Faculty of Economics and Business

MACROECONOMICS EFFECT OF CARBON DIOXIDE EMISSIONS IN INDIA

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Statement of Originality

The work described in this Final Year Project, entitled
"**Macroeconomics Effect of Carbon Dioxide Emissions in India**"
is to the author's knowledge that of the author except where due
reference is made.

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ABSTRACT

MACROECONOMICS EFFECT OF CARBON DIOXIDE EMISSIONS IN INDIA

By
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The study investigate the relationship between carbon dioxide emission and macroeconomic variables in India. The selected dependent variable is carbon dioxide emission while independent variables are Gross Domestic Product (constant US$), Foreign Direct Investment and Tourist Arrival. The objective of this study is to assess the relationship between Gross Domestic Product, Foreign Direct Investment and Tourist Arrival, which statistically significant to the carbon dioxide emission. In this study, the period used for model estimations is annual data starting from year 1981 to 2017 and time series analysis is adopted throughout the study. There is specific test that have been employed in this paper which are Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test that are used to determine the stationarity for each variable. Later on, Johansen-Juselius test is applied to determine the existence of long run relationship for the variables used in the estimation. The analysis is followed by Granger causality based on the Vector Error Correction Model (VECM) for India. The empirical results implies that there is one cointegrating vectors between variables, which indicate that there is a unidirectional causality relationship between Gross Domestic Product (constant US$), Foreign Direct Investment and Tourist Arrival towards carbon dioxide emission in long run.

ABSTRAK

KESAN MAKROEKONOMI OLEH PELEPASAN KARBON DIOKSIDA DI INDIA

Oleh
Nur Izzati Binti Mohd Radzi

Kajian ini mengkaji hubungan antara pelepasan karbon dioksida dan pembolehubah makroekonomi di India. Pemboleh ubah bersandar ialah pelepasan karbon dioksida sementara pemboleh ubah bebas adalah KDNK (US$ tetap), Pelaburan Langsung Asing dan Kedatangan Pelancong. Objektif kajian ini adalah untuk menilai hubungan antara KDNK (US$ tetap), Pelaburan Langsung Asing dan Kedatangan Pelancong, yang secara statistik signifikan terhadap pelepasan karbon dioksida. Dalam kajian ini, jangka masa yang digunakan untuk anggaran model adalah data tahunan dari tahun 1981 hingga 2017 dan analisis siri masa digunakan sepanjang kajian. Terdapat ujian khusus yang telah digunakan dalam kajian ini iaitu ujian unit akar Augmented Dickey Fuller (ADF) dan ujian unit akar Phillips Perron (PP). Kemudian, ujian Johansen-Juselius diterapkan untuk menentukan kewujudan hubungan jangka panjang bagi pemboleh ubah yang digunakan dalam perkiraan. Analisis diteruskan dengan ujian Granger Causality berdasarkan Vektor Pembetulan Ralat Model (VECM). Hasil empirik menunjukkan bahawa terdapat satu vektor penyatuan antara pemboleh ubah, yang menunjukkan bahawa terdapat hubungan kausalitas tidak arah antara Keluaran Dalam Negara Kasar (US$ tetap), Pelaburan Langsung Asing dan Kedatangan Pelancong terhadap pelepasan karbon dioksida dalam jangka panjang.

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My special gratitude and appreciation go to my family who always being my number one support system throughout my journey in Unimas. Thank you for the never ending loves, supports and motivations. Special thanks to my brothers and sister, Haziq Radzi, Azfar Hazim, Danial Ammar and Aimi Badrina for always helping me doing the house chores, cleaning the cats litter box and being tolerate with me.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

According to IPCC (2014), carbon dioxide emission (CO_2) is one of the major components of greenhouse gases (GHG) and its contribution can cause global warming and drastic climate changes. The effect of CO_2 emission in the future is inevitably multiplying and according to Union of Concerned Scientist (2017), CO_2 emission has been the highest contributor compared to any other drivers of global warming between 1750 and 2011. Climate change is triggered due to the contribution from human activities that substantially increase the release of CO_2 and other heat trapping gases in the atmosphere which began from the Industrial Revolution practiced all over the world. According to EPA (2017), the causes of the increase in the Earth's surface temperature and for greenhouse effect to take place is due to the rise in the level of CO_2 emission. Hence, rapid industrialisation which worsens the ecological environment can stimulate global warming (Adom et al, 2012).

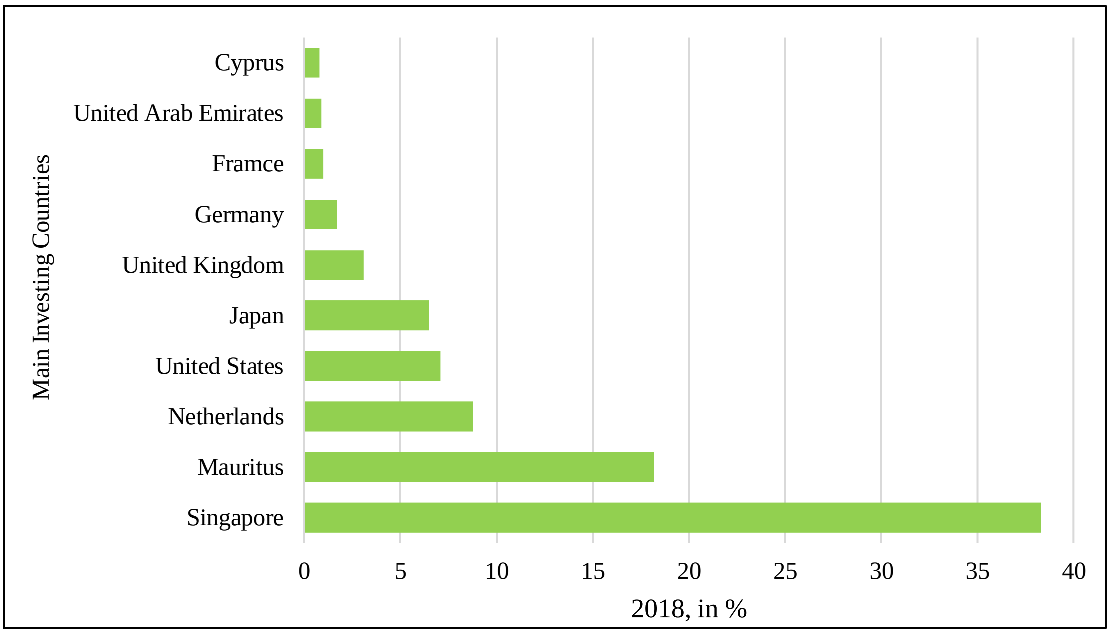
The changes in land utilisation and burning of fossil fuel are examples of human activities which release a large amount of carbon emission, causing high concentration in the atmosphere (EPA, 2017). Compared to the pre-industrial revolution times, there is about a 40% increase in carbon emission in today's world. According to Solomon (2007), carbon emission absorbs heat in the atmosphere and more carbon emission will lead to an increased amount of heat in the Earth's heat balance. The span of carbon emission in the atmosphere is longer compared to the other major heat-trapping gases.

According to Forster (2007), much of today's emission will be gone in a century but the remaining of almost 20% will still be in the atmosphere for about the next 800 years. Long-lasting carbon emission in the atmosphere gives an urgency to reduce the level of carbon emission without any further delay (UCS, 2017).

Middle income countries in Asia or more specifically, India and China, are the largest carbon producer in the world. Energy consumption and agriculture are the major contribution of the pollution which are related to the economic growth and Foreign Direct Investment (FDI) of the country. The intensity of the tourism industry heavily influenced the degradation of environment in the country and also global warming as a whole. According to the World Resources Institute (2018), the carbon emission emitted in India was 6.3% of the global emission in 2018. As a result, it made India the third-largest emitter after China and the United States. Despite rapidly increasing of its use in electricity and coal consumption, the country is also emerging as a pioneer in renewable energy. According to the IPCC (2014), nations would have to reduce their CO2 emission to zero by 2050 in order for the planet to meet the Paris goal of reducing global warming to 1.5-degree Celsius. It would take massive cuts to remain below 2.0-degree Celsius of heating. In fact, under existing policies and environmental commitments, emissions are still increasing.

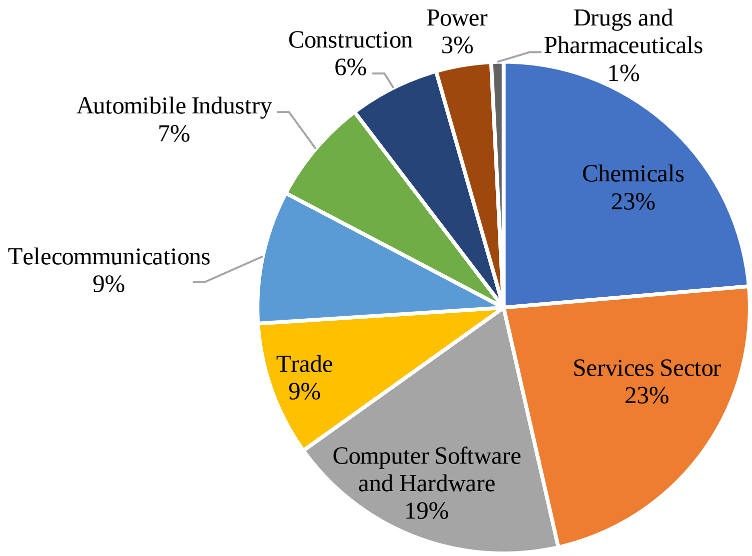
According to UNCTAD's 2020 World Investment Report, India's FDI inflows hit an all-time high of USD 51 billion in 2019, an increase of 20% if compared to 2018. FDI stock reached USD 427 billion in 2019, which represents a rise of more than USD 220 billion when compared to 2010. India ranks 12th among the top 20 host economies for FDI and the biggest host in the subregion; the country historically accounts for 70% to

80% of inflows in the region. During the year, India has relaxed administrative regulations for foreign investors in some industrial sectors by abolishing the requirement for approval by the Reserve Bank of India under certain conditions. The overall growth of FDI in India is thanks to its many assets, especially its high degree of specialisation in services, with a skilled, English-speaking and inexpensive labour force and a potential market of one billion inhabitants. Based on Figure 1.1, Singapore, Mauritius, the Netherlands, the U.S., Japan, the U.K., Germany, France, the U.A.E., and South Korea are the main investing countries in India. Investments were mainly oriented towards chemicals, services, computer software and hardware, trade, telecommunications, the automobile industry, construction, manufacturing, power, and pharmaceuticals. The percentage of each sectors contribution towards India's FDI inflow can be seen in Figure 1.2.



Source: Department of Industrial Policy and Promotion, Ministry of Commerce and Industry (2020)

Figure 1. 1: India's FDI Equity Inflows by Country



Source: Department of Industrial Policy and Promotion, Ministry of Commerce and Industry (2020)

Figure 1. 2: India's FDI Inflow by Industries

The aim of this study is to discuss all the relevant factors, ideas and concepts including the macroeconomic factors that can affect the increase of carbon emission in India. The first section of this study includes the topic and provides the background of study, problem statement, research questions, general objectives, specific objectives, significance of the study, scope of the study and summary. The second section of this study will review the empirical framework and the literature review of this study. Meanwhile, Chapter 3 will explain the methodology used in this study. Chapter 4 expounds on the preliminary test taken and the regression results obtained. Lastly, Chapter 5 will conclude the study, suggests relevant recommendations for policymakers and will discuss the limitations faced while conducting the study.

1.2 Background of Study

According to scientists around the world, the new Paris agreement promises from nations will only restrict global warming to 3.0-degree Celsius, while even a 1.5-degree Celsius increase will be catastrophic for many people. The Global Carbon Report, generated by 76 scientists from 57 research institutions in 15 countries, showed that the main drivers of the rise in carbon dioxide emission in 2018 were more burning of coal in India and China as their economies expanded and more fuel used in more transportation. More fuel was also used by industry. Renewable energy has grown rapidly, but not enough to account for rising fossil fuel usage.

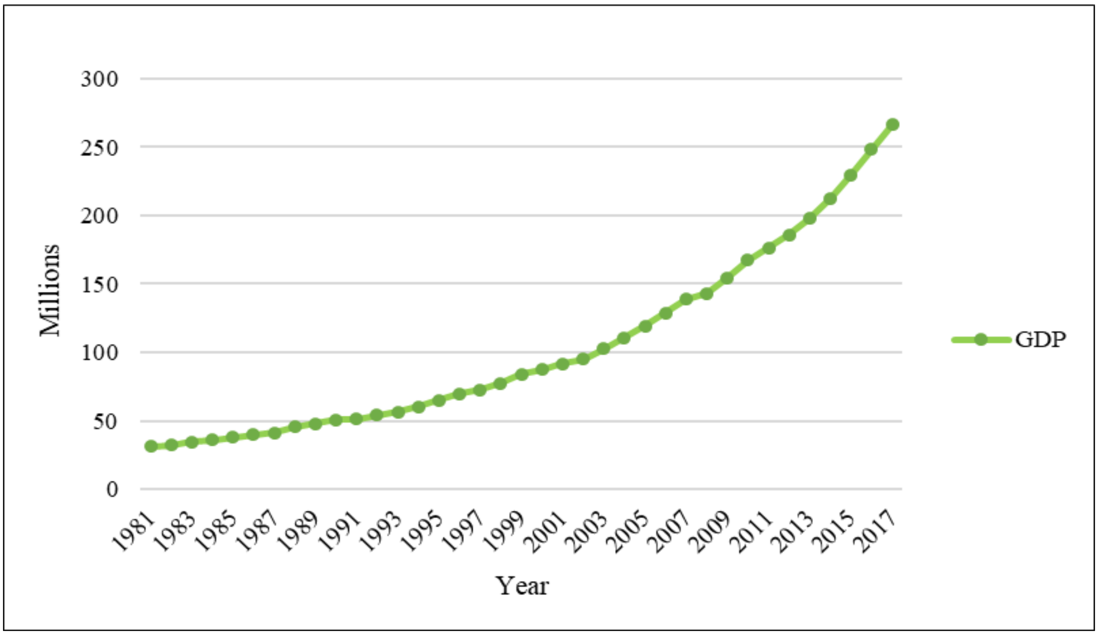
Increase in the Greenhouse Gases (GHG) in India can be considered as global importance as India is one of the countries with a high population in the world. More than half of the increase in global CO2 emission has been driven by the nation since 2013. According to statement from European Union (EU) and China, slower growth in coal-fired power generation will also give advantages to the country's air quality efforts, as India lack in the pollution controls which is commonly required and essentially in all coal-fired power plants. Since 2005, the carbon emission in India have doubled and driven due to a rapid expansion in coal use sector but the growth predicted to slow down about 2% lower than the annual increase in any year since 2001. According to International Energy Agency (IEA) (2019), the carbon emission in India in 2018 is 4.8% rise from the last year which is 6.62% in 2017. However, India had shown an improvement in energy intensity decline about 3% from previous year even their renewable energy facilities rises by 10.6% from previous year according to the IEA report.

1.2.1 Economic Growth

Carbon emission can be influence by the rising in the economic performance of a country which resulting on the environmental degradation and global warming. Due to the rapid development in economic growth, its trigger the high intensity of carbon emission in term of energy consumption (Ahmad, 2017). Stern (2007) stated that the overall cost related to climate change that causes by carbon emission is equivalent to 5% reduction in every year now and towards the end also 20% for the cases that no immediate action is taken place. Therefore, to solve the problem regarding on mitigating carbon emission, Martinho (2016) suggested to reduce the demand in energy use. Thus, by raising the economic growth it will initially lead to increase in the amount of the carbon emission and eventually falls as the impact of the economic growth increase.

Based on the graph of the economic growth in India, it shows a positive result towards the carbon emission in India. This is because, due to the many sectors that driving up the economic growth in India. As example, India is the 4th largest automobile industry in the world with its sales raised about 9.5% per year to 4.02 million units in 2017. Also, in term of the Fast-Moving Consumer Goods (FMCG) sector, India is the 4th largest in the economy for its rapid growth in FMCG sectors and known as the world's largest producer of generic medicines accounting for 20% of the global volume. Besides, the demand in the energy oil and gas in India is going to be growing at the fastest rate among all the major economies in the world which put India to become the 3rd largest consumer of oil with consumption of 4.69 mbpd of oil in

2017. As the result, all the sectors not only driving up the economic growth, but it also contributes to the level of carbon emission in the atmosphere as well.

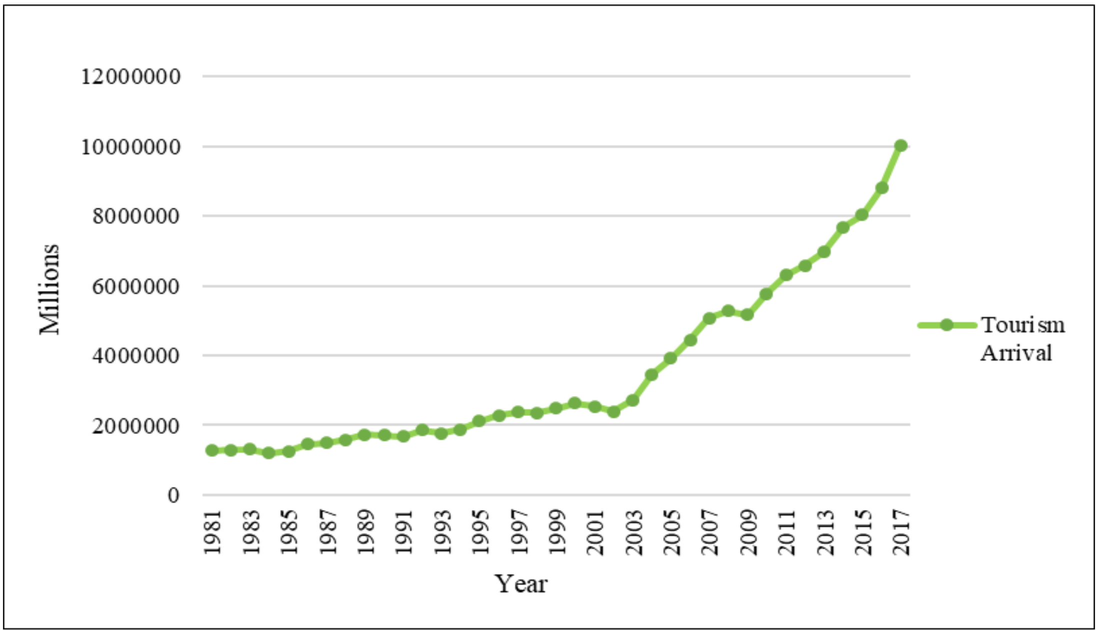


Source: The World Bank Data (2020)

Figure 1. 3: India's Gross Domestic Product, GDP (Constant 2010 US $)

1.2.2 Tourists Arrival

According to the World Economic Forum (2019), in the rank of the world tourism, India's tourism is on the 34th ranking out of 140 countries to be chosen as the best holiday destination due to the famous tourist place which is New Delhi, the capital city of India. India made a huge improvement for overall score in tourism whereby it jumped up from 40th rank of the world in 2017 to 34th rank in 2019. As the results, the tourism arrivals in India is getting to increase (6.7%) from 2016 to 2017. Tourism economic has interrelation between itself with the environment. It is been proven by Cadarso, Gomez, Lopez, & Tobarra (2014), mentioned that the energy required for tourism production activities give high impact on the level of the carbon emission emitted. To support the facts, UNWTO (2008) stated that tourism sector generated 5% across the global in term of the emission. On the tourism arrival, this study is focusing on the number of people that visit India in a year which can be described as a function of the tourism activities.



Source: The World Bank Data (2020)

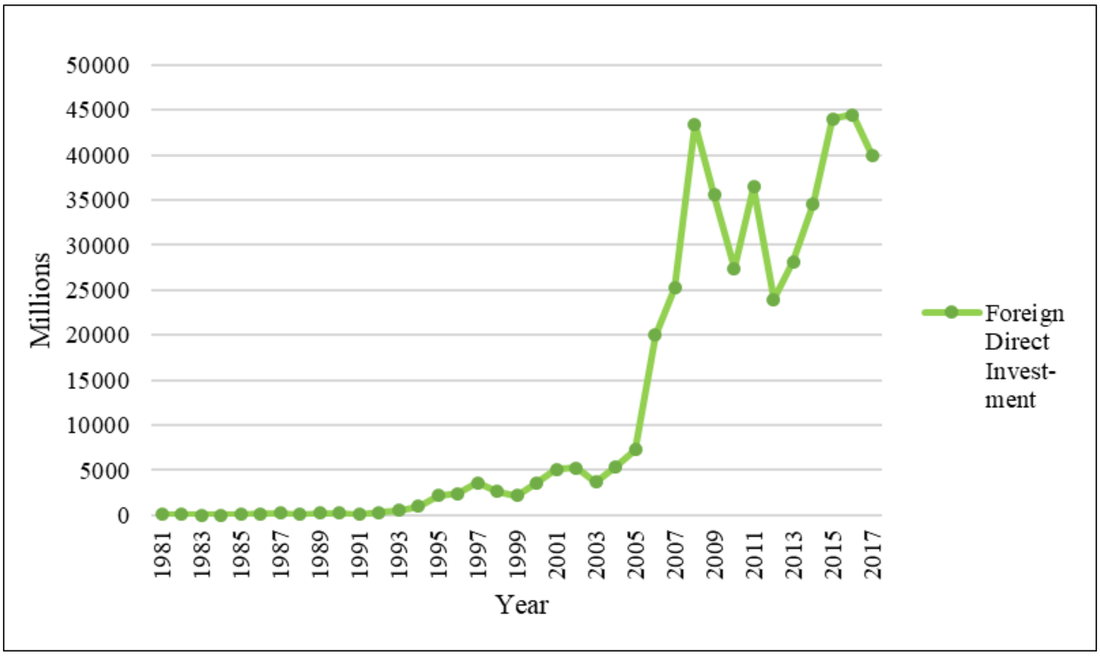
Figure 1. 4: Number of Tourist Arrival, TA (Per Person)

Based on the Figure 1.1 above, the number of tourist arrival in India is getting increasing year by year which also can contribute to the GDP in India. At the same time, the number of people that come to visit India shows that the tourism sector in India is getting better in term of hotel, transportation, various of interesting activities and attractive places to visit in India as well. The place that makes India become the chosen country to be visited is Taj Mahal which is the iconic domed Mughal mausoleum. Also, India is a land of a variety of destinations from hill stations to the beaches and the spiritual places in the world. As the result, more facilities in term of communication services, tourism services that includes the hotel and transportation need to be upgraded year by year so that it can enhance the tourism sector and can contribute to a higher GDP in India.

According to Ozturk (2016), besides infrastructure, marketing and price as determinants for more likely to attract tourist, it cannot be denied that quality of the environment also plays an important role that can influence tourist to visit the country. Ozturk clarified that if the tourist has the variety destinations available that promising a comparable price, the tourists will not be hesitated to return to polluted, unattractive destinations and dirty environment as their choices. Therefore, it can be concluded that there is positive impact on the economic impact of the carbon emission distinguishes and also to the environmental impact on the tourism industry. Therefore, the impact of carbon emission can be measured using the tourism arrival by decoupling it.

1.2.3 Foreign Direct Investment

FDI has been identified as one of the main engines of economic growth, a potential source of employment, as well as a channel through which advanced technologies can be transferred to host countries (Sapkota & Bastola, 2017). However, FDI also leads to environmental degradation for the host countries. Host countries considered the trade-off between environmental degradation and growth so that they are able to attract FDI to their countries. In practice, many incidents have occurred in relation to significant environmental damages for the host countries, such as the case of Formosa Chemicals Corporation in Vietnam in 2016, a significant degradation led to at least 115 tons of dead fish; 450 hectares of coral reefs were significantly destroyed and more than 350 hectares of shrimp farming were killed, affecting the living conditions and income of more than 226,000 local vulnerable people in Vietnam.



Source: The World Bank Data (2020)

Figure 1. 5: Foreign Direct Investment, FDI (BoP, Current US$)

According to graph above, it shows that the FDI in India is not at the stable position due to lacking number of investors that invest in India. Also, in pure retailing of the FDI at the present is not permitted under the India law which means the government in India has allowed FDI enter in the retail for the specific brand of the product. In 2010, the FDI started to raise back but drop to USD 40 billion based on the United Nation Conference on Trade and Development (UNTCTAD) report. However, the FDI outflow in India is the main source of the FDI in South Asia and more than doubled to USD 11 billion. Decline in FDI inflow put a high pressure on the country’s balance of payments and may also impact the value of the rupee which also can affect the investor and also tourism arrival in India indirectly.

Thus, increasing in the FDI can increase the job opportunities and the infrastructure in India and also driven up the carbon emission in India as well. It is shown that FDI can lead to the increase in the level of CO2 emission. It also led to the increase in environmental degradation at the first stage of the economic growth but decrease at the next stage. Based on the threshold of the peak level of the FDI inflow, it can estimate and predict whether the host countries are in the good balance between environment and growth.

1.2.4 Pollution Haven Hypothesis

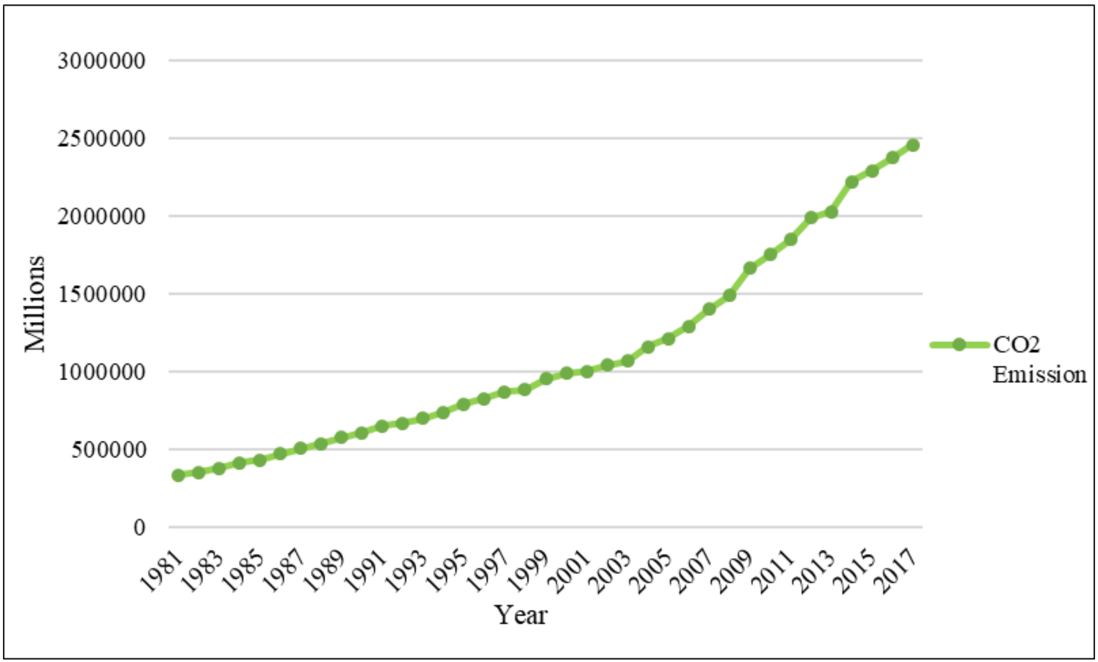
The Pollution Haven Hypothesis (PHH) states that differences in environmental regulations between developed and developing countries may be compounding this general shift away from manufacturing in the developed world and causing developing countries to specialize in the most pollution intensive manufacturing sectors. In the developed world the cost of meeting environmental regulations appears to be increasing regularly over time and in the USA alone was estimated to be $184 billion in 2000, equivalent to 2.6% of US GNP (UNCTAD, 2019). Since such costs are undoubtedly far lower in most developing countries it is possible that developing countries may possess a comparative advantage in pollution-intensive production.

Survey papers by Beghin (1996) and Jaffe (1995) have dealt with the industrial flight and the PHH. In this case, regarding the relocation of industries, the popular argument is that the relatively low environmental standards in developed countries compared to the industrialized nations leads to “dirty industries” shifting their operations to these countries. In addition, the general apprehension is that the developing countries may purposely undervalue the environment in order to attract new investment. These capital flight and PHH, if true, imply that pollution level of a country will increase due to FDI-led expansion of economic activities in the dirty industries. Even if the hypothesis is being rejected, there can still be significant environmental damages that can be caused by FDI. Environmental damages, in the long run arise through the growth impact of FDI. At the heart of this relationship lies the observed inverted-U relationship between output growth and the level of pollution known as the Environment Kuznets Curve (EKC).

1.3 Problem Statement

India has been listed as the largest per capita carbon emission producer and ranked among the top largest emitters, taking the top three spots in the world. According to the Global Carbon Project (2017), India emitted about 2.5 billion tonnes each year which is 6.8% global emission and was the second largest emitter in Asia which contributed 53% of global emission.

From Figure 1.6, it clearly shows that the level of carbon emission in India increase gradually due to the certain sector that driven up the carbon emission in India. About 68.7% of GHG emission come from the energy sector (19.6%), agriculture (6.0%), industrial processes (3.8%), land-use change and forestry and waste (1.9%) relatively to GHG emission in India. As the world average, India emits twice based on the relative to GDP. This is because, theoretically, economic growth will give a positive impact to the carbon emission whereby the more the economic growth in term of building the infrastructure, transportation and human activities will lead to the higher the level of carbon emission in the atmosphere.



Source: The World Bank Data (2020)

Figure 1. 6: Total Carbon Dioxide Emission of Fossil Fuel used and Industrial Processes (Millions Per Capita)

In spite of severe socioeconomic challenges that every country is facing, India had made a progress to break through global economy during the past decade and now becoming a developing country as well as fast emerging economy country. With a consistently rising on the growth rate due to the several sectors which are agriculture, import and export and demand of oil and gases made India to be considered as the one of the fastest-growing economy in the world and is predicted to become the world's first power by 2050. In environmental situation, rapid growth of economic is not good for a country's as it will give a negative impact on the environmental surrounding.

The environmental impact of economic growth will lead to higher level of pollution and potential loss of environmental habitats as well as the human health. It has been proven by the Lancet Planetary health Journal stated that India had suffered 26% of premature mortality and health loss attributable to air pollution globally. Also, in 2017, over half of the 1.4 lakh death attributable to air pollution and asserted 77% of the population in India are exposed to outdoor air pollution that above the National Ambient Air Quality Standard (NAAQS) safe limit. It is good to be labelled as one of the fast-growing economies but having a rapid economy also can affect the rate of a country's life expectancy due to the carbon emission emitted in the atmosphere.

According to Ghosh (2018), Indian travellers' carbon footprint is ranked as the fourth largest in the world and been driven by large population and increasing in the income level. The number of tourists travelling across borders is expected to reach 1.8 billion a year by 2030, according to the latest UNWTO predictions. This will be alongside a further 15.6 billion domestic tourist arrivals. Such growth will bring many opportunities, including socio-economic development and job creation. At the same time, however, GHG linked to tourism-related transport are also rising, challenging the tourism sector's ambition to meet the targets of the Paris Agreement.

India's carbon emission from aviation only has recorded an increase in 17.97 million tonnes in 2017, from 16.06 million tonnes in 2016. This is due to the global demand for tourism and boom in the low-cost of airlines in India. The emergence of low-cost airlines generally stimulates the tourism demand, leading to a higher travel frequency but lower length of stay which resulting in a higher carbon intensity per trip and an expanding overall tourism emission. It is also found that, emission produced to support tourism within India was 268 tonnes carbon dioxide equivalent while tourism emission made by citizens of India stood at 240 tonnes carbon dioxide equivalent. Thus, this result shows an importance to investigate deeper on the link between tourism arrivals and CO2 emission in India in order to help the policies maker and government of India in reducing the tourism carbon footprint.

The impact of FDI on environment has remained a debatable topic for years. The developing countries attract polluting industries from developed nations through lenient environmental policies and regulations (Xing & Kolstad, 2002). The benefits of India's richness in natural resources, its cheap labor, low environmental standards, and relaxed environmental laws have given large scope of FDI and India has been a host for FDI for many years. It has attracted multinational companies (MNCs) to invest in all forms of development activities.

Moreover, India also has remained among the top 20 most attractive destinations for FDI in the world in spite of the numerous concerns about environmental degradation and a fall in global FDI in 2016 (UNCTAD, 2016). With increased competition for FDI, polluting industries in developed countries would tend to move to developing countries such as India due to strict regulations and the rising cost of pollution abatement in developed countries. This phenomenon is known in the environmental literature as the pollution haven hypothesis (PHH). The PHH hypothesis then serves to highlight that more empirical research is needed on FDI and CO2 emission in India.

1.4 Objective of the Study

1.4.1 General Objective

The general objective of this study is to find out the main factors affecting carbon dioxide emission in India.

1.4.2 Specific Objective

i. To examine the long run relationships between carbon dioxide emission and its determinants.
ii. To find out the short run causality between CO2 emission, the dependent variable and independent variables (economic growth, tourist arrival and foreign direct investment).
iii. To confirm the Pollution Haven Hypothesis (PHH) in India.

1.5 Significance of the Study

This paper is to explore the relationship between tourist arrival, economic growth, foreign direct investment and carbon dioxide emission in the Republic of India. Such significant relationships among the variables can be proven by performing the Augmented Dicker-Fuller (ADF) Unit Root test and Phillips-Perron (PP) Unit Root test, Johansen Cointegration test, Vector Error Correction Model (VECM) Granger Causality test, and the diagnostic tests. Literature reviews and related journal articles are referred to support the findings.

Firstly, by analysing the effect of tourist arrival, economic growth and foreign direct investment towards carbon dioxide emission, significant results may be used to prove whether the independent variables are providing the said effects. This will help future researchers and scholars whenever they want to further explore the factors which may affect the carbon emission in different countries. It is expected to contribute informative findings to policymakers, researchers, or even economists on the factors affecting carbon dioxide emission in India. This would also provide effectives recommendations the most suitable action need to be taken on the nature of the relationship between carbon emission over the independent variables.

1.6 Scope of Study

This research examines the link that exist between tourist arrival, economic growth, foreign direct investment with the CO2 emission in India. For this study, the data used is yearly data which starting from 1981 to 2017. The tourist arrival is measured using the total number of tourist arrival, economic growth is measured in GDP constant 2010 US$, while foreign direct investment is measured by the net inflows (BoP, current S$). The measurement for carbon emission is the total carbon dioxide emission of fossil fuel used in industrial processes.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The aim of this study is to examine the relationship between carbon dioxide emission, the dependent variable and economic growth, tourist arrival and foreign direct investment as the independent variables. The second section of this chapter will discuss on the empirical framework applied in this study. Meanwhile, the third section of this chapter will discuss on the literature review as a whole.

2.2 Empirical Framework

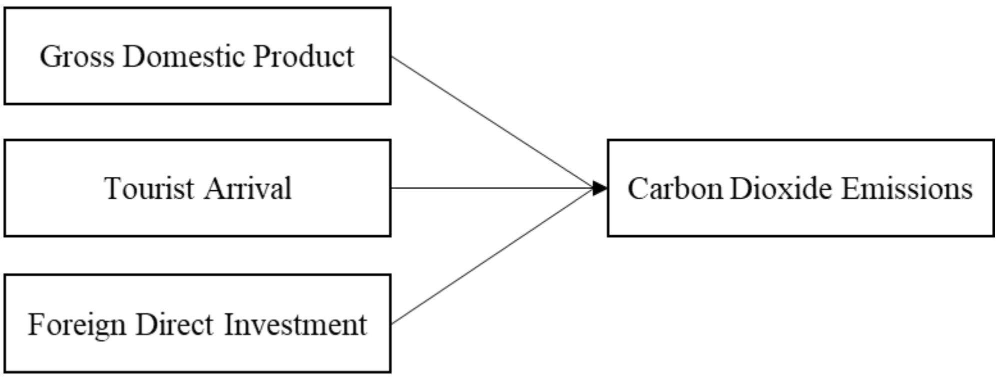


Figure 2. 1: Empirical Framework

2.3 Literature Review

Based on the previous study, the relationship between CO2 emission, economic growth, FDI and tourist arrival can be identified as following;

2.3.1 Economic Growth

Many past studies have shown that gross domestic product (GDP) exhibits a positive relationship with carbon dioxide (CO_2) emission. According to Khan, Alam, & Hafeez (2018), GDP has a significantly positive relationship with CO_2 emission while the square of GDP found is negatively associated with CO_2 emission. In theory, the Environmental Kuznets Curve (EKC) have shown that as per capita income of a country increases, the environmental degradation of the country first increases, then decreases after a certain height of development is achieved as the country progresses.

It is found in one study done among Central and South American countries that there is no short-run causality between economic growth and CO_2 emission. However, based on the Fully Modified Ordinary Least Square (FMOLS) and Dynamic Ordinary Least Square (DOLS) method, the long-run results indicated that economic growth contribute significantly to an increased CO_2 emission in the stated region (Jebli, Youssef, & Apergis, 2014).

Ang (2008) used a multivariate vector error correction model to examine the dynamic relationship between output, CO_2 emission and energy consumption for Malaysia. The empirical results indicate that CO_2 emission are positively related to output in the long run. Based on a provincial panel data set, Du, Wei and Cai (2012) investigated the driving forces, emission trends and reduction potential of CO_2 emission in China. The results show that economic development, technology progress and industry structure affect China's carbon dioxide emission. Puzon (2012) discovered that GDP per capita is one of the possible determinants for per capita CO_2 emission in 8 East Asian countries.

2.3.2 Tourist Arrival

Al-Mulali, Fereidouni and Mohammed (2015) did a research on the effect of tourist arrival on CO_2 emission in 48 top international tourist destinations and have found that tourist arrivals and economic activities led to a positive long-run relationship with CO_2 but only in countries from Africa, Asia Pacific, America and the Middle East. Countries in the Europe do not have a significant long-run relationship with CO_2 emission due to strong environmental regulations in the transportation industry among the European Union countries (Al-Mulali, Fereidouni, & Mohammed, 2015). A study done in Nepal in 2019 showed that there is a unidirectional long-run causality between tourism and CO_2 emission showing a 1% increase in tourist arrival can lead to a 0.98% increase in CO_2 emission (Nepal, Irsyad, & Nepal, 2019).

According to a study done by Robaina-Alves, Moutinho, & Costa (2016), the increase in CO_2 emission is caused by greater tourist activities. However, there is also initiative being exercised to reduce CO_2 emission with the increase in tourist arrival. The reduction of emission should not just pass by technological and energy changes on the production side of the business cycle, but also by an orientation of demand for cleaner tourism activities in which tourists are encouraged to make environmentally protective decisions from the choices of accommodation and transportation during their length of stay in the respective destinations.

In a developing country or less-developed country where technology to manage the environmental pollution is unavailable, the effects of tourist arrival could be adverse. In the case of Malaysia, there is a positive unidirectional long-run Granger causality flowing from tourist arrivals to pollutant emission and the sign of coefficient of tourist arrival is positive, indicating that higher tourism growth increases pollution in the country (Solarin, 2014). Through the poor choices of accommodation and transportation of tourists along with the lack of energy-efficient technology, increased tourist activities may lead to increased pollutions.

The study done by Jebli, Youssef and Apergis (2014) found that there is an absence of short-run causality between number of tourist arrivals and CO2 emission, showing that any changes in tourist arrivals to Central and South American countries will not affect environmental quality. The opposite is true where any degree of pollution in the countries also will not have a major impact on tourist arrivals. In the long run, however, it is discovered that increased tourist arrivals can cause the decrease of CO2 emission, while stimulating economic activity. Hence, among the policies recommended by this paper was to expand the tourism industry in the region as it is able to contribute to enhanced environmental quality.

2.3.3 Foreign Direct Investment

The theoretical framework used in this study is the Environment Kuznets Curve (EKC) which explains both the negative and positive relationship between FDI and CO2 emission. In the long run, a 1% increase in FDI leads to a 0.065% decrease in CO2 emission due to the influx of good FDI for the environment which reduces pollution

(Tang & Tan, 2015). The good FDI includes transferring technologies which are environmental-friendly and also production techniques from more developed countries to the least developed countries or developing countries.

In a study done among Central and South American countries, it is seen that real GDP and trade are two major drivers in increasing CO2 emission (Jebli, Youssef, & Apergis, 2014). However, short-run causality in both directions is absent which means that no amount of trade would increase CO2 emission in this region and trade activities will not be significantly impacted by the degree of pollution as well in the short-run.

2.4 Concluding Remarks

The relationship between CO2 emission with economic growth, tourist arrival and FDI have been done by many researches over the past few decades. Different results had been found for different countries including European countries, Asian countries and many more. Therefore, it is interesting to know the results for India in this study.

Alam (2019) found that there is a long run relationship between GDP per capita and CO2 emission however it is found that GDP per capita is negatively related to CO2 emission. Nain, Ahmad, & Kamaiah (2015) in their study found that there is a long run relationship found between GDP and CO2 emission examine using the ARDL Bound Test approach. Besides, study by Makarabbi, Gururaj, Khed, G., & Jamaludheen (2017) found that GDP per capita is positively related to CO2 emissiosn however squared of GDP per capita is found negatively related to CO2 emission ruling that there is no existence of EKC in India context. Ghosh S. (2010) fails to establish long-run equilibrium relationship and long-term causality between carbon emission and economic growth; however, there exists a bi-directional short run causality between the two.

Study conducted by Makarabbi, Gururaj, Khed, G., & Jamaludheen (2017) and Acharyya (2009) found that there is a long run relatisonship exist between FDI and CO2 emission and is positively related to CO2 emission in the long run. Muthusamy & Rani (2019) also find that there is positive long run relationship exist among Fdi and CO2 emission and is positively related in case of India. From Granger Causality test, the study indicating the presence of unidirectional causality among FDI and CO2 emission. In the other hand, study by Jungho & Koo (2009) find that FDI do not have a long run relationship with CO2 and is negatively related. However, FDI is seems to only have a short-run linkage with the CO2 emission.

Al-Mulali, Fereidouni, & Mohammed (2014) and Zhang & Liu (2019)found from the co-integration regression suggest that tourim has a positive long run relationship linkage with the CO2 emission. The Granger Causality test also reveals that tourim is the major factor of the increasing in the level of CO2 emission in the context of India. Shakouri, Yazdi, & Ghorchebigi (2017) in their study also found that tourism arrival have significant positive impact on the CO2 emission levels in the long run. The results of Granger Causality test from that study also reveals that, there is unidirectional causality from tourism arrival and CO2 emission.

Table 2 1: Summary of Literature of Review

Author	Country	Methodology	Findings
Acaravci, A., & Ozturk, I. (2010)	Europe	▪ Panel Unit Root Test ▪ ARDL Bound Test ▪ Granger Causality Test ▪ CUSUM & CUSUMQ Test	▪ An increase in energy consumption results in an increase in emission. ▪ As Real GDP per capita increases, carbon emission per capita increases as well until some threshold level of Real GDP per capita is reached after which carbon emission per capita begin to decline ▪ Any increase in Real GDP per capita reduce the carbon emission per capita in Denmark and Italy.
Acharyya (2009)	India	▪ Unit Root Test ▪ Johansen-Juselius Cointegration Test ▪ Granger Causality Test ▪ VECM	▪ The cointegration analysis shows that FDI inflow in India did have a positive, but marginal, long run impact on GDP growth. ▪ The pollution heaven hypothesis may not be a plausible argument for the upsurge in FDI inflow in the 1990s, such inflows did have a quite large positive impact on the CO2 emission through output growth.
Alam (2019)	India	▪ ADF Unit Root Test ▪ Johansen Cointegration Test ▪ VECM Test	▪ The study shows that there is a long run relationship among CO2 emission with GDP per capita and industrial value added. ▪ GDP per capita is found to be negatively related to the CO2 emission.
Ali, R., Bakhsh, K., & Yasin, M. A. (2019)	Pakistan	▪ Unit Root Test ▪ ARDL Bound Test ▪ CUSUM & CUSUMQ Test	▪ The study shows that in the long-run, urbanization triggers carbon emission and deteriorates environment in Pakistan. ▪ This study also shows that there is unidirectional short run causality from urbanization to CO2 emission. ▪ GDP per capita is insignificant which shows no contribution to the environment degradation in Pakistan.

Author	Country	Methodology	Findings
Al-Mulali, Fereidouni, & Mohammed (2014)	Africa, Middle East, American, Asia & Pacific, Europe	▪ Panel Unit Root test ▪ Panel Cointegration test ▪ Panel granger Causality Test	▪ The results in general show that tourism have a significant impact on the CO2 emission in all the selected countries with the exception of the European countries. ▪ The insignificant impact of tourism on CO2 emission in the European countries is due to the strict environmental regulations.
Al-Mulali, U., Fereidouni, H. G., & Mohammed, A. H. (2015)	Africa, Middle East, Americans, Asia & Pacific & Europe	▪ Unit Root Test ▪ Cointegration Test ▪ Granger Causality Test ▪ FOMLS	▪ Tourism arrivals, energy consumption, economic activities and urbanization have a positive long-run relationship with carbon dioxide emission from transportation only in countries from Africa, Asia Pacific, Americas and the Middle East. TOR has no significant long-run relationship with TCO2 in Europe due to strong environmental regulations in the transportation industry.
Amzath, A., & Zhao, L. (2014)	Maldives	▪ Unit Root Test ▪ Correlation Test	▪ Tourism development contributes enormously to the increase in CO2. High growth rate in tourism have increased national receipts and CO2 emission in the past three decades.
Ang (2008)	Malaysia	▪ Unit Root Test ▪ Johansen Cointegration Test ▪ Cointegrating Vector ▪ Causality Test ▪ Multivariate VECM	▪ There is a long run relationship between CO2 emission and energy consumption ▪ Increase in the pollution leads to increase in the economic growth in Malaysia

Author	Country	Methodology	Findings
Azam, M., Alam, M. M., & Hafeez, H. M. (2018)	Malaysia & Singapore	▪ Unit Root Test ▪ Cointegration Test ▪ CUSUM & CUSUMQ Test ▪ Granger Causality Test	▪ The results of this study also reveal that there are causalities in two ways between CO2 emission and income, and between Vietnam's FDI and CO2 emission. ▪ Additionally, energy consumption is found at Granger due to short- and long-run CO2 emission. ▪ The key determinants of CO2 emission in Vietnam include energy consumption, FDI, and income.
Balogh, J. M., & Jámbor, A. (2017)	168 Countries	▪ Panel Unit Root Test ▪ Panel Cointegration Test	▪ Regression results were positive and significant for per capita GDP and negative for per capita squared GDP.
Basarir, C., & Cakir, Y. N. (2015)	Turkey, France, Italy, Spain & Greece	▪ Panel Unit Root Test ▪ Panel Cointegration Test ▪ FMOLS	▪ There is a one-sided relationship is detected from financial development to energy consumption and to CO2 levels. ▪ This study also shows that tourist variable effects CO2 and energy emission
Ben Jebli, M., Ben Youssef, S., & Apergis, N. (2019)	African Countries	▪ Unit Root Test ▪ Cointegration Test ▪ FOMLS ▪ DOLS	▪ Real GDP and commerce are the two main drivers for increasing CO2 emission. ▪ The impact on CO2 emission of both renewable energy consumption and the number of tourist arrivals is negative and can contribute to long-term pollution reduction. ▪ Short causality links between CO2 emission and economic growth, which means that increases in economic growth are not expected to have any impact on the quality of the environment, while increases in the share of pollution cannot affect the development of economic activities.

Author	Country	Methodology	Findings
Dogan, E., & Aslan, A. (2017)	European Union Countries	▪ Panel Unit Root Test ▪ LM Bootstrap Test ▪ FMOLS ▪ OLS ▪ DOLS	▪ There is negative impact of economic growth on the CO2 emission. ▪ Increases in energy consumption lead to environmental degradation. ▪ Tourism sector is not a concern for environmental pollution in the sample countries instead increases in tourist arrival reduce the level of CO2 emission.
Du, Wei, & Cai (2012)	China	▪ Provincial panel data analysis	▪ Economic development, technology progress & industry structure are the most important factors affecting CO2 emission. ▪ Impacts of energy consumption structure, trade openness and urbanization level are negligible. ▪ Inverted U-shaped relationship between CO2 emission and economic development level is not strongly supported by the estimation results.
Durbarry, R., & Seetanah, B.(2014)	Mauritus	▪ Unit Root Test ▪ Cointegration Test ▪ ARDL Bound Test	▪ 1% increase in tourist arrival result in 0.8% increase in CO2 emission. ▪ Number of vehicles on road and investment contributes to pollution. Population increase also contribute to increase in CO2 emission.
Farhani, S., & Ozturk, I. (2015)	Tunisian	▪ Panel Unit Root Test ▪ ARDL Bound Test ▪ Granger Causality Test ▪ VECM Test ▪ Diagnostic Checking	▪ ARDL Tests show that there is a long run relationship between the variables. ▪ Tunisia does not support the EKC hypothesis as the CO2 emission initially increase with Real GDP and still increase without reaching the threshold
Ghosh S. , (2010)	India	▪ Unit Root Test ▪ ARDL Bound Test ▪ Johansen-Juselius	▪ The study fails to establish long-run equilibrium relationship and long-term causality between carbon emission and economic growth.

Author	Country	Methodology	Findings
		Cointegration Test ▪ Granger Causality Test ▪ Generalized Variance Decomposition Test ▪ CUSUM & CUSUMQ Test	▪ However, there exists a bi-directional short run causality between the two. ▪ There is unidirectional short-run causality running from economic growth to energy supply and energy supply to carbon emission
Haseeb, Xia, Danish, Baloch, & Abbas (2018)	Brazil, India, Russian, China, South Africa	▪ LM Test ▪ CIPS and CADF unit root test ▪ Wester Lund Cointegration test, ▪ Dynamic seemingly unrelated regression (DSUR) ▪ Dumitrescu-Hurlin Granger causality test show	▪ Energy consumption and financial development contribute to the carbon dioxide emission whereas globalization and urbanization have negative but insignificant relationship with carbon dioxide emission. ▪ Supports the EKC hypothesis in BRICS economies. ▪ Bidirectional causality exists among energy consumption, financial development, economic growth and square of GDP with carbon dioxide emission whereas globalization and urbanization have unidirectional relationship with carbon dioxide emission
Jungho & Koo (2009)	India & China	▪ Unit Root Test ▪ ARDL Bound Test ▪ Cointegration Test ▪ Granger Causality Test	▪ This study found a significant positive relationship between CO2 emission and FDI for China in both the short- and long-run. ▪ For India, on the other hand, the inflow of FDI is found to have a detrimental effect on the environment in the short-run but has little impact in the long-run.
Katircioglu, S. T., Feridun, M., & Kilinc, C. (2014)	Cyprus	▪ Unit Root Test ▪ ARDL Bound Test	▪ Tourism arrivals have a positive and statistically significant impact on CO2 emission and energy consumption. ▪ Increases in energy consumption not only result in

Author	Country	Methodology	Findings
		▪ Granger Causality Test	economic growth but also result in growth in the number of international tourist arrivals ▪ A change in tourism stimulates changes in carbon dioxide emission and energy consumption.
Lee, J., W., & Brahmasrene, T. (2013)	Malaysia	▪ Panel Unit Root ▪ Panel Cointegration ▪ Granger Causality Test ▪ CUSUM & CUSUM Q Test	▪ This study shows that there is inverted U-shaped relationship between CO2 emission and urbanization in the long run. ▪ Based on this study, it implies that the rapid urbanization in Malaysia led an increase energy demand which dominated by fossil fuels.
Liu, J., Feng, T., & Yang, X. (2014)	Chengdu	▪ Methods introduced by IPCC Report	▪ Indirect energy requirements and indirect CO2 emission dominate overall energy consumption and overall CO2 emission, with an overwhelming 90%. ▪ Transportation is the biggest contributor to tourism industry's energy consumption and carbon emission. Transportation and shopping tend to be of relative importance, while food and entertainment tend to decrease
Makarabbi, Gururaj, Khed, G., & Jamaludheen, (2017)	India	▪ Unit Root Test ▪ ARDL Bound Test ▪ Granger Causality Test ▪ VECM ▪ OLS Estimation	▪ The results indicate the existence of long run relationship between CO2 emission per capita, GDP per capita, FDI inflows and energy consumption per capita. ▪ Existence of bi-directional causality between CO2 emission per capita and FDI, CO2 emission per capita and energy consumption. ▪ EKC hypothesis (inverted U-shaped curve does not exist between GDP per capita and CO2 emission per capita in India's context.

Author	Country	Methodology	Findings
Muthusamy & Rani (2019)	India	▪ Unit Root Test ▪ ARDL Bound Test ▪ OLS Estimation ▪ Cointegration Test ▪ Granger Causality Test	▪ Ordinary Least Square Method suggests that there is a positive relationship between foreign direct investment (FDI) and environment (CO2) and GDP. ▪ The study also found that there is a long run relationship among economic growth and CO2 emission with FDI. ▪ Granger Causality found that there is uni-directional link between economic growth and CO2 emission towards FDI.
Nain, Ahmad, & Kamaiah, (2015)	India	▪ ADF Unit Root Test ▪ DF-GLS Unit Root Test ▪ KPSS Unit Root Test ▪ ARDL Bound Test ▪ Johansen Multivariate Cointegration test ▪ Granger Causality Test ▪ MWALD Test ▪	▪ The autoregressive distributed lag bounds test reveals that there is a long-run relationship among the variables concerned at both aggregate and disaggregate levels. ▪ The Toda–Yamamoto causality tests, however, reveal that the long-run as well short-run causal relationship among the variables is not uniform across sectors. ▪ The weight of evidences of the study indicates that there is short-run causality from electricity consumption to economic growth, and to CO2 emission
Nepal, R., Indra al Irsyad, M., & Nepal, S. K. (2019)	Nepal	▪ Unit Root Test ▪ ARDL Bound Test ▪ CUSUM & CUSUMQ Test ▪ Granger Causality Test	▪ The results provide strong evidence of a tourism sector driven by the economy, where expansion of economic output leads to expansion of tourist arrivals. ▪ In turn, more tourist arrivals generate positive impacts on the formation of gross capital. Energy consumption has a negative effect on tourist arrivals, calling for more attention to improve energy efficiency and diversity.

Author	Country	Methodology	Findings
Ozturk, I. (2015)	Developed and Developing Countries	▪ Correlation Matrix ▪ Panel Unit Root ▪ Panel Cointegration Test ▪ VAR Model ▪ FMOLS ▪ OLS ▪ DOLS	▪ Health expenditure increases tourist receipts (Medical tourism) ▪ Increase in CO2 emission increases tourist arrival (Ecotourism) ▪ Insufficient energy base decreases international tourists' arrivals. (Renewable energy sources)
Paramati, S. R., Alam, M. S., & Chen, C.-F. (2016)	Developed & Developing Countries	▪ Panel Unit Root Test ▪ Panel Cointegration Test ▪ Granger Causality Test	▪ Environmental Kuznets's Curve (EKC) does not necessarily exist across developed and developing countries. ▪ Developed countries show that tourism has a important role in stimulating economic growth although it increases CO2 emission.
Puzon (2012)	8 East Asia countries	▪ Hausman test ▪ Serial correlation and heteroskedasticity ▪ Fully corrected model	▪ The inverted U shaped EKC does exist. ▪ The economic and demographic variables contribute to environmental degradation. ▪ GDP per capita, GDP per capita-squared, manufacturing intensity, energy efficiency, population growth and debt share in GDP are the possible determinants for per capita CO2 emission.
Robaina-Alves, M., Moutinho, V., & Costa, R. (2016)	Portugal	▪ Logarithmic Mean Divisia Index	▪ Tour operators & travel agencies' subsector emission are strongly influenced by the effect of tourism activity, which is responsible for reducing emission in this subsector, whereas the energy mix has had a positive impact. ▪ Tourism activity in Transport is an important effect, but the effect of energy intensity has had a stronger impact on emission reduction , especially since 2006.

Author	Country	Methodology	Findings
Shakouri, Yazdi, & Ghorchebigi (2017)	Asia Pacific	▪ Panel Unit Root Test ▪ Panel GMM ▪ Panel Granger Causality Test	▪ Tourist arrivals have significant positive effects on carbon dioxide emission levels in long-run. ▪ The results of the Granger causality test that unidirectional causality from energy consumption to tourism arrivals and unidirectional causality from CO2 emission to tourism arrivals for Asia-Pacific countries.
Solarin, S. A. (2014)	Malaysia	▪ Unit Root Test ▪ ARDL Bound Test ▪ Granger Causality Test	▪ A positive long-run unidirectional causality of Granger flowing from tourist arrivals to Malaysian pollutant emission. ▪ The sign of a coefficient of tourism is positive and statistically significant, showing that higher growth in tourism increases the country's pollution.
Ubaidillah, N. Z. (2012)	Malaysia	▪ Unit Root Test ▪ VECM Test	▪ All the variables are significant whereby RGDP has a positive effect on TOUR while CO has a negative effect on TOUR.
Wang, M., C., & Wang, C., S. (2018)	OECD Countries	▪ Panel Unit Root Test ▪ Panel Cointegration Test ▪ Hausman Test ▪ ARCH Test	▪ The improvement of energy use efficiency reduces CO2 emission and helps tourism development to decrease CO2 emission. ▪ Renewable Energy consumptions has a significance influence on reducing CO2 emission, but it does not help tourism to reduce CO2 emission
Yazdi, S. K., Shakouri, B., Khanalizadeh, B. (2019)	Iran	▪ Unit Root Test ▪ VECM Test ▪ Granger Causality Test	▪ Real GDP and tourist arrivals main drivers in increasing CO2 emission. ▪ Increase in energy consumption also increases CO2 emission. Coefficient of trade openness on CO2 emission is negative. 1% increase in trade openness decreases emission by 0.18%.

Author	Country	Methodology	Findings
Yorucu, V. (2015)	Turkey	▪ Unit Root Test ▪ ARDL Bound Test ▪ Granger Causality Test	▪ Rapid tourism development in Turkey has triggered CO_2 emission
Zaman, K., Moemen, M. A., & Islam, T. (2019)	Albania, Armenia, Azerbaijan, Belarus, Bosnia, Herzegovina, Croatia, Georgia, Kazakhstan, Kyrgyz, Republic Russian, Ukraine	▪ Correlation Matrix ▪ Panel Fixed Effect Regression, ▪ Panel Causality Test ▪ Panel Variance Decomposition Technique.	▪ GDP per capita and urban population increases CO_2 emission ▪ Tourism transportation indicators all have an indirect relationship CO_2 emission ▪ Energy demand, FDI trade openness and urban population have a negative correlation with the GDP per capita, while tourism transportation expenditures increases GDP per capita significantly
Zhang, S., & Liu, X. (2019)	Asian Countries	▪ Panel Unit Root Test ▪ Panel Cointegration Test	▪ Positive impact of tourism on emission is found in Indonesia, Korea, and Russia, while negative impact in the Philippines ▪ Only unidirectional causality from GDP and tourism to emission, and no causality between energy and emission, reveal that emission can be controlled by sustainable tourism and economy.

CHAPTER 3

METHODOLOGY

3.1 Introduction

The main purpose of this study is to develop an understanding of the relationship between carbon dioxide emission and tourist arrival in India between year 1981 until 2017. This chapter has been divided into five parts. The introduction of this chapter will be discussed in section 3.1, whereas the empirical model of this study will be reviewed in section 3.2. Meanwhile, the third and fourth section of this paper will be dealing with the data descriptions and methodology used in this research paper. The final parts of this chapter will be the conclusion and a brief summary of this chapter.

3.2 Empirical Model

To investigate the relationship of Gross Domestic Product, tourist arrival and Foreign Direct Investment on carbon dioxide emission, the following function is employed:

$$CO_2 = f\,(GDP, TA, FDI) \tag{3.1}$$

The function also can be written into an econometric model:

$$CO_{2t} = \beta_o + \beta_1 LGDP_t + \beta_2 LTA_t + \beta_3 FDI_t + \varepsilon_t \tag{3.2}$$

where, CO_{2t} = the logarithmic rate of carbon dioxide emission in t_{th} yearly;

$LGDP_t$ = the logarithmic price of gross domestic product in t_{th} yearly;

LTA_t= the logarithmic number of tourist arrival in t_{th} yearly;

$LFDI_t$= the logarithmic price of foreign direct investment in t_{th} yearly;

β_o= the constant terms;

β_1, β_2, and β_3= the coefficient to measure the impact of CO2 emission;

ε_t= the stochastic term.

The coefficient of β_o is expected to be positive as the rate of carbon dioxide emission is always in positive values. The coefficients of β_1 and β_2 is also expected to be in positive values as increase in gross domestic product and tourist arrival will leads to increase in the CO_2 emission. This is caused by the increase in production of the country has resulted in increase of greenhouse gases emission. Besides, increase in the number of tourist arrival has always been associated with the increase of number of transportations that actually also lead to increase in the carbon dioxide gas emission to the country. Last but not least, the coefficient of β_3 is expected to be in the positive values too, this is the result of increasing in the economic activity in the country which leads to the damage to the environment quality, increasing the natural disaster as well as increasing the air pollution.

3.3 Data Description

The time period that will be used in this study is from year 1981 until 2017 a total of 37 observations. The reason of considering of this time period is because of the data availability.

Table 3. 1: Features of the Variables

Variables	Symbol	Measurements	Sources
Carbon Dioxide Emission	CO_2	Total Carbon Dioxide Emission of Fossil Fuel Use and Industrial Processes	
Gross Domestic Product	GDP	Constant 2010 US$	World Bank Data
Tourist Arrival	TA	Per Person	
Foreign Direct Investments	FDI	BoP, current US$)	

3.4 Methodology

3.4.1 Augmented-Dickey Fuller (ADF) Test

The presence of unit roots which compromise the auxiliary regression as shown in equation 3.3 and 3.4 can be tested using the Augmented-Dickey Fuller Test. The test stipulates the serial correlation by including the lagged Δy_t term.

$$\Delta y_t = \beta_1 + \beta_2 t + \pi y_{t-1} + \sum_{j=1}^{k} y_j \Delta y_{t-j} + u_{1t} \quad (3.3)$$

$$\Delta y_t = \beta_1 + \pi y_{t-1} + \sum_{j=1}^{k} y_j \Delta y_{t-j} + u_{2t} \qquad (3.4)$$

where, $\beta_1, \beta_2, \pi \; and \; y =$ the parameters to be estimated;

$\Delta y_{t-j} =$ the first differences with j lags; and

$u_{it} =$ the error term in the regression

The null hypothesis of this test state that, the variables is has unit root or in other words it is non-stationary. Meanwhile, the alternative hypothesis state that, the variable has no unit root, or it is stationary. The null and alternative hypothesis of this test can be stated as below:

$$H_0 : \beta = 0 \text{ (}y_t \text{ consist of a unit root or } y_t \text{is non} - \text{stationary)}$$

$$H_a : \beta < 0 \text{ (}y_t \text{ do not consist of a unit root or } y_t \text{is stationary)}$$

The t-statistics was used to identify the stationarity of the variables by using the optimum lag length which is determined by the Akaike Information Criterion (AIC). The significance of the variables is based on the 1%, 5% and 10% value of the significance level. If the t-statistic is larger than the critical value, hence, reject the null hypothesis and the variables is concluded as significance. However, if the t-statistic is smaller than the critical value, hence, do not reject the null hypothesis and the variables will be concluded as not-significance.

3.4.2 Phillips-Perron Test

Phillip-Perron test administer a semi-parametric test of the unit root hypothesis for a single time series. This test tries to correct the effect of residual serial correlation in a simple Dickey-Fuller regression by using the non-parametric estimates of the long-run variance. This test can be written as below;

$$X_t = \alpha_O + \beta_{Xt-1} + u_t \tag{3.5}$$

where, X_t= time series represented as $u_t$defined as the innovation term;

t = number of observations.

The null hypothesis of this test can be written as below;

$$H_0 : \beta = 0 \ (X_t \text{ consist of a unit root or } X_t \text{is non} - \text{stationary})$$

$$H_a : \beta < 1 \ (X_t \text{ do not consist of a unit root or } X_t \text{is stationary})$$

The significance of the variables is selected based on critical value in 1%,5% and 10% significance level. If the t-statistic is larger than the critical value, hence reject the null hypothesis. Therefore, the variable is significance. However, if t-statistics is smaller than the critical value, hence do not reject the null hypothesis. Therefore, the variable is not significance.

3.4.3 Johansen Cointegration Test

Johansen Cointegration Test is used to identify the long-run relationship between the dependent variables and the macro independent variables of the research model. Johansen cointegration test regression can be referred as below equation:

$$\Delta X_t = r_1 \Delta X_{t-1} + r_2 \Delta X_{t-2} + \cdots + r_k \Delta X_{t-k+1} + \pi X_{t-j=1} + \mu + \theta D_t + \varepsilon_t \quad (3.6)$$

where, $r_1 = -I + \pi_1 + \pi_2 + \cdots + \pi_i$ for $i = 1,2, \mathrm{K} - 1$

$\pi = -I + \pi_1 + \pi_2 + \cdots + \pi_i$ is an identity matrix

The $r_1$denoted as a short-term adjustment parameter and π comprise of long-term equilibrium relationship of the X variables. π decomposed into the product of two n by r matrix α and β. Therefore, $\pi = \alpha\beta . \beta$ is a matrix that contains r cointegration vectors and α denoted as the speed of adjustment parameter.

Two likelihood test use to examine the number of cointegration vector . The likelihood test consists of trace test and maximum Eigenvalue test. The trace test is described in the following regression of:

$$T_{trace} = -T \sum_{i=r+1}^{N} In[(1 - r_i)]^2 \quad (3.7)$$

where, T is the number of observations, N is number of observations and r_i is the highest value of estimated Eigenvalue.

$H_o : r = 0$

$H_a : r \leq 0$

The null hypothesis of this Trace test indicates that, there is no cointegration exists in the model while the alternative hypothesis states that there is cointegration exists in the model. If the computed value of trace test is larger than the critical value, hence, the null hypothesis needs to be rejected. Therefore, there is at least one cointegration exists in the model.

The Eigenvalue Test can be expressed in the following equation:

$$T_{max} = -TIn(1 - \lambda_{r-1}) \quad (3.8)$$

where, T = number of observations;

λ_{r-1} = the largest estimated Eigenvalue.

The null and alternative hypothesis of this test are stated below:

$H_o : r\ cointegrating\ vector$

$H_a : r + 1\ cointegrating\ vector$

The null hypothesis states that there is no cointegrating factor in the long-run while alternative hypothesis states that there is cointegrating factor in the long-run. If the computed Eigenvalue is bigger than the critical value, it indicates to reject the null hypothesis. Therefore, the model has cointegrating factor in lung run and vice versa.

3.4.4 Granger Causality Test

Granger Causality test is a statistical hypothesis test, run to decide whether a one time series can give impact in forecasting other time series. A time series of Z is said to Granger-cause time series X if it only can be shown by a series of t-test and F-test on the lagged of value of the Z and X, that those Z and X values provide statistically significant information about future value of Z and Y. The causality is defined by Granger in two principle which is the cause happens prior to its effect and the cause has a unique information about the future values of its effect. Based on these assumptions of causality, Granger proposed to test the following hypothesis to describe the causal effect of Z on X:

$$P[X(t+1)\epsilon \mid I(t)] \neq P[X(t+1) \in A \mid I_{xt} \tag{3.9}$$

where, A is an arbitrary of non-empty set. The symbols I(t) and I_{xt} denote all the information until time t in the entire universe and the modified universe in which Z is excluded, respectively. If the hypothesis is accepted, call Z Granger causes X.

3.4.5 Vector Error Correction Model Test

Based on Granger (1988), if the variables in the model is said to be cointegrated, hence, Vector Error Correction Model based on Granger Causality must be carried out to avoid the misspecification problem. By running this test, it can tell the presence of both short-run and long-run causal relationship among the variables. The significance results of F-test will show the presence or absence of short-run causality while Error

Correction Term (EC_(t-1)) represents the long-run causal effects. Vector Error Correction Model based Granger Causality equation for this study can be shown as below:

$$\Delta CO_{2t} = a_1 + \sum_{i=1}^{m} \beta_{1,i}\, CO_{2t-i} + \sum_{i=1}^{n} \beta_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \beta_{3,i} \Delta TA_{t-i} + \sum_{i=1}^{q} \beta_{4,i} \Delta FDI_{t-i} + \mu_1 EC_{t-1} + \epsilon_{1t}$$

$$\Delta GDP_t = a_2 + \sum_{i=1}^{m} \emptyset_{1,i}\, CO_{2t-i} + \sum_{i=1}^{n} \emptyset_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \emptyset_{3,i} \Delta TA_{t-i} + \sum_{i=1}^{q} \emptyset_{4,i} \Delta FDI_{t-i} + \mu_2 EC_{t-1} + \epsilon_{2t}$$

$$\Delta TA_t = a_3 + \sum_{i=1}^{m} \delta_{1,i}\, CO_{2t-i} + \sum_{i=1}^{n} \delta_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \delta_{3,i} \Delta TA_{t-i} + \sum_{i=1}^{q} \delta_{4,i} \Delta FDI_{t-i} + \mu_3 EC_{t-1} + \epsilon_{3t}$$

$$\Delta FDI_t = a_4 + \sum_{i=1}^{m} \gamma_{1,i}\, CO_{2t-i} + \sum_{i=1}^{n} \gamma_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \gamma_{3,i} \Delta TA_{t-i} + \sum_{i=1}^{q} \gamma_{4,i} \Delta FDI_{t-i} + \mu_4 EC_{t-1} + \epsilon_{4t}$$

where, $\Delta =$ *the lag operator*;

$\alpha' s, \beta' s, \emptyset' s$ *and* $\gamma' s =$ the coefficient to be estimated;

m, n, p *and* $q =$ optimal lag for the series;

μ_1, μ_2, μ_3 *and* μ_4 =response measurement of variables to departure equilibrium

$EC_{t-1} =$ the error correction term;

$\epsilon_t =$ the random error term.

For an example to determine whether GDP Granger cause CO_2 or not the null hypothesis states that GDP does not Granger cause CO_2 while the alternative hypothesis states that GDP does Granger cause CO_2 in the short run:

$$H_o : \beta_{2,i} = 0 \; (GDP \; does \; not \; Granger \; cause \; CO_2 \; in \; the \; short \; run)$$

$$H_a : \beta_{2,i} \neq 0 \; (GDP \; does \; Granger \; cause \; CO_2 \; in \; the \; short \; run)$$

This test can be performed by using the Wald Test of restriction. If the F-test statistic of the Wald test is larger than the critical value hence the null hypothesis needs to be rejected. The Error Correction Term simply tells if there is long run causality. EC_{t-1} is said to be significant when its coefficient has a negative sign, smaller than zero and statically significant.

3.4.6 Diagnostic Checking

3.4.6.1 Jarque-Bera Test

The Jarque-Bera Test, a type of Lagrange Multiplier Test, is used to test the normality of a data. Normality is one of the assumptions for many statistical tests, like the t test or F test; the Jarque-Bera test is usually run before one of these tests to confirm normality. If any assumptions are violated, it can give an accurate result and can cause misleading in the research. A sample of skewness and sample of kurtosis is used in this test. It is a normality test that usually tests for huge datasets because other normality test is not reliable when the number of observations is too large.

Specifically, the test matches the skewness and kurtosis of data to see if it matches a normal distribution. The null and alternative of this test are;

$H_o: The\ error\ term\ is\ normally\ distributed$

$H_a: The\ error\ term\ is\ not\ normally\ distributed$

Based on the rejection rule, when 5% level of significance is larger than p-value, then rejected the null hypothesis. Hence, the error term is not normally distributed. As the variables are normally distributed and the p-value is larger than the 5% level of significance, do not reject the null hypothesis.

3.4.6.2 Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM test is a test that is used to examine whether there is an autocorrelation problem of error term due to the lag order of pre-specified integer. First order autocorrelation is used to test the correlated relationship between the error terms in the previous study. The null and alternative hypotheses are stated as:

$H_0: There\ is\ no\ autocorrelation$

$H_a: There\ is\ autocorrelation$

If the 5% level of significance is greater than the p-value, reject the null hypothesis. This means that error term is autocorrelated. This indicates the estimated OLS standard errors are invalid and the estimated coefficients will be inaccurate and inconsistent.

3.4.6.3 Heteroskedasticity Test

Heteroscedasticity test had been conducted to test whether there is heteroscedasticity in the residuals of the model. Heteroscedasticity occurs when the variance of the unobservable error conditional on explanatory variables is not constant. White test is one of the tests that is used to test for heteroscedasticity. Heteroscedasticity indicates that the OLS estimators are not Best Linear Unbiased Estimators (BLUE). The hypothesis can be expressed as follow:

H_0: *The error term is homoscedasticity*

H_a: *The error term is not homoscedasticity*

Reject the null hypothesis if the p-value is less than the 5% level of significance. If the null hypothesis is rejected, it is indicated that the error term is not homoscedastic, and it has heteroscedasticity problem.

3.4.6.4 Ramsey RESET Test

Ramsey's RESET test is designed to detect if there are any neglected non linearities in the model. The intuition behind the test is that if non-linear combinations of the explanatory variables have any power in explaining the response variable, the model is misspecified in the sense that the data generating process might be better approximated by a polynomial or another non-linear functional form. The null hypothesis of the RESET test says that the model is correctly specified

$$H_o: \delta_1 = 0, \delta_2$$

In large samples and under the Gauss-Markov assumptions, the usual F restrictions test follows the F(2, n − k − 3) distribution. If the F statistic is greater than the critical value at a given significance level, then the null hypothesis of correct specification will be rejected. This indicates that, there is a functional form misspecification.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter shows the findings and the result of the data. The empirical results are obtained by running some test from the software in EViews version 10. Tests that have been used in this study are Augmented Dicker-Fuller (ADF) and Phillips Perron (PP), Johansen Cointegration Test, Vector Error Correction Model (VECM) Granger Causality Test, and the Diagnosis Tests.

4.2 Unit Root Test

According to Granger and Newbold (1974), the outcome of regression results could be spurious assuming the variables has unit root (non-stationary). In order to prevent spurious estimation results, unit root test was conducted to reaffirm the stationarity of the variables before proceeding to cointegration and VAR or VECM testing procedures. From the various types of unit root test, Augmented Dickey-Fuller (ADF) unit root test and Phillips-Perron (PP) test is selected to verify the stationarity or non-stationarity of the series of LCO2, LTA, LGDP AND LFDI in India. These four variables were included in the estimation which named in the total carbon dioxide emission (LCO2), total tourist arrival (LTA), total gross domestic product (LGDP) and total foreign direct investment (LFDI).

Within the unit root test, the null hypothesis for both in the level, I (0) and first difference, I (1) represents the existence of unit root exists (non-stationary) meanwhile as for the alternative hypothesis represents the absence of unit root (stationary). The decision rule for ADF unit root test is reject the null hypothesis if the value of t-statistics is shown greater than the critical value in magnitude.

Based on the results in table 4.1 and table 4.2, in ADF unit root test, all the four variables mention were categorized as non-stationary variables at I (0) for ADF test. In order to determine whether all the variables were stationary at first difference I (1), the study proceed to I (1) and the results show that all of the intercept and trend and intercept form of LCO2, LTA, LGDP and LFDI are rejecting the null hypothesis. This is because t-statistics for both intercept and trend and intercept are exceeding the critical value in magnitude. This implies that the LCO2, LTA, LGDP and LFDI was stationary in the first difference.

Table 4.1 and Table 4.2 obtained from PP test at level indicating all variables such as LCO2, LTA, LGDP and LFDI are not significant level at 1 percent for intercept at level. However, result show only LFDI is significant 10 percent for trend and intercept at level. Overall, the testing does not reject null hypothesis which indicates that most of the variable are stationary at level. In constant at first different, all variables such as LCO2, LTA, LGDP and LFDI are significant at 1 percent of significant level for both trend and intercept and intercept in PP test because p-value is less than significant level. Thus, the testing rejects null hypothesis which indicates that all the variables are stationary at first difference.

Table 4. 1: Level at Augmented Dicker-Fuller (ADF) and Phillips Perron (PP) Unit Root Test

	Level			
Variables	ADF		PP	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LCO2	-1.126(0)	-3.262(0)	-1.052(3)	-2.137(3)
LGDP	2.282(0)	-1.444(0)	10.440(35)	-0.986(13)
LTA	1.587(0)	-1.743(0)	1.539(2)	-1.743(0)
LFDI	-0.902(0)	-4.344(0)	-0.577(7)	-3.437(1)*

Note: Asterisks (***) denoted as level of significant 1%, (**) level of significant 5% and (*) level of significant 10%

Table 4. 2: First Difference at Augmented Dicker-Fuller (ADF) and Phillips Perron (PP) Unit Root Test

	First Difference			
Variables	ADF		PP	
	Intercept	Trend & Intercept	Intercept	Trend & Intercept
LCO2	-6.223(0)***	-6.299(0)***	-6.265(3)***	-6.330(3)***
LGDP	-5.533(0)***	-6.118(0)***	-5.545(5)***	-13.892(34)***
LTA	-4.459(0)***	-4.783(0)***	-4.491(1)***	-4.689(3)***
LFDI	-6.340(0)***	-6.244(0)***	-7.700(9)***	-7.762(9)***

Note: Asterisks (***) denoted as level of significant 1%, (**) level of significant 5% and (*) level of significant 10%

4.3 Johansen-Juselius Cointegration Test

After ascertaining that every time series are stationary at first difference, the study employs the cointegration test procedure proposed by Johansen and Juselius (1990). The results of the Johansen and Juselius cointegration test are displayed in Table 4.3 which indicate that both trace and maximum eigenvalue test statistics simultaneously identify one cointegrating vector for the total carbon dioxide emission (LCO2), total tourist arrival (LTA), total gross domestic product (LGDP) and total foreign direct investment (LFDI).

Based on the result, it has enough statistical evidence to reject the null hypothesis at 5 percent level of significant and 10 percent level of significant. Trace test implies that there is one cointegrating vectors exist between the variables for the sample period at 5 percent while maximum eigenvalue test implies that there is one cointegrating vectors exist between the variables for the sample period at 10 percent. Trace statistics recorded 53.941 is greater than critical value of 47.856 at 5 percent level of significance whereas maximum eigenvalue statistic recorded 38.773 is greater than 27.584 at 10 percent level of significance. Therefore, it can be concluded that there is one long run equilibrium exists between the variables.

Table 4. 3: Results on Johansen and Juselius Cointegration Test

Null	Alternative	k=2		r=1	
		Trace Statistics	0.05 Critical Value	Max-Eigen Statistics	0.05 Critical Value
r=0	r=1	53.941***	47.856	38.773***	27.584
r≤1	r=2	16.168	29.797	9.668	21.132
r≤2	r=3	5.449	15.495	4.721	14.265
r≤3	r=4	0.778	3.841	0.778	3.841

Note: Trace test and Max-eigenvalue test indicate a cointegrating equation(s) at the 0.05 level. Asterisks (***) denoted as level of significant 1%, (**) level of significant 5% amd (*) level of significant 10%. Chosen r: number of cointegrating vectors that are significant under both tests.

Table 4. 4: Normalized Cointegrating Vector Test Results

Cointegration Equation	Normalized [t-statistics]
Constant	17.884
LCO2	-1.000
LGDP	-0.945[3.246]***
LTA	1.275[5.749]***
LFDI	0.135[5.197]***

Notes: The estimated coefficients were obtained by normalizing the independent variables with respect to their respective dependent variable (LCO2). Asterisk (***), (**) and (*) indicate statistically significant at 1%, 5% and 10% level respectively.

LCO2=	17.884	-0.345LGDP	+1.275LTA	+0.135LFDI
		[5.749]	['-3.246]	[5.197]

4.4 Vector Error Correction Model

The Johansen-Juselius cointegration results displayed there is one cointegrating vector, then later on the study proceed to examine the long run relationship between the variables. The existence of one cointegrating vector as shown in the Johansen and Juselius results had suggested that the variables are being cointegrated and a long run relationship does exist with one error correction term (ECT). Therefore, the author proceeds using Vector Error Correction Model (VECM) to conduct the test. According to the results in Table 4.3, the ECT of LCO2 in the tested model is less than 1, statistically significant at 5 percent level of significant (equal to critical value of 1.96) and negative value. LCO2 solely bears the brunt of short run adjustment to bring about the long run equilibrium.

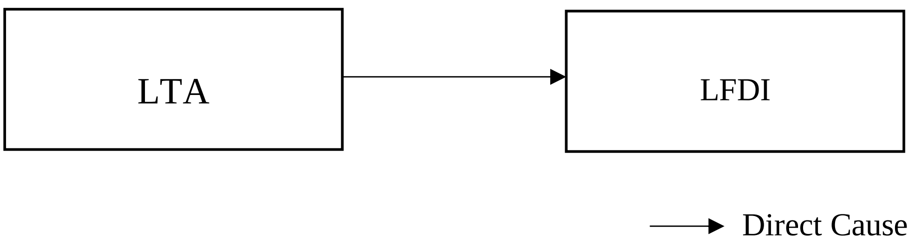
Based on above results, it could be seen that LFDI is the most endogenous variable because it can get influence by one variables (LTA). In other word, LTA is the most exogenous variable because it could influence one variable at the same period. Lastly, the coefficient of LNCO2 show 0.138% of adjustment to go back to the equilibrium and the coefficient of LNTA shows 0.392% of adjustment to go back to the equilibrium.

Table 4. 5: Vector Error Correction Results

Dependent Variable	χ^2-Statistics				ECT	
	ΔLNCO2	ΔLNGDP	ΔLNTA	ΔLNFDI	Coefficient	t-statistics
ΔLNCO2	-	1.837 (0.399)	0.427 (0.808)	2.021 (0.364)	-0.138	-2.974**
ΔLNGDP	0.158 (0.924)	-	1.801 (0.406)	1.218 (0.544)	0.392	2.835**
ΔLNTA	2.426 -0.297	1.798 (0.407)	-	6.745** (0.034)	0.032	0.704
ΔLNFDI	1.279 (0.528)	0.163 (0.922)	0.973 (0.615)	-	1.128	0.842

Note: χ^2-Statistics test the joint significant of the lagged value of the independent variables. The significance of the ECT evaluated with t-statistics, Δ is the first difference operator. Asterisks (***), (**) and (*) indicated significance level at 1%, 5% and 10%.

4.4 Granger-Causality Test



Source: Author's Estimation

Figure 4 1: Short Run Causality Direction

The rejection rule of VECM Granger causality is that the null hypothesis if p-value is smaller than the 5 percent level of significant. In other word, assume that the null hypothesis is being rejected, the independent variable does Granger cause the dependent variable. The Granger causality test in Table 4.5 has indicates that LFDI can

Granger cause TA in 5 percent level of significant. Based on Figure 4.1, it can easily detect the short run direction causality running from foreign direct investment (LFDI) have bidirectional relationship with total tourist arrival (LTA).

4.5 Diagnostic Test

Based on Table 4.6, the result of Jarque-Bera (JB) Normality test shows that the Jarque-Bera statistic is about 0.134, and the probability of obtaining such a statistic under the normality assumption is about 93.5%. Therefore, this indicate that, do not reject the null hypothesis that the error term is normally distributed and has no normality problem at 5 percent significance level.

Within Table 4.6, Breusch-Godfrey (BG) Serial Correlation LM test consists a probability of the test which is 0.851. This figure implies that an insignificant figure to 5 percent level of significance. Therefore, it can conclude that there is not sufficient evidence to reject null hypothesis. Therefore, there is no serial correlation problem on the model at 5 percent significance level.

As for Autoregressive Conditional Heteroskedasticity (ARCH) test results display in Table 4.6, the probability of Chi-Square is 0.284 which is insignificant at 5 percent significance level. Hence, null hypothesis cannot be rejected. Therefore, this concluded that the model does not have heteroscedasticity problem at 5 percent significance level.

For the Ramsey RESET test results as shown in Table 4.6, the probability for F-statistic is 0.277 which is insignificant at 5 percent significance level. Therefore, it can conclude that there is not sufficient evidence to reject null hypothesis. Hence, it can be concluded that the model is correctly specific at 5 percent significance level. Lastly, the CUSUM and CUSUMQ test is perform in order to check the constancy of the coefficients in the model. As shown in the Figure 4.2 and Figure 4.3, the results for both CUSUM and CUSMQ test shows that the blue line is within the red line, indicating that the model is stable.

Table 4. 6: Summary of Diagnostics Test Results

Diagnostic Test	Results (P-value)	Diagnostic Test	Results (P-value)
JB	0.134(0.935)	RESET(2)	1.239(0.277)
BG(2)	0.324(0.851)	CUSUM	Stable
ARCH(1)	1.148(0.248)	$CUSUM^2$	Stable

Notes: JB is Jarque-Bera Statistic for testing normality, AR and ARCH are the Lagrange Multiplier test for order serial correlation and ARCH effects, respectively. RESET refers to Ramsey RESET specification test. CUSUM and CUSUM2 are the CUSUM and CUSUM of squares stability tests. Asterisks (*), (**) and (***) denoted the rejection of null hypothesis at 10 percent, 5 percent and 1 percent significant levels, respectively.

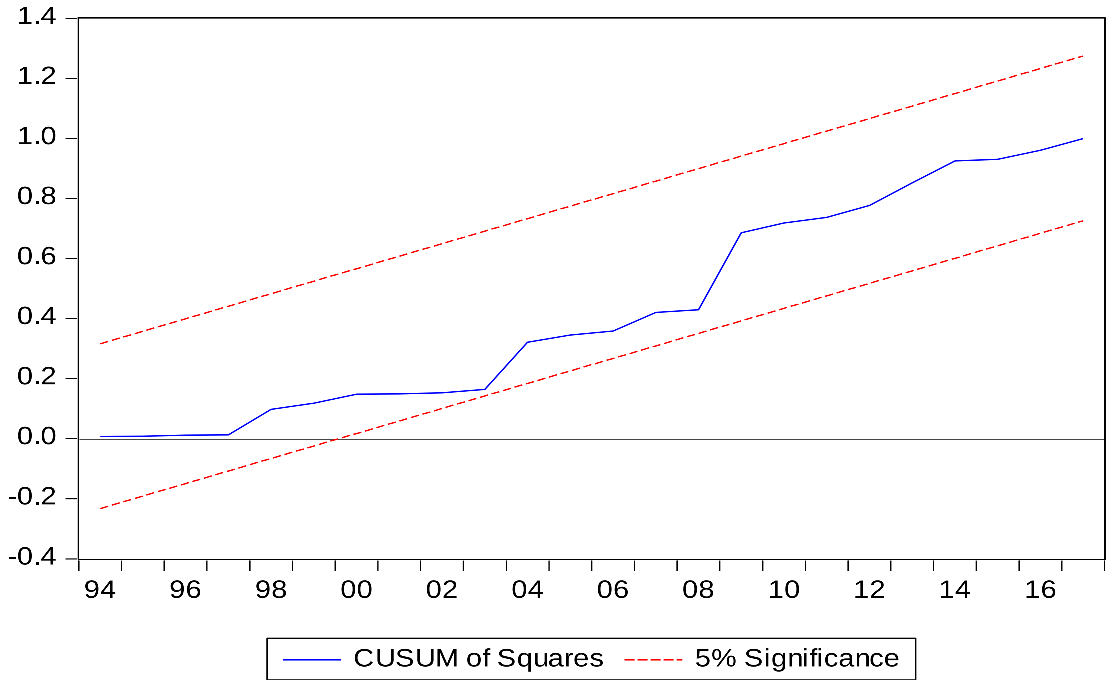


Figure 4 2: CUSUM Test Result

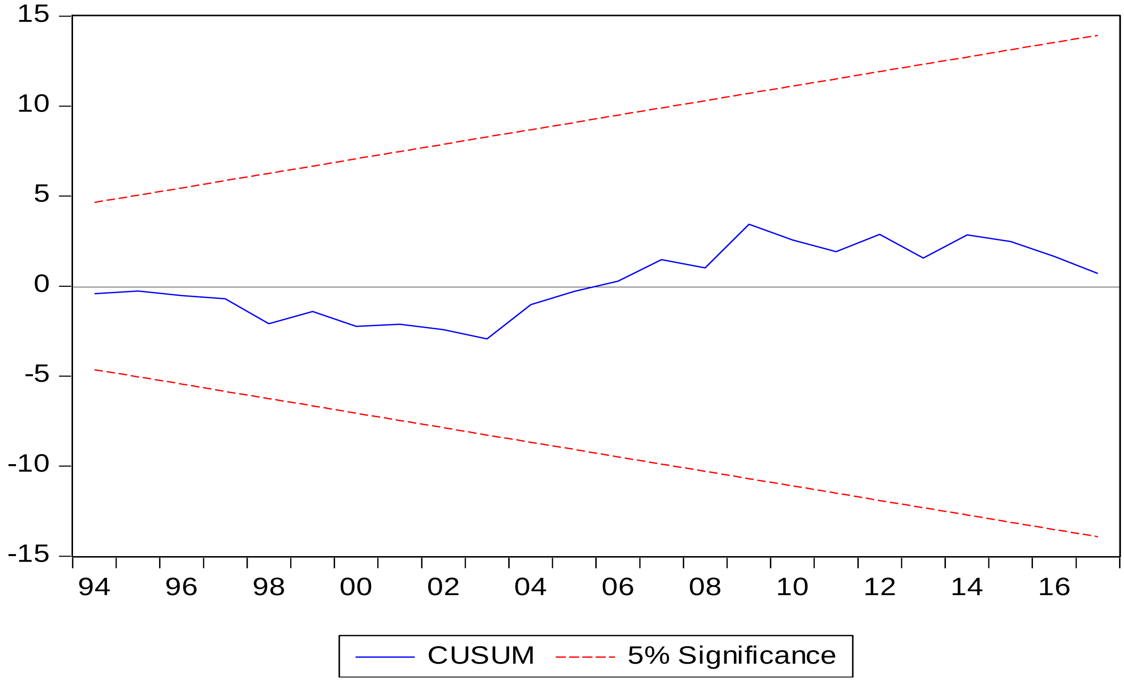


Figure 4 3: CUSUMQ Test Results

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter will conclude the overall data pertaining to the relationship between carbon dioxide emission and macroeconomic factors in India conducted in this report. This final chapter will also address the report's overview, policy makers guidelines and limitations encountered during the conduct of this research.

5.2 Summary of the Study

The objective of the study was to investigate the relationship between carbon dioxide emission and the macroeconomic variables in India. In this study, the period used for model estimations is annual data starting from year 1981 to 2017 and time series analysis is adopted throughout the study. There is specific test that have been employed in this paper which are Augmented Dickey Fuller (ADF) test and Phillips Perron (PP) test are used to determine the stationarity for each variable. Later on, Johansen-Juselius test is applied to determine the existence of long run relationship for the variables used in the estimation. The analysis is followed by Granger causality based on the Vector Error Correction Model (VECM) for India.

From the empirical results obtained, every variable is significant at 95 percent confident level and stationery in first difference where it is considered as I(1) for ADF unit root test. As for PP unit root test, all variables are significant at 99 percent of confident level for both trend and intercept which indicates that all the variables are stationary at first difference.

The next analysis is Johansen Juselius cointegration test to determine and clarify the existence of long run relationship for the variables used in estimation. The cointegration tests prove similar results for both Trace and Maximum Eigenvalue test. Trace test and Maximum Eigenvalue test were rejected at 5 percent significant level and 10 percent significant respectively. It also implies that there is one cointegrating vector. Based on the results obtained, there is a cointegrating vector or existence of a long-run relationship among the variables such as total carbon dioxide emission (CO2), total tourist arrival (TA), total gross domestic product (GDP) and total foreign direct investment (FDI) in India.

After performing the Johansen Juselius cointegration test, it is followed by the Granger Causality based on Vector Error Correction Model (VECM). VECM is adopted to examine the short run and long run causal relationship between the variables. From the results obtained, there is a short run direction causality running from total foreign direct investment to total tourist arrival. Based on the Granger causality test result, there is no presence of relationship among total carbon dioxide emission and other economic variable such as total tourist arrival, total gross domestic product and total foreign direct investment in the short run.

From the results obtained in this study, PHH does not appear to be an acceptable argument behind FDI inflow in India. This does not mean, however, that FDI inflow did not cause any environmental damages. Without having proper empirical estimates on the relationship between sectoral composition of FDI inflow and sectoral contribution of environmental damages it is premature to conclude either way. This is because the pollution intensities and emission rates differ across the sectors. Moreover, FDI inflows may have multiplier effects on sectoral growth which may also differ significantly across the sectors due to asymmetries in the production and labour market conditions. Thus, even a small FDI inflow may have a large long run growth impact on environmental damages caused by different industries.

5.3 Recommendation of Study

Based on the results of the empirical study, the result will recommend certain policy recommendation for this study in order to reduce the carbon dioxide emission in India. Indirectly, it will boost the economic growth in India. In our opinion, investment always play an important role to reduce the carbon dioxide emission in India. One of the mentioned economic variables is foreign direct investment (FDI), and this could be used to bring in capital investment, technology and management knowledge needed for economic growth. Moreover, the advancement in technology in terms of production can preserve the environment as primary objective and it will enhance the productivity of India's firms. For example, under the Government Route which is prior to investment, railways pitching for building bullet train coaches locally requires an approval from the Government of India. In fact, approval signal to India first bullet train network between Mumbai-Ahmedabad has not only strengthened the bilateral ties between two developed countries between India and Japan but also provide opportunities for a better environment with reduced carbon dioxide emission.

The other policy recommendation is voluntary approaches involving government and industry in India. The adoption requires all parties to focus on policy instruments such as economic growth, voluntary agreements and trading. This could influence its gross domestic product in India which consists of a specific initiative about their government and increasingly involving industry partners when developing or revising emission mitigation policies for any related industry sector. Various types of voluntary approaches which include India economic growth could be adopted to reduce greenhouse gas emission from industry by the India government through proper agreement with other developed countries such as Japan or America. Voluntary approaches can also be developed by government in allowing the collaboration between individual firms which often include setting emission reduction as their primary targets. For instance, India firms and government could monitor and report their company's emission inventory from time to time to understand their product and services in terms of whether or not they are legally binding, which also include sanctions for non-compliance mechanism projects or emission trading to boost India economic growth. Hence, the aims to meet a specific energy-efficiency or emission performance standard could have very different characteristics to increase economic development in India and reduce carbon dioxide emission.

Lastly, India tourism sector is considered as an important sector only after the independence and when the government introduced various schemes and plans for its development. Therefore, the government of India should provide the required support facilities and incentives to both domestic and foreign investors to encourage private investment in the tourism sector and introducing the regulatory measures to ensure social, cultural and environmental sustainability as well as safety and security of tourists. Besides, another policy recommendation for India is to take advantage of their availability of labour force in India in order to enhance tourists' experiences by training skilled and unskilled workers in the hospitality industry through public programmes. Assuming India’s potential growth could be realised, it needs a significant amount of managerial talent. One of the drawbacks of a career in hospitality industry is the lack of a clear career path and progression. India State in collaboration with the industry should continuously address major issue related to the reduction of carbon dioxide emission to be able to attract their best talent and maintain professionalism. In order to achieve high standards of professional skill development, it is equally significant to include training and skillset development of workers who are particularly involved in the environmental health of India.

5.4 Limitation of the Study

There are few limitations or constraints of this study. The first limitation would be the limited data available. Earlier stage of this research, urbanization and life expectancy are chosen as of the variables to this study, however after running through the system there is some unreasonable effects happened towards the equation make it impossible for it to be regressed in this study. Therefore, the variable need to be changed in order to further the study.

Secondly, the data of carbon dioxide emission available in the study is limited until 2014 which is available in the World Bank Database Indicator. However, to kerb the problem of outdated data in this study, the author need to forecast the data until 2017 to meet the timeframe like the other independent variables. This study may not really show the real state of affairs of current $CO2$ emission in India.

The lack of journals for this study makes it hard to find the resources to refer into the relationship between the variables of this study. This is because most of researcher having a different variable and different method of the empirical analysis in this study.

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