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Causality of urbanization, carbon dioxide, and economic growth with life expectancy: a perspective of Bangladesh

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Abstract: The paper has investigated the impact of urbanization, carbon dioxide, and economic growth on life expectancy for Bangladesh from 1972 to 2014. Using time series unit root test we find that all variables are stationary at order of integration one. The Granger causality test supports that there is a bidirectional relationship between urbanization, carbon dioxide, and life expectancy, while economic growth has no causal association with life expectancy for Bangladesh.

Keywords: life expectancy, Urbanization, carbon dioxide, Granger causality test.

Introduction

Life expectancy has visible connection with social well-being, human health condition, and economic progress because it reveals the better standard of living of a country (Lomborg, 2002). Although the rate of life expectancy is different to different regions, recent data shows that it follows an upward trend in all countries. According to the United Nations Population Division, the life expectancy of Bangladesh is 72.32 years in 2018 while 46.507 years in 1972. However, better living and working environments, appropriate education and economic development are the main responsible for an upward rate of life expectancy (Ali and Ahmad, 2014). In addition, different socio-economic and environmental elements affect the life expectancy such as urbanization, carbon

dioxide, and economic development. The historical works of Preston (1976, 1980), Grosse et al., (1989) and Kakwani (1993) exhibit that socio-economic determinants have a significant impact on life expectancy.

There are many works, which examined the determinants of life expectancy in developed and developing economies. According to Grossman (1972), inflation has an inverse association with life expectancy. Besides, Rogers (1979) introduced firstly the theoretical framework of income and life expectancy. Barro et al., (1995) examine the effect of economic progress on life expectancy and find that there is a positive impact of economic growth on life expectancy as well as vice-versa. Mariani et al., (2008) checked the association between the dynamics of environmental quality and life expectancy. The findings find that environmental qualities affect the life expectancy. Also, World Bank (1997) finds a robust positive relationship between per capita income and life expectancy in the perspective of developing economies.

According to Anand and Ravallion (1993), there is significant and positive association between life expectancy and GNP per capita. The findings suggest that GNP has negative on first model when the study takes independent variables as public expenditure on health and poverty. However, Kalediene et al., (2000) test that urbanization is one of the significant element of life expectancy for both developing and developed economies. The study finds that urban people get better medical treatment, better education system and high socio-economic formation, which can lead a positive effect on the health conditions.

Considering the initial study of Grossman and Krueger (1995) who have found the absence of evidence revealing the presence of causal association between the degradation of environment and economic growth, in opposition to the findings of Shafik (1994) revealing that carbon dioxide emissions has a parallel positive impact on economic growth. Martinez-Zarzo et al., (2004) describe that level of income and carbon dioxide are inversely related in low-income economies, while they are positively associated with high-income economies. In addition, Stern et al (1993) find that a well-defined income opening of an economy falls the level of carbon dioxide emissions while Akbostanci et al (2006) fail to follow the principles of the hypothesis (CEK). However, Halicioglu (2010) tested the determinants of life expectancy in Turkey over the period of 1965-2005. The study divided the determinants into economic, social and environmental dynamics. The findings show

that the availability of nutrition and food factors were the main element for enhancing life expectancy, while smoking killed the lifetime. Bergh and Nilsson (2009) investigated the dynamics of economic, social and political globalization and life expectancy applying a panel of 92 economies from 1970 to 2005. The authors find a positive impact of economic globalization on lifetime.

From the above-mentioned literature, there is no study on the relationship among urbanization, carbon dioxide, economic growth and life expectancy for the case of Bangladesh. This is the uniqueness of this paper. The remainder of the study proceeds as follows: Section 2 describes methodology, Section 3 presents the results and discussion, and finally, Section 4 reports conclusions.

Methodology

The aim of this research is to investigate the causal relationships of urbanization, carbon dioxide, and economic growth with life expectancy for Bangladesh. This paper analyzes time-series data of 43 observations from 1972 to 2014. The data is collected from the World Development Indicators (WDI). To test the causality, this current study applies a simple model to check the relationship among the variables.

$$LE = f(UR, CO, EG) \quad (1)$$

Where, LE indicates life expectancy, UR reports urbanization, CO shows carbon dioxide, and EG reveals economic growth.

To find the relationship, after taking natural logarithm of the variables we can rewrite the equation (1) as the following equation:

$$LNLE_t = \beta_0 + \beta_1 LNUR_t + \beta_2 LNCO_t + \beta_3 LNEG_t + \varepsilon_t \quad (2)$$

Where, Coefficients β_1 and β_2 are empirically expected to be a positive sign.

Table 1. Summary statistics of the variables:

Variables	Observation	Mean	Std. Dev.	Min	Max
LNLE	43	4.093767	.1270928	3.850807	4.273926
LNUR	43	6.146516	.3046483	5.761109	6.82672
LNCO	43	2.974958	.3772414	2.106692	3.51259
LNEG	43	9.788076	.8765803	8.163177	11.20081

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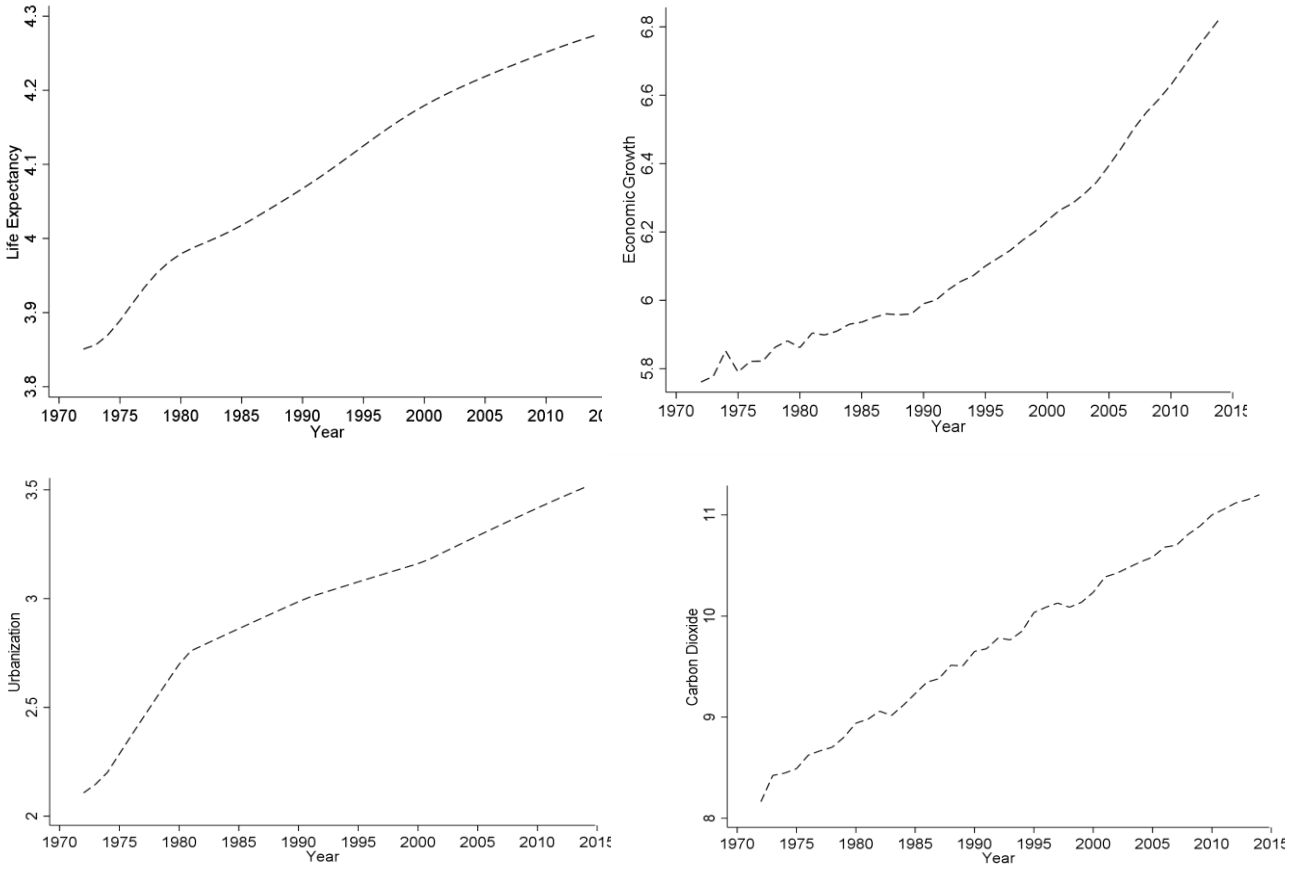
Figure 1: Graphical Expression of the variables



Results and Discussion

Unit Root Test

The unit root test is examined to check the stationary of the variables. In this study, Augmented Dickey- Fuller (ADF) test (Dickey and Fuller, 1981) is applied to test a unit autoregressive root. The ADF test is based on the following regression,

$$\Delta Y_t = \alpha + \delta Y_{t-1} + \mu_t \quad (3)$$

Where, α is the constant term, δ is the slope coefficient, t is a linear time trend, and μ is the error term.

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Table 2: Augmented Dickey-Fuller (ADF) test

Variables	Without trend		With trend	
	Level	1st Difference	Level	1st Difference
LNLE	-1.276	-9.310***	3.058	-13.732***
LNUR	-0.747	-2.905*	-6.302	-4.155**
LNCO	-0.646	-5.139***	-3.613**	-5.174***
LNEG	6.684***	-6.235***	1.388	-9.515***

*Notes: (ⅰ) figures within parentheses indicate lag length chosen by the Akaike Information Criterion (AIC); (ⅱ) *, **, and *** denote rejection of the null hypothesis of unit root of the 10%, 5%, and 1% significance level respectively.*

Regarding the estimated findings of the Augmented Dickey- Fuller (ADF) test show that some variables are non-stationary at levels as the calculated T-statistics are less than the critical values but applying the first difference for all variables (such as: LNLE, LNUR, LNCO, and LNEG) become stationary for both with and without trend.

Granger Causality test:

This study uses Granger causality test (Granger 1969) to investigate the causal relationships of urbanization, carbon dioxide, and economic growth with life expectancy of Bangladesh.

$$\Delta LNLE_t = \sum_{i=1}^{n} \beta_{11} LNLE_{t-1} + \sum_{j=1}^{n} \beta_{12} LNUR_{t-j} + \varepsilon_{1t} \quad (4)$$

$$\Delta LNLE_t = \sum_{j=1}^{n} \beta_{21} LNLE_{t-1} + \sum_{i=1}^{n} \beta_{22} LNCO_{t-i} + \varepsilon_{2t} \quad (5)$$

$$\Delta LNLE_t = \sum_{j=1}^{n} \beta_{31} LNLE_{t-1} + \sum_{i=1}^{n} \beta_{33} LNEG_{t-i} + \varepsilon_{3t} \quad (6)$$

Where, i and j represent lag length

Table 3: Granger Causality Wald Test

Null Hypothesis	χ^2-value	P > χ^2	Direction of Causality
LNUR does not granger cause LNLE	127.78***	0.000	LNUR ↔ LNLE
LNLEX does not granger cause LNUR	10.241***	0.006	
LNCO does not granger cause LNLE	29.539***	0.000	LNCO ↔ LNLE
LNLE does not granger cause LNCO	5.0248*	0.081	

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LNEG does not granger cause LNLE	2.6404	0.267	No
LNLE does not granger cause LNEG	3.6361	0.162	

*Notes: *, **, and *** denote rejection of the null hypothesis of unit root of the 10%, 5%, and 1% significance level respectively.*

In the table 3, the P-values indicate that null hypothesis (i.e., LNUR does not granger cause LNLEX) is rejected as the calculate value is less than 0.05. On the other hand, the null hypothesis (i.e., LNLEX does not granger cause LNUR) is also rejected. Therefore, it confirms that Granger causality goes two way between LNUR and LNLE which is called bidirectional causal association. Regarding the findings, the null hypothesis (i.e., LNCO does not granger cause LNLE) is rejected and also the hypothesis (i.e., LNLE does not granger cause LNCO) is rejected with 1% significance level. There is also a bidirectional causal relationship between LNLE and LNCO. Finally, there is no causal relationship between LNLE and LNEG.

Table 4. Hypotheses Assessment Summary

Null Hypothesis	Significance	Prob.	Conclusion
LNUR does not granger cause LNLE	0.05	0.000	Rejected
LNLE does not granger cause LNUR	0.05	0.006	Rejected
LNCO does not granger cause LNLE	0.05	0.000	Rejected
LNLE does not granger cause LNCO	0.05	0.081	Rejected
LNEG does not granger cause LNLE	0.05	0.267	Accepted
LNLE does not granger cause LNEG	0.05	0.162	Accepted

Conclusions

This current study examines the relationship of urbanization, carbon dioxide, and economic growth with life expectancy for Bangladesh. To do this, the time series data of 43 years from 1972 to 2014 is used. The estimated findings by using STATA-16 software express that urbanization and carbon dioxide have a bidirectional relationship with life expectancy, while economic growth has no causal association with life expectancy for Bangladesh. The policy recommendations of the findings suggest that the government should concentrate on the urban area

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and environmental conditions of Bangladesh ensuring medical cares, proper education, and environmental safety which can lead a better life time for the people of Bangladesh.

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