

Environmental Degradation in Developed and Developing Countries from the Stand Point of Financial Development and Institutional Quality

Muzian Batool¹, Muhammad Jamil²

Abstract

Environmental pollutants has become a dreadful problem and burning issues for the present world irrespective of a country who is responsible for it. The objective of the study is to investigate the socioeconomic determinants of environmental degradation. The empirical analysis is based on panel data for developing and developed countries over the time of 1996-2016. The aim of the study is to fill the gap in the literature by examining the impact of not only economic growth on environmental degradation but also the effect of financial development and institutional quality on environmental degradation. Given the pace of economic growth in developing and developed countries, it's become crucial for the policy makers to understand the relationship between economic growth and environmental pollutants. In this study index of financial development is a combination of various indicators. Its split into two categories i.e. financial market which mainly focused on stock and debt market and financial institutions which consist of the banking sector, mutual and pension funds and insurance companies. Each indicator has further divided into three indices based on financial depth, financial access, and financial efficiency. For the empirical analysis fixed effect and the random effect is carried out. Our study confirmed the importance of institutional quality and financial development and show a significant relationship with CO₂ emission in the context of developed and developing countries.

Keywords: CO₂ emissions, financial development index, institutional quality, economic growth

1. Introduction

Environmental degradation has become a dreadful problem and burning issues for the present world irrespective of a country who is responsible for it. Environmental degradation is a global issue and all countries are facing serious threats from environmental deterioration. Environmental degradation can be defined as exhaustion of natural resources such as land, water, and air. It's the change towards the ecosystem which is undesirable for environmental health. Increasing human activities, the use of fossil fuels in the part of industrial production and energy consumption has raised the anthropogenic impacts and uplift the global temperature and put maximum pressures on earth resources in direct and indirect ways. The environmental degradation is connected with the ineffective and worse quality of institutes which are caused by the weak implementation process of these regulations. Economist, social scientist and policymakers have shown extensive interest in

¹ Muzian Batool is student of MPhil Economics at School of Economics, Quaid-i-Azam University, Islamabad. Contact: batoolmuzian@gmail.com

² Dr. Muhammad Jamil is working as Assistant Professor at School of Economics, Quaid-i-Azam University, Islamabad. Contact: mjamil@qau.edu.pk, +92-51-90643229.

the relationship between the quality of institutional and environmental degradation. The system of government that has a significant and direct impact on the quality of the environment is the control of corruption rule of law, government productivity, voice and accountability, and political constancy. The presence of rule of law minimizes the effect of market failure. The quality of the political institution is helpful in productive cooperation so it's an essential element in term of CO₂ emissions.

The emission of carbon in the environment depends upon a number of factors which are responsible for the environmental pollution likewise energy consumption, openness to trade, education level, urban population, foreign direct investment, growth in GDP, industrialization, and population growth rate. According to North (1990) through the structure of incentives, the good quality of institutions enhances the productivity of inputs. More progress and development will lead to a hazardous impact on the environment. Financial development performs a dynamic role in the utilization and mobilization of savings, control of resources toward productive sectors and facilitation of transactions. Through different channels, financial development could have an impact on the environment: (1) by providing the necessary capital to the industrial sectors and others firms it causes an increase in environmental pollutants, (2) by providing better access to the environment-friendly technology the financial mediators will reduce environmental hazards at less financial cost.

The economic development has increased the income level of the individual at the cost of a clean environment. Environmentalists explain that the Environmental Kuznets Curve (EKC) hypothesis offers U-shape relationship between degradation of environmental and income of per-person. In the initial stage of the economic evolution process, the environmental degradation would flourish; then after reaching a certain level of per capita income, the environment starts improving. The theoretical studies are inspired by North (1990) and the study explores that the economic exchange and economic development is enhanced by strong formal legal rule. The reason is that at very low cost strong formal institutions like a property right boost up investment, innovations and enhances market exchanges.

In the viewpoint of Aron (2000), its responsibility of the government of a state to enforce sanctions and laws are necessary to be implemented in order to lessen the uncertainty, improved the regulatory quality and implementation of effective enforcement of rules. Thus, the important aspects of growth-enhancing institutions are accountability, contract enforcement, the rule of laws, regulatory quality, property right protections, political stability and control of corruption. From this framework, inefficient institutions are responsible for high transaction costs and, they are not able for the provision of private activities, market exchanges, and economic growth. In this sense quality of better settings of institutions are extremely important for fast economic development. Economic growth is often linked with the environment and has influences on it.

The prominent framework for economic growth is explained via scale effect, technological effect and composition effect: (a) The scale effect is explained as, in the absence of technological innovations, the growth in the production needs more use of natural resources and produce more wastes and emissions. More pollution is creating with more scale of production. (b) The composition effect is based on the concept that the attitude towards ecological issues changes with the higher living standard. With the rise in the income the claim for health and environmental quality increases. Basically, wealth

accretion is linked up with the change in the productive system. In this expansion of the cleanest activity increases, and less pollution is emitted. (c) In the last the technological effect this is mostly for the rich nations such countries afford the latest technologies and expenditure on research and development. In this sense, the effective technologies lessen the charge of pollution abatement, save non-renewable resources and shift to the cleaner production process.

The pace of economic development of any country is dependent on several factors. These studies shows that to lift the high rate of growth each country used different mechanism and exploitation of natural resources. This type of growth via over-exploitation of natural resources, degradations, and loss of natural habitat usually produces a harmful effect on the environment. These empirical studies shows positive, negative and ambiguous effect of economic development on environmental pollutants (Bruyn *et al.*, 1998; Tamazian *et al.*, 2009; Ozturk and Acaravci, 2013; Shahbaz *et al.*, 2013; Moghadam and Lotfalipour, 2014; Li *et al.*, 2015; Özokcu and Özdemir 2017). Financial development is another factor that may explain the environmental degradation. The inverted U-shape relationship between financial development and environment can also be expressed. So, in the initial stage of financial development due to high priority of economic growth over clean environment the financial development increases the volume of industrial activities but after reaching the favorable economic growth in the next stage, the financial development start improving the environmental degradation by investing in environmentally friendly project and introducing such a technology which reduces the number of emissions in the atmosphere (Shahbaz *et al.*, 2013).

Most of the countries emphasized on the financial sector development to have stable economic expansion and environmental degradation. According to the study, this sector is a high value-added and green industry. While analyzing the impact of financial development and environmental degradation the particular indicators such as income level, trade openness, energy consumption and financial reforms are used by different studies. The negative relationship is supported by the following studies (Jalil & Feridun, 2011; Yuxiang & Chen, 2011; Shahbaz, 2013; Charfeddine & Khediri, 2016).

On contrary, another important fact is that financial development in the context of economic growth is responsible for industrial pollution and environmental degradations (Sehrawat *et al.*, 2015). Financial development lead to increase in the CO₂ emissions because when the financial systems are sound and efficient it makes the procedure of getting loans more convenient and easier as a result of which consumer buys those products which emit more carbon dioxide such as vehicles, generator, air conditioners and construction of houses (You *et al.*, 2011). The studies (Tamazian & Rao, 2010; Karimzadeh *et al.*, 2014; Moghadam & Lotfalipour, 2014; Gokmenoglu *et al.*, 2015; Sehrawat *et al.*, 2015; Ayeche *et al.*, 2016) find positive relationship between financial development and environmental deterioration.

In the same context, institutional quality plays a most imperative character in increasing the environmental quality. Better policies and regulations compensate the adverse impact of climate change and decrease CO₂ emissions. The poor institutional quality failed to implement stringent environmental policies. The environmental standard cannot be achieved without the political will and financing of high-income countries. The government effectiveness is also play an important role in this regard because the rate of investment slow down when there are excessive red tape, poor public goods provision and

inefficient bureaucracy. This means the presence of good governance can minimize the effect of market failures. It facilitates good and effective cooperation in the markets (Olson, 1996). The following studies [Ulman and Bujancă \(2014\)](#) and [Sahli and Rejeb \(2015\)](#) explore positive relationship of environmental quality with institutional quality.

While most of the studies explored negative relationship of institutional quality with the environmental degradation such as that when the people have freedom of information and political rights, it will create groups having environmental interest and they raise the awareness among the public regarding environment which encourages and promote environmental legislation ([Bernauer and Koubi, 2009](#); [You et al., 2015](#); [Sulaiman et al., 2017](#); [Abid, 2017](#); [Bhattacharya et al., 2017](#); [Dhrifi, 2018](#)).

There exists extensive literature on the association between economic growth and environmental pollutants but the relationship and influence of financial development institutional quality on environmental degradation are still largely absent. There are lots of factors working behind it. So, the question is what makes the quality of institutions and financial development so essential when it comes to environmental quality and economic growth? This study jointly links the effect of financial development, the role of institutional quality, and economic growth with environmental degradation in both developed as well as in developing countries. This study encompasses the linkage of socio-economic determinants of environmental degradation.

Moreover, none of the studies incorporated the index of financial development and mostly used a proportion of private credit to GDP and stock market capitalization as a proxy of financial development but with the passage of time, it becomes a modern and multi-dimensional process. So, it's reasonable to use the index for financial development which incorporates the indicators of both the financial market and financial institutions. In the last, the study also includes six indicators of institutional quality because in recent years most of the countries comprehend the importance of institutions in tackling the pollution. There is a general belief of policymakers of many countries that good institution has a central role in combating against pollution. Good political institutions such as political stability, property right, rule of law, voice and accountability, and control of corruption are important determinants for mobilizing resources and providing opportunities to the citizens to become more productive and for better environmental standards.

2. Theoretical Framework

Environmental degradation is among the top burning issues along with climate change and food security. Number of researchers tried to investigate the sources of environmental degradation. The increasing economic and human activities are responsible for global warming. Most of the factors like economic growth, energy consumption, lifestyle, technological innovations, institutional quality and financial development are responsible for the different pattern of emission of CO₂.

Theoretically, the impact of financial development and economic growth on environmental degradation can be shown by three effects known as scale effect, composition effect and technological effect. When there is more financial development and economic activity more inputs in the production of goods are required which cause greater emissions in the environment called the scale effect.

As the economic activity increases it raises serious concerned about the environmental degradation thus, leads towards a reduction in the anthropogenic emissions.

This is promoted by the use of an environmentally friendly technology known as technical effect proposed by (Grossman and Krueger, 1995).

Composition effect justifies that rising income its leads to an increase in demand for the cleaner good. Because of which the firms use an alternative method of production which lower the pollution. From this EKC hypothesis postulates that scale effect dominates composition effect at the lower level of income but as income rises and reached at the critical or turning point composition effects dominates scale effect (Halkos and Tzeremes, 2013).

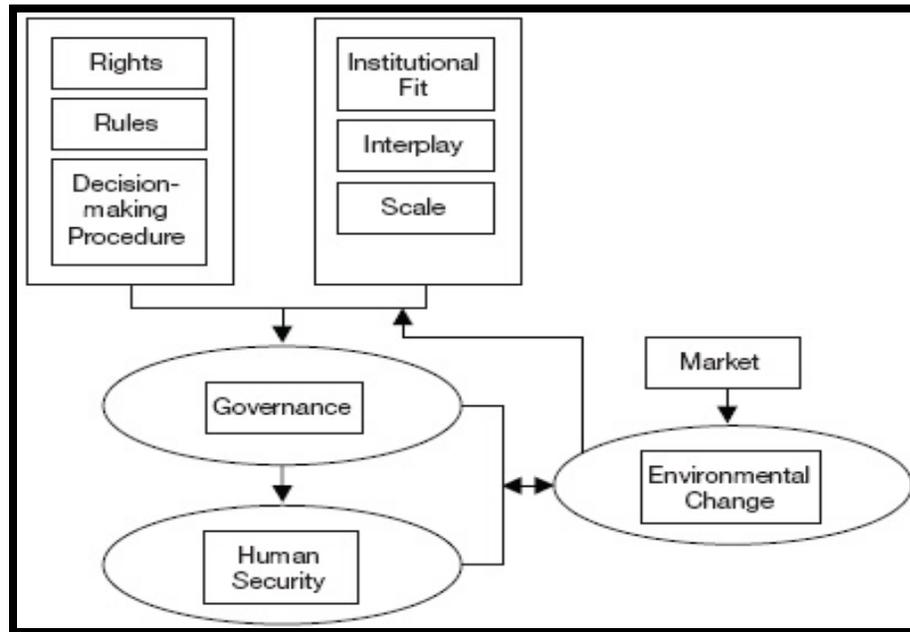
The Foreign Direct Investment (FDI) and a higher degree of research and development are attracted by good political institutions. As a result of which it improves and increases the economic growth and environmental performance (Frankel and Romer, 1999). In the market, heavy regulation on the entry of the firms is affiliated with more amount of corruption, autocracy and informal economies (Djankov and Hoekman, 2000). A country can gain more confidence to producer and successfully enforce laws and regulations of controlling CO₂ emission if the powerful and efficient intervention of government having a nominal amount of bureaucracy, better provision of public service and sound financial systems and integrity are ensure (Pushak *et al.*, 2007).

The developed financial sectors are responsible to channelize savings and offer households to keep assets in liquid forms and invest in those companies that use cleaner, efficient and advance friendly technology which also reduces global environmental pollutants in the productions process (Birdsall & Wheeler, 1993). Another important fact is that financial development in the context of economic growth is responsible for industrial pollution and environmental degradations (Sehrawat *et al.*, 2015). Developed financial sector decreases the transaction costs, reduces operating risk and raises the credits channels as a result of which it becomes relatively cheap to make an investment and installation of new projects which are the main cause of CO₂ emissions (Tamazian & Rao, 2010).

The sound and powerful institutions can play a dynamic and significant role in improving environmental degradation. Figure 1 shows that the association and influences of environmental pollutants and economic growth. The existence of powerful and efficient institution rapidly makes the movement of the curve to reach the turning point and thus because of which it promotes the economic growth. The relocation of dirty industries is ensuring by strong institutional quality, in this way they will guide against the pollution haven (Egbetokun *et al.*, 2016).

Similarly, the poor and worse quality institutions in environmental management are creating lots problem and challenges towards the environmental pollutants. The reasons are weak laws, regulations of environmental policies, lack of financial development and inefficient human resources which are creating institutional vacuum towards environmental quality. Besides poverty, wealth, authority and greed the worse quality of institutions is responsible for the environmental failure. Every level of social organizations, regimes regarding resources and environment institutions are a set of rights, laws, rules, regulations and decision-making power.

Figure 1: Interaction between Environment and Institutional Quality



Source: [Egbetokun et al. \(2016\)](#)

So, it's necessary to provide social and environmental rights to lessen the severity of environmental issues which are the major threats towards human security. For this purpose, freedom of voice and right is necessary for the effective implementation of the policies. One of the group believes that indicator of institutional quality i.e. control of corruption and democracy can improve the environmental pollutants while another group believes that it will further worsen the situation because they argue that economies having strong and powerful institutions are the main reason to attract foreign direct investment which further deteriorates the situation regarding environmental quality. If the institutions are strong it will promote the economic growth which in turn increases the environmental pollutants which again control by institutional interventions. The environmental degradation as consequences of economic growth can provide some signals on institutions for promoting green growth and sustainable development. The empirical findings and literature show contradictory views on the impact of institutional quality and environmental degradation.

3. Model

Environment Kuznets Curve is originally presented by ([Kuznets, 1995](#)). Explaining that at the initial stage of economic development the income inequality tends to rises at a low level of income but after a certain threshold level its declines. The number of researchers focused on the sources of environmental degradation. Following the methodology of [Abid \(2017\)](#), the model investigates the link and impact of socio-economic determinants on environmental pollutants and check whether it's significant or not. For this purpose, below is raw mathematical equations which will pass through different stages.

$$CO_2 = f(EG, IFD, IQ) \quad (1)$$

Here, CO₂ is measured in per capita metric tons and its proxy for environmental degradation. According to (Foster and Bedrosyan, 2014) 80% of greenhouses emissions are represented by CO₂ emissions. To adjust the effect of the growth of population on the population level the CO₂ per metric ton emission is used. To measure the economic growth log of GDP is incorporated. IQ is the index of institutional quality to measure the performance of governance six indicators are incorporated i.e. rule of law, voice, and accountability, regulatory quality, control of corruption, the absence of violence and political stability. Whereas the construction of an index of financial development is discussed in section 4.2.

For the empirical investigation, the objective of the study is to apply the econometrics techniques to explore the impact of economic growth, institutional quality and financial on environmental degradation.

For the more sophisticated analysis for the determinants of environmental degradation, following specification has been incorporated and the main equation is adopted from (Hsiao, 1986) is stated below:

$$LCOPC_{i,t} = \alpha_0 + \alpha_1 LGDP_{i,t} + \alpha_2 FDI_{i,t} + \alpha_3 IQ_{i,t} + \alpha_4 X_{i,t} + \varepsilon_{i,t} \quad (2)$$

Where $i = 1,2,3, \dots, 122$ are countries in a panel data or cross sections and $t = 1,2,3, \dots, 21$. We have already discussed IFD, and IQ above. So, LGDP is log of Gross Domestic Product, X is vector of control variables such as foreign direct investment net inflows, trade openness percentage of GDP, population growth, education as primary gross school enrollment, urbanization percentage of the total, R&D is used as a proxy of technological development, the share of industrialization in GDP and log of energy consumption and $\varepsilon_{i,t}$ is error the term.

The main goal of the study is to explore the relation of socio-economic indicators of environmental degradation so, the appropriate econometric technique is required to assess this relationship. For the estimation technique, we use panel data estimation technique. Unlike the cross-sectional analysis, the panel data methodology has been adopted because it has an advantage that to control for individual heterogeneity, more variability, more degree of freedom and high efficiency and less collinearity among the variables. Panel data also called cross-sectional time series data and longitudinal panel data is a set of data of different entities in which characteristics and behavior of different groups are observed across the time. Most of the researchers examining panel data choose between Fixed Effect Model (FEM) and Random Effect Model (REM).

Panel data consist of unobserved heterogeneity because the mean of the dependent variable is not constant across the country and each country has its own special characteristics which may not be same with other factors. It's allowed to control of variables which are not possible to measure and or observe due to different cultural factors. For this purpose, we estimate the models with different techniques such as FEM, REM, and Common Effect Model (CEM) in a panel data. First of all, stationary of the variables is checked by using different test such Levin-lin-chu test, im, pesaran and shin test and fisher-type and then estimated the panel data with well-known methods stated as CEM, FEM and REM.

4. Data

For the empirical analysis panel data is formed and based on data availability 122 countries are selected. The data on the institutional quality is extracted from the Worldwide

Governance Indicators (WGI). The time is taken over the period of 1990-2016 due to limited availability of the data we have restricted the time for the estimations. Following the definitions of variables are provided for better understanding.

4.1. CO₂ emissions (metric tons per capita):

CO₂ per capita is calculated by total national CO₂ emissions per year divided by total population. The data has been published by Global Carbon Project. The benefit of using this is that it incorporates the emission of CO₂ by per person and takes it to account the nation's population size. The source of CO₂ emission is from [Le Quéré et al. \(2017\)](#).

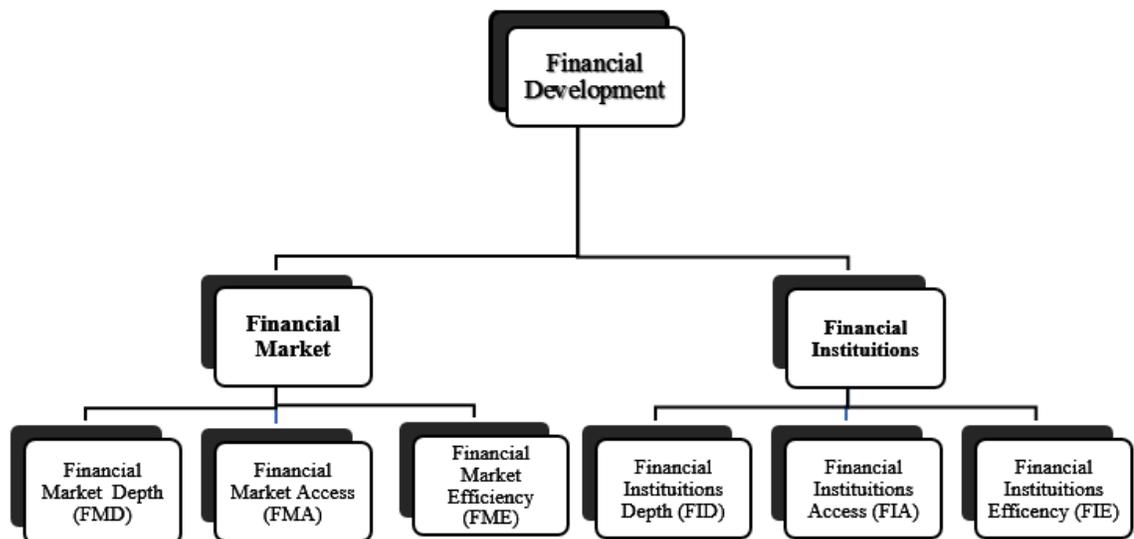
4.2. Financial development:

By defining financial development as it is a mixture of the *depth* that is the magnitude and market liquidity, *accessibility* means how easily firms and the individual can access funds and finally base on *efficiency* means how financial institutions can provide fund at the minimal cost with sustainable returns and multidimensional activities in the capital market. Stock and bonds markets are part of the financial market whereas insurance companies, mutual and pension funds, banking sector etc. are part of financial institutions ([Levin et al., 2012](#)).

Lots of the literature used a different proxy to measure the financial development. Most of the study used the ratio of private credit to GDP and stock market capitalization but with the passage of time financial systems have become a modern and multidimensional process. It does consist of companies, mutual funds, capital market, the stock market, insurance companies etc. financial markets allow individuals to channelize their savings into a different form and the ability of firm increases to raise funding and money through the stock market, bonds, and wholesale market.

It's crucial and mandatory part of a financial system that it must be accessible and efficient. The reason is that even the financial market is large and sizeable but if they are not easily accessible to the general public and firms then their role in economic development become limited and wasteful ([Aizenman et al., 2015](#)). Financial development index can be shown in the form of a pyramid as shown in figure 2.

Figure 2: Components of financial development index



Source: ([Svirydzenka, 2016](#))

The above pyramid shows that financial development is categorized into two parts. Each part has further sub three indices. These indices are constructed by incorporating a list of indicators which are presented as follow:

4.2.1. Financial Market:

The basic focus of financial market indicators is on stock and debt market. Further detail of indicators regarding financial market depth, access and efficiency are discussed below.

- a) **Financial Market Depth:** Financial market depth is calculated by using stock market capitalization to GDP, the stock traded to GDP, total debt securities of non-financial corporations to GDP, total debt securities of financial corporations to GDP. To line up with the autonomous domestic debt data, the corporate debt just based upon the nationality and the principle of residence is not a part of it.
- b) **Financial Market Access:** Financial market access incorporated the percent of market capitalization outside of the top 10 largest companies. It becomes difficult and problematic for newer issuers when there is more concentration in the stock market. The bond market access includes domestic and foreign debt market of financial and non-financial corporate issuers.
- c) **Financial Market Efficiency:** The index of financial market efficiency depends on the stock market turnover ratio which is the ratio of stock traded to stock market capitalization. More turnover means greater liquidity and efficiency of the market.

4.2.2. Financial Institutions:

Financial institutions consist of the banking sector, mutual and pension funds and insurance companies. Financial institutions depth, access, and efficiency are discussed below.

- a) **Financial Institutional Depth:** The index of financial depth relies on private-sector credit to GDP, Pension fund assets to GDP, mutual fund assets to GDP and insurance premiums, life and non-life to GDP.
- b) **Financial Institutional Access:** Due to limited availability of data on other financial institutions banking sector are used as a proxy to measure the financial market access and efficiency. The indicators include bank branches per 100,000 adults and ATMs per 100,000 adults.
- c) **Financial Institutional Efficiency:** The index of financial institutional efficiency intends to incorporate those indicators which are related to bank efficiency.
 - a) Net interest margin which shows the proficiency of the banking sector to channelize savings into productive investment and the lending-deposits spread.
 - b) Return on assets and return on equity to quantify the profitability.
 - c) Non-interest income to total income and overhead costs to total assets to measure the operational efficiency.

4.3. Financial Development Index:

So, after understanding the meanings of financial market and financial institutions depth, access and efficiency we can drive the index of financial development index. Different indicators are used to check efficiency, depth, and accessibility of financial market and institutions. These indices are denoting FMD, FMA, FME, FID, FIA, and FIE. These indices are combined into two indices known as the financial market (FM) and Financial Institutions (FI) to observe how much developed and efficient these markets are. In the last stage, these two indices FM and FI are gathered to formulate index of financial development FD-index (Svirydzenka, 2016).

4.4. Institutional Quality (IQ)

Similarly, index of institutional quality includes six variables extracted from World Governance Indicator namely voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law and control of corruption. Following are the brief details of the indicators: Voice and accountability mean that how much a citizen of a country has freedom of speech, association, and expressions. It also means to which extent a person has a choice in electing the government. Political stability means the perception of the probability that the existing government will overthrow by illegal ways like terrorism. Government effectiveness mean the provision of public good, quality of public service, degree of freedom from political pressure, the implementations of the policies and the government commitments towards them. Rule of law mean rules of society which must be abide by the agent of the. It's in the form of property right, contract enforcements the judiciary and the police.

Regulatory quality mean for the development process the ability of government to formulate regulations, the rule and implementation of policies. In the last, control of corruption mean how public power is used for private and personal gain.

4.5. Gross Domestic Product per Capita (GDP)

GDP per capita used as a proxy for economic growth measures the overall wealth of individual in the country. The gross domestic product is the value added of all resident plus the amount of taxes on the product minus the amount of the subsidies of the product. This variable is included in the study because the relationship between carbon emission and economic growth is incorporated in the hypothesis of EKC which was originated by (Grossman and Krueger, 1995).

5. Results

To analyze the socio-economic determinant of environmental degradation different econometrics test, scheme and methodology are incorporated. To check the reliability of the data that none of the variables is the non-stationary various test is applied. In the panel data to check whether the data has a unit root or stationary Fisher PP, LLC and IPS test is applied. The null hypothesis is that the data is stationary or have no unit root against the alternative that data is non-stationary or have a unit root. The panel regression results of the model is presented in table 1.

The F-statistics of overall goodness of fit model shows whether the linear regression is a better fit on overall data. In choosing between CEM and FEM model the P-value is less than 0.05. So, F-statistics reject the null hypothesis i.e. common effect is preferred over fixed effect and accept the alternative hypothesis that is the FEM is preferred over the Common effect model. Likewise, deciding between CEM and REM the values of the Breusch-Pagan LM test indicate that the REM perform better than CEM. The P-value of F-statistics demonstrates that the H_0 is rejected at 1% level of significance. In the last, Hausman test is employed between fixed effect model and the REM. The P-value of F-statistics is highly significant and we reject the null hypothesis that is the differences in the coefficient is not systematic against the alternative hypothesis i.e. differences in the coefficient is systematic. Results of the Hausman test reveals that the FEM is relatively better in all cases. Diagnostic tests indicated that, in all the specifications, the fixed effect model performs better than CEM and REM.

In table 1 signs of most of the coefficients of the variables are according to theory. Moreover, most of the coefficients are statistically highly significant. except for trade

openness results of fixed effect postulates a significant and positive relationship of all variables on CO₂ emission while population growth exerts a negative relationship on CO₂ emission. Among the contributors to environmental degradation, economic growth appeared to be highly significant. In all the specifications, growth indicated positively and significantly affecting environmental degradation. The results for economic growth depicts 1% increase in the log of GDP will lead to increase the CO₂ emission by 0.39%. The reason is that economic growth usually changes the style of the production process, industrialization, and urbanization. The positive relationship between economic growth and CO₂ emission is supported by the following studies ([Soytas and Sari, 2009](#); [Shahbaz et al., 2013](#); [Moghadam and Lotfalipour, 2014](#)).

Similarly, the effect of foreign direct investment is highly significant at 1% level of significance. The results depict that 1% increase in inflows of foreign direct investment will increase the level of CO₂ emission by 0.016%. Our results are in accordance with ([Bakhsh et al., 2017](#)). Likewise, gross primary enrollment is highly significant i.e. 1% increase in gross primary enrolment leads to 0.127% increase in the level of CO₂ emission. The reason is that when a person is educated it will enhance its level of productivity, skills, and information which eventually boost up the income level and consequently the purchasing power and consumption increases ([Jorgenson, 2003](#)). The empirical analysis shows that a 1% increase in institutional quality will leads towards 0.006% increase in the level of emission also the presence of good governance play a vital role in the growth of the economies. The reason is FDI is attracted by the good institutional quality which causes more pollution in the economy, moreover weak institutional quality failed to imposed better environmental policies which cause the deterioration of the environment. It also attracts FDI and other developmental projects. In the last, results show that 1% increase in the index of financial development leads to 0.05% decrease in the level of carbon emission. There is a negative relationship between carbon emission and financial development. The reason is that developed financial sector channelizes the savings of household and offer them to keep the assets in liquid form and invest in those companies which used clean, efficient and environment-friendly ([Birdsall and Wheeler, 1993](#)).

Similarly, the impact of socioeconomic determinants on environmental degradation can be seen by introducing R&D, urbanization, industrialization and energy consumption. The table 2 provides the basic results. The results for economic growth depict 1% increase in the log of GDP will lead to increase the CO₂ emission approximately by 0.1%. Similarly, FDI is statistically significant at 1% level of significance only in the first model. 1% increase in FDI leads to 0.014% increase in the level of carbon emission. On contrary, trade openness is statistically not significant in the second model and fourth but become significant in the third model i.e. 1% increase in trade openness leads to 0.04% fall in the carbon emission. Trade openness declines carbon emission, the pattern of goods production usually ends up towards those technologies which are environmentally friendly, energy efficient and emits less emission. This implies the technical effect is significant in context trade for environmentally friendly technologies, which shows, that exchange and trade of better technologies reduce the level of emission in the production process of various goods across the borders.

Table 1: Results for macroeconomics determinates of environmental degradation

VARIABLES	Common Effect Model				Specific Fixed Effect				Specific Random Effect			
	Reg-1	Reg-2	Reg-3	Reg-4	Reg-1	Reg-2	Reg-3	Reg-4	Reg-1	Reg-2	Reg-3	Reg-4
LGDP	0.388*** (16.5)	0.386*** (16.20)	0.309*** (14.22)	0.203*** (8.10)	0.343*** (21.99)	0.340*** (21.16)	0.331*** (20.73)	0.330*** (19.09)	0.343*** (22.61)	0.338*** (21.75)	0.328*** (21.16)	0.319*** (19.22)
FDI	0.030 (1.57)	0.025 (1.25)	-0.022 (-1.23)	-0.014 (-0.76)	0.015*** (4.08)	0.013*** (3.52)	0.014*** (3.76)	0.015*** (3.99)	0.015*** (4.11)	0.013*** (3.56)	0.014*** (3.89)	0.015*** (3.97)
TO	1.100*** (17.62)	1.060*** (16.82)	0.624*** (10.40)	0.511*** (8.35)	0.004 (0.20)	0.001 (0.05)	0.006 (0.28)	0.008 (0.36)	0.014 (0.64)	0.011 (0.48)	0.018 (0.81)	0.020 (0.86)
GPOP	-15.32*** (-8.80)	-16.11*** (-9.21)	-8.81*** (-5.47)	-10.2*** (-6.30)	-1.31** (-2.56)	-1.352*** (-2.62)	-1.550*** (-3.01)	-1.300** (-2.52)	-1.387*** (-2.71)	-1.43*** (-2.77)	-1.683*** (-3.25)	-1.452*** (-2.80)
EDU		0.211 (1.18)	0.052 (0.33)	0.083 (0.52)		0.144*** (2.75)	0.147*** (2.82)	0.127** (2.41)		0.143*** (2.73)	0.147*** (2.81)	0.130** (2.47)
IQ			0.038*** (22.64)	0.028*** (10.51)			0.007*** (4.73)	0.006*** (4.00)			0.008*** (6.04)	0.007*** (5.35)
IFD				1.420*** (6.59)				-0.051 (-0.69)				-0.000 (-0.01)
Constant	-10.21*** (-29.32)	-10.21*** (-25.81)	-8.97*** (-24.82)	-6.37*** (-12.59)	-8.03 (-23.07)	-8.04*** (-22.52)	-8.24*** (-23.03)	-8.06*** (-21.10)	-8.01*** (-22.62)	-8.02*** (-22.08)	-8.24*** (-22.94)	-7.80*** (-20.83)
t	21	21	21	21	21	21	21	21	21	21	21	21
n	115	115	115	115	115	112	112	109	115	112	112	109
N	2,297	2,240	2,240	2,178	2,297	2,240	2,240	2,178	2,297	2,240	2,240	2,178
F-stat [Wald χ^2]	289.01	289.01	381.38	340.99	241.23	182.68	157.51	126.56	[1007.24]	[951.51]	[1001.31]	[937.67]
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Diagnostic Tests											
	F-test (H ₀): Common effect model is better than Fixed effect model				Hausman test (H ₀): Random effect is preferred over Fixed effect model				Breusch-pagan test (H ₀): Common effect model is better than Random effect model			
	1042.15	1024.39	838.19	824.64	57.96	70.84	62.44	69.96	20142.70	19663.21	20186.92	19577.09
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Source: Authors own calculations. t-values are in parentheses. Whereas, ***, **, * indicates significance at 1%, 5% & 10% level of significance, respectively.

Table 2: Results for impact of R&D, industrial share, urban population and energy consumption on environmental degradation

Variables	Common Effect Model				Fixed Effect Model				Random Effect Model			
	Reg-1	Reg-2	Reg-3	Reg-4	Reg-1	Reg-2	Reg-3	Reg-4	Reg-1	Reg-2	Reg-3	Reg-4
LGGDP	0.222*** (11.55)	0.017 (1.09)	0.002 (0.13)	-0.032* (-1.72)	0.329*** (17.91)	0.154*** (9.90)	0.178*** (11.52)	0.038** (2.44)	0.299*** (16.97)	0.131*** (9.03)	0.155*** (10.59)	0.037** (2.50)
FDI	-0.036** (-2.32)	0.014 (1.21)	0.024** (1.93)	0.044*** (3.02)	0.013*** (3.77)	0.002 (0.89)	0.003 (1.04)	0.003 (1.28)	0.013*** (3.54)	0.002 (0.83)	0.003 (1.11)	0.003 (1.25)
TO	0.693*** (13.66)	-0.049 (-1.25)	-0.089** (-2.14)	-0.297*** (-6.55)	0.004 (0.22)	-0.010 (-0.55)	-0.043** (-2.36)	-0.024 (-1.44)	0.015 (0.65)	-0.007 (-0.38)	-0.037** (-2.06)	-0.025 (-1.53)
UPOP	3.988*** (38.01)	0.943*** (8.90)	1.031*** (9.36)	0.005 (0.04)	0.218 (1.37)	-0.607*** (-4.66)	-0.558*** (-4.42)	-0.482*** (-4.00)	0.719*** (4.70)	-0.387*** (-3.13)	-0.364*** (-3.01)	-0.457*** (-3.90)
EDU		0.244** (2.21)	-0.084 (-0.68)	-0.098 (-0.44)		.254*** (5.68)	0.277*** (6.26)	0.085* (1.71)		0.256*** (5.72)	0.278*** (6.28)	0.086* (1.72)
LECON		1.024 (42.76)	0.999*** (38.42)	1.078*** (31.09)		.920*** (37.50)	0.871*** (34.60)	0.981*** (41.89)		0.944*** (39.85)	0.895*** (36.69)	0.984*** (42.96)
INDG			.219** (2.06)				0.376*** (9.65)				0.363*** (9.32)	
R&D				-0.089*** (-3.46)				-0.064*** (-5.27)				-0.064*** (-5.29)
Constant	-6.815*** (-23.60)	-7.978*** (-32.28)	-7.398*** (-27.42)	-6.429*** (-15.60)	-7.786*** (-20.45)	-9.543*** (-30.01)		-6.738*** (-20.73)	-7.312*** (-19.47)	-9.280*** (-30.12)	-9.652*** (-31.47)	-6.738*** (-20.97)
t	21	21	21	21	21	21	21	21	21	21	21	21
n	115	102	95	65	115	102	95	65	115	102	95	65
N	2,297	2,040	1,903	1,301	2,297	2,040	1,903	1,301	2,297	2,040	1,903	1,301
F-stat [Wald χ^2]	950.50	1326.71	908.99	333.89	239.55	480.83	416.37	385.97	[1023.75]	[3212.47]	[3156.49]	[2814.02]
P-Value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Diagnostic test												
	F-test (H ₀): Common effect model is better than Fixed effect model				Hausman test (H ₀): Random effect is preferred over Fixed effect model				Breusch-pagan test (H ₀): Common effect model is better than Random effect model			
	652.31	531.78	620.38	964.32	117.60	30.53	29.98	2.40	20550.23	18667.76	17556.74	12317.52
	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.934	0.000	0.000	0.000	0.000

Source: Authors own calculations. t-values are in parentheses. Whereas, ***, **, * indicates significance at 1%, 5% & 10% level of significance, respectively.

Likewise, urban population have a negative relationship with the carbon emission and statistically significant in the models. 1% increase in urban population leads to almost 0.05% fall in the level of CO₂ emission. According to [Martínez-Zarzoso \(2011\)](#), the impact of urbanization varies across different income groups. The EKC hypothesis also holds in this case, i.e. as the share of urban population percentage of the total is achieved at the certain point, its start reducing the environmental destructions. The elasticity of urbanization is highest and positive for low-income countries, for middle-income countries its start falling and for developed countries the sign of elasticity turns to negative.

The industrial growth as a share of GDP is included which is statistically highly significant at 1% level of significance. 1% increase in industrial growth leads to a 0.38% increase in the level of carbon emissions. The reason is that economic development leads to change in the pattern of and industrialization. Generally, the rise in income is due to the large-scale withdrawal of labor from rural primary agriculture sectors to the industrial sector in urban areas.

In the last, the coefficient of Research and Development (R&D) is statistically significant at 1% level of significance. Means that a rise in (R&D) leads to a decrease in the level of carbon emission up to 0.068%. High and latest technologies reduce the cost of pollution abatement, save non-renewable resources and shift to the cleaner production process. Technological development through R&D encourages that technology which is environment-friendly and creates less pollution in the atmosphere ([Sanstad, 2006](#)).

6. Conclusion

Environmental degradation has become a burning issue in the present world irrespective of a country who is responsible for it. Environmental degradation is a global issue and all countries are facing serious threats from environmental destructions. Several empirical studies justify the relationship of economic growth with the environmental degradation but there are a lot of factors working behind it. The present study aims to justify how these socio-economic indicators namely institutional quality, financial development and economic growth have an impact on environmental degradation. The objective of the study is to evaluate the impact of economic growth, financial development and institutional quality on environmental degradation. The annual data is taken from 1996-2016 for the panel of developed and developing countries. There are numbers of studies which explore the linked between economic growth and environmental degradation but the role of developed financial sector and impact of institutional quality on environmental destruction is not jointly explored for the panel of developed and developing countries.

Moreover, most of the studies used one indicator credit to private sector as a proxy for financial development. This study incorporated the index of financial development because it' a broad and multidimensional concept. Different indicators for the financial market (FMD, FME, and FMA) and financial institutions (FID, FIE and FIA) are incorporated. Likewise, the index of institutional quality comprises of six indicators namely, rule of law, political stability and accountability, regulatory law, control of corruption, government effectiveness and absence of violence. The good institution has a central role in combating against pollution. So, the null hypothesis of the study is that financial development and institutional quality has an insignificant impact on environmental degradation against the alternative that it postulates a significant relationship with the environmental degradation. Results of this study are based on panel

data of developed and developing countries classified by the World Bank. For this purpose, different well-known econometric technique of panel data i.e. CEM, FEM and REM is used. The outcome of a socio-economic indicator revealed a significant impact of the variables on environmental degradation. We accept the alternative hypothesis in our study.

In most of the cases, FEM is chosen instead of REM. For economic growth, scale effect dominates in all the specifications. In general, economic growth has a positive, significant and direct relationship with the carbon emission level but the contribution for CO₂ emission is more in the case of industrialization, urbanization and energy consumption. Likewise, the Pollution Haven Hypothesis (PHH) is supported because FDI has a direct link with CO₂ emission. Trade openness provides us with interesting outcomes which are supported by the theories. Moreover, population growth has an indirect relationship with the carbon emission. The index of financial development postulates a negative relationship with carbon emission and the index of institutional is positive in all cases. The presence of good governance minimized the effect of market failure and promote cooperation among the players. The educational level has imperative importance in case of developed and developing countries and in all cases it's significant. Similarly, for the urban population, we get mixed results and it's significant in all the specifications. The sign of the urban population depends on diversified income groups. In the last, the captivating results for R&D show a significant relationship. For developed countries, R&D leads to a reduction in the carbon emission while it exerts positive relation in the context of developed countries

Though, need for additional empirical analysis and investigation remain pertinent and hopefully improved further. It can be expanded by changing the size of the data, applying different estimation techniques and by making decomposed analysis for financial development and institutional quality. The study will also be extended to make a comparison of different regions of the world.

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