Master Thesis

The Linkage between Tourism Transportation Expenditures, FDI and Economic Development in the context of Co2 (carbon dioxide emission): Evidence from Bangladesh

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The Graduate School of Hansung University

Major in International Market Analysis

Dept. of International Trade and Economics

Hossain Md Sajjad

Master Thesis
Advisor professor InSeon Kim

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ABSTRACT

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The aim of this study is to understand the relationship between tourism transportation expenditures, FDI, electricity consumption. Fossil fuel consumption, urban population. economic development and Co2 (carbon dioxide emission) in Bangladesh using time series data for the period 1973-2014. To achieve this goal, we applied Autoregressive Distributed Lag (ARDL) model bound testing approach and VAR Granger Causality test and found that cointegration exists among the variables. The empirical results reveal that electricity consumption, fossil fuel consumption, urban population and economic growth have positive

and significant long-term impacts on carbon emission. However, FDI has negative and significant long-term effects on Co2 emission. The results also reveal that tourism transportation expenditures, fossil fuel consumption, and urban population has short-term effects on Co2 emission. Only the coefficient of economic growth are negative and insignificant. Moreover, the Granger causality results of this study reveal that there are two-way causalities between electricity and urban population, and one way causalities are between GDP and Co2 emission, GDP and fossil fuel consumption, FDI and electricity consumption, FDI and urban population, fossil fuel consumption and urban population in Bangladesh. Only found that tourism transportation expenditures have no Granger causalities. Based on these findings, the study recommends that Bangladesh should adopt environmental friendly technologies (transferring clean and pollution free technologies) from developed or developing countries to reduce carbon emission in the country. Besides, strict environment rules, reform regulatory energy consumption and the most important social welfare would be helpful to reduce environmental degradation in the country and sustainable economic development at the same time.

[Keyword] : ARDL, Cointegration, Co2 (carbon emission), Tourism transportation expenditures, Economic growth and Environmental degradation.

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Chapter 1: Introduction

All over the world, Global warming and Climate change has appeared a serious concern to the citizens. The carbon dioxide (co2) emission representing a primary driver of greenhouse gases (GHG) is considered one of the most important reasons of increasing global temperatures and climate change. International community decided that global temperatures should be control under 2 ℃ at the end of 21st century during the 5th IPCC Review Article. Moreover, the impact of Co2 emission on global warming is expected to continue in future(Stocker, 2013).

In developing nations, tourism is a potential area in terms of GDP growth in the modern era of globalization has been identified for environmental erosion. Nowadays, tourism plays an important role in most of the countries as the number of international tourist passengers has considerably expanded according to the (United Nations Environment Program, 2011). In every nation, this sectors represents as an important part of economic development (GDP) and employs directly and indirectly as an important portion of total workforce, represents an important share of total exports and Foreign Direct Investment (FDI) impersonates a vital source of world's tourism Investment. The increasing earth temperature is resulting in an expansion of this sector and it continues to produce Fossil fuel consumption and greenhouse gases. According to the(Hamilton et al., 2005), it is clear that impact of warm weather is harmful for health. It leans to affect human health with various types of diseases. Not only it is responsible for human health and world environment, but also it has a strongly negative effect on sustainable economic development.

According to the (Tourism Organization, 2021) stated that, the total number of tourist arrivals is supposed to increase at the global level in the coming years. In 1950, the number of tourists was 25 million and it increased to 1466 million by 2019, in which 34.0 million related to South Asia. The UNTWO also reported that the annual

growth rate of number of tourist's arrivals was 323 million in 2019 compared to the number of 267 million in the fiscal year 2018. Also, during the fiscal year of 2019 the Government of Bangladesh receipt 388 million USD compared to 353 million USD in 2018. But due to the pandemic of covid 19 in 2020, the total number of tourist arrival was low compared to the previous year and received low revenue approximately 217 million USD in 2020.
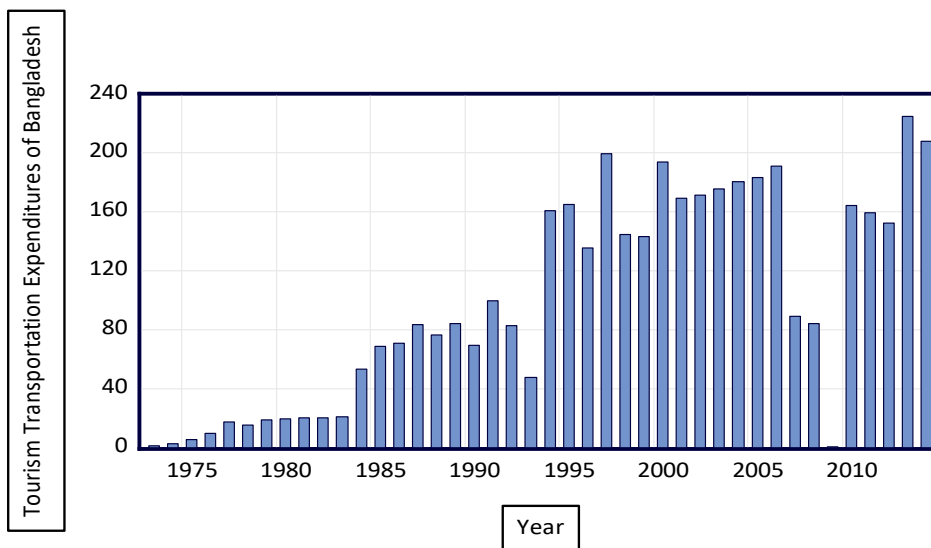
Bangladesh is known as one of the foremost crowded populated nations in the world. Bangladesh became Independent in 1971 and during the liberation the economic growth collapsed nearly one-fifth of the country's total economy and the country's economy increased gradually over the past two decades. Bangladesh is presently gradually moving from agrarian economy to mechanical economy and is considered nowadays as a rising economy. In this situation, the government of Bangladesh and other organization(NGO) all are trying to create a friendly investment environment through disclosing new economic policies, incentives for investors etc. It is now a great headache for the economists how FDI effects the host countries economic growth. Since 1971, there has been a significant improvement of living standard people and huge things need to be done to remove poverty of the country(Hussain & Haque, 2016).

In general, Foreign Direct Investment (FDI) can be defined as establishing or expanding business into foreign country with transfer of capital, labor etc. According to the UNCTAD, FDI is defined as an investment through a long-term relationship and extending their lasting interest between to foreign countries and control by one economy country to another country.

FDI is considered one of the major sources for booming economic growth at each country. FDI which helps recipient's nations to trade related activities by establishing whether multinational corporation or transnational by foreign countries. Bangladesh has created many significant opportunities and developed many trade openness strategy for the both domestic and foreign investors by establishing many EPZ (Export Processing Zones) into the country. As part of its policy execution, Bangladesh has established 1st EPZ (Export Processing Zones) in 1980's and there are currently eight EPZ into the country. Over the next several years, Bangladesh Economic Zones Authority plans to establish approximately 100 EZ (Economic Zones) throughout the county and already 97 EZs site selection have been completed during the year of February 2021. Bangladesh received $1.6 billion FDI in 2019 which is one of the lowest FDI rate in South Asia and

United State is the top FDI investors countries which investment is $3.5 billion in 2019 (*Bangladesh – United States Department of State*, 2021). Moreover, Bangladesh is well-known for export oriented business like as; garments sectors and low labor cost as well as huge young workforce globally. It has been seen that more FDI comes to in this sector and this sector consume huge electricity as well. There is a linked between FDI and the export oriented business and its use of electricity to CO_2 emission in Bangladesh and it causes environmental degradation.

In recently, by maintaining more than 6% growth rate, Bangladesh has transferred to the status of developing nations from the least developed nations over the last decade (Islam,2018) and it tends to surpass this growth trap by maintaining and utilizing both internal and external economic forces and determinants for promoting industrialization. Industrialization is an important part for increasing economic growth in every country. Similarly, Industrialization in our country is increasing rapidly and it requires more use of energy and it increase in energy consumption contributes to enhance CO_2 emission which is harmful to environmental quality in our country. In 2016, fossil-fuel based CO_2 emissions were 74,476,230 tons and compared to last years it increased by 4.5%. On the other hand, the CO_2 emissions of per capital accounted for 0.47 tons, which increased by 0.02 as related to previous year. This results shows a huge change especially 3.4% per capital change in CO_2 emissions (*Bangladesh CO2 Emissions – Worldometer*, 2022). Also, the given figure 2 shows the trends of CO_2 in Bangladesh is gradually increasing from 1997 to 2014.
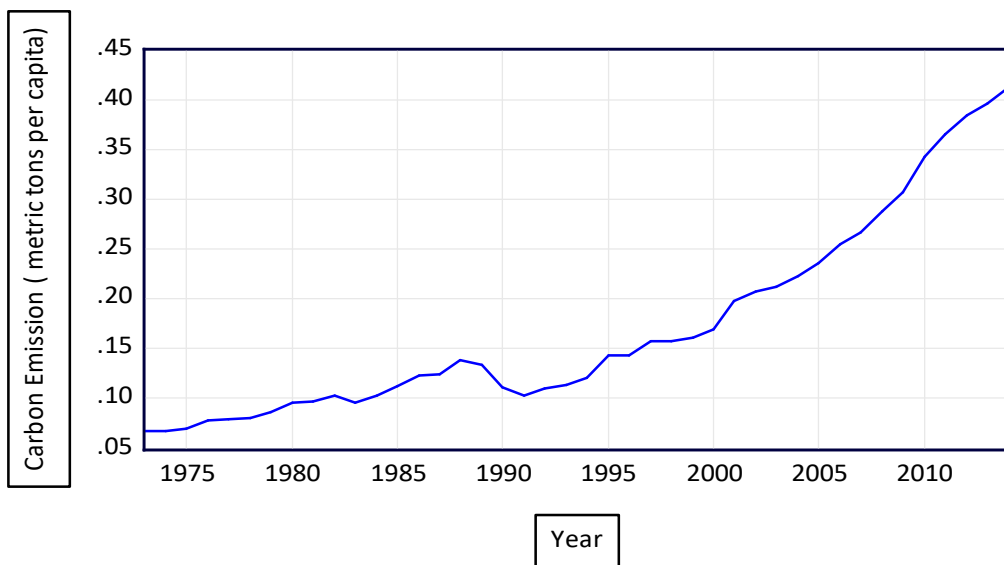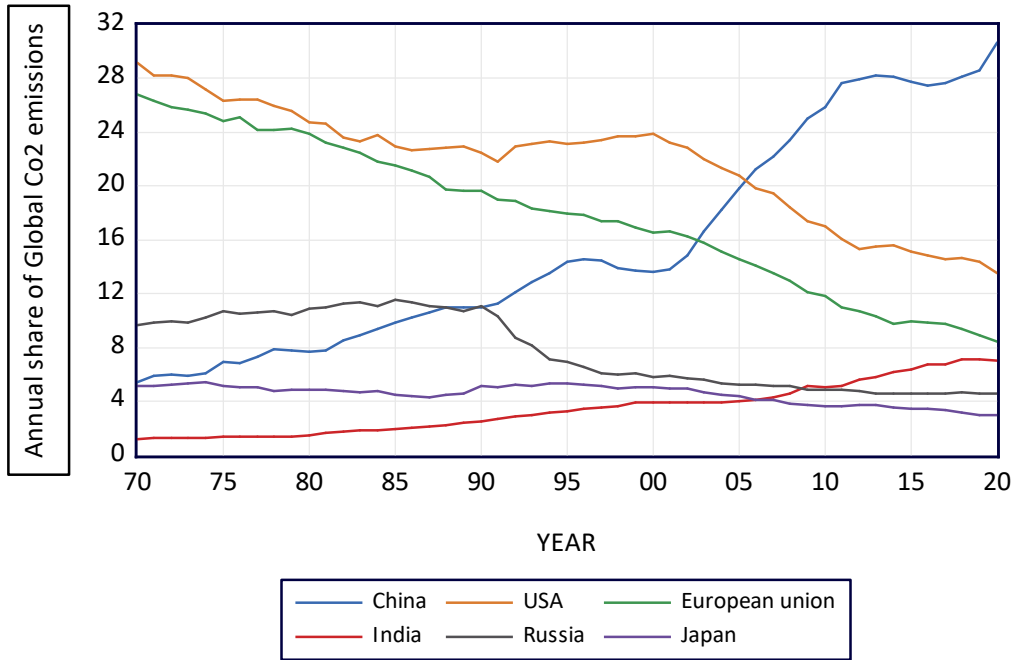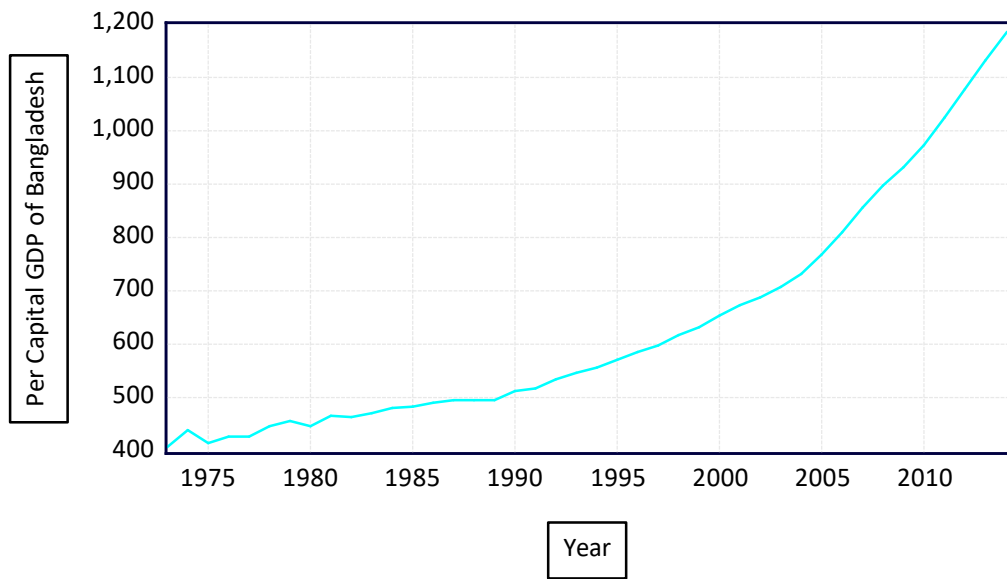
transportation sectors which is also associated the larger carbon footmark. In recent years, the relationship between urbanization and various environmental issues such as energy related issues, carbon emission issues have been discussed widely all over the world. Some researchers show that urbanization increases energy demand, creating more co2 emission (Khoshnevis Yazdi & Dariani, 2019; Sharmin, n.d.; Test, 2022).

In recent years, we can see that many developed and developing countries are started to act against the environmental degradation where they are establishing many policies in order to combat this problem. Some countries have enforced charges on outflow of carbon dioxide emission which is considered the principle of increasing global temperatures. Other countries have set up a general point of imprisonment on carbon emission discharges and allows organization to purchase environmental friendly technologies to reduce carbon emission. Some believe that for expanding economy, environmental erosion is a must. But it is already known that the economic activities also play an important role for the development of a country must contributes to increase environmental degradation . Hence, we cannot ignore this issues in Bangladesh. Therefore, this study is investigated the impact tourism transportation expenditures and other economic factors on carbon emission in Bangladesh.

 The rest of the paper is embodied as follows: Section 2 will discuss the review of literature; Section 3 describes the research design and hypothesis of this research; Section 4 is devoted the data and methodology; Section 5 discuss the empirical results; Section 6 represents discussion and policy recommendations and section 7 concludes the paper .

Chapter 2: Literature review

The prime purpose of this section is to investigate the theories and research which is refers to the impact of Tourism transportation expenditures, FDI, electricity consumption, fossil fuels consumption, urban population and economic growth on carbon dioxide emissions (co2) in Bangladesh. This section begins with the importance of the above factors between co2 (Carbon Emission) and followed by positive or negative relation and some researcher's arguments on between FDI, electricity consumption, fossil fuel consumption, urban population and economic development.

2.1 The nexus between Internal dynamics FDI, economic development and Co2 emissions

Islam et al. (2018) attempted to scrutinizes the effect of foreign direct investment, globalization, energy consumption on Co2 emission in the presence of institutional quality of Bangladesh. The study period was 1972-2016. They applied ARDL model followed by Jordan and Phillips (2018) and their empirical results reveals that FDI, globalization have a negative effect on Co2 emissions in improving Co2 quality. On the other hand, energy consumption and economic development have a positive impact both in the long and short run. In the context, of foreign direct investment it shows negative impact and establishes "pollution halo hypothesis" in the case of Bangladesh where foreign firm should have utilized clean technologies to clean the environment as well as energy-efficient strategy

Behera & Dash, (2017)assessed the influence of urbanization, energy consumption, and foreign direct investment (FDI) on the Co2 emission in

South and Southeast Asian (SSEA) region between the years 1980 and 2012. They attempted to find out the intensity of Co2 emission over the 17 countries and they divided the total sample countries into three categories such as high, middle and low-income according to their GDP per capital. The findings of the research reveals that all the variables are co-integrated in all sub -groups of countries and especially energy consumption and FDI influences the Co2 emission in this region. Also, their empirical results suggest that both primary and fossil fuel consumption are notably increasing Co2 emissions from middle-income countries and leading greenhouse gas problem in this region.

In Bangladesh context, (Sarker, 2016) assessed the power of FDI, natural gas use, energy consumption, economic growth on Co2 emissions for the period 1978 to 2010. Their study reveals that FDI had a positive impact in intensifying Co2 emissions as well as environmental degradation.

Using data from 1995 to 2011, (Dogan & Aslan, 2017) conducted an identical study to investigate the relationship between Co2 emission, real GDP, energy consumption and tourism in the EU and candidate countries for the period 1995-2011. By adopting heterogeneous panel estimation techniques with cross-sectional dependence, co-integration test, OLS, FMOLS, DOLS and Fixed effect model, the study found Long run relationship among the variables and reveals that energy consumption contributes to the level of Co2 emissions while real income and tourism decrease Co2 emissions. Also, The Emirmahmutoglu-Kose panel Granger causality test suggests to the study that causality exists one way and running from carbon emissions to tourism, and bidirectional causality exists between Carbon emissions and energy consumption, and between real GDP and Carbon emissions.

On the other hand,(Ghosh, 2010) failed to establish long run relationship and long term causality between co2 emission and economic growth in India. However; there was exists a bidirectional short run causality between them. This study also established a unidirectional short run causality running from GDP to energy supply and energy supply to Co2 emission.

A bound testing analysis was used to investigate the long and short-run impact of FDI (Manufacturing and non-manufacturing sectors) on carbon emission in Mauritius. Data was collect from 1980 to 2012. (Fauzel, 2017) applied ARDL model using time series data and found that manufacturing companies are responsible for generating carbon emission in the   Mauritius. However, the study also reveals that FDI in non-manufacturing companies does not affect the environment in their small islands. Moreover, Economic growth, energy has been seen in their study increases carbon emission.

Khuong et al., (2014) examined the causality links between foreign direct investment , economic growth and co2 emission in 54 global countries using panel data from 1990 to 2011. Scholars applied dynamic simultaneous-equation model in to three regional such as Europe-Central Asia, Latin America and Caribbean- Middle East and North Africa-sub Saharan Africa. Their empirical results provide evidence of causality links between FDI inflows and gross domestic product for all sub region. On the other hand, they also found that causality links between Co2 emission and FDI except North and South Asia. Moreover, a one-way causality link between Co2 emission and GDP exists all the sub panels except Middle East and all their empirical results are interest to policy makers and should bring sound economic policies to sustainable economic development in this sub-regional country.

Moreover, using panel data from 2004 to 2015,(Lin et al., 2022) investigated heterogeneous spatial effects of foreign direct investment on co2 emission in all regions of China. They examined pollution Haven hypothesis and Halo hypothesis through spatial Durbin economic model with two-way fixed model. The findings of the study disclose that FDI in host countries is a key contributor to reduce carbon emission of the whole country and this study will be an example of other developing countries.

Shahidan Shaari et al, (2014) experimented a paper on the relationship between foreign direct investment and economic growth on carbon emission in 15 developing countries using panel data over the period of

1992-2012. Scholars applied Johansen Cointegration test and FMOLS (Fully Modified Ordinary Least Squared) model to determine the impacts of all independent variables on carbon emission. The results of Johansen Cointegration test revealed that there is no cointegration between FDI, GDP and Co2 emission. Also, they found that FDI have no long-run effect on carbon emission while GDP intensifies carbon emission simultaneously. Moreover, they also applied VECM Granger Causality test and suggests that there is no effect of FDI and GDP on carbon emission in the short run.

Using time series data from 1974 to 2010 (Shakil Ahmad, 2014) explored the relationship between foreign direct investment , capital formation on carbon emission in Pakistan. The authors applied ARDL (Autoregressive Distributed Lag) model to analyze the effect of FDI and capital formation on carbon emission. Their empirical results reveal that foreign direct investment damage the environment while capital formation can bring back environmental quality by introducing environmental friendly technologies such as production techniques. Moreover, The study also recommends that Pakistan Government should take better policy for the well-being of the environment by reducing overseas direct investment techniques and encouraging capital formation.

(Peng et al., 2016) investigated the relationship among foreign direct investment, economic growth on Co2 emission in China. The study period was 1985- 2012 . They used a sample of province level panel data and all data was divide into seventh five- year plan (1986-1990) through the research. Also they used 16 province for data availability and all the provinces are grouped into three economic belts. They applied bootstrap Granger panel causality approach through cross-sectional dependence and homogeneity of different regions in China. Their empirical results discloses that there is a bidirectional causality between FDI and GDP in Beijing, Jilin, Shanxi and Gansu . In the end, they found a unidirectional relationship between FDI and Co2 emission in Beijing, Henan, Shanxi and bidirectional relationship FDI and Co2 emissions in Neimenggu.

Using secondary annual data (Ahmad et al., 2016) investigated the effects of economic activities on Co2 emission in Malaysia over the period 1980–2011. They employed Ordinary Least Squared (OLS) model to experiment the impact of economic activities towards Co2 emission. The estimated result reveals that FDI has less significant impact on Carbon emission while other variables have significant impacts on carbon emission.

2.2 The nexus between tourism transportation expenditures and Co2 emissions

Transportation is an important element for international tourism to reach the tourist destination. The air transportations, railway transportations, sea transportations are the diverse mode of transportation that required different level of energy to support of its operation. In the context of Bangladesh, tourism transportation sector has been seen that highly sensitive issues due to the obsessive use of energy which through generates sufficient amount of income in terms of duty and customs that support to the economic growth. Nowadays, this topic is a tremendous issue across the globe. Numerous research has been done on tourism sector across the world and every country find out their possible solution through their research which sector affecting the most co2 emission. In the context of Bangladesh, the construction of hotels, infrastructure, tourism facilities, the transportation of tourists, increased different level of energy and decrease of natural and agricultural regions can call contribute to environmental erosion. In contrast, environmental deterioration may result in a decrease of tourism growth.

Zaman (2017) conducted a paper on the impact of tourism transportation expenditures, FDI, energy demand, trade openness and urban population on Co2 emissions and per capital income for the panel of 11 transaction economics. The study period was 1995–2013. The study model includes the variables Co2 emissions from transport as a dependent variable and international tourism transport passengers travel

items, FDI, urban population, energy use (kg of oil equivalent) and economic growth as independent variables. The author applied Unit root test checking the stationary of panel series, pedroni's residual co-integration test Fixed Effect Random model, causality test and variance of decomposition to investigate the relation between the dependent and independent variables and observed the shocks between the variables for the next 10-year period. They found there is no unit root problem as all the variables in Augment Dicky-Fuller test and per capital income escalates the Co2 emission and international tourism receipt and international tourism expenditures for travel items jointly effect Co2 emissions and per capital income in the region. They also found that tourism-led growth and FDI hypothesis in the region by Causality test.

Rahaman, (2022) have examined the impact of Foreign direct investment, electricity consumption, tourism and economic growth on carbon emission in Bangladesh. They used Auto Regressive Distributed Lag(ARDL) model from 1990 to 2019 to find out the long and short-run association between the variables where variables used Co2 as dependent variables and FDI, tourism, electricity consumption and GDP as independent variables. Their results revealed that all independent variables have positive and significant long term effect on Co2 emissions in Bangladesh. However, Tourism have long term negative effect on Co2 emissions in Bangladesh. In the short run tourism, electricity consumption, economic development and GDP^2 have no effect on Co2 emissions in Bangladesh.

Moreover,(Rashid Khan et al., 2018)assessed the power of Air transportation, Railways transportation and Port container traffic on energy demand, customs duty and economic development in a panel of 40 heterogeneous countries and divided into three categories according to their economic growth per capital for the period 1990-2015. Scholars used panel econometric technique which account for cross-sectional dependence and heterogeneity. Their empirical result revels that air-railways transportation has a positive and significant relationship with the energy demand in the low income and middle-low income countries whereas air-passengers carried and railways transported goods positively

increased energy demand in this region. Also, the decomposition analysis shows that GDP per capital will largely influenced by energy demand over the next 30 years and the needs for energy transportation infrastructure development which escalates the sustainable economic growth across the countries.

(Al-Mulali et al., 2015) investigated the impact of tourism arrival on carbon emission from transport sectors in 48 top international destinations (divides into five region) using Fully Modified Ordinary Least Squares (FMOLS) method with annual data over the period of 1995-2009. Besides they also applied VECM Granger Causality test to ascertain the relationship between the Co2 emission and all independent variables such as GDP, tourism arrival, energy. Their empirical result reveals that tourism arrival has a great significant impact on Co2 emission in all the regions except Europe regions because this region has strict rules for transportation sectors and all the countries including Europe union is mandatory to maintain all the environmental degradation rules. Therefore, this region is an example of reduction of carbon emission and authors suggested to the other countries to implement their rules for reducing carbon emission.

(Song at el., 2019) assessed the effect of taxation on tourist budget allocation through two areas such as micro-level tourism demand and the composition of tourist budget during a trip using Compositional Data Analysis (CODA) approach to transport trip budget into three log ratio using binary sequentially. Their results reveals that air passenger duty (APD) modified outbound of UK tourist by increasing share of transport expenditure's on the contrary of decreasing expenditure's on destinations including food accommodation items.

(Holden, 2007) Conducted a book on the environment and tourism and revealed that international tourism transportation has become play a vital role that considerably damaged natural environment across the environment. The second edition of this book also disclosed that how tourism interact with environment and the positive and negative relationship with society, tourism and the natural environment. Also, he

addressed so many issues in this book including natural disaster with tourism and sustainable environmental management and planning for tourism, poverty and tourism.

(Dubois et al., 2011) assessed the future tourism mobility of the world population using backcasting techniques to explore the attainment of a global objective to avoid dangerous climate change. Global passenger transport remains one of the critical factors which is associated with tourism that contributes to increase carbon emission globally. The authors used three backcasting scenarios and techniques of quantitative and qualitative elements and found that passenger transport item and international tourism continues to account for the highest shares of carbon emission from two scenarios. In distribution of carbon emission over the different transport modes and market, Air transport mode has the highest rates to continue damage the carbon emission rather than the other transport mode.

Applying ARDL (Autoregressive Distributed Lag) model and Granger Causality test based on the VECM with time series data (Bano et al., 2021) investigated the relationship between Tourism and other economic factors on carbon emission in Pakistan over the period 190-2017. Their findings reveal that tourism has the great contributor to boost economic development as well as generates CO_2 emission at the same time . This study also found that renewable energy which is playing the moderate operator to improve tourism, accelerating economic development , thus helping combat CO_2 emission in the country simultaneously.

(Saleem et al., 2018) explored the impact of air- railway transportation, population density, bilateral aid flow on Carbon emission using panel data in transition 11 countries. The data period was 1975-2015. The authors employed heterogeneous cointegration techniques and cross-section dependence to evaluate the impact of each variables on carbon emission in this region. They found that railway good transport, energy demand and population density increases rapidly carbon emission while energy demand and population density also increases GHG emission . In addition, they also found that air transport freight has a positive

relationship with GHG emission . On the other hand, it has a negative impact on natural resource rents in this region. Furthermore, the causality reveals that there is a bidirectional relationship between railway transport with economic development and environmental factors while there is a one way relationship between energy to bilateral aid and economic development. In the end, we found that all variables are the key predictor that will effects largely carbon emission, natural resource rents and GHG emission for the next ten years through variance decomposition analysis.

2.3 The relationship between electricity consumption and Co2 emiss ion

Several empirical studies have examined in electricity consumption, economic development and Co2 emission in current periods. A study on the impacts of electricity consumption, economic development, financial development and foreign direct investment (FDI) on Co2 emissions in Kuwait conducted by (Salahuddin , 2018)using time series data for the period 1980–2013. They applied ARDL bound testing approach and found that co-integration exits among the variables. Their empirical findings reveal that electricity consumption, economic growth and FDI stimulate Co2 emission both in the long and short run. The VECM Granger Causality analysis also reveals that all variables has strongly granger cause Co2 emission. Based on their findings the study recommends Kuwait by establishing storage plan, capitalizing on vast solar plan energy and reducing household electricity consumption scheme and the most important expertise for achieving electrician generation efficiency to reduce emissions in this country.

Salahuddin & Alam,(2015)have investigated the impacts of internet usage and economic development on electricity consumption for Australia for the period from 1985 to 2012. Their findings revealed a significant positive relationship between Internet use and economic development with electricity consumption in the long term. On the other hand, they found

all the independent variables was insignificant in the short-run.

Ozturk & Al-Mulali, (2015)used a multivariate framework to examine panel data to ascertain the effect of natural gas consumption on economic development for GCC countries. The study period was 1980-2012. Scholars found a cointegration relationship exist between natural gas consumption and economic development for these countries. The study also established a positive effective long-term relation between GDP growth and natural gas consumption in these countries.

Khan & Ullah, (2019)have experimented the relationship between globalization and co2 emission in Pakistan using annually data for the period 1975 to 2014. Their result came up with the conclusion that Co2 emissions are influenced by globalization positively and significantly.

(Papachristos, 2015) conducted a paper on the basis of two approach; sociotechnical approach and engineering approach to determine the household electric consumption using smart meters. They also used shed light in the first method of the particular factors affecting household electricity consumption and the second method using smart meter diffusing, consumer behaving to explore the effect the household electricity consumption. Simultaneously, their empirical findings reveal that the reduction of household electricity consumption on co2 emission.

Moreover, Lean & Smith, (2010) investigated the relationship between carbon emission and electricity consumption by applying VECM model from 1980-2006 into the five ASEAN countries. Their results disclose that electricity consumption and carbon emission has positive significant relations and found a unidirectional causality relationship between both dependent and independent variables through Granger Causality test. Their findings suggested to policy makers to adopt multi-pronged strategy to increase investment in energy sector as well as established social consciousness to the whole country to reduce carbon emission.

Electricity consumption is considered the main culprit behind the increase of carbon emission in Saudi Arabia. (Xu et al., 2018) conducted a paper on the basis of financial development on Co2 emission for the period of

1971-2016. Scholars employed ARDL and VECM model with time series data to determine the long-run and causality relationship among the variables . Their empirical results indicate that financial development stimulates carbon emission significantly while globalization have insignificant environment erosion. Also, empirical results indicate that in the long-run there is a bidirectional causality exists between globalization and Co2 emission and each variables like financial development and Co2 emission granger cause each other. This study also recommends that policymakers can get benefit by understanding the role of financial development and co2 emission in order to combat with global emission.

(Rahman, 2020) investigated the impacts on electricity consumption, economic growth and globalization on carbon emission of top ten electricity consuming countries. They used annual data from1971 to 2013 for this study. Also, they applied panel cointegration approach, FMOLS (Fully Modified Ordinary Least Squared) model and DOLS (Dynamic Ordinary Least Squared) model to determine the long the relationship among the variables. For checking Causality among the variables, the authors applied Dumitrescu and Hurlin. The empirical results indicate that there is long-term relationship exists among the all variables and electricity consumption and economic growth have significantly and positively increase the carbon emission in this region. On the other hand, globalization is found to be negatively affect the carbon emission. Also, the findings of this study confirm the EKC hypothesis in this region. Finally, the results of causality test revels that, there is a bidirectional causality between GDP to Co2 emission, electricity consumption and co2 emission , between globalization and economic growth while there is a unidirectional causality between GDP to electricity consumption , between globalization to co2 emission and between globalization to electricity consumption.

Using panel causality analysis (Cowan et al.,) re-examined the association between the electricity consumption, economic development and carbon emission in the BRICS (Brazil, India, Russia, China and South Africa) countries from 1990 to 2010. The authors applied heterogeneity and dependency for differencing in energy resource endowments, policy of

energy and population size. In the context of electricity and GDP association, the empirical results indicate that there is a positive relationship exists in Russia and South Africa. In contrast, there is no relationship between electricity consumption and GDP in others three countries. They also found that electricity consumption have causalities in India. Based on the findings of this study, they suggested that no policy implementation are working together in the BRICS countries because these countries showed different effects each other.

(Haddad & Mezghani, 2016) conducted a paper on the relationship between electricity consumption and economic growth (oil, non-oil) on carbon emission in Saudi Arabia using Time-Varying Parameters Vector Autoregressive (TVP-VAR) over the period 1971-2010. The analysis of time-varying suggest that responses of real GDP (oil, non-oil) electricity consumption and CO_2 emission depend on the magnitude of structural volatiles of all variables shocks. The empirical results reveal that high volatility of electricity consumption has negative impacts on real GDP oil, and carbon emission and has positive effects on real non-oil GDP level. Also, the volatility of low and high GDP oil levels have positive association on electricity consumption and CO_2 emission. The results indicate that energy policy must be considered regarding to the relationship of each variables in the country.

Furthermore, to investigate the EKC hypothesis exists (Balsalobre-Lorente et al., 2017) explores the relationship between economic growth and CO_2 emission in 5 European countries (France, Germany, Italy, Spain and the United Kingdom) for the period of 1985-2016. The empirical results confirms the N-shaped relationship between GDP and CO_2 emission among the countries. Then, the results indicate that, renewable electricity consumption, economic development and trade openness have positive relationship with carbon emission. Therefore, the study suggests that regulations of renewable energy resources is needed to increase renewable sources that promoting to energy use consciousness resulting in decrease carbon emission as well as environmental erosion.

In recent years, electricity is used in every sectors from households to

organizations. Without electricity, no one can do any work. Electricity plays the most vital role for boosting economic growth. Those countries who have achieved high economic growth, that means largely used electricity resulting in environmental degradation. In this context, every developed countries are moved to renewable electricity sources such as solar and wind . Regarding the above experts views it can be clearly seen that electricity consumption has a great impact on global warming.

2.4 The nexus between Fossil Fuels and Co2 emission

(Karmaker et al., 2019) conducted a paper on Greenhouse Gas emission from fossil fuel power station in Bangladesh through hybrid Optimization of Multiple Energy Resources (HOMER) software to measure the emission rate from different fuels used in Bangladesh power plant. Electricity generations comes from different fossil fuels such as Coal, Gas and Oil in Bangladesh. As a result, carbon emission is increasing rapidly in this country. The results of this study shows coal is the top sector producing carbon emission in Bangladesh by 0.90kg respectively, which is following by diesel 0.76kg and natural gas 0.56kg respectively.

Hanif (2019), the EKC (Environmental Kuznets Curve) is hypothesized to investigate the relationship between fossil fuels, FDI and Economic development have triggered Co2 emission in Asian Economics for the period from 1990 to 2013. The co-integration analysis using ARDL bounds testing approach was incorporated. The overall results of this study indicates that, fossil fuels and foster economic growth is the key contributor to increase Co2 emission at the regional level. Moreover, Foreign Direct Investment is a source of environmental erosion to increase Co2 emission at the domestic level and confirming the pollution Haven Hypothesis. Finally, their study suggests that, reducing fossil fuels consumption and fostering environmentally friendly economic growth strategy will prove helpful for the well-being of the environment of this

region.

Similarly, (Uzair Ali, 2020)The EKC is hypothesized to investigate the impact of fossil fuels consumption, economic development and population growth on Co2 emissions in India, Pakistan and Bangladesh using annual data over the period 1971–2014. The authors applied panel ARDL model, VECM model and Granger Causality for finding the causality direction. Using thee multivariate equations model, the empirical results reveals that, ARDL model confirmed the EKC hypothesis at first that the relationship between Co2 and economic growth is U-shaped and fossil fuels and population density have positive impact in the long run. Also, the VECM model indicates that short – run causalities from fossil fuels to Co2, economic development to Co2 and population density to Co2 exists in this countries and Co2 have negative impact on economic development while fossil fuels, FDI, total export has positive significantly impact on economic growth in the long run. Lastly, they call for policy drivers and suggests to use efficient and low carbon emission to reduce Co2 emission and clean the environment for well-being of this countries.

Applying a Toda-Yamamoto method of economic growth, fossil fuel consumption, and carbon dioxide emissions (Lotfalipour, 2010)found a unidirectional Granger causality running from economic growth and two proxies of energy consumption (petroleum products and natural gas consumption) to Co2 emissions, and no Granger causality running from total fossil fuels consumption to Co2 emissions in the long run in Iran and Data was collected from 1967– 2007.

Similarly, applying Linear ARDL model (a bound testing approach of cointegration) between fossil fuel energy, renewable energy, nuclear energy and Co2 emission in the growth of Pakistan economy(Rehman et al., 2022) found a positive and most valuable association between all the above variables with economic growth in Pakistan. The data period was 1975–2019. Their empirical results also revealed that, electricity produced from nuclear sources, energy usage and electric consumption have an opposite association with Pakistan's economic development.

However, fossil fuel consumption is harmful for human health.

(Rasoulinezhad et al., 2020) investigated the relationship between fossil fuel consumption, economic growth, mortality and carbon emission in Commonwealth of Independent States (CIS) over the period 1993–2018. The author's applied GMM (Generalized Method of Moment) to determine the mortality which is affecting by various variables related to this research. The results demonstrated that fossil fuel has a positive impact on mortality (diabetes, cancer diseases). Moreover, human development index has an adversative effect on increasing mortality in CIS. This study also recommends to the CIS members by implementing different strategies in energy sectors can move from fossil fuel to renewable sources.

Fossil fuel consumptionn is considered the main source of energy for all of the countries that affects the environment and genmerate global warming and air pollution. (Martins et al., 2019) assessed the fossil fuel energy consumption on environment in European countries. They discovers the preservation of resources is a main objectives that support the sustainable development of Circular Economy Strategy is not established in recently. They applied Mathematical and Statistical analysis and found that most of the European countries are heavily depends on fossil fuel consumption. Moreover, They also indicates that European countries have small reserve of fossil fuels and they will be dissolve if they need to continue use it.

Using time series data and Autoregressive Distributed Lag (ARDL) model and Cointegration bound test (Sadi Ali et al., 2015) investigated the dynamic relationship between financial development, energy prices, energy consumption and economic development In Nigeria from !972Q1– 2014Q4. The empirical results of Bound test confirms the cointegrated relationship among the variables. In the long–run, financial development found an insignificant negative effects on energy consumption while economic growth indicated same relationship on energy consumption except insignificant. However, their findings also reveal that, financial development and economic growth has negatively significantly impacts on fossil fuel consumption in the short–term. In order to comply with the adverse effect between financial development and fossil fuel consumption,

this research recommends some policy that the Nigerian government should try to move renewable energy sources , and should practice green energy to reduce carbon emission in the country.

Applying Global Vector Autoregressive (GVAR) model that contains interdependences across countries in line with international propagation of economic (Smith et al., 2021) assessed the effect of Covid-19 on fossil fuel consumption and carbon emission in 32 major CO_2 emitting countries over the two year horizon 2020Q1-2021Q4. Based on GDP growth scenarios , the empirical results show that coal prices has smaller possibility effect on economic growth. Therefore, the results confirm that, Covid-19 pandemic for each countries would not provide strong reasons for delaying efforts of global warming mitigation.

China is the largest countries that produce CO_2 emission globally. Fossil fuel combustion and Cement industry is a key driver of producing CO_2 emission and environmental erosion. (Gregg et al., 2008) conducted a paper on China who is the leader of producing carbon emission in globally from fossil fuel combustion and cement industry. The authors present two patter; seasonal and spatial pattern in terms of carbon emission in china. Also, they break sectors according to the emission.. Overall, there results confirm that, China is the largest source of CO_2 emission across global in 2006 .

(Erdyas Bimanatya & Widodo, 2018) explored the relationship between fossil fuel consumption on CO_2 emission in Indonesia by employing Vector Error Correction model and Grange causality , Long-run Energy Alternative Planning's (LEAP) to determine the impact of energy conservation as well as the energy projection mix based on national master plan. Their empirical finding show that there is a unidirectional granger causality running from coal to oil in the short run. However, in the long-run oil consumption will lead to Carbon emission. In addition, The LEAP projection results indicate that, energy conservation has a smaller energy saving rate rather than the vision 25/25 in Indonesia.

Fossil fuel consumption comes from various energy resources such as coal, oil and gas. All this resources are using in electricity generation ,

manufacturing companies (garments, cement industry), transportation etc. More use of energy in different sectors will lead to increase more fossil fuel consumption causes environmental erosion. This variables are playing the most important role for climate change which is support by the above authors comment that continues to increase at different levels according to the modes of countries. In recently, developing countries like Bangladesh are using oil most of the sectors rather than other renewable energy resulting in increasing the carbon emission in the country.

2.5 The nexus between Urban Population and Co2 emission

Urbanization has been seen alternative to the environment and its connection to industrialization, trade, consumption, transportation in the case of economic development. For sustaining urban expansion, peoples are using different energy sector, transportation, environment unfriendly technology that destructs the environments of the eco-systems and increases carbon emission(Foster, 2000)

Additionally, numerous research assessments of the association between urbanization and energy consumption related sectors have found that urban population increases Co2 emission significantly(Sheng et al., 2017). In contrast, it also not true for both urbanization and energy consumption. Some researchers also found that urbanization have negative impact on energy consumption that leads to decrease carbon emission(Nathaniel et al., 2019).

(Sarkodie et al., 2020) examined the impact of urban sprawl, trade, industrialization and economic development on carbon emission across the 206 countries using panel data for the period 1960-2018. The Authors applied dynamic panel estimation technique that accounts for cross-sectional dependence across countries and reveals that economic development, urbanization increases carbon emission at national level.

Similarly,(Istihak Rayhan, Khaleda Akter, Mohammad Safiqul Islam, 2018) investigated the relationship between urbanization, energy consumption and carbon emission in Bangladesh. The study used autoregressive distributive lag (ARDL) and bound testing approach for the period 1973–2014. The result reveals that urbanization and energy consumption have statistically significant positive impact on Co2 emission while impact of economic openness and FDI have negative impact on carbon emission. Moreover, the EKC hypothesis is found to be exist in Both long and short-run.

On the other hand,(Mosikari & Eita, 2020) studied urban population, energy consumption, economic growth and carbon emission in selected African countries using Panel Smooth Transition Regression (PSTR) estimation technique. The result reveals that energy consumption has a plus impact on Co2 emission and Urban population has a negative impact on Co2 emission with existing EKC hypothesis. The study also recommends that all selected African countries should come up with social integration program for rising awareness about the risk of carbon emission.

Moreover, applying panel data fixed-effect model (Anwar et al., 2020) assessed the major contributors of carbon emission in Far East Asian countries for the period of 1980–2017. Their finding reveals that, trade, urbanization and economic accrual have impact on carbon emission in the selected countries. To establish green and sustainable urbanization they can reduce carbon emission suggested provide to this region by the authors of this research paper.

Using panel data through regression model (Sadorsky, 2014) investigated the association between urbanization and carbon emission in 16 emerging economies from 1971 to 2009 simultaneously. They found energy intensity and affluence have a positive and significant relation across the countries while urbanization have positive relations but statistically insignificant relations with carbon emission.

Based on income level how carbon emission are infected by urbanization and environmental policy using panel data of 80 countries from 1983 to

2005 a research conducted by(Ponce De Leon Barido & Marshall, 2014) to explore the impacts of these variables on carbon emission. They applied fixed effect and random effect model based on global average and empirical results reveal that urbanization has positively significantly impact on carbon emission in several region such as Latin America, India, Lower-income Europe and Africa continent. They discovered that urbanization-emission elasticity mostly depends on the environment policy rather than increasing income level. In the end, they also assumed that the coming global population growth mostly occur in the urban area of lower-income countries that is the most vital findings of this study.

(Sheng & Guo, 2016) explored the long-term and short-term relationship between urbanization and Co2 emission in China. Data period was 1995-2011. They applied panel error correction model, mean group, pooled mean group and dynamic fixed effect analysis and the estimation shows urbanization will lead to increase carbon emission both in the long and short run. On the other hand, empirical results indicate that urbanization have long lasting impact on environment in the long run. In addition, they also suggests that policy maker can get help from this study because this study shows the impact of urbanization on carbon emission that continue to increase economic development . policymaker would be benefit through this study by establishing policy of the effective reduction of carbon emission.

Applying regression analysis (Ala-Mantila et al., 2014) investigated the relationship between urbanization, expenditures , household size and direct, indirect Co2 emission using household survey in 2006 where 4007 households completed survey. The results found the positive association between urbanization and carbon emission. In addition, they also indicate that rural lifestyles in the holding expenditures are related largely with Co2 emission. For gaining understanding of mitigation policy of climate change, both direct and indirect emission will be useful in future and that cannot be ignored.

(Liddle, 2014) experimented the effect of urbanization, population and age structure based bon macro-level and cross-country analysis on Co2

emission. Empirical estimation reveals that urbanization has positive relationship with carbon emission while household size has negative relationship with road energy use that generates carbon emission. Also, age structure is found to insignificant relationship with carbon emission. In addition, higher population density always creates high emission that results is also found in it.

In recent years, environmental issues has become an issues due to the climate change and environmental degradation across the globe. In this context, FDI has been considered the most striking factor that boosting the each country economic development as well as producing high level of GHG emission. Without FDI, any country in the world cannot develop their economy and FDI helps to build infrastructure development in the country. Despite FDI investment in electricity consumption, this sectors provide large level of carbon emission in global temperature. Especially, electricity generates form coal sources in our country that also producing huge level of fossil fuel in the country environment that effects natural environment. Moreover, tourism has play the significant role for booming economic development globally. The transportations mode of tourism can play the significant role for increasing carbon emission at different levels which is confirm by the existing literatures views. Lastly, for living better life people are moving from rural areas to urban areas that damages natural climate rapidly. The reason behind that, more people comes to urban area that means to need huge energy resources, increase use of transportation, electricity as well as need more accommodation resulting in increases carbon emission quickly. In the above , all these variables are important to determine the dynamic relationship and its impact on carbon emission. For this reasons, our study used all these vital factors to determine the causality long and short-run relationship on carbon emission.

In conclusion, the literature review of the empirical studies shows that there is a positive and negative long-run association between tourism transportation expenditures, FDI, fossil fuel consumption, electricity consumption, urban population and economic development on Co2 emission. The empirical evidence suggests that tourism transportation

expenditures, fossil fuel consumption and economic development have positive influence on Co2 emission. These evidence was in line with those of (Rashid Khan et al., 2018; Uzair Ali et al., 2020; Zaman et al., 2017). However, no study has yet been undertaken to determine such dynamic relationship in the context of Bangladesh, which is a very potentially country for such an investigation. Hence, this study is the first attempt to establish the effect of decisions intended to diminish carbon emission in the environment to the best of author's knowledge.

Chapter 3: Research Design

This section begins with the core of research aims, research objectives, research question, research hypothesis and research model. This paper is investigating the impact of tourism transportation expenditures, FDI, fossil fuel consumption, electricity consumption, economic development and urban population on CO_2 emission in Bangladesh through ARDL model for the period 1997-2014. For obtaining a good result, our study explains the research method through empirical estimation and has a general aim and objectives are given below:

3.1 Aim of the Study

The general goal of this research is to experiment the impact of Tourism Transportation expenditures and economic development on CO_2 emission in Bangladesh.

3.2 Research Objectives

The prime objectives of this study are referring as follows:

- To investigate the alliance between tourism transportation expenditures, FDI, economic development, electricity consumption, fossil fuel consumption, urban population and CO_2 (carbon dioxide emission) in Bangladesh.
- To investigate the impact of tourism transportation expenditures and other factors on CO_2 emission in Bangladesh.
- To provide a unique learning opportunity of tourist economy for this country's that is suffered from the environmental impacts of to

urism in Bangladesh.

3.3 Research Question

In response to the above objective, the study addresses the following research questions:

- What is the association between tourism transportation expenditures, FDI, economic development, fossil fuel, electricity consumption, urban population and Co2 emissions in Bangladesh?
- To what extent Tourism transportation expenditures coupled with economic growth factors contributes to carbon emission (Co2) in Bangladesh?
- What strategies does this study recommend for Bangladesh?

3.4 Hypothesis of the Study

The hypothesis of the study which was investigated during the empirical evaluation are as follows:

H1: Gross Domestic Product per capital have a positive relationship with carbon emission in Bangladesh.

H2: Electricity Consumption have a positive relationship with carbon emission in Bangladesh.

H3: Foreign Direct Investment have a positive relationship with carbon emission in Bangladesh.

H4: Fossil Fuel Consumption have a positive relationship with carbon emission in Bangladesh.

H5: Tourism Transportation Expenditures have a positive relationship with carbon emission in Bangladesh.

H6: Urban Population have a positive relationship with carbon emission in Bangladesh.

3.5 Research Model

The given research model shows the relationship of each variables to Co2 emission and how they are affecting carbon emission in Bangladesh. In the view of figure 5, this study indicates that all independent variables for this study increases carbon emission significantly.

Nowadays, foreign direct investment (FDI) can be considered is an engine for job creation as well as stimulate economic growth for all countries. FDI for the host country brings infrastructure development and increase production mechanism in all sectors. FDI inflow in Bangladesh is related to every sector like as; electricity production, tourism transportation, export, import and economic development. Bangladesh is an export oriented countries. Economic development is mostly depending on export sector and in this sector foreign investment are increasing day by day. To export more product, to use more electricity production, use of transportation, use of different energy oil (petrol, diesel, kerosene), to increase urban population in big cities for living standard life resulting increase carbon emission rapidly in this country. This is life cycle of FDI variables and all variables are connected to FDI.

Tourism transportation expenditures also connected to FDI. Moreover, many tourist coming in this countries nowadays. Businessman are making new buildings, hotel, motel etc. and all these types of building needs huge electricity, transportation (oil consume) which is producing huge fossil fuels. In addition, this sector has play a significant role for booming economic development in Bangladesh. All these variables jointly increase greenhouse gas in the environment.

Electricity consumption which is needed in all sector of works. Without

electricity we cannot live a moment or do anything right now. FDI investment in electricity production is increasing rapidly because of huge pressure of urban population, industrial sectors, etc. For Economic growth of Bangladesh this sector has play a vital role and jointly all variables increase carbon emission.

Generally, fossil fuel consumption is generating from different energy sources such as coal, gas, oil and which is linked to FDI, transportation sectors, economic development, resulting in increases carbon emission.

Urbanization needs more FDI which can make them all the necessities of urban people and also related to use of electricity, transportation, resulting in rises Co2 emission.

Economic development which is also linked with the all above variables that boost the economic development in Bangladesh resulting in environmental degradation.
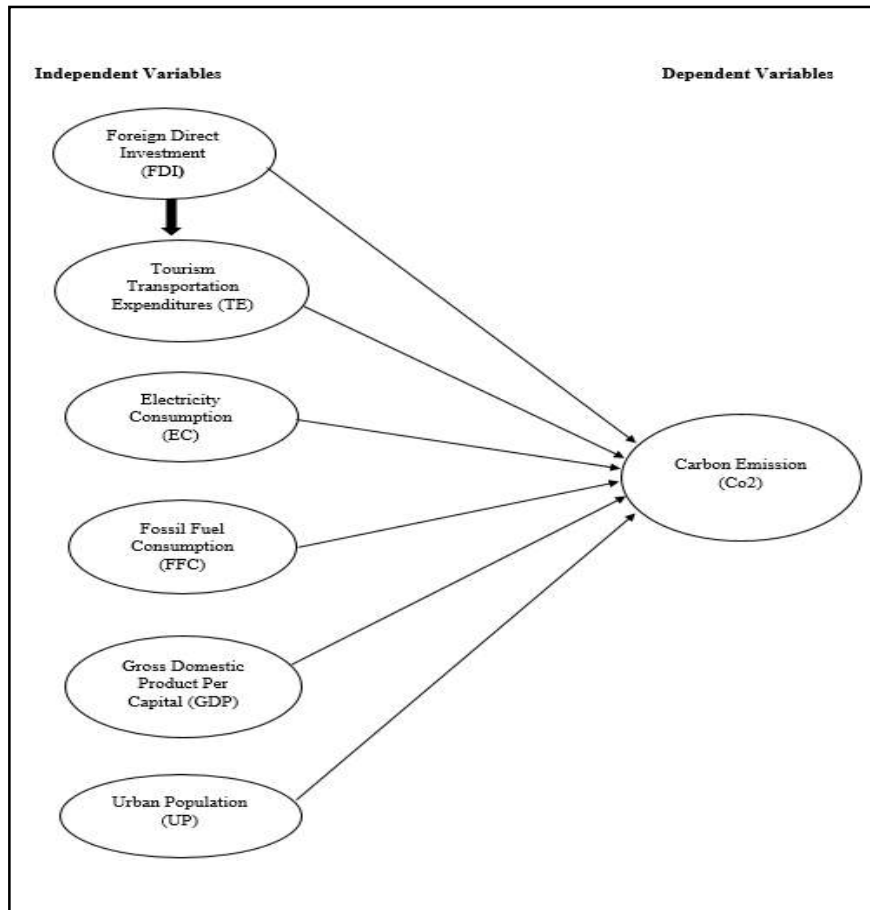
Figure 5: Relationship of the Variables

Chapter 4: Research Methodology

4.1 Data

The study aims to investigate the long and short-run relationship between the tourism transportation expenditures and other economic growth factors on Co2 (carbon dioxide emission) in Bangladesh for the period of 1973-2014. Annual data are used for empirical purposes. The program E-views 12 is used to analyze the data to get significant results.

Table 1: Variable Description

Variables	Description	Measurements	Source
Co2	Carbon dioxide emission	Metric tons per capita	WDI
FDI	Foreign Direct Investment	Current U.S. dollars (balance of payments)	WDI
GDP	Gross Domestic Product	Constant 2015 US$ per capita	WDI
EC	Electricity Consumption	kWh per capita	WDI
TE	Air transport Freight	Metric tons times kilometers	WDI
FFC	Fossil Fuel Energy Consumption	Oil equivalents	WDI
UP	Urban Population	2018 revision, World Urbanization Prospects	WDI

4.2 Model Specification (Autoregressive Distributed Lagged)

To develop a model to investigate the impact of tourism transportation expenditures, foreign direct investment, fossil fuel consumption, electricity consumption, urban population, economic development and co2 emission, the present study uses ARDL model, developed by (Pesaran et al., 2001). The function form of the econometric model based on the previous research by (Kalaycı & Özden, 2021; Rahaman et al., 2022; Zaman et al., 2017) can be described as follows:

$$CO2 = f(TE,\ FDI,\ GDP,\ EC, FFC, UP)\dots\dots\dots\dots\dots\dots\dots .(1)$$

Here, (CO2) shows carbon emission, (TE) represents the tourism transportation expenditures, (FDI) represents foreign direct investment, (GDP) represents per capital of gross domestic product, (EC) represents electricity consumption, (FFC) represents fossil fuel consumption, (UP) represents urban population.

Natural logarithms (ln) have been applied to the all variables and the logarithms econometric regression model can be written as follows:

$$\ln CO2_t = \beta_0 + \beta_1 \ln TE_t + \beta_2 \ln FDI_t + \beta_3 \ln GDP_t + \beta_4 \ln EC_t + \beta_5 \ln FFC_t + \beta_6\ \ln UP_t + \mu_t \dots\dots\dots ..(2)$$

Equation 2, where (ln) represents the logarithms term and (lnCO2) represents the carbon emission, (lnTE) represents the tourism transportation expenditures, (lnFDI) represents foreign direct investment, (lnGDP) represents the gross domestic product, (lnEC) represents electricity consumption, (lnFFC) fossil fuels consumption, (lnUP) represents urban population, β_0 represents the constant term, t represents the time, β represents the slope parameters, μ_t are the error term. The Environments Kuznets Curve (EKC) hypothesis was first introduced by (Kuznets, 1955) and concluded the existence of an inverted U−

relationship between economic growth and income equality . When expected sign come to Equation (2), β_1, β_2, β_4, β_5, β_6, should have positive sing and β_3 should have negative sign that means EKC hypothesis is valid in this equation.

Equation (3) shows the relationship between the dependent and independent variables. To employ the ARDL (Autoregressive Distributed Lag) approach there is need to be add the short-run dynamics in to the long run this will be given in Equation (4). The long-run ARDL approach of the variables are as follows:

$$\triangle \ln CO2_{jt} = \beta_0 + \sum_{i=0}^{n1} \alpha i \triangle \ln CO2_{jt-i} + \sum_{i=0}^{n2} \delta i \ \triangle \ln TE_{t-i} + \sum_{i=0}^{n3} \gamma i \ \triangle \ln FDI_{t-i} + \sum_{i=0}^{n4} \theta i \ \triangle \ln GDP_{t-i}$$

$$+ \sum_{i=0}^{n5} \vartheta i \ \triangle \ln EC_{t-i} + \sum_{i=0}^{n6} \rho i \ \triangle \ln FFC_{t-i} + \sum_{i=0}^{n} \sigma i \ \triangle \ln UP_{t-i} + \omega_1 \ln CO2_{jt-i} + \omega_2 \ \ln TE_{t-i}$$

$$+ \omega_3 \ \ln FDI_{t-i} + \omega_4 \ \ln GDP_{t-i} + \omega_5 \ \ln EC_{t-i} + \omega_6 \ \ln FFC_{t-i} + \omega_7 \ \ln UP_{t-i} + \mu_t \cdots\cdots\cdots (3)$$

Where, $\triangle$ is represents the first difference, β_0, αi, δi, γi, θi, ϑi, ρi, shows the short-run coefficient ω_1, ω_2, ω_3, ω_4, ω_5. ω_6, ω_7, represents the long- run coefficient and $\eta 1$, $\eta 2$, $\eta 3$, $\eta 4$, $\eta 5$, $\eta 6$ are the determines of the appropriate lag length of the variable and μ_t is term for an error.

$$\triangle \ln CO2_{jt} = \beta_0 + \sum_{i=0}^{n1} \alpha i \triangle \ln CO2_{jt-i} + \sum_{i=0}^{n2} \delta i \ \triangle \ln TE_{t-i} + \sum_{i=0}^{n3} \gamma i \ \triangle \ln FDI_{t-i} + \sum_{i=0}^{n4} \theta i \ \triangle \ln GDP_{t-i} +$$

$$\sum_{i=0}^{n5} \vartheta i \ \triangle \ln EC_{t-i} + \sum_{i=0}^{n6} \rho i \ \triangle \ln FFC_{t-i} + \sum_{i=0}^{n} \sigma i \ \triangle \ln UP_{t-i} + \omega_2 \ \ln TE_{t-i} + \omega_3 \ \ln FDI_{t-i}$$

$$+ \omega_4 \ \ln GDP_{t-i} + \omega_5 \ \ln EC_{t-i} + \omega_6 \ \ln FFC_{t-i} + \omega_7 \ \ln UP_{t-i} + \theta ECT_{t-i} + \mu_t \cdots\cdots (4)$$

Equation (4), represents error correction model or short-run for the ARDL models. Here, θECT_{t-i} represents error correction term of the short –run approach for ARDL model. There are two steps of ARDL method to determine the lagged levels of the variables in a first difference regression through *Wald test* or *F statistic* to signify whether the long-term relationship exists or not. Two sets of acceptable critical values developed by (Pesaran et al., 2001) for the diverse numbers of regressors

depending on whether an intercept trend or both were used in the approach of find out the long-run relationship. In one set assuming that all regressors in the auto regressive distributed lag are meant to be I (1) and another assuming that they all are I (0). If the *F statistic* critical value is higher than the upper level I (1), there is long-term relationship exists between the dependent and independent variables. If the F statistic critical value is less than the lower level I (0), there is no long-term relationship exists with the dependent variable. If the result of F statistic critical value falls between the upper level I (1) and the lower level I (0), the result is inconclusive. Moreover, to check the long-run co-integration, the null hypothesis of no co-integration can be represents as:

$$H_0 : \gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = \gamma_7 = 0$$

While the alternative hypothesis of no co-integration can be written as follows:

$$H_1 : \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq \gamma_5 \neq \gamma_6 \neq \gamma_7 \neq 0$$

4.3 Unit Root Test

(Pesaran et al., 2001) developed bound testing approach to determine the relationship exists between regressors through two sets of asymptotic critical values and no variables must be included in I (2) because this would be reject the procedure. For ARDL co-integration techniques, pre-evaluation of unit root tests does not need since co-integration exists underlying regressors are purely I (1) or purely I (0); otherwise a mixture of them. Before going to the next procedure of the research, all the variables must be check stationary; otherwise this would be the wrong procedure. Variables can be checked Stationary or Non-Stationary through Augmented Dicky-Fuller(ADF) and Phillips-Perron(PP) as a method of unit root testing.

4.4 Cointegration Tests

Johansen Cointegration techniques and bound testing approach can be used for determining the cointegration exists among the variables. This test will investigate the long-term association among the variables. If F statistic critical values is more than upper level, I (1); it means cointegration exists among the variables. On the other hand, if F-statistics critical value is less than the lower I (0) level; there is no cointegration among the variables. The long-term estimation results and coefficient may be generated the second stage of the research. ECM (Error Correction Term) of ARDL model can now be approximated through the results. After selecting ARDL model using AIC, SC or HQ Lag Length Criterion to calculate the long-run relationship. Cointegration test can be determined through equation 2.

4.5 Diagnostics Test of the Models

The residual diagnostics test of the equation (3) which is free from serial correlation and variables are normally distributed can be determined by serial correlation of LM test, Histogram Normality test, Heteroscedasticity test, Heteroscedasticity ARCH test, etc. All this diagnostics test is meant to be the key element of the ARDL model bound testing approach.

4.6 Stability test of the Models

CUSUM and CUSUM of SQUARES test which are the significant method of stability checking for any autoregressive model investigated(Brown et al., 1975). Any types of autoregressive model must have its stability test; otherwise it will be considered invalidate.

4.7 Granger causality

After finding co-integration exist in this research, the vector auto regression (VAR) Granger causality test is applicable to estimate their causal link through(Engle & Granger, 1987). Before taking Granger Causality test, all data must be stationary at 1st difference or level. Since, all variables are stationary at 1st difference in this research, we can proceed causality test through VAR granger causality. The result of the causal link helps policy maker to implement the best policy of the findings.

Chapter 5: Empirical results and analysis

Table 2: Summary of Descriptive Statistics

	CO2	TE	FDI	GDP	FFC	EC	UP
Mean	0.172245	99.58150	360.1580	633.4570	49.55185	101.4374	5.350271
Median	0.135787	84.15950	9.828894	551.8751	49.85397	69.13117	4.343418
Maximum	0.412899	225.1869	2602.962	1184.863	73.76894	320.2099	10.90885
Minimum	0.067336	0.013000	0.247908	408.6063	24.21142	15.40565	3.474967
Std. Dev.	0.098926	71.40998	657.4852	214.0109	15.84110	90.15315	2.441511
Skewness	1.082999	0.068731	2.162683	1.109998	−0.096487	1.017088	1.530371
Jarque-Bera	8.212985	3.618720	61.50128	8.661873	3.057526	7.313571	17.45690
Observations	42	42	42	42	42	42	42

Note: Author's own calculation

5.1 Results of Descriptive Statistics

Above the table 2 reports summary of descriptive statistics for all the variables to determine the nature of data distribution. The largest standard deviation is FDI, which is followed by GDP, electricity consumption (EC), transportation expenditures (TE), FFC, UP and Co2 emission. The data of all series are normally distributed supported by Jarque-Bera as all the variables have skewness values

between −1 and 1, suggesting that all the variables are symmetrically balanced; however, FDI has a skewness values between −2 and 2 suggesting that it is skewed significantly. Moreover, the largest mean value of all the variables is GDP approximately 633.4570, which is followed by FDI, EC, TE, FFC, UP and Co2 almost 360.15, 101.43, 99.58, 49.55, 5.35 and 0.17. The observation of all the variables is 42 with the biggest maximum value belongs to FDI and minimum value belongs to GDP is 2602.96 and 408.60 respectively. Finally, as a result of this investigation, it is clear that all series are normally distributed and there is no serial correlation among the variables.

Table 3: Results of Johansen Cointegration test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical value	Prob.**
None*	0.880308	218.2245	125.6154	0.0000
At most 1*	0.714893	135.4342	95.75366	0.0000
At most 2*	0.622573	86.49348	69.81889	0.0013
At most 3*	0.421513	48.49277	47.85613	0.0435
At most 4	0.335328	27.14655	29.79707	0.0981
At most 5	0.234267	11.21652	15.49471	0.1985
At most 6	0.020468	0.806553	3.841465	0.3691
Rank test (Trace) indicates 4 cointegrating eqns(s) at the 0.05 level				
*refers to reject of the hypothesis at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max−Eigen	0.05	
No. of	Eigenvalue	Statistic	Critical	Prob.**

CE(s)			value	
None*	0.880308	82.79039	46.23142	0.0000
At most 1*	0.714893	48.94068	40.07757	0.0039
At most 2*	0.622573	38.00071	33.87687	0.0152
At most 3	0.421513	21.34623	27.58434	0.2558
At most 4	0.335328	15.93003	21.13162	0.2290
At most 5	0.234267	10.40997	14.26460	0.1864
At most 6	0.020468	0.806553	3.841465	0.3691
Max-eigenvalue test reveals 3 cointegrating eqn(s) at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Note: Author's own calculation

5.2 Johansen Cointegration results

Table 3 shows the johansen cointegration test of all the variables using non-stationary data at the same level before stationary. The above table, provides information that there are two test inside the johansen cointegration test which one is called Trace test and another is Maximum Eigenvalue test. Based on the Trace test and maximum Eigenvalue test, the results indicated that Trace test has 4 cointegration equations at the 0.5 level; and Eigenvalue test has 3 cointegration equations at the 0.5 level. Both the test has probability value is less than 0.05 that our study concludes that we refused the null hypothesis of no cointegration; however, we accepted the alternative null hypothesis cointegration exists among the variables. Finally, after finding co-integrated between all the variables, our study applies ARDL method to determine the long-run and short-run relation of the variables.

5.3 Unit Root Test Results

Our study investigates the long-term and short-term impact between the variables, using ARDL bound test technique. Before going to checks bound test for finding long term impacts between the variables, it is mandatory all the variables must have data stationary either at level I (0) or 1st difference I (1); otherwise mixture of them. The PP estimation (Phillips & Perron, 1988) and ADF (Dickey & Fuller, 1981) estimation were used for establishing the unit root test and the order of all the variables . The results of Both test shows that Log Co2 (carbon emission), Log GDP (Economic growth), Log FDI (foreign direct investment), Log UP (urban population) variables are stationary and co-integrating at order I (1), while Log FFC (fossil fuel consumption), Log EC (electricity consumption, Log TE (transportation expenditures) variables are stationary and co-integrating at order I (0) and order I (1). Thus, it can be concluded that our variables are co-integrated at level and at 1st difference, therefore our study can proceed the next step for checking the ARDL bound test approach to determine the cointegration exists among the variables.

Table 4: Chow Breakpoint test of TE variables

Variable	Breakpoint Date	H_0 : No break at specified breakpoints	
TE	1984		
F-statistic	16.22672	Prob. F(1,40)	0.0002
Log likelihood ratio	14.30153	Prob. Chi-Square(1)	0.0002
Wald statistic	16.22672	Prob. Chi Square(1)	0.0001

Note: Author's own calculation

5.4 Results of Chow Breakpoint test

Our study found one structural break in Tourism transportation expenditures (TE) variables in 1984. Then, we applied breakpoint chow test whether this date breakpoint test prob. value is significant or insignificant. The result of Chow Breakpoint test is presented in the above table and the probability value of the breakpoint test F-statistic is 0.0002 and prob. of Chi-square (1) is 0.002; similarly, Prob. chi-square (2) is 0.001 respectively. Hence, this study concludes that we can reject the null hypothesis of no break at specified times. The structural break 1984 implies that economy of Bangladesh slowed down because of the military rule and continued up to 1990(Personal & Archive, 2011). For this structural break, we made dummy variables and the dummy for the prediction period from 1973 to 1983=0 and 1984 to 2014=1 as a null and alternative hypothesis.

Table 5: Chow Breakpoint test of FDI variables

Variable	*Breakpoint Date*	H_0 : No break at specified breakpoints	
FDI	*1997,2004*		
F-statistic	88.50233	Prob. F(1,40)	0.0000
Log likelihood ratio	71.89301	Prob. Chi-Square(1)	0.0000
Wald statistic	177.0047	Prob. Chi Square(1)	0.0000

Note: Author's own calculation

Table 5 provides Prob. value of F-statistic from Chow Breakpoint test. Similarly, our study finds another two structural break in Foreign Direct Investment (FDI) variables in 1997 and 2004. Again we applied chow breakpoint test and found the probability value of F-statistic is less than 0.5, and significant. So, our study rejects the null hypothesis of no breaks at specified times and accept the alternative hypothesis. In 1994, Bangladesh economic drastically affected by a series of strikes of political

party and continued to the remained years and Bangladesh economy was struggled by the severe flood in 1998 and 2004. More than 36 million people were affected (almost a quarter of the total population) living in the northwestern, northeastern, and central districts, including Dhaka(Asian Development Bank; World Bank, 2005). Finally, we made two dummy variables for this two structural breaks and the dummy for the prediction period from 1973 to 1996=0 and 1997 to 2014=1; similarly, from 1973 to 2003=0 and 2004 to 2014 =1.

Table 6: The Cointegration: ARDL Bound Test

			H_0: No relationship	
Test Statistic	value	Signif.	I(0)	I(1)
			Asymptotic : n = 1000	
F – Statistic	11.19223	10%	1.8	2.8
K	9	5%	2.04	2.08
		2.5%	2.24	3.35
		1%	2.5	3.68

Note: Author's own calculation

5.5 Results of ARDL Bound Test

In the ARDL Cointegration bound test, it is obvious that the cointegration exists among the variables. After data turned into stationary F-statistic is obtained by using ARDL bound testing techniques. Here, the F-statistic is calculated 11.19, which is much greater than the upper bound I (1) critical value at 5% level. As a result, our study rejected the null hypothesis of no cointegration and accepted the alternative hypothesis of linked variables. Therefore, the results of bound test suggest a long-term cointegration relationship exist between the dependent and independent variables.

Table 7: Long-Term Estimation results of ARDL

			Dependent Variable : DCO_2	
Variable	Coefficient	Std.Error	t-Statistic	Prob.
DGDP	4.809556	1.648355	2.917791	0.0096
DEC	0.376823	0.144008	2.616679	0.0180
DFDI	−0.022678	0.009403	−2.411893	0.0275
DFFC	1.741385	0.435537	3.998247	0.0009
DTE	0.008671	0.004655	1.862567	0.0799
DUP	0.343675	0.100835	3.408295	0.0033
C	−0.136930	0.041267	−3.318127	0.0041

Note: Author's own Calculation

5.6 Long-term estimation results

Table 7 provides long run coefficients from ARDL estimates. The results in the above table show that there is a highly significant long-run relationship exists between GDP and Co2 emission (at the 1% level of significance) which is increasing carbon emission in Bangladesh. More precisely, one percent increase in economic growth increases carbon emission by almost 4.80%. Thus, the results indicate that economic growth in developing countries like Bangladesh appears at the expenses of increasing carbon emission and environmental erosion. These findings are also related to those of (Hanif et al., 2019; Salahuddin et al., 2018).

The results indicate that electricity consumption (EC) in Bangladesh also increases carbon emission significantly. A 1% increase EC causes a 0.37% rise in Co2 emission. More precisely, Bangladesh is famous of export oriented country (garments sector) and it consume huge electricity resulting in increases Co2 emission. The estimation findings also reveal that despite efforts for increased use of renewable sources, especially Solar panel which will be played a significant role to decrease Co2 emission is still far from the reality. Our empirical findings are in line with the those of(Rahaman et al., 2022; Salahuddin et al., 2018; Salahuddin & Alam,

2015).

The most remarkable result depicts that the impact of FDI on Co2 emission is statically significant and negative association in the given period of time. A 1% increase in FDI will lead to a 0.02% decrease in carbon emission. In particular, our results support the neo-liberal argument that the inflow of FDI is good for environment and reduces Co2 emission by receiving production techniques and environmental friendly technologies from developed countries to Bangladesh. that by receiving environmental friendly. Finally, our findings reject the null hypothesis of pollution haven hypothesis in Bangladesh and this finding are in line with the (Kirkulak et al., 2011; Salahuddin et al., 2018) but contrary to(Hanif et al., 2019; Rahaman et al., 2022). Besides, we realized that FDI makes a great contribution to job creation and income in our country.

Considering the ARDL long-run estimation results, it is obvious that a positive and significant relationship established between fossil fuel consumption (FFC) and Co2 emission in Bangladesh. More specifically, a 1% increase in FFC results for a 1.74% increase in Co2 emission. Thus, the consumption of fossil fuel is indeed increasing Co2 emission and playing the most important role in environmental erosion in Bangladesh. These empirical findings are not stunning for Bangladesh because fossil fuels are used to quicken financial development and to meet growing energy requirements. Like other developing countries, Bangladesh are confronting numerous economic challenges and are continuously battling to move forward the living benchmarks of their population. Bangladesh are utilizing more fossil fuels and generating waste in the mode of Co2 emission and other harmful gases in order to produce more products. Since, Bangladesh used to oil base technologies to produce more goods while consuming more fuel results in increasing Co2 emission and air pollution and augmenting well-being issues across the country. This is in line with the findings of(Hanif, 2017; Hanif et al., 2019; Lotfalipour et al., 2010).

On the other hand, the results show that tourism transportation

expenditures (TE) have a positive and insignificant association with carbon emission in Bangladesh. More precisely, A 1% increase in transportation expenditures (TE) increases carbon emission by 0.008% respectively. Transport in tourism considered solely with airlines in most cases and air transport that is undertaken by tourism that emits carbon emission is injurious to health. Tourism transportation expenditures showing a small portion of increases carbon emission in Bangladesh that means all airlines are using clean technologies in order to generate less Co2 emission effectively. These results are in line with the findings of(Zaman et al., 2017)

Finally, the empirical findings indicate a positive and significant relationship between urban population and Co2 emission in Bangladesh. Nowadays, highly portion of people is moving from rural areas to urban areas to search for job, better living standard, better education, better health resulting in carbon emission in Bangladesh. In particular, the results depict that, each 1% increase in urban population (UP) increase carbon emission (Co2) by 0.34% respectively. This is in line with the findings of(Khoshnevis Yazdi & Dariani, 2019; Sharmin, n.d.; Test, 2022)

Table 8: Short-term Estimation results

			Dependent Variable : DCO_2	
Variable	Coefficient	Std.Error	t-Statistic	Prob.
DTE	0.007073	0.001264	5.594069	0.0000
DGDP	−0.048729	0.335894	−0.145072	0.8864
DFFC	1.461198	0.144117	10.13897	0.0000
DUP	−0.088889	0.043345	−6.110932	0.0000
DDUM1TE	0.408931	0.049157	8.318804	0.0000
DDUM2FDI	0.154390	0.028882	5.345482	0.0000
DDUM3FDI	−0.094154	0.030515	−3.085450	0.0067
CointEq(−1) *	−1.198882	0.085736	−13.98338	0.0000
R-squared − 0.922990			Adjusted R-squared − 0.891616	

Note: Author's own calculation

5.7 Short-term estimation results

In the short-run, we find that tourism transportation expenditures (TE), fossil fuel consumption (FFC), have substantial short-term impact on Co2 emission in Bangladesh. Only the coefficient of UP variable reduces Co2 emission in Bangladesh. A 1% increases in Urban population reduces carbon emission by 0.08% respectively. These results are in line with the findings of(Mosikari & Eita, 2020). However, we fail to find any significance evidence about the effect of GDP on Co2 emission in Bangladesh. The results indicate an inverted U-shaped relationship between Co2 emission and economic growth insignificantly. Moreover, the results of error correction framework indicate the error correction term (ECT_{t-1}) has a negative coefficient and statistically significant at the 5% confidence level, which shows the set of independent variable have effect on Co2 emission and thus, confirms the estimated model significance. The results of the coefficient of error correction term ECT_{t-1} is -1.19 and has statistically significant negative sign. Furthermore, this negative sign shows the speed of adjustment of the estimated model towards equilibrium and the 119% error will be corrected each year from short-run to long-run estimates.

Table 9: Breusch-Godfrey Serial Correlation LM test

		H_0 : No serial correlation at up to 2 lags	
F- Statistic	0.795340	Prob. F(2,15)	0.4696
Obs*R-squared	3.739241	Prob. Chi-Square(2)	0.1542

Note: Author's own calculation

Table 10: Breusch-Pagan Godfrey Heteroscedasticity test

		H_0 : Homoscedasticity	
F- Statistic	0.966646	Prob. F(21,17)	0.5354
Obs*R-squared	21.22499	P r o b .	0.4453

|	
Series: Residuals	
Sample 1976 2014	
Observations 39	
Mean	-9.92e-17
Median	7.49e-16
Maximum	0.038172
Minimum	-0.070742
Std. Dev.	0.023241
Skewness	-0.730449
Kurtosis	4.053386
Jarque-Bera	5.271251
Probability	0.071674
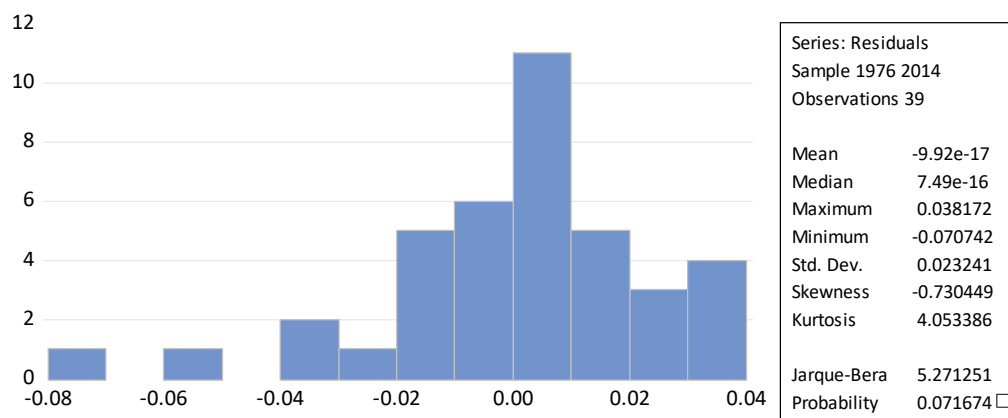
Scaled

SS

homoscedasticity.

Finally, Table 12 shows the results of the normality test. This study reveals that residuals term is normally distributed and there is no any evidence of non-normality residual terms as supported by the heteroscedasticity. In the above graph of normality test, the probability value is 0.07 and the prob. value of Jarque-Bera is 5.27 which is greater than 0.05. So, we cannot reject the alternative hypothesis of normality test.

5.9 Results of the Stability Model test

For checking the stability of the long-run and short-run estimation, CUSUM and CUSUM of Sum are used to examine whether the model is fit or not through two graphical plots of Figure 1 and Figure 2. Both of the graphical figure shows the estimated coefficient (blue lines in the figure) lie between the upper and lower critical bound at the 5% significance level; thus both graph confirms the stability of the estimated model.
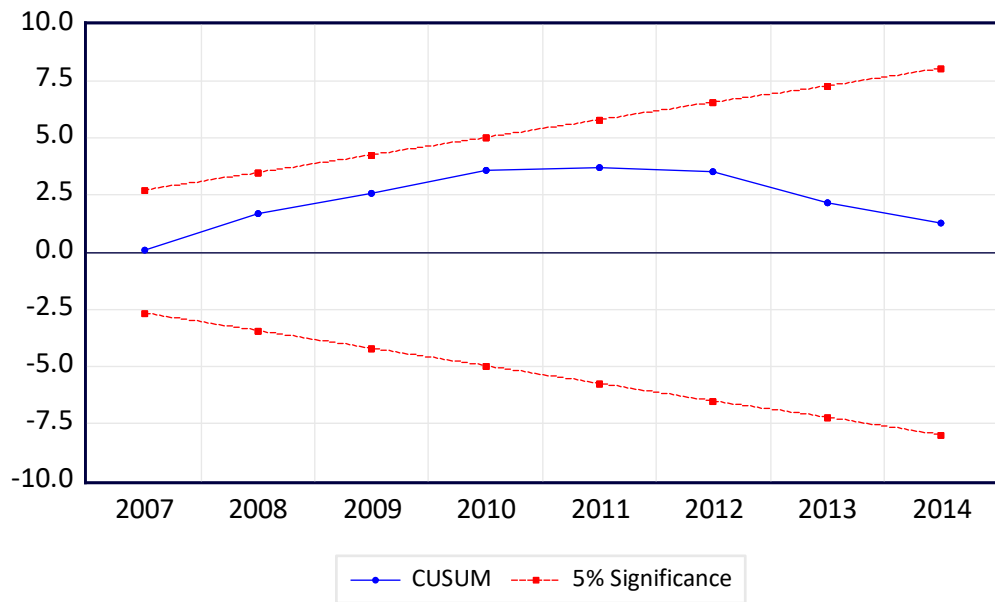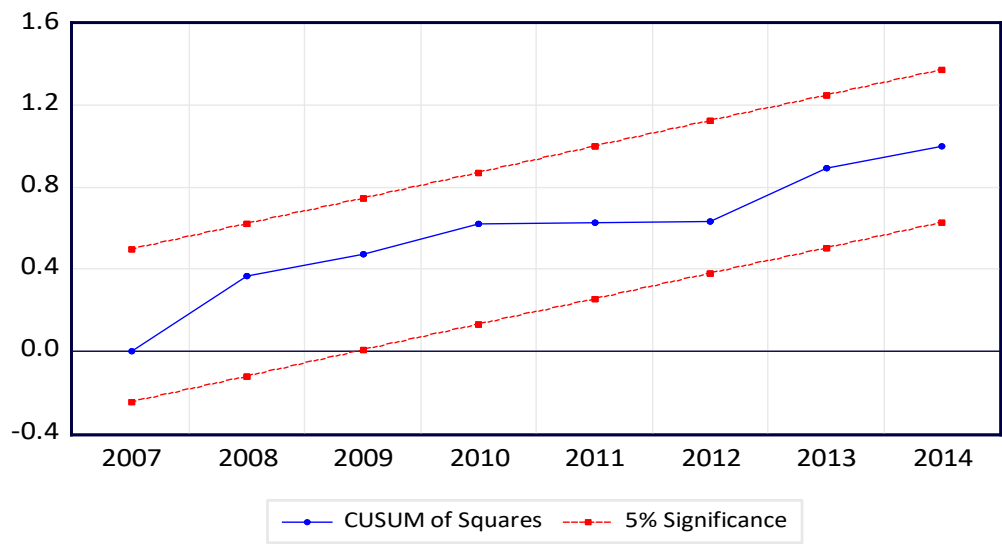
Chapter 6: Discussion and Policy Recommendations

6.1 Discussion

The findings from this study suggest that economic growth, electricity consumption, tourism transportation expenditures, fossil fuel consumption and urbanization has a statistically positive significant impact on Co2 emission in Bangladesh. However, FDI is found to be negative impact on carbon emission in Bangladesh. In addition, an increase in FDI inflow in Bangladesh will lead to decrease carbon emission in Bangladesh. Furthermore, the Granger Causality test suggest that there is no causality relationship between Co2 emission and other variables, as well as tourism transportation expenditures and carbon emission. According to the above empirical result, there are some interesting phenomena are given below:

In terms of economic growth and electricity consumption, this study reveals that both of the variables have significant positive association with carbon emission in Bangladesh. The higher the economic growth and increases use of electricity will lead to increase environmental degradation. The reason is behind at present, Bangladesh is a well-known country for Readymade Garment sectors, manufacturing industry all over the world and it needs huge energy consumption day by day. Bangladesh economic growth mostly depends on manufacturing industry. At the same time, this manufacturing industry not only promote economic growth but also generates a huge carbon emission(Hanif et al., 2019; Rahaman et al., 2022; Salahuddin et al., 2018; Salahuddin & Alam, 2015).

Similarly, in terms of energy intensity, we can observe that fossil fuel consumption have positive and highly significant relationship with carbon emission in this country. Fossil fuel consumption comes from various energy resource (coal, gas, oil) and all this resources are used in

manufacturing industries, transportation, electricity generation etc. More use of energy resources will lead to increase more fossil fuel consumption resulting in increasing environmental erosion(Hanif, 2017; Hanif et al., 2019; Lotfalipour et al., 2010).

Moreover, our study suggest that tourism transportation expenditures has play the vital role for booming economic growth in Bangladesh. Bangladesh is situated with numerous natural beauty such as historical place, rivers, hills, mangrove forest and the longest sea beach in the world. Every year huge tourist comes to our country and explore this place. At the same time not only tourism transportation expenditures stimulating economic growth but also raising carbon emission in the country's environment.

In contrast for FDI, our study suggests that the impact of FDI on carbon emission have negatively significant relationship with carbon emission in Bangladesh. Besides, our study suggest that Bangladesh has no need pollution haven hypothesis or Halo effect hypothesis. Finally, our results support the neo-liberal argument that the FDI inflow in Bangladesh manufacturing all companies are using environmental friendly technologies and production techniques received from developing countries resulting in decreasing environmental degradation(Kirkulak et al., 2011; Salahuddin et al., 2018).

Furthermore, in view of urbanization, our study reveals that all the coefficient of urban population are statistically significant and positive which means to higher urbanization lead to higher carbon emission in Bangladesh. The reason is behind at present, for living standard life as well as searching for job, people are gathering in big cities. Urban population not only are responsible for increases urbanization rate but also leads to the demand of high emission products such as vehicles, real state etc. resulting in increasing carbon emission in Bangladesh.

6.2 Policy Recommendations

Based on the results of this study, there are several points that Bangladeshi policymakers may need to take considerations for the purpose of drafting effective environmental policies to fight global warming while increasing economic growth at the same time. The study proposes the following policy recommendation based on the findings are given below:

1. Our findings reveal that higher economic growth will cause higher CO_2 emission in Bangladesh and economic growth have one-way Granger cause with CO_2 emission. To meet with the growing energy demand, especially electricity is generated from fossil fuel sources, therefore the government of Bangladesh are trying to seek the alternative sources of power generation along with other potential sources to mitigate CO_2 emission. In this context, solar and wind are the two potential renewable energy sources for Bangladesh that should be considered as alternative for generating electricity. From policy perspective, the government of Bangladesh needs to ensure a favorable regulatory framework for promoting carbon related activities such as carbon capture, storage and reform energy price to reduce electricity consumption growth. Also, Bangladesh should adopt multi-pronged strategy of increasing investment in energy infrastructure and energy conversation putting in a place to improve delivery efficiency.

2. We have found a unidirectional relationship between FDI and electricity consumption, urban population and FDI is considered an engine for job creation for the growing population in Bangladesh. Besides, FDI play the most vital role in stimulating economic growth in Bangladesh. From policy perspective, Bangladesh should adopt environmental friendly technologies that will play a significant and effective role in transferring clean and pollution-free technologies to developing countries. Besides, foreign investors would have concerned the impact of climate change simultaneously.

3. Moreover, tourism transportation also increases carbon emission significantly. Therefore, the government of Bangladesh needs to tak

e consideration this factors for long time development and reform existing environmental rules and regulation. Also the authority should enforce low carbon activities for the all transportation sectors because carbon emission in Bangladesh is generating mostly from this sectors.

4. In order to search for job or live standard life, people comes from rural areas to urban areas increasingly. As a result, urban population increase carbon emission greatly. From policy perspective The Bangladesh Government has taken a number of steps with the villagers in mind, one of which is to establish EPZ (Export Processing Zone) so that people can get jobs.

5. Finally, authorities should create raising awareness, campaign about the conservation of energy because this sector mostly generating carbon emission in Bangladesh nowadays. To decrease carbon emission government of Bangladesh should enforce environmental degradation rules and everyone must be contributing to it.

6.3 Academic contribution

In light of these, our study focuses on the long-run and short-run effects of tourism transportation expenditures, FDI, economic development, fossil fuel consumption, electricity consumption, urban population on carbon emission in Bangladesh using annual time series data from 1973 to 2014. Though, the linkage between all the above factors have been examined in the existing literatures(Behera & Dash, 2017; Hanif et al., 2019; Li et al., 2022; Rahaman et al., 2022; Salahuddin et al., 2018; Zaman et al., 2017) but perhaps no studies have investigated the relationship between tourism transportation expenditures, FDI, economic development, fossil fuel consumption, electricity consumption, urban population on CO_2 emission in the context of Bangladesh simultaneously. As a result, the current study is an attempt to fill this gap. Besides, this study will helps the policy maker or foreign investor before taking any decisions.

6.4 Limitations

Our study has potential limitations within which our findings need to interpreted carefully. This study focuses on the impact of Tourism Transportation expenditures, FDI and Economic Development on Co2 emission. The empirical results of the estimation demonstrates that, tourism transportation expenditures have significantly positively relationship with Co2 emission in the short-run. We have used limited time from 1973 to 2014 for this study, however in future researchers can be used longer period of time for better results. Also, the methods for obtaining data collection has limited access to different sources and they are not provide permission to collect data. Moreover, previous research related to our topic has small portion . However, for obtaining literature views in tourism transportation expenditures on carbon emission provides resource limitation during the study. In addition, our study did not examine the robustness checking through FMOLS and DOLS . But last in least , time consuming for obtaining gathered information is limited during the research.

6.5 Recommendations for Future Research

In our study, the impact of tourism transportation expenditures, FDI, Economic Development, Electricity consumption, Fossil Fuel consumption and Urban population are linked with Co2 emission In Bangladesh. The results of this study would be useful to foreign investors and policymakers of the country who are seeking to better understanding the role of each variables in the context of carbon emission in Bangladesh. The positive impact of each variables except FDI on carbon emission may raise concern among world Health organizations, Global World Carbon Emission Forum, policymakers of Bangladesh as well as Bangladesh Environment Department which are working together to rise well-being of the environment in this country. All these organization jointly may help to the Bangladesh government to take proper steps for the reduction of Carbon emission and environment degradation.

In addition, future research should be focused on the causal relationship between Tourism Transport modes and Co2 emission in Bangladesh. Also, it is recommended that in future the impact of tourism transportation expenditures can be measured by health expenditures, carbon tax, tourism transport modes, household expenditures etc. Policymakers should also create environmental free pollution technology and enforce law for reducing carbon emission as well.

Chapter 7: Conclusion

The study investigated the impact of tourism transportation expenditures, FDI, economic development, fossil fuel consumption, electricity consumption and urban population on CO_2 emission using time series data for Bangladesh for the period 1973-2014. We used the method of ADF and PP test for obtaining data stationary at 1st difference I (1) or at level I (0). Also we used the method of Johansen Cointegration test and granger causality to achieve the objectives of this study. The ARDL estimation reveals that economic growth, electricity consumption, fossil fuel consumption, urban population and tourism transportation expenditures have a positive and significant relationship with CO_2 emission for Bangladesh in the long run. However; FDI is found to be negatively affecting CO_2 emission in the long run and this is a very good sign for Bangladesh. In the short-run, economic growth has insignificantly negative impact on CO_2 emission in Bangladesh while tourism transportation expenditures have significantly positive relationship with CO_2 emission in Bangladesh. Only the fossil fuel consumption is found to be positive and significant relationship with CO_2 emission for Bangladesh, both in the long and short run. In addition, the study also explored the causal relationship between the variables using VAR Granger Causality test. The Granger Causality results reveals that all the variables have no strong causality on CO_2 emission and tourism transportation expenditures. Also the results indicate that there is unidirectional causality between FDI to electricity consumption, FDI to urban population, electricity consumption to urban population, GDP to CO_2 emission, GDP to fossil fuel consumption and fossil fuel consumption to urban population. Furthermore, there is also a bidirectional causal relationship between electricity consumption and urban population.

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Appendices

Table 11: Results of Unit Root test

Variables		At Level		At 1st Difference		
		Intercept	Intercept &Trend	Intercept	Intercept & Trend	Conclusion
Log CO_2	ADF	0.988	0.856	0.001***	0.005***	I (1)
	PP	0.987	0.803	0.001***	0.006***	I (1)
Log GDP	ADF	1.000	0.999	0.568	0.000***	I (1)
	PP	1.000	1.000	0.000***	0.000***	I (1)
Log FDI	ADF	0.802	0.285	0.000***	0.001***	I (1)
	PP	0.911	0.307	0.000***	0.000***	I (1)
Log TE	ADF	0.004***	0.006***	0.000***	0.000***	I (0), I (1)
	PP	0.004***	0.007***	0.001***	0.000***	I (0), I (1)
Log EC	ADF	0.981	0.040**	0.000***	0.000***	I (0), I (1)
	PP	0.987	0.054**	0.000***	0.000***	I (0), I (1)
Log FFC	ADF	0.194	0.965	0.000***	0.000***	I (1)
	PP	0.005***	0.929	0.000***	0.000***	I (0), I (1)
Log UP	ADF	0.313	0.174	0.002***	0.017**	I (1)
	PP	0.585	0.227	0.004***	0.028**	I (1)

Note: Author's own calculation

Table 12: Results of VAR Granger Causality test

Independent Variables	Dependent Variables	Probability	Decision	
UP	FDI	0.031**	Unidirectional Causality	Granger
EC	FDI	0.05**	Unidirectional Causality	Granger
CO2	GDP	0.05**	Unidirectional Causality	Granger
FFC	GDP	0.01**	Unidirectional Causality	Granger
UP	FFC	0.07*	Unidirectional Causality	Granger
EC	UP	0.02**	Bidirectional Causality	Granger
UP	EC	0.06*	Bidirectional Causality	Granger

Note: ** and * represents the significance level at 5% and 10%, respectively

국 문 초 록

– Co2(이산화탄소 배출)의 맥락에서 관광 교통 지출, FDI 및 경제 개발 간의 연결: 방글라데시의 증거 –

한 성 대 학 교 대 학 원

국 제 무 역 경 제 학 과

국 제 무 역 시 장 전 공

호 세 인 사 자 드

이 연구의 목적은 관광 교통 지출, FDI, 전기 소비 간의 관계를 이해하는 것입니다. 방글라데시의 화석 연료 소비, 도시 인구, 경제 개발 및 Co2(이산화탄소 배출)을 1973-2014년 기간의 시계열 데이터를 사용하였습니다. 이 목표를 달성하기 위해 자기 회귀 분산 지연(ARDL) 모델 경계 테스트 접근법과 VAR Granger 인과성 테스트를 적용하여 변수 사이에 공분산이 존재한다는 것을 발견했습니다. 경험적 결과는 전기 소비, 화석 연료 소비, 도시 인구 및 경제 성장이 탄소 배출에 긍정적이고 중요한 장기적 영향을 미친다는 것을 보여줍니다. 그러나 FDI는 CO2 배출에 부정적이고 중요한 장기적 영향을 미칩니다. 그 결과는 또한 관광 교통 지출, 화석 연료 소비, 그리고 도시 인구가 이산화탄소 배출에 단기적인 영향을 미친다는 것을 보여줍니다. 경제 성장 계수만 부정적이고 미미합니다. 또한, 본 연구의 Granger 인과관계 결과는 전력과 도시인구 사이에는 양방향 인과관계가 존재하고, GDP와 CO2 배출량, GDP와 화석연료 소비, FDI와 전력소비, FDI와 도시인구, 방글라데시의 화석 연료 소비와 도시 인구. 관광 교통 지출에는 Granger 인과 관계가 없다는 것만 발견했습니다. 이러한 연구 결과를 바탕으로 연구는 방글라데시가 탄소 배출량을 줄이기 위해 선진국이나 개발 도상국의 환경 친화적인 기술 (청정하고 무공해 기술 이전)을 채택해야한다고 제안합니다. 또한 엄격한 환경 규칙, 규제 에너지

소비 개혁 및 가장 중요한 사회 복지는 국가의 환경 악화를 줄이는 동시에 지속 가능한 경제 발전에 도움이 될 것입니다.