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Article

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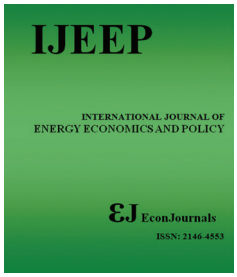

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Empirical Investigation of the Impact of Energy intensity and Financial Institutions Efficiency on Environmental Degradation in Pakistan

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ABSTRACT

Pakistan's is relentlessly affected by climate change and is looking for foreign assistant to deal with climate change challenges. Also, Pakistan is trying to tackle with climate change domestically. Environmental degradation consequently leads to climate change domestically as well as globally. Environmental degradation is extensively studied in empirical literature. Efficient use of resources only can ensure to lessen environmental degradation and its effects in terms of climate change. Henceforth, the current empirical study is analyzing the impact of energy intensity and financial institutions efficiency on environmental degradation in Pakistan. The energy intensity is considered as a factor of environmental degradation as it is one of the proxy for energy efficiency. Moreover, for overall economic activities impact on environmental degradation, this study considered GDP as a control variable. The time series techniques such as unit root and bounds cointegration techniques are applied for non-stationarity, cointegration and results estimates. The result of this study documented that energy intensity, financial institutions efficiency and GDP are factors of environmental degradation and energy intensity and GDP are aggravating environmental degradation whereas financial institutions efficiency has abstained it in Pakistan.

Keywords: Energy Intensity, Financial Institutions Efficiency, Environmental Degradation
JEL Classification: E01, G10, P18, Q53

1. INTRODUCTION

Environmental degradation is the major concern for human kind in the recent decades. The nature and characteristic of environmental degradation is anthropogenic pollutants. The creed of economic growth and development increased anthropogenic pollutant in environment, which have pernicious consequences on the Mother Nature but the desire is never ended (Shrinkhal, 2019). In 20th century the problem of environmental degradation got great importance. In environmental degradation, greenhouse gases are the prime factor of polluting the nature. The major element of greenhouse gases is the CO_2 emission (Gorus and Aslan, 2019). In addition, the report by intergovernmental panel on climate change, consumption of fossil fuel energy will further deteriorate the environment, especially the global warming. This will have severe consequences on the economic and social life individuals especially in the less developing countries (Edenhofer et al., 2014). Furthermore, the recent trend of globalization has increased the flow of foreign direct investment (FDI) from developed to developing countries, as developing countries has weak environmental policies compare to developed countries, thus increasing the bulk of polluted industries in the less developed countries (Cole and Elliott, 2005; Cole et al., 2006), which further deteriorate the environment of these nations. To reduce carbon emission, in 1997 the industrialized countries and international organization (United Nation and Europe union) signed an

agreement known as Kyoto Protocol to reduce greenhouses gas emission to <5% globally (Gorus and Aslan, 2019). In similarly way, to reduce the carbon emission and environmental degradation, it was decided to deduce the carbon emission up to 2°C by 2020, in a meeting of United Nations Framework Convention on climate change (UNFCCC, 2015).

Global warming and climate change coupled with deteriorating environment of Pakistan has severely affected the economy in recent decades. The environmental degradation has suffered the economy in various ways. Firstly it increase the annual temperature by 0.5°C from the last 50 years inside the Pakistan. The increasing temperature has adverse effects on the agriculture, water, biodiversity, the livelihood of the animals and humans (Economic Adviser's Wing, 2005; Abbas et al., 2018). Secondly the climate change has changed the pattern of whether in shape of extensive rains, floods and drought, which not only affecting the socioeconomic life of people but also the supply of agricultural goods and services. Thus hindering the growth of agricultural and industrial sector. There are several factors that contribute to the degradation of the environment, like deforestation, industrial growth and services sector. In these forces, the major contributors are energy consumption and carbon emission. Due to this, Pakistan has been ranked as the 5th air pollutant and environmentally degrading economy (German Watch, 2019). Furthermore, Pakistan has been ranked as the 2nd most polluted country in the world by the World Development Index report (WDI, 2020). To reduce these effects, the economy needs to take widespread modifications and alleviation procedures, in order to alter the energy sector towards a less polluting and carbon impartial economy.

Keeping in view the current situations, scholars have tried to find the determinants of environmental quality and sustainability. In this regard, Ahmed et al. (2015) carried an empirical study to determine the factors of environmental degradation using traditional Kuznets Curve (EKC). The study has taken deforestation as an indicator for environmental degradation, and thus found the negative impact of economic growth on deforestation, Moreover, he found bidirectional causation between economic growth and energy consumption. In the same way Abbas et al. (2020) has taken socioeconomics variables as a factors of environmental degradation, which are FDI, GDP per capita and population, agricultural land and industrialization. The study found FDI, GDP and industrialization are factors that contribute positive to environmental deterioration, while agriculture land have no significant impact on environmental degradation. In similar fashion, Zhang et al. (2021) determined GDP as a factor of environmental degradation while, human capital and natural resources are also factors of environmental sustainability. However, the researcher has not found any study so far in Pakistan that analyzes the effect of energy intensity and financial efficiency on environmental degradation. Therefore, the study takes financial efficiency, energy efficiency and GDP growth as a factors of environmental degradation. As carbon dioxide (CO_2) emission has been considered as the most degrading factor of environmental degradation (Eyuboglu and Uzar, 2021; Chien et al., 2021), therefore the study taken CO_2 emission as proxy for environmental degradation. Financial efficiency is considered as a factor of environmental sustainability and argued that financial efficiency significantly reduces environmental degradation (Habiba and Xinbang, 2022). Therefore, this study includes financial efficiency as a factor of environmental degradation in Pakistan. This study taken energy intensity as factor of environmental degradation, because energy efficiency has been used as a factor of environmental sustainability in literature (Xu et al., 2022). As energy efficiency is being considered as tool to produce output at least cost, while using least amount of energy. Therefore, the study includes energy efficiency as tool producing cost efficient output while consuming least amount of energy. Therefore, the study has two main objectives, one is to find the link between the financial institutions efficiency and environmental degradation, and the other is to find the link between energy intensity and environmental degradation.

This study uniquely contributing to current literature related to factors of environmental degradation in many ways. Firstly, the existing literature on association between energy intensity, financial institutions efficiency, and carbon emission is limited. Secondly, no study has been conducted in Pakistan to explore the relationship among financial institutions efficiency, energy intensity, GDP growth and carbon emission. Moreover, it is argued that energy efficiency and financial institutions efficiency are the elements of environmental sustainability. Besides, this study also made comparison of the prevailing situation of these variables of the study with important regional economies, Bangladesh and India as these regional economies share almost same economic and trade structure especially exports and also share socio-economic and culture facets. Therefore, the study will help the policy makers in Pakistan to devise policies regarding energy sector, financial sector and environment. Some policy measures are also discussed in this study. This study is arranged in the following way that subsequent section presents review of literature. Moreover, empirical model of the study is also discussed in this section. Research Methodology including data, its sources and time series techniques are described and presented in third section. Results are interpreted and discussed in fourth section while conclusion, limitations and policy implications are discussed in the last section of the study.

2. LITERATURE REVIEW

Sustained economic growth is the ultimate objective of every economy. To achieve this objective, economist and policy makers have stress on various factors of growth and developments. Such determinants of economic growth and development are determined in literature. Such as growth of agricultural sector, industrial sector, services sector, technological innovation, foreign direct investment, growth of financial institutions and efficiency of natural and capital resources (Chirwa and Odhiambo, 2016). In this regard, the study conduct by Tian et al. (2012) concluded that construction sector is the most polluting and carbon emitting sector in china, furthermore the study reveals that the service sector and manufacturing are the other most carbon emitting sector of environmental deterioration in China. Highlighting the impact of transport sector in economic growth and environment, Du et al., (2019) found that transport sector has the positive association

with carbon emission, while rail transport has been significant factor of carbon reduction. Likewise, transport sector, the growth of industrial and services sector has substantial contribution to environmental degradation, as Mohsin et al. (2022) argued that service and industrial sector is highly correlated with energy consumption, because most of energy sources are fossil fuels, which has significant contribution in environmental degradation. Moreover, Waheed et al. (2019) established the same results, while conducting study for developing countries. There are numerous studies on the association between the economic growth and carbon emission and concluded positive association between these indicators (Soytas and Sari, 2009; Narayan et al., 2016; Wu et al., 2019; Khan et al., 2020; Naseem et al., 2022; Shikwambana et al, 2021; Shuai et al., 2019).

The role of financial sector cannot be neglected in the growth of economy. Therefore, financial sector development has been considered as a significant factor of economic growth and development (Shahbaz et al., 2013). It can be defined in number of ways, by financial development we mean, the development of financial sector, in other words, the improvement in the efficiency of financial sector that can be improved via improvement in the structure of financial sector, innovation of financial instruments and diversification of financial institutions (IGI, 2022). Even though it has great importance to growth and development, but it has also great importance in terms of environmental sustainability. The literature on the effect of financial development on development and environmental degradation has showed distinct outcomes, depending upon the study region and environmental indicators. For example, Shahbaz et al. (2013) concluded that financial development is the factor of environmental sustainability. The study revealed that financial development is inversely related with CO_2 emission and directly related to economic growth. Moreover, various scholars have studied the role financial development in the framework of environmental aspects and confirm that it has significant role in reducing environmental degradation (Omri et al., 2015; Gill et al., 2019; Gokmenoglu and Sadeghieh, 2019; Yao and Tang, 2020; Abbasi and Riaz 2016). Besides this, that financial development is considered as factor of environmental sustainability, that reduces carbon emission, some empirical studies also found the positive effect of financial development on carbon emission. Likewise, the study of Khan et al. (2014), showed the bond of CO_2 emissions with financial development, economic variables, like foreign direct investment, Liquid liabilities and money in South Asia. The results demonstrated no impact in the short run, but it showed, direct influence of all the economic and financial variables on environmental degradation in the long run.

Energy intensity which also presents energy efficiency is a vital determinant of energy security and carbon emission. Energy efficiency can be defined as "production of goods and services at least cost mitigating the carbon emission, while consuming least amount of energy" (EESI, 2022). The prevailing evidence on the energy efficiency strategy shows that, energy efficiency has significantly reduced carbon emission irrespective of the developmental stage of countries (Mahapatra and Irfan, (2021). The strategy of energy efficiency has been considered as an optimal instrument for environmental sustainability. Besides this, the intensity of energy efficiency in environmental sustainability depends on the environmental conditions prevailing in the country (Chang, 2015). In this regard the Akram et al. (2022) conducted panel study for MINT countries, and found that energy efficiency as positive element of carbon emission, while Xu et al. (2022) found that energy efficiency is lessening carbon emission. This result is also claimed by Fernando and Hor (2017) and Akram et al. (2020). Studies on the determinants of environmental sustainability also found that renewable energy sources are vital role in carbon reduction. In this way various studies have been conducted (Yao et al., 2019; Saidi and Omri, 2020; Jin and Kim, 2018), the findings confirm that renewable energy sources have significant contribution in reducing carbon emission.

Summing up the above literature, scholar have used different indicators to measure the environmental degradation, such as carbon emission, nitrous oxide, methane and deforestation, but as the most emitting gas in greenhouse gases is CO_2 and also mostly CO_2 emission is taken as proxy of environmental degradation in literature. Therefore, the study takes CO_2 emission as a proxy for environmental degradation. Similarly, literature have determined the factors of environmental degradation and sustainability, such as GDP growth, industrial growth, energy consumption, urbanization, population growth and renewable energy resources, financial efficiency, technological innovation, energy efficiency respectively (Pao and Tsai, 2010). Therefore, it is concluded from the literature review that GDP growth, financial efficiency and energy efficiency are the significant factors of environmental degradation and sustainability in case of Pakistan. Therefore, the following empirical model was constructed to explore the influence of the economic growth, financial efficiency and energy efficiency on carbon emissions. The functional and econometric model is given as;

$$CO_2 = f(GDP, FE, EE) \quad (1)$$

In Equation (1), CO_2 denotes carbon emissions, GDP denotes GDP growth, FD indicates financial efficiency and EE signifies energy efficiency. The reproduction of the current research in linear description is described in equation (2):

$$\log CE_t = \beta_0 + \alpha_1 \log GDP_t + \alpha_2 \log FE_t + \alpha_3 \log EE_t + \epsilon_t \quad (2)$$

Where, β_0 provides the intercept while α_i shows corresponding coefficient of the independent variables and ϵ_t implies the error term.

3. METHODOLOGY

To analyze the nexus between energy efficiency, financial efficiency and carbon emission, the study used Carbon dioxide (CO_2) as a proxy of environmental degradation, because in greenhouse gases carbon dioxide is the most environmentally degrading gas. The CO_2 emission is measured in million metric tons per annum. Similarly, GDP growth is considered as an indicator for the economic health of the country. The GDP growth is link with industrial and energy consumption. Beside this, studies have found correlation between GDP growth

and CO_2 emission (Ozturk and Acaravci, 2013; Acaravci, and Ozturk, 2010). Therefore, this study uses GDP as proxy for GDP growth, which is measured in million dollars at Constant US2015. Regarding financial development and carbon nexus scholar have different findings. Likewise, Khan et al. (2014) found that financial development increases carbon emission while Shahbaz et al. (2013) consider financial development diminishes carbon emission therefore this study incorporated financial institutions efficiency index, which is collected from IMF (International Monetary Fund) (IMF, 2022). For environmental sustainability, scholar employed different variable which reduce carbon emission in the air. For this many studies argue the use of renewable energy sources while (Xu, 2022) considered energy intensity, as he argued that it also one of the proxy for energy efficiency, as indicator for environmental sustainability. Therefore, this study also considering energy intensity as a factor of environmental degradation that is quantified as GDP in USD per kg of oil equivalent. To estimate the model, the study employed quarterly time series data for the period of 1991-2015. The data on carbon emissions, energy intensity and GDP is taken and collected from World Bank (2022).

Before measuring parameters of the model in short run and long run, the data set of all variables must be evaluated to check assumptions of regression. Keeping in view regression analysis, one of the assumption is that it must be free of stationarity problems, and there must be no trend in the data over time. In case the violation of these assumptions, the regression findings will be inaccurate and spurious. For this objective, the study used Philips and Perron (1988) test, to check the stationarity problem in the model. The Phillips and Perron (1988) test is used because, ADF test take into account the autocorrelation (Dickey & Fuller, 1979). While, Philips and Perron (PP) does not include the autocorrelation problem. After analyzing the data for stationarity problem, the study applies Autoregressive Distributive Lag model (ARDL), to estimate the long run and short run parameters (Pesaran et al., 2001), because PP test shows that all variable are integrated at same order. The ARDL method has some advantages over other cointegration techniques. It can be used regardless of the order of integration of the variables, whether it I(0) or I(1). Secondly it gives efficient even in case of small sample. Thirdly it has both short run and long run dynamics. Fourthly it give the restricted and unrestricted error correction term and can be easily obtain by linear transformation. The ARDL equation applied in the current research is depicted as follows:

$$\Delta logCE_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i \Delta logCE_{t-i} + \sum_{i=0}^{m} \alpha_1 \Delta logGDP_{t-i} + \sum_{i=0}^{m} \alpha_2 \Delta logFE_{t-i} + \sum_{i=0}^{m} \alpha_3 \Delta logEE_{t-i} + \beta_1 logGDP_{t-1} + \beta_2 logFE_{t-1} + \beta_3 logEE_{t-1} - \beta_6 ECT + \varepsilon_t \quad (3)$$

Equation (3) is composed of two both long run and short run dynamics. The first term which include summation and difference shows the short run, while the other part shows the long run coefficients. The α_i and summation signifies the slope of variables in short run and β_i characterizes the long run coefficients. The error term is characterized by ε_t, whereas the constant term is expressed by α_0.

4. RESULTS, INTERPRETATION AND DISCUSSION

The unit root problem in the data is checked with the PP test and results are depicted in Table 1, which shows that all the variables are stationary at first difference I (1). Moreover, the carbon emission, energy efficiency, financial institutions efficiency and GDP are significant at 1% level of significance. Based on these results the study employed ARDL technique to find the short run and long run relationship, as ARDL can be used, whether all variables are having same integration level or mixed order of integration but not high order of integration than first order.

Table 2 provides the result of bounds and diagnostic tests. The bound test is used to check, whether there is long run cointegration among variables proposed in the study. The decision role is that, if F-calculated value is smaller than the F bound lower limit, we may conclude that there is no cointegration. If F-calculated value is greater than upper bound value, we may accept that there is long run cointegration and test is inconclusive if F-calculated value falls between the upper and lower bound value. The results showed that there is long run cointegration among variables as F calculated statistic is greater than F upper bound value. Additionally, it is essential to diagnose the problems associated with estimations, such as, serial correlation, heteroscadasticity and specification bias. The results of these tests are depicted in lower segment of the Table 2. It is one of the OLS assumption the, the model should be freed from auto correlation. The autocorrelation in the data is checked with help of Breusch-Godfrey Serial Correlation LM Test. The null hypothesis is that the model is free from serial correlation, against the alternative that it contains serial correlation. The model

Table 1: Result of philips perron test

Variable	Level	First difference	Decision
logCE	−0.65	−5.77***	I (1)
loge	2.18	−4.44***	I (1)
logFE	−2.19	−6.19***	I (1)
LogGDP	−0.54	−4.34***	I (1)

**and ***Shows 5% and 1% level of significance

Table 2: Bounds and diagnostic tests results

Test	Value	Sig.	Lower bound value	Upper bound value
F-statistic	7.94***	10%	2.72	3.77
K	3	5%	3.23	4.35
		1%	4.29	5.61
Diagnostic tests				
Tests	**Coefficient**	**P-value**		
Serial correlation	1.18	0.31		
Heteroscadasticity	0.85	0.60		
Ramsay's RESET	1.85	0.18		

***Significance at 1% level

is free from serial correlation as its prob. Is >0.05, which provide the evidence that we could not reject the null hypothesis of no serial correlation. The Heteroscadasticity problem in the model is checked with the help of Breauch pagan test and we can conclude there is no heteroscadasticity problem. Similarly, the specification bias problem is checked with the help of Ramsay's Rest test, which showed the model is free from specification error.

Table 3 provides long run and short run result of ARDL model. The results show that energy efficiency, gross domestic product has positive impact on carbon emission in long run while financial development has negative but insignificant impact on carbon emission. The result should that if there is 1% increase in energy efficiency the carbon emission would increase by 0.65%, however in literature it is argue that the energy efficiency is a factor of environmental sustainability (Hasanov et al., 2021), however, in case of Pakistan, it has positive impact on carbon emission, because Pakistan is energy deficient country. If we compare per capita energy consumption of Pakistan with world it is 0.51 tons of oil equivalents (toe) and 557 kwh per annum as compare to world energy consumption per capita i.e. 3081 kwh (Enerdata, 2020). Beside this, most of energy sources are fossil fuels which significantly contributing to environmental deterioration in Pakistan (Rasool et al., 2019). It is evident that financial efficiency has positive and significant role in reducing carbon emission in Pakistan, which mean that financial development efficiency is factor of environmental sustainability. One percent (%) increase in financial efficiency would reduce the CO_2 emission by 0.01%, which means that, Carbon emission is positively link with gross domestic product, as GDP grows carbon emission also grows. A 1% increase in GDP would increase carbon emission by 1.245%. As Zhang et al., (2018) also confirm that carbon emission rises with rise in economic growth in case of Pakistan. The lower part of Table 3 portrayed the results of short run ARDL. In short run, the energy intensity has significant impact on carbon emission. Financial efficiency has negative impact in both short run and long run, this means that the growth of financial sector is the elements of environmental sustainability in Pakistan. Similarly, the GDP is found to have positive effect on carbon emission in short run, this mean that economic growth has detrimental effects on environment. The last part of the diagram shows the model stability results. The results are negative and significant, which shows that the model is stable and will recover it from any shocks in long run.

Table 3: Result estimates

Long run estimates		
Variable	**Coefficient**	**t-statistic**
logEE	0.66***	6.58
logFE	−0.01	−0.25
logGDP	1.24***	57.61
Cointegration form estimation (short run)		
D (logCE(−1))	0.44***	4.76
D (LogCE(−2))	0.21**	2.38
D (logEE)	0.88***	3.64
D (logEE(−1))	−0.49*	−1.86
D (logFE)	−0.10***	−3.18
D (logFE(−1))	0.04	1.35
D (logGDP)	1.10***	4.57
D (logGDP(−1))	−0.27	−0.61
D (logGDP(−2))	−0.38	−1.52
CointEq(−1)	−0.30***	−5.47

***,** and *Significance at 1%, 5% and 10% respectively

Now it is better to shed light on the important variables of the study and its situation in Pakistan. Figure 1 portrays the level of carbon emissions metric tons per capita in Pakistan and its comparison with India and Bangladesh. All these selected countries are members of SAARC and share common history. Moreover, other reason for selecting these countries is the composition of economies, trade and socio-economic conditions and culture as these traits can play role in uplifting economic conditions and also affect sustainability. Although, Pakistan is emitting lesser carbon per capita compare to India but is emitting much more compare to Bangladesh whereas in recent years Bangladesh is doing well on many economic indicators such as exports and per capita income. These facts show that Pakistan is not utilizing its resources environment friendly and economic growth is accompanied with aggravating environmental degradation.

Figure 2 displays the level of energy intensity in Bangladesh, India and Pakistan. It can be seen that there is continuous decrease in the level of energy intensity in India and Pakistan over period from 2000 to 2016 however, through the period the energy intensity level is higher in India than in Pakistan whereas Pakistan has higher energy intensity than Bangladesh. This implies that

Figure 1: Carbon emissions metric tons per capita (World Bank, 2022)

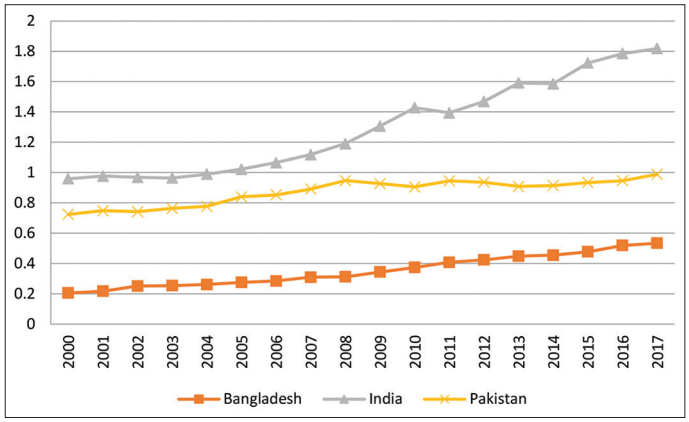


Figure 2: Energy intensity (World Bank, 2022)

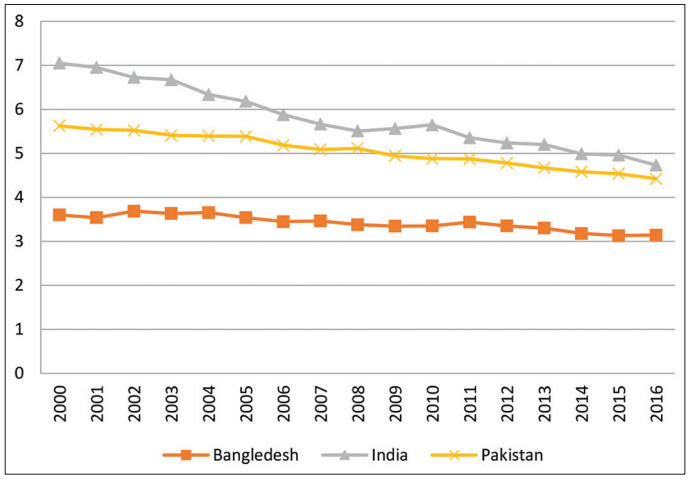
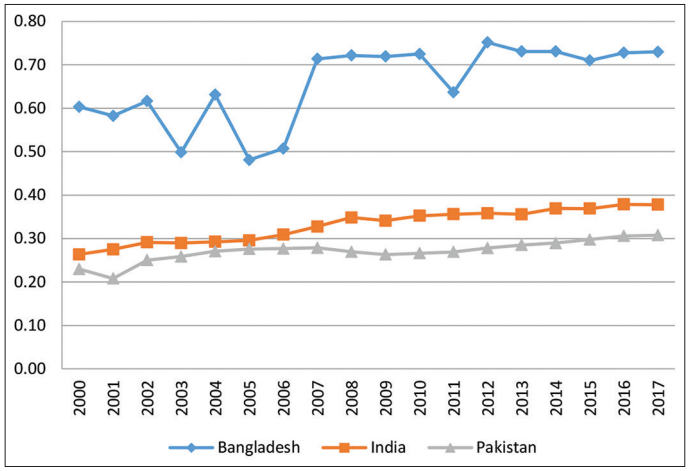


Figure 3: Financial institutions efficiency (IMF, 2022)



Pakistan is producing with least output from energy than India but producing greater output from energy than Bangladesh. However, the conversion of energy units to output and production is not in Pakistan is not environment friendly in Pakistan compare to Bangladesh as carbon emissions per capita is high in Pakistan than Bangladesh. Likewise, Figure 3 displays the situation of financial institutions efficiency in Bangladesh, India and Pakistan. Bangladesh has higher financial institutions efficiency than India and Pakistan through the selected period from 2000 to 2017. Bangladesh financial institutions efficiency is more than 2.5 times than Pakistan whereas India has greater financial institutions efficiency than Pakistan. This implies that this is a good room for financial institutions efficiency improvement in Pakistan.

This study established the positive impact of energy intensity on environmental degradation and negative impact of financial institutions efficiency on environmental degradation in Pakistan. Henceforth, these study policy implications are describing here. It is recommended that Pakistan has to improve its energy conversion to output production in a way that has to be environment friendly. This could be possible in three ways. First, steps are required to improve production efficiency and secondly, through up to date technological techniques and gives incentives for environment friendly technology in production. Thirdly, Pakistan has to make sure that large share of energy is fulfilling from renewable resources. Likewise, Pakistan has to reforms its financial sector and institutions in such a way to improve its efficiency and make it environment friendly. This could be possible through training and incentivizing green financing. Only through such policy implications Pakistan will not only improve socio-economic indicators but can also ensure sustainable environment and development.

5. CONCLUSIONS AND RECOMMENDATIONS

Global warming and climate change coupled with deteriorating environment of Pakistan has severely affected the economy in recent decades. The environmental degradation has suffered the economy in various ways. The increasing temperature has adverse effects on the agriculture, water, biodiversity, the livelihood of the animals and humans. The climate change has changed the pattern of weather in shape of floods and drought, which not only affecting the socioeconomic life of people but also the supply of agricultural goods and services. Thus hindering the growth of agricultural and industrial sector. There are several factors that contribute to the degradation of the environment, like deforestation, industrial growth and services sector. In these forces, the major contributors are energy consumption and carbon emission. Moreover, Pakistan has been ranked as the 5th air pollutant and environmentally degrading economy. Same time Pakistan is facing many challenges in the form of energy security, environmental and climate issues. Keeping in view the current situation and problems of Pakistan, scholars have tried to find the determinants of environmental degradation and factors of environmental sustainability in Pakistan. Environmental degradation ultimately results in climate change domestically as well as globally. Environmental degradation is extensively studied in empirical literature. Efficient use of resources only can ensure to lessen environmental degradation and its effects in terms of climate change. Henceforth, the current empirical study is analyzing impact of energy intensity and financial institutions efficiency on environmental degradation in Pakistan. The energy intensity is considered as a factor of environmental degradation as it is one of the proxy for energy efficiency. Moreover, for overall economic activities impact on environmental degradation, this study considered gross domestic product (GDP) as a control variable. The study uses quarterly time series data for from 1991 to 2015, and employed ARDL bounds technique to find the result estimates in short run as well as in long run, after checking the data for stationarity. The study also uses some preliminary and post estimation tests to check the model is free from econometric problems. The model full fill all of its assumptions. The long run results show that GDP and energy efficiency has positive impact on carbon emission, while financial institutions efficiency has negative but insignificant impact on carbon emission. Similarly, the short run results also confirm the long run results.

The study finds the positive impact of energy intensity on carbon emission. This means that environment is deteriorating with rise in energy consumption and energy efficiency. The reason behind the positive association is that Pakistan energy sources are largely dependent on fossil fuel consumption as Pakistan is producing 64%, 27%, 5% and 4% electricity from fossil fuels, hydropower, nuclear power and renewable sources respectively (Reuters, 2021). Beside this, if we compare per capita energy consumption of Pakistan with world it is 0.51 tons of oil equivalents (toe) and 557 kwh per annum as compare to world energy consumption per capita i.e. 3081 kwh. These are factor which contributing negatively to environment. So it is recommended that policy makers should shift the gear from fossil fuels to more renewable energy sources, in order to protect the environmental sustainability. Secondly the study found the positive link of GDP growth with environmental degradation, the factor behind environmental degradation, are the growth of industrial, service and agricultural sector, which can be seen by the emission produce by each sector. The total CO_2 emission from fossil fuel combustion, electricity and heat production, manufacturing industries and construction, transport,

residential and commercial and public service sector are, 183.4, 54.5, 52.6, 53.9, 16.5 and 3.8 million tons respectively. This means that the growth of these which are consider as element of economic growth has significant negative effect on environment in Pakistan. So there is need of the policy implication are not only growth oriented but environment friendly. Similarly, the study found financial development efficiency as an element of environmental sustainability but in case of Pakistan the results are insignificant. This study established the positive effect of energy intensity on environmental degradation and negative impact of financial institutions efficiency on environmental degradation in Pakistan. Henceforth, these study policy implications are describing here. It is recommended that Pakistan has to improve its energy conversion to output production in a way that has to be environment friendly. This could be possible in three ways. First, steps are required to improve production efficiency and secondly, through up to date technological techniques and gives incentives for environment friendly technology in production. Thirdly, Pakistan has to make sure that large share of energy is fulfilling from renewable resources. Likewise, Pakistan has to reforms its financial sector and institutions in such a way to improve its efficiency and make it environment friendly. This could be possible through training and incentivizing green financing. Only through such policy implications Pakistan will not only improve socio-economic indicators but can also ensure sustainable environment.

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