangladesh ranks high in the list of most vulnerable countries on earth. Bangladesh's high vulnerability to

climate change is due to a number of hydro-geological and socio-economic factors that include: (a) its geographical location in South Asia; (b) its flat deltaic topography with very low elevation; (c) its extreme climate variability that is governed by monsoon and which results in acute water distribution over space and time; (d) its high population density and poverty incidence; and (e) its majority of population being dependent on crop agriculture which is highly influenced by climate variability and change. Despite the recent strides towards achieving sustainable development, Bangladesh's potential to sustain its development is faced with significant challenges posed by climate change (Ahmed and Haque, 2002).

The climate change substantially influence economic performance is well established in the literature from very ancient time. The linkages of climate and economic performance are found in the writings of an ancient Greek writer 'Ibn Khaldun' in his fourteenth-century 'Muqaddimah'. In that writings he noticed the adverse effect of climate change on economic performance (Gates, 1967). Environmental economists are concerned that the long-term neglect of the environmental assets is likely to jeopardize the durability of economic growth (Thampapillai, 2002). Climate change impacts on development prospects have also been described in an interagency project on poverty and climate change as 'Climate Change will compound existing poverty'. Its adverse impacts will be most striking in the developing nations because of their dependence on natural resources, and their limited capacity to adapt to a changing climate. Within these countries, the poorest people are most vulnerable because they have the least resources and the least capacity to adapt with the changing climate (African Development Bank et al., 2003). Climate change is identified as a serious risk to poverty reduction in developing countries, particularly because these countries have a limited capacity to cope with current climate variability and extremes not to mention future climate change (Schipper and Pelling, 2006).

The inseparability of environment and development has been widely recognised ever since the Brundtland Commission (WCED, 1987). In the United Nations' Millennium Development Goals (MDGs), for example, environmental considerations are reflected in the 7th goal and the operative target, among others, is to reverse loss of environmental resources by 2015. Overall, how to meet the target of integrating the principles of sustainable development in national policy and reversing the loss of environmental resources remains a partially answered question for most countries (Kates et al., 2005). In a report of climate change cell of Bangladesh, the following vulnerable sectors due to climate change are identified. The report mentioned - 'Impacts of observed changes are felt most in the following sectors: Water resources, Coastal resources, Agriculture, Health, Livelihoods, Food Security and Habitat/Settlement security' (CCC, 2007). Among the mentioned sectors except habitat/settlement security all others are very closely related with two broad goals, i.e., eradicating extreme poverty and hunger and human health

(Reducing child mortality, Improving maternal health and Combating HIV/AIDS and other respiratory diseases) related MGDs. Though all goals of MDGs are vulnerable to climate change and its adverse effects but some of them are affected directly and rest of them are indirectly influenced. Health related MDGs and eradication of extreme poverty and hunger are the directly affected sectors (OECD, 2009; German watch, 2010. P. 10).

Children are the future of any nations. Considering the importance, the millennium declaration had set the goal: reduce child mortality at goal 4 of MDGs and decided to reduce the mortality rate by two-third between 1990 and 2015. Bangladesh has made tremendous success in achieving this goal and already the target is achieved. Besides maintaining the rate of reduction, the challenge of the country is to keep it at a stable rate.

Most impacts of climate change on achievements of reducing child mortality is less substantial in the short-run, i.e., before the stipulated time period, 2015. The medium-term is a different matter. However, the impacts of climate change are important to consider in the long-run for sustaining the achievements attained by this time. Published literature on the links between reduction of child mortality and climate change is extremely sparse in Bangladesh.

In light of the stated problem of the research, the study tries to answer the following questions –

a) What achievements the country has made in reducing child mortality of its residence?
b) Is the climate change threatening the achievements of reducing child mortality in short-run as well as long-run?
c) Will the achievements the country has made over few decades, sustain in future under changing climate?

Literature Review

Climate change is expected to have considerable impacts on human health. The most important include increased vector-, water- and food-borne diseases: injuries and deaths caused by extreme hydro-geological events: heat-related diseases and deaths caused by heat waves (thermal stresses) and negative impacts on malnutrition. These negative consequences might be compensated by some beneficial effects, such as fewer deaths from cold weather in temperate regions, but the overall impact is expected to be negative. Evidence suggests that developing countries, including those of sub-Saharan Africa are expected to suffer major health impacts due to climate change (IPCC, 2007; McMichael et al., 2004).

Evidence from Rabassa et al. (2012) reveals that weather shocks exacerbate child morbidity and mortality in Nigeria rural areas and is of considerable magnitude.

Rainfall shocks have a statistically significant and robust impact on child health in the short run for both weight-for height and height-for-age, and the incidence of diarrhea. The fact that diarrhea is the leading cause of child malnutrition, and the second leading cause of death for young children in the country underscores the severity of the impact on human development and long term welfare implications of weather changes. The intensity is highest in hottest regions. However, children seem to catch up with their cohort rapidly after experiencing a shock.

Several actuaries have investigated the determinant of child mortality for effective healthcare intervention and program evaluation of clinical and financial outcomes (Guyatt et al., 1999; Cousins et al., 2002; Zhao et al., 2003; Mesike et al., 2012). For other studies that focuses on the determinant of child mortality (Ojikutu, 2008; 2010; Wolpin, 1977; Caldwell, 1979; Ouma, 1991; Espo, 2002; Mutunga, 2007; Adeyemi et al., 2009; Rahman et al., 2009). Child mortality risks can be viewed from the framework of a health production function to depend on both observed health inputs and unobserved biological endowment or frailty (Mutunga, 2007). Excluding these unobserved characteristics or existing relation between children within a family may lead to inefficient estimators (Ridder & Tunali, 1999). There are many different frameworks with which the effect of different determinants on childhood mortality may be considered. Demographic studies by Mosley and Chen (1984) and Schultz (1984) distinguished between socio-economic (exogenous) and biomedical (endogenous) factors. The effect of these exogenous variables are said to be indirect as they operate within the endogenous biomedical factors called proximate determinants (Mutunga, 2007). Mosley and Chen (1984) in their study categorized these proximate determinants into maternal, environmental, nutrient deficiency, injuries and personal illness control factors.

Several studies on infant and child mortality have been carried out using census and survey data. Most of these studies have estimated child mortality using indirect methods such as Trussel's technique and Preston method (Mojekwu & Ajijola, 2011; Jada, 1992; Omariba, 1993; Okumbe, 1996; Wanjohi, 1996). In Nigeria, Oni (1988) uses indirect methods to estimate level of mortality in Ilorin. Ogunjuyigbe (2004) combine Samoza method and univariate and bivariate analysis to calculate mortality indices for each woman in Ondo and Ekiti state. Ozumba and Nwogu-Ikojo (2008) applied multiple regressions with auto correlation adjustment to estimate mortality. Antai et al. (2010) employ the multilevel logistic regression while Doctor (2011) uses multivariate logistic regression. All these studies find demographic, socio-economic and environmental factors (source of drinking water, sanitation facilities) to be significantly related to infant and child mortality.

Espo (2002) in his study, use indirect methods to estimate levels and trends of mortality in Malawi. The results indicate that source of drinking water and sanitation facilities are strong predictors of child mortality. Also, Folasade (2000) in

her study to determine the relative significance of environmental and maternal factors on childhood mortality in southwestern Nigeria find that child mortality rate continued to be a function of an environmental factor namely source of drinking water and a child care behaviour factor, where the child was kept when mother was at work. Similarly, Timaeus and Lush (1995), in a comparative study of rural areas of Ghana, Egypt, Thailand and Brazil, discover that children's health is affected by environmental conditions and the economic status of the household. Hala (2002) utilized duration modelling to assess the impacts of water and sanitation on child mortality in Egypt. Though sanitation is found to have more pronounced impact than water, the results also show that access to municipal water reduces the risk of mortality. A Bayesian geoadditive survival model was introduced by Adebayo et al. (2002) to analyze child mortality in Nigeria. The results show the existence of a district-specific geographical variation in the level of child mortality.

Klaauw and Wang (2003) developed a flexible parametric hazard rate framework for analyzing child mortality. Their model predicts significant correlation between child mortality and access to electricity, provision of sanitation facilities, improving maternal education and reducing indoor air pollution. Jacoby and Wang (2003) in a related study, examine the linkages between child mortality, morbidity, and household quality and community environment in rural China using a competing risks approach. The findings of the study show that, the use of clean cooking fuels, access to safe water and sanitation reduces the risks of child mortality. In examining the environmental determinants of child mortality in Ethiopia, Wang (2003) constructed three hazard models to study three age-specific mortality rates by location, female education attainment, religion affiliation, income quintile, and access to basic environmental services (water, sanitation and electricity). The results show a strong statistical relationship between child mortality and poor environmental conditions.

Burkart et al. (2013) aimed to investigate the effects of heat in a multi-stratified manner, distinguishing by the cause of death, age, gender, location and socioeconomic status. They examined 22,840 death counts using semiparametric Poisson regression models, adjusting for a multitude of potential confounders. Although Bangladesh is dominated by an increase of mortality with decreasing (equivalent) temperatures over a wide range of values, the findings demonstrated the existence of partly strong heat effects at the upper end of the temperature distribution. Moreover, the study demonstrated that the strength of these heat effects varied considerably over the investigated subgroups. The adverse effects of heat were particularly pronounced for males and the elderly above 65 years. They also found increased adverse effects of heat for urban areas and for areas with a high socioeconomic status. The increase in, and acceleration of, urbanization in Bangladesh, as well as the rapid aging of the population and the increase in non-

communicable diseases, suggest that the relevance of heat related mortality might increase further. Considering rising global temperatures, the adverse effects of heat might be further aggravated.

Saha and Soest (2012) Conduct a study to investigate whether family planning reduces infant mortality in Bangladesh or not. Using Surveillance data of Matlab upazila under Comilla district, Bangladesh they found that, the effect of family planning on child survival remains an important issue but is not straight forward because of several mechanisms linking family planning with birth intervals, total fertility and child survival. They conclude that the mortality risks for first-born are higher than for later births; contraceptive use reduces the number of higher order birth, and as result contraceptive use reducing infant deaths.

Begum (1983) mentioned that, during the sixties overall infant mortality rate of Bangladesh was largely static. It increased considerably in the early seventies following the liberation war of 1971 and the country wide famine of 1974. Mortality differentials by residence however reveal that unchanged mortality situation during sixties prevailed only in rural area of Bangladesh and urban mortality had been achieving noteworthy improvements at that time. This situation got reverse during bad years of early seventies. Urban mortality at that time as evidenced deteriorated more compared to that in rural area suggesting greater vulnerability of the urban mortality in Bangladesh due to food shortages and other crises. The study found negative relationship between infant mortality and the parent's education and also with the house types or housing condition.

A report of Planning Commission, Government of Bangladesh (BDHS, 1996-1997) and UNDP Bangladesh has showed that the infant mortality rate in Bangladesh is higher for the mothers who are less than 18 years or over 34 years of age at the time of delivery. Birth spacing is negatively associated to infant mortality rate and birth order is positively related with infant mortality rate. The sex of the children, place of residence, and number of children in a family has also impact on infant and child mortality.

Research Objectives

The general objective of the study is to know the achievements the country has made and the impacts of climate change on the achievements of reducing child mortality in Bangladesh. However, the specific objectives of the research are –

1. to know the child mortality trend in Bangladesh;
2. to investigate the impacts of climate change on reducing child mortality; and
3. to investigate the sustainability of the achievements in reducing child mortality in Bangladesh.

Methodology

Theoretical Model: Dell et al. (2008) incorporated the climatic variables in the mostly used Cobb-Douglas production function to formulate their model, which is considered as the basis of the study. Depending on the theoretical framework the following functional form is considered to estimate the impact of climate on the outcome variables.

$$Y = f(X, C) \quad (1)$$

Where Y is a vector of outcome variables, X is a vector of socio-economic variables and C is a vector of climatic variables Following the functional form (Dell, Jones and Olken, 2014), to analyse the time series data, the empirical model for the study is considered as –

$$Y_t = \alpha + \beta X_t + \gamma C_t + \varepsilon_t \quad (2)$$

In this time series model ε_t is white noise error term and subscript t represents time.

Empirical Model: Following the earlier theoretical model the study decided to investigate the following model to estimate the impacts of climate change on the reduction of child mortality. The model specified by Mukherjee, White and Whyte (1998) and incorporating climatic variables following Dell, Jones and Olken (2014) is decided for the study purpose is as follows –

$$CMR = f(FLR, IMMU, TMP, RAIN) \quad (3)$$

Where, CMR is the endogenous variable and represents Under-five Mortality Rate, FLR is Female Literacy Rate, IMMU is Immunization of children against Measles, TMP is Temperature and RAIN is the Rainfall. These all are the exogenous variables of the model.

Considering the linear model of the above functional form and taking subscript t for time –

$$CMR_t = \alpha + \beta FLR_t + \gamma IMMU_t + \delta TMP_t + \theta RAIN_t + \varepsilon_t \quad (4)$$

Where, ε_t is random disturbance term.

The autoregressive distributed lag (ARDL) model is decided to perform to evaluate the short-run dynamics and long-run relationship among the stated model (equation 2). The ARDL model is able to estimate the short-run dynamics and long-run equilibrium relationship among variables simultaneously. Beside this, there are ample reasons to consider the model, i.e., the model can be applied for a small sample size like the present study; the ARDL methodology is relieved of the burden of establishing the order of integration amongst the variables; furthermore, it can distinguish dependent and explanatory variables, and allows to test for the existence

of relationship between the variables. Finally, with the ARDL it is possible that different variables have differing optimal number of lags.

The long-run error correction model under ARDL environment for equation (4) is as follows:

$$\Delta CMR_t = b_0 + \sum_{i=1}^{m} c_i \Delta CMR_{t-i} + \sum_{i=0}^{n} \beta_i \Delta FLR_{t-i} + \sum_{i=0}^{o} \gamma_i \Delta IMMU_{t-i} + \sum_{i=0}^{p} \delta_i \Delta TMP_{t-i} + \sum_{i=0}^{q} \theta_i \Delta RAIN_{t-i} + \lambda ECT_{t-1} + \tau_t \quad (5)$$

The Data: Various socio-economic factors affecting child mortality in a number of ways. Numerous numbers of literatures has been reviewed to identify the influencing factors of child mortality. Due to data unavailability all the identified variables could not possible to consider in this study. Considering relative importance of the variables and the country's socio-economic perspective, per-capita gross domestic product (PGDP), female literacy rate (FLR), immunization against measles (IMMU) are identified for this study. But due to multicollinearity problem per-capita GDP is decided to drop from the model. Beside these the climatic factors, yearly average temperature (TMP) and rainfall (RAIN) are included in the model to estimate the climatic effects on child mortality.

The study is based on yearly time series of 1980 to 2014 data, which are secondary in nature. The data sources are: Under Five Mortality Rate from SVRC, MICS & BER; Female Literacy Rate from BANBEIS & BER; Immunization against Measles from WDI; and Temperature and Rainfall data are from Bangladesh Meteorological Department.

Using one of the sophisticated econometric softwares 'EViews 9 Student Lite' version, the specified model is investigated.

Empirical Findings and Analysis

Unit Root Test: Although unit root test is not the prerequisite for testing cointegration using the ARDL approach, it is necessary for verifying that both series are not cointegrated of order higher than one, and also for conducting Granger causality test. We use the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test for conducting the unit root test. Both ADF and PP tests the null hypothesis of non stationarity. Following table shows the summary results of unit root test.

Name of the variables	Level of integration CMR
CMR	I(1)
FLR	I(1)
IMMU	I(1)
TMP	I(0)
RAIN	I(0)

Table: Findings of Unit Root Test

Lag length selection for the Model: Selecting appropriate lag length is the big challenge before estimating the ARDL model. Generally there are four different approaches are used to select the lag structure of the model. These approaches are Akaike Information Criteria (AIC); Schwarz Information Criteria (SIC) or Bayesian Information Criteria (BIC); Hannan-Quinn Information Criteria (HQ) and Adjusted R^2 criteria. It is observed from earlier literature that, some of the criteria overestimate the model and others under estimate it. To avoid the over estimation or under estimation problem, the study decided to employ all the four possible criterion suggested by the 'EViews 9 Student Lite' software, and the suggested lag-length by the corresponding criterion are as follows –

ModelselectionCriteria	Selected modelAIC
AIC	ARDL (3,2,4,3,3)
SIC/BIC	ARDL (2,2,4,3,3)
HQ	ARDL (3,2,4,3,3)
Adjusted R^2	ARDL (3,2,4,3,3)

Table: Model selection criterion

Employing all possible criteria available in the software it is found that, after evaluating 2500 models each criterion selected the most appropriate model (represented in the earlier summary table). Three criteria (AIC, HQ and Adj. R^2) gives similar results. On the basis of majority criterion, the study decided to estimate the model by employing Akaike information criterion (AIC).

The estimated ARDL model: Using Akaike Information criteria the model is estimated. Here child mortality rate (CMR) is the dependent variable and FLR, IMMU, TMP and RAIN are the explanatory variables of the model. The R^2 and Adjusted R^2 of the model is very high which are 0.999272 and 0.998014 respectively. The F statistic of the model is 794.4535, which is very high and the corresponding probability value is 0.000000, which is highly significant. The Durbin-Watson statistic of the model is 2.183230. The estimated model is enclosed in appendix.

For the estimated model all possible residual tests has been performed and found, there is no serial correlation in the residual; the residual of the model is normally distributed; there is no Heteroskedasticity. So the model satisfies all the properties of white noise disturbance term.

Stability Test of the model: CUSUM and CUSUMSQ of Recursive Estimates are conducted to test the stability of the model. Both the tests found that the estimated line is entirely within the two red marked boundary lines at 5% significance level. So the estimated model is stable.

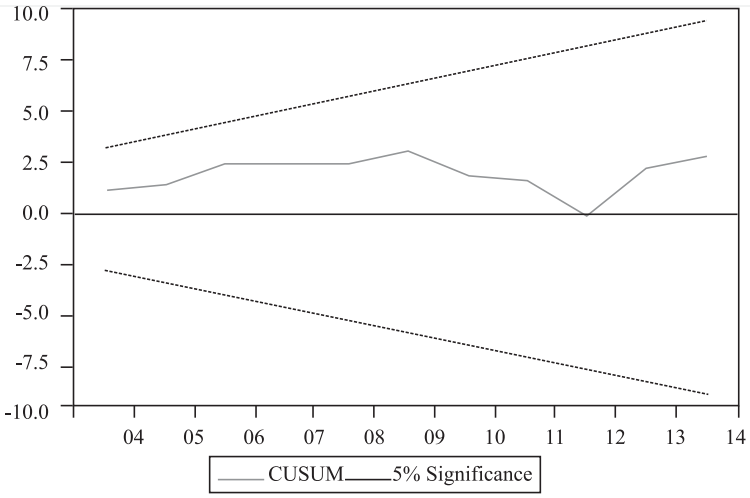

Figure: CUSUM test of stability under recursive estimates

ARDL bounds test: To test the long-run relationship between explanatory variables and dependent variable of the model, the ARDL bounds test has been conducted. Here, the null hypothesis is –

H_0: there is no long run relationship between explanatory variables and dependent variable of the model.

The findings are as follows –

Test Statistic	Value	K
F-statistic	33.7991	4

Critical value bounds:

Significance level	Lower bound	Upper bound
10%	2.2	3.09
5%	2.56	3.49
2.5%	2.88	3.87
1%	3.29	4.37

We know, in order to make decision about ARDL bound test it is known that the calculated F statistic is compared with the lower and upper bounds suggested by Pesaran and Shin (1999); and Pesaran et al. (2001). Here the guideline is, if the calculated F value is higher than the upper bound then the null hypothesis is rejected, alternatively when the calculated F statistic is less than the lower bound then the null hypothesis can't be rejected whereas if the calculated F value is within the two bounds, i.e., in between the lower and upper bounds then the test is inconclusive. From the result it is found that, the calculated F statistic is (F = 33.7991) significantly higher than the upper bounds at any level of significance. So the null hypothesis is rejected. In other words it can be said that, the alternative hypothesis is

accepted, that means there are long-run association-ship among the variables in the estimated model.

Since the estimated ARDL model satisfy all the required residual tests and it is also found stable, as well as there exists long-run relationship among the variables, so the long-run model can be estimated. The long-run model is as follows -

The long-run model

$$CMR = \underset{(-18.26)}{-2.4690}*FLR \underset{(-14.02)}{-0.4634}*IMMU \underset{(-4.82)}{-31.4637}*TMP \underset{(-5.97)}{-0.0355}*RAIN + \underset{(7.11)}{1120.9947}$$

(N.B.: Values in the parenthesis indicate t-statistic)

From the estimated model it is found that, female literacy rate and immunization of children against measles contribute significantly in the reduction of child mortality. On the other hand the study result suggests that, child mortality will be increased with a decrease in Temperature and rainfall in Bangladesh.

Short-run causality: The short-run causality has been investigated by employing Wald-coefficient test. Under ARDL environment the short-run causality is investigated independently for each of the variables with respect to dependent variable. The Wald-coefficient test used the coefficient of the variables from the estimated model. From the test results it is found that, female literacy rate (FLR), immunization of children against measles (IMMU), temperature (TMP) and rainfall (RAIN) granger-cause reduction of child mortality rate (CMR) in the short-run.

Error-correction term: From the long-run model it is observed that, the coefficient of ECT_{t-1}, i.e., $\lambda = -0.9347$ which represents the speed of adjustment of the model. It is negative and highly significant. So, it can be concluded that, the whole system is getting adjusted towards long-run equilibrium at a speed of 93.47 percent per period.

The ARDL bounds test ensures long-run association-ship among the explanatory variables and endogenous variable of the model. The model satisfies all necessary residual tests as well as the model is found stable. Female literacy rate, immunization of children against measles, temperature and rainfall granger-cause child mortality rate in the short-run as well as affecting significantly and negatively in the long-run. The error correction term of the model is 0.9347 which found negative and highly significant. It ensures overall significance of the model.

Limitations: Following limitations are noted –

Data insufficiency: The yearly time series data is used here. Climatic impacts might more significant with seasonal variations. Human health especially the health of vulnerable group like child and old age people is seems to be more vulnerable in winter and rainy seasons. So the seasonal data might better predict the climatic impacts on outcome variables.

Regional impacts are ignored: The study is performed in the national context of Bangladesh. Though all the regions of the country are not equally affected by the natural calamities but due to data unavailability the study is remained limited to national context only. The panel data analysis might better estimate the regional impacts of climate change but again the data unavailability is the only reason to keep it limited to time series analysis.

Conclusion

The study has provided an empirical evaluation for the contribution of climate change on reduction of child mortality in Bangladesh for the period of 1980-2014. In line with existing literature, this study finds that the climate change has a negative and statistically significant relationship with the target variables in Bangladesh. Climate change could hamper the achievement of reduction of child mortality. The estimated model is found stable which ensures the overall significance of the model. So it is said that, climate change hampers the achievement of reducing child mortality under consideration. This study therefore recommends incorporating the policy and effective regulation that will reduce carbon. Intervention of the governments at all levels i.e. in formulating national and regional policies that will minimize the enormous constraints to economic development and reduce child mortality in Bangladesh.

For better understanding the nexus between climate change and Child mortality further research might be conducted; Regional impact of climate change should be investigated. Panel data analysis can be performed for this purpose by collecting primary data. Seasonal Impacts should also be investigated. There are three prominent seasons in Bangladesh with distinct features. In the different seasons the impacts of climate change is also different. Due to data insufficiency the present study remains limited to yearly time series analysis. A new dimension can be explored by incorporating seasonal impacts of climate change in the model.

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