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Effect of financial development and institutional quality on the environmental degradation in developed and developing countries

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ABSTRACT

Environmental pollutants have 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 impact of financial development and institutional quality on environmental degradation. The study is based on panel data for developing and developed countries over the time of 1996-2016. For the empirical analysis fixed effect and the random effect is carried out. Results show that institutional quality, economic growth, foreign direct investment, gross primary enrolment, and industrial growth have significant positive effect on corban emissions whereas financial development, population growth, trade openness, urban population and R&D expenditures have significant negative effect on corban emissions. One percent point increase in the index of institutional quality leads towards 0.006 percent points increase in the level of CO_2 emissions. One percent point increase in the economic growth lead to increase the CO_2 emissions by 0.39 percent points. One percent point increase in inflows of foreign direct investment increase the level of CO_2 emissions by 0.016 percent points. One percent point increase in industrial growth leads to a 0.38 percent points increase in the level of CO_2 emissions. Furthermore, one percent point increase in the index of financial development leads to 0.05 percent points decrease in the level of CO_2 emissions. One percent point increase in urban population leads to almost 0.05 percent points fall in the level of CO_2 emissions. Finally, one percent point rise in R&D expenditures leads to decrease in the level of CO_2 emissions by 0.068 percent points.

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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. 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

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policymakers have shown extensive interest in the relationship between the quality of institutional and environmental degradation as shown in Fig. 1.

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, shown in Fig 2. 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 is an essential element in term of CO_2 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 Gross domestic product (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. 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

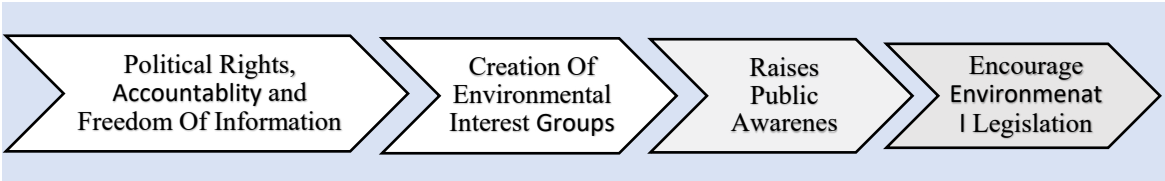

Fig. 1: Link of institutional quality in improving environmental degradation

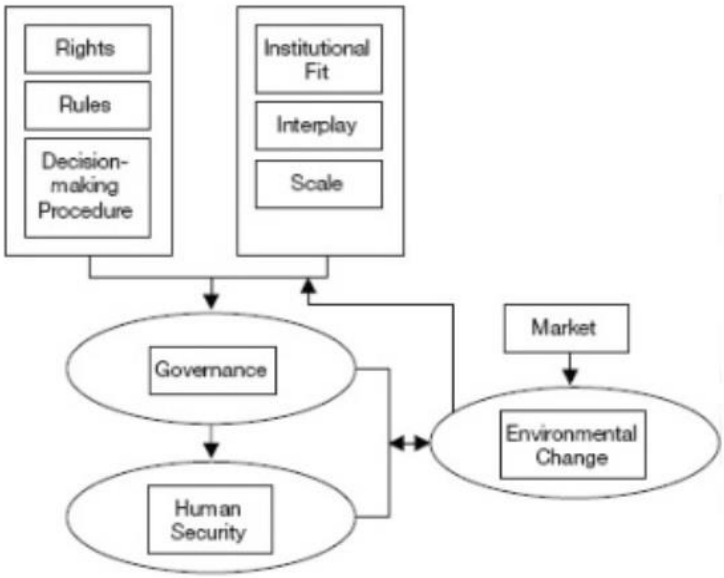

Fig. 2: Interaction between environment and institutional quality (Egbetokun *et al*., 2016)

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 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 and 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 CO_2 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 CO_2 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, 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 is 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. This study has been carried out in Islamabad, Pakistan during 2018-2019.

MATERIAL AND METHODS

Model and estimation methods

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 is significant or not. For this purpose, Eq. 1 is raw mathematical equations which will pass through different stages.

$$CO_2 = f\left(\mathrm{EG}, \mathrm{IFD}, \mathrm{IQ}\right) \tag{1}$$

Here, CO_2 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 CO_2 emissions. To adjust the effect of the growth of population on the population level the CO_2 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 later section. 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 as Eq. 2.

$$LCOPC_{i,t} = \alpha_{\circ} + \alpha_1 LGDP_{i,t} + \alpha_2 FDI_{i,t} + \alpha_3 IQ_{i,t} + \alpha_4 X_{i,t} + \varepsilon_{i,t} \tag{2}$$

Where, *i = 1,2,3,…,122* are countries in a panel data or cross sections and *i = 1,2,3,…,21.* It is 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, the study used 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 is allowed to control of variables which are not possible to measure and or observe due to different cultural factors. For this purpose, the study estimate the models with different techniques such as FEM, REM, and Common Effect Model (CEM) in a panel data. The basic assumption of Common Effect Model (CEM) is that X is exogenous variable and error term is normally distributed having a constant mean and constant variance. Fixed effect model is used in analyzing the effect of variables which are not constant over time. Each group has individual characteristics which may or may not have an influence on the predictor variables. One of the assumptions of FE model is that error term of the entity and the predictor variables have not correlated each other, and the individual may impact the independent variables so there is need to control for this. The net effect of independent variables on the outcome is asses by removing the effect of time invariants characteristics. Another assumption of the FE model is that error term of each entity is not correlated with individual's error term because individuals have unique characteristics and they are time invariant. Fixed effect model is used to study the causes of change within the individual characteristics.

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 the study restricted the time for the estimations. Following the definitions of variables are provided for better understanding.

CO_2 emissions (metric tons per capita)

CO_2 per capita is calculated by total national CO_2 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 CO_2 by per person and takes it to account the nation's population size. The source of CO_2 emission is from Le Quéré *et al*. (2017).

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 is 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 Fig. 3. The below pyramid shows that financial development is categorized into two parts. Each part has further sub three indices.

Financial development index

After understanding the meanings of financial market and financial institutions depth, access and efficiency one 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).

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 is 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.

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).

RESULTS AND DISCUSSION

Descriptive Statistics

For the empirical study, the description of data in the precise form is essential because the descriptive coefficient gives the summary of the data set. It is the representative of the sample for the given population. It allows the reader to extract the required information from the data so the accurate and appropriate information can be extracted from the sample. For the dispersion from the mean value standard deviation and arithmetic mean is calculated. For the developing and developed countries Table 1 consist of mean, minimum, maximum and standard deviation of the given dataset. For overall countries developed and developing one's Table 1 is composed and it shows that the mean value of the variable is greater than the standard deviation. Standard deviation is calculated to check the dispersion in the data. A higher value of standard deviation means high dispersion. Overall there are variations in the data. The average of the data for high-income countries is better as compared to developing countries. The

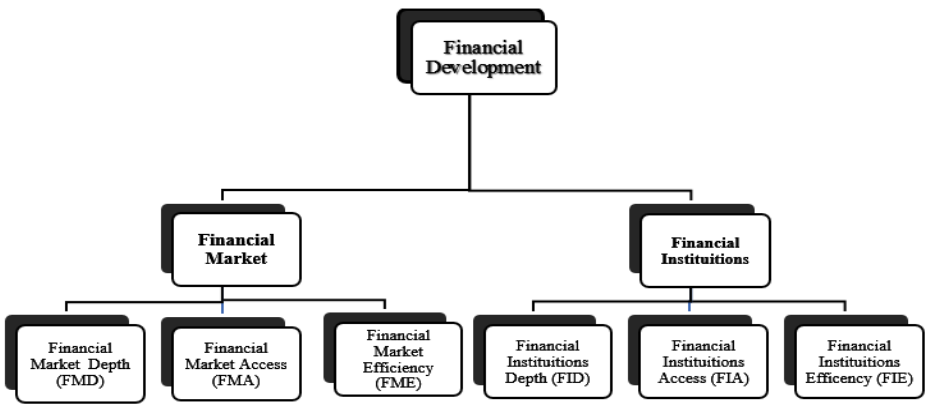

Fig. 3: Components of financial development index (Svirydzenka, 2016)

variables like GDP, energy consumption, and industrial growth shows that growth in these in variables leads to more emissions. Fig. 4 shows the emission of carbon in different regions of the world. The data is taken from "The Global Carbon Atlas''. It can be seen from the figure that China is on top of the list and contributes a large amount of CO_2 emission, emitting 24% of the total world CO_2. Moreover, 11% of the emission is done developing regions of the world. Similarly, the carbon emission done by individuals can see from Fig. 5. It is clear that much of emission per person is done in Oceania, North America, Middle East, and Europe.

Regression 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.

Table 1: Descriptive statistics

Variables	Obs.	Mean	S.D.	Min..	Max
Overall data					
LCOPC	2,436	0.8323	1.51	-3.03	4.24
LGDP	2,562	24.84	2.12	19.87	30.4
LECON	2,289	7.324	1.03	4.73	9.99
FDI	2,437	20.94	2.35	6.90	27.3
IQL	2,562	53.86	15.4	19.4	84
POPG	2,562	0.012	0.01	-0.03	0.16
UPOP	2,562	0.579	0.22	0.11	0.99
ED	2,478	1.012	0.14	0.28	1.65
TO	2,541	0.84	0.44	0.00	4.10
IFD	2,477	0.361	0.23	0	1
INDG	2,394	0.301	0.1	0.02	2.13
R&D	1,449	1.094	0.95	0.004	4.40
High income countries					
LCOPC	1,554	1.616	1.03	-2.74	4.24
LGDP	1,680	25.37	2.17	19.87	30.4
LECON	1,533	7.839	0.79	5.91	9.99
FDI	1,593	21.59	2.29	6.91	27.3
IQL	1,680	60.61	14.0	24.8	84
POPG	1,680	0.009	0.01	-0.03	0.16
UPOP	1,680	0.687	0.17	0.18	0.993
EDU	1,617	1.03	0.08	0.68	1.65
TO	1,680	0.897	0.48	0.156	4.10
IFD	1,637	0.453	0.23	0	1
INDG	1,596	0.319	0.16	0.05	2.13
R&D	1,197	1.255	0.97	0.03	4.40
Low income countries					
LCOPC	882	-0.55	1.21	-3.03	2.60
LGDP	882	23.82	1.58	19.95	28.53
LECON	756	6.28	0.61	4.73	8.017
FDI	844	19.72	1.95	11.89	24.51
IQL	882	40.98	7.92	19.4	57.9
POPG	882	0.019	0.01	-0.025	0.053
UPOP	882	0.373	0.16	0.113	0.83
EDU	861	0.977	0.19	0.28	1.49
TO	861	0.726	0.33	0.001	1.99
IFD	840	0.180	0.10	0	0.59
INDG	798	0.264	0.08	0.03	0.522
R&D	252	0.332	0.27	.0004	1.19

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 are presented in Table 2. 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 of data 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 at1%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 the study 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

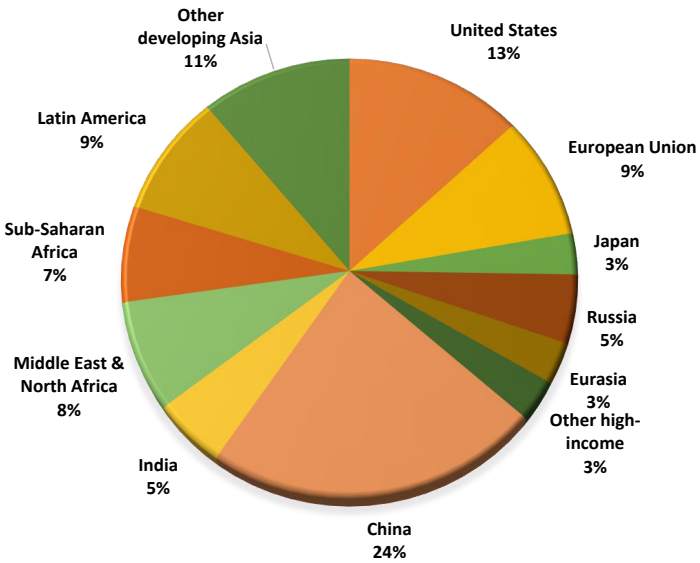

Fig. 4: Annual emissions produced by developing and developed countries

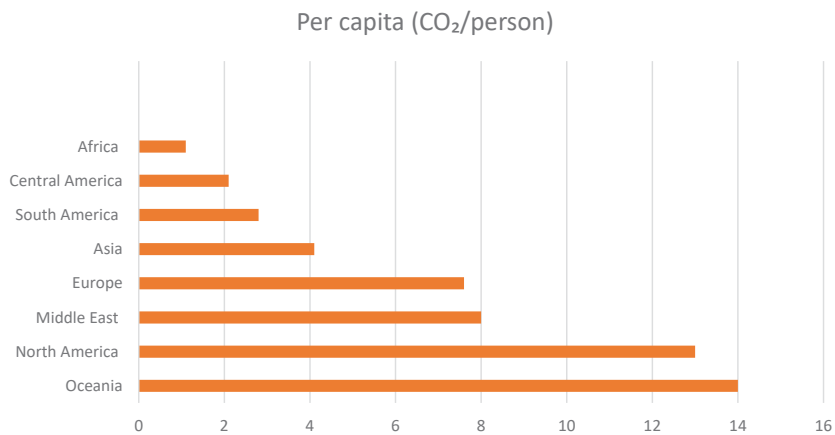

Fig. 5: Carbon emission Per Capita (CO_2/person)

Table 2: 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***	0.386***	0.309***	0.203***	0.343***	0.340***	0.331***	0.330***	0.343***	0.338***	0.328***	0.319***
	(16.5)	(16.20)	(14.22)	(8.10)	(21.99)	(21.16)	(20.73)	(19.09)	(22.61)	(21.75)	(21.16)	(19.22)
FDI	0.030	0.025	-0.022	-0.014	0.015***	0.013***	0.014***	0.015***	0.015***	0.013***	0.014***	0.015***
	(1.57)	(1.25)	(-1.23)	(-0.76)	(4.08)	(3.52)	(3.76)	(3.99)	(4.11)	(3.56)	(3.89)	(3.97)
TO	1.100***	1.060***	0.624***	0.511***	0.004	0.001	0.006	0.008	0.014	0.011	0.018	0.020
	(17.62)	(16.82)	(10.40)	(8.35)	(0.20)	(0.05)	(0.28)	(0.36)	(0.64)	(0.48)	(0.81)	(0.86)
GPOP	-15.32***	-16.11***	-8.81***	-10.2***	-1.31**	-1.352***	-1.550***	-1.300**	-1.387***	-1.43***	-1.683***	-1.452***
	(-8.80)	(-9.21)	(-5.47)	(-6.30)	(-2.56)	(-2.62)	(-3.01)	(-2.52)	(-2.71)	(-2.77)	(-3.25)	(-2.80)
EDU		0.211	0.052	0.083		0.144***	0.147***	0.127**		0.143***	0.147***	0.130**
		(1.18)	(0.33)	(0.52)		(2.75)	(2.82)	(2.41)		(2.73)	(2.81)	(2.47)
IQ			0.038***	0.028***			0.007***	0.006***			0.008***	0.007***
			(22.64)	(10.51)			(4.73)	(4.00)			(6.04)	(5.35)
IFD				1.420***				-0.051				-0.000
				(6.59)				(-0.69)				(-0.01)
Constant	-10.21***	-10.21***	-8.97***	-6.37***	-8.03	-8.04***	-8.24***	-8.06***	-8.01***	-8.02***	-8.24***	-7.80***
	(-29.32)	(-25.81)	(-24.82)	(-12.59)	(-23.07)	(-22.52)	(-23.03)	(-21.10)	(-22.62)	(-22.08)	(-22.94)	(-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

t-values are in parentheses. Whereas, ***, **, * indicates significance at 1%, 5% and 10% level of significance, respectively.

better in all cases. Diagnostic tests indicated that, in all the specifications, the fixed effect model performs better than CEM and REM. In Table 2 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 CO_2 emission while population growth exerts a negative relationship on CO_2 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 CO_2 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 CO_2 emission is supported by the following studies (Soytas, 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 CO_2 emission by 0.016%. Our results are in accordance with (Bakhsh *et al*., 2017). Likewise, the population growth exerts a negative relationship i.e. 1% increase in growth of population leads to almost 1.3% decrease in the level of carbon emission. The reason is that developing countries are labor abundant and lack behind in capital accumulation. Most of the production processes involved the labor participation rather than machinery unlike in developed countries which are capital intensive. The developing countries mostly specialized in the production of agricultural goods in which they have the comparative advantage as stated by the Heckscher-Ohlin theorem. Likewise, gross primary enrollment is highly significant i.e. 1% increase in gross primary enrolment leads to 0.127% increase in the level of CO_2 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 leads towards 0.006% increase in the level of emission also the presence of good governance plays 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, Wheeler, 1993). Similarly, the impact of socioeconomic determinants on environmental degradation can be seen by introducing R&D, urbanization, industrialization and energy consumption. The purpose of the construction of this model is that the study have few cross-sections. So, the study makes separate analysis for it. Table 3 provides the basic results and shows that on the basis of Hausman test FEM is preferred over random effect model. The results for economic growth depict 1% increase in the log of GDP will lead to increase the CO_2 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. 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 CO_2 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

Table 3: 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***	0.017	0.002	-0.032*	0.329***	0.154***	0.178***	0.038**	0.299***	0.131***	0.155***	0.037**
	(11.55)	(1.09)	(0.13)	(-1.72)	(17.91)	(9.90)	(11.52)	(2.44)	(16.97)	(9.03)	(10.59)	(2.50)
FDI	-0.036**	0.014	0.024**	0.044***	0.013***	0.002	0.003	0.003	0.013***	0.002	0.003	0.003
	(-2.32)	(1.21)	(1.93)	(3.02)	(3.77)	(0.89)	(1.04)	(1.28)	(3.54)	(0.83)	(1.11)	(1.25)
TO	0.693***	-0.049	-0.089**	-0.297***	0.004	-0.010	-0.043**	-0.024	0.015	-0.007	-0.037**	-0.025
	(13.66)	(-1.25)	(-2.14)	(-6.55)	(0.22)	(-0.55)	(-2.36)	-1.44	(0.65)	(-0.38)	(-2.06)	(-1.53)
UPOP	3.988***	0.943***	1.031***	0.005	0.218	-0.607***	-0.558***	-0.482***	0.719***	-0.387***	-0.364***	-0.457***
	(38.01)	(8.90)	(9.36)	(0.04)	(1.37)	(-4.66)	(-4.42)	(-4.00)	(4.70)	(-3.13)	(-3.01)	(-3.90)
EDU		0.244**	-0.084	-0.098		0.254***	0.277***	0.085*		0.256***	0.278***	0.086*
		(2.21)	(-0.68)	(-0.44)		(5.68)	(6.26)	(1.71)		(5.72)	(6.28)	(1.72)
LECON		1.024	0.999***	1.078***		0.920***	0.871***	0.981***		0.944***	0.895***	0.984***
		(42.76)	(38.42)	(31.09)		(37.50)	(34.60)	(41.89)		(39.85)	(36.69)	(42.96)
INDG			.219**				0.376***				0.363***	
			(2.06)				(9.65)				(9.32)	
R&D				-0.089***				-0.064***				-0.064***
				(-3.46)				(-5.27)				(-5.29)
Constant	-6.815***	-7.978***	-7.398***	-6.429***	-7.786***	-9.543***		-6.738***	-7.312***	-9.280***	-9.652***	-6.738***
	(-23.60)	(-32.28)	(-27.42)	-15.60	(-20.45)	-30.01		(-20.73)	(-19.47)	(-30.12)	(-31.47)	(-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

t-values are in parentheses. Whereas, ***, **, * indicates significance at 1%, 5% and 10% level of significance, respectively.

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).

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. The study accepts 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 CO_2 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 CO_2 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 is significant. Similarly, for the urban population, the study gets mixed results and it is 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.

AUTHOR CONTRIBUTIONS

M. Batool performed conceptualization, methodology, software, literature review and manuscript preparation. Y. Jehan performed data curation, writing original draft preparation, writing reviewing and editing references. Naveed Hayat helped in the visualization, investigation, software validation.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

ABBREVIATIONS

FEM	Fixed Effect Model
IPS	Im-Pesaran-Shin
LLC	Levin-Lin-Chu
GDP	Gross Domestic Product
REM	Random Effect Model
CO2	Carbon Dioxide
EKC	Environmental Kuznets Curve
CEM	Common Effect Model
PHH	Pollution Haven Hypothesis
FMD	Financial Market Depth
FME	Financial Market Efficiency
FMA	Financial Market Access
FID	Financial Institutions Depth
FIE	Financial Institutions Efficiency
FIA	Financial Institutions Access
WGI	World Governance Indicators

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