Ali, Amjad; Audi, Marc; Roussel, Yannick

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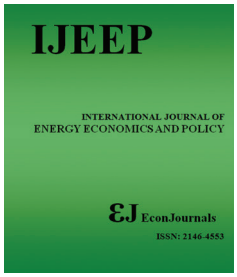

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Natural Resources Depletion, Renewable Energy Consumption and Environmental Degradation: A Comparative Analysis of Developed and Developing World

Amjad Ali[1,2]*, Marc Audi[1], Yannick Roussel[1]

[1]European School of Administration and Management, France, [2]Lahore School of Accountancy and Finance, University of Lahore, City Campus, Lahore, Pakistan. *Email: chanamjadali@yahoo.com

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ABSTRACT

This article investigates the impact of renewable energy consumption and natural resource depletion on environmental degradation from 1990 to 2014. The analysis of this study is distributed into three parts, developing country analysis, developed country analysis and complete sample analysis. An insignificant relation has found between natural resource depletion and environmental degradation in the case of complete sample analysis and developing country analysis, but vica-versa in developed countries. Fossil fuel energy consumption has a positive and significant impact on environmental degradation in developing countries. Renewable energy consumption has negative impact on environmental degradation in the case of complete sample analysis and developed country analysis, but visa-versa in developing countries. Economic growth positively and significantly effecting environmental degradation in all the three cases, this mean for higher economic growth we have to bear some environmental degradation. But it is the need of the hour that we should find some threshold between economic growth and pollutant emissions, so that a healthy environment can be safe for coming generations. So, for a healthy environment, fossil fuel consumption should be reduced and consumption of renewable energy with merchandised trade and urbanization can be encouraged.

Keywords: Environmental Degradation, Natural Resources, Economic Growth, Renewable Energy
JEL Classifications: Q57, Q26, F43, Q20

1. INTRODUCTION

The burning of biomass and combustion of fossil fuels is attached to human activities, generate greenhouse gasses that disturb the global climate and atmosphere. Few last few decades the human activities witnessed different extension which creates the rapid urbanization and high pace of industrialization, this ultimately increase the energy consumption and damage to the environment. Thus, the study of energy consumption, economic growth and environmental degradation become an important topic from all perspectives i.e. energy consumption, economic and environmental policies at national and international levels. There are numerous empirical and theoretical studies which explore the association of energy consumption and pollutant emissions across the world (Selden and Song, 1994; Agras and Chapman, 1999; Ang, 2007; Ang, 2008; Halicioglu, 2009; Apergis and Payne, 2010; Ghosh, 2010; Jayanthakumaran et al., 2012; Akpan and Akpan, 2012; Ozcan, 2013; Lau et al., 2014; Long et al., 2015; Xu and Lin, 2015; Alshehry and Belloumi, 2015; Robaina-Alves et al., 2016; Alam et al., 2016; Zhao et al., 2017; Yeh and Liao, 2017; Zhang et al., 2017; Jebli and Youssef, 2017; Bildirici, 2017; Riti et al., 2017; Mikayilov et al., 2018; Chaudhary and Bisai, 2018; Rauf et al., 2018; Liu and Bae, 2018; Song et al., 2018; Bano et al., 2018). But still no consensus has been developed by these studies. Therefore, the main focus of this article is to find the relationship of natural resources depletion, renewable energy consumption and

environmental degradation, a comparison among the developed and developing countries. To the best of our knowledge, this study is a healthy contribution towards respective literature.

During the present era, natural resource depletion is faster than the resource replenishment (Hook et al., 2010). The availability of a resource decides its value, more depleted resource has higher value. Natural resource depletion has several types i.e. slash-and-burn agricultural practices, mining for fossil fuels and minerals, deforestation, aquifer depletion, soil erosion, pollution or contamination of resources, and overconsumption, excessive or unnecessary use of resources. The measurement of a natural resource depletion is very complex to quantify like a house, car or bread, because there is no suitable unit of measurement which decide how to deal with collective nature of ecosystems and possible extent of duplication (Boyd, 2007). Some social scientists and economists believe that measurement includes the attached benefits of natural resource for public and natural recovery of that resource. But still no unanimous global consensus is available for its measurement. While talking about deforestation, it is considered so extensive for having environmental impact i.e. less biodiversity, rising soil erosion, change in water cycle and emissions of carbon in the atmosphere. So, natural resource depletion is often considered a major contributor of global warming as well.

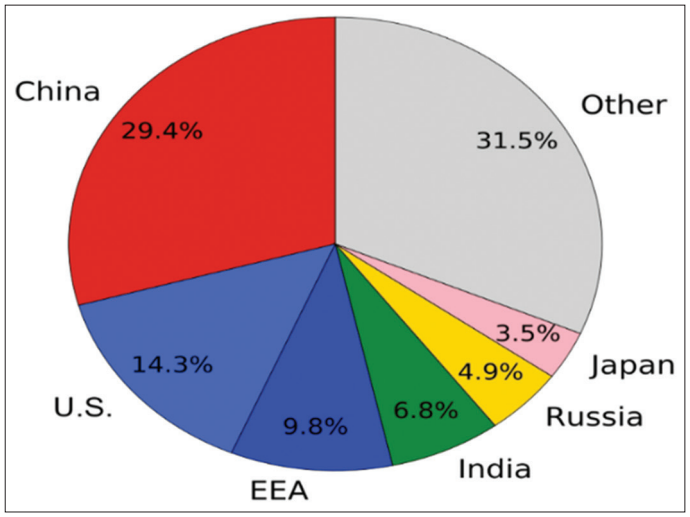
Recently, green economy, green job and green growth have become very famous terms among the environmentalists, economists and other social scientists. The way to a green economy prefers renewable energy resources instead of mineral and depletable energy resources. Pigou (1932) and Coase (1960) mention that over use of environmental goods leads to potential environmental externalities and if imbalance is severe, a solid public policy is required to correct for future generations. It is private ownership and free market forces which increase the negative gap between economic growth and environmental depletion (Hotelling, 1931). During the 20th century, the rising greenhouse gasses among developed and developing nations urge the world to think about it seriously. The Figure 1 shows that major contributors of gasses emissions are developing countries and this share is increasing day by day, in the presence of new international emissions control policies. The creation of the World Health Organization is stepping stone towards the solution of this issue. The rising combustion of energy is considered one the main driving forces towards higher greenhouse gasses emissions.

Till the last decade of the 20th Century greenhouse gasses emissions are rising tremendously throughout the world, although number of international binding agreements are existed to control environmental degradation i.e. Kyoto Protocol etc. The local level pollutants create environmental issues across nations and times, and the behavior of free riders may cause the environment long lasting losses (Arrow et al., 1995), thus environmental degradation is considered a universal phenomenon. But more than 60% population of the world is living in developing countries and these countries have higher poverty, unemployment rate, income inequality and low national output as well. These socioeconomic targets can be achieved with the help of economic activities and energy consumption is the main driving forces of all types of economic activities. Higher output depends upon higher fossil fuel energy consumption and fossil fuel higher energy consumption is attached with higher environmental degradation (Ekpo, 2013). Figure 1 explains that human activities are the prime factor of rising greenhouse gasses in the atmosphere since last 150 years. Solomon et al. (2008) point out that rising human activities are attached with higher energy demand. The energy demand in the production process is an important as other inputs (Kraft and Kraft, 1978; Bhattacharyya, 1995; Heil and Selden, 2001). More than 30% emissions are produced by industrial sector only and most of the developing countries are under the conditions of limited energy supply. The limited supply of fossil fuel energy consumption with limited use of renewable energy consumption create environmental pollution and the growing concern about global warming, attract the interest of policy makers towards environmental degradation (Figure 2).

2. LITERATURE REVIEW

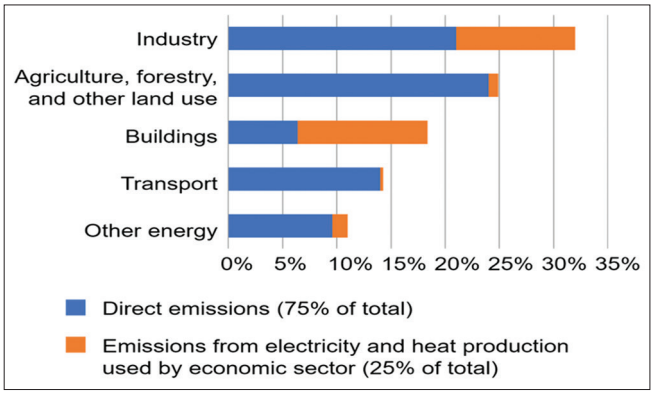
Greenhouse gasses are creating an adverse impact on the quality of ecosystem in general and human life specific. So, it becomes necessary to examine the main roots of environmental

Figure 1: Major contributors of emissions



Source: Paris Agreement - Status of Ratification, 2019

Figure 2: Greenhouse gas emissions by economic sector



Source: Paris Agreement - Status of Ratification, 2019

degradation and prepare some suitable remedies. Following the volume of carbon emission in ecosystem, previous literature considers it, as main indicators to aggregate greenhouse gasses. To date, extensive body of literature is available which examine the connection of economic growth, energy consumption and pollutant emission, but here in literature review purpose, we have selected recent and most relevant studies. Friedl and Getzner (2003) investigate the connection of economic development and carbon dioxide emissions in the case of small opened and industrial country i.e. Austria, data from 1960 to 1999 has been used for empirical analysis. A cubic relationship has been found between economic development and CO_2 emissions. The findings indicate that emission projections of single country support the policy changes under the Kyoto Protocol. Ang (2007) explores the causality among total output, consumption of energy and pollutant emissions in France from 1960 to 2000. The outcomes present the evidence of the long run relationship amon the pollutant emissions, consumption of energy and output in France. The outcomes of causality support the idea that it is level of economic growth which causes energy use and growth of pollutant emission over the long run in France. In another study, Halicioglu (2009) focuses on dynamic causal link of pollutant emission, consumption of energy, level of income and international trade in Turkey from 1960 to 2005. The findings of this study are consistent with the findings of Ang (2007).

Ozturk and Acaravci (2010) explore the causality among the employment ratio, consumption of energy, pollutant emission and level of economic growth in Turkey over the time period 1968-2005. For this purpose, autoregressive-distributed-lag-bounds testing approach of co-integration and Granger-causality-test has been used. The empirical outcomes highlight long-run association is existed among the selected indicator in Turkey. The findings of this study show that environmental Kuznets do not exist in Turkey over the selected time period. The overall outcomes display that policies of energy conservation, i.e. rationing for consumption of energy and control over the emissions of carbon; put negative impact over growth of real output in Turkey.

Al-Mulali and Sab (2012) analyses the impact of pollutant emission and consumption of energy on financial development and GDP in 30 Sub-Saharan nations over the period of 1980 to 2008. The results highlight that consumption of energy has vital contribution in the level of growth and financial development. The results recommend that African economies should focus on productivity of energy by raising its efficiency, encourage projects of energy conservation and savings and utilize outsourcing of energy infrastructure.

Arouri et al. (2012) investigate association among real GDP, consumption of energy, and pollutant emission, a sample of 12 MENA has been selected over the period 1981to 2005. For this purpose, advance bootstrap panel stationarity tests and co-integration have been used. The results of this study show that consumption of energy has positive long-run impact on pollutant emission and real GDP has nonlinear influence on pollutant emission.

Camarero et al. (2013) examine the level of environmental degradation convergence among the OECD nations from 1960 to 2018. The methodology developed by Phillips and Sul (2007) has been used for this purpose. The outcomes of the study reveal that with the passage of time there is evidence of convergence of environmental degradation among the OECD nations as like the level of development among these countries.

Dogan and Seker (2016) explore the link among real income, non-renewable and renewable consumption of energy and openness of trade on pollutant emission. Environmental Kuznets curve model has been tested for some selected European nation from 1980 to 2012, advance panel methods have been applied for empirical analysis. The outcomes of the analysis reveal that liberalization of trade and energy production by renewable resources diminish emissions of carbon in environment, whereas non-renewable energy has vice-versa impact. The findings of this study show a bidirectional causal relationship between pollutant emission and consumption of renewable and unidirectional causal relationship from real income to pollutant emission, from pollutant emission to nonrenewable energy, and from liberalization trade to pollutant emission.

3. THE MODEL

The link between renewable resources and environmental conditions is attached to Ricardian rent theory, as the prices of scare renewable resources are higher that the less cost depletable resources (Ricardo, 1891). Lower level of environmental degradation is attached to a higher living standard, so every nation is trying to improve environmental conditions with less carbon emissions. This study is examining the effect of natural resources depletion and consumption of renewable energy on degradation of environment from 1990 to 2014. The World Development Indicator and some national sources have been used for data collection. Based on a detailed review of literature, our model follows Govindaraju and Tang (2013), Shahbaz et al. (2013), Ali and Audi (2016) and Audi and Ali (2018), our model functional form becomes as:

$$CO2_{it} = F(\mathrm{NRD}_{it}, \mathrm{FEC}_{it}, \mathrm{RNC}_{it}, \mathrm{ECOG}_{it}, \mathrm{URB}_{it}, \mathrm{TRADE}_{it}) \quad (1)$$

Here

CO_2 = Environmental degradation
NRD = Natural resource depletion
FEC = Fossil fuel energy consumption
RNC = Renewable energy consumption
ECOG = Economic growth
URB = Urbanization
TRADE = Merchandise trade
I = i^{th} country (1, 2, 3,… 66)
t = time period (1990 to 2014).

4. DISCUSSION OF RESULTS

This section is comprised of estimated results and discussion, this study uses Panel Least Square method for examining the effect of

natural resource depletion, and consumption of renewable energy on environmental degradation among selected developed and developing countries. This study distributes its analysis into three parts, complete sample analysis, developed country analysis and developing country analysis. The results of descriptive statistic of all three cases are presented in appendixes Table A-E. The descriptive statistic of complete sample analysis shows that selected variables have mean value between 2.745632 and 74.36373 and median and Maximum value range 0.828648-81.22369 and 220.4074-0.00000 respectively. The data are positive Skewed except consumption of energy through fossil fuel and economic growth, all indicators have Kurtosis value in positive. The descriptive statistic of developed country analysis shows that selected variables have mean value between 0.662743-78.45416 and median and Maximum value range 0.168449-81.92648 and 208.1709-0.00000 respectively. The data are positive Skewed except consumption of energy through fossil fuel and economic growth, all indicators have Kurtosis value in positive. The descriptive statistic of developing country analysis shows that selected variables have mean value between 3.927667 and 71.33698 and median and Maximum value range 1.996871-79.61963 and 220.4074-0.00000 respectively. The data are positive Skewed except consumption of energy through fossil fuel and economic growth, all indicators have Kurtosis value in positive. The descriptive statistic results of all three cases reveal that our selected data fulfill all the requirements of the Panel Least Square.

The outcomes of the correlation matrix of all three cases have been given in appendixes Table B, Table D, and Table F. The outcomes in Table B of complete sample analysis reveal that natural resource depletion has inverse and insignificant correlation with degradation of environment. The estimated results show a positive and significant correlation between fossil fuel energy consumption and degradation of environment. Renewable consumption of energy, urbanization and merchandise trade have significant inverse correlation with degradation of environment. Economic growth has positive and insignificant correlation with degradation of environment in case of complete sample analysis. Fossil fuel energy consumption, economic growth and urbanization are positively and significantly correlation to natural resources depletion; renewable energy consumption has positive and insignificant correlation with natural resources depletion; merchandise trade has negative and insignificant correlation with natural resource depletion. Consumption of energy through fossil fuel and consumption of energy through renewable sources have negative and significant correlation; economic growth and urbanization have positive, but insignificantly correlated to consumption of energy through fossil fuel; merchandise trade is positively and significantly correlated to fossil fuel energy consumption. Economic growth is positively and significantly correlated to renewable energy consumption; urbanization has positive but insignificant correlation with renewable energy consumption; merchandise trade has negative and significant correlation with renewable energy consumption. The results explain that urbanization and merchandise trade are positively and significantly correlated to economic growth; urbanization is also positively and significantly correlated to merchandise trade.

The results of the correlation matrix of developed country analysis have been given in appendix Table D. The results show that natural resource depletion, consumption of energy by renewable resources, urbanization and merchandise trade are negatively and significantly correlated to environmental degradation; while fossil fuel energy consumption has positive and significant correlation with environmental degradation in developed countries. Fossil fuel energy consumption, urbanization and merchandise trade have negative and significant correlation with natural resources depletion; renewable energy consumption has positive significant correlation with natural resources depletion whereas economic growth has positive and insignificant correlation with natural resource depletion. Renewable energy consumption has significant and positive correlation with fossil fuel energy consumption; economic growth and urbanization are positively and significantly correlated to fossil fuel energy consumption; whereas fossil fuel energy consumption is negatively and insignificantly correlated to merchandise trade. Economic growth and merchandise trade are negatively and insignificantly correlated to renewable energy consumption; urbanization is positively and significantly correlated to renewable energy consumption. The estimated outcomes show that urbanization and merchandise trade are positively and significantly correlated to economic growth; urbanization and economic growth in the case of developed countries.

The results of the correlation matrix of developing country analysis have been given in appendix Table F. Natural resources depletion, fossil fuel energy consumption and economic growth have positive and significant correlation with environmental degradation; renewable energy consumption, urbanization and merchandise trade have negative and significant correlation with environmental degradation. Fossil fuel energy consumption, economic growth and urbanization have positive and significant correlation with natural resource depletion; renewable energy consumption has negative and significant correlation with natural resources depletion; whereas merchandise trade has positive and insignificant correlation with natural resource depletion. Fossil fuel energy consumption has negative and significant correlation with renewable energy consumption; economic growth and merchandise trade have positive and significant correlation with fossil fuel energy consumption; urbanization has positive and insignificant correlation with fossil fuel energy consumption. Economic growth and urbanization have insignificant negative correlation with renewable energy consumption; merchandise trade has negative and significant correlation with renewable energy consumption. Urbanization has positive but insignificant correlation with economic growth; merchandise trade has positive and significant correlation with economic growth. Urbanization has positive and significant correlation with merchandise trade in the case of development.

The comparative analysis of correlation matrices of complete analysis, developed country analysis and developing country analysis show that natural resources depletion has negative but insignificant correlation with environmental degradation incomplete sample analysis; Natural resource depletion has negative and significant correlation with environmental degradation in developed country analysis; whereas natural

resources depletion has positive and significant correlation with environmental degradation in developing countries. Fossil fuel energy consumption has positive and significant correlation with environmental degradation in all the three cases. Renewable energy consumption has negative and significant correlation with environmental degradation in all the three cases. Economic growth has insignificant correlation with environmental degradation in the case of complete sample analysis and developed country analysis; whereas there is positive and significant correlation between environmental degradation and economic growth in the case of developing countries. The estimated results show that urbanization and merchandise trade have negative and significant correlation with environmental degradation in the complete sample analysis, developed country analysis and developing country analysis. The overall correlation matrix shows that mostly selected variables have significant correlation with environmental degradation in the three cases over the selected time period.

The estimated Panel Least Square of complete sample analysis has been given in the Table 1. Natural resource depletion has an insignificant impact on environmental degradation in case of complete sample. Fossil fuel energy consumption has a positive impact on environmental degradation in the case of complete sample analysis. Fossil fuel is the easiest and cheapest method of energy production, but it is attached with higher amount of greenhouse gases (Ulgiati and Pimentel, 1997; Youngquist, 1997; Pimentel and Kounang, 1998; Croysdale, 2001; Pimentel et al., 2001; Fuel's Gold, 2002; Lieberman, 2002; Hodge, 2002). So, a 1% increase in fossil fuel energy consumption in the world increases environmental degradation (0.014351) percent in the world. Renewable energy consumption has a negative and significant impact on environmental degradation. Renewable energy resources and their use has become very vital for lower environmental degradation. The advancement and development of renewable energy resources are considered environment friendly, less costs and long lasting (Dincer and Rosen, 1998; Dincer and Dost, 1996; Norton, 1991). Our study finds that 1% increase in renewable energy consumption reduces environmental degradation by (0.027552) percent. Economic growth has positive and significant impact on environmental degradation. Kraft and Kraft (1978) mention that in the starting stages of economic development, there is a direct positive relationship between environmental degradation and economic growth. Our results show that 1% increase in economic growth increases environmental degradation by (0.027885). Urbanization has a positive and significant impact on environmental degradation. Following the theory of urban population, urban population is attached to higher education and better life conditions. Moreover, urban population cares healthier environment as compare to rural population. So, urbanization has negative impact on environmental degradation, our study finds that 1% increase urbanization decreases environmental degradation by (0.066083) percent. Merchandise trade has a negative and significant impact on environmental degradation. Following trade theory, the importing countries prefer the quality of product, unhealthy production process reduces the benefits of exporting countries. So, for getting the higher benefits from exports, the exporting countries use healthier and environment friendly methods of production, which lower the overall environmental degradation in societies. Our results show that 1% increase in merchandise trade, decreases environmental degradation by (0.014573) percent.

Table 1: Panel least square; dependent variables: CO_2

Variables	Whole sample	Developed countries	Developing countries
NRD	0.002917	0.161392***	0.003471
FEC	0.014351***	−0.012986***	0.065496***
RNC	−0.027552***	−0.061456***	0.022768***
ECOG	0.027885***	0.022032**	0.020619***
URB	−0.066083***	−0.048953***	−0.070439***
TRADE	−0.014573***	−0.018665***	−0.008835***
C	13.55205***	16.09054***	8.125993***

***,**,*Present significance level 1%, 5% and 10% respectively

The estimated results of the developed country analysis have been presented in Table 1. Natural resource depletion has a positive and significant impact on environmental degradation. Natural resources are the main source of maintaining the eco-system, so an increase in natural resources depletion, changes the share of greenhouse gases in the ecosystem. An immediate impact of higher natural resource depletion will increase the environmental degradation, our study finds that 1% increase natural resource depletion, increases environmental degradation by (0.161392) percent. Fossil fuel energy consumption has a negative and significant impact on environmental degradation in the case of developed countries. This shows that developed countries are in the position of Kuznet environmental degradation inverted U-shaped relationship between fossil fuel energy consumption and environmental degradation. Our results reveal that 1% increase in fossil fuel, decreases environmental degradation by (0.012986) percent in the case of developed countries. Renewable energy consumption has a negative and significant impact on environmental degradation in the case of developed countries. Renewable energy sources are one of the main growing sources of energy production and it is considered environmentally friendly. Our study finds that 1% increase in renewable energy consumption brings (0.061456) percent decrease in environmental degradation in the case of developed countries. Economic growth has positive and significant impact on environmental degradation in developed countries. The estimated results show that 1% increase in economic development increases environmental degradation by (0.022032) percent. This shows that for higher economic growth specific amount of environmental degradation has to be faced. Urbanization has a negative and significant impact on environmental degradation in developed countries. Following the World Urbanization Prospects (2011), the urban population in developed countries cares more their surroundings and environment. All the developed countries have more than 80% urban population, this is the main reason that rising urbanization reduces the environmental degradation. Our study finds that 1% increase in urbanization decreases environmental degradation by (0.048953) percent. Merchandise trade has a negative and significant impact on environmental degradation. After the emergence of World Trade Organization, all the trading goods must be banned which production process is not environment friendly. So, rising trade discourages trade of unfriendly trading goods, this further reduces the environmental degradation in developed countries. Our findings show that

1% increase in merchandise trade decreases environmental degradation by (0.018665) percent.

The estimated Panel Least Square of developing country analysis has been given in the Table 1. Our estimates show that natural resource depletion has a positive, but insignificant impact on environmental degradation in developing countries. Fossil fuel energy consumption has a positive and significant impact on environmental degradation in developing countries. The estimated results show that 1% increase in fossil fuel energy consumption increases environmental degradation by (0.065496) percent. Renewable energy consumption has a positive and significant impact on environmental degradation. Renewable energy resources are getting much attention in the process of energy production, but unlike the developed countries, renewable energy consumption has a positive impact on environmental degradation. This shows that renewable energy consumption in developing countries is not as efficient as like in developed countries, so it is enhancing environmental degradation in developing countries. Our results show that 1% increase renewable energy consumption, increase environmental degradation by (0.020619) percent in the case of developing countries. Developing countries are in the early stage of economic development, so there is a positive and significant impact of economic growth on environmental degradation in the case of developing countries. Our results show that 1% increase in economic growth, (0.020619) percent increase has been occurred in environmental degradation in the case of developing countries. Like the developed countries, urbanization has a negative and significant impact on environmental degradation in developing countries. Our study finds that 1% increase in urbanization, (0.070439) percent decrease in environmental degradation has been occurring in the case of developing countries. Merchandised trade has a negative and significant impact on environmental degradation in developing countries, this effect is same like in developed countries. Our findings show that 1% increase in merchandised trade, (0.008835) percent decrease is occurring in environmental degradation in the case of developing countries. The overall results show that fossil fuel consumption and renewable energy consumption are positively contributing in environmental degradation, whereas urbanization and merchandised trade have a negative impact on environmental degradation.

Panel causality results of the all three cases have been given in Table 2. The results show that unidirectional causality is running from natural resources depletion to environmental degradation in the case of complete sample analysis and developed country analysis. Whereas there is no causal relationship between natural resources depletion and environmental degradation in the case of developing country analysis. Unidirectional causality is running from fossil fuel consumption to environmental degradation in the case of complete sample analysis and developing country analysis. Bidirectional causality is running between fossil fuel energy consumption and environmental degradation in the case of developed country analysis. Bidirectional causality is running between renewable energy consumption and environmental degradation in the case of complete analysis and developed country analysis. But unidirectional causality is running from renewable energy consumption to environmental degradation in the case of developing countries. Unidirectional causality is running

Table 2: Panel pairwise granger causality tests

Complete Sample	Developed Countries	Developing Countries
NRD→CO_2	NRD→CO_2	NRD→CO_2
FEC→CO_2	FEC→CO_2	FEC→CO_2
RNC→CO_2	RNC→CO_2	RNC→CO_2
ECOG→CO_2	ECOG→CO_2	ECOG→CO_2
URB→CO_2	URB→CO_2	URB→CO_2
TRADE→CO_2	TRADE→CO_2	CO_2→TRADE
FEC→NRD	FEC→NRD	FEC→NRD
RNC→NRD	RNC→NRD	RNC→NRD
ECOG→NRD	NRD→ECOG	ECOG→NRD
URB→NRD	URB→NRD	URB→NRD
TRADE→NRD	TRADE→NRD	TRADE→NRD
RNC→FEC	RNC→FEC	RNC→FEC
ECOG→FEC	ECOG→FEC	ECOG→FEC
URB→FEC	URB→FEC	URB→FEC
FEC→TRADE	FEC→TRADE	FEC→TRADE
ECOG→RNC	ECOG→RNC	ECOG→RNC
URB→RNC	URB→RNC	URB→RNC
TRADE→RNC	RNC→TRADE	TRADE→RNC
URB→ECOG	URB→ECOG	URB→ECOG
TRADE→ECOG	TRADE→ECOG	TRADE→ECOG
URB→TRADE	URB→TRADE	URB→TRADE

→: Bidirectional causaity, →: Unidirectional causality, →=No causality

from economic growth to environmental degradation in the case of complete sample analysis and developing country analysis, whereas bidirectional causality is running between economic growth and environmental degradation in the case of developed country analysis. Unidirectional causality is running from urbanization to environmental degradation in the case of complete sample analysis and developing country analysis, but bidirectional causality is running between urbanization and environmental degradation in the case of developed countries. Unidirectional causality is running from merchandised trade to environmental degradation in all the three case i.e. complete sample analysis, developed country analysis and developing country analysis.

There is no causal relationship between fossil fuel consumption and natural resource depletion in the case of complete sample analysis and developing country analysis, but bidirectional causality is running between these two in the case of developed country analysis. No causality is existed between renewable energy consumption and natural resources depletion in the case of compete sample analysis, but bidirectional causality is running between these two in the case of developed countries analysis whereas unidirectional causality is running from renewable energy consumption to natural resources depletion in the case of developing countries analysis. There is no causal relationship between economic growth and natural resource depletion in the case of complete sample analysis and developing country analysis, but unidirectional causality is running from natural resources depletion to economic growth in the case of developed country analysis. No causality is running between urbanization and natural resource depletion in the case of complete sample analysis and developing country analysis, but these two have bidirectional causality in the case of developed country analysis. Unidirectional causality is running from natural resources depletion to merchandised trade in the case of complete sample, bidirectional causality is existed between these two in the

case of developed country analysis, no causal relationship between merchandised trade and natural resource depletion in the case of developing countries. Bidirectional causality is running between renewable energy consumption and fossil fuel energy consumption in all the three types of analysis. Bidirectional causality is running between economic growth and fossil fuel energy consumption in the case of complete sample analysis and developed country analysis, but unidirectional causality is running from economic growth in fossil fuel energy consumption in the case of developing country analysis.

No causality is running between urbanization and fossil fuel energy consumption in the case of complete sample analysis and developing country analysis, whereas bidirectional causality is running between these two in the case of developed country analysis. Unidirectional causality is running from merchandised trade to fossil fuel energy consumption in the case of complete sample analysis and developed country analysis, but there is no causal relationship existed between these two in the case of developing country analysis. Bidirectional causality is running between economic growth and renewable energy consumption in the case of complete sample analysis and developed country analysis, whereas unidirectional causality is running from economic growth to renewable energy consumption in the case of developing countries. No causality is existed between urbanization and renewable energy consumption in the case of complete sample analysis and developing country analysis, but bidirectional causality is running between these two in the case of developed country analysis. No causality is running between merchandised trade and renewable energy consumption in the case of complete sample analysis and developing country analysis, but unidirectional causality is running from merchandised trade to renewable energy consumption in the case of developed country analysis. Bidirectional causality is running between urbanization and economic growth in all the three types of analysis. Unidirectional causality is running from economic growth to merchandised trade in the case of complete sample analysis and developing country analysis, but bidirectional causality has existed between these two in the case of developed country analysis. No causality is existed between urbanization and merchandised trade in the case of complete sample analysis and developing country analysis, whereas bidirectional causality has existed between these two in the case of developed country analysis.

Overall causality results show that most of the variables have a unidirectional causal relationship with environmental degradation in the case of complete sample analysis and developing country analysis, whereas most of the variables have a bidirectional causal relationship with environmental degradation in the case of developed country analysis. This reveals that selected variables have strong predicating power to explain environmental degradation in the case of developed and developing countries.

5. CONCLUSIONS AND POLICY IMPLICATIONS

This paper has examined the impact of renewable consumption of energy and natural resources depletion on environmental degradation from 1990 to 2014. This study uses environmental degradation as dependent variable, whereas economic growth, natural resources depletion, fossil fuel consumption of energy, renewable energy consumption, urbanization and merchandise trade has been used as explanatory variables. This study has used 66 developed and developing countries for empirical analysis, among them, 38 are developing countries and 28 are developed countries, the selection is based International Monetary Fund's World Economic Outlook Database and list of countries is given in the appendix. The analysis of this study is distributed into three parts, developing country analysis, developed country analysis and complete sample analysis.

The study finds insignificant impact of natural resource depletion in the case of complete sample analysis and developing country analysis. Natural resource depletion is increasing environmental degradation in the case of developed countries, so for better environmental conditions, the developed nations should reduce natural resource depletion. Moreover, the developing countries natural resource depletion are done by developed countries, so developing countries have an insignificant relationship between natural resources depletion and environmental degradation (Lieberman, 2002; Hodge, 2002). Fossil fuel consumption of energy has a significant and positive effect on environmental degradation in the complete sample analysis and developing country analysis. So, for the improvement of environmental conditions in developing countries should reduce fossil fuel consumption, but there may be other factors which increase environment degradation in developed countries, as there is an inverse relationship between environmental degradation and fossil fuel consumption of energy. The renewable consumption of energy has negative influence on environmental degradation in the case of complete sample analysis and developed country analysis. This show that developed countries should enhance energy production with the help of renewable resources as these sources are environmentally friendly and less costly.

The developing countries have a positive association amid renewable consumption of energy consumption and environmental degradation, this shows that developing country's renewable energy production is less efficient, so it is increasing environmental degradation. This means that developing countries should use, efficient methods of renewable energy consumption method as like the developed countries, so that environmental degradation can be reduced.

Economic growth has a positive and significant effect on degradation of the environment in all the three types of analysis, this mean for higher economic growth we have to bear some environmental degradation. But it is the need of the hour that we should find some threshold between economic growth and environmental degradation, so that a healthy environment can be safe for coming generations. Urbanization and merchandise trade have a negative and significant effect on the environment. So, for a healthy environment, economies should promote urbanization and free trade among countries.

The results of causality test reveal that most of the selected explanatory variables have a significant effect on environmental

degradation. So, for a healthy environment, fossil fuel consumption should be reduced and renewable energy consumption with urbanization and merchandised trade can be encouraged.

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APPENDIXES

Table A: Descriptive statistic of complete sample

	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
Mean	11.35301	2.745632	74.36373	23.17951	3.157721	25.71431	70.53699
Median	11.12274	0.828648	81.22369	15.26307	3.414654	23.65385	63.43954
Maximum	16.14687	43.65421	100.0000	94.98880	34.50000	74.56980	220.4074
Minimum	6.562064	0.000000	3.780881	0.000000	−34.80864	2.867021	13.75305
SD	1.688643	5.052347	21.82053	22.86331	4.839223	13.02636	34.43644
Skewness	0.066495	3.719332	−1.079306	1.229378	−1.123729	0.568445	1.151944
Kurtosis	3.031526	19.95435	3.421963	3.699989	18.13292	3.241124	4.658931
Jarque-Bera	1.283476	23566.38	331.7829	449.3133	16091.38	92.85771	554.1217
Sum	18721.11	4530.293	122402.7	38246.19	5210.239	42428.61	116386.0
Sum Sq. Dev.	4699.296	42092.72	783243.0	861983.1	38616.41	279812.5	1955497
Observations	1649	1650	1646	1650	1650	1650	1650

Table B: Correlation matrix of complete sample

Variables	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
LCO_2	1.000000						
NRD	−0.030261	1.000000					
FEC	0.465343***	0.068002***	1.000000				
RNC	−0.479868***	0.029212	−0.905958***	1.000000			
ECOG	0.013751	0.143885***	0.026408	0.049562**	1.000000		
URB	−0.564737***	0.109122***	0.029510	0.026688	0.070928**	1.000000	
TRADE	−0.284119***	−0.009299	0.152551***	−0.234920***	0.060638***	0.213674***	1.000000

***,**,*Present significance level 1%, 5% and 10% respectively.

Table C: Descriptive statistic of developed countries

	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
Mean	11.72516	0.662743	78.45416	15.08113	2.112794	24.08287	74.70251
Median	11.21516	0.168449	81.92648	9.013570	2.395094	22.66940	67.65734
Maximum	15.57160	10.06595	98.52626	61.37896	11.44974	53.04243	208.1709
Minimum	8.923993	0.000000	29.77475	0.608264	−13.99821	5.412514	16.01388
SD	1.380310	1.383562	15.86426	13.46952	3.109870	11.87727	34.68962
Skewness	0.676691	4.078147	−1.073002	1.422437	−1.082657	0.393413	1.019593
Kurtosis	3.155462	22.20307	3.451572	4.915821	6.790323	2.352440	3.909653
Jarque-Bera	54.12785	12695.75	140.2698	343.1072	555.7748	30.28753	145.4177
Sum	8207.611	463.9199	54917.91	10556.79	1478.956	16858.01	52291.75
Sum Sq. Dev.	1331.774	1338.056	175920.6	126818.2	6760.231	98607.69	841155.7
Observations	700	700	700	700	700	700	700

Table D: Correlation matrix of developed countries

Variables	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
LCO_2	1.000000						
NRD	−0.076659**	1.000000					
FEC	0.236281***	−0.121049***	1.000000				
RNC	−0.458658***	0.511049***	−0.705458***	1.000000			
ECOG	−0.034954	0.012424	0.068933*	−0.021170	1.000000		
URB	−0.585457***	−0.068220*	0.084280**	0.140012***	0.079084**	1.000000	
TRADE	−0.503436***	−0.043973	−0.030118	−0.027952	0.118733***	0.129119***	1.000000

***,**,*Present significance level 1%, 5% and 10% respectively

Table E: Descriptive statistic of developing countries

	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
Mean	11.08131	4.280393	71.33698	29.14674	3.927667	26.91641	67.46766
Median	11.03136	1.996871	79.61963	20.67226	4.465166	24.88514	59.44135
Maximum	16.14687	43.65421	100.0000	94.98880	34.50000	74.56980	220.4074
Minimum	6.562064	0.011899	3.780881	0.000000	−34.80864	2.867021	13.75305
SD	1.838072	6.114472	24.92197	26.28026	5.671801	13.69427	33.94109
Skewness	0.069214	2.910549	−0.841241	0.773166	−1.364520	0.596533	1.276772
Kurtosis	2.650774	12.83265	2.670846	2.476796	16.74007	3.419692	5.390610
Jarque−Bera	5.586034	5168.243	115.8490	105.4850	7767.727	63.31535	484.3261
Sum	10527.25	4066.373	67484.78	27689.40	3731.283	25570.59	64094.27
Sum Sq. Dev.	3206.206	35480.05	586943.7	655428.8	30528.69	177968.9	1093246.
Observations	950	950	946	950	950	950	950

Table F: Correlation matrix of developing countries

Variables	LCO_2	NRD	FEC	RNC	ECOG	URB	TRADE
LCO_2	1.000000						
NRD	0.056704*	1.000000					
FEC	0.525524***	0.169668***	1.000000				
RNC	−0.457281***	−0.142218***	−0.965798***	1.000000			
ECOG	0.077338**	0.095036***	0.055485*	−0.005238	1.000000		
URB	−0.548379***	0.110936***	0.031260	−0.052422	0.044887	1.000000	
TRADE	−0.208439***	0.048308	0.223631***	−0.299810***	0.071114**	0.293726***	1.000000

***,**,*Present significance level 1%, 5% and 10% respectively.

List of Selected Countries

Argentina, Australia, Austria, Azerbaijan, Bangladesh, Belarus, Belgium, Benin, Brazil, Bulgaria, Cambodia, Cameroon, Canada, Chile, China, Colombia, Costa Rica, Cote d'Ivoire, Croatia, Denmark, Ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Hungary, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kuwait, Macedonia, Malaysia, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Oman, Pakistan, Peru, Philippine, Poland, Portugal, Romania, Russian Federation, Saudi Arabia, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Thailand, Tunisia, Turkey, Ukraine, United Kingdom, United States.