Millennium development goals affecting child mortality in Bangladesh: A Vector Error Correction model

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Abstract

This paper investigates over the last two decades across states a can be attributed to achieve the Millennium Development Goals for target reducing the under-5 mortality by two-thirds of Bangladesh. The paper analysis is able to condition upon a number of socio-economic and demographic variables, under-five child mortality determining by the asymmetric effects of female literacy rate, per capita gross national income and millennium development goal as a dummy variable. Using the time-series data, 1991-2012 period, and applying unit root test, cointegration test and by estimating a vector error correction model. The results find a single cointegrating equation showing a long-run stable relationship between the child mortality and the explanatory variables in the model. And also find that achieved Millennium Development Goals has a significant impact on the child mortality in Bangladesh, convergence of the short-run dynamics towards the long-run equilibrium, but sustainable level of child mortality is expected to be an important prerequisite for ensure future generation of Bangladesh.

Keywords: *Child Mortality, Millennium development goal, Bangladesh*
JEL Classifications: *J11, I18, C5*

I. Introduction

Bangladesh is one of the signatories among 189 countries in declaration of the Millennium Development Goals (MDG) by United Nations (UN). The UN General Assembly in 2000 declared the eight development goals which are recognized as MDG. Bangladesh is committed to achieve the goals by 2015 and working accordingly (United Nations, 2000). Among these, Goal: 4 "Reduce Child Mortality" that comprise the following indicators to be achieved by the stipulated timeframe of UN declaration, in case of reducing child mortality the statistical base year would be as 1990 and the respective countries have to achieve the target of two-third reducing by 2015, also shown *Appendix-A.1:* summarizes the MDG target and indicators, benchmark and the latest information on the achievement of health related MDGs in Bangladesh.

Bangladesh has achieved remarkable progresses in reducing under-five mortality rate in the last two decades. The under five mortality decreased significantly from 133 to 94 per 1000 live births between 1989 and 1999. The reduction in under-five mortality rate from 2000 to 2003, compared to the earlier period, was not satisfactory. During 2003-2006 the under-five mortality rate reduced from 88 to 65 at a momentous rate of 4.3 percent per year. Given this situation, the under-five mortality rate will have to reduce at the rate of only 2.6 percent per year to attain the MDG target level, which is 50 per 1000 live births, in 2015. Therefore, Bangladesh is on track towards meeting the under-five mortality MDG target (BDHS 2007).

In Bangladesh, the decline in infant mortality forms a major challenge in attaining the MDG on child survival (i.e. under-five mortality) as it accounts for a significant. Six countries including Bangladesh received the UN MDG award in New York's Astoria hotel for its remarkable achievements in attaining the Millennium Development Goals (MDGs) particularly in reducing child mortality (September 19, 2010, New York).

The empirical results suggest that factors explaining the under-five mortality in Bangladesh have been a very successful family planning program even in the absence of strong economic growth and improving socioeconomic conditions (UNDP, 2005). In that case Bangladesh has to achieve minimum 4% of MDG target per year. Real annual GDP per capita growth of 4% (or annual growth of household consumption expenditure per capita of 2.7%) would be associated with a reduction in under-five mortality of 8 deaths per 1,000 live births. Together, the four interventions are associated with a reduction of 52 deaths per 1,000 live births in the under-five mortality rate – bringing that rate below the MDG level (46 deaths per 1,000 live births).

The specific objective is as follows, how to ensure achieved the Millennium Development Goals under-five child mortality for future generation of Bangladesh in respects to the budget constraint? The remainder of this paper is organized as follows. Section II discusses the literature review of the under-five child mortality rate. Section III describes the econometric methodology used for the present study as well as the data. Section IV examines and discusses the analysis of results to the time series properties of the variables. Finally, summary and conclusions are presented in Section V.

II. Review of Literature

The review of different literatures on under-five child mortality shows that a number of socioeconomic and demographic factors are influencing child mortality. Caldwell et al. (2000), Debpuur et al. (2005), Hosseinpoor et al. (2005), Madise and Diamond (1995) have found a significant relationship between various socioeconomic factors, demographic factors and infant-child mortality by analyzing various countries' survey and census data. They found that gross domestic product, female education, and other factors explained practically all variations in child mortality across countries. The situation with regard to Goal-4 in the South-East Asian sub region is mixed.

Significant advances have been made in Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand and Vietnam. The under-five mortality rates in these countries have been brought down to between 20 and 38 deaths per 1,000 live births, and even to 9 per 1,000 in Brunei Darussalam and 12 per 1,000 in Malaysia. By contrast, the under-five mortality rate in several other countries of this sub-region remains extremely high. Cambodia has the second highest under-five mortality rate in the Asia-Pacific region and ranks 25th globally, with 143 under-five deaths per 1,000 live births (UNICEF, 2006).

Near five million children across the Asia-Pacific region still die every year before reaching the age of five, which represents half of all under-five deaths in the world (ESCAP, UNDP and ADB, 2005; UNICEF, 2005a). While overall child mortality rates are falling and the MDG target is on track for the region as a whole, it is worrisome that progress in lowering the infant mortality rate is slow (ESCAP, UNDP and ADB, 2006). However, achievement of Goal 4 remains elusive for many countries in the region. There are wide variations in status and progress with regard to Goal-4 across the Asia-Pacific region. The pace of child mortality reduction in East Asia and the Pacific is slowing (World Bank, 2006b).

Some of the highest under-five mortality rates in Asia and the Pacific are in the South and South-West Asian sub-regions. Bangladesh, Bhutan, India, Nepal and Pakistan account for 37 per cent of the entire population of Asia and the Pacific and have an average under-five mortality rate of between 76 and 103 deaths per 1,000 live births. Bangladesh, Bhutan and Nepal have, nevertheless, made important progress in the last decade towards achieving Goal 4, having achieved levels which are half of their 1990 baseline benchmarks for under-five mortality (UNICEF, 2005a).

Child mortality rates in rural areas in most developing countries tend to be higher than in urban areas. A wide range of factors contribute to such disparities. Factors in rural areas affecting higher child mortality include the availability of fewer health facilities, physical barriers to accessing them, higher levels of poverty and lower literacy levels. Some poor rural areas infant and under-five mortality has actually increased in recent years (Blumenthal and Hsiao, 2005). Under-five mortality in cities such as Shanghai and Beijing is 7.5 times lower than in the poorest province of Guizhou-8 versus 60 deaths per 1,000 live births respectively (UNDP, 2005a).

Kapoor (2009) using district-level data for the year 1991 and 2001 of the Census of India, he has found out that the increase in female literacy and labor force participation considerably reduces child mortality at the district level. Mustafa and Odimegwu (2008) have found that social and economic empowerment of women should be encouraged to achieve the MDG on child mortality. Recently, Omariba et al. (2007) have supported the influence of demographic factors.

Mondal et al. (2009) have shown that, as the risk of child mortality decreased with increased female education and better access to safe treatment places, they have suggested paying more attention to female education and expansion of public health system in order to reduce the risk of infant and child mortality. Using data from Bangladesh Health and Demographic Survey (BDHS, 2000), have decided that urban-rural residence, education of father and mother, preceding birth interval, family size, toilet facility, delivery place and antenatal care are the major determinants of child mortality in Bangladesh (Rahman and Sarkar, 2009).

Tandon (2005) found most of the Asian developing member countries were not ‘on track’ to achieve the required 4.3 percent reduction per year. Based on an estimated income elasticity of 0.7 for child mortality from cross-country data, he concluded that per capita income growth of 6% would be needed to achieve ‘on track’ 4.3% reduction in child mortality. For ‘off-track’ countries, the required growth rate would be higher than 6% per capita. Simulations based on the multivariate model estimated result shows that changes in mean consumption per capita, adult female schooling, and suggest that the under-five mortality in Bangladesh could decline substantially – by more than 50% – over the period through 2015 (World Bank, 2005).

III. Econometric Model and Data
III.1 Empirical Methodology

We have used child mortality model specified by *Chandan Mukherjee, Howard White, and Marc Whyte* (1998) to estimate under-five child mortality function for Bangladesh.

In general, the empirical estimation of under-five child mortality model is *the long-run*:

$$CM_t = \alpha_0 FLR_t^{\beta_1} PGNI_t^{\beta_2} DUM_t^{\beta_3} e^{\mu_t} \tag{1}$$

Where *CM* denotes the under-five Child Mortality, *FLR* is the Female Literacy Rate, *PGNI* is the per capita Gross National Income, and *DUM* is the Millennium Development Goals (MDG's) as a dummy variable of Bangladesh respectively.

In natural log (ln) linear function of the form,

$$\ln CM_t = \alpha_0 + \beta_1 \ln FLR_t + \beta_2 \ln PGNI_t + \beta_3 DUM_t + \mu_t \tag{2}$$

The behavioral assumptions require that $\alpha_0 > 0$, β_1, β_2 and $\beta_3 < 0$ respectively and that the μ_t sequence is stationary, so that any deviations from long-run child mortality equilibrium are temporary in nature.

$$\mu_t = \ln CM_t - \alpha_0 - \beta_1 \ln FLR_t - \beta_2 \ln PGNI_t - \beta_3 DUM_t \tag{3}$$

that is stationary.

We have argued that $CM_t, FLR_t, PGNI_t \ \& \ DUM_t$ are most likely integrated of order one, so that their changes are stationary. If these variables are each I (1), then it is typically true that the error μ_t will also be I(1). However, stationarity in μ_t would establish (3) as a plausible long-run relationship, with the short-run dynamics incorporated in μ_t, usually referred to as the *equilibrium error*. Then the integrated variables $CM_t, FLR_t, PGNI_t \ \& \ DUM_t$ are said to be cointegrated and equation (3) is referred to as the cointegrating regression, as in Engle and Granger (1987).

In matrix notation, equilibrium Child mortality requires that

$$\mu_t = \beta' X_t = \left[1 - \alpha - \beta_1 - \beta_2 - \beta_3\right] \begin{bmatrix} CM_t \\ 1 \\ FLR_t \\ PGNI_t \\ DUM_t \end{bmatrix} = Stationary \tag{4}$$

The vector $\beta' = [1 - \alpha - \beta_1 - \beta_2 - \beta_3]$ is called the *cointegrating vector* for the nonstationary stochastic process *Xt*, corresponding to $[CM_t, FLR_t, PGNI_t \,\&\, DUM_t]'$. This cointegrating vector isolates (in the present context) the stationary linear combination, μ_t.

III.2 Data

The paper used the data of the four indicators, under-five Child Mortality (CM), Female Literacy Rate (FLR), per capita Gross National Income(PGNI), per annual 2000 U.S. $, and Millennium Development Goals (MDG's) as a dummy variable of Bangladesh (DUM) for the past two decades starting from year 1991 to 2012 from the three sets of national household surveys.

The trend analysis mainly used the secondary data available from the survey reports of First, data from three rounds of the nationally-representative Bangladesh Demographic and Health Survey (BDHS), Second, Sample Vital Registration Survey (SVRS) done by Bangladesh Bureau of Statistics (BBS), Third and finally, unit record data from the Household Expenditure and Income Survey (HIES), also conducted by the Bangladesh Bureau of Statistics (BBS). In addition, the simulations undertaken in this report are based on empirical analysis of secondary data, which typically relies on many assumptions about data quality and measurement, inferences of causality between variables, and potential biases of statistical and econometric estimates.

IV. Analytical Framework

IV.1 Unit Root Test

IV.1.1 Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) Test (Dickey and Fuller 1981) can also be generalized to allow for higher-order autoregressive dynamics, in case that an AR(1) process is inadequate to render ε_t white noise. The ADF test for a unit autoregressive root tests the null hypothesis H_0: $\delta = 0$, against the alternative H_1: $\delta < 0$ in the following regression:

$$\Delta Y_t = \alpha_0 + \delta Y_{t-1} + \theta_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad (5)$$

Where $\Delta Y_t = Y_t - Y_{t-1}$ is the first difference operator, and Y is the variable under consideration, is chosen by Schwarz criterion and ε_t is a white noise error term, m is the number of lags in the dependent variable. The optimal lag length, *m*, can be chosen using data dependent methods that have desirable statistical properties when applied to unit root tests.

If Y_t is stationary around a deterministic linear time trend, then the trend't' i.e., the number of observation must be added as an explanatory variable. Alternatively (5) can be written as

$$\Delta Y_t = \alpha_0 + \beta_0 t + \delta Y_{t-1} + \theta_i \sum_{i=1}^{m} \Delta Y_{t-1} + \varepsilon_t \qquad (6)$$

In the equation (6) Y_t is a random walk with drift around a stochastic trend. Here β_0 is an unknown coefficient and the ADF statistic is the OLS t-statistic testing $\delta = 0$ in (6).

IV.1.2 Phillips–Perron (PP) Test

The test regression for the Phillips and Perron (1988) tests is:

$$Y_t = \alpha_0 + \delta_t + \theta_1 Y_{t-1} + \theta_i \sum_{i=1}^{m} \Delta . Y_{t-1} + \mu_t \tag{7}$$

Where, δ_t may be 0, ε, or $\varepsilon + \beta_t$ and μ_t is I (0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the error term μ_t by directly modifying the test statistics $t_\pi = 0$ and $T\hat{\pi}$. The hypothesis testing procedure is the same asymptotic distribution as the ADF test.

IV.2 Cointegration Test

The Johansen's (1988) maximum likelihood (ML) approach is sufficiently flexible to account for long-run properties as well as short-run dynamics. In the case of the stochastic process, $X_t = [\ln CM, \ln FLR_t, \ln PGNI_t, DUM_t]'$. Johansen and Juselius (1992) suggest as

$$\Delta X_t = \sum_{i=1}^{k} \Gamma_i \Delta X_{t-i} + \Pi X_{t-k} + u_t \tag{8}$$

Where

$$\Gamma_i = -\left(I - \sum_{j=1}^{i} A_j\right) \quad \text{and} \quad \Pi = -\left(I - \sum_{i=1}^{k} A_i\right)$$

Where I is the $n \times n$ identity matrix A and elements of X_t will be given by the rank of Π, denoted as r. Hence, λ is an eigenvalue of A if and only if $(A-\lambda I)$ is not invertible, which in turn means that the determinant $|A - \lambda I| = 0$.

In the trace test, the null hypothesis that there are at most r cointegrating vectors is tested (against a general alternative) by calculating the test statistic

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{p} \ln\left(1 - \hat{\lambda}_i\right) \tag{9}$$

In this case, each $\ln(1-\hat{\lambda}_i)$ will equal zero (since log 1 = 0), and λ_{trace} equals zero. However, the farther the estimated eigen values are from zero, the more negative is each of the expressions, and the larger the λ_{trace} statistic.

In the maximum eigen value test, the null hypothesis of r cointegrating vectors is tested against the alternative of $(r + 1)$ cointegrating vectors by calculating the test statistic.

$$\lambda_{\max}(r, r+1) = -T \ln\left(1 - \hat{\lambda}_{r+1}\right) \tag{10}$$

Again, if the estimated eigen value, $\hat{\lambda}_{r+1}$, is close to zero, $\lambda_{\max}$ will be small, and the null hypothesis that the number of cointegrating vectors is r will not be rejected.

IV.3 Vector Error Correction Model (VECM)

Empirical analysis in terms of first differencing to induce stationarity has recently been questioned by Engle and Clive Granger in their 1987 article "Co-Integration and Error Correction: Representation, Estimation and Testing". The cointegration and error-correction approach to the reduce child mortality in the long-run equilibrium relationship between child mortality and its determinants as well as the short-run variation and dynamics. Therefore, an unrestricted VECM considering up to ρ lags for child mortality functions is respectively as follows:

$$\Delta \ln CM_t = \delta_0 + \sum_{j=1}^{\rho} \theta_k \Delta \ln CM_{t-j} + \sum_{j=1}^{\rho} \eta_k \Delta \ln FLR_{t-j} + \sum_{j=1}^{\rho} \phi_k \Delta \ln PGNI_{t-j} + \sum_{j=1}^{\rho} \varphi_k \Delta DUM_{t-j}$$
$$+ \lambda \left[\ln CM_{t-1} - \hat{\alpha}_0 - \hat{\beta}_1 \ln FLR_{t-1} - \hat{\beta}_2 \ln PGNI_{t-1} - \hat{\beta}_3 DUM_{t-1} \right] + \varepsilon_t \qquad (11)$$

Where Δ is the first difference operator, λ depict the speed of adjustment from short run to the long run equilibrium, ε_t is a purely white noise term.

V. Empirical Results[1]

To statistically validate these findings, we apply the standard Augmented Dickey-Fuller (ADF) test has been used to perform the unit root test in all the series of the model and examine their *order of integration*. This report shows, from *Appendix-A.2*, the results of regression analysis based on first difference with intercept, intercept and trend and *ln(CM)* has a unit root test whether the series is integrated in first order, its first difference is taken and its stationary property is tested using ADF Unit Root test. In that case, *p-value* statistically highly significant at any level, which means the CM, is stationary. Similarly, Phillips–Perron test also gives the similar results and the stationary property is tested for this variable.

To test for the presence of more than one unit root in all these variables, this result from *Unit-root tests* provide strong evidence of non-stationarity *at levels* and stationarity *at first difference* for all variables, that these series are integration to degree one, *I(1)*. The residuals are also found stationary using a Schwarz Information Criterion (SIC) and a maximum lag length of 4 and 22 observations in the study.

To test for cointegration among the variables, Johansen Maximum Likelihood procedure has been applied to a VEC model. The cointegration between variables reveals the existence of the stable long-run equilibrium relationship. The results are shown in *Appendix-A.3.* The Trace statistics and Maximum Eigen statistics rejects the null hypothesis of no co-integration at 5% level, indicating that there exists a single co-integrating relationship among the variables of the equation (2). Underneath part of the table shows the most significant co-integrating vector normalized on child mortality (CM). The parameter estimates representing the cointegration between the child

[1] After operating analysis in software *E-Views 5.1* version, we got the result significant and observing the obtained result we can illustrate that the macroeconomic variables in Bangladesh.

mortality and the endogenous factors in the model, is specified as:

$$ln(CM) + 0.479ln(FLR)_t + 1.744ln(PGNI)_t + 0.120(DUM)_t - 16.729 = 0$$

$$Or,\ ln(CM) = 160.729 - 0.479ln(FLR)_t - 1.744ln(PGNI)_t - 0.120(DUM)_t$$

With the existence of cointegration established, the cointegrating equations are generally interpreted as the long run equilibrium relationships characterizing the data, with the error correction equations representing short-run adjustment towards such equilibria. Since there is a single cointegrating equation, the VEC model needs to include an error correction term involving levels of the series, and this term appears on the right-hand side of each of the VEC model, which otherwise will be in first differences. The estimated error correction model for the CM is including the DUM to capture the effects of MDG on CM in Bangladesh. The estimated equation of the model in error correction form for the child mortality rate, Δ *ln(CM),* is shown by OLS result in the following way:

$$\Delta \ln(CM_t) = -0.387\Delta\ln(CM_{t-1}) - 0.454\Delta\ln(CM_{t-2})$$
$$(-1.868) \qquad (-2.806)$$

$$+ 0.365\Delta\ln(FLR_{t-1}) - 0.551\Delta\ln(FLR_{t-2})$$
$$(1.762) \qquad (-2.973)$$

$$- 2.737\Delta\ln(PGNI_{t-1}) - 3.453\Delta\ln(PGNI_{t-2})$$
$$(-2.247) \qquad (-2.926)$$

$$+ 0.119(DUM_{t-1}) - 0.246(DUM_{t-2})$$
$$(1.932) \qquad (-2.891)$$

$$- 0.152\,[\ln(CM) + 0.479\ln(FLR)_t + 1.744\ln(PGNI)_t + 0.120(DUM)_t - 160.729] \qquad (12)$$
$$(-3.534) \qquad (7.297) \qquad (6.849) \qquad (9.448)$$

In equation (12) parentheses represents the *t-statistics*[2] for the respective sign of the estimated coefficients. In the short-run the sign of the estimated coefficients of, – the *ln(PGNI)* at 1-period and 2-period time lag both are negative but at 1-period time lag is 5% level of significant and 2-period time lag is 1% level of significant, which shows reduced of the *ln(CM)* immediate after a increase in *ln(PGNI)* at 1and 2-period lag in case of Bangladesh, though at any level of significant in the short-run case of Bangladesh. Again *ln(FLR)* at 1-period time lag is 10% level of significant but 2-period time lag is 1% level of significant, this indicates a reduced of the *ln(CM)* in case of Bangladesh.

Similarly, the sign of the estimated coefficient of the millennium development goal as a dummy variable *(DUM)* at 1-period and 2-period time lag is both positive and negative but significant at any level. This indicates a reduced of the CM immediate after an increase in DUM which shows an deteriorate of the CM at 1-period lag, but MDG program over 2015 may be improvement of the CM at lag 2-period in case of Bangladesh. The estimated coefficient sign of the child

[2] *t- Statistic* denotes rejection of the hypothesis of no relationship at the 10%, 5% and 1% level respectively.

mortality of Bangladesh is also consistent with` the socio-economic view at any level of statistically not significant in the short run but statistically significant in the long run.

The key finding from the short-run dynamics, the coefficient of the adjustment parameters in the under-five child mortality function carry both sign positive and negative and are also statistically 1%, 5% and 10% level of significant. This means that the speed of adjustment coefficient at which the rate of variation of the under-five child mortality $\Delta ln(CM)$, the dependent variable in the first equation of the vector error correction (VEC) system, adjusts towards the single long-run cointegrating relationship differs from zero. In other words, the equation for the under-five child mortality $\Delta ln(CM)$, contains information about the long-run relationship since the vector autoregressive does enter into this equation. According to the estimates, short-run under-five child mortality disequilibrium is corrected at the rate of 15 percent per annum. The speed of adjustment coefficient indicates that under-five child mortality convergent towards the equilibrium and their convergent sign indicate that statistically significant at any level in the long run.

An Extension of the Long -run relationship

Solving equation (12) the long-run relationship between the variables in the model can be written as (while all the Δ's equal zero at equilibrium):

$$\underset{}{ln(CM)} = 24.431 - \underset{(-7.297)}{0.073 ln(FLR)_t} - \underset{(-6.849)}{0.265 ln(PGNI)_t} - \underset{(-9.448)}{0.018 (DUM)_t}$$

The resulting estimate of β_1 is -0.073, with a t-value of *-7.297*. That is, the point estimate suggests that a change in female literacy rate is associated with reduced under-five child mortality rate. It indicates that a one basis point (percent point) increase in the female literacy rate, keeping the other variables constant, leads to an average 0.073 basis point (percent point) reduced of the child mortality rate.

The equation reveals that the estimated coefficient of nominal disposable income (*PGNI*) has a negative sign with high level of significance (e.g., β_2 is -0.265, with a t-value of *-6.849*). Accordingly increase disposable income of Bangladesh or real income of leads to an improvement of the child mortality rate. It indicates that a one basis point (percent point) increase in the disposable income of Bangladesh, keeping the other variables constant, leads to an average 0.265 basis point reduced of the child mortality rate.

Similarly, the sign of the estimated coefficient of *DUM,* is the millennium development goal (MDG) as a dummy variable, is negative and statistically significant and suggesting that the ever-rising DUM has been associated with deteriorates of the child mortality rate of Bangladesh. The resulting estimate of β_3 is -0.018, with a t-value of *-9.448*. It indicates that a one basis point increase in the DUM, assuming other variables remain constant, leads to an average 0.018 basis point reduced of the child mortality rate. Thus, the sustainable level of under-five child mortality is expected to be an important prerequisite for ensure achieved the Millennium Development Goals for future generation of Bangladesh in respects to the budget constraint.

VI. Summary and Conclusion

The commitment is recapitulated in eight Millennium Development Goals (MDGs), and these targets are very helpful for policy formulation and cost effective resource allocation given the resource constraints in the developing countries (United Nations, 2000). In Bangladesh, the decline in infant mortality forms a major challenge in attaining the MDG on child survival (i.e. under-five mortality) as it accounts for a significant. Six countries including Bangladesh received the UN MDG award in New York's Astoria hotel for its remarkable achievements in attaining the Millennium Development Goals particularly in reducing child mortality (September 19, 2010, New York).

The model is estimated using standard time series econometric techniques, a vector error correction (VEC) method after testing the stationary of the data series and cointegration among variables of the model. The estimation results show that more MDG leads to a reduce under-five child mortality of Bangladesh. Given these stylized facts and despite the limitations in our analysis, it seems important to determine the exogenous effect of socio-economic and demographic policies on under-five child mortality in Bangladesh.

Children are considered as the future of a nation. So, the health of a nation depends on the health of its children (Sen, 1998). Child mortality rate is a reflection of the care, health and nutrition status of children below the age of five years and also indicates the social, cultural, and economic progress in the country. To have an efficient nation with healthy citizens in 2021, it is very necessary to ensure survival and healthy improvement of all children, Goal-4 (CPD, 2007). Government of Bangladesh (GoB) should have to take into consider this issue very actively and in order to reduce the child mortality as per target must be ensured sustainability correlated program for urban and rural area and allocate double in health budget.

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Appendix

A.1: The MDG Targets and Indicators

Global goal, target and indicator			Bangladesh target, benchmark and current situation		
Goal	Target	Indicator	Target (Year)	Benchm ark (Year)	Achievement (Reference)
Goal 4: Reduce child mortality	Target 5: Reduce by two thirds the mortality rate among children under-five	<5 year mortality rate/ 1,000 live births	48.0 (2015)	144.0 (1990)	67.00 (MICS 2009) 53.84 (SVRS 2008) 65.00 (BDHS 2007)
		Infant mortality rate/ 1,000 live birth	31.3 (2015)	94.0 (1990)	45.00 (MICS 2009) 41.26 (SVRS 2008) 52.00 (BDHS 2007)
		1 year old children immunized against measles (%)		52 (1991)	82.8 (BECES 2009) 83.1 (BDHS 2007)

Source: Authors' compilation, based on BDHS 2007 (Bangladesh Demographic and Health Survey 2007); MICS 2009 (Multiple Indicators Cluster Survey 2009 done by Bangladesh Bureau of Statistics; SVRS 2008 (Sample Vital Registration Survey 2008 done by Bangladesh Bureau of Statistics; BECES 2009 (Bangladesh EPI Coverage Evaluation Survey 2009).

A.2: ADF Statistics for Testing for Unit Roots for Period 1991 to 2012

Variables	Levels, I(0)		First Differences, I(1)	
	t-ADF	*P-Value*	*t-ADF*	*P-Value*
Intercept				
lnCM	-0.257313	0.9161	-4.579096	0.0019
lnFLR	-3.154283	0.0377	-3.767717	0.0109
lnPGNI	9.868232	0.9473	-5.262376	0.0486
DUM	-1.051580	0.7146	-4.472136	0.0024
Intercept and Trend				
lnCM	-3.676736	0.0513	-4.429145	0.0115
lnFLR	-2.874674	0.1893	-3.837952	0.0358
lnPGNI	2.083484	0.4514	-5.250932	0.0028
DUM	-1.881280	0.6283	-4.358332	0.0132

Notes: (i) ADF statistics at I(0) indicate acceptation, I(1) indicate rejection of the unit root hypothesis at the 1%, 5% and 10% respectively level of significance. (ii) *p-value* sign indicate lag length chosen by Schwarz Information Criteria (SIC), but MAXLAG =4. (iii) The Phillips–Perron test also gives the similar results.

A.3: The Cointegration Analysis

Trend assumption: No deterministic trend (restricted constant) Included observations: 19 after Sample adjustments (1994 - 2012) Series: LNCM DUM LNFLR LNRGDP Lags interval (in first differences): 1 to 2							
Hypothesized No. of CE(s)	Eigen value	Unrestricted Cointegration Rank Test *(Trace)*			Unrestricted Cointegration Rank Test *(Maximum Eigenvalue)*		
		λ_{trace}	Critical Value 0.05	Prob.**	$\lambda_{\max}$	Critical Value 0.05	Prob.**
None*	0.961092	120.3009	47.85613	0.0000	61.68433	27.58434	0.0000
At most 1*	0.916652	58.61662	29.79707	0.0000	47.20992	21.13162	0.0000
At most 2	0.431614	11.40670	15.49471	0.1877	10.73413	14.26460	0.1680
At most 3	0.034779	0.672565	3.841466	0.4122	0.672565	3.841466	0.4122

Notes: Trace test and Max-eigenvalue test both are indicates 2 cointegrating eqn(s) at the 0.05 level. *denotes rejection of the hypothesis at the 0.05 level. **MacKinnon-Haug-Michelis (1999) p-values.