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A NEW ECONOMIC DIMENSION TO THE ENVIRONMENTAL KUZNETS CURVE: ESTIMATION OF ENVIRONMENTAL EFFICIENCY IN CASE OF PAKISTAN

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ABSTRACT

This study attempts to examine the linkage between environmental degradation and economic growth in Pakistan over the period 1972-2011. The main concern of this study is to test the validity of Environmental Kuznets Curve in case of Pakistan and aims to find out the total and per capita carbon efficiency of Pakistan. Moreover, this study estimates the tipping point of environmental Kuznets curve in case of Pakistan. The study used Autoregressive Distributed Lag (ARDL) model to determine the robustness of long-run relationship among environmental degradation and economic growth. The results show that the inverted U-shaped relationship between economic growth and environmental degradation is valid in case of Pakistan. The values of total carbon efficiency for Pakistan is 47.69 and per capita carbon efficiency for Pakistan is 0.0002, which are relatively low as compare to other developing and developed countries like in the region. The Tipping Point of EKC in case of Pakistan is 338.34. This study recommends that government should keep into consideration the sustainable economic policies with environmental policies, as environmental sustainability largely based on the economic conditions and economic policies adopted by the countries.

Keywords: Environmental degradation, Economic, Growth environmental kuznets curve, ARDL

1. INTRODUCTION

The issue of the possible relationship between environmental degradation and economic growth is based on the Simon Kuznets's idea[1], which states that there is a nonlinear relationship between pollution and economic growth (Kuznets, 1955). Environmental Kuznets Curve (EKC) states that environmental degradation increases, when countries are in the transition stage of development, but then declines after a threshold level (Grossman and Krueger, 1991). In the initial stage of development, economies often rely on heavy infrastructure projects, which lead to environmental degradation due to emissions of various pollutants, such as carbon dioxide, sulfur, and nitrogen oxides (Islam *et al.*, 1999; Dasgupta *et al.*, 2002). Daly (1977) argues that increased extraction of natural resources, increased concentration of pollutants and accumulation of waste will therefore results in the environmental degradation and a decline in human welfare, despite of rising incomes. Hence, in the initial stage of development, there is some degradation of environment (Dasgupta *et al.*, 2002). However, after a threshold level, high sustained economic growth recovers the quality of life and reduces emission of various pollutants. Hence, over the passage of time, the effluence absorption intensity will turn down. According to Beckerman (1992), "*The strong correlation between incomes, and the extent to which environmental protection measures are adopted, demonstrates that in the longer run, the surest way to improve your environment is to become rich*". Hence, the relationship between economic growth and environmental quality is not fixed along a country's economic development. It may change from positive to negative as a country reaches a level of high income with demand of luxury living standard and cleaner environment (Shafik and Bandyopadhyay, 1992).

The concept of EKC was initially examined by trade economist (Grossman and Krueger, 1991; Shafik and Bandyopadhyay, 1992; Selden and Song, 1994; Shafik, 1994)in the context of international trade agreement rather than by environmental/resource economists (e.g. (Ehrlich and Holden, 1971; Meadows *et al.*, 1972; Frank and Bernanke, 2005) in environment improving context (Carson, 2010). According to Johansson and Kriström (2007) due to the availability of extensive research on the environmental Kuznets curve (EKC) there is no need to further discuss this issue. However, some Stern (2004) argued that the issue needs to be discussed in the presence of precise panel data and time-series methods (Stern, 2004). Hence, there is rich debate among researchers regarding the presence of EKC. Some of the researchers and scientists support the existence of EKC(see (Pezzey, 1989; Lopez, 1994; Selden and Song, 1994; Dasgupta *et al.*, 2002; Stern, 2003; Dinda, 2004; Stern, 2004; Bousquet and Favard, 2005; Jorgenson, 2006; Yörük and Osman, 2006; Aubourg *et al.*, 2008; Lee *et al.*, 2009; Poudel *et al.*, 2009; Drabo, 2010; Miah *et al.*, 2011; Nasir, 2011), while some researchers provided evidence against EKC (as (Brajer *et al.*, 2008; Aslanidis and Iranzo, 2009; He, 2012). According to Cavlovic *et al.* (2000), the use of various methodologies can drastically affect the results of the relationship between environmental degradation and economic growth. Moreover, the use of various proxies for environmental

[1] The original idea was that income inequality first rises and then falls as economic development proceeds. See Kuznets (1955) for further details.

degradation also affects the shape of EKC. In the literature income-environment relationships is estimated for many environmental indicators, such as energy use, transport emissions of CO_2, CO, and NO2, chlorofluorocarbons (CFC) emissions, SO2, SPM and methane (Selden and Song, 1994; Grossman and Krueger, 1995; Cole and Neumayer, 2005). The resource economists derived different inferences by using different set of environmental variables. Moreover, CO_2 emissions and municipal waste per capita show continued worsening as incomes rise (Rothman, 1998).

The data of the past several decades is showing a relationship between income and environmental degradation (United Nations, 2001). However, the issue of positive relationship before a threshold level and negative relationship after a threshold level is debatable among environmentalist and policy makers. Moreover, the order of causality is also debatable among academia and researchers. Roegen (1971) and Meadows *et al.* (1972) argued that for the economy to enlarge its production and consumption of various commodities, a considerable amount of energy and waste by-products is required.

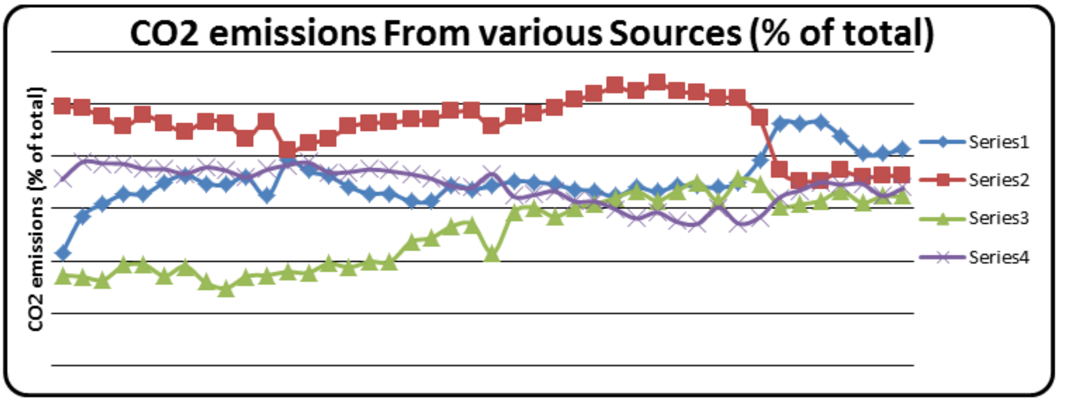
The issue of possible environment-growth nexus is of immense importance for the development of policies, because of the shape of EKC, which has crucial implication for policy (Arrow *et al.*, 1995). Many researchers primarily focused on the relationship between economic growth and environmental degradation. While, some others utilized control variables in order to examine the environment-growth nexus. This study is an attempt to explore the environment-growth nexus in the presence of control variables. Our work is different from the existing literature in case of Pakistan. To the best of our knowledge, no study, till date, has examined the transmission channel of environment-growth nexus in case of Pakistan. Moreover, this study performs sensitivity analysis to select the set of robust control variables in order to test the environmental Kuznets Curve (EKC) in the presence of control variables. Further, the study estimates the values of total carbon efficiency and per capita carbon efficiency of Pakistan. The study focuses on the tipping point of EKC in case of Pakistan. As carried out by many previous EKC studies on environmental degradation, this study also includes variables other than income as explanatory variables, because the causes of environmental degradation is considered to be complex and interlinked. In our analysis, the significances of population, energy consumption, as well as income, are investigated. The addition of these variables would facilitate to explain what kinds of policies can reduce environmental degradation. The results of this study provide better policy recommendations for economy of Pakistan to achieve better environmental quality with sustainable growth.

The rest of the paper is organized as follow. The next section presents the Environmental conditions in the context of Pakistan economy. This section explains the main sources of CO_2 emission in case of Pakistan over the period of 1972 to 2011. Section 3 presents the model specification, data and methodology used in this study. Section 4 presents the empirical results of the study by employing different econometric methods. The last section summarizes the results of the study by providing concluding remarks and policy recommendations.

2. ENVIRONMENTAL CONDITION OF PAKISTAN ECONOMY

Environmental situation is quickly changing at international and national level due to contemporary improved industrialization, urbanization and economic growth (Khan and Jaffar, 2002). Over the period of time economic growth enhances at the cost of environmental degradation in case of Pakistan. Deforestation is one of the main reasons of environmental degradation in Pakistan. According to a World Bank report 2010, Fossil fuel energy (coal, oil, petroleum, and natural gas) consumption in Pakistan was 61.76 in 2009 exhausted natural assets. While, CO_2 emissions from transport sectors in Pakistan was reported at 31.50 (million metric tons) in 2008, which is due to combustion of fossils fuels, except of international flights and marine transport. CNG promoted in power plants and vehicles industry reduces pressure on coal assets and market import of petroleum (World Bank Report, 2010). The reasons were Pakistan economic status of past suffering from population growth, internal political disputes and conflict with bordering countries.

Figure-2.1. CO_2 Emission from Various Sources (% of Total)



Series 1: CO_2 emissions from gaseous fuel consumption (% of total)

Series 2: CO_2 emissions from liquid fuel consumption (% of total)

Series 3: CO_2 emissions from electricity and heat production, total (% of total fuel combustion)

Series 4: CO_2 emissions from manufacturing industries and construction (% of total fuel combustion)

The CO_2 emissions for energy production increases from 1990-2010 due to increased use of gaseous fuel instead of liquid fuel in different sectors of Pakistan, thus decreasing the CO_2 emissions from the liquid fuel from 2000-2010. While CO_2 emissions from electricity and power plants shows increasing trend till 1990s; however, after that period with developmental transition it stabilize after 2000 in CO_2 emissions. It was also affected by fuel type as use of CNG has been promoted in Pakistan instead of coal (high CO_2 emission efficiency). Manufacturing and construction industries shows decreasing trend in CO_2 emissions till 2000 but increases when compared to mid developmental period. This is due to increased industries and goods with reduction of carbon sinks. Decreasing trend was due to change in fuel type as many industrial processes also use electricity and therefore indirectly causes the emissions[2].

Overall CO_2 emissions from all the sources shows increasing trend, while in 2008-2011 it shows stabilization with no further increases with developmental activities and policies implementation. Government of Pakistan, Ministry of Environment paying compensation to forest communities in participation in Reducing Emissions from Deforestation and Forrest Degradation (REDD+) that will guide in reduction in CO_2 in Pakistan.

3. MODEL SPECIFICATION, DATA AND METHODOLOGY

This study follows the methodology used by Lipford and Yandle (2010) in order to find out the technically efficient of Pakistan in avoiding carbon emissions when generating GDP. Lipford and Yandle (2010) find out the value of Total Carbon Efficiency for 8 developed and 5 developing countries.

Following Lipford and Yandle (2010), the standard formula for total carbon efficiency and per capita carbon efficiency are given below:

$$TCE = \Delta TCO_2E / \Delta Yp \quad \text{.................................... (1)}$$

$$PCE = \Delta PCO_2E / \Delta Yp \quad \text{.................................... (2)}$$

Where TCE is Total Carbon Efficiency, PCE Per Capita Carbon Efficiency, Yp is GDP per capita, TCO_2E is total CO_2 emission and PCO_2E is per capita CO_2 emission.

The standard form of EKC is:

$$E_t = \lambda o + \lambda 1 Yp_t + \lambda 2\ (Yp)^2_t + \mu \quad \text{........................ (3)}$$

Where E represents environmental degradation measured by CO2 emissions per capita (metric tons), Yp represents GDP per capita. Some of the studies (De Bruyn *et al.*, 1998; Binder and Neumayer, 2005) used cubic functions to determine the second threshold level of income for environment; however, this study focuses on quadratic function because of possible one threshold level of income.

By using ARDL model to examine the relationship between environmental degradation (CO_2) and economic growth (GDP) in the presence of control variables, this study estimates the following non linear equation:

$$E_t = \lambda o + \lambda 1 Yp_t + \lambda 2\ (Yp)^2_t + \lambda 3 Z_t + \mu \quad \text{................. (4)}$$

Z represents the set of control variables (such as population density and energy consumption). The validity of EKC is checked by the sign of coefficients $\lambda 1$ and $\lambda 2$. The environmental hypothesis is valid if $\lambda 1 > 0$ and statistically significant and $\lambda 2 < 0$ and statistically significant.

[2]Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States. http://www.indexmundi.com/facts/pakistan/CO2-emissions.

The data for CO_2 emission is taken from the site of Index Mundi[3]. The data on energy consumption and population density (people per sq. km of land area) and GDP per capita PPP (current international $) are taken from the World Development Indicators (World Bank, 2012). Following Alstine *et al.* (2010) and Bernard *et al.* (2011), the threshold level of per capita income can be calculated as:

$$Yp^* = \exp(-\lambda 1/2\lambda 2) \quad \ldots\ldots\ldots\ldots (5)$$

However, for the calculation of turning point the necessary condition is that $\lambda 1 > 0$ and $\lambda 2 < 0$ and both coefficient are statistically significant.

In order to examine the environmental Kuznet hypothesis, this study use Autoregressive Distributive Lag Model (ARDL) established by (Pesaran and Pesaran, 1997; Pesaran and Smith, 2001). Most of literature on EKC concentrated on ordinary least square methods and avoid time series econometric techniques. The results of EKC can be challenged in the presence of non stationary data. As indicated by Wagner (2008), the series of per capita gross domestic product (GDP) and per capita carbon dioxide (CO_2) emissions are often non-stationary, and this problem has not been sufficiently addressed in the EKC literature. Hence, this study examines the staionarity of variables under consideration.

4. RESULTS AND DISCUSSION:

Following the methodology of Lipford and Yandle (2010) this study finds out the value of total carbon efficiency and per capita carbon efficiency for Pakistan economy. The results are given in table 4.1:

Table-4.1. Estimates of Carbon Efficiency for Pakistan[4]

Total Carbon Efficiency	Per Capita Carbon Efficiency
35.94	0.0002

The values of total carbon efficiency and Per Capita Carbon Efficiency of Pakistan is relatively low as compare to other developing and developed countries like China and India, Brazil, Japan, Russia, South Africa, Mexico and United States (2173.27 and 532.92, 48.29, 51.27, 107.01, 136.27, 136.40 and 204.34 respectively), however, it is higher from other developed countries like Germany, France, Italy, United Kingdom and Canada (-2.69, 2.47, 11.92, 17.36, 21.28 respectively). Pakistan is relatively moderate pollutant country as compare to other countries.

[3] Source: Carbon Dioxide Information Analysis Center, Environmental Sciences Division, Oak Ridge National Laboratory, Tennessee, United States. http://www.indexmundi.com/facts/pakistan/CO_2-emissions.

[4] For Comparison of total carbon efficiency and per capita carbon efficiency for Pakistan with other countries, the values of total carbon efficiency and per capita carbon efficiency for China and India, Brazil, Japan, Russia, South Africa, Mexico, United States, Germany, France, Italy, United Kingdom and Canada are taken from Lipford and Yandle (2010).

Table-4.2. Tests for Unit-Roots (With Time Trend and Intercept)

Variables	Level		First difference	
	Augmented Dickey Fuller	Phillips Perron	Augmented Dickey Fuller	Phillips Perron
CO_2	-1.67	-1.88	-4.51*	-5.01*
Yp	-0.75	-0.53	-5.01*	-4.13*
Energy Consumption	-2.12	-1.35	-7.81*	-6.42*
Population Density	-0.49	-1.07	-5.61*	-4.81**

* 1% level of significance, ** 5 % level of significance.

The results of table 5 show that all variables are integrated of order one. The results of table 4.2 enable us to apply any co-integration technique. However, we focus on ARDL econometric technique, as it provides better results in the presence of endogenuity. The advantage of ARDL is well documented in the litertuere (See (Pesaran and Pesaran, 1997; Pesaran and Smith, 2001)).

After knowing the order of integration of different variables, the F-test Statistics is estimated on the basis of Wald -test. The famous Akaike Information Criteria is used to find the optimum order of lag length. The results are reported in table 4.3:

Table-4.3. Lag length Selection

Order Of the lags	Akaike Information Criteria	F-test Statistics
1	151.24	145.15
2	141.08	132.18*

*significant at 1percent level, ** significant at 5percent level

The significant value of F-statistics at optimum lag length of 2 indicates that there is long run relationship among the variables in model 2. After investigating the long run relationship the long run results are estimated by using ARDL. The results are reported in table 4.4.

Table-4.4. Results of EKC Model &Tipping Point of EKC

Dependent Variable CO_2		
Regressors	Model 1 ARDL (1, 1,1,0,1)	Model 2 ARDL (1,1,0,1,1)
Yp	2.48*	2.03*
Yp^2	--	-0.003**
Yp^3	--	--
Energy Consumption	0.38*	0.73**
Population Density	0.71***	0.48***
	R^2 = 0.99 Adjusted R^2 = 0.98 F-statistic = 541.21 Dh Stat: = 2.05	**Tipping Point of EKC=338.34** R^2 = 0.99 Adjusted R^2 = 0.98 F-statistic = 503.27 Dh Stat: = 2.19

Where Yp is GDP per capita, population density is equal to total population divide by total land area.

It is clear from the results of table 7 that the inverted U-shaped relationship between economic growth and environmental degradation is valid in case of Pakistan. The presence of EKC is obvious from the positive significant coefficient of Yp and negative significant coefficient of Yp.

The long run results suggest that population density has positive impact on per capita carbon emission. The coefficient of energy consumption is positive and significant suggests that an increase in energy consumption leads to environmental degradation. Following Bernard *et al.* (2011), this study also finds the turning level of income per capita. The turning point of income per capita in Pakistan economy is US $338.34.

5. CONCLUSION

Enhancement of economic growth and search for better environmental quality has been the primary objectives of the government since past many years. The empirical Studies regarding the relationship between environmental degradation and economic growth have received less attention in Pakistan. In this study, an attempt has been made to examine the linkage among environmental degradation and economic growth in Pakistan over the period 1972-2011. The main concern of this study is to test the environmental Kuznets curve in case of Pakistan. The study used Autoregressive Distributed Lag (ARDL) model to determine the robustness of long-run relationship among environmental degradation and economic growth. The results show that the inverted U-shaped relationship between economic growth and environmental degradation is valid in case of Pakistan. The long run results suggest that population density has positive impact on per capita carbon emission. Moreover, an increase in energy consumption leads to environmental degradation. Following the methodology of Lipford and Yandle (2010) this study finds out the value of total carbon efficiency and per capita carbon efficiency for Pakistan economy. The values of total carbon efficiency (35.94) and Per Capita Carbon Efficiency (0.0002) of Pakistan are relatively low as compare to other developing and developed countries like in the region. The Tipping Point of EKC in case of Pakistan is 338.34.

This study recommends that government should keep into consideration the sustainable economic policies with environmental policies, as environmental sustainability largely based on the economic conditions and economic policies adopted by the countries.

The government should not avoid the harmful consequences of environmental degradation, which is most probably increase in the initial stage of economic development. The government is currently pays little attention to the environment protection measures, which may have adverse consequences on health. However, as a developing county, Pakistan is in the transition stage of development, therefore, large concentration is given on industrial production; however, the government requires huge amounts of investments to get on on the path of economic development from its current situation of backwardness. The government should concentrate on public investment, which is the complimentary of private investment in order to achieve the desirable level of economic growth. Once the government is able to achieve the threshold level of economic growth, further enhancement in economic growth will recover the quality of life and reduces emission of various pollutants.

REFERENCES

Alstine, V., James and E. Neumayer, 2010. The environmental kuznets curve. In: Gallagher, Kevin P. , (ed.) Handbook on trade and the environment. Elgar original reference . Edward Elgar, Cheltenham, UK.

Arrow, K.B., R. Bolin, P. Costanza, C. Dasgupta, C. Folke, B. Holling, S. Jansson, K. Levin, C. Mäler, Perings and D. Pimental, 1995. Economic growth, carrying capacity and the environment. Science, 268: 520-521.

Aslanidis, N. and S. Iranzo, 2009. Environment and development: Is there a kuznets curve for co2 emissions? . Applied Economics, 41(4-6): 803-810.

Aubourg, R.W., G.D. H. and K. Krutilla, 2008. Debt, democratization, and development in latin America: How policy can affect global warming. Journal of Policy Analysis and Management, 27(1): 7-19.

Beckerman, W., 1992. Economic growth and the environment: Whose growth? Whose environment? World Development, 20(4): 481-496.

Bernard, J.T., M. Gavin, L. Khalaf and M. Voia, 2011. The environmental kuznets curve: Tipping points, uncertainty and weak identification, working paper 2011-4. Center for Research on the economics of the Environment, Agri-food, Transports and Energy.

Binder, S. and E. Neumayer, 2005. Environmental pressure group strength and air pollution: An empirical analysis. Ecological Economics, 55(4): 527-538.

Bousquet, A. and P. Favard, 2005. Does s. Kuznets's belief question the environmental kuznets curves? Canadian Journal of Economics/Revue canadienne d'économique, 38(2): 604-614.

Brajer, V., R. W. Mead and F. Xiao, 2008. Health benefits of tunneling through the chinese environmental kuznets curve (ekc). Ecological Economics, 66(4): 674-686.

Carson, T.R., 2010. The environmental kuznets curve: Seeking empirical regularity andtheoretical structure. Review of Environmental Economics and Policy, 4(1): 323.

Cavlovic, T.N., K.H. Baker, R.P. Berrens and K. Gawande, 2000. A meta-analysis of environmental kuznets curve studies. Agricultural and Resource Economics Review, 29(1): 32-42.

Cole, M.A. and E. Neumayer, 2005. Environmental policy and the environmental kuznets curve: Can developing countries escape the detrimental consequences of economic growth? In Press. Dauvergne (Ed.), International Handbook of Environmental Politics. Cheltenham and Northampton: Edward Elgar.

Daly, N.J., 1977. Australia. Urban regions. Atmosphere Pollution by photochemical oxidising agents, Reports, surveys (ANB/¬PRECIS SIN 0180319) Bibliography: 96-99.

Dasgupta, S., B. Laplante, H. Wang and D. Wheeler, 2002. Confronting the environmental kuznets curve. The Journal of Economic Perspectives, 16(1): 147-168.

De Bruyn, S.M., J.C.J.M. van den Bergh and J.B. Opschoor, 1998. Economic growth and emissions: Reconsidering the empirical basis of environmental kuznets curves. Ecological Economics, 25(2): 161-175.

Dinda, S., 2004. Environmental kuznets curve hypothesis: A survey. Ecological Economics, 49(4): 431-455.

Drabo, A., 2010. Environment quality and economic convergence: Extending environmental kuznets curve hypothesis. Economics Bulletin, Access Econ, 30(2): 1617-1632.

Ehrlich, P. and J. Holden, 1971. Impact of population growth. Science 171(3977): 1212-1217.

Frank, R.H. and B.S. Bernanke, 2005. Principles of economics. 3rd Edn.: New York: McGraw-Hill.

Grossman, G.M. and A.B. Krueger, 1991. Environmental impacts of a north american free trade agreement. Papers 158, Princeton, Woodrow Wilson School - Public and International Affairs.

Grossman, G.M. and A.B. Krueger, 1995. Economic growth and the environment. Quarterly Journal of Economics, 110(2): 353-377.

He, J.W., H. , 2012. Economic structure, development policy and environmental quality: An empirical analysis of environmental kuznets curves with chinese municipal data. Ecological Economics, 76:49-59.

Islam, N., J. Vincent and T. Panayotou, 1999. Unveiling the income-environment relationship: An exploration into the determinants of environmental quality. Harvard Institute for International Development, Development Discussion Paper No, 701.

Johansson, P.O. and B. Kriström, 2007. On a clear day you might see an environmental kuznets curve,"environmental & resource economics. European Association of Environmental and Resource Economists, 37(1): 77-90.

Jorgenson, A.K., 2006. Unequal ecological exchange and environmental degradation: A theoretical proposition and cross-national study of deforestation, 1990–2000. Rural Sociology, 71(4): 685-712.

Khan, A. and M. Jaffar, 2002. Lead contamination of air, soil and water in the vicinity of rawal lake, Islamabad. Journal of Applied Sciences, 2(8): 816-819.

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

Lee, C.C., Y.B. Chiu and C.H. Sun, 2009. Deforestation, environmental kuznets curve, and threshold effects: International evidence. Singapore Economic Review Conference.

Lipford, J.W. and B. Yandle, 2010. Environmental kuznets curves, carbon emissions, and public choice. Environment and Development Economics, 15(4): 417-438.

Lopez, R., 1994. The environment as a factor of production: The effects of economic growth and trade liberalization. Journal of Environmental Economics and Management, 27(2): 163-184.

Meadows, D.H., D.L. Meadows, J. Randers and W. Behrens, 1972. The limits to growth. London: Earth Island Limited.

Miah, D., F.H. Masum, M. Koike, S. Akther and N. Muhammed, 2011. Environmental kuznets curve: The case of Bangladesh for waste emission and suspended particulate matter. Environmentalist, 31(1): 59-66.

Nasir, M.R., F. , 2011. Environmental kuznets curve for carbon emissions in Pakistan: An empirical investigation. Energy Policy, 391(3): 1857-1864.

Pesaran, M.H. and B. Pesaran, 1997. Working with microfit 4.0: Interactive econometric analysis. Oxford: Oxford University Press.

Pesaran, S. and Smith, 2001. Bound testing approaches to the analysis of level relationship. Journal of Applied Econometrics, 16(3): 289-326.

Pezzey, J.C.V., 1989. Economic analysis of sustainable growth and sustainable development. Environment Department Working Paper No. 15, The World Bank, Washington DC.

Poudel, B.N., K. P. Paudel and K. Bhattarai., 2009. Searching for an environmental kuznetsm curve in carbon dioxide pollutant in latin American countries. Journal of Agricultural and Applied Economics, 41(1): 13-27.

Roegen, N.G., 1971. The entropy law and the economic process. Cambridge, Harvard University Press.

Rothman, S., 1998. Environmental kuznets Curve – Real progress or passing the buck? A Case for Consumption Based Approaches Global Economics. Ecological Economics, 25:177-194

Selden, T.M. and D. Song, 1994. Environmental quality and development: Is there a kuznets curve for air pollution? Journal of Environmental Economics and Environmental Management, 27(2): 147-162.

Shafik, N., 1994. Economic development and environmental quality: An econometric analysis. Oxford Economic Papers, 46: 757-773.

Shafik, N. and S. Bandyopadhyay, 1992. Economic growth and environmental quality: Time series and cross-country evidence. Background Paper for the World Development Report1992, The World Bank, Washington DC.

Stern, D.I., 2003. The environmental kuznets curve, online encyclopedia of ecological economics.

Stern, D.I., 2004. The rise and fall of the environmental kuznets curve. World Development, 32(8): 1419-1439.

United Nations, U., 2001. Population, environment and development. The Concise Report, New York.

Wagner, M., 2008. The carbon kuznets curve: A cloudy picture emitted by bad econometrics? Resource and Energy Economics, Elsevier, 30(3): 388-408.

World Bank, 2012. World development indicators on CD-ROM, Washington, DC.

World Bank Report, 2010. World development report. New York: Oxford University Press.

Yörük, B.K. and Z. Osman, 2006. The kuznets curve and the effect of international regulations on environme. Economics Bulletin, 17(1):1-7.