IOSR Journal Of Humanities And Social Science (IOSR-JHSS)
Volume 19, Issue 4, Ver. VIII (Apr. 2014), PP 60-67
e-ISSN: 2279-0837, p-ISSN: 2279-0845.
www.iosrjournals.org

Causal Relationship between Education, Carbon Dioxide (CO_2) Emission and Economic Growth in Bangladesh

Mirza Md. Moyen Uddin
Assistant Professor (Economics), Bangladesh Civil Service General Education Cadre, Under National University, Directorate of Secondary and Higher Education, Ministry of Education, Bangladesh, Dhaka

Abstract: *The purpose of this study is to test the relationship among education, environmental pollution and economic growth in Bangladesh. Perhaps this is the first research done using time series data for 37 years from 1974-2010. Vector Error Correction Mechanism (VECM) techniques is applied to establish the long run and short run relationships among the variables in the model. Using Johansen cointegration method, the empirical findings indicate that there exists long run cointegration among the variables. Unit root test were performed to test the statistical properties of the data used in variables. Results show strong positive relationship among environmental pollution, education expenditure and economic growth. The results of this study will help the environmental authorities to understand the effects of economic growth for degrading the environmental quality and manage the environmental pollution by creating awareness through education.*

Keywords: *Environment, Education, VECM, GDP, Bangladesh*

I. Introduction

Global warming and climate change attracted considerable attention worldwide. The intergovernmental panel on climate change (IPCC) reported that the global temperatures increase by 1.1 to 6.4 ^{o} C and rise in the sea level of about 16.5 to 53.8 cm by 2100 (IPCC, 2007). This would have tremendous negative impact on the half of the population of the world live in coastal areas (Lau et al., 2009). In this circumstance many countries like Bangladesh will totally submersed by sea water by 2100.

Bangladesh is a small developing country in South-east Asia. Its population is above 160 million and the world's most density of population is situated here. Bangladesh is also recognized worldwide as one of the most vulnerable countries to the impact of climate change. For the past few decades, Bangladesh government has been showing concern about environmental pollution. Here with the production and economic activities it emits huge amount of carbon dioxide every year especially from fossil fuels, gas fuels, liquid fuels and solid fuels. On the other hand higher economic growth causes environmental degradation threatens the sustainability of the environment because economic growth is closely related to energy consumption which is responsible for higher levels of CO_2 emissions. It became the general consensus that higher economic growth should not be pursued at the expense of the environment and this issue raised the question of how economic growth can be made more sustainable. Sustainable development defined by Brundtland (1987) as development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Some of international organizations around the world continuously attempt to reduce the adverse impacts of global warming. One such attempt is the Kyoto Protocol agreement, made in 1997 as an attempt to reduce the adverse impact of global warming. Among the variety of polluting substances, Carbon Dioxide (CO_2) is a major one and represents 60 percent of green house gas emission (World Bank, 2007).

II. Literature Review

Grossman and Krueger (1991) and Kuznets (1955) states that in the early stages of economic growth, environmental quality decreases with an increase in per capita income, but after a certain level environmental degradation starts decreasing with the increase in the level of per capita income, thus resulting in an inverted U-shaped curve (i.e. Environmental Kuznets Curve, EKC). Saboori, et al. (2012), analyzed that the dynamic relationship between carbon dioxide emissions and economic growth in Indonesia based on the EKC hypothesis. This confirms that CO_2 emissions declines at initial level of economic growth then reaches a turning point and increases with the higher level of economic growth. Ahmed et al. (2012) claimed that there is a strong positive relationship between environmental pollution and economic growth. Granger Casualty Test indicates changes in GDP per capita Granger-cause Emission. Ru, et al., (2012), analyzed that the relationship between economic development and the factors causing the environmental pressures is the basic premise of formulating and adjusting the environmental policy. A sound environmental policy should be effective to reduce or mitigate the

environment pressures and simultaneously maintain economic development. Odhiambo, (2011), examined that the unidirectional causal flow from economic growth to CO_2 emissions in South Africa without a feedback. The results also show that energy consumption Granger-causes CO_2 emissions and economic growth. Alkhathlan, (2012), found that the positive and significant relationship between GDP and CO_2 emissions in Saudi Arabia. He analyzed that the long run income elasticity of carbon emissions is greater than the short run income elasticity of carbon emissions. This implies that income leads to greater carbon dioxide emissions in the long run. Islam, et al., (2012), found that there is a strong positive relationship between international trade and carbon (CO_2) emissions from the gas fuels of various manufacturing sector of Bangladesh. Bloch, et al. (2011) analyzed that the relationship between coal consumption and GDP in China using both a supply side and a demand side framework. The error correction mechanism (ECM) is used to examine both short run and long run Granger causality. The results shows that coal prices Granger cause coal consumption, so a reduction in pollution without restricting economic growth may be possible by withdrawing the current policy of coal subsidization by the Chinese Government and replacing it with a policy of subsidizing greener energy sources. Gunter, (2010), analyzed in context of Bangladesh that the lower GDP growth rates imply higher population growth where the long term impact of low GDP growth on CO_2 emission is actually worse. Higher GDP growth rates will increase CO_2 emission faster, but it implies that the peak of CO_2 emission reaches earlier and due to the lower population, at a lower emission level. In other words, development can be considered to contribute to lower long run CO_2 emissions. Salequzzaman and Davis (2003) found that there are unique challenges for ecologically sustainable development with a very high population density, a still high population growth rate and limited natural resources. A significant program of environmental education and development of local expertise is needed for massive changes in behaviour with respect to the environment. The formal education system provides a ready framework for reaching a large part of the existing population and can help make future generations conscious of the importance of environmental conservation. In Bangladesh, NGOs and universities with environmental education departments can play a significant role in teacher training and providing materials for formal and non-formal education.

Review of literature helps to know the research gap. That is why, a number of literatures have been reviewed to know the Causal Relationship between Education, CO2 Emission and Economic Growth and identified research gap in this field. Environmental pollution education is a new phenomenon in the world and in context of Bangladesh it is also very recent idea. Most of the study relates this environmental pollution to other things rather than education. But education is vital elements that create awareness especially among those are the students, because they are the future of the country. Very few studies are found on the relevant field. Moreover it is observed that no specific work is done by using empirical model to determination the causality between education and environmental pollution on this topic in Bangladesh. So the researcher thinks, there prevail an immense research gap which is the main justification of the research.

III. Model Specification and Variables

The study applied multivariate model analysis techniques to examine the relationships among environmental pollution i.e. CO_2 emission, education expenditure and GDP growth in Bangladesh. The study based on the assumption that in GDP production is driven by high energy consumption that is likely to produce CO_2 emissions that causes environmental pollution and education expenditure in GDP is driven to create awareness through education among people about environmental pollution. The basic form of the relationship among the variables can be expressed as:

$$Ep_t = \alpha + \alpha_1 Ed_t + \alpha_2 GDP_t + \varepsilon_t \qquad (1)$$

Where, Ep = Environmental pollution i.e. CO_2 emission**,** Ed = Education Expenditure, GDP= Gross Domestic Production, ε = Error terms.

IV. Empirical Study

The empirical study consists of unit root test, the cointegration test and error correction mechanism. These are discussed below.

4.1 Testing Methods of Unit Roots

Testing for the unit root problem the Augmented Dickey-Fuller test and Phillips- Perron test were used here.

4.1.1 Augmented Dickey-Fuller (ADF) Test

The Augmented Dickey-Fuller (ADF) test is used to test for the existence of unit roots and determine the order of integration of the variables. The ADF test requires the equation as follows:

$$\Delta y_t = \beta_1 + \beta_2 t + \delta y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

Where u_t is assumed to be identical and independently distributed random variable. The ADF test statistic checks the null hypothesis of the stationary time series. If ρ=0 (where, $\beta = \rho - 1$) against the alternative ρ <0 then y_t contains a unit root. The test we do both with and without a time trend. SIC method is used to choose the optimal lag length. It can be seen in Table 1 that presence of a unit root which indicates non-stationarity, cannot be rejected in level form. But in difference form the non stationarity problem is vanished.

4.1.2 Phillips-Perron (P.P) Test

Phillips-Perron (1988) test deals with serial correlation and heteroscedasticity**.** An important assumption of the DF test is that the error term u_t is independently and identically distributed. The ADF test adjusts the DF test to take care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand. Phillips and Perron use non parametric statistical methods to take care of serial correlation in the terms with adding lagged difference terms. Phillips-Perron test detects the presence of a unit root in a series. Suppose, y_t is estimating as

$$\Delta y_t = \alpha + \beta t + \rho^* y_{t-1} + u_t \qquad (3)$$

Where, the P.P test is the t value associated with the estimated co-efficient of ρ*. The series is stationary if ρ* is negative and significant. The test is performed for all the variables where both the original series and the difference of the series are tested for stationary.

4.2. Cointegration Testing Methods

4.2.1 Concept of Cointegration

The concept of cointigration was introduced by Granger (1983) and the statistical analysis of cointigrated process was organized by Engle and Granger (1987). Cointegration means that despite being individually non-stationary, a linear combination of two or more time series can be stationary (Gujarati, 2011). When a linear combination of non stationary variables is stationary, the variables are said to be cointegrated and the vector that is quite possible for a linear combination of integrated variables to be stationary. In this case the variables are said to be cointegrated. The key point of cointegration is:

(i) cointegration refers to a linear combination of non stationary variables.

(ii) all the variables must be integrated of the same order.

Suppose, considering the following cointegrated regression equation as

$$y_t = \alpha + \beta x_t + u_t \qquad (4)$$

In this series y_t and x_t are I (1) and the error term u_t is I (0). Then the coefficient measures the equilibrium relationship between the series y and x. The term u_t, indicates the deviation from the long run equilibrium path of y_t and x_t. A time series data (y_t) is said to be integrated of order one and that can be denoted as I (1). If the original non stationary series has to be differenced'd' times for stationary process, the original series is integrated of order'd' that can be denoted by I (d). Consistency in ECM requires all of terms to be integrated of order zero, I (0). This is possible only if y and x are cointegrated in a linear form, that is $X_t = \alpha y_t + u_t$ which is stationary.

There are several methods for testing cointegration. Here Granger Causality test, Trace Statistics and Maximum Eigen value test were used to find cointegration among the variables.

4.2.2 Trace Statistics and Maximum Eigen Test

Johansen and Juselius (1990) method employs VAR system to test for the numbers of cointegration vectors and that test provides two Likelihood Ratio (LR) test statistics for cointegration analysis in time series. First test is named trace (λ_{trace}) statistics and the second is maximum eigenvalue ($\lambda_{\max}$) statistics. These tests can be shown as follows:

Trace Statistic:

$$\lambda_{trace}(r) = -T\sum_{i=r+1}^{k}\ln(1-\hat{\lambda}_i) \qquad (5)$$

Maximum eigenvalue Statistic:

$$\lambda_{\max}(r, r+1) = -T\ln(1-\hat{\lambda}_{r+1)}) \qquad (6)$$

where *r* is the number of cointegrating vectors under the null hypothesis and $\hat{\lambda}_i$ is the estimated value for the *i*th ordered eigenvalue from the matrix *Π*. The trace statistics tests the null hypothesis that the number of cointegrating relations is *r* against of *k* cointegration relations, where *k* is the number of endogenous variables. The maximum eigenvalue test examines the null hypothesis that there are *r*-cointegrating vectors against an alternative of *r+1* cointegrating vectors. To determine the rank of matrix *Π*, the test values obtained from the two test statistics are compared with the critical value from Mackinnon-Haug-Michelis (1999). For both tests, if the test statistic value is greater than the critical value, the null hypothesis of *r* cointegrating vectors is rejected in favor of the corresponding alternative hypothesis.

More specifically, Table 3 shows that at 5 percent level of significance the likelihood ratios (trace statistics) for the null hypothesis having one (r=1) cointegration (57.33895) is higher than the critical values (35.19275). At 5% level of significance, the maximum eigenvalue statisticsfor the null hypothesis having one cointegration (37.93834) is higher than the critical value (22.29962). Hence, according to the likelihood ratio and maximum eigenvalue statistics tests- environmental pollution (i. e. CO_2 emission), education expenditure and GDP i.e. economic growth are cointegrated. Thus, there is existence of the long run equilibrium relationship among these variables.

4.3 Error Correction Modeling (ECM)

Granger and Engle (1983) analyzed that if the variables are integrated of order one and cointegrated, then there exists the Error Correction Term (ECT) and these variables bears the steady state situation or in equilibrium situation.

Considering the following equation which exist each other relationship as:

$$\Delta y_t = \beta_1 + \sum_{i=1}^{n}\beta_2\Delta y_{t-1} + \sum_{i=1}^{n}\beta_3\Delta x_{t-1} + \alpha_1\Delta ETC_{t-1} + \varepsilon_{1t} \qquad (7)$$

$$\Delta x_t = \gamma_1 + \sum_{i=1}^{m}\gamma_2\Delta x_{t-1} + \sum_{i=1}^{m}\gamma_3\Delta y_{t-1} + \alpha_2\Delta ECT_{t-1} + \varepsilon_{2t} \qquad (8)$$

Where x_t and y_t denotes the variables, ECT_{t-1} is the error correction term which is the lagged residual series of the cointegrating vector, ' Δ 'denotes the first difference, ' ε 'denotes the error correction term. Here the error correction term capturing the disequilibrium situation. The negative and significant coefficient of error terms suggests that there is a short run adjustment process working behind the long run equilibrium relationship among the variables. Coefficient parameters of error correction term are the speed of adjustment for the short run imbalances. In fact, in the vector error correction model all the variables are endogenously determined within the model. When the variables are cointegrated, there is a systematic and general tendency of the series to return to their equilibrium situation. This means that the dynamics of adjustment is intrinsically embodied in the theory of cointegration.

The error correction model states the dependence on both x_t and y_t of error correction term. If the error correction term is not zero, then the model is out of equilibrium. That is y_t lies it's equilibrium values and it starts falling in the next period to correct the equilibrium error.

V. Empirical Results

5.1 Results of Unit Root Test

We first perform unit root tests on all three series in levels and first difference in order to determine the univariate properties of the data in the analysis. To investigate the stationary properties of the variables we run the regression analysis with an intercept term and with intercept term with trend for testing the presence of a unit root. The Augmented Dickey-Fuller test is used to test for the existence of unit roots and determine the order of integration of the variables. The tests are done both with and without a time trend. Results show that the variables CO_2 emission, education expenditure and GDP growth are non stationary in level form because the ADF test statistic of their level form of the variables are less than their respective critical values. This means that they all have the unit root problems and hence they suffer from instability problem in the short run.

Results of ADF test of the variables in level and difference form are also given in Table 1. which indicates that the non-stationarity problems vanished after the difference form of the data series, because here the ADF statistic are greater than their critical values and the null hypothesis of non stationarity are rejected.

Table: 1. Augmented Dickey-Fuller Unit Root Test Results

Variable	Statistics	Critical Values			Statistics	Critical Values		
	With intercept	1%	5%	10%	With trend and intercept	1%	5%	10%
Level Form								
CO_2 emission	3.138912(2)	-3.626784	-2.945842*	-2.611531*	-0.989891(2)	-4.234972	-3.540328	-3.202445
Education	2.928958(2)	-3.632900	-2.948404	-2.612874*	2.638842(2)	-4.243644	-3.544284	-3.204699
GDP	1.750733(2)	-3.626784	-2.945842	-2.611531	-1.099151(2)	-4.234972	-3.540328	-3.202445
Difference Form								
CO_2 emission	-4.681470(2)	-3.632900*	-2.948404*	-2.612874*	-6.739015(2)	-4.262735*	-3.552973*	-3.209642*
Education expenditure in GDP	2.631175(2)	-3.632900	-2.948404	-2.612874*	-6.022913(2)	-4.252879*	-3.548490*	-3.207094*
GDP	-5.201792(2)	-3.632900*	-2.948404*	-2.612874*	-6.033745(2)	-4.243644*	-3.544284*	-3.204699*

Note: On the base of critical value * denote that the rejection of null hypothesis of unit root at 1%, 5% and 10% levels of significance. Here we consider the variables with intercept only, and with trend and intercept, both in level and first difference form. Number in the bracket denotes lag length.

5.2. Phillips-Perron Test

We have also applied Phillips Perron non parametric test for checking the non stationarity of the variables. In the level form, some cases there have the unit root problem in respect of environmental pollution i.e. CO_2 emissions, education expenditure and GDP growth. But in difference form both with constant and with constant and trend, the statistic value is greater than that of critical value at 1%, 5% and 10% levels of significance. So, the null hypothesis of non-stationarity is rejected, i.e., the data series are stationary at difference form. Results of Phillips Perron test is shown in Table 2.

Table 2: Results of Phillips-Perron (P.P.) Test

Variable	Statistics	Critical Values			Statistics	Critical Values		
	With intercept	1%	5%	10%	With trend and intercept	1%	5%	10%
Level Form								
CO_2 emission	6.132033(2)	-3.626784*	-2.945842*	-2.611531*	-0.655198	-4.234972	-3.540328	-3.202445
Education expenditure in GDP	13.38117(2)	-3.626784*	-2.945842*	-2.611531*	12.53238	-4.234972*	-3.540328*	-3.202445*
GDP	1.839900(2)	-3.626784	-2.945842	-2.611531	-1.054326	-4.234972	-3.540328	-3.202445

CO_2 emission	-4.818463(2)	-3.632900*	-2.948404*	-2.612874*	-9.851673(2)	-4.243644*	-3.544284*	-3.204699*
Education expenditure in GDP	3.873066(2)	-3.632900*	-2.948404*	-2.612874*	-6.022913(2)	-4.252879*	-3.548490*	-3.207094*
GDP	-5.209039(2)	-3.632900*	-2.948404*	-2.612874*	-6.056790(2)	-4.243644*	-3.544284*	-3.204699*

Note: The test is conducted using Eviews 7.1

5.3 Cointegration Results

Cointegration test clarifies the existence of long run equilibrium relationship among the variables. The estimated results, particularly Maximum Eigen value and Trace statistics are presented in Table 3 which indicates that the statistics values are greater than their critical values. This means that the hypothesis of no cointegration is rejected and hence they are cointegrated. The Trace statistics and Maximum Eigen value tests indicate that there is one cointegration equation at 5% level. This means that the variables- environmental pollution (i.e. CO_2 emission), share of GDP in education and total GDP have the long run relationships. So, it is clear that there is one linear cointegration equation that there is one long run relationship and liner deterministic trend among the variables.

Table: 3. Cointegration among the Variables Education Share in GDP, CO_2 Emission i.e. Environmental Pollution and Total GDP.

H0	H1	Trace Statistics	5% Critical value	Max. Eigen value	5% critical value	Hypothesis
H_0: r=0	H_1: r=1	57.33895	35.19275	37.93834	22.29962	None**
H_1: r=1	H_1: r=2	19.40061	20.26184	11.99227	15.89210	

Note: The test is conducted using Eviews 7.1

5.5 Results of Error Correction Model (ECM)

After checking unit root tests, Johansen maximum likelihood procedures are used to test for cointegration and to estimate the error correction parameters to confirm that each series is in I (*1*) process. Since cointegrating relationship is found among the variables, an Error Correction Model (ECM) is constructed to determine the direction of causality. The significant lagged ECT coefficient indicates that the current outcomes are affect by the past equilibrium errors.

If the two variables are cointegrated, there must exists an error correction mechanism. This implies that error correction model is associated with the cointegration test. The long term effects of the variables can be represented by the estimated cointegration vector. The adjusted coefficient of error correction term shows the long term effect and the estimated coefficient of lagged variables shows the short term effect. Causality test among the variables are based on Error Correction Model with first difference. Table 5 shows the Vector Error Correction Model (VECM).

Table 4: Results of Vector Error Correction Model for CO2 emission (EM), Education Share in GDP (ED) and Total GDP

Error Correction	D(EM)	D(ED)	D(TGDP)
CointEq1 (ECT)	-0.137464**	-0.013702**	0.020512
	[-3.36278]	[-2.15379]	[0.76930]
D(EM(-1))	-0.039416	-0.027249	0.311982**
	[-0.24723]	[-1.09819]	[3.00017]
D(EM(-2))	-0.212151	0.018546	0.128171
	[-1.10799]	[0.62236]	[1.02627]
D(ED(-1))	-2.175981	0.706698**	1.460010
	[-1.60648]	[3.35235]	[1.65256
D(ED(-2))	-3.342343**	-0.225857	-0.573544
	[-2.23678]	[-0.97119]	[-0.58847]
D(TGDP(-1))	0.205923	-0.013257	-0.075350
	[0.70041]	[-0.28972]	[-0.39293]
D(TGDP(-2))	-0.643603**	0.024088	0.003069
	[-2.57319]	[0.61880]	[0.01881]
C	1380984.**	112907.2**	-202825.7

	[3.96764]	[2.08430]	[-0.89340]

Note: ** denotes the rejection of the hypothesis at 5% level of significance. The (**) values are statistically significant and shows the estimated coefficient of lagged variables. Values in the third brackets are t-statistics.

Table 4 shows that the error correction term is significant for carbon dioxide (CO_2) emission (EM), and education expenditure (ED), indicating the long run and short run relationship between education share in GDP and environmental pollution. If the error correction term of CO_2 emission (EM) i. e. environmental pollution and education expenditure (ED) are statistically significant and cointegrated, they have the long and short term causal effects on each other.

VI. Conclusion

In this study we have used carbon emission data as the environmental pollution indicator, GDP as the economic growth indicator and education expenditure in GDP as the education indicator. Time series data for 37 years from 1974 to 2010 was used to analyze causal relationship between environmental pollution, education and economic growth in Bangladesh using VECM based test techniques to establish the short run and long run relationship among the variables in the model. Result shows that there have the long run linear deterministic relationships among the variables. From VECM results it is clear that carbon dioxide (CO_2) emission (EM), and education expenditure (ED) are statistically significant and cointegrated and that is why they effects on each other. It can be said that more education share in GDP intensify the literacy rate and increase in literacy rate create awareness among the people that reduces emission, i.e., environmental pollution. The educational attainments lead to reduce environmental pollution and it also leads to GDP growth, i.e., sustainable development. There has the unidirectional causality between education expenditure and environmental pollution i.e. education and sustainable economic growth. These results will help the environmental authorities to understand the effect of economic growth to the environmental pollution as well as the necessity of environmental awareness through education in Bangladesh. This results postulates that Bangladesh can obtain higher economic growth with better environmental pollution management by creating awareness through education.

References

[1]. Ahmed, A., Herve, D.B. and Zhao, L., 2012, Emperical Study on Relationship between Environmental Pollution and Economic Growth of Maldives Using Environmental Kuznets Curve and OLS Method, International Journal of Business and Management, 7, 21, 15-24.

[2]. Alkhathlan, K., Alam, M. Q. and M. Javid, 2012, Carbon Dioxide Emission, Energy Consumption and Economic Growth in Saudi Arabia: A Multivariate Co integration Analysis, British Journal of Economics, Management and Trade, 2, 4, 327-339. SCIENCEDOMAIN International, www.sciencedomain.org.

[3]. Bloch, H., Rafiq, S. and Salim, R., 2012, Coal consumption, CO_2 emission and economic growth in China: Empirical evidence and policy resposes, Energy Economics 34, 518-528, Journal homepage: www.elsevier.com/locate/eneco

[4]. Dickey, D.A., and W.A. Fuller, 1981, Distribution of the estimators for the autoregressive time series with a unit root, Econometrica, 49, 1057-1072.

[5]. Engle, R.F., and C.W.J. Granger, 1987, Cointegration and error correction-representation, estimation and testing, Econometrica, 55, 251-276.

[6]. Lau, L.C., Tan, K.T., Lee, K.T. and Mohamed, A.R., 2009, A comparative study of the energy policies in Japan and Malaysia in fulfilling their nation obligations towards the Kyoto protocol. Energy Policy, 37, 4771-4780, http://dx.doi.org/10.1016/j.enpol.2009.06.034

[7]. Gunter, B. G., 2010, The Impact of Development on CO_2 Emission: A case study for Bangladesh until 2050, Bangladesh Development Research Working Paper Series, www.bangladeshstudies.org/wps/

[8]. Grossman, G. and Krueger, A., 1991, environmental impacts of a North American Free Trade Agreement, National Bureau of Economic Research Working Paper 3914, Cambridge MA: http//www.nber.org/papers/w3914.pdf

[9]. Gujarati, D. N., 2011, Basic Econometrics, Eighth reprint, McGraw-Hill Publications, New York.

[10]. Islam, m. R., Cheng, Y. and Rajib, S. U., 2012, International Trade and Carbon Emissions (CO_2): The case of Bangladesh, Journal of Economics and Sustainable Development, 3, 5, 18-26, www.iiste.org

[11]. Kuznets, S., 1955, Economic growth and income inequality, American Economic Review, 49, 1-28.

[12]. McKinsey Global Company, 2008, The carbon productivity challenge: Curbing climate change and sustaining economic growth. The McKinsey Quarterly, 7, 2-33.

[13]. Odhiambo, N. M., 2011, Economic growth and carbon emission in South Africa: An empirical investigation, International Business and Economics Research Journal, 10, 7, 75-82.

[14]. Phillips-Perron, 1988), Testing for Unit root in Time Series Regression, Biometrica, 75, 335-346. http://dx.doi.org/10.1093/biomet/75.2.335

[15]. Ru, X., Chen, S. and H Dong, 2012, A Study on Relationship between CO_2 Emission and Economic Development in China Based on Dematerialization Theory, Energy and Environmental Research; 2, 2, 37-44, Published by Canadian Center of Science and Education.

[16]. Saboori, B., Sulaiman, J. B., and S. Mohd, 2012, An Empirical Analysis of the Environmental Kuznets Curve for CO_2 Emissions in Indonesia: The Role of Energy Consumption and Foreign Trade, International Journal of Economics and Finance, 4, 2, 243-251, www.ccsenet.org/ijef.
[17]. Salequzzaman, M. and J.K. Davis, 2003, Environmental Education and Environmental Management in Bangladesh and their Sustainability, Environmental Informatics Archives, 1, 70-82.
[18]. Ong, S.M. and S. K. Sek, 2012, Interactions between Economic Growth and Environmental Quality: Panel and Non-Panel Analysis, Applied Mathematical Sciences, 7, 2013, 14, 687 - 700