IMPACT OF FINANCIAL DEVELOPMENT ON ENVIRONMENT; A CASE OF LOW-, MIDDLE- AND HIGH-INCOME COUNTRIES

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CERTIFICATE

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Abstract

Environmental deterioration has been the main cause of interest for together developed and developing countries. Financial Development (FD) is among the primary drivers of strong economic growth and can help in sustainable development. This study seeks to examine the impact of FD on environmental indicators, namely carbon dioxide ($CO_{2)}$, nitrous oxide (N_2O), and methane (CH_4) in low, middle, and high-income countries for the time of 1990-2018. This study also investigates the presence of pollution haven/pollution halo hypothesis in low, middle, and high-income countries. The empirical findings interestingly showed that FD increases CO_2, N_2O, and CH_4 emissions significantly in low-income countries, whereas in middles income countries, FD raises CO_2 and N_2O emissions significantly but reduces CH_4 emissions. While in high-income countries, FD posits a significant negative impact on CO_2 and N_2O emissions, whereas an insignificant impact was found on CH_4. Regarding Foreign Direct Investment (FDI), pollution haven hypothesis prevails in low-income countries (CO_2), and in middle-income countries (CO_2 and N_2O). Whereas in high-income countries, pollution halo hypothesis exists (CO_2). The observed findings of research recommend that stronger environmental regulations should accompany FDI, and the financial sector should be obliged to dedicate more resources for clean energy projects.

Keywords: Environmental Deterioration, Financial Development, Environmental Indicators, Pollution Haven Hypothesis, Pollution Halo Hypothesis.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BRIC	Brazil, Russia, India, and China
BRI	Belt and Road Initiative Countries
CO_2	Carbon Dioxide
CH_4	Methane
CPI	Consumer Price Index
EKC	Environmental Kuznets Curve
EC	Energy Consumption
FD	Financial Development
FE	Fixed Effect
FDI	Foreign Direct Investment
GDP	Gross Domestic product
GHG	Green House Gas emissions
HO	Heckscher-Ohlin
IPCC	Intergovernmental Panel of Climate Change
N_2O	Nitrous Oxide
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Square
PHH	Pollution Haven Hypothesis
PHH	Pollution Halo Hypothesis
R&D	Research and Development
RE	Random Effect
TO	Trade Openness

CHAPTER 1

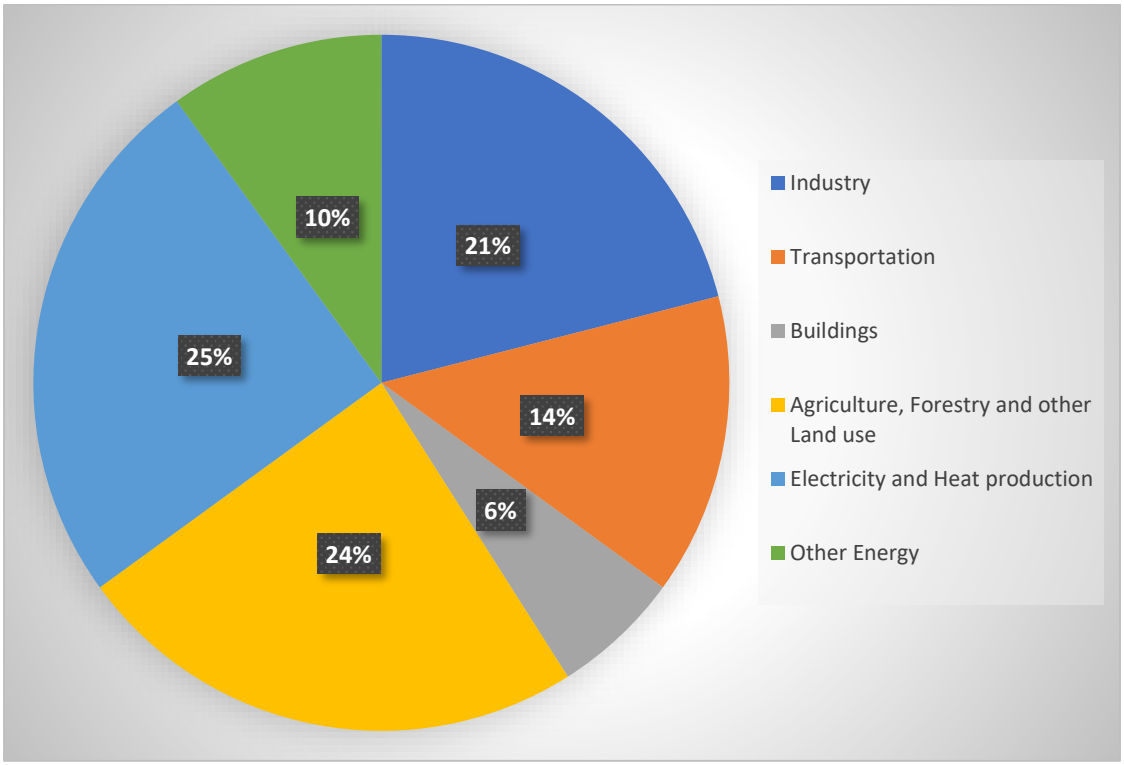
Introduction

Changes in environment and worldwide temperature change are the highly discussed issues in the world today. An understanding of the relationship between environmental Indicators, i.e., carbon dioxide, nitrous oxide, methane, and financial development, is essential in order to make policies in developing and developed countries since there are some policies that increase the growth of the economy but eventually increase CO_2 emissions as well. Likewise, the increase in Financial Development (FD) may stimulate economic development, which further raises energy consumption and CO_2 emission. Hence due to the challenges of climate change, an overall rise in global emissions has stayed a severe concern to policymakers.

The first environmental indicator is carbon dioxide, which is emitted from fossil fuels and by human activities, which together heat up our planet's environment and oceans (IPCC, 2007). Anthropogenic activities that contribute to greenhouse gas emissions directly or indirectly affect global warming. Many results are already being observed, i.e., intense weather events, ice melting, sea-level rise, changes in productivity in agriculture, etc. Sequentially, these changes affect ecosystems, wildlife, and human beings. By reducing CO_2 emissions, many countries seek to diminish the impact of global warming. Over the past 250 years, the atmospheric CO_2 mixing rate has risen by around 36%. The increase in worldwide carbon emissions in the era of industrial development is primarily due to emissions from fossil fuel and gas burning and the manufacture of cement. The second environmental indicator is nitrous oxide, which has increased in the atmosphere since the pre-industrial era. Agricultural practices are the key source of N2O emissions and have been boosted by the use of energy-related farm equipment and inputs like fertilizers. The third environmental

indicator is methane, which has risen by 30% over the last 25 years. The global sources of CH_4 are largely biogenic and include wetlands, rice growing, burning biomass, and animals with ruminants. The global impacts of temperature change are even now evident in rising the rate of intense weather events, changing patterns of rainfall, highlighting the strength of the hurricanes, changing ocean flows, and escalating sea level. These variations can have major impacts on ecosystem performance, wildlife sustainability, and human security.

Figure 1.1: Global Emissions by Economic Sector



Source: IPCC (2014)

Growth initiatives in recent years have focused increasingly on environmentally sustainable development rather than pure growth. Energy use and environmental destruction have gained a lot of attention worldwide in this regard. In this respect, green funding aims at a new financial blueprint that will improve growth and the environment.

This was founded upon the concept of 'green credit,' which is used by financial institutes to enhance the environment by funding energy-effective technology and green financing. Similarly, financial institutes are also promoting research and development (R&D) in new power resources, with a focus on organic agricultural production (Xu, 2013).

Tamazian (2009) argued that FD in BRIC countries has lowered carbon emissions and ultimately helped in reducing environmental degradation. Halicioglu (2009); Tamazian (2009); Rao (2010) proposed that the growth of the FD is expected to have environmentally friendly programs that lower cost and therefore reduce pollutants in the energy sector. Tamazian (2009) stated that FD decreased in the case of Indonesia. FD in a country can boost environment quality and also provide green and sustainable technology to reduce CO_2 emissions (Shahbaz, 2013). In comparison to Pakistan, the coefficient of FD has shown a significant positive sign that further shows that FD exists on the expense of environmental quality environment (Javid, 2016).

Many studies have shown that the advancement of the financial field can raise the usage of energy and carbon emissions. This result was reached by Shahbaz et al. (2012), Alam et al. (2013. Whereas numerous studies have revealed that the development of financial institutions leads toward the reduction of CO_2 emissions and energy usage. This result was reached by Tamazain and Rao (2010) and Park et al. (2018).

Although the link between foreign direct investment and carbon emissions attracted many scholars in the past few years, however, there is no general agreement among scholars. This is because, during the past few decades, many underdeveloped economies have been rapidly developing due to FDI inflows. FDI can be described as

a transfer from one country to another that comprises of either a local or government establishing operation or acquiring tangible assets in foreign business. There are basically two contradictory hypotheses about the effect of FDI on the quality of the environment of the host nation. i.e., the pollution halo and the pollution haven hypothesis (Copeland & Taylor 1994) (Tobey, 1990). Pollution haven tells that when developed nations want to set their industries or offices in a foreign country/developing country, they will pursue the cheapest resources and labor force. This, though, always occurs at the expense of environmentally flawed practices (Levinson, 2008); (Cole, 2004); (Lan et al., 2012); (Shahbaz et al., 2015). Several research, on the other side, rejected this hypothesis (Bin and Yue, 2012); (Javorcik and Wei, 2004). According to the pollution halo theory, foreign direct investment spreads technology and disseminates managing strategies in host countries that build halos of pollution to lessen pollution by positive external variables. Several articles have also endorsed the halo hypothesis (Eskeland and Harrison, 2003); (Antweiler et al., 2001); (Levinson and Taylor, 2008). Ren et al. (2014) analyzed CO_2 emissions from different segments of the Chinese industry. They noted that foreign direct investment boosted emissions in the industrial sector due to a lack of resource and technical capacity utilization. Lau et al. (2014) researched EKC's role for FDI in Malaysia, and It has been founded that FDI increases CO_2 emissions in the long term.

Our study is distinctive in the sense that this analysis will provide a thorough comparison in the sense of FD and its impact on three key Environmental indicators, i.e., CO_2, N_2O, and CH_4. In this study, we have also analyzed the existence of pollution halo and pollution haven hypothesis in the framework of FDI for the given three pollution indicators for three income-group nations. In comparison, all previous studies either are performed in a few countries or for specific years, taking into account certain

variables (energy use, growth) only in the sense of CO_2, but the present research is being conducted on global income groups for three different environmental pollution indicators namely CO_2, N_2O, and CH_4 individually.

1.1 Objective of the Study

1. To evaluate the impact of FD on CO_2, N_2O, and CH_4 in low-, middle- and high-income countries.
2. To investigate the Pollution Haven Hypothesis and Pollution Halo Hypothesis for low-, middle-, and high-income countries.

1.2 Statement of the Problem

Environmental degradation and global temperature change are two of the biggest issues the world is facing today. The reason behind the environmental deprivation and global temperature change is anthropogenic activities, which are degrading our environment. Therefore, this is the hour to consider environment externalities, i.e., CO_2, N_2O, and CH_4, into account.

Our study seeks to identify the effect of FD on three pollution indicators, i.e., CO_2, N_2O, and CH_4 in low, middle- and high-income economies as these three gases play its role in degrading the environment also previous studies have not incorporated nitrous oxide and nitrous oxide in their studies. Complete analysis of Pollution Halo and Pollution Haven Hypothesis is also quantified. This study has given a wide range of world level analysis (low, middle- and high-income countries) in the context of FD and its impact on three environmental pollution indicators.

1.3 Organization of the Study

This study is organized into 6 chapters. Chapter 1 includes the introduction of the study, objectives, and statement problem. Chapter 2 includes a literature review on

financial development, foreign direct investment, and environment pollution indicators, and the literature gap. Chapter 3 includes the theoretical background and hypothesis, whereas chapter 4 includes methodology and sources and sample of the data. Chapter 5 includes descriptive statistics, correlation matrix, and Hausman test results. Chapter 6 includes discussion and recommendations, along with a conclusion.

Chapter 2

Literature Review

A growing range of observed studies has focused on the association among FD and environment quality, and this relationship is expected to change from positive to negative as more productive systems and energy-saving technology are implemented in the country's development practices (Jalil and Feridun, 2012); (Alam et al., 2013); (Shahbaz, 2013); (Al-Mulali et al., 2015). Whereas the relationship between FDI inflows and the environment is quite controversial in the sense that some authors suggested that FDI inflows increase CO_2 emissions (Cole, 2004); (Shahbaz et al., 2015). While others stated that FDI inflows decrease emissions (Levinson and Taylor, 2008); (Ren et al., 2014)

2.1 Environment Pollution Indicators and Financial Development

The literature has emphasized the role of FD on environmental indicators. Uyi and Hooi (2019) assessed the effect of financial trends on CO_2 emissions in 122 countries for the year 1990-2014. It was found that financial growth helped in minimizing CO_2 emissions in advanced countries. However, the results were reversed for less developed and developing countries. Ghorashi and Alavi (2018) analyzed the influence of financial sector development on carbon emissions by using the Panel ARDL technique. Results showed that in the long term, financial development degrades the environment. Meanwhile, Jalil (2011) confirmed that FD and environmental pollution has a negative relation and hence improves the environment as it lowers the environmental contamination in China.

Sadi et al. (2019) applied the ARDL bound approach to find the relation among CO_2 emissions and financial sector development in Nigeria from 1971 to 2010. Their study has revealed that the coefficient of financial growth has an important and positive

long-term effect on carbon emissions. Qi et al. (2017) worked on a panel of 30 regions of China for the years 1997 to 2011. Extended STIRPAT model and spatial panel econometrics methods were employed to test the relationships among financial sector development and carbon emissions. Regression showed that the increase in financial development, CO_2 decreases per capita and hence promotes the environment at the province level.

Empirical studies indicate that there is an existence of a strong correlation among financial growth and carbon emissions (Xu et al., 2018). The analysis also showed that when FD increases CO_2 emissions in the case of Saudi Arabia, this increases the growth of the economy, which further increases energy usage. In the case of Indonesia, FD shrinks carbon emission, whereas the energy sector and GDP were found to be the main contributors to CO_2 emissions. (Shahbaz, 2013).

Siddique and Muhammad (2017) worked on FD and CO_2 emissions in Pakistan for years 1980 to 2015. The findings showed the existence of long-term relationships among CO_2 emissions and FD, while in the short term, the effect was insignificant. Charfeddine and Ben (2015) used several unit root experiments to analyze the association among CO_2 emissions and FD. Results have proved the existence of that long-term and fundamental association among CO_2 emissions and financial developments in the UAE. Saidi and Ben (2017) worked on 19 emerging economies. Data were collected for the time of 1990-2013. Few tests like unit root, cointegration, and GMM-SYS were applied to the regression. Their results showed that in all three models, the FD coefficient is negative, which means that FD promotes the environment, and we can use financial reforms to sustain the environment. In the Turkish economy, FD happened at the expense of environmental degradation (Cetin and Ecevit, 2017).

In a panel of selected developing and developed countries, carbon emissions were increased by 0.499% and 1.204% with the increase in financial development in the long run, respectively, while in short, there is an insignificant impact of FD in both panels. (Muhammad Shoaib et al., 2020). According to the records of the Malaysian economy, the per capita carbon emissions raised from 1.584% to 7.097% from the year 1970 to 2009, which is a 450% rise in CO_2 emissions. Shahbaz et al. (2013) has proved that FD is playing a positive part in reducing CO_2 emissions for the Malaysian economy. Cetin et al. (2018) provided the evidence that in the longer run, FD and carbon dioxide emissions are correlated positively in the sense that a 1% surge in FD will lead to raising carbon emissions by 0.04% in Turkey. Whereas in Pakistan, both short-run and long-run FD worsens the environmental value, i.e., with an increase in FD, carbon emissions also increased and hence degraded the environment (Ali, 2015)

There exists a long-run and causative relation amongst CO_2 per capita emissions and FD in India. To find the causation between the variables, the author used the logarithm equation in which CO_2 is considered as a response variable, and FD is a predictor variable. To check the cointegration between the variable, the ARDL technique was used. The results have found that FD is affecting carbon emissions positively, which means that FD tends to degrade the environment in the environment. Moghadam and Lotfalipour (2014) studied the effect of FD on the quality of the environment for the time of 1970-2000 by applying Auto Regression Model Distributed Lag (ARDL). The results have shown that the FD coefficient is positive, suggesting that FD has an adverse impact on the quality of the environment in Iran.

The FD enhances environmental quality for Belt and Road Initiative (BRI) countries. Haseeb et al. (2018) analyzed the consequences of FD in 59 BRI countries. The findings showed the existence of two-way relation among FD and environmental

quality as it has a positive contribution towards environmental quality in few developing nations and harms the environmental quality in some countries. Ganda and Fortune (2019) argued that FD is helping in reducing the CO_2 emissions and greenhouse gas emissions in Organizational for Economic Cooperation and Development (OECD) countries. But on the other side, both economic growth and FD contributes positively towards CO_2 emissions and greenhouse gas emissions in OECD countries. Alam et al. (2014) stated that CO_2 emissions showed a positive relationship with the coefficients of FD. In another study, Faiza and Khalid (2016) Suggested that other mitigation strategies need to be implemented to minimize carbon footprints in such developing countries where there has not yet been a significant level of growth in FD in the financial sector. Different variables of FD had played an essential part in mitigating emissions in the latter stage only when there was a large degree of liberalization and growth of the FD.

Both the arguments that the impact of FD on CO_2 emission is positive, and the impact of FD on carbon is negative are quite appealing. Zhang and Jun (2001) are in the favor that FD increases emissions, whereas Park et al. (2018) are in the favor that FD decreases emissions.

2.2 Pollution Halo and Pollution Haven Hypothesis

There are two types of writings on the topic of FDI and the environment. One is pollution halo, and the other is the pollution haven hypothesis. Pollution halo hypothesis suggests that international industries transfer technology in the form of FDI. If transferred technology is green technology, then it will reduce the pollution level and hence improves the environmental quality. The pollution haven theory suggests that dirty factories are fleeing to the less developed economies from environmentally strict

industrialized countries, which provide such factories with their weak environmental standards as pollution havens.

From a theoretical perspective, therefore, several studies have also shown confusing results on the influence of FDI on the pollution in the host nation. The observed studies in China provided some diverse results regarding the role of FDI and the quality of the environment. Numerous studies have proved that with FDI in china, environmental degradation increases and hence proves pollution haven hypothesis, but on the one hand, there are some studies that are in favor of Pollution Halo Hypothesis that is with FDI, environment quality improves in China as FDI brings technological development in a country.

Few studies found that the impact of FDI to be negative, which means that FDI inflows do not contribute to increasing pollution levels. Foreign industries may also transfer technology that is the environment to the host country, hence enhancing the environment. In case green technology is introduced, it might reduce the demand for pollution-intensive energy sources.

In Pakistan, the coefficient of FDI has been found to be negative and hence rejects pollution haven hypothesis, as FDI increases in Pakistan, carbon emissions also increase and hence degrade the environment (Ali, 2015). Xing (2002) studied the consequence of foreign direct investment on the quality of the environment in emerging and advanced economies. Results reported that poor Pollution haven proof, such that advanced nations are using lax environmental regulations as opportunities for developing countries to apply strict environmental regulations to FDI. Manufacturing has moved to emerge economies in recent years.

Levinson and Taylor (2003) found that the effect of emissions on the flow of FDIs depends on the strictness of the regulation, as well as on the type of instrument

employed. FDI encourages economic development but also adversely impacts the climate (Xing and Kolstad., 2002).

Jei (2006) worked on the environmental impacts of FDI in China, and his findings stated that the impact of FDI on Sulphur oxide is little. With a rise of FDI capital stock, emissions from industrial Sulphur oxide will increase by 0.098 percent. i.e., FDI degrades the environment. A time-series analysis by Khalil & Inam (2006) proved FDI had risen CO_2 emissions in Pakistan. By using cointegration and vector correction techniques, Baek and Koo (2009) stated that Foreign Direct Investment plays a key part in growth through the accumulation of capital and technological spillovers. However, FDI has shown a decreasing impact on environmental quality in India and China. Liang (2006) analyzed the link among FDI and the quality of air by using city-level data. He discovered that FDI had a beneficial impact on the regional environment in China. Haseeb et al. (2018) found a two-way correlation among FDI and the quality of the environment. In 11 countries, FDI harmed environmental quality and improved in 9 countries.

Zhang & Zhou (2016) used the FE model in order to analyze the relation among FDI and CO_2 emissions in the 29 provinces of China. The finding showed that FDI decreases CO_2 emissions. Jorgenson (2007) investigated the effect multinational production firms have an effect on the quality of the environment in less advanced countries. The findings of the fixed effects panel study indicated that foreign investment in the industrial industry raises carbon emissions, and foreign investment dependency in the industrial industry raises organic water pollution in the less advanced nation. Acharyya (2009) analyzed the relation among inflows of FDI and pollution by carbon emissions in India. The writer found a positive and marginal effect of FDI on the economy of India in the longer run. It was also found that FDI creates a very high level

of carbon emissions. The results of a panel of cross-state inquiry by Jorgenson & Dick (2010) stated that foreign direct investment leads to CO_2 emissions.

Mahmood & Chaudhary (2012) worked on FDI and CO_2 emissions in Pakistan. Results showed that FDI has an upward effect on CO_2 emissions in both the long and short-term in the economy of Pakistan. In the Malaysian economy, the pollution haven hypothesis doesn't exist (Agarwal, 2012. Bin & Yue (2012) stated that foreign direct investment decreases pollution of the industrial sector and supports the hypothesis that the effect of technology is higher in China. Hassaballa (2013) studied the relation between FDI inflows carbon dioxide emissions by using a dynamic panel model in evolving economies. The conclusions of the analysis did not validate the link between FDI and the climate. The writer, furthermore, suggested an analysis of this relationship on the basis of an individual economy. FDI harms the efficiency of the environment in Pakistan (Bukhari et al., 2014). It was also being proposed that increasing capital accumulation will help to improve the economy's environment. FDI can have an implicit effect on the natural environment through the development process.

Theoretic and practical literature is full of claims that FDI promotes investment and development in host economies. Some authors support the statement that foreign direct investment has a beneficial effect on development in host economies (Ahmad et al., 2012), (De Mello, 1997); (Agarwal, 2012), (Marwah & Tavakoli, 2004); (Ali, 2013), (Ali et al., 2014a); (Li & Liu, 2005). On the other side, several authors say that FDI inflows increase the level of air contamination (Eskeland & Harrison, 2003); (Shahbaz et al., 2015); (Al-mulali, 2012) (Cole and Elliott, 2005)

2.3 Literature Gap

All the past and current research are done on the carbon emissions solely in the context of a single nation or on a panel of few nations by considering financial

development. But there is a huge gap in the literature for the impact of FD separately on environment pollution indicators carbon, nitrous oxide, and methane. Furthermore, the pollution haven hypothesis in context to foreign direct investment is the contribution to the existing research. Emissions of carbon dioxide have recently been considered a major problem internationally as a result of the negative effect of these emissions on climate change. Climate changes include changing rainfall patterns, an increase in the intensity of storms, escalating sea levels, and a reversal in oceans flows. These differences have substantial impacts on ecosystems and the survival of wildlife and the well-being of humankind (Boutabba, 2014).

Chapter 3

Theoretical and Conceptual Background

Environment and FD are the two widely discussed topics nowadays. In this study, we analyze the effects of financial developments on measures of environmental pollution indicators, namely carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4). Some researchers have used Sulphur dioxide and carbon dioxide as environmental pollution indicators, while few of them found only carbon dioxide as the environmental pollution indicator. Our study concentrates on three environmental pollution indicators: carbon dioxide, nitrous oxide, and methane. A financial system that is well-developed and has a stable banking system would enable the development of technology and growth. Technology funding that needs a significant amount of investment can easily be given in established financial structures (Tamazian et al., 2009). The growth of the financial sector would encourage minimal expense investment, including investment in green initiatives (Tamazian and Rao, 2010). Enterprises, with financial growth, access advanced and renewable technology that reduces CO_2 emissions and increases domestic demand only when countries follow strict environmental standards. Thus, FD and investment help in environmental sustainability (Yuxiang and Chen, 2010). This research also incorporates the pollution haven hypothesis and pollution halo hypothesis. The pollution haven hypothesis states that, when there are strict environmental policies, countries tend to invest in countries that have flexible environmental policies, cheap labor, etc.

The theory about the pollution haven hypothesis has three dimensions. The first is the shifting of highly polluting companies from developed nations with stringent environmental regulations to developing nations, where similar practices do not exist. The second issue is the transfer of hazardous materials produced in developed

economies (industrial and nuclear generation) to developing economies. The third factor is the unregulated extraction of non-renewable resources by multinational companies engaged in the production of petroleum and agricultural products, timber and other forest resources, etc. in developing nations.

Domestic credit to the private sector is being used as a measure of financial development; trade (TRD) is being used as a measure of aggregate trade volume; gross domestic product (GDP) is being used as a measure of economic growth; FDI is being used as a measure of Pollution Halo and Pollution Haven Hypotheses and Energy Usage (ENERGY) is being used as a measure of Energy Consumption. The following function will, therefore, be used to analyze the functional relationship of this study in conjunction with the work of Jalil and Feridun (2011)

$P_{it} = f(GDP_{it}, FD_{it}, FDI_{it}, TRD_{it}, Energy_{it})$ **Equation 3.1**

Where P stands for carbon dioxide, Nitrous Oxide and Methane by countries (i) at period t, GDP is the gross domestic product at period t, FD is Financial Development at period t, FDI is Foreign Direct Investment at period t, TRD is the trade at period t, and, the Energy is energy consumption at period t.

To obtain the effect of FD on environment pollution indicators, a functional relationship will be stated in a logarithmic form. So, the equation will be as below following (Boopendra et al., 2018), (Saud et al., 2018), (Shahbaz et al., 2013), (Boutabba, 2014), (Jalil, 2011).

$P_{it} = \alpha_0 + \alpha_1 lnGDP_{it} + \alpha_2 lnFD_{it} + \alpha_3 lnFDI_{it} + \alpha_4 lnTO_{it} + \alpha_5 lnEC_{it} + e_{it}$

Equation 3.2

Where P stands for $ln CO_2$ (natural logarithm of carbon dioxide emissions), $ln N_2O$ (natural logarithm of nitrous oxide emissions), $ln CH_4$ (natural logarithm of methane emissions); lnGDP is a natural logarithm of gross domestic product, lnFD is a natural logarithmic form of domestic credit to the private sector. The parameter α_2 is the elasticity coefficient of lnFD. lnFDI is a natural logarithmic of Foreign Direct Investment. lnTO is a natural logarithmic form of trade, and finally, lnEC is a natural logarithmic form of energy consumption. In this equation, α_0 is an intercept, α_1 is the elasticity coefficient of lnGDP, α_2 is the elasticity coefficient of lnFD, α_3 is the elasticity coefficient of lnFDI, α_4 is the elasticity coefficient of lnTO, α_5 is the elasticity coefficient of lnEC and e is an error correction term.

By using cross-section and time-series data together through panel data, it is often of concern to examine the relationship between variables. The key benefit of the panel data is that the degrees of freedom and power can be expanded by using more knowledge about the behavior of many entities at the same time. The additional benefits of panel data are to minimize multicollinearity problems that can occur when individually modeled time-series and the inclusion of heteroscedasticity in cross-sectional data. Such an issue can be solved successfully by the panel data method. Panel data provides larges number of data points for analysis. Moreover, as data belongs to different units (countries), therefore, there are fewer chances for multicollinearity to occur. Nonetheless, when we analyze the panel data, heterogeneity between entities/units is a central issue. In order to overcome heterogeneity, the study uses the two most common estimation methods (Fixed effect model, Random effect model). The panel fixed effect model is:

$y_{it=} \alpha_i + \beta x_{it} + e_{it}$ **Equation 3.3**

Here α_i is the intercept for each entity; β is the slope of the linear panel regression, and the same for all entities x_{it} is an independent variable, and e_{it} is an error term. The FE estimation handles the unit-specific heterogeneity by eliminating all time-constant information (demanded values) for each individual ith from the data. The null hypothesis of a fixed-effect model (FEM) is that all units/entities share the same intercept. The possibility is that we have different methods of detection. This is tested and calculated by statistics from a combined F-test. Occasionally, however, intercepts from a particular unit can cause a random error to be inconsistent.

The random-effect model (REM) predicts when non-observed heterogeneity is uncorrelated to any of the model's explaining components. That is to say, αi is a kind of random disruption at the individual level.

$y_{it} = \alpha_0 + \beta_j x_{it} + \alpha_i + e_{it}$ **Equation 3.4**

If α_i has no correlation with independent variables in Random effect model, then β_j can be correctly assessed for a single cross-section, and that panel data need not be used. However, in other periods of time, this model can lose the most useful information about entities. The correct estimation technique of the model depends on the α_i whether the parameters are to be calculated in the fixed-effect model or α_i to be estimated in the random-effect model.

The hypothesis is formulated by:

Null hypothesis: Random effect is appropriate (we shall accept the null hypothesis if the probability value of the Hausman test > is greater than 5%)

Alternative hypothesis: The fixed effect is appropriate (if the probability value of the Hausman test is less than 5%)

3.1 Hypotheses

This research investigates the impact of financial sector development on the environment, i.e., carbon dioxide (CO_2), nitrous oxide (N_2O), and methane (CH_4) and the existence of pollution haven hypothesis/pollution halo hypothesis with evidence of low, middle- and high-income countries.

$H_{1:}$ There exists a negative relationship between FD and carbon dioxide, nitrous oxide, and methane in a panel of low, middle, and high-income countries.

$H_{2:}$ There exists Pollution Haven Hypothesis in framework to Foreign Direct Investment in a panel of low, middle- and high-income countries.

Chapter 4

Data and Methodology

4.1 Statistical techniques used for Data Analysis

The unbalanced panel for countries from 1990-2018 is utilized in this study. The sample is divided into three categories based on the income category listed by the World Bank. All data of variables are obtained from the World Bank's Development Indicators (WDI). Thus, according to Baltagi (2005), panel data methodologies are superior to time series methods, particularly in the control of endogeneity, heteroscedasticity, serial correlation, and multicollinearity. We employed the panel data methods to analyze the impact of GDP, Financial development, trade openness, energy consumption, and foreign direct investment on CO_2, N_2O, and CH_4 emissions. We use FE and RE estimators in order to check whether there exists a correlation between α_i and xit in all periods of time or not. The Hausman (1978) tells us the correct pattern i.e. verification of which estimator is accurate (FE estimator or RE estimator) is done by the Hausman test. If α_i is not correlated with an independent variable, we use RE estimators as it is more efficient in this case. But if α_i is correlated with the independent variable, then the FE estimator is used.

4.2 Data Sources

The data is taken from World Bank Development indicators for low-income countries, middle-income countries, and high-income countries for the time of 1990-2018. The countries are selected from the World Bank classification of countries. The variables that we used in the study are Gross Domestic Product (GDP), Financial Development (FD), Foreign Direct Investment (FDI), Energy Consumption, and Trade Openness.

4.3 Sample of the Data

This study is carried out for the years 1990 to 2018 on the availability of data as the World Bank income division consists of low-income nations, middle-income nations, and high-income nations, which are based on certain income ranges during FY2018.

4.4 Construction of Variables

All the variables are used in logarithmic forms.

Dependent Variables (Environmental pollution Indicators)

Variable name	Variable Measure	Symbol
Carbon Dioxide emissions	Metric tons per capita	CO_2
Nitrous emissions	Thousand metric tons of CO_2 equivalent	N_2O
Methane	Kt of CO_2 equivalent	CH_4

4.5 Independent Variables

Variable name	Variable measure	Symbol	Expected Sign	Economic Implication
Financial Development	Domestic credit to the private sector (% of GDP)	FD	+/-	If the coefficient of FD is positive, it means that it boosts the industrial sector and causes an increase in environmental indicators (CO_2, N_2O, CH_4). If the coefficient of FD is negative, it means that it helps in promoting green technology and enhances the environment.
Gross Domestic Product	GDP (constant 2010 US$)	GDP	+/-	If the coefficient of GDP is positive, it means that it is degrading the environment as higher per capita income level increases environmental indicators (CO_2, N_2O, CH_4). If the coefficient of GDP is negative, it means that it is improving the environment. Technological innovation aims to reduce emissions of contaminants by incorporating green technology.
Foreign Direct Investment	Foreign Direct Investment, net inflows (% of GDP)	FDI	+/-	When the coefficient of FDI is positive, that means that FDI is polluting the environment. The positive relation between FDI and environmental pollution is a known pollution haven hypothesis. This hypothesis suggests that FDI boosts production in heavy-polluting industries and deteriorates the quality of the environment. If the coefficient of FDI is negative, then it means that FDI improves the environment. The negative relation between FDI and environmental pollution is known as the pollution halo hypothesis. This hypothesis suggests that FDI inflows bring advanced energy-saving technologies and will ultimately reduce environmental degradation.
Trade Openness	Trade (% of GDP)	TO	+/-	If the TO coefficient is positive, it means that the pollutant factories of developed economies are generating a significant amount of CO2 emissions by their production processes. If the TO coefficient is negative, this implies that the production of pollution producing goods are limited due to environmental protection legislation.
Energy Consumption	Energy consumption (kg of oil equivalent per capita)	EN	+/-	If the coefficient of EN is negative, it means that energy is utilized efficiently in green technology. It helps in reducing environmental degradation (Stern et al. 2006). If the coefficient of EN is positive, it means that there is more demand for fuels and gas, and it will ultimately lead to pollution and will deteriorate the environmental quality.

Chapter 5

Empirical Results

5.1 Descriptive Statistics

This chapter shows the empirical results of the study, which includes descriptive statistics of low-, middle-, and high-income countries, correlation Metrix of low-, middle-, and high-income countries and results of Hausman tests of low-, middle-, and high-income countries.

Table 5.1 Descriptive statistics for low-income countries

Variable		No of countries	Obs	Mean	Std.Dev.	Min	Max
CO_2	Carbon Emissions	10	290	0.3444102	0.3277921	0.0172641	1.593091
N_2O	Nitrous Oxide Emissions	10	290	10828.55	19546.37	910.3367	149775
CH_4	Methane Emissions	10	290	16332.42	21637.22	701.9527	189678
GDP	Gross Domestic Product	10	290	1.19e+10	8.60e+09	1.79e+09	5.24e+10
FD	Financial Development	10	290	17.81863	14.91677	-52.18977	103.6323
FDI	Foreign Direct Investment	10	290	2.723462	4.883334	-1.304135	39.4562
TO	Trade Openness	10	290	63.85095	25.47541	-20.07844	181.5901
En	Energy Consumption	10	290	414.9679	171.736	188.9489	1005.686

The statistics show that the minimum value of carbon emissions in the low-income group is 0.017 that belongs to Congo in 2001, while Tajikistan had the maximum value of 1.59 in 1990. The minimum value of nitrous oxide emissions is 910.33, which belongs to Haiti in 1990, while Congo had the maximum value of 149775

in 2007. The minimum value of methane emissions is 701.95, which belongs to Togo in 1994, while Sudan had the maximum value of 189678 in 2017. Regarding financial development, the Minimum value of FD is -52.18 that belongs to Congo in 2002, while the maximum value of FD is 103.63, which belongs to Zimbabwe in 2002. Concerning the foreign direct investment, the Minimum value of FDI is -1.30 that belongs to Tanzania, while the maximum value of FDI is 3.67 that belongs to Mozambique in 2013.

Table 5.2 Descriptive statistics for middle-income countries

Variable		No of countries	Obs	Mean	Std.Dev.	Min	Max
CO_2	Carbon Emissions	55	1566	2.554294	2.686422	0	19.17002
N_2O	Nitrous Oxide Emissions	55	1566	29605.37	76493.46	155.7831	707168.4
CH_4	Methane Emissions	55	1566	79074.21	213570.3	206.989	2114537
GDP	Gross Domestic Product	55	1566	2.50e+11	7.82e+11	2.44e+09	1.08e+13
FD	Financial Development	55	1566	39.63928	35.2728	-2.063452	176.9244
FDI	Foreign Direct Investment	55	1566	3.117735	4.134739	-37.15476	50.63641
TO	Trade Openness	55	1595	75.46494	35.4134	11.08746	220.4068
En	Energy Consumption	55	1595	1056.448	839.8482	118.8983	5123.923

The statistics show that the minimum value of carbon emissions in the middle-income group is 0 that belongs to Cameron in 1991, while Kazakhstan had a maximum value of 19.17 in 1997. The minimum value of nitrous oxide emissions is 155.78, which belongs to Mauritius in 2003, while China had the maximum value of 707168.4 in 2018. The minimum value of methane emissions is 206.98, which belongs to Mauritius in 1991, while China had the maximum value of 2114537 in 2018. Regarding financial development, the minimum value of FD is -2.06 that belongs to Cambodia, while the

maximum value of FD is 176.92, which belongs to Malaysia in 1999. Concerning the foreign direct investment, the Minimum value of FDI is -37.15 that belongs to Cambodia, while the maximum value of FDI is 50.63 that belongs to the Congo Republic in 2017.

Table 5.3 Descriptive statistics for high-income countries

Variable		No of countries	Obs	Mean	Std.Dev.	Min	Max
CO_2	Carbon Emissions	26	754	9.721741	6.607291	1.089525	38.34561
N_2O	Nitrous Oxide Emissions	26	754	23417.94	61075.04	71.74175	366029.4
CH_4	Methane Emissions	26	754	46700.99	106163.7	331.714	637636
GDP	Gross Domestic Product	26	754	1.05e+12	2.75e+12	7.92e+09	1.79e+13
FD	Financial Development	26	754	86.89134	54.62979	6.513303	308.9863
FDI	Foreign Direct Investment	26	754	4.419368	7.609612	-46.12349	58.51875
TO	Trade Openness	26	754	95.58852	79.17132	13.75305	442.62
En	Energy Consumption	26	754	4424.206	3076.629	-4719.505	18178.14

The statistics show that the minimum value of carbon emissions in the middle-income group is 1.08, which belongs to Panama in 1995, while Kuwait had the maximum value of 38.34 in 1992. The minimum value of nitrous oxide emissions is 71.74, which belongs to Bahrain in 1991, while the United States had the maximum value of 366029.4 in 1996. The minimum value of methane emissions is 331.71, which belongs to Iceland in 1994, while the United States had the maximum value of 637636 in 1990. Regarding financial development, the Minimum value of FD is 6.513, which belongs to Argentina in 2004, while the maximum value of FD is 308.98, which belongs to Iceland in 2006. Concerning the foreign direct investment, the Minimum value of

FDI is -46.1 that belongs to Kuwait, while the maximum value of FDI is 58.51 that belongs to Hong Kong in 2015.

5.2 Correlation Metrix

The tables in Appendix-B contain the correlation matrices for the groups of low, middle, and high-income countries. B5.2.1 shows the correlation between environmental indicators (CO_2, N_2O, CH_4) and FD as well as other independent variables. There exists a positive correlation between FD and carbon emissions and methane emissions, whereas a negative correlation with nitrous oxide. FDI, carbon emissions, and nitrous oxide move in the same positive direction (positive correlation), whereas methane and FDI are moving in the opposite direction, meaning negative correlation.

Table B5.2.2 shows the correlation between environmental indicators (CO_2, N_2O, CH_4) and FD as well as other explanatory variables. A positive correlation is found between FD and the three environmental indicators (carbon dioxide, nitrous oxide, and methane). Correlation between FDI and carbon emissions is found to be positive, whereas the correlation between FDI and nitrous oxide and methane emissions is negative.

Table B5.2.3 shows the correlation between environmental indicators (CO_2, N_2O, CH_4) and FD as well as other explanatory variables. A positive correlation is found between FD and carbon emissions and nitrous oxide emissions, whereas negative correlation is found between FD and methane emissions. There exists a positive correlation between FDI and nitrous oxide, whereas negative correlation is found between FDI and methane and carbon emissions.

5.3 Results of the Hausman Test

5.3.1 Results for Lower income group (as per Hausman Test)

The findings of the fixed effect model are described in table 5.3.1.1. In a panel of low-income countries, ten countries are selected based on the availability of the data, which includes 257 observations. In three models on environmental pollution indicators, the fixed effect is preferred according to the Hausman test as P-value is less than 0.05.

An increase in GDP level creates environmental degradation as it happens at the expense of natural resources. This implies that a 1 % increase in GDP leads to 0.669% increase in CO_2 emissions. The positive relation among carbon emissions and GDP is showing that GDP affects the quality of the environment negatively. This can be because the revolution of the industrial sector has worsened the environment in different ways, such as to gain maximum growth natural resources are exploited, no plan for sustainability of resources for our next generation, etc. this also has an indirect effect on the well-being of people. Our results that GDP causes an increase in carbon emissions are similar to the findings of Lean (2010); Smyth (2008); Salahuddin (2014). Findings showed that financial development increases carbon emissions indirectly by increasing the use of the energy sector such that FD is showing a positive and significant impact on carbon emissions; that is when FD increases, carbon emissions increase by 0.077%. Development of the financial sector makes it easy for people to take loans from the banks and buy energy-intensive products, i.e., vehicles. Taspinar (2017) noted that the expansion of the financial sector would make countries continue to rely on energy that could raise CO_2 emissions. This result in line with Hafeez et al. (2018), Coban (2013). Here we reject 1st hypothesis as in low income countries, financial development degrades the environment. The funding which comes through FDI creates

invention regarding the advancement in technology. This further increases green and sustainable technology. The coefficient of FDI inflow (-0.062) supports the pollution halo hypothesis; a 1% increase in FDI inflow decreases CO_2 emissions by -0.062%. The negative coefficient shows that FDI inflow improves the environment. Our results are similar to Li & Liu, (2005); Ahmad et al. (2012) that is FDI passes high technology and disseminates industry standards in developing countries that build halos of emissions to mitigate emissions by executing benefits to society. Here we reject the 2nd hypothesis as in case of low-income countries, pollution halo hypothesis prevails. Trade openness has a significant and positive influence on carbon emissions, that is with a 1% increase in trade openness carbon emissions rise by 0.238% in the low-income group. Our result is similar to Hafeez et al. (2019) and Omri et al. (2015). The demand for energy consumption increases when there is an introduction of a higher level of FD, which ultimately increases carbon emissions in low-income countries. Energy consumption has a significant and positive impact on CO_2 emissions (1.133), and the results are similar to Ozturk (2013). The positive coefficient shows that energy consumption increases environmental degradation in a panel of a low-income group such that if there is an increase in the growth of the economy, consumption of non-renewable energy increases, which further increases carbon emissions.

A percentage increase in economic growth, nitrous oxide emissions decrease by 0.270%. This can be because of technological advancement or usage of green technology, which is decreasing nitrous oxide emissions. Financial development degrades the environment by 0.169%, with a 1% increase in FD. This might be because of finance available for the domestic sector, which will make them invest in new projects, which will ultimately increase the consumption of energy and nitrous oxide emissions. Here we reject 1st hypothesis as in low income countries, financial

development degrades the environment. Whereas the coefficient of FDI is negative, but its impact is insignificant on nitrous oxide. The coefficient of trade openness has a negative and significant effect on nitrous oxide; that is, a percentage rise in trade openness leads to 0.399% decrease in nitrous oxide in a panel of low-income countries. The negative relation of trade might be because of the effective process of production. Lastly, energy consumption degrades the environment in such a way that an increase in energy consumption increases the emissions of nitrous oxide by 0.43%. This can be because of using traditional and pollution-intensive technology, which increases the level of nitrous oxide in the environment.

There exists a positive relation among GDP and methane, such that with a 1% increase in the level of GDP, methane emissions increase by 0.218% and thus degrades the environment. This might be because low-income countries use energy sources that are non-renewable for their economic activities because of which GDP increases but as well as methane emissions. On the other, industrial advancement has also put pressure on the environment, such that FD has a positive impact on methane, showing that by 1% increases in financial development, methane emissions rise by 0.080%. Methane is released by biomass burning, rice-growing, etc., so when people get loans from the banks, they use the same techniques for their business and hence will increase the level of methane emissions in the environment. Here we reject 1st hypothesis as in low income countries, financial development degrades the environment. Though the coefficient of FDI and energy consumption are positively effecting methane emissions but have an insignificant impact on the environment. Trade openness is promoting the environment in a positive way such that a 1% increase in trade openness leads to a 0.140% fall in methane emissions in a panel of low-income countries. When there are

lenient environmental standards, incorporating higher trade openness leads to deterioration of environment increases.

Table 5.4 Low-income countries

Variable name	**CO_2**	**N_2O**	**CH_4**
	Fixed Effect	**Fixed Effect**	**Fixed Effect**
LnGDP	0.669*** (0.048)	-0.270*** (0.076)	0.218*** (0.040)
LnFD	0.077** (0.037)	0.169*** (0.057)	0.080*** (0.030)
LnFDI	-0.062*** (0.012)	-0.005 (0.018)	0.006 (0.009)
LnTO	0.238*** (0.056)	-0.399*** (0.088)	-0.140*** (0.046)
LnEN	1.133*** (0.105)	0.437*** (0.165)	0.101 (0.036)
Constant	-24.773*** (1.192)	13.984*** (1.862)	4.001*** (0.974)
Number of Observations	257	257	257
Number of countries	10	10	10
R-Squared	0.77	0.137	0.349
Prob>F	0.000	0.000	0.000
P-Value	0.0000	0.0000	0.0000

*** p<0.01, ** p<0.05, * p<0.1

5.3.2 Results for the middle-income group (as per Hausman Test)

The results of the fixed effect model are described in table 5.3.1.2. In a panel of middle-income countries, fifty-four countries are selected, and established on the accessibility of the data, which includes 1504 observations. In three models on

environmental pollution indicators, the fixed effect is preferred according to the Hausman test as P-value is less than 0.05.

A percentage rise in economic growth in middle-income countries, it causes a 0.217% rise in carbon emissions and degrades the environment. Many of the natural resources are exploiting in the process of economic growth. This puts pressure on the environment as emissions increases and degrades the environment. Zhang (2009) gave empiric analysis that an upsurge in GDP has the ability to boost energy usage and eventually exacerbates CO_2 emissions. The FD coefficient is positive and impacting significantly on carbon emissions, that is, an increase in FD assists to 0.056% growth in carbon emissions. An effective financial system can provide a favorable environment for customers to purchase more loans that enable them to raise their demand for CO2-emitting products. Our findings are similar to Jalil (2011). Here we reject 1st hypothesis as in middle income countries, financial development degrades the environment. In middle-income countries, there exists a pollution halo hypothesis, such that with a 1% rise in FDI, CO_2 emissions decrease by 0.011%. With more inflows of FDI in middle-income countries, environmental quality improves, and there is an advanced technology, which is reducing pollution. Our results are similar to De Mello (1997), Marwah & Tavakoli (2004). Here we reject 2nd hypothesis as in middle income countries, pollution halo hypothesis prevails. On the other side, if there are weak environmental standards, it will cause trade to contribute to environmental deprivation. The trade and energy consumption coefficients are positive and significant, showing that both variables contribute to environmental degradation. Our results are similar to Tamazian and Rao (2010); Shahbaz et al. (2013).

A percentage increase in economic growth causes a 0.173% increase in nitrous emissions and degrades the environment. This may be because of the non-sustainability

of the resources, as more and more resources are used on a daily basis for the rise in GDP, but it initiates an adverse impact on the environment. Coefficient of FD effects carbon emissions positively but is insignificant. In middle-income countries, pollution halo hypothesis exists, which is with a 1% rise in inflows of FDI, nitrous oxide emissions decrease by 0.027%. FDI promotes the environment. Here we reject 2nd hypothesis as in middle income countries, pollution halo hypothesis prevails. While the coefficient of trade openness has an insignificant influence on nitrous oxide, while the coefficient of energy consumption is positive and significant (0.230), showing that it contributes to environmental degradation. If countries use old sources of energy, it will cause deterioration of quality of environment.

A percentage increase in GDP in middle-income countries causes a 0.310% increase in methane emissions and hence degrades the environment. The degradation of the environment is due to economic growth, which causes the excess burning of biomass, which is used in production processes. The coefficient of FD has a negative influence on methane emissions, such that an expansion in FD leads to a 0.026% fall in methane emissions. Here we accept 1st hypothesis as in middle income countries, financial development improves the the environment. In middle-income countries, pollution halo hypothesis prevails, such that an increase in inflows of FDI, methane emissions decrease by 0.007%. Here we reject 2nd hypothesis as in middle income countries, pollution halo hypothesis prevails. While, coefficient of trade openness is affecting methane positively and hence degrading the environment while energy consumption coefficient is significantly positive (0.075%), showing that the variable contributes to environmental degradation.

Table 5.5 Middle-income countries

Variable name	CO_2	N_2O	CH_4
	Fixed Effect	Fixed Effect	Fixed Effect
LnGDP	0.217*** (0.017)	0.173*** (0.028)	0.310*** (0.018)
LnFD	0.056*** (0.009)	0.011 (0.015)	-0.026*** (0.010)
LnFDI	-0.011*** (0.004)	-0.027*** (0.006)	-0.007* (0.004)
LnTO	0.065*** (0.021)	0.045 (0.033)	0.037* (0.021)
LnEN	0.759*** (0.028)	0.230*** (0.045)	0.075*** (0.029)
Constant	-10.471*** (0.338)	2.949*** (0.542)	1.653*** (0.347)
Number of Observations	1500	1,504	1504
Number of countries	54	54	54
R-Squared	0.724	0.1636	0.382
Prob>F	0.000	0.000	0.000
P-Value	0.0000	0.0000	0.0000

*** p<0.01, ** p<0.05, * p<0.1

5.3.3 Results for High-income group (as per Hausman Test)

The results of the fixed effect model are described in table 5.3.1.3. In a panel of high-income countries, twenty-six countries are selected, established on the accessibility of the data, which includes 702 observations. In three models on environmental pollution indicators, the fixed effect is preferred according to the Hausman test as P-value is less than 0.05.

A percentage rise in GDP in high-income countries causes 0.183% rise in carbon emissions and hence degrades the environment, results are similar to Lean (2010), Narayan (2008), Salahuddin et al. (2015), Tamazian and Rao (2010). With increased inflows of financial development, new monetary funds and trainings could be introduced for environmental developments which try to lessen expenses as well as enhance the general situation of their environments. The FD coefficient has a negative and sizeable influence on CO_2 emissions, such that an increase in FD is leading to 0.054% fall in carbon emissions. A properly performing financial structure establishes a carbon trading mechanism that produces occasions to reduce carbon emissions. This included Findings that are like Claessens and Feijen (2007). An effectual financial system allows nations to execute environmentally friendly laws, and it also influences companies and house level economic procedures to reduce CO_2 emissions. Findings are similar to Omri et al. (2015); Yuxiang (2010). Here we accept 1st hypothesis as in high-income countries, financial development improves the environment. An improved version of the finance structure can have a positive effect on the performance of the environment, FD will make more cost-effective funding possible. FDI stimulates economic growth together with additional carbon emissions. Financial intermediation enables the procurement of dangerous goods in terms of its larger carbon dioxide emissions. In high-level income states, pollution haven hypothesis in case of carbon

emissions exists, i.e., with 1% growth in FDI, carbon emissions boost by 0.031%. Findings are similar to Acharyya (2009). Here we accept 2nd hypothesis as in high income countries, pollution haven hypothesis prevails. On the other hand coefficient of trade, openness has a negative impact on the CO_2 emissions, such that 1% growth in trade openness leads to 0.226% reduction in carbon emissions and hence improves the environment, this is advocated by Shahbaz et al., (2013) while the coefficient of energy consumption does not have any significant effect on CO_2 emissions.

A percentage increase in economic growth in high-income countries, causes 0.234% increase in nitrous oxide emissions and hence degrades the environment. The coefficient of FD is significant and has a negative impact on N_2O emissions, such that a growth in FD is leading to a 0.135% fall in nitrous oxide emissions. Here we accept 1st hypothesis as in high income countries, financial development improves the environment. In high-income countries coefficient of Foreign direct investment plays a positive role but has an insignificant impact on nitrous oxide. While the trade coefficient plays a significant negative part on the nitrous oxide such that an enhancement in trade openness, reduces in nitrous oxide by 0.303%. The negative coefficient means that high-income countries are more open to trade, but this is not the cause of the high level of nitrous oxide emissions, while the coefficient of energy consumption is significantly negative, showing that with a 1 percentage rise in energy consumption leads to 0.139% fall in the nitrous oxide.

The percentage rise in GDP causes a 0.338% rise in methane emissions and hence degrades the environment. If the economic activity contains the burning of biomass etc. it would lead towards an increase in methane emissions in the environment. FD and FDI do not hold significant effect on methane emissions in the panel of high-income countries. While the trade coefficient is significantly negative

effect, which means that high-income countries are accessible to trade, it does not contribute to environmental degradation hence improves the environment. Contrary, the coefficient of energy consumption degrades the environment because more non-renewable resources are used, that is a percentage rise in energy consumption causes an increase in methane emissions by 0.029.

According to the findings of this study, the role of FD in the two groups is the same, that is in low- and middle-income groups, FD is degrading the environment except for CH_4 in the middle-income group, which is enhancing the environmental quality. But in high-income countries, the effect of FD is different; FD is promoting the environment quality (CO_2, CH_4). Foreign direct investment improves the environment in the low middle (CO_2), Middle (CO_2, N_2O, and CH_4), providing the existence of pollution halo hypothesis. On the other hand, in high-income countries, FDI is degrading the environmental quality (CO_2), providing evidence of the pollution haven hypothesis.

Table 5.6 High income countries

Variable name	CO_2	N_2O	CH_4
	Fixed Effect	Fixed Effect	Fixed Effect
LnGDP	0.183*** (0.037)	0.234*** (0.043)	0.338*** (0.031)
LnFD	-0.054** (0.026)	-0.135*** (0.029)	-0.014 (0.022)
LnFDI	0.031*** (0.007)	0.002 (0.009)	0.009 (0.006)
LnTO	-0.226*** (0.041)	-0.303*** (0.047)	-0.308*** (0.035)
LnEN	0.045 (0.049)	-0.139** (0.055)	0.029 (0.041)
Constant	-1.935** (0.788)	2.085** (0.881)	1.855*** (0.665)
Number of Observations	702	702	702
Number of countries	26	26	26
R-Squared	0.098	0.065	0.251
Prob>F	0.000	0.000	0.000
P-Value	0.007	0.0000	0.001

*** p<0.01, ** p<0.05, * p<0.1

Chapter 6

Discussion and Policy Recommendations

This chapter discusses the overall findings of the study along with some recommendations. The overall findings of the study are as follows:

GDP raises CO_2, N_2O, and CH_4 in low, middle, and high-income countries as extreme growth of the economy leads to environmental deprivation, but in low-income countries, GDP is reducing N_2O emissions. The result of carbon emissions is like Narayan (2008) and Salahuddin et al. (2015). All three income groups must adopt efficient means of capital and move towards green technology in order to reduce their emissions, as the environment is degrading at a high pace.

FD has a positive impact on CO_2, N_2O, and CH_4 in low- and middle-income countries except for CH_4 in the middle in countries, that is with financial development, CH_4 decreases and N_2O in middle income countries is insignificant.. Our results are similar to Farhani and Ozturk. (2015); Zhang (2011). Contrary, in a panel of high-income countries, FD decreases CO_2 and N_2O. Results are like Shahbaz et al. (2013). The influence of FD on carbon emissions in different income-groups is different because of dissimilar levels of financial development. Our results are similar with (Yuxiang and Chen, 2010), he stated that the countries which have developed financial sector offer a chance to firms to adopt advanced and green technology in order to reduce carbon emissions. Hence, policy recommendation for low-income countries is that they should focus on their financial sector and make it advance and sound in order to reduce their emissions. On the other side, the negative impact of FD posits that those countries have already started advanced and green technology, but the positive impact of FD posits that those countries have not started any adoption of green policies to protect

their environment. Countries must grow economically, but they should not neglect the quality of the environment. FDI promotes the environment in low-income countries, such that FDI decreases carbon emissions while the impact on the other two pollution indicators is insignificant, while middle-income countries, FDI decreases CO_2, N_2O, and CH_4. In both panels, there exists a pollution halo hypothesis. Whereas, in high-income countries, FD degrades the environment in a sense that FDI increases carbon emissions, and there exists a pollution haven hypothesis. Results are similar to Ahmad et al. (2012), and Ali (2013). Since FDI is not degrading the environment or says increasing the pollution in low- and middle-income countries, the government must emphasize on positive effects of FDI rather than negative effects. Moreover, the government should attract more foreign investment by keeping protecting the environment as well. For high-income countries where FDI increases pollution, the government should implement stringent environmental policies to reduce emissions in their countries. Trade openness degrades the environment as it affects environmental pollution indicator (CO_2) positively in low and middle-income countries, trade effects positively on environment pollution indicators (CO_2, CH_4) countries. The trade of the big-ticket item must be reduced in order to decrease emissions. Environmentally responsive excise duties can be introduced to essential industries. Optimal industrial taxes must be levied on pollution-intensive factories. Trade openness promotes the environment quality in high-income countries. Our finding is similar to Shahbaz et al. (2013). While, energy consumption is a degrading environment (CO_2 and N_2O) in low-income countries and in middle-income countries (CO_2, N_2O, CH_4). Our results are similar to Arouri et al. (2012). In this situation, countries must implement the use of renewable energy sources. This might be because of an increase in usage of renewable energy sources which reduce CO_2 emissions. So, the government must focus on making

those policies that would ensure an adequate energy supply by rising steadily the number of renewable sources of energy in the aggregate of the electricity supply. On the other hand, energy consumption decreases N_2O in high-income countries; our results are similar to Mirza and Kanwal (2017).

6.1 Conclusion

We have accomplished the impact of FD on environment pollution indicators, namely carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), and) in low, middle- and high-income countries. We employed FE on all three regressions for low, middle- and high-income countries to analyze the existence of correlation between α_i and xit in all periods of time. The study found that there exists a correlation between FD and environmental indicators in low and middle-income countries, such that FD increases pollution because low and middle-income countries do not have access to green or environment-friendly technology and use the conservative techniques till now. While, high-income countries use green technology, such that the impact of FD is negative on carbon emissions. This difference is because of the level of FD these countries receive. A high level of FD decreases emissions, whereas a low level of FD increases emissions.

The implication of foreign direct investment is that it reduces pollution level in low and middle-income countries; this means that foreign investment brings advancement in the industries by introducing effective technology. These outcomes support the existence of pollution halo hypothesis, which says that FDI inflows supply more efficient and advance technology and hence reduces the pollution. While in the high-income group, pollution haven hypothesis exists, that states when a foreign business moves to the host country, as it brings a high level of pollution to the host country.

References

Abdul Jalil, M. F. (2011). The impact of growth and financial development on the environment in China: A cointegration analysis. *Energy economics 33 (2011),* 284-291.

Acharyya, J. ((2009)). FDI, Growth, and the Environment: Evidence from India on CO2 Emission during the Last Two Decades. *Journal of Economic Development, 34(1),* 43-58.

Agarwal, R. ((2012)). Economic Globalization, Growth, and the Environment: Testing of Environment Kuznets Curve Hypothesis for Malaysia. *Business & Financial Affairs, 1(2),* 1-8.

Ahmad, N. H. (2012). The Causal Links between Foreign Direct Investment and Economic Growth in Pakistan. *European Journal of Business and Economics, 6,* 20-21.

Alam, F. I. (2013). Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis. *Economic Modelling,* 435-441.

Ali, S. (2013). External Debt and Domestic Investment in Pakistan: A Cointegration Analysis. *Journal of Managerial Sciences, 7(2),* 179-191.

Ali, S. W. (2014). M. Foreign Capital and Investment in Pakistan: A Cointegration and Causality Analysis. *Journal of Basic and Applied Scientific Research 4(4),* 217-226.

Ali, S. W. (2014a). Analysis of Financial Development and Economic Growth in Pakistan. *Journal of Basic and Applied Scientific Research, 4(5),* 122-130.

Aliyu, M. A. (2005). Foreign Direct Investment and the Environment: Pollution Haven Hypothesis Revisited. *Eighth Annual Conference on Global Economic Analysis.* Lübeck, Germany.

Alkhathlan, K, J. M. (2013). Energy consumption, carbon emissions, and economic growth in Saudi Arabia: an aggregate and disaggregate analysis. *Energy Policy 62,* 1525–1532.

Al-mulali, U. (2012). Factors affecting CO2 emission in the Middle East: A panel data analysis. *Energy, 44,* 564–569.

Al-Mulali, U. T. (2015). Does financial development reduce environmental degradation? Evidence from a panel study of 129 countries. *Environmental Science and Pollution Research 22(19),* 14891-14900.

Al-mulali, U., & Tang, C. (2013). Investigating the validity of the pollution haven hypothesis in the gulf cooperation council (GCC) countries. *Energy Policy 60,* 813–819.

Antweiler, W., Copeland, B., & Taylor, S. (2001). Is free trade good for the environment? *Am. Econ. Rev. 91,* 807–908.

Araya, M. (2012). FDI and the environment: What empirical evidence does—And does not—Tell us. *In International Investment for Sustainable Development Balancing Rights and Rewards; Routledge: London, UK.*, 46–73.

Arif Alam, M. A. (2014). Environmental quality indicators and financial development in Malaysia: Unity in Diversity. *Environ Sci Pollut Res*.

Arouri ME, Y. A. (2012). Energy consumption, economic growth, and CO2 emissions in the Middle East and North African countries. *Energy Policy 45*, 342–349.

Artur Tamazian*, J. P. (2009). Does higher economic and financial development lead to environmental degradation: Evidence from BRIC countries. *Energy Policy*, 246-253.

Artur Tamazian, J. P. (2009). Does economic and financial development lead to environmental degradation: Evidence from BRIC countries. *Energy Policy*, 246-253.

Artur Tamazian, J. P. (2009). Does Economic Growth and financial development lead to environmental degradation? *Energy Policy 37 (2009(*, 246-253.

Baek, J. &. ((2009).). A Dynamic Approach to the FDI-Environment Nexus: The Case of China and India. *Journal of International Economic Studies, 13(2)*, 87-108.

Balassa, B. (1978). Exports and economic growth: Further evidence. *Journal of Development Economics, 5(2)*, 181-89.

Baltagi, B. H. (2005). *Econometric Analysis for Panel Data.*

Bhagwati, J. a. ((1983)). Lectures on International Trade, Cambridge: MIT Press.

Bin, S., & Yue, L. (2012). Impact of foreign direct investment on china's environment: An empirical study based on industrial panel data. *Soc. Sci. China 33*, 89–107.

Bin, S., & Yue, L. (2012). Impact of foreign direct investment on china's environment: An empirical study based on industrial panel data. *Soc. Sci. China 33*, 89–107.

Boopendra SEEtanah, R. v. (2018). impact of economic and financial development on environmental degradation: Evidence from small island and developing states (SIDS). *Emergy markets finance and trade*.

Boutabba, M. A. (2014). the impact of financial development, income, energy, and trade on carbon emissions: Evidence from the Indian economy. *Economic modeling*, 33-41.

Bukhari, N. S. ((2014)). Consequences of FDI on CO2 Emissions in Case of Pakistan. *Middle-East Journal of Scientific Research, 20(9)*, 1183-1189.

Coban S, T. M. (2013). The nexus between financial development and energy consumption in the EU: a dynamic panel data analysis. *Energy Econ 39*, 81-88.

Cole, M. (2004). Trade, the pollution haven hypothesis, and the environmental Kuznets curve: Examining the linkages. *Ecol. Econ 48*, 71–81.

Cole, M., & Elliott, R. (2005). FDI and the capital intensity of "dirty" sectors: A missing piece of the pollution haven puzzle. *Rev. Dev. Econ 9*, 530–548.

Copeland, B., & Taylor, M. (1994). North-South Trade and the Environment. *Q. J. Econ. 109*, 755–787.

Daly, H. (1993). Problems with Free Trade: Neoclassical and Steady-State Perspectives. *D. Zaelke, P. Orbuch, and R. F. Housman, eds.* (pp. pp. 147–157). Washington, DC: Island Press.

De BruynSM, O. (1997). Developments in the throughput-income relationship: theoretical and empirical observations. *EcolEcon*, 20:255–68.

De Mello, L. ((1997)). Foreign Direct Investment in Developing Countries and Growth: A Selective Survey. *Journal of Development Studies, 34*, 1-34.

E, C. S. (2007). Financial sector development and the millennium development goals. *World Bank Publication*.

Erik Dietzenbacher, *. a. (2007). An Empirical Examination of the Pollution Haven Hypothesis for India: Towards a green Leontief Paradox. *Environmental & Resource Economics 36*, 427–449.

Eskeland, G., & Harrison, A. (2003). Moving to greener pastures? Multinationals and the pollution haven hypothesis. *J. Dev. Econ, 70*, 1–23.

Esteve V, T. C. (2012.). Threshold cointegration and nonlinear adjustment between CO2 and income: The Environmental Kuznets Curve in Spain, 1857–2007. *EnergyEcon*.

Faiza Abbasi, K. (2016). CO2 emissions and financial development in an emerging economy: An augmented VAR approach. *Energy policy*, 102-114.

Farhani S, O. I. (2015). Causal relationship between CO2 emissions real GDP, energy consumption, financial development, trade openness, and urbanization in Tunisia. *Environ Sci Pollut Res 22(20)*, 5663–15676.

Ganda, F. (2019). The environmental impacts of financial development in OECD countries: *Environmental Science and Pollution Research*.

Grossman, G. M. ((1995)). Economic Growth and the Environment. *Quarterly Journal of Economics, 110*, 353–77.

Grossman, G., & Krueger, A. (1991). Environmental Impacts of a North American Free Trade Agreement; NBER Working Paper No. 3914; MIT Press. *Cambridge, MA, USA*, 1–57.

Hadi Esmaeilpour Moghadam, M. R. (2014). Impact of Financial Development on the Environmental. *Chinese Business Review, Vol. 13, No. 9*, 537-551.

Hafeez, M, C. Y. (2018). Does finance affect Environmental degradation: Evidence from one belt and one road initiative region? Implications for the environment. *Energies 12(7)*, 1358.

Hafeez M, Y. C. (2019(a)). Evaluating the energy consumption inequalities in the one belt and one road region: implications for the environment. *Energies 12(7)*, 1358.

Hafiz Muhammad Shoaib, M. Z. (2020). Impact of financial development on CO2 emissions: A comparative analysis of developing countries (D8) and developed countries (G8). *Environmental science and Pollution Research*, 12461-12475.

Halicioglu. (2009). An econometric study ofCO2 emissions, energy consumption, income, and foreign trade in Turkey. *EnergyPolicy*, 1156–64.

Hamisu Sadi Ali, S. H. (2019). Financial development and carbon emissions in Nigeria: Evidence from ARDL bounds Approach. *Goejournal*, 641-655.

Haseeb, S. S. (2018). Impact of financial development and economic growth. *Environmental Science and Pollution Research*.

Hassaballa, H. ((2013)). Environment and Foreign Direct Investment: Policy Implications for Developing Countries. *Journal of Emerging Issues in Economics, Finance, and Banking, 1(2)*, 75-106.

He, J. (2006). Pollution haven hypothesis and environmental impacts of foreign direct investment: The case of industrial emission of sulfur dioxide (SO2) in Chinese provinces. *Ecological Economics 60*, 228-245.

IPCC. (2007). *Climate Change 2007: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* Cambridge University Press, Cambridge, UK, 976pp.: M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and CE.

Jaffe, A. P. (1995). Environmental Regulation and The Competitiveness of US Manufacturing: What Does the Evidence Tell Us? *Journal Economic Literature 33*, 132-163.

Jalil A, F. (2012). The impact of financial development on the environment in China: A cointegration analysis. *EnergyEcon*, 33:284–91.

Jalil A, F. M. (2011). The impact of growth, energy, and financial development on the environment in China: a cointegration analysis. *Energy Econ 33(2)*, 284-291.

Javorcik, B., & Wei, S.-J. (2004). Pollution havens and foreign direct investment: Dirty secret or popular myth? *Contrib. Econ. Anal. Policy, 3*, 1–32.

Jorgenson, A. K. ((2007)). Does Foreign Investment Harm the Air We Breathe and the Water We Drink? A Cross-National Study of Carbon Dioxide Emissions and Organic Water Pollution in Less-Developed in less developed countries 1975-2000. *Organization & Environment, 20(2)*, 137-156.

Jorgenson, A. K. (2010)). Foreign Direct Investment, Environmental INGO Presence, and Carbon Dioxide Emissions in Less-Developed Countries, 1980-2000. *Revista Internacional de Organizaciones(4)*, 129-146.

Kartircioglu ST, T. N. (2017). Testing the moderating role of financial development in an environmental Kuznets curve: empirical evidence from Turkey. *Renew Sust Energy 87(6)*, 572-586.

Khalil, S. &. (2006). Is Trade Good for Environment? A Unit Root Cointegration Analysis. *The Pakistan Development Review, 45(4(Part II))*.

Kias Saidi, M. B. (2017). The impact of income, trade, urbanization, and financial development on CO2 emissions in 19 emerging economies. *Environ Sci Pollut Res*, 12784-12757.

Kizito Uyi, H. H. (2019). Effects of Energy consumption, economic growth, and financial Development on Carbon emissions: evidence from heterogeneous income groups. *Environmental Science and Pollution Research*, 22611-22624.

Krueger, A. (1997). Trade Policy and Economic Development: How We Learn". *American Economic Review, 87 (1)*, 1-22.

Lan, J., Kakinaka, M., & Huang, X. (2012). Foreign Direct Investment, Human Capital, and Environmental Pollution in China. Environ. *Resour. Econ, 51*, 255–275.

Lanouar Charfeddine, K. B. (2015). Financial Development and Environmental Quality in the UAE. *Renewable and Sustainable Energy Reviews*.

Lau, L. (2014). Investigation of the environmental Kuznets curve for carbon emissions in Malaysia: do foreign direct investment and trade matter? *EnergyPolicy 68*, 490–497.

Leamer, E. E. (1980). The Leontief Paradox, Reconsidered',. *Journal of Political Economy 88*, 495–503.

Lean HH, S. R. (2010). CO2 emissions, electricity consumption, and output in ASEAN. *Appl Energy 87(6)*, 1858–1864.

Lean HH, S. R. (2010). CO2 emissions, electricity consumption, and output in ASEAN. *Appl Energy 87(6)*, 1858–1864.

Levinson A, T. S. (2008). Unmasking the pollution haven effect. *Int Econ Rev 49(1)*, 223–254.

Levinson, A. a. ((2003)). "Unmasking The Pollution Haven Effect, Mimeo," *International Economic Review,49(1)*, 223-254.

Li, X. &. (2005). Foreign Direct Investment and Economic Growth: An Increasingly Endogenous Relationship. *World Development, 33*, 393-407.

Liang, F. H. (2006). Does Foreign Direct Investment Harm the Host Country's Environment? Evidence from China. *Haas School of Business, UC Berkeley*.

M. Shahbaz, S. A. (2013). Does financial development reduce CO2 emissions in the Malaysian economy? A time-series analysis. *Economic modeling*, 145-152.

Mahmood, H. &. ((2012)). FDI, Population Density, and Carbon Dioxide Emissions: A Case Study of Pakistan. *Iranian Journal of Energy & Environment, 3(4)*, 354-360.

Majeed, M. T. ((2016)). Distributional consequences of remittances: Evidence from sixty-five developing countries. *Pakistan Journal of Commerce and Social Sciences, 10(2)*, 374-295.

Marwah, K. &. (2004). The Effect of Foreign Capital and Imports on Economic Growth: Further Evidence from Four Asian Countries. *Journal of Asian Economics(15)*, 399-413.

Mirza FM, K. A. (2017). Energy consumption, carbon emissions, and economic growth in Pakistan: dynamic causality analysis. *Renew Sust Energ Rev 72*, 1233–1240.

Muhammad Javid, F. (2016). EnvironmentalKuznetscurveand financial development in Pakistan. *Renewable and Sustainable Energy Reviews 54*, 406–414.

Muhammad Shahbaz, Q. M. (2013). Economic growth, energy consumption, financial development, international trade, and CO2 emissions in Indonesia. *Renewable and Sustainable Energy Reviews*, 109-121.

Muhammad Shahbaz, S. A. (2013). Does financial development reduce CO2 emissions in the Malaysian economy? A time-series analysis. *Economic Modelling*, 145-152.

Muhammad, S. (2013). Economic growth, energy consumption, financial development, international trade, and CO2 emissions in Indonesia. *Renew Sustain Energy Rev 25*, 109–21.

Murat Cetin, E. E. (2017). The impact of financial development on carbon emissions under the Structural Breaks: Empirical Evidence from the Turkish Economy. *International Journal of Economic perspectives*, volume 11, issue 1, 64-78.

Murt Cetin, E. E. (2018). The impact of economic growth, energy consumption, trade openness, and financial development on carbon emissions: Empirical Evidence from Turkey. *Environmental Science and Pollution Research*.

Naghmeh Ghorashi, A. A. (2018). Impact of Financial Development on CO2 emissions: Panel Data Evidence from Iran's Economic Sectors. *Journal of community health Research*, 127-133.

Narayan PK, N. S. (2010). Carbon Dioxide Emissions and Economic growth: Panel data evidence from developing countries. *EnergyPolicy*, 38:661–6.

Narayan PK, S. R. (2008). Energy consumption and real GDP in G7 countries: new evidence from panel cointegration with structural breaks. *Energy Econ 30*, 2331–2341.

Narayan PK, S. R. (2008). Energy consumption and real GDP in G7 countries: new evidence from panel cointegration with structural breaks. *Energy Econ 30*, 2331–2341.

Omri A, D. S. (2015). Financial development, environmental quality, trade, and economic growth: what causes what in MENA countries? *Energy Econ 48,* 242-252.

Omri A, D. S. (2015). Financial development, environmental quality, trade, and economic growth: What causes what in MENA countries. *Energy Econ 48*, 242–252.

Ozturk I, A. A. (2013). The long-run and causal analysis of energy, growth, openness, and financial development on carbon emissions in Turkey. *Energy Econ 36*, 262–267.

Pearce, D. W. (1993). World Without End: Economics, Environment, and Sustainable Development, New York: Oxford University Press.

Proops, J. L. (1999). International Trade and the Sustainability Footprint: A Practical Criterion for its Assessment. *Ecological Economics 28*, 75–97.

Qi, L. X. (2017). Financial Development and Carbon emissions in Chinese provinces: A spatial Panel data Analysis. *The Singapore Economic Review*.

Raspiller, S. a. (2004). Do environmental regulations influence the location behavior of French firms? *Paper Presented at the Thirteenth Annual Conference of the EAERE, Budapest,* Hungary.

Ren, S. (2014). International trade, FDI (foreign direct investment), and embodied CO2 emissions: a case study of China's industrial sectors. *ChinaEcon.Rev.28*, 123–124.

Salahuddin, M, G. J. (2015). Is the long-run relationship between economic growth, electricity consumption, carbon dioxide emissions, and financial development in Gulf Cooperation Council Countries robust? *Renew Sust Energ Rev 51*, 317–326.

Salahuddin, M, G. J. (2014). Economic growth, energy consumption C02 emissions in gulf cooperation council countries. *Energy 73*, 44-58.

Seldon, T. M. (1994). Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions? *Journal of Environmental Economics and Management, 27*, 147–62.

Shah Saud, S. C. (2018). impact of financial development and economic growth on environmental quality: an empirical analysis from Belt and Road Initiative (BRI) countries. *Environmental Science and Pollution Research*.

Shahbaz, M, L. H. (2012). Environmental Kuznets Curve hypothesis in Pakistan: Cointegration and Granger causality. *Renew Sust Energy Rev*, 2947–53.

Shahbaz, M, T. A. (2013). The effects of financial development, economic growth, coal consumption, and trade openness on CO2 emissions in South Africa. *Energy Policy 61*, 1452–1459.

Shahbaz Muhammad. (2013). Economic growth, energy consumption, financial. *Renew Sustain EnergyRev*, 25:109–21.

Shahbaz, M. H. (2013). Economic growth, energy consumption, financial development, international trade, and CO2 emissions in Indonesia. *Renewable and Sustainable Energy Reviews, 25*, 109-121.

Shahbaz, M. S. (2013). Does financial development reduce CO2 emissions in the Malaysian economy? A time-series analysis. *Economic Modelling, 35*, 145-152.

Shahbaz, M., Nasreen, S., Abbas, F., & Anis, O. (2015). Does foreign direct investment impede environmental quality in high-, middle- and low-income countries? *Energy Econ. 51*, 275–287.

Sharafat Ali, H. W. (2015). Analyzing the dynamics of energy consumption, liberalization, Finacial Development, Poverty, and Carbon Emissions. *Journal of applied environmental and Biological Sciences*, 166-183.

Siddique, H. M. (2017). impact of financial development and energy consumption on CO2 Emissions: Evidence from Pakistan. *Bulletin of Business and Economics*, 68-73.

Tamazain A, R. B. (2010). Do economic, financial, and institutional developments matter for environmental degradation? Evidence from transitional economics. *Energy Econ*, 32:137–45.

Tamazian A, R. B. (2010). Do economic, financial, and institutional developments matter for environmental degradation? Evidence from transitional economies. *Energy Econ 32*, 137–145.

Tamazian, A. &. (2010). Do economic, financial, and institutional developments matter for environmental degradation? *Energy Economics 32(1)*, 137-145.

Tamazian, A. a. (2010). Do economic, financial, and institutional developments matter for environmental degradation? Evidence from transitional economies. *Energy Policy, 37(1)*, 246-253.

Tobey, J. (1990). Effects of Domestic Environmental Policy on Patterns of International Trade: An Empirical Test. *Kyklos Int. Rev. Soc., Sci. 43*, 191–2019.

Tsaurai, K. (2019). The impact of Financial development on Carbon Emissions in Africa. *International Journal of Energy Economics and policy*, 144-153.

WR., U. G. (1998). An alternative analysis of apparent EKC-type transitions. *EcolEcon*, 25:221–9.

Xing, Y. &. (2002). Do Lax Environmental Regulations Attract Foreign Investment? *Environmental and Resource Economics, 21(1)*, 1-22.

Xing, Y. a. (2002). Do Lax Environmental Regulations Attract Foreign Investment? *Environmental and Resource Economics, 21(1)*, pp. 1-22.

Xu, L. ((2013)). On the evaluation of the performance system incorporating “green credit” policies in China‟s financial industry. *Journal of Financial Risk Management, 2(02)*, 3337.

Y, Z. (2011). The impact of financial development on carbon emissions an empirical analysis in China. *Energy Policy 39(4)*, 2197–2203.

Yongmoon Park, F. M. (2018). The effect ICT, financial development, growth, and trade openness on CO2 emissions. *Environmental science and Pollution Research*, 30708-30719.

Yuxiang K, C. Z. (2010). Financial development and environmental performance evidence from China. *Environ Dev Econ 16(1)*, 93–111.

Yuxiang K, C. Z. (2010). Financial development and environmental performance: evidence from China. *Energy Policy 39 (4)*, 2197-2203.

Yuxiang, K. &. (2010). Financial development and environmental performance: Evidence from China. Environment and. 16, 1-19.

Zefeng Xu, M. A. (2018). Nexus between Financial development and CO2 emissions in Saudia Arabia: Analyzing the role of Globalization. *Environmental science and Pollution Research*, 28378-28390.

Zhang XP, C. X. (2009). Energy Consumption, carbon emissions, and economic growth in China. *Ecol Econ 68(10)*, 2706-2712.

Zhang, C., & Zhou, X. (2016). Does foreign direct investment lead to lower CO2 emissions? Evidence from a regional analysis in China. *Renew. Sustain. Energy Rev 58*, 943–951.

Zhang, C., & Zhou, X. (2016). Does foreign direct investment lead to lower CO2 emissions? Evidence from a regional analysis in China. *Renew. Sustain. Energy Rev. 58*, 943–951.

Zhang, Y.-J. (2011). The impact of financial development on carbon Dioxide: An empirical analysis in China. *Energy Policy*, 2197-2203.

Zhu, Q., Sarkis, J., & Lai, K. (2007). Initiatives and outcomes of green supply chain management implementation by Chinese manufacturers. *J. Environ. Manag*, *85*, 179–189.

Appendix-A

Low-Income Countries	Middle-Income Countries		High-Income Countries
1. Benin	1. Albania	30. Kazakhstan	1. Argentina
2. Congo, Dem. Rep.	2. Algeria	31. Kenya	2. Australia
3. Haiti	3. Armenia	32. Kyrgyz Republic	3. Bahrain
4. Mozambique	4. Bangladesh	33. Malaysia	4. Chile
5. Nepal	5. Belarus	34. Mauritius	5. Croatia
6. Senegal	6. Bolivia	35. Mexico	6. Czech Republic
7. Tajikistan	7. Botswana	36. Moldova	7. Denmark
8. Tanzania	8. Brazil	37. Mongolia	8. Hong Kong SAR, China
9. Togo	9. Bulgaria	38. Morocco	9. Hungary
10. Zimbabwe	10. Cambodia	39. Namibia	10. Iceland
	11. Cameroon	40. Nicaragua	11. Israel
	12. China	41. Nigeria	12. Japan
	13. Colombia	42. Pakistan	13. Korea, Rep.
	14. Congo, Rep.	43. Paraguay	14. Kuwait
	15. Costa Rica	44. Peru	15. New Zealand
	16. Cote d'Ivoire	45. Philippines	16. Norway
	17. Dominican Republic	46. Romania	17. Oman
	18. Ecuador	47. South Africa	18. Panama
	19. Egypt, Arab Rep.	48. Sri Lanka	19. Poland
	20. El Salvador	49. Sudan	20. Saudi Arabia
	21. Gabon	50. Switzerland	21. Singapore
	22. Ghana	51. Thailand	22. Sweden
	23. Guatemala	52. Tunisia	23. Switzerland
	24. Honduras	53. Turkey	24. United Kingdom
	25. India	54. Ukraine	25. United States
	26. Indonesia	55. Vietnam	26. Uruguay
	27. Iran, Islamic Rep.		
	28. Jamaica		
	29. Jordan		

Appendix-B

Table B-5.2.1 Correlation Metrix of low-income countries								
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1)LnCO_2	1.000							
2)LnN_2O	-0.537	1.000						
3)LnCH_4	-0.577	0.908	1.000					
4)LnGDP	-0.038	0.620	0.742	1.000				
5)LnFD	0.669	-0.609	-0.457	-0.112	1.000			
6)LnFDI	0.008	0.000	-0.029	0.022	-0.100	1.000		
7)LnTO	0.372	-0.412	-0.441	-0.406	0.302	0.326	1.000	
8)LnEn	0.396	0.050	0.042	0.193	0.259	0.067	0.104	1.000

Table B-5.2.2 Correlation Metrix of middle-income countries								
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LnCO_2	1.000							
LnN_2O	0.071	1.000						
LnCH_4	0.091	0.963	1.000					
LnGDP	0.340	0.821	0.854	1.000				
LnFD	0.410	0.166	0.159	0.372	1.000			
LnFDI	0.081	-0.157	-0.160	-0.130	0.109	1.000		
LnTO	0.232	-0.509	-0.517	-0.491	0.172	0.373	1.000	
LnEn	0.911	0.084	0.093	0.296	0.290	0.079	0.246	1.000

Table B-5.2.3 Correlation Metrix of high-income countries								
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$LnCO_2$	1.000							
LnN_2O	0.020	1.000						
$LnCH_4$	0.219	0.880	1.000					
LnGDP	0.315	0.778	0.744	1.000				
LnFD	0.157	0.039	-0.049	0.426	1.000			
LnFDI	-0.224	-0.177	-0.262	-0.197	0.063	1.000		
LnTO	-0.002	-0.707	-0.701	-0.473	0.125	0.491	1.000	
LnEn	0.064	-0.290	-0.194	-0.148	0.268	0.073	0.110	1.000