

Nexus among Infant Mortality Rate, Literacy Rate and Carbon Emission Rate compared with GDP: an Empirical Analysis in Bangladesh

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Abstract: *Infant Mortality Rate, CO₂Emission and Literacy Rate have great influence in the economic development of Bangladesh. In this paper, the relationship among per capita GDP, Infant Mortality Rate, Literacy Rate and CO₂Emission for Bangladesh using Co-integration, Augmented Dicky Fuller's (ADF) and Vector Error Correction Model (VECM) with data set of 1979-2018 is explored. The results indicate that there is a long-term relationship and short-term relationship among the variables. Infant Mortality, CO₂Emission, and Literacy Rate directly have an impact on GDP. Infant Mortality Rate and CO₂Emission have a Negative Impact on GDP. In contrast, Literacy Rate has a Positive Impact on GDP. The outcome has considerable substantial implications on the degree of sentiment of economic development, social condition, pollution, and awareness.*

Keywords: *Infant Mortality, CO₂Emission, Literacy Rate, GDP, ADF Test, Johansen Test, VECM, CUSUM, CUSUM square.*

I. Introduction

Bangladesh produces about 50 megatons of CO₂ annually, for a country that has moderate pollution of such a large population. Also, in the previous year (2019) Infant Mortality death ratio in Bangladesh was 25.788 passing per 1000 live births, the literacy ratio was 72.9%. In addition to this, the GDP is 347.991 billion. Bangladesh is a developing country with more than 18 million in population. The excessive population is not only a curse but also a blessing because they have two productive hands. If people work hard then it's very near to becoming a developed country. GDP is one of the traits of the financial improvement of a nation. CO₂Emission is the major cause of pollution. Infant Mortality is one of the major hindrances to development. The Literacy Rate is also an indicator of economic development. These inquiries subordinate on time-series information (1979-2017) and show the rapport among the Dependent Variable (GDP) and Independent

Variables (Infant Mortality, CO₂Emission and Literacy Rate). Infant Mortality and CO₂Emission have a Negative effect on GDP whereas Literacy Rate has a Positive effect on GDP.

II. Literature Review

It was proposed by Zaman (2012) that the mutation speed was sharper for trade transparency along with CO₂ outflows and GDP per capita which have changed the speed of reclamation for quite a while. Founded by Alam (2014) that a quicker fundamental move from harvesting to non-agribusiness and development of administrations as the established piece of the economy for which CO₂ emission showed uprising ways. Gunter (2010) showed how problematic the determinants for (a) Gains in vitality convincingness and (b) Changes in carbon force are in low-pay regions. Ghosht al. (2014) found that vitality utilization had a favorable and significant effect on monetary advancement while carbon emission had a negative and inconsequential effects founded by Ghosh et al. (2014). Husain(2016) explored that there existed a long run co integration among CO₂ emission, financial development, and vitality utilization from non-inexhaustible assets for Bangladesh given the period viable. Comparing two nations, Waldmann(1992) said that the poor had comparable profound salaries, whereas the rich were prosperous, perhaps going to have a higher Infant Mortality ratio. Assuming several components, for example, training, clinical workforce, and ripeness, the favorable connection between Infant Mortality and the allowance of the rich proposes that deliberation genuine livelihoods might be a poor proportion of social government assistance. Dey(2017)observed that there was a critical unfavorable rapport between female education ratio and Infant Mortality ratio in Bangladesh. In this way, female training is the most vital weapon for decreasing Infant Mortality and improving the wellbeing status of Bangladesh. Mondal(2009) stated the most critical indicators of neonatal, post-neonatal, and youngster mortality levels are inoculation, even breastfeeding, and mother's age during childbirth and birth interim as well. The most noteworthy indicators of a neonatal, post-neonatal, newborn child and youngster mortality were a living agreement, parent's teaching, type of latrine office, riches status, staring at the TV, long periods of breastfeeding, and birth interim was explored by Karmakeret al. (2014). Hossain(2010)stated that utilization of illustrations of Bangladeshis were shifting after some time alongside financial and social improvement. Furthermore, a sharp reduction in kid and newborn child death ratios, broadened per capita salary, and improved sustenance security have set Bangladesh on the mark to achieve the status of a middle-income nation sooner rather than later. Baird et al. (2007) found that there was a strong, unfavorable relationship between modifications in per capita GDP and Infant Mortality-in a first-differenced particular, they suggested versatility of baby mortality as for per capita GDP was roughly – 0.56. Basuet al. (2001) explored outer consequences of workout on particular income. Carrying a scope of unique personalities permanently, an innocent grown-up acquires entirely more in the non-ranch economy when occupancy in a household within an incident is one specialist part. Psakiet al. (2019) found that first birth negatively affected English mastery and numeracy. Among those with more crucial levels of examination achievements, little evidence of the consequences of childbearing on literary abilities were realized. Childbearing had little consequence on nearby language education. Senet al. (2018) found that education was positively and significantly related to the economic growth.

III. Objectives

The primary motive of this paper is to identify the scope of economic improvement in Bangladesh by considering the specific variables. The connection among the Dependent Variable (GDP) and Independent Variables (CO₂Emission, Infant Mortality, and Literacy Rate) and how they have an effect on GDP were investigated. This paper aims to recommend potential remedies of improving the economic condition of Bangladesh.

IV. Methodology

This paper is a time series analysis; it is qualitative in nature whereas data is quantitative. Secondary data is collected from World Development Indicator (WDI). ADF test has been applied to check the stationary state of

the data set. The Johansen test has been used to test the long-term relationship among variables. VECM, CUSUM and CUSUMQ tests have been applied to test the stability of the relationships among variables.

V. Results (Econometric Estimations)

Augmented Dicky Fuller's (ADF) unit root test (Table 01) says that data is stationary at the second difference on the bottom meaning that the test measurement is not precisely the basic worth.

Table01: Augmented Dicky Fuller (ADF) Unit Root Test

Null Hypothesis: D(GDP,2) has a unit root			
Exogenous: Constant			
Lag Length: 0 (Automatic - based on SIC, maxlag=9)			
		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		7.094902	0.0000
Test critical values:	1% level		3.621023
	5% level		2.943427
	10% level		2.610263
*MacKinnon (1996) one-sided p-values.			

Source: Estimated

Johansen Test (Table 02) says that in the long run Co₂Emission and Infant Mortality have a Negative Impact where as Literacy Rate has a Positive Impact on GDP. The coefficient is measurably massive at the 1% level. The null hypothesis has no aggregation on deported against the option of a co-integrating relationship in the model. So, there exists a long run relationship among the variables.

Table02: Johansen Test

Normalized Co-integrating Coefficients (Standard Error in Parentheses)			
GDP	Co2 Emission	Infant Mortality	Literacy Rate
1.000000	0.000000	1.033864	-5.709304
		(0.18238)	(0.66929)
0.000000	1.000000	0.006718	-0.004686
		(0.00057)	(0.00207)
Adjustment Coefficients (Standard Error in Parentheses)			
D(GDP)	0.019466	-10.93083	
	(0.02453)	(8.85249)	
D(Co2 Emission)	0.000150	-0.050089	
	(0.00017)	(0.06213)	
D(Infant Mortality)	-0.000629	-0.765932	
	(0.00048)	(0.17243)	
D (Literacy Rate)	0.232975	-70.38060	
	(0.01657)	(5.98076)	

Source: Estimated

VECM model (Table 03) refers that for a 1% change in Co₂Emission, 14.17% decrease in GDP. For a 1% change in Infant Mortality, 1.4% decrease GDP, besides a 1% change in Literacy Rate, GDP increase by

4.97%. The initial year divergence, from since quite a while ago, run surplus is remedied at a change speed of 0.37% (Table 04). In the short run relationship, a percent change in CO₂Emission is associated with a 0.14 % decrease in GDP. A percent change in Infant Mortality is associated with a 0.23% decrease in GDP. A percent change in Literacy Rate is associated with 0.107% increase in GDP.

Table03: Vector Error Correction Model (ECM)

Cointeg rating Equation:	CointEq1
GDP(-1)	1.000000
Co2Emission (-1)	14.17257
	(172.754)
	[0.08204]
Infant Mortality (-1)	1.402339
	(0.51421)
	[2.72715]
Literacy Rate (-1)	-4.965547
	(0.68800)
	[-7.21740]
C	44.14001

Source: Estimated

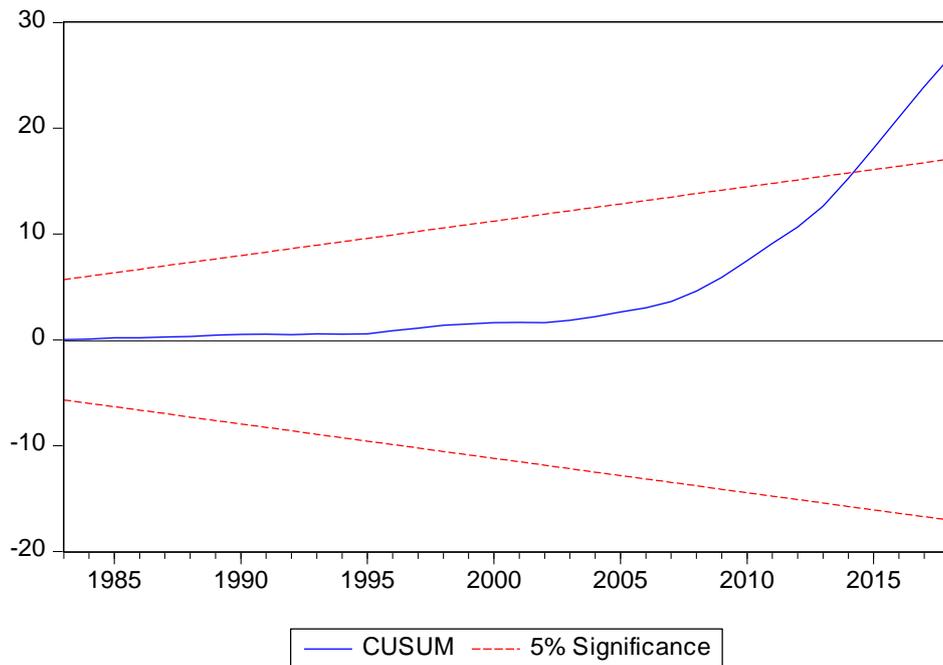
Table04: Vector Error Correction Model (ECM)

Error Correction	GDP	Co2 Emission	Infant Mortality	Literacy Rate
Co-integrating Equation 1	0.003695	9.99E-05	-0.004162	-0.002253
GDP	0.606222	0.001166	0.007218	0.039401
CO2Emission	-0.143091	-0.175182	-0.257263	-20.62375
Infant Mortality	-0.224910	-0.014923	0.362440	-1.528140
Literacy Rate	0.107163	-6.75E-05	-0.007611	-0.179179

Source: Estimated

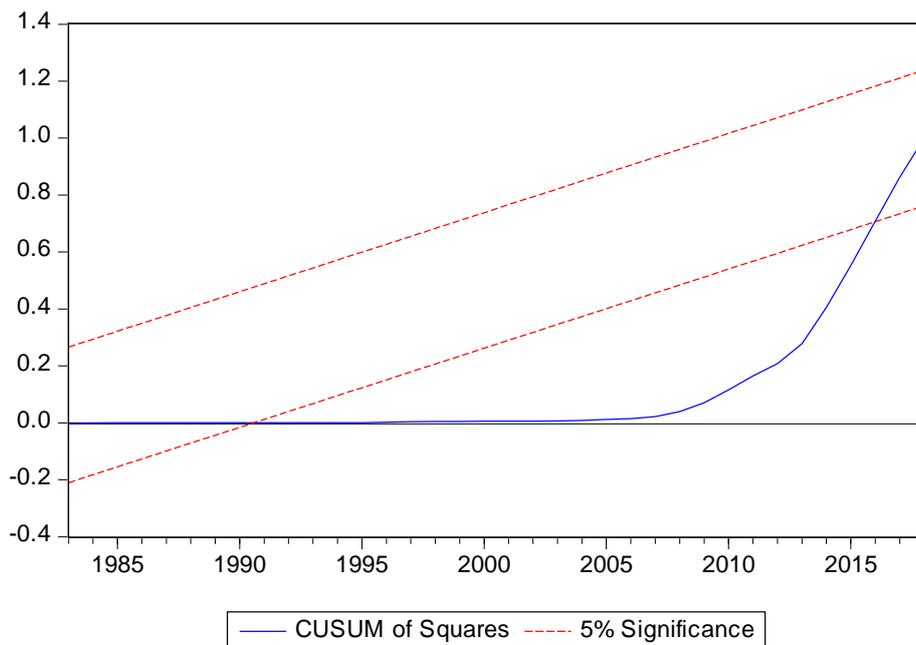
Infant Mortality & CO₂Emission have a Negative effect on GDP whereas Literacy Rate has a Positive Impact on GDP. There are a strong short term and long-term relationship among the variables and CUSUM (Figure 01) & CUSUM square (Figure 02) tests suggest that the model is not stable over the year (1979-2018) because each test lies over 5% boundaries.

Figure01: CUSUM Test



Source: Estimated.

Figure02: CUSUMQ Test



Source: Estimated.

VI. Conclusions and Policy Implications

Bangladesh is a formulating nation. It's the 39th largest on the planet in ostensible terms and 29th largest by purchasing power equality. Infant Mortality and CO₂Emission are a hindrance in becoming a developed country

whereas the Literacy Rate is an indicator of development. Being an overpopulated country, it's not so easy to control pollution as well as Infant Mortality. On the other hand, the Literacy Rate is increasing day by day. All three variables have an impact on the economic development. CO₂Emission needs to be reduced, for example by tree plantation and increasing people's awareness. By providing proper medical equipment, increasing women's education and people's awareness Infant Mortality rate could be controlled. Those factors may directly improve GDP. Furthermore, there is a long haul and transient connection among those aspects found in the VECM. These analyses indicate that those variables have to be considered and there is a huge scope of improvement of economic growth by improving Literacy Rate, decreasing CO₂Emission and Infant Mortality rate. Further research direction or limitation of the study is those issues and variables behind CO₂Emission, Infant Mortality, Literacy Rate, and GDP to be considered in Bangladesh economy development.

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