Foreign Direct Investment and the *Pollution Haven Hypothesis*: Evidences from Bangladesh

A Thesis Submitted as a Requirement for the Degree of Master of Philosophy in Economics

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CERTIFICATE

This is to certify that the dissertation titled: "**Foreign Direct Investment and the Pollution Haven Hypothesis: Evidences from Bangladesh"** submitted by Tonmoy Chowdhury for the fulfillment of the requirements for the degree of Master of Philosophy in Economics is her own independent and original research work carried out at the Department of Economics in the University of Dhaka under my supervision. This work has not been submitted in part or full to any other university or institution for any degree or diploma. We, therefore, forward this dissertation for evaluation and necessary action.

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DECLARATION

This is to certify that the dissertation titled: "**Foreign Direct Investment and the Pollution Haven Hypothesis: Evidences from Bangladesh",** submitted in partial fulfillment of the requirements for the degree of Master of Economics in Environmental Economics under the University of Dhaka is a record of bonafide research work carried out by me under the supervision of Dr. Syed Naimul Wadood, Department of Economics, University of Dhaka (DU). I, further, declare that this has not previously formed the basis for the award of any degree, diploma, fellowship or other similar title of recognition.

(Tonmoy Chowdhury) Dhaka, Bangladesh

DEDICATION

Dedicated to

My Beloved Parents

&

Younger Brother

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(**Tonmoy Chowdhury**)

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LIST OF ABBREVIATIONS

GHG: Greenhouse Gas

FDI: Foreign Direct Investment

UNCTAD: United Nations Conference on Trade and Development

OECD: Organisation of Economic Co-operation and Development

CO2: Carbon Dioxide

EKC: Environmental Kuznets Curve

MNC: Multinational Corporation

MNE: Multinational Enterprise

WB: The World Bank

GOB: Government of the People's Republic of Bangladesh

PHH: Pollution Haven Hypothesis

PHH: Pollution Holo Hypothesis

PH: Porter Hypothesis

ASEAN: Association of South East Asian Nations

ECOWAS: Economies of West African States

EIA Environmental Impact Assessment

ECA: Ecologically Critically Area

ECA: Environment Conservation Act

ECR: Environment Conservation Rules

DoE: Department of Environment

MoEF: Ministry of Environment and Forest

ETP: Effluent Treatement Plant

ZD: Zero Discharge

ZLD: Zero Liquid Discharge

ABSTRACT

This study investigates the potential existence of the Pollution Haven Hypothesis (PHH) in Bangladesh. The objective is to examine the impact of lax environmental policies on foreign direct investment (FDI) inflows and evaluate the subsequent effects of these inflows on pollution levels within the country. *Employing both quantitative and qualitative approaches*, the analysis incorporates the Johansen cointegration test, Vector Error (VECM), and Granger causality test, complemented by Key Informant Interviews (KII) with 12 experts. The Johansen cointegration test identifies a long-run relationship between CO2 emissions and FDI inflows, though this connection lacks statistical robustness. The VECM results suggest that FDI inflows are shaped by a combination of economic and environmental factors, with inflation emerging as a significant deterrent. The Granger causality test reveals no significant causal relationships between FDI and CO2 emissions, inflation, or trade openness, although FDI significantly impacts GDP per capita and electric power consumption. The *qualitative findings* emphasize low labour costs, market size, and geopolitical considerations as key determinants of FDI, while concerns are raised about the environmental risks posed by FDI in polluting industries. *Overall, the study has found limited evidence in support of the pollution haven hypothesis (PHH) in Bangladesh, concluding that weak environmental regulations are not the primary factor attracting FDI in Bangladesh.* The study advocates for strengthened environmental enforcement, the diversification of FDI into less polluting sectors, and the promotion of cleaner technologies to achieve sustainable industrial growth without compromising environmental integrity.

CHAPTER ONE
INTRODUCTION

1.1 Background and Motivation

Investment has long been recognized as a fundamental engine of economic growth, particularly in developing nations, where it plays a critical role in fostering productivity, generating employment, and encouraging technological innovation (Anwar et al., 1999; Kasyanenko et al., 2023). Historically, investment has been essential to economic development, but its importance became more pronounced in the 20th century when globalization intensified, and countries began liberalizing their economies to attract both domestic and foreign capital (Taylor, 2003). This period marked a significant shift, as many nations sought to tap into the global market by opening their doors to foreign investors, with international financial institutions like the International Monetary Fund (IMF) and the World Bank promoting private investment through structural adjustment programs (SAPs) (Zattler, 1989; Muhumed et al., 2016; Serven et al., 1991). These programs aimed to liberalize economies, reduce government intervention, and create environments that were conducive to both domestic and foreign investments, especially in developing nations.

Governments in these countries also took proactive measures to attract investment by implementing a range of policies, incentives, and regulatory frameworks designed to encourage capital inflows (Zampetti et al., 2018). Among these strategies was the establishment of Special Economic Zones (SEZs), where tax incentives, subsidies, and infrastructure support were offered to businesses in an effort to lure investors (Sauvant et al., 2015). As a result, investment in developing nations typically fell into two broad categories: domestic investment, which focused on internal capital and resource mobilization, and foreign investment, largely in the form of Foreign Direct Investment (FDI), which brought in external capital and expertise (Suprapto et al., 2022).

Domestic investment, often sourced from local businesses, government initiatives, and individual contributions, is key to developing a nation's infrastructure, such as roads, energy systems, communication networks, and essential services like healthcare and education (Weiss et al., 2016; Sayef, 2017). These foundational investments provide the groundwork for sustained economic growth and development by addressing basic needs and facilitating business operations. Meanwhile, foreign

investment, particularly FDI, is regarded as a complementary force, bringing advanced technologies, management expertise, and access to international markets (Ali, 2014). This influx of foreign capital is vital for industrialization, enabling developing countries to leapfrog stages of development and integrate more rapidly into global value chains.

FDI, defined as cross-border investments by firms or individuals from one country into the business interests of another, is widely acknowledged as a key driver of economic growth in developing nations, addressing critical challenges such as capital shortages, low productivity, and unemployment (Gregorio, 2003; Kukaj et al., 2016). Recognizing its potential, many developing countries have implemented a wide range of policies to attract FDI. These measures include fiscal incentives, such as tax breaks and financial subsidies, as well as the relaxation of regulatory frameworks, including environmental standards (Zampetti et al., 2018). The rationale is that by attracting foreign investment, countries can accelerate industrialization and stimulate long-term development (Ali, 2014).

While the economic benefits of FDI are well documented, concerns have emerged about its environmental consequences, particularly in relation to the Pollution Haven Hypothesis (Badri et al., 2014; Zheng et al., 2017). The PHH suggests that multinational corporations from countries with stringent environmental regulations may relocate their more polluting industries to countries with weaker environmental protections (Garsous et al., 2017; Gill et al., 2018). This allows them to cut costs associated with compliance, such as adopting cleaner technologies and managing emissions (Ferrari, 2018). As a result, developing countries with less rigorous environmental standards may inadvertently become havens for industries that contribute to significant environmental harm, including air and water pollution, deforestation, and depletion of natural resources (Hassaballa, 2014; Sarmidi et al., 2015).

The PHH has raised pressing questions about the trade-offs between economic growth and environmental sustainability (Mabey et al., 1999). Proponents of the hypothesis argue that in their pursuit of economic development, developing countries may deliberately or unintentionally weaken environmental regulations to attract foreign investors. This can lead to heightened environmental degradation, particularly in pollution-intensive sectors such as mining, manufacturing, and heavy

industry (Yoon et al., 2017; Dijkstra et al., 2015; Hayashi, 2006). Empirical evidence on the PHH is mixed. Some studies have shown that weak environmental policies correlate with the relocation of polluting industries to developing countries, particularly in sectors such as chemicals, oil refining, and textiles (List et al., 2000; Henna, 2010; Chung, 2004). This trend has been observed in Southeast Asia, Latin America, and Sub-Saharan Africa, where rapid industrialization has often coincided with environmental degradation (Behera et al., 2017; Sapkota et al., 2017).

However, other research indicates that FDI can yield positive environmental outcomes, especially when foreign firms introduce cleaner technologies and better management practices that enhance resource efficiency and reduce pollution (Xi et al., 2011). In some cases, FDI can promote sustainable practices by aligning with international environmental standards. As developing countries grow economically, they may strengthen their environmental regulations, a dynamic that aligns with the Environmental Kuznets Curve (EKC) theory (Ahmed, et al., 2020). The EKC suggests that while environmental degradation may rise during the early stages of economic growth, it eventually declines as countries reach higher income levels and prioritize environmental protection (Moreno et al., 2021). The evolving landscape of international trade and investment agreements has also influenced the discourse around FDI and the PHH. Many agreements now include provisions on environmental protections, and public awareness of environmental issues such as climate change and biodiversity loss has grown (Ferrari, 2018). Consequently, multinational corporations face increasing pressure from governments, consumers, and civil society to adopt sustainable business practices, regardless of the regulatory environment in host countries

Despite these trends, the core concern of the PHH remains relevant, especially as developing countries continue to compete for foreign investment (Begum, 2020). The challenge lies in balancing short-term economic gains with long-term environmental sustainability, particularly in nations with weak institutions, corruption, and poor enforcement of environmental laws (Begum, 2020; Aminu, 2005; Sarmidi et al., 2015). In countries like Bangladesh, this balancing act is particularly delicate, as rapid industrialization driven by FDI has sparked concerns about environmental degradation (Haque, 2013).

Bangladesh's experience with FDI is a prime example of these complexities. Over the past few decades, the country has successfully attracted significant foreign investment in sectors such as textiles, energy, telecommunications, and manufacturing (FDI survey report, 2020). This FDI has contributed to robust GDP growth and helped integrate Bangladesh into global value chains. However, the environmental costs have been substantial. In sectors like textiles, which account for a large share of FDI, pollution has become a major issue (FDI survey report, 2018; Haq, 1989). Factories often discharge untreated effluents into water bodies, contributing to widespread water contamination (Haq, 1989). Air pollution has also worsened due to industrial emissions, particularly in densely populated areas with high concentrations of foreign-owned manufacturing plants.

The evolution of Bangladesh's environmental policies in response to increasing FDI inflows has been marked by a delicate balancing act between growth and sustainability. In the early years of economic liberalization, the country prioritized investment and economic growth, often at the expense of environmental protection (Nahida, 2013). While Bangladesh has made progress in enacting environmental regulations, enforcement remains weak, particularly in industries such as textiles, energy, and manufacturing, which are vital for FDI (Haque, 2013). This dynamic raise significant concerns about the country's long-term sustainability. Compounding the issue is the lack of comprehensive data on key environmental indicators such as sulfur and nitrogen emissions, water contamination, and soil degradation (Nahida, 2013). Without such data, it is difficult for policymakers to fully assess the impact of FDI-driven industrialization on the environment. Moreover, the rising levels of PM 2.5 and deteriorating air quality present serious public health risks, particularly in urban and industrial zones.

In this context, the motivation for this study stems from the urgent need to explore how Bangladesh's relatively lax environmental policies influence FDI inflows and, conversely, how these inflows affect environmental health. The research aims to address key questions: Do weak environmental policies make Bangladesh a pollution haven? How do these policies impact FDI decisions, and to what extent does FDI contribute to environmental degradation? These questions are not only academically

important but also have significant implications for Bangladesh's policy framework and sustainable development goals.

By combining empirical analysis with qualitative insights from in-depth interviews with experts and foreign companies operating in Bangladesh, this study aims to provide a comprehensive understanding of the relationship between FDI, environmental policies, and sustainability. The ultimate goal is to offer actionable policy recommendations that can guide Bangladesh toward a more balanced approach to industrialization, one that harnesses the economic benefits of FDI while mitigating the environmental risks.

This research is critical for policymakers, international stakeholders, and civil society as Bangladesh continues its journey toward becoming a middle-income nation. Understanding the environmental costs associated with FDI and how they can be mitigated is key to ensuring the country's long-term sustainability.

1.2 Research Question

This study aims to explore the relationship between environmental policies and Foreign Direct Investment (FDI) in Bangladesh, particularly in the context of the Pollution Haven Hypothesis (PHH). The research question of this study is to investigate the effects of lax environmental policies on FDI inflows and to assess whether these inflows contribute to increased pollution levels in Bangladesh.

1.3 Goal and Objectives of the Study

Goal of the Study: The main objective of this research is to empirically analyze how lenient environmental policies influence FDI inflows and to evaluate the impact of these inflows on environmental degradation in Bangladesh.

Specific Objectives: In addition to the overarching goal, the study will focus on the following specific objectives:

- To examine the impact of lax environmental policies on FDI inflows in Bangladesh.

- To investigate the impact of FDI inflows on pollution levels in Bangladesh.
- To provide policy recommendations addressing the interplay between FDI and environmental degradation in the context of Bangladesh.

1.4 Study Methodology

The methodology of this study is meticulously designed to empirically investigate the impact of lax environmental policies on FDI inflows and to assess the extent to which FDI inflows contribute to increased pollution levels in Bangladesh. A mixed-methods approach is employed, integrating both quantitative and qualitative data collection and analysis techniques to provide a comprehensive understanding of the Pollution Haven Hypothesis (PHH) within the Bangladeshi context.

The quantitative analysis utilizes the Johansen cointegration test, the Vector Error Correction Model (VECM), and the Granger causality test to explore the relationships among the variables. Concurrently, the qualitative component consists of Key Informant Interviews (KIIs), which enrich the findings by incorporating expert perspectives. This dual approach facilitates a more nuanced exploration of the interplay between environmental policies, FDI, and pollution.

1.5 Scope and Limitations of the Study

Despite the growing importance of foreign direct investment (FDI) in global economies, its relationship with environmental policy laxity in Bangladesh remains underexplored at a theoretical level in the existing literature. This paper seeks to address that gap by providing a nuanced analysis of the intersection between FDI and environmental concerns in the context of Bangladesh. It departs from previous studies in two critical ways. First, while much research has focused on FDI prospects, determinants, and future outlooks (Rayhan, 2009; Rahman, 2012; Abdin, 2015; Sumon, 2014), there is a dearth of scholarship that explicitly links FDI inflows with environmental policy issues in Bangladesh. This study aims to bridge that gap by examining the environmental implications of FDI inflows in the country.

Second, to assess the environmental impact of FDI, this study evaluates the applicability of the "pollution haven hypothesis" (PHH) in Bangladesh, a concept that has been widely associated with FDI. While previous studies have examined the relationship between FDI and the PHH (Garsous, 2017; Yoon, 2017; Hassaballa, 2014; Aminu, 2005; Dean, 2002; Javorcik, 2004), most of this research is either global or regional in scope, with little focus on the specific dynamics in Bangladesh. By concentrating on Bangladesh's unique economic and environmental landscape, this study seeks to offer policy recommendations that can contribute to the ongoing trade and environmental policy debates, while also raising public awareness and providing timely inputs for policymakers.

A key limitation of this study lies in the restricted access to comprehensive industrial field data, which poses challenges in accurately capturing real-time pollution metrics. Additionally, the lack of detailed sector-specific environmental data complicates the analysis of industry-specific pollution patterns. Furthermore, this study's reliance on secondary data sources may limit the precision of its findings, and the absence of longitudinal data constrains the ability to assess the long-term impact of FDI on environmental degradation in Bangladesh. Finally, the scope of this study is limited by the exclusion of certain pollution indicators, such as PM 2.5 emissions and water and soil pollution, due to data unavailability.

1.6 New Contribution of the Study

This study makes several important contributions to the understanding of the relationship between environmental policies, foreign direct investment (FDI), and pollution in Bangladesh, offering both theoretical and practical insights. It advances the broader literature on FDI inflows and environmental regulations in developing countries by providing novel findings and implications that add complexity to the existing discourse.

A key contribution of the study is its extension of the Pollution Haven Hypothesis (PHH) within the context of Bangladesh. Despite the presence of relatively lax environmental policies, the analysis finds no statistically significant evidence to suggest that these policies attract FDI. This finding challenges the conventional assumption that developing countries with weaker environmental regulations tend to

attract higher levels of FDI, particularly in pollution-intensive industries. By demonstrating that lax environmental regulations are not the primary determinants of foreign investment in Bangladesh, this study offers a more nuanced understanding of the PHH and its relevance to specific developing economies.

Additionally, the inclusion of qualitative insights from Key Informant Interviews (KIIs) with experts adds depth to the quantitative findings. These interviews reveal that while FDI inflows are increasing in Bangladesh, a substantial portion of this investment is concentrated in industries with potential environmental risks. Experts expressed concern about the possibility of future environmental degradation, particularly if the government fails to implement and enforce stringent environmental regulations in environmentally sensitive sectors. These insights emphasize the need for stronger environmental governance to mitigate the potential adverse effects of rising FDI on the country's environmental sustainability.

In conclusion, this study contributes to both the theoretical discourse surrounding the PHH and the practical policy discussions on FDI attraction in Bangladesh. It offers a more refined understanding of the factors influencing FDI inflows, challenges conventional assumptions regarding the role of environmental regulations, and highlights the importance of policies that balance economic growth with environmental protection.

1.7 Organization of the Study

The rest of the dissertation has been organized as follows. This dissertation consists of five chapters.

Chapter One

This chapter provides background information on FDI and the pollution haven hypothesis. It also illustrates global, regional, and domestic trends in FDI inflows and their overall impact on the environment. In some cases, a positive relationship is observed between FDI inflows and pollution levels—the more FDI, the higher the pollution. However, studies on developing countries often show

that this positive interaction does not hold, with pollution levels not necessarily increasing alongside FDI inflows.

Chapter Two

This chapter is designed to review significant literature on FDI inflows and the pollution haven hypothesis. Key topics discussed include the definition and types of FDI, motives for FDI, and major FDI theories. The overall impacts of FDI inflows—such as economic, environmental, and social impacts—are also covered. Additionally, the chapter focuses on the pollution haven hypothesis (PHH) and its connection with FDI, explaining how they influence each other.

Chapter Three

This chapter outlines the methodology used in the study, detailing the data requirements, data sources, data collection procedures, and data analysis techniques. The hypotheses are also presented in this section. To fulfil the study's objectives, both quantitative and qualitative techniques were employed, with the detailed procedures for each discussed in this chapter.

Chapter Four

This chapter explains the environmental policy and its effectiveness in Bangladesh. It includes a brief analysis of the National Environmental Policy, Environmental Conservation Act, and Environmental Conservation Rules. Additionally, this chapter discusses the effectiveness of the environmental policy on the textile industry, as well as the power, gas, and petroleum industries.

Chapter Five

Chapter Five discusses the overall scenario of FDI in Bangladesh, covering various policies related to FDI from 1971 to the present, as well as the trends and sectoral distribution of FDI in the country. Additionally, a brief history of industrialization and environmental pollution is presented, and the chapter concludes with a summary.

Chapter Six

The outcome of the study is explained in Chapter Six, which is divided into two parts: Part A and Part B. To fulfill the study's objectives, both quantitative and qualitative methods were used. The results from the quantitative analysis are discussed in Part A, while the results from the qualitative analysis are discussed in Part B. Finally, the chapter concludes with a summary of the findings.

Chapter Seven

The final chapter of the dissertation, Chapter Seven, summarizes the major findings and suggests possible areas for policy recommendations.

CHAPTER TWO
REVIEW OF LITERATURE

2.1 Introduction

Investment has long been considered one of the key drivers of achieving high economic growth (Anwar, 1999; Sial, 2010; Sangeetha, 2015). Most developing countries around the world use investment as a tool to stimulate their growth and development (Epaphra, 2016; Anderson, 1990). However, the amount of investment in these countries is significantly low due to a low savings rate (Ganioglu et al., 2015). A critical analysis of the economic conditions in developing countries reveals a reluctance to save, primarily due to these low savings rates (Abu et al., 2013; Jagadeesh, 2015). Since capital formation depends on savings, and investment relies on the availability of sufficient capital, low savings rates adversely affect investment opportunities. Developing countries face a capital shortage due to low savings rates on one hand, and their limited capacity to attract sufficient foreign credit on the other. In this challenging situation, these countries turn to FDI to boost investment and achieve high economic growth. They view FDI as a key driver of economic growth (Azam et al., 2020). FDI can help a country by alleviating capital shortages, creating employment opportunities, and assisting in poverty reduction (Mwilima, 2003; Suharto, 2017). For these reasons, many developing countries actively seek FDI to strengthen their economies.

Since the 1980s, developing countries, particularly those in Asia and Africa, have experienced a surge in FDI inflows (UNCTAD, 2019). A report by UNCTAD provides a comparative analysis of FDI inflows in these two regions from 1980 to 2019. Although there has been some fluctuation in FDI inflows to African countries, a consistent increase is evident in Asian countries. For instance, in 1980, FDI inflows to Asia and Africa were just $573 million and $400 million, respectively. By 1990, these figures had risen significantly to $22,973 million for Asia and $2,845 million for Africa. From 2000 to 2019, Foreign Direct Investment (FDI) made a significant leap in two continents. In Asia, FDI increased from $142,031 million to $473,898 million, while in Africa, it grew from $9,651 million to $45,368 million.

(https://unctadstat.unctad.org/wds/TableViewer/tableView.aspx?ReportId=101). It is apparent that FDI is flowing into the developing countries of Asia and Africa at an increasingly rapid pace. However, this surge in FDI has not come without repercussions. On one hand, FDI has significantly contributed to stimulating economic growth and alleviating poverty. On the other hand, it has been accompanied by numerous unfavorable environmental externalities. It is widely believed that FDI plays a major role in degrading environmental conditions and contributing to resource depletion in developing countries (Margulis, 2003)

Keeping the above-mentioned facts in mind, this chapter will focus on issues such as the meaning and types of FDI, the motives and modes of FDI, major theories of FDI, the relationship between GDP growth rate and FDI, the nexus between FDI and the environment, and the Pollution Haven Hypothesis (PHH). Finally, the chapter will present key observations and highlight the research gap in the study.

2.2. Definition of FDI

When a producer or production entity from one country sets up a new outlet in another country or acquires an existing firm in that country, securing both ownership and managerial control of the firm, this is called foreign direct investment (Chung, 2014). This investment can be made in either manufacturing or non-manufacturing sectors. Well-known manufacturing sectors include technology, brand names, specialized skills, and marketing networks. In contrast, notable non-manufacturing sectors include finance, capital goods, and intermediate inputs.

According to a well-established definition provided by UNCTAD (2008), FDI refers to a long-term financial relationship between source countries and recipient countries (Ali, 2014). Source countries are those that invest in firms located in other countries, while recipient countries are those that permit or allow foreign investment in their domestic firms.

Thus, the process of obtaining ownership of a foreign firm beyond geographical boundaries is considered FDI. Items included in FDI are bonds, bank deposits, real estate, equity shares, land, industries, and production activities (Duce et al., 2003).

Therefore, any form of purchasing or acquiring ownership in a foreign firm qualifies as FDI. This can take the form of direct, indirect, or reinvestment, as well as equity capital and net borrowing (Ali, 2014).

So, it can be said that when investors from one country invest in another country and control the management of the firm they invest in, it is called FDI.

2.3. Types of FDI

FDI can be three types:

2.3.1 Horizontal FDI

When multinational firms produce homogenous goods and services for home countries and host countries it is called horizontal FDI. The principal objective of this type of FDI is to reduce transportation cost (Ramondo et al., 2011). Through this FDI multinational firms capture the foreign markets with minimum cost. Horizontal FDI minimizes tariff cost, transportation cost etc. This emerges as a substitute for export substitute industries (Kurtovic, 2012; Subhanij et al., 2016).

2.3.2 Vertical FDI

When multinational firms involve different types of production in different countries but that different types of production are related to the original production is called vertical FDI (Roording, et al., 2010). Through vertical FDI, value added chain of the Multinational Companies will be divided into different parts and these parts will be produced in different countries (Chung, 2014). The primary objective of vertical FDI is to reduce the production cost.

The cost of factors of production is varied among different countries. This cost differences among the countries create vertical FDI (Yokota et.al., 2007; Milliou et al., 2016). Vertical FDI can be backward and forward (Protsenko, 2003). So, it can be said that if a firm expands its production activities more than two stages, it is called vertical FDI.

2.3.3 Conglomerate FDI

In the case of conglomerate foreign direct investment investors choose completely different industries for investment.

2.4. Motives of FDI

Investors have certain motives to invest in foreign countries. There are four different types of motive behind the foreign direct investment (Dunning et al., 2008). These motives are: 1) natural resource seeking FDI 2) market seeking FDI 3) efficiency seeking FDI and 4) strategic asset seeking FDI. These are briefly explained in below:

2.4.1. Natural resource seeking FDI

When investors find the possibility of getting available resources at low price in any country compare to their home country, they become inclined to invest in those countries. This motive of FDI is defined as natural resource seeking FDI (Bitzenis et al. 2007). From the perspective of developing countries, this is the oldest form of FDI. The prioritizing sectors for this type of FDI are: raw material, physical infrastructure, stock of labor, skill and efficiency of labor (Kudina, 1999; IISD, 2002). Dunning has mentioned three types of resource seekers: 1) those who are interested to physical resource which includes raw material and different types of agricultural products etc 2) those who are interested to low paid unskilled and semi-skill labor 3) those who are interested in technological capacity, management skill and proper marketing system.

2.4.2. Market seeking FDI

When investor themselves ensure the production and supply of their own products and services to a foreign market then it is called market seeking FDI (Gorynia et al. 2007). This strain of FDI comes into being in the event of import restriction. The chief objective of this variety of FDI is not only to restrict import but also to lessen export as well as transportation costs. If investor find it more expensive to produce particular goods and services in home country than that of abroad, Investor choose to shit the production line to these less expensive foreign countries instead of exporting to these countries (IISD, 2002). Basically, to meet certain interest such as to capture the large consumer market in foreign countries, to minimize export as well as transportation cost, to minimize production cost and to ensure physical presence, investors became interested in investing in this type of investment.

2.4.3. Efficiency seeking FDI

Two factors influence most for the emergence of this variant of FDI. Firstly, Firms take the advantage of different production cost a well as availability and sufficiency of factors of production in different countries and access to them. Therefore, countries where supply of factors of production is abundant and cost of production is comparatively low compared to the home country, investors express their interest to invest in those countries (Kudina, 1999). Secondly, with difference in economies of scale, test of consumer and supply capabilities, firms get different sort of benefit out of these. On that account, Investors become very much inclined to invest to those countries where there is possibility of getting benefit related to economies of scale, large number of consumers and supply capabilities (Soud, 2011).

2.4.4. Strategic assets seeking FDI

The chief driving factor of this type of investment is to obtain new technological knowledge. Here, new technology attracts investors and motivates them to invest. The countries that have

the greatest possibility to use new technology, the investors prefer those technology rich countries to invest (Lintunen, 2011).

2.5. Theories of FDI

The need of FDI has been raised globally since the middle of the twentieth century. Many research works have been conducted on FDI theories (Soud, 2011).The researchers who developed concern among the policy makers about the necessity of FDI are Hymer, Dunning, Vernon etc. They have performed significant contribution to develop and improve the FDI theories. They believe that FDI could play an important role to enhance the economic growth of developing countries . Most of these theories are discussed under perfectly and imperfectly competitive markets structure. The theories that are discussed under perfectly competitive markets are: rate of return theory, market size theory etc. And the theories that are analyzed under imperfectly competitive markets are: production cycle theory, internalization theory and eclectic theory of FDI etc. These theories are briefly explained below:

2.5.1. FDI theories under imperfectly competitive market

The theories that deal with imperfectly competitive market structure are discussed below:

2.5.1.1. Production cycle theory

Vernon is called the architect of production cycle theory. He developed this theory in 1966. This dynamic theory of Vernon has brought great change in trade of a country in the long run. Vernon has mentioned four stages of produced goods in the production cycle theory. According to him every production maintains four stages of production. These stages are: innovation, growth, maturity and decline. Usually, these four stages are followed in the trade of the export of produced goods (Zeqiri et al., 2016).

In the first stage, when the goods are innovated, the countries that innovate the goods will be the consumer of the goods and export of these goods will be at a very limited scale as most of the produce is consumed by home market. Therefore, in this stage, producers remain confined to their domestic market as they produce only to meet their domestic demand. At this stage of production a technological gap is raised between the innovating countries and the rest of the world. Hence, innovating countries exercise a monopoly power and use this to garner much profit. Usually, this type of thing happens in developed countries (Denisia, 2010; (Marandu et al., 2018). In the second stage, importing countries will demand these products. In many cases, few countries even try to imitate this innovation. Thus, the number of producers as well as the level of competition increases as well. That being the case, volume of export of the innovating countries would fall and other competitors would move to capture the market share. Actually, in the second stages of production many countries of the world will show their interest on these products. It is at the third stages of production that the products get matured. At this stage, technology that is used to produce the products is well established and easily operable. Hence, semi-skilled labour can easily operate the technology and produce these goods. Underdeveloped and developing countries that have large number of second-rated and semi-skilled labor force can produce these goods at a convenient production cost. The low production cost of these countries then attract MNCs. And in turn by taking advantage of this low cost production method, the MNCs export these goods to the advance economies that were the inventors of those goods (Suod, 2011). The fourth and the last stages of production is the declining state of the product. At this stage of production, innovating countries that first invented the goods would be the net importer of these goods. Less developed and developing countries would be the net exporters of these goods because of the comparative advantage. This comparative advantage will shift from one nation to other which is also applicable in FDI.

2.5.1.2. The internationalization theory

This theory was developed by Buckly and Casson in 1976 (Ardiyanto, 2012). It's explained that MNCs organized their activities in such a way that they could create certain facilities in production so that they could enjoy few advantages through these special facilities later. These advantages are: brand name, technological efficiency, cheap and easy production process etc. MNCs could earn lots of profit from many countries of the world by using these advantages. They employ these advantages by creating imperfectly competitive market. MNC creates internal investment environment among the countries which would help them to fulfill their targets. The role of transaction cost is negligible here (Buckley, 2016; Zequiri, 2016; Nayak et al., 2014). Basically, Coase was the prime founder of the internalization theory. He gave this theory in 1937 in the national context. After that Hymer improved this theory in 1976 in which Hymer mentioned two important variables as a determinant of FDI. The first one is abolition of all competition and the second one is some special facilities that firms create through their internal activities (Hashim, 2012). Hymer explains that if the benefits that multinational companies generate through their internal production arrangements are more than the production cost of operating the production activities in other countries, large amount of FDI would be occurred. He also argued that MNC emerges because of imperfect market competition. This imperfect competition is market failure which is the deviation of perfect competition. Hymer also mentioned that firms are deprived of getting proper information while investing in foreign countries. MNC do not know the exact rules governing investment of the Government of other countries. They faced currency risk. Therefore, investors faced few adjustment costs also (Kastrati, 2013; Hashim, 2012; Denisia, 2010; Nayak et al., 2014).

2.5.1.3. Eclectic theory of FDI

Economist Dunning has developed Eclectic Theory of FDI to explain the reason behind the FDI of MNC. As claimed by this theory, foreign investment decision of investors is influenced

by three variables which are: ownership advantage, locational advantage and internalization (Makoni, 2015); Ardiyanto, 2012). Hence, this theory is known as OLI.

2.5.1.3.1 Ownership advantage

By achieving the ownership of some special resources, firms enjoy a couple of facilities in production which is called ownership specific advantage. These special resources are: possession of bundle of scare resource, innovative capacity, organizational capacity, marketing system, managerial skills, intellectual property rights such as; brand name, technological know-how etc (Ardiyanto, 2012). The firms that have the possession of these resources get special facilities compare to other firms that don't have in their possession these resources. The owners of those assets will also be possible. When MNCs find the possibility of getting these special resources to other countries, they show their interest to invest in those countries. But the importance of those resources' changes over time. For example, during 1970, physical assets were being prioritized in investment decision which included natural as well as mineral resources. Hence, countries that were abundant in natural as well as mineral resources had been the best destination for investment to investors. Therefore, Investors become prone to invest in that resource rich countries. However, the importance of physical assets in determining investment decision began to decline since 90's. The importance of physical assets are replaced by technology and brand name and with time Investors move their demand to these components (technology and brand name) for investment (Ruhl, 2016; Oppong, 2018; Abotsi, 2016; Denisia, 2010).

2.5.1.3.2. Internalization

This theory spells out why MNCs continue production through FDI to other countries instead of exporting or importing. It is a very important theory to get the full advantage of ownership and locational advantage. A firm's profitability depends on perfect utilization of ownership and

location advantage. Therefore, any safeguarding on that front would be profitable for the firm. If the benefits of internalization are more than costs, the MNCs may lean towards FDI (Ruhl, 2016; Oppong, 2018; Buckley, 2016; Abotsi, 2016; Denisia, 2010).

2.5.1.3.3. Locational advantage

Considerable importance has been given to locational advantage while invest in foreign countries. Mostly, this locational advantage determines which country will get how much FDI. The major determinants of locational advantages are: economic facilities, improve social infrastructure, political stability etc (Abotsi, 2016). Countries that ensure these facilities are the best destination for the investors to invest. There are, however, many theories on locational advantage. These theories explain what kind of resources are push factor for developing locational advantage. A brief explanation of these theories is given bellow:

2.5.1.3.3.1. Classical theories

Classical theories explain that abundance of natural as well as mineral resources are essential to create locational advantage of a country. They mainly focus on the importance of natural resource. However, man-made resource such as physical infrastructure is also equally important. The resources that they put high priorities are: quality and quantity of natural resources, availability of labor, market size, economic growth, income level, transportation cost, infrastructure and so on. Countries that ensure these facilities largely become the great destination for the investors.

2.5.1.3.3.2. Agglomeration theory

Factors that are considered critically in this theory are: market demand, market supply and externalities.

2.5.1.3.3.3. Theories related to govt. induced incentives

These theories emphasize Government induced incentives for investment to foreign investors. These incentives are: favorable tax policy, well defined rules and regulations for using natural and mineral resources etc.

2.5.1.3.3.4. Theories related to the presence of complementary assets

To attract MNCs for FDI this theory highlights on production, innovation and marketing. Mutual cooperation is essential for marketing. To maximize overall benefits transportation cost has to be reduced.

2.6.1.3.3.5. Theories of risk diversification

The MNCs diversify their portfolio among the potential countries to minimize risk

2.5.1.3.3.6. Knowledge enhancing theories of location

MNCs seek the countries in which they have scope to upgrade their knowledge. They put great emphasis on innovation. They increase their competence through upgrade technology and innovation.

2.5.2. FDI theories under perfectly competitive market

The theories that focused the perfectly completive market are illustrated below:

2.5.2.1. Market size theory

This theory explains that foreign investors will invest those countries where market size is large. Market size could be measure through number of populations, population growth rate, size of GDP, GDP growth rate etc. If source country finds that host country has large market, source country decides to invest to the host country. This makes investment profitable (Bajrami, et al., 2019).

2.5.2.2. Rate of return theory

Rate of return is an important theory to explain FDI. It is a classical theory of investment. The essence of this theory is that investors invest to those countries where rate of return is high. This rate of return, however, is varied among the countries. The differences of rate of return among the countries have made this theory. Investors' natural propensity is to invest to those countries in which the possibility of getting high return is of great vertical extent (Suod, 2011). This theory explains that other things being constant, only the movement of capital will increase from low return countries to high return countries. The process of movement will be continuing as long as the rate of return of both countries would be same. That means FDI continues as long as marginal cost and marginal return will be equal among the countries. But many researchers were not able to provide perfect evidence of this theory. They didn't find any correlation between capital flow and rate of return (Zeqri, 2016).

The weak point of this theory is, it failed to distinguish between foreign direct investment and foreign portfolio investment. In the portfolio investment investors have no control over the management of the investing firms. But in the foreign direct investment investors have direct control over the management of the firms.

From the above analysis it has been observed that investors decide to invest to those countries where factors of production are available with cheap market price. So, it is seen that factor abundant developing countries are naturally the preferred destination for the foreign investors. Developing countries on the other hand invite foreign investment to boost their economic growth rate. They believe that FDI may have positive impact on their economic growth and development. The relationship between FDI and GDP growth rate are discussed below:

2.6. Relationship between FDI and GDP growth rate

Many research works have been conducted on FDI and economic growth. The main objective of these research works is to analyze the effect of FDI on economic growth of different

countries across the world. According to the report of World Bank, from 1970 to 2006 the growth rate of FDI has increased by 23.4 percent around the world. In 2006, the total amount of FDI was $ 1.4 trillion and in 2019 it was $1.54 trillion (UNCTAD, 2019). This raising tendency of FDI may indicate the positive relationship between FDI and GDP growth rate (Turkcan et al. 2008). But this relationship may differ between developed and developing countries. Iihan (2007) found no significant impact of FDI on the economic growth of developed countries. But in case of developing countries the relation is positive and, to a large extent, significant. Two groups of researchers have opted two different views on how FDI could affect the economic growth of developing countries. One group of researchers believes that FDI has increased the dependency of the recipient countries and hampered their own development pattern ((Turkcan et al. 2008). Other group of researchers believe that the FDI inflow into the developing countries help to attain high economic growth. They argue that FDI inflow in the developing countries help to accumulate capital, expand investment activities, create employment opportunities, increase income level and thus eradicate poverty level (Chowdhury et al., 2006; Flexner, 2000).

Tamar et al. (2020) worked on the role of FDI on economic growth of one hundred eleven developing and developed countries. From the result it has been found that the impact of FDI on GDP growth rate is high in the developing countries and low in the developed countries. Dierk (2010) has found the opposite result. The author investigates the impact of FDI on economic growth of forty-four developing countries with a time span of almost three decades from 1970 to 2005. By using cointegration test and granger causality test the study found that the impact of FDI on forty-four developing countries is negative. Bilas (2019) observed impact of FDI on GDP growth rate of Croatia. By using ARDL model the study found that FDI has no significant impact on GDP growth rate of Croatia. Shitu (2018) investigated the impact of FDI on GDP growth rate of ECOWAS (West African Member States) countries. With the help of

panel cointegration test the study has found positive relationship between FDI and GDP growth rate. Bilas (2020) examined the relationship between FDI and GDP growth rate of 13 EU countries. The study has used sixteen years of observations from 2002 to 2018. By using panel ARDL model the study has found positive relationship between FDI and GDP growth rate. If FDI is high, GDP growth rate is high also and vice-versa. Abbas et al. (2011) examined the impact of FDI on economic growth of SARRC countries. The study has used nine years observations and the time that was covered was from 2001 to 2010. With the help of simple regression analysis the study found positive relationship between FDI and GDP growth rate. Sankar et al. (2020) observed the relationship between FDI and GDP growth rate. The study has used forty-seven years observations spanning almost three decades from 1970 to 2017. ARDL has been used to explore the relationship between the variables FDI and GDP growth rate. From the result the study has found the long run cointegrating relation between the variables and the direction of causality is unidirectional. In the short run GDP granger causes FDI but not FDI granger causes GDP. Mawugnon (2011) observed the relationship between FDI and economic growth of Togo. The study has used nineteen years observations and the time period was covered from 1991 to 2009. By using granger causality test the study has found unidirectional relationship between FDI and GDP growth rate. FDI granger causes GDP. That means GDP growth rate of Togo is influenced by FDI. Qureshi et al. (2021) examined the relationship among FDI, GDP growth rate and corruption of developed and developing countries. The study has used twenty-two years observations expanding a time frame from 1996 to 2018. By using PVAR model it has been found that in case of developing countries the relationship among the variables is positive but in case of developed countries the relationship is negative. Begum et al. (2018) examined the relationship between FDI inflow and GDP growth rate. The study has used twenty-eight years observations and the time period was covered from 1985 to 2014. Here, Data has been extracted from World Development

Indicators, World Bank. To explain the relationship among the variables such as FDI inflow, GDP growth rate and trade openness the study has used Johansen cointegration test, Granger causality test and variance decomposition techniques. From the result it has been found that there exists a long run causal relationship among the variables.

Obine et al. (2020) showed the impact of FDI on economic development of Nigeria. Data that has been used in the study were covering the period from 1981 to 2018 (27 years). To analysize the data the study used ARDL model. Data has been sourced from World Development Indicators/ World Bank. All observations were annual. Gross fixed capital information was used as a proxy to measure the economic development. The result of the study explained that FDI played positive role on the economic development of Nigeria. Moreover, the study also illuminated that for ensuring more FDI inflow into the country the Government of Nigeria should improve the infrastructure quality such as ensure electricity supply, improve roads and highways etc.

Grachunga (2019) explained the impact of FDI on economic development in Kenya. Impact of FDI upon three sectors has been depicted here. These three sectors are infrastructure, manufacturing and agriculture. Data that has been used in the study were covering the period from 2000 to 2017 (17 years). To explain the data the study used augmented Solow Model, which was developed by Mankiew in 1992. According to this model economic growth is a function of FDI, manufacture, infrastructure, and agriculture. This function explain growth model. GDP has been used as a proxy variable to measure the economic growth. Data has been extracted from World Bank, Kenya National Bureau of Statistics etc. The results of the study showed that FDI inflow has positive effects on the infrastructure sector of the Kenya. But it has no significant positive effect on manufacture and agriculture sectors.

Antwi et al. (2013) examined the impact of FDI on economic growth of Ghana. Data that has been used in the study were covering the period 1980 to 2010. All observations were annual. This data extracted from IMF. To analysis the data the study used OLS regression model. To measure the economic growth the study used GDP growth rate as a proxy variable. From the outcome of the study we found that there was a positive relationship between FDI and GDP growth rate. If FDI inflow increases, GDP growth rate also increases and vice-versa.

Tsaurai et al. (2012) showed the impact of FDI on economic growth in Zimbabwe. The net flow of FDI in Zimbabwe was very negligible from 1980 to 1990. Different types of policies taken by the Government were responsible for that low rate of FDI inflow. Since 1980, the Government policy regarding FDI inflow has changed in Zimbabwe. The Government of Zimbabwe adopted new investment policy in which they prioritized FDI issues. In the new investment policy, interest of foreign investors was considered with great attention. For instance, foreign investors got the opportunity to repatriate their 50 percent profit to their home country. In many cases this repatriation amount reached to even closer to100 percent. Because of these various types of incentives, the FDI inflow of Zimbabwe increased to a great extent from 1992 to 1997. Manufacturing and mining sectors were dominant in terms of FDI recepient during this time. Although the new investment policy trigared FDI inflow into Zimbabwe's economy more than before, this raising amount of FDI couldn’t be able to influence the economic growth positively. This study examined this causal relationship between FDI and GDP growth rate in Zimbabwe. Data that was used in this study was covering a period from 1980 to 2010. By using ARDL model the study found that there was a unidirectional relationship between FDI and GDP growth rate. That means if FDI inflow increases, GDP growth rate increases also but not vice-versa.

Koojaroenprasit (2012). Illuminate the impact of FDI on economic growth in South Korea. Before 1990 Korea was an underdeveloped country. But later on, various types of growth

enhancing factors had made South Korea a developed country. Among the growth stimulating factors, FDI is one of the most important one. This study examined how this FDI affects economic growth of South Korea. Data that has been used in this study was covering a period from 1980 to 2009. All observations were annual. Data were extracted from World Bank, and South Korean National Sources. Multiple regression model had been used to analyze the data. To measure the economic growth various types of proxy variable such as domestic investment, employment, export and human capital had also been used in this study. From the result it was found that FDI inflow in South Korea had positive effects on GDP growth. Besides FDI, human capital, employment and export had also had positive effects on FDI but domestic investment had no significant impact on FDI.

Saquib et al. (2013). Examined the impact of FDI on economic growth in Pakistan. Economic growth of a country is influenced by many variables. Of these different types variables, FDI is one of them. Many developing countries of the world considered FDI as an important growth stimulating factor. Like others, Pakistan has also considered FDI as an important variable to raise their GDP growth rate. This study examined the effect of FDI on economic growth rate of Pakistan. Data that was used in this study was covering a period from 1981 to 2010. Data were extracted from World Bank. OLS method was employed to analyze the data. Besides FDI, this study also used others important variables such as debt, trade, inflation and domestic investment. From the results it was found that FDI had negative effects on economic growth of Pakistan whereas domestic investment had contributed positively on GDP growth of Pakistan. Besides domestic investment other variables such as debt, trade, and inflation had also had negative impacts on GDP growth rate.

In light of the above discussion, it could be made out that most of the developing countries invite FDI to secure high economic growth. In many cases FDI has played positive role to achieve high economic growth of the developing (recipient countries) countries. Besides this

positive impact, FDI has also generated some negative environmental externalities for the recipient countries. Over the last few decades, the level of CO2 emission in the developing countries has risen greatly. Many argue that FDI is partially responsible for this heightened level of CO2 emission in those developing countries. So, the study has also discussed the connection between FDI and the environment below:

2.7. Nexus between FDI and Environment

Relation between environment and foreign direct investment is ambivalent. Some researchers with their work tried to establish a favorable relation between foreign direct investment and their effect on environment (Albornoz et al., 2009; Gorg et al., 2005). They are in the opinion that foreign direct investment accelerated the mobility of refined technology. Therefore, a commercial relationship builds between technologically rich countries and technologically backward countries which bring favorable input upon the environment. This technological mobility rises from MNCs foreign investment that is known as *Pollution Halo Hypothesis* whereas, other groups of researchers demonstrate that foreign direct investment bring negative environmental repercussion on environment (Kostakis et al., 2016; Levinson, 1996; Zarsky, 1999) . They argue that countries with stringent environmental regulation compel the investors to move their polluting industries into the countries where regulations relating to environmental pollution are relatively lax. This sort of manner ultimately contributes significantly in raising the pollution level of the world environment. Jun et al. (2018) studied the effect of FDI on pollution level in China. The authors largely focused on two types of emissions such as carbon dioxide (CO2) and sulfur dioxide (SO2) emissions. The staple objective of the study was to find out the impact of FDI on CO2 and SO2 emissions of china. The variables that were used in the study were FDI inflow, carbon dioxide emission and sulfur dioxide emission. Of the variables, dependent variable was FDI inflow and independent variables were carbon dioxide (CO2) and sulfur dioxide (SO2) emissions. Data was covering a period of 34 years from 1982

to 2016, and was extracted from World Bank, China Environmental Statistics Yearbooks. Wavelet technique was used to inspect the data. From the result it was found that FDI inflow elevated the carbon dioxide emission and sulfur dioxide emission level in China. It was only after taking the open up policy by the Government of China, the amount of FDI inflow had inflated significantly. This rising trend of FDI inflow swelled the pollution level specially CO2 and SO2 emissions of China. As FDI inflow was increasing overtime it accumulated large number of polluting industries which were in turn mostly responsible for CO2 and SO2 emissions both in the short run as well as in the long run. The study, therefore, found the existence of PHH in China. The author recommended that the Government of China should take proper initiatives such as green technology to reduce the upward trend of pollution level in China.

Baek et al. (2017) investigated, whether foreign direct investment harms the environment in developing countries. The primary objective of the study was to examine the effect of FDI inflow, energy consumption and income level on CO2 emission of the seventeen Latin American countries in the long run. Here, CO2 emission was dependent variable and the rest of the variables such as FDI inflow, energy consumption and income level were independent variables. Data was collected from World Bank and it was covering a period of 40 years from 1971 to 2011. Pooled Mean Group (PMG) was used to analyze the data. With the help of this econometric method it was found that the effect of FDI on CO2 emissions of seventeen Latin American countries was positive. This means that if FDI inflow increases CO2 emission increases also. Other independent variable such as energy consumption also found positive here. If energy consumption increases CO2 emission will increase also. In case of income level, the study revealed the truthfulness of Environmental Kuznet Curve (EKC).The study showed that initially income level increase caused CO2 level to leap up; however, it reduces after a threshold in income level is crossed. According to the study initially increasing level of income

caused CO2 emission but after a threshold level increasing income reduced CO2 emission. Thus, from the different outcomes of the study the authors found the existence of the PHH in these seventeen Latin American countries. To wit, a rational producer relocates his production activities from the countries where environmental policy is strict to the countries where environmental policy is lax.

Yoon et al. (2017) explored how environmental regulation affects the FDI decisions of Korean manufacturing sectors. The key objective of the study is to find out the validity of PHH. Because of the strict environmental policy in the home country the polluting manufacturing industries shift to the countries where environmental policy is lax. This process of relocation of polluting industries is known as PHH. From the outcome of the study, it was observed that FDI inflow was highly influenced by the environmental regulation of the country. But that effect was different for production and non-production part. In case of production part, if environmental policy is strict, FDI inflow will lower and vice versa. But environmental policy has no impact on FDI inflow in case of non-production part such as marketing, advertising etc.

Zheng et al. (2017) investigated the impact of foreign direct investment on the environment of China. Before 80's, Chinese economy was not so open. The Government of China took open up policy since 1980. After taking the liberal trade policy the inflow of FDI in China inflated significantly. According to the study it was found that in 1980 the total FDI inflow in China was $57million whereas in 2014 it reached to almost a doubling amount of $100billion. The pre-eminent goal of this study was to look into the effect of FDI inflow on CO2 emission in China. The variables that were used in the study were: FDI inflow, Carbone emission, GDP per capita, number of secondary and tertiary industries, energy intensity and unemployment rate. Among these variables CO2 emission was dependent variable and the rest of the variables were independent variable. Thirty provinces of China were taken as sample. Data, covering the period from 1997 to 2009, was excerpted from various sources such as Chinese Statistical

Yearbook, The Chinese Energy Statistical Yearbook, Chinese Economic Research Network, and The Statistical Database on CCER. From the results it was observed that FDI had positive impact on CO2 emission. This means that if FDI inflow increases, CO2 emission will increase too. This outcome also supported the validity of PHH.

Olufemi et al. (2016) carried out an inquiry into environmental quality and growth effects of foreign direct investment in Nigeria. In this study authors used forty-three years observations which were covering the period from 1970 to 2013. All observations were annual. Various types of variables such as per capita income, environmental degradation, foreign direct investment, human capital, inflation, trade openness, interest rate, CO2 emission were used in this study. Here, dependent variable was FDI inflow and the independent variables were per capita income, environmental degradation, human capital, inflation, trade openness, interest rate, CO2 emission. Among these variables CO2 emission was used as a proxy variable to measure the stringency of environmental regulations. The study showed that if the level of CO2 emission is low, environmental regulation will strict and vice versa. From the result of the study it was found that FDI inflow didn't severely affect the CO2 emission of Nigeria. The authors also pointed out that the level of CO2 emission shouldn't exceed the threshold level which was 67.4 percent. They argued that environment is luxurious goods whereas economic growth is essential goods. So, essential good like economic growth should be the first priority of the country like Nigeria. Though the country benefited from the FDI inflow through creating employment opportunities, eradicating poverty level but the level of CO2 emission shouldn't crossed that boundary level. In Nigeria level of pollution was high till 1070s. But, the level of pollution had been reducing since 1980. This happened because the Government of Nigeria took various types of initiatives to reduce the pollution level of the country. So, it could be concluded that EKC was valid in Nigeria. That means, at the initial stage of development,

growth and emission both rise but after the threshold level, growth rises but emission level declines.

Sarmidi et al. (2015) revealed how FDI inflow was influenced by environmental stringency and corruption of the developed and developing countries. One hundred ten developed and developing countries were taken as a sample. Data that was used in the study was covering the period from 2005 to 2012 and was drawn out from UNCTAD, Yale University, World Bank, World Economic Forum and Transparency International. The dependent variable of the study was FDI inflow and the independent variables were environmental performance index, WEF's stringency of environmental regulation, corruption perception index, GDP growth, inflation, private sector credit, total population, openness, number of telephone lines, etc. Environmental Performance Index was used to measure the stringency of environmental policy. Dynamic panel GMM method was used to analyze the data. From the result it was observed that stringent environmental policy discourages FDI inflow and lax environmental policy attracts more FDI inflow. Besides this environmental policy, corruption level of a country also influences the FDI inflow of a country.

Bialek (2015) inquired into the validity of Pollution Haven Hypothesis in German manufacturing sector. According to the study FDI out flow of the manufacturing sector was influenced by the pollution level of the sector. If pollution intensity is higher, FDI outflow will be higher and if pollution intensity is lower, FDI out flow will be lower. From the result it was found that FDI decisions of the investors depend on the level of pollution intensity of the firms. If the industry is more polluted, the investor will choose to relocate the industry from strict environmental policy to lax environmental policy country. But if the industry is less polluted, the investors have no intention to move their production activities to another country. Thus, it could be said that investors preference to move their production activities depend on the level of pollution intensity of that particular industry. Moreover, less polluting industry prefers the

places where environmental regulations are lax. Establishment of green field industry is highly influenced by the environmental policy of a country but merger and acquisition doesn't follow the same view.

Hassaballa, (2014) examined the effect of lax environmental laws in developing countries. Twenty-two developing countries were taken as sample and data were covering the period from 1990 to 2010; 20 years. Various types of variables were used to meet the objectives of the study. These variables were Carbone dioxide emissions, FDI inflow, availability of labor, market size, trade openness, macroeconomic stability, secondary school enrollment ratio, net energy imports etc. According to the study FDI inflow was dependent variable and the rest of the above-mentioned variables were independent variables. A fixed effect model with homogenous slope was used to analysis the data and the nature of the data was panel data. From the results of the study it was unearthed that CO2 emission had significant positive impact on FDI inflow of the developing countries. It indicated that lax environmental policy which was measured by increasing level of CO2 emission attracted more FDI in these twenty-two developing countries. Except human capital, other independent variables had significant and positive effect on FDI inflow. Most of the developing countries had low-skilled uneducated labor. The Government of developing countries should adopt appropriate policies to improve human capital and ensure more FDI inflow to its economy.

Ridzuan et al. (2014) examined environmental stringency, corruption, and foreign direct investment from a panel of countries. The objective of the study was to show the effect of strict environmental regulation as well as corruption on one hundred ten developed and developing countries. The variables that were used in the study were stringency of environmental regulation, honesty, openness, inflation, GDP growth, total population, financial development, and infrastructure. Among these variables, FDI inflow was dependent variable whereas the rest of the variables were independent variable. Data that was used in the study was covering the

period from 2006 to 2010. Data was extracted from UNCTAD, Yale University, World Economic Forum (WEF), Corruption Perception Index (CPI), Transparency International, World Development Indicators etc. By using Generalized Method of Moment (GMM) the study found that strict environmental policy reduced the FDI inflow in the developing countries and lax environmental policy in the developing countries raised the FDI inflow. This result supports PHH. Another explanatory variable honesty had also affected negatively on FDI inflow in the developing countries. If the corruption level is low in the developing countries, FDI inflow will also be low in those countries. Because profit maximize investors wouldn't invest those countries where honesty level is high.

Fan, (2012) looked into pollution haven behavior in China. The main objective of this paper was to investigate how environmental regulatory stringency affects the FDI in different provinces in China. The study took twenty-seven provinces in China. Data that was used in the study was covering the period from 1996 to 2003. These data was drawn out from Chinese Statistical Yearbooks, Provincial Statistical Yearbooks, Chinese Environmental Yearbooks, etc. The variables were total collected water, roads length, rail road length, number of year-end urban telephone, numbers of skilled, semi-skilled and unskilled labor, consumption per capita. Fixed Effect Model was used to analyze the data. From the result it was found that the existence of PHH was not valid in the country. Moreover, environmental regulatory stringency of different provinces in China didn't affect the FDI decisions. The Government of China took various initiatives to improve the environmental quality without the fear to loss FDI inflow.

Lu et al. (2012) scrutinizes the Pollution Haven effect in China. The primary objective of this study was to show how location decision of the firms influenced by the environmental policy of a country. Variables that were used in the study were: FDI, GDP growth rate, number of industrial production, number of retail consumption, number of road area, number of taxi, number of telephone, number of college students, number of high school students etc. Among

these variables, only FDI was dependent variable and the rest of the variables were independent variables. Data was extracted from Chinese City Statistical Yearbooks, Chinese Environmental Yearbooks, The State Council's Official Documents. These data were covering the period from 1992 to 2009. The Difference-in-Difference estimation method was used to analysis the data. From the result it is found that strict environmental regulations discourage FDI inflow.

Aminu (2005) studied the impact of environmental policy on FDI outflow of polluted industries. The study showed how FDI inflow affects the environmental quality of the host countries. To measure the environmental stringency two proxy variables such as environmental tax and environmental sustainability index was used in the paper. Fourteen developing countries of OECD was taken as a sample. Data was excerpted from Yale University and OECD dataset and these data were covering the period from 1990 to 2000; a eleven years periods. Panel data regression model was used to analyze the data. From the results it was perceived that strict environmental policy in the home countries increased the FDI outflow of polluted industries to the developing countries whose environmental regulations were lax. That means there is a positive relation between FDI outflow and environmental stringency. The more stringent the environmental regulations in the donner countries, the more the FDI out flow towards the recipient countries.

From the above discussion, it can be concluded that the relationship between FDI and the environment is equivocal. Some researchers have observed a positive impact of FDI on the environment, supporting the Pollution Halo Hypothesis. However, other researchers have found a negative impact of FDI, arguing that it is partially responsible for environmental degradation in recipient countries. This latter group supports the Pollution Haven Hypothesis. According to our topic, the Pollution Haven Hypothesis is stated below:

2.8. Pollution Haven Hypothesis

The Pollution Haven Hypothesis (PHH) can be seen as a tacit means of establishing trade relations between developed and developing countries (Gill et al., 2018). Since the 1970s, as global awareness of environmental pollution has grown, developed countries have increasingly focused on the strict enforcement of environmental regulations to ensure a healthier environment. As a result, strict regulations have been imposed on polluting industries in developed countries (Harris, 2004; Gill et al., 2018). These regulations, such as pollution fees, permit fees, and compliance costs, have raised the production costs of polluting firms (Kolstad, 2010). This increase in cost has led these firms to seek ways to reduce production expenses and maximize their profit margins.

In this context, trade liberalization has played a crucial role. Through liberalized trade policies, developed countries with stringent environmental regulations have relocated their polluting industries to developing countries with more lenient environmental policies. This process of transferring or relocating polluting industries is referred to as the Pollution Haven Hypothesis (Levinson, 1996). The hypothesis suggests that strict environmental regulations in developed countries drive polluting firms to shift their production infrastructure to countries with laxer environmental policies.

As a result, pollution levels in developing countries have escalated due to trade activities involving firms from developed countries (Aller et al., 2015). For instance, between 1970 and 2000, the ASEAN countries experienced a rise in CO2 emissions, largely due to the increase in exports of ‘dirty goods’ (Atici, 2012). Similarly, in Taiwan, both CO2 emissions and exports of dirty goods have increased (Yang, 2001). In countries like India and China, many polluting industries such as steel, iron, and chemical sectors have expanded their operations (Sawhney et al., 2015; Lopez et al., 2013).

The primary cause of this increase in CO2 emissions and the expansion of dirty exports is free trade policies. These free trade policies, along with lenient environmental regulations, are partly responsible for the environmental degradation in developing countries (Ibrahim et al., 2015; Kiuila, 2015).

In conclusion, free trade policies and lax environmental regulations have turned developing countries into pollution havens for dirty industries. The relocation of these industries from developed to developing countries often occurs through foreign direct investment (FDI). The amount of FDI a country receives depends on its environmental regulations. Countries with more relaxed environmental policies tend to attract more FDI, while those with stricter regulations see a reduction in FDI inflows. Thus, it can be concluded that the inflow of FDI is influenced by the environmental policies of the host country.

2.9. Major Observations and Research gap

Previous research on foreign direct investment (FDI) and economic growth in developing nations has generally shown that FDI positively influences economic growth. Developing countries often welcome FDI as a driver of their economic progress. However, it later became evident that the growing preference for FDI inflows in these nations often came with environmental hazards. As a result, it became clear that rising FDI can act as a catalyst for environmental degradation in developing countries.

Researchers have explained this negative impact through the Pollution Haven Hypothesis (PHH). Most studies support PHH, while a few have found no evidence to back it. Many developing nations have conducted research projects on the relationship between FDI and PHH. However, limited analysis has shown that no research has yet been conducted specifically on the relationship between FDI and PHH in Bangladesh. Therefore, the primary aim of this research project is to investigate the relationship between FDI inflows and PHH in Bangladesh,

particularly to determine whether increasing FDI inflows contribute to elevated pollution levels in developing countries like Bangladesh.

2.10. Conclusion

The main objective of this chapter is to explain the global and regional trends of FDI, the motives behind it, and major theories related to FDI. Additionally, the chapter explores the relationship between FDI, GDP growth, and the environment. The analysis reveals that FDI positively impacts the economic growth of many developing countries, contributing to the acceleration of their GDP growth rates. However, it also has a negative effect on the natural environment in these countries. In pursuit of economic growth through FDI, developing nations often compromise their environmental standards. Many polluting firms from developed countries relocate to developing nations via FDI, leading to environmental degradation in these host countries. This phenomenon is explained by the Pollution Haven Hypothesis (PHH), and all of these issues have been discussed in detail in this chapter.

CHAPTER THREE

Conceptual Framework and Research Methodology

3.1 Introduction

The primary aim of this chapter is to examine the relationship between foreign direct investment (FDI) and the pollution haven hypothesis in the context of Bangladesh. This chapter discusses the data requirements, data sources, data collection procedures, and data analysis methods employed in the study. To address the research objectives—namely, the effects of lax environmental policies on FDI inflow and the influence of FDI inflow on pollution levels in Bangladesh—two hypotheses have been formulated, which are outlined below:

Hypothesis 1:

H_0: Lax environmental policy has negative impact on FDI inflow in Bangladesh

H_1: Lax environmental policy has positive impact on FDI inflow in Bangladesh

Hypothesis 2:

H_0: FDI inflow has negative impact on pollution level in Bangladesh

H_1: FDI inflow has positive impact on pollution level in Bangladesh

To test these hypotheses, this study uses both quantitative and qualitative techniques. The detailed procedures of these two techniques are discussed in this chapter. Additionally, a brief summary of the chapter is provided at the end.

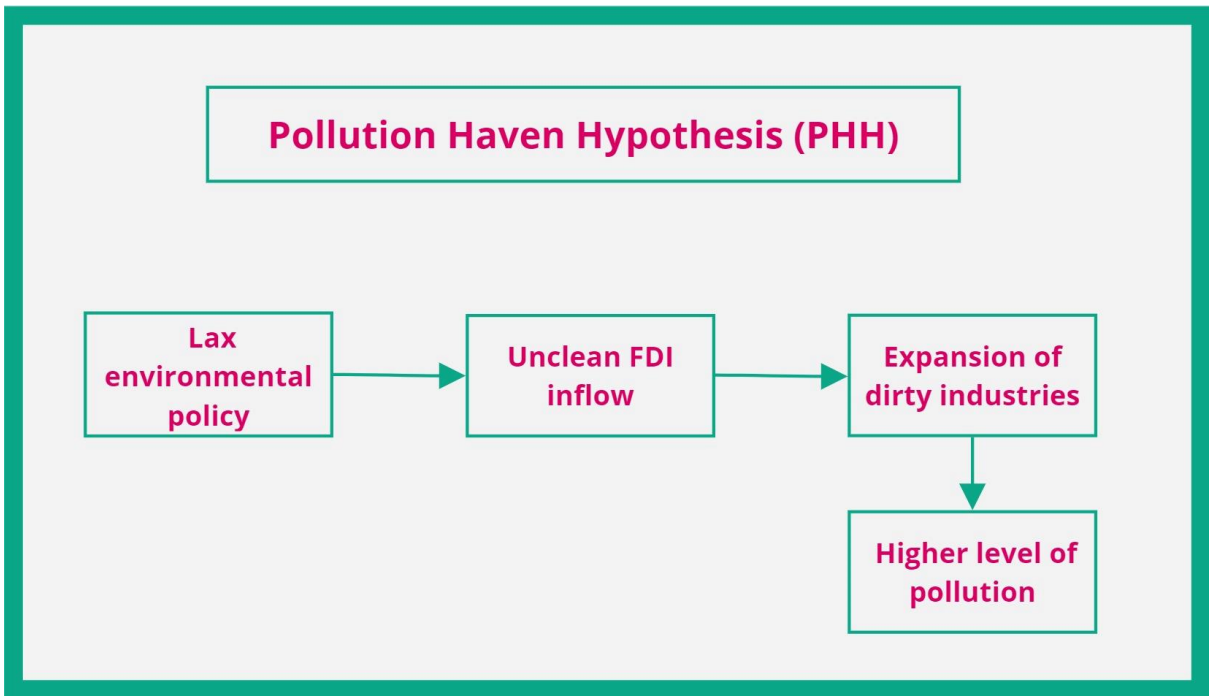
This chapter has been divided into three parts: Part A, Part B, and Part C. The theoretical framework of the research has been discussed in Part A, while the detailed procedures of the quantitative technique and the qualitative technique have been discussed in Part B and Part C, respectively.

Part A

3.2 Theoretical Framework

The theoretical framework for this study is based on the Pollution Haven Hypothesis (PHH), first introduced by Walter et al., in 1979 and later refined by Baumol and Oates in 1988 (Yi et al., 2023). This hypothesis posits that companies in developed countries with stringent environmental regulations relocate their polluting industries to developing countries where environmental laws are less strict (Gill et al., 2018). Foreign Direct Investment (FDI) plays a key role in this relocation, as firms invest in setting up operations in countries with more lenient environmental policies (Hassaballa, 2014).

Figure 3.2.1 A conceptual diagram of the Pollution Haven Hypothesis as applied to Bangladesh.



Source: Author's own compilation

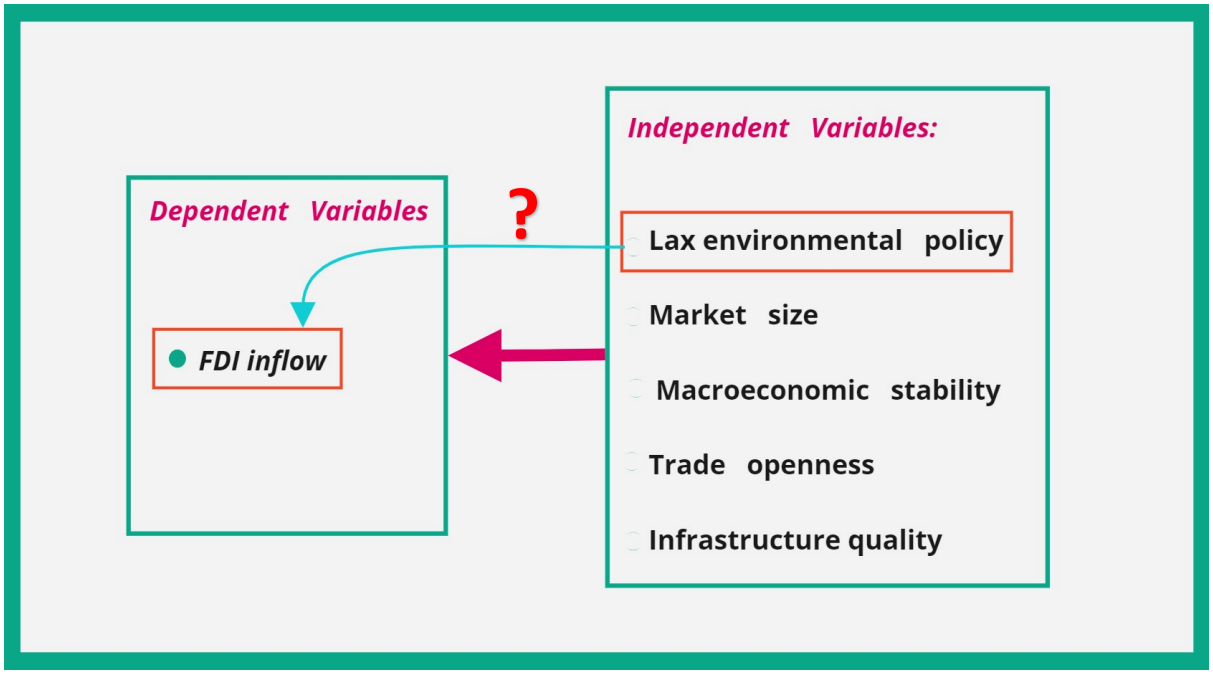
This hypothesis highlights the relationship between foreign investment flows, environmental regulations, and environmental outcomes (Kalamova et al., 2011). It explains how

environmental policies influence the FDI decisions of polluting firms globally (Randaccio et al., 2011). Countries with stricter environmental regulations may experience reduced FDI inflows as firms seek more favorable regulatory environments. Conversely, countries with more relaxed environmental policies may attract higher FDI, often at the cost of environmental degradation. This trade-off frequently leads to increased CO2 emissions and other pollutants, negatively affecting public health and local ecosystems.

As environmental regulations are increasingly viewed as secondary trade barriers, international trade and investment patterns are influenced by these regulations. In the context of North-South trade and investment, it is evident that flows between developed (global North) and developing (global South) countries are shaped by the environmental policies of both home and host countries (Gill et al., 2018). Most developed countries have stringent environmental regulations, leading pollution-intensive firms to relocate their production activities through FDI to developing countries, where environmental regulations are more lenient. Consequently, many developing countries in the global South become pollution havens for industries from the global North, where environmental standards are higher (Khcarslan et al., 2017).

Based on this framework, this study investigates the impact of lax environmental policies on FDI inflows in Bangladesh and the subsequent effect of FDI inflows on pollution levels in the country. The graphical representation of the theoretical framework is given below.

Figure-3.2.2: Graphical representation of the theoretical framework



Source: Perceived framework, adopted and modified from Hassaballa (2014))

The theoretical framework depicted in Figure-3.2.2 is adapted from Hassaballa (2014), who examined the impact of lax environmental regulations on FDI inflows in developing countries. Hassaballa (2014) employed a panel cointegration test and panel Granger causality test to analyze the cointegration and causality among variables. While this study utilizes Hassaballa's (2014) econometric model, it specifically focuses on Bangladesh as the country of interest.

Part B

Quantitative Technique

3.3. Empirical model specification

The empirical model in this study examines the impact of lax environmental policies on FDI inflows in Bangladesh, as well as the effect of FDI inflows on pollution levels in the country. Following the econometric framework of Hassaballa (2014), the implicit model used in this analysis is presented below.

3.3.1 Implicit model:

$$FDI_{inflow=} f (ENV, MS, MACES, TO, IQ)$$

Here,

FDI_{inflow} = foreign direct investment inflow

ENV = measure of lax environmental policy

MS = market size

MACES = macroeconomic stability

TO = trade openness

IQ = infrastructure quality

3.4 Choices of the explanatory variables

Environmental degradation is a major problem with the increase in foreign direct investment (FDI) inflow in developing countries (Hamid, 2016). Bangladesh is a developing country, and its environmental condition is worsening day by day. Due to flexible environmental regulations, domestic and foreign investments in polluting sectors are increasing. Besides lax environmental policy, this study has used several explanatory variables that may affect FDI inflow in Bangladesh. These variables include market size, trade openness, macroeconomic stability, and infrastructure quality. Many studies have used these explanatory variables as determinants of FDI inflow (Randelovic et al., 2017; Asghar, 2016; Hassaballa, 2014; Shah, 2013; Akin, 2009).

3.4.1 Dependent variables

The dependent variable of this study is FDI inflow. The study investigates the impacts of lax environmental policy on FDI inflow in Bangladesh and the impact of FDI inflow on the pollution level in Bangladesh. FDI per capita, FDI as a percentage of GDP, FDI inflows, net exports, and FDI net inflows are often used as proxies for FDI (Ayadi et al., 2019; Hassaballa, 2014). If a country has a strong and well-organized financial market, positive outcomes can

result from FDI inflow (Alfaro, 2003). It is important to take into account the role of financial markets when developing local policies and institutions to benefit from FDI (Carkovic, 2002).

3.4.2 Explanatory variables

The study uses the following explanatory variables:

3.4.2.1 Lax environmental policy

According to the Pollution Haven Hypothesis, strict environmental policies prompt producers of polluting goods to relocate from countries with stringent regulations to those with more lenient environmental policies (Aller et al., 2015). In this context, lax environmental policies tend to attract higher levels of foreign direct investment (FDI), while stricter policies discourage it. Several studies have used variables like CO2 emissions, the Environmental Performance Index (EPI), environmental taxes, regulatory delays, participation in international environmental agreements, environmental agencies' budgets, permit fees, and public awareness of environmental issues as proxies for environmental policy stringency (Hoffmann et al., 2005; Aminu, 2005; Ayadi et al., 2019).

Due to data availability, this study adopts CO2 emissions as a proxy for the laxity of environmental policies (Hassaballa, 2014; Aminu, 2005). Countries with weaker environmental regulations tend to create a favorable environment for polluting firms, which are often established through FDI, contributing to higher pollution levels. The more polluting firms a country hosts, the greater the pollution, as indicated by increased CO2 emissions. Therefore, CO2 emissions can be seen as a reflection of the strength of a country's environmental policies: higher emissions suggest more lenient regulations, while lower emissions point to stricter policies (Hassaballa, 2014).

This study assumes a positive relationship between CO2 emissions and FDI inflows. In other words, higher CO2 emissions, indicative of lax environmental policies, are associated with greater FDI inflows, whereas lower emissions, representing stricter policies, correspond to reduced FDI inflows (Hassaballa, 2014; Aminu, 2005).

3.4.2.2 Market size

Market size refers to the number of potential buyers and sellers within a given market for a specific product or service. Before launching a new product, investors carefully analyze the potential market size, which is a critical determinant of foreign direct investment (FDI) inflows (Chakrabarti, 2001). A large market enables businesses to capitalize on economies of scale and utilize resources more efficiently. Market size is typically measured using indicators such as GDP, GDP growth rate, per capita GDP, population size, and the size of the middle class.

Numerous studies have employed variables like GDP growth rate and per capita GDP as proxies for market size (Root et al., 1979; Tsai, 1994; Shamsuddin, 1994; Kandiero et al., 2006), while some studies have used population size as a proxy (Chakrabarti, 2001; Billington, 1999). In this study, GDP per capita is used as a proxy for market size due to data availability. Economies with larger markets tend to attract more FDI, suggesting a positive relationship between GDP per capita and FDI inflows.

3.4.2.3 Macroeconomic stability

Macroeconomic stability is another crucial factor in attracting foreign direct investment (FDI). Foreign investors seek countries where macroeconomic indicators perform consistently and predictably. Stable macroeconomic conditions create a favorable environment for both domestic and foreign investments, while instability in these indicators undermines investor confidence. Macroeconomic instability, characterized by high inflation, rising external debt,

and government expenditure deficits, introduces uncertainty into trade and investment, hindering economic growth and capital accumulation (Fisher, 1993; Alguacil et al., 2002).

Many researchers have used indicators such as the inflation rate, domestic credit to the private sector as a percentage of GDP, and the inflation GDP deflator as proxies for macroeconomic stability (Noorbakhsh et al., 2001). In this study, the inflation GDP deflator is selected as a proxy for macroeconomic stability. A negative relationship between the inflation GDP deflator and FDI inflow is assumed: higher deflator values indicate higher inflation and greater economic instability, which deters FDI, while lower deflator values, signifying more stable inflation levels, attract more FDI.

3.4.2.4 Trade openness

Trade openness measures the extent of a country's trade relationships with the rest of the world, a concept first introduced by economist Adam Smith in 1776 in his seminal work "An Inquiry into the Nature and Causes of the Wealth of Nations." Smith argued that trade enables nations to achieve positive gains (Salvatore, 2013). Later, many economists emphasized that trade openness could facilitate higher economic growth. It expands investment opportunities for multinational corporations (MNCs), leading to increased trade, job creation, poverty reduction, and overall economic development.

Economists view trade openness as a crucial determinant of economic growth. Many researchers have used trade volume as a proxy for trade openness (Kandiero et al., 2006; Asghar, 2016; Constant, 2010). Trade volume refers to the total value of exports and imports. High trade volume indicates low trade barriers and encourages foreign direct investment (FDI) inflows. Conversely, low trade volume suggests higher trade barriers and limited FDI inflow (Asghar, 2016). Some researchers, such as Mottaleb (2007), have used total exports and imports as proxies for trade openness.

This study defines trade openness as the ratio of (exports plus imports) to GDP, multiplied by 100, and assumes a positive relationship between trade openness and FDI inflow

3.4.2.5 Infrastructure quality

Infrastructure is a key factor in attracting foreign direct investment (FDI). Numerous studies have demonstrated that robust infrastructure promotes foreign investment, while inadequate infrastructure deters it (Rehman et al., 2011; Mlambo, 2006). Chakrabarti et al. (2013) found a positive correlation between FDI inflows and strong physical infrastructure in India. Similarly, Behname (2012) noted that well-developed urban infrastructure attracts foreign investment. Fung et al. (2005) echoed this view, stating that strong infrastructure attracts FDI, whereas poor infrastructure discourages it.

Many developing countries are actively competing to attract substantial FDI to address their capital shortages. As these nations face significant capital constraints, they have increasingly relied on FDI to meet their growing demand for capital. Consequently, most developing countries have prioritized infrastructure development to attract sufficient FDI, with the aim of alleviating their capital crises.

In various studies, infrastructure quality has been proxied by factors such as transportation costs, telecommunications, road and highway length, and electricity consumption (Rehman et al., 2011; Coughlin et al., 1991; Cheng et al., 2000; Wheeler et al., 1992; Khadaroo et al., 2010). Due to data availability, this study uses electricity consumption (kWh per capita) as a proxy for infrastructure quality and assumes a positive relationship between infrastructure quality and FDI inflows in Bangladesh.

3.5. Data Sources

For the specific objectives of this study, which focus on the impact of lax environmental policy on FDI inflows and the effect of FDI inflows on pollution levels in Bangladesh, secondary data has been utilized. The primary sources of this data include: the World Bank (World Bank),the United Nations Conference on Trade and Development (UNCTAD), Publications from the Government of Bangladesh, such as reports from the Ministry of Environment, Forest and Climate Change and the Bangladesh Bureau of Statistics.

Additionally, relevant technical documents and annual reports published by these agencies and departments were collected. Information on major trade and investment-related events, technical details, and historical policy decisions was also gathered from various official sources to support the study's objectives.

3.6 Methods of Data Collection

The secondary data for this study have been collected over a 46-year period, from 1973 to 2019. Data beyond this period were not included, as they were unavailable both before 1973 and after 2019. All observations are on an annual basis, as quarterly data were not found from the available sources.

Data on FDI inflows and CO2 emissions in Bangladesh were sourced from UNCTAD and the World Bank, respectively. Additional explanatory variables, including total population size, inflation (GDP deflator), electricity consumption (kWh per capita), trade openness, and others, were extracted from the World Bank's World Development Indicators (WDI).

3.7. Methods of Data Analysis

Different time series econometric models have been performed to achieve the objective of the study: whether lax environmental policies have any impact on FDI inflows and the effect of FDI inflows on pollution levels in Bangladesh. A cointegration test has been performed first, to find out whether there is any short or long run relationship is present here. Finding out the extent of the relationship (long-run profound relationship), the Vector Error Correction Model (VECM) has been considered to carry on. Finally, a Granger causality test is conducted to examine the causal relationships between the variables.

3.7.1. Data interpolation

To calculate the missing data, this study used 3MA methods.

3.7.2. Unit root test

A unit root test is a method used to determine if a time series is stationary. The major problem with the time series data is its non-Stationary characteristic (Maddala et al., 2004). Thus, stationary tests are compulsory to check the stationary level of the time series data. Stationary data means that the series has zero means and constant variance over time (Hamid, 2016). There are several techniques to check the stationary level of the time series data. These are Augmented Dickey Fullel test, Dickey Fuller test, KPSS test, AR test, MA test, ARMA test etc (Maddala et al., 2004). This study has used ADF test to find the unit root problem in the series. Augmented Dickey Fuller (ADF) test was developed in 1982 by Dickey and Fuller. According to the test if null hypothesis (H_0= 0) is zero, the series has unit root problem. The general form of the Augmented Dickey Fuller test is:

$$\Delta Xt = \alpha + \beta t + \phi Xt\text{-}1 + \theta 1 \Delta Xt\text{-}1 + \theta 2 \Delta Xt\text{-}2 \ldots\ldots\ldots\ldots\ldots\ldots \theta\rho \Delta Xt\text{-}\rho + \varepsilon t$$

Where, Xt denotes the time series variable to be tested, used in model. t is time period, Δ is first difference and ϕ root of equation. βt is deterministic time trend of the series and α denotes intercept. The numbers of augmented lags (ρ) determined by the dropping the last lag until we get significant lag. The Augmented Dickey Fuller unit root concept is illustrated through equation $\Delta Xt = (\rho-1)\ Xt-1 + \varepsilon t$, where, (ρ-1) can be equal to ϕ, if ρ = 1 so series has the unit root, so root of equation is ϕ = 0 (Raza et.al 2016).

3.7.3. Cointegration

The cointegration test demonstrates that cointegrated variables will not deviate from their equilibrium point in the long run (Maddala et al., 2004). This indicates a long-term relationship among the variables. Among various tests available, three popular methods for assessing the association among variables are the bivariate Johansen cointegration test, the bivariate Granger causality test, and the Phillips-Perron test (Fawson et al., 1994).

The Johansen cointegration test assesses whether two or more time series are cointegrated by employing maximum likelihood estimates to validate the cointegration relationship among the variables. There are two types of Johansen cointegration tests: 1) the trace test and 2) the maximum eigenvalue test. If the null hypothesis of no cointegrating relationship is rejected in both tests, it indicates the presence of a long-run cointegration relationship among the variables.

After confirming the cointegration relationship, the Vector Error Correction Model (VECM) is utilized to analyze both the long-run and short-run equilibrium. Once the cointegration relationship is established, the VECM model serves to explain the dynamics of long-term and short-term interactions among the variables.

3.7.4. VECM model

If a cointegration relationship is detected, we can use the Vector Error Correction Model (VECM) to analyze our study, as it signifies both long-term and short-term equilibrium. Conversely, if no cointegration is present, we can forgo the VECM and proceed with Granger causality to examine the causal relationships between the variables. Cointegration indicates the presence of linear combinations of non-stationary variables that can form stationary series (Osman et al., 2017; Asari et al., 2011).

A VECM with a negative and significant coefficient suggests that short-term fluctuations will ultimately stabilize the relationship between the variables over the long term. The results from the model will provide the long-term coefficients for our equation, which we will assess for statistical significance. The significance of these coefficients can be evaluated by comparing the t-statistics. For a variable to be significant at the 0.01 level, the t-statistic must exceed 4. At the 0.05 significance level, the t-statistic should fall between 2 and 4 (Anussha et al., 2016).

3.7.5. Least square (LS) method

To examine short-term relationships among the variables, we need the p-values for the coefficients. These values aren't directly available in the VECM. However, we can obtain them using the Least Squares (LS) method. If the p-values are below the 0.05 significance level, we reject the null hypothesis. If they are higher, we fail to reject the null hypothesis (Anussha et al., 2016).

3.7.6. Granger causality

Ganger causality test is used to identify the causality among the variables. For example, if x and y are two variables and they are cointegrated, we can say that x ganger causes y and y ganger causes x. Granger (1969) categorizes the relationship between two time series as

unidirectional, bidirectional, or independent. Granger causality analysis requires the data to be stationary; if it is not, differencing is necessary before testing for Granger causality. This method solely identifies the direction of causality and does not quantify the magnitude or effect of the variables involved.

The null hypothesis for the Granger causality test is H0: X does not Granger-cause the dependent variable Y. The alternative hypothesis is H1: X Granger-causes the dependent variable Y. We reject the null hypothesis if the p-value is less than 0.05, indicating statistical significance. This leads us to conclude that the dependent variable is indeed Granger-caused by the independent variable. If the p-value is greater than or equal to 0.05, we fail to reject the null hypothesis.

Part C

Qualitative Technique

3.8 Qualitative Analysis

To address the objectives of examining the impact of lax environmental policies on FDI inflows and the effect of FDI inflows on pollution levels in Bangladesh, this study employed a qualitative approach.

3.8.1 Data and Method

This study employed qualitative analysis, specifically through key informant interviews (KIIs), to explore the relationships between lax environmental policies, FDI inflows, and pollution levels in Bangladesh. The primary aim of conducting these interviews was to gather expert insights on the connections among these factors. Information was collected from relevant stakeholders, yielding valuable perspectives on the subject matter. KIIs provide qualitative data

by engaging with experts, policymakers, environmentalists, and other key individuals. These interviews illuminate the practical and contextual factors influencing the interplay between environmental policies, FDI inflows, and pollution levels. There may be unquantifiable elements—such as political motives, stakeholder interests, and gaps in regulatory enforcement—that affect environmental policies and FDI, which quantitative models may overlook. KIIs help to reveal these nuanced aspects.

3.8.2. Expert Selection Procedures

A purposive sampling technique was employed to select informants for the interviews. Informants were chosen based on their extensive knowledge of the research objectives and their expertise in relevant fields. The selected informants included academic scholars, researchers, industry experts, and ministry officials, among others. The interviews were conducted using a semi-structured interview guide. Some were held face-to-face, while others were conducted via Zoom. Voice recordings were made with the informants' consent. Details of the experts can be found in Appendix Table 3.8.2.

3.9 Conclusion

From the preceding discussion, it can be concluded that the primary aim of this chapter is to explain the research methodology of the study. To address the specific objectives—namely, the impacts of lax environmental policies on FDI inflows in Bangladesh and the effects of FDI inflows on pollution levels in the country—the study employed a mixed-methods approach. For the quantitative analysis, econometric methods such as cointegration tests, the Vector Error Correction Model (VECM), and Granger causality tests were utilized. This actually helped to get insight about the thin layer of the impact of lax environmental policies on FDI. All necessary data were collected from sources including UNCTAD, Bangladesh Bank, various government documents, reports, and previous literature. In the qualitative analysis, key

informant interviews (KIIs) were conducted, with informants being experts in their respective fields. Need explanation

CHAPTER FOUR

Environmental Policy and its Effectiveness in Bangladesh

4.1. Introduction

A massive discussion regarding environmental issues has been ongoing since the 1970s. Since then, it has been a significant challenge for global leaders to ensure a healthy environment while maintaining high economic growth (King et al., 2007; Cordero et al., 2004). Currently, most countries around the world are working to achieve the targets of sustainable development. Every nation is focused on attaining economic well-being, social well-being, and environmental sustainability (Coscieme et al., 2021; King et al., 2007). Like other countries, Bangladesh has concentrated on these areas to meet its sustainable development targets. Recently, Bangladesh achieved the status of a lower-middle-income country, moving up from least developed country status (The Daily Star, 2021). To attain this status, Bangladesh has opted for a path of industrialization (Economic Review, 2021; 7th Five Year Plan 2015 to 2021). Rapid industrialization ensures economic and social well-being; however, it also creates many negative environmental externalities such as pollution. Excessive use of natural resources, loss of biodiversity, and deforestation have resulted from industrialization (Patnaik, 2016). Therefore, the government has a responsibility to minimize these negative environmental externalities and to ensure a safe and healthy environment. To regulate irrational behavior and promote environmental health, the Government of Bangladesh has adopted various environmental policies. The major environment-related policies and their effectiveness are discussed below:

4.2. Environmental policies in Bangladesh

Environmental policy is a set of rules and regulations designed to regulate human behavior to protect the natural environment (King et al., 2007). The primary goal of these environmental policies is to safeguard the environment, ecosystem, and ecology. In Bangladesh, there are many laws, acts, and policies related to environmental issues. Currently, there are

approximately 210 laws and 30 policies concerning the environment in Bangladesh (Clemett, 2006; Hossain, 2014).

In the Constitution of Bangladesh, environmental issues are addressed in Article 18A. The article states: "The state shall endeavor to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests, and wildlife for the present and future citizens" (DoE, 2010). This article indicates that after gaining independence, this newly born state expressed significant concern for environmental conservation. The Bangladesh government has adopted several policies related to the environment from 1973 to the present. The first ordinance pertaining to the environment was declared in 1973, known as the "Wild Life Conservation Act" (Ahmed et al., 2016). The core environmental policies of Bangladesh are discussed below:

4.2.1. National Environmental Policy 2018

To minimize environmental problems, the Government of Bangladesh declared its first National Environmental Policy in 1992. This policy was adopted based on two UN conferences held in 1972 and 1992: the Conference on the Human Environment in Stockholm in 1972 and the Earth Summit in 1992. In 2018, the government declared the National Environmental Policy 2018 (Ahmed et al., 2012). The main objective of this policy is to ensure a sustainable and environmentally friendly industrialization process, as well as the conservation of the national environment. The central points of this environmental policy include: banning polluting industries, making Environmental Impact Assessments (EIAs) mandatory for new industries, encouraging the 3Rs (reduce, reuse, recycle), producing environmentally friendly products, adopting a zero-emission policy in industries, and promoting green products and green industries (National Environmental Policy, 1992; 2018). If these strategies are implemented effectively, we can expect a reduction in environmental degradation in the long

run. For the effective implementation of NEP'92, the Government of Bangladesh has adopted two supporting policies: the Environmental Conservation Act of 1995 and the Environmental Conservation Rules of 1997 (Ahmed et al., 2012).

4.2.2. Environmental Conservation Act 1995

In order to secure environmental protection, the National Environment Conservation Act was declared in 1995 (MoEF). This Act serves as a supporting framework for the National Environmental Policy. The top priority of the Environment Conservation Act (ECA '95) is to ensure the conservation of the natural environment and control environmental pollution. To protect the natural environment, Ecologically Critical Areas (ECAs) have been designated under ECA '95. If the ecosystem of any area or site is threatened, the government designates these sites as Ecologically Critical Areas (ECAs). Currently, ten sites have been declared as ECAs in Bangladesh.

Additionally, to protect the natural environment, restrictions have been imposed on filling wetlands, the 3Rs (reduce, reuse, recycle) have been encouraged in production, and limitations have been placed on the production, storage, transportation, and distribution of environmentally harmful products. To regulate environmental pollution, the provision for an Environmental Clearance Certificate (ECC) was introduced in the Environmental Conservation Act (ECA, 1995). According to ECA '95, it is mandatory for all industrial plants to obtain an ECC before commencing their production activities. Without an ECC, firms cannot continue their production. In cases of violation of the law, penalties have been established. The ECC is issued by the Department of Environment (DoE), and the procedure for obtaining an ECC is detailed in the Environmental Conservation Rules (ECR, 1997) (Ahammed et al., 2012).

4.2.3. Environmental Conservation Rules 1997

The Environmental Conservation Rules 1997 were adopted based on Section 20 of the Environmental Conservation Act of 1995. The Environmental Conservation Rules categorize industries and projects into four types based on the level of pollution they generate: Green, Orange-A, Orange-B, and Red categories (Environmental Conservation Rules 1997).

Among these four types of industries, Green and Orange-A categories do not require an Environmental Clearance Certificate (ECC), while ECC is mandatory for Orange-B and Red category industries. The Department of Environment (DoE) provides this ECC (Environmental Conservation Rules 1997). To obtain an ECC from the DoE, Orange-B and Red category industries must conduct an Environmental Impact Assessment (EIA). The purpose of conducting an EIA is to ensure a healthy environment. The DoE has introduced the EIA to ensure that the production activities of any industrial plant do not cause environmental degradation. The detailed procedure for obtaining an ECC is described in the Environmental Conservation Rules 1997. However, many experts opine that the EIA is a short-term solution and does not work effectively in the long run. Additionally, a well-organized framework regarding the standard quality of air, water, noise, and other environmental factors is outlined in ECR'97.

In addition to the policies, acts, and rules mentioned above, there are many other regulations in Bangladesh for the conservation of the environment. These include: Biodiversity Conservation Act 2017; Bangladesh Biosafety Rules 2012; Ecologically Critical Area Management Rules 2016; Sound Pollution Rules 2016; Environment Court Act 2000; Medical-Waste Rules 2008; Hazardous Waste and Ship-Breaking Management Rules 2011; Ozone-Depleting Substances Rules 2004; Brick Manufacturing and Brick Kiln Establishment Law 2013; Govt. Order about Reuse of Lead Acid Battery etc (Hossain, 2014; MoEF).

4.3. Effectiveness of Environmental Policies in Bangladesh

The Government of Bangladesh has adopted several policies, acts, and rules to preserve the natural environment (Hossain, 2014). The Ministry of Environment and Forests (MoEF) is the initiator of these policies, laws, acts, and rules and is also responsible for their implementation. To support and cooperate in its activities, the MoEF established the Department of Environment (DoE) in 1989 (Ahammed et al., 2012). The DoE is tasked with the practical implementation of these environmental policies, acts, and rules. It also monitors whether these environmental policies are being effectively implemented in practice. If the DoE observes that industries are producing harmful products, it will suggest to the government that the production activities of those industries be closed by not issuing an ECC. Therefore, it can be said that the effectiveness of environmental policy entirely depends on the active participation of the DoE. If the DoE is active, the environmental policy will be effective; otherwise, it may not be (Ahammed et al., 2012).

Two examples regarding the effectiveness of environmental policies are discussed briefly below, focusing on the textile and power industries. The reasons for selecting these two sectors are: 1) the current study examines the relationship between foreign direct investment (FDI) and the environment, and most FDI in Bangladesh is concentrated in these sectors; and 2) these industries contribute significantly to national economic growth while also being major sources of environmental pollution. Therefore, this study aims to investigate the effectiveness of environmental policies in these two sectors.

4.3.1. Textile industry and EIA

We have all heard about the environmental pollution caused by the textile industry, which consists of five sub-industries: spinning, weaving, dyeing, knitting, and export-oriented garments. Among these, the most polluting segment is dyeing (Mia et al., 2019). Although the

textile sector generates a significant amount of pollution, its contribution to the national economy is substantial. In fact, the textile sector is the most vibrant among the manufacturing industries. Approximately 80 percent of total exports come from this industry, and nearly 4 million people are employed in this sector (Economic Review, 2021). Despite these positive contributions, the sector also has negative impacts, such as pollution. In Dhaka city, 60 percent of total pollution is attributed to industrial sources, with the textile sector being the primary contributor to this issue (The Daily Star, 2021). Three important rivers—Buriganga, Shitalakkhya, and Turag—surrounding Dhaka have been declared dead rivers due to industrial pollution, resulting in the near destruction of their ecosystems (Parvin et al., 2020). This situation should not have occurred. According to the National Environmental Policy of 1992 and 2018, the establishment of polluting industries must be banned, and an Environmental Impact Assessment (EIA) is a mandatory requirement to obtain an Environmental Clearance Certificate (ECC) for red-category industries. If these policies were effectively implemented, the severity of environmental pollution would not be as high. The Environment Conservation Rules of 1997 (ECR'97) clearly state that without an ECC, orange-B and red-category industries cannot continue their production activities (Environment Conservation Rules, 1997). The ECC is issued by the Department of Environment (DoE) after conducting an EIA for each individual firm. The DoE is also responsible for monitoring these industries. However, in practice, the DoE has primarily focused on conducting EIAs and lacks strict rules and regulations for implementation. Industries often conduct EIAs solely to obtain ECCs, disregarding the actual environmental impacts of their production activities. The effective implementation of EIAs depends on the strong and active performance of the DoE. If the DoE is proactive, the implementation of EIAs will be assured. Therefore, to ensure the effective implementation of EIAs, financial and technical assistance to the DoE must be increased.

4.3.2. Power Sector and EIA

The contribution of the power sector is significant in achieving high economic growth through industrialization. Currently, the total electricity generation capacity is 21,778 MW (Economic Review, 2021). The overall electricity service has been unsatisfactory over the last few decades. The second perspective plan of Bangladesh has set a target to increase electricity generation capacity to 33,000 MW by 2031 and 56,743 MW by 2041 (2nd Perspective Plan 2021 to 2041, p. 135). Ensuring a sufficient supply of electricity is essential for sustainable development. In Bangladesh, the major source of electricity generation is gas. Of the total electricity production, 57.4 percent is gas-based, 32.4 percent is from liquid fuel, 2.8 percent is coal-based, 6 percent is imported, and 1.4 percent comes from other sources (2nd Perspective Plan 2021 to 2041, p. 132). The Government of Bangladesh has emphasized low-cost sources for electricity production. In this regard, non-renewable sources could be the best option. Non-renewable sources include gas, oil, and coal, among others. Among these, coal can produce electricity at the lowest cost. In India, 57 percent of electricity is generated from coal-based power plants, whereas, in Bangladesh, the contribution of coal-based power plants is only 2 percent (Eighth Five Year Plan 2020 to 2025). The government has set a target to increase electricity generation from coal-based power plants to 35 percent by 2041 (2nd Perspective Plan 2021 to 2041). Although coal-based power plants can generate electricity very cheaply, these non-renewable sources can lead to significant environmental degradation. In the USA, 33 percent of pollution is produced from coal-based power plants (Jain, 2015). The emissions released from coal-based power plants include SO_2, NO_x, CO_2, mercury, fly ash, and other heavy metals (Sharif et al., 2019). The National Environmental Policy of 1992 (revised in 2018) clearly states that the use of coal, gas, and oil for electricity production is discouraged. Emphasis has been placed on the use of environmentally friendly fuels such as solar, wind, and hydro to generate electricity (National Environmental Policy 2018). As the power, gas, and

petroleum sectors fall under the red category, obtaining an Environmental Clearance Certificate (ECC) is mandatory to operate production activities in the market (Environmental Conservation Rules 1997). To obtain an ECC, it is required for red projects to conduct an Environmental Impact Assessment (EIA). Now the question arises: is this EIA sufficient to minimize environmental pollution from red projects, or is it effective in fulfilling the targets of ECA'95 or NEP'92? In this regard, we will discuss two cases: the Rampal power plant and the Matarbari power plant.

Environmentalists have expressed concerns about the environmental risks and impacts of two joint venture projects: the Rampal and Matarbari power plants. The Rampal power plant is a joint venture between Bangladesh and India, while the Matarbari power plant is a partnership between Bangladesh and Japan (Ahmed et al., 2016). Environmentalists argue that the Rampal power plant could negatively affect the Sundarbans ecosystem (Chowdhury, 2017). However, according to the Environmental Impact Assessment (EIA) report conducted by the Department of Environment (DoE), the project is not expected to have any negative environmental impact. The validity of this report has been questioned.

According to the Environmental Conservation Rules (ECR) of 1997, it is strictly prohibited to establish any industrial plant within 24 kilometers of an Ecologically Critical Area. The Rampal power plant, however, has been built within 14 kilometers of the Sundarbans, which violates the ECR (TIB, 2015). Additionally, the EIA for the Rampal project was prepared by the DoE, which is a violation of the ECR and international law, as EIAs must be conducted by a neutral, independent body. Since the DoE is a government organization and it conducted the EIA for the Rampal project, it can be argued that the government evaluated its own project, which is a breach of international legal standards (Shakil et al., 2015). A similar situation occurred with the Matarbari power plant project.

4.4 Conclusion

In light of the above discussion, it can be concluded that Bangladesh has around two hundred environmental laws, acts, regulations, and policies. These laws and policies are comprehensive and well-structured, addressing various environmental problems and their solutions. In fact, the quality of these policies is comparable to any standard environmental policy globally. However, the primary weakness lies in the lack of effective implementation.

In Bangladesh, the Ministry of Environment and Forests (MoEF) is the key organization responsible for managing environmental policies. To support the MoEF in its activities, the Department of Environment (DoE) was established in 1989. The DoE is responsible for enforcing all environmental rules and regulations to protect the country's natural environment.

CHAPTER FIVE

Overall Scenario of FDI in Bangladesh

5.1 Introduction

Bangladesh is an agrarian country, with 70 to 75 percent of its rural population depending directly or indirectly on agriculture (Alauddin et al., 2014). The contribution of agriculture to GDP declined from 60 percent in 1974 to 13.35 percent in 2020 (Bangladesh Economic Review, 2020; Monirul, 2012), showing a gradual decrease over time. Therefore, it is essential to strengthen the industrial sector to promote economic growth. Numerous measures have been taken to bolster this sector. In 1971, the industrial sector contributed around 10 percent to GDP, and by 2020, it had risen to 35.36 percent (Nath, 2012; Bangladesh Economic Review, 2020). This gradual increase indicates the growing importance of the industrial sector. Foreign direct investment (FDI) has played a significant role in driving this growth.

The primary aim of this chapter is to examine the trends and patterns of FDI inflow in Bangladesh. Additionally, it offers a comprehensive analysis of sector-wise FDI trends and patterns, along with a brief overview of the relationship between FDI, GDP growth rate, and industrialization.

5.1.2 Trend of FDI inflow in Bangladesh

Post-independence, Bangladesh received its first foreign direct investment in 1973, amounting to only USD 2 million (Annexure: Table A1). This amount was quite negligible at the time. The industrial policies of the government and the devastated state of the economy were the primary reasons for this low investment. To combat poverty and achieve high economic growth through industrialization, the government launched its First Five-Year Plan (1973–78) (Kabir, 2013). The plan prioritized high economic growth, rapid industrialization, and poverty alleviation (Chowdhury, 1975). To achieve rapid industrialization, the government adopted the "Industrial Investment Policy" in 1973, which discouraged both domestic and foreign private investment (Mamun, 2020). As a result, FDI inflows to Bangladesh were minimal during this

period. After independence, the government declared that all industries would be transformed into publicly owned corporations. During the Pakistani regime, most industrial units were owned by West Pakistanis, so the newly formed Government of Bangladesh took over responsibility for these industries. At that time, 90 percent of companies were publicly owned, while only 10 percent were privately owned (Mollah, 2020). Foreign investors, however, were more interested in investing in the private sector, which was limited until the 1980s. Consequently, foreign investment remained insignificant until that period.

The investment scenario began to change in the 1980s, with the introduction of a privatization policy aimed at encouraging investment. Over time, many publicly owned companies were transformed into privately owned limited companies (Bhattacharaya, 1998). Since the early 1980s, foreign direct investment has gradually increased due to privatization policies implemented by successive governments. To further encourage FDI, the "Foreign Investment Act" was introduced in 1980. Additionally, the "New Industrial Policy" in 1982 and the "Revised Industrial Policy" in 1986 were adopted to attract foreign investment.

Despite these investment-friendly policies, FDI inflows remained modest until 1990. Prior to the 1990s, Bangladesh's economy was heavily dependent on foreign aid. However, during the 1990s, the country transitioned from an aid-dependent economy to a trade-dependent one. This shift accelerated the demand for significant investment, leading to the invitation of foreign investors to meet the growing investment needs. Later on, this policy continued, and various regimes have taken numerous measures to encourage FDI (Hossain, 2015). With the aim of increasing FDI inflow, the government introduced the "New Industrial Policy" in 1999. The government offered various incentives such as tax exemptions, tax holidays, the establishment of special economic zones, and the creation of a privatization commission. These attractive incentives helped increase FDI inflow into the economy.

The trend of net FDI inflow in Bangladesh from FY 1996-97 to 2019-20 is illustrated in the following table and figure:

Table-5.1.2 Trend of Net FDI inflow and total GDP of Bangladesh from FY1996-97 to FY2019-20

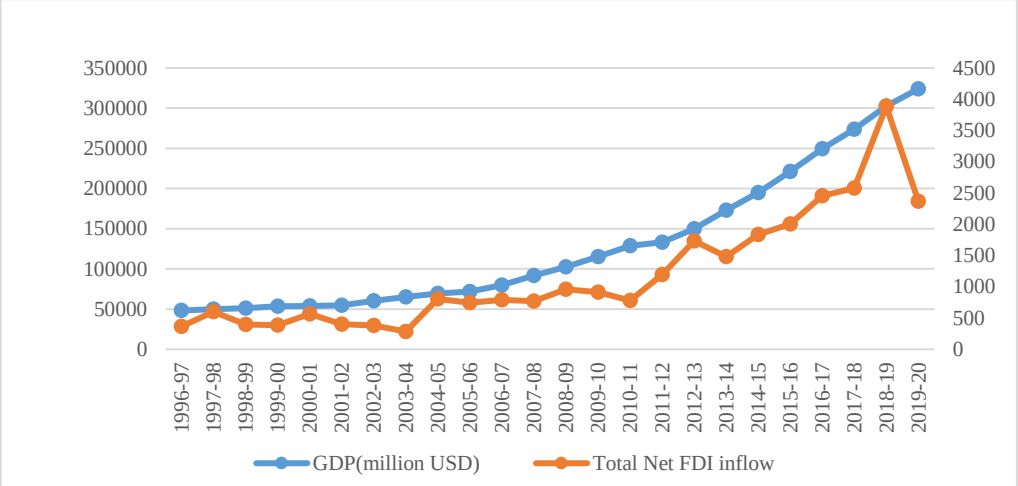
Year	Total GDP (million USD)	Net FDI inflow (million USD)	% of Net FDI inflow in GDP
1996-97	48244.309	366.85	0.76
1997-98	49984.559	603.30	1.20
1998-99	51270.57	394.10	0.77
1999-00	53369.787	383.22	0.72
2000-01	53991.29	563.93	1.04
2001-02	54724.081	400.93	0.73
2002-03	60158.929	379.18	0.63
2003-04	65108.544	284.16	0.43
2004-05	69442.943	803.78	1.15
2005-06	71819.084	744.61	1.03
2006-07	79611.888	792.74	0.995
2007-08	91631.278	768.9	0.84
2008-09	102477.79	960.59	0.934
2009-10	115279.08	913.02	0.79
2010-11	128637.94	779.04	0.61
2011-12	133355.75	1194.88	0.896
2012-13	149990.45	1730.63	1.15
2013-14	172885.45	1480.34	0.856
2014-15	195078.68	1833.87	0.94
2015-16	221415.19	2003.53	0.90
2016-17	249710.92	2454.81	0.98
2017-18	274038.97	2580.44	0.94
2018-19	302563.4	3888.99	1.29

2019-20	324239.18	2370	0.73

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Table 5.1.2 above shows the trend of net FDI inflow and GDP of Bangladesh from FY 1996-97 to FY 2019-20. From the table, it can be seen that Bangladesh received USD 3,888.99 million in FDI in FY 2018-2019, the highest amount to date, but this represented only 1.29 percent of its annual GDP. A significant portion of this, USD 1.47 billion, came from Japan Tobacco Inc., which drove the overall FDI figure up in FY 2018-2019 (The Daily Star, 2019). The country experienced its lowest FDI inflow in FY 2003-04, with only USD 284.16 million. The total net FDI in Bangladesh from FY 1996-97 to FY 2019-20 was USD 28,675.84 million, which is just 1 percent of GDP. Therefore, although the amount of net FDI has been increasing over time, its contribution to GDP has remained around 1 percent.

Figure-5.1.2 Trend of Net FDI inflow and total GDP of Bangladesh from FY1996-97 to FY2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure 5.1.2 above shows the trend of FDI inflow and GDP of Bangladesh from FY 1996-97 to FY 2019-20. From the figure, we can see that net FDI inflow into the economy increased at a steady rate from FY 1996-97 to FY 2003-04. After that, a more accelerated growth was observed until FY 2018-19. However, a sudden decline in net FDI was noted in FY 2019-20. One possible reason for this decline could be the impact of the global COVID-19 pandemic. According to a UNCTAD report, global investment fell by 42 percent due to COVID-19. In 2019, global investment stood at USD 1.5 trillion, but by 2020, it had dropped to USD 859 billion (The Daily Star, 2021).

5.1.3 Trend of Sector wise Net FDI inflow in Bangladesh

5.1.3.1 Manufacturing Sector

The industrial sector of Bangladesh consists of four sub-sectors: manufacturing, power, gas and water, mining and quarrying, and construction (Economic Review, 2020). Among these, the most vibrant is the manufacturing sector. In FY 2019-20, the manufacturing sector contributed 24.18 percent to GDP. Since industrial growth partially depends on the manufacturing sector, both domestic and foreign investments have been encouraged in this area. The trend of net FDI inflow in the manufacturing sector is shown below:

Table-5.1.3.1 Net FDI inflow in the manufacturing sector in Bangladesh from FY1996-97 to FY2019-2020

Year	Net FDI inflow (in million USD)	FDI inflow in Manufacturing Sector (in million USD)	% of total FDI inflow in the manufacturing Sector
1996-97	366.85	135.08	36.82159
1997-98	603.30	183.14	30.35637
1998-99	394.10	76.45	19.39863

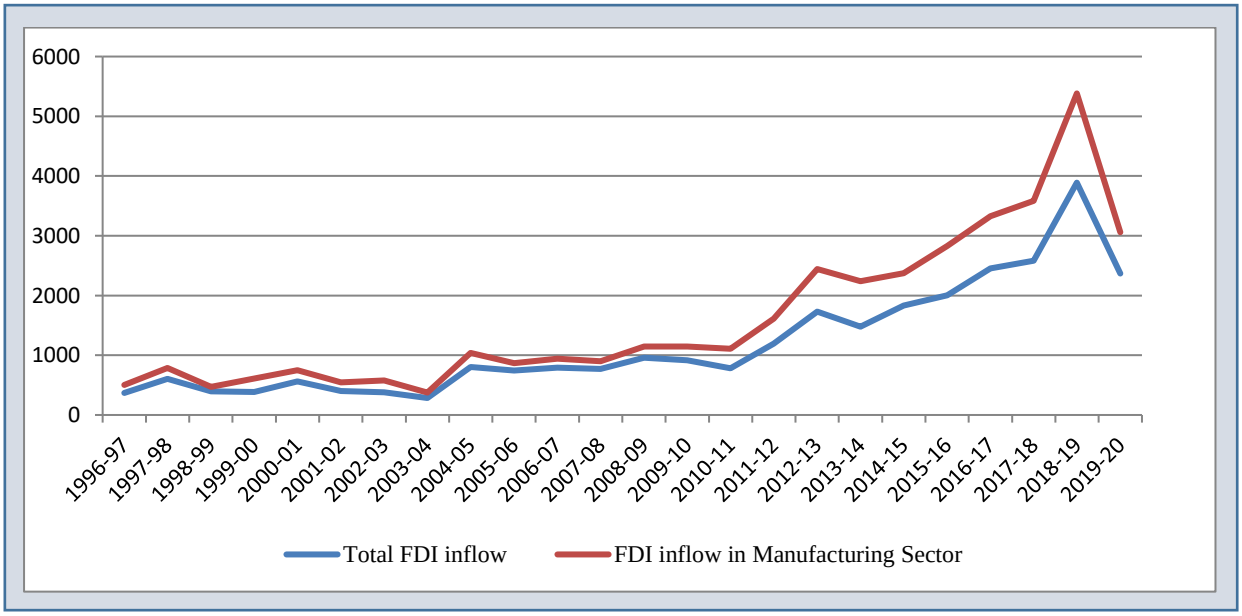
1999-00	383.22	225.79	58.91916
2000-01	563.93	183.95	32.6193
2001-02	400.93	143.99	35.914
2002-03	379.18	196.22	51.74851
2003-04	284.16	90.94	32.0031
2004-05	803.78	235.51	29.30031
2005-06	744.61	120.94	16.24206
2006-07	792.74	147.46	18.60131
2007-08	768.9	128.92	16.76681
2008-09	960.59	183.96	19.15073
2009-10	913.02	233.74	25.60075
2010-11	779.04	330.25	42.39192
2011-12	1194.88	414.98	34.72985
2012-13	1730.63	712.88	41.19194
2013-14	1480.34	757.47	51.16865
2014-15	1833.87	539.28	29.40666
2015-16	2003.53	825.85	41.21975
2016-17	2454.81	869.43	35.41741
2017-18	2580.44	1005.65	38.97204
2018-19	3888.99	1493.75	38.40972
2019-20	2370	688.77	29.062025

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Table 5.1.3.1 shows the trend of net FDI inflow in the manufacturing sector. This sector received the highest amount of FDI in FY 2018-19, totaling USD 1,493 million, which accounted for 38.41 percent of the total FDI inflow. In FY 1998-99, the sector received the

lowest amount of FDI: USD 76 million, which was only 19.39 percent of the total. Analyzing the year-by-year FDI inflow, we find that from FY 1996-97 to FY 2019-20, the net FDI inflow in this sector totaled USD 9,924.4 million, representing 34.60 percent of the total.

Figure-5.1.3.1 Trend of net FDI inflow in the manufacturing sector in Bangladesh from FY1996-97 to FY2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

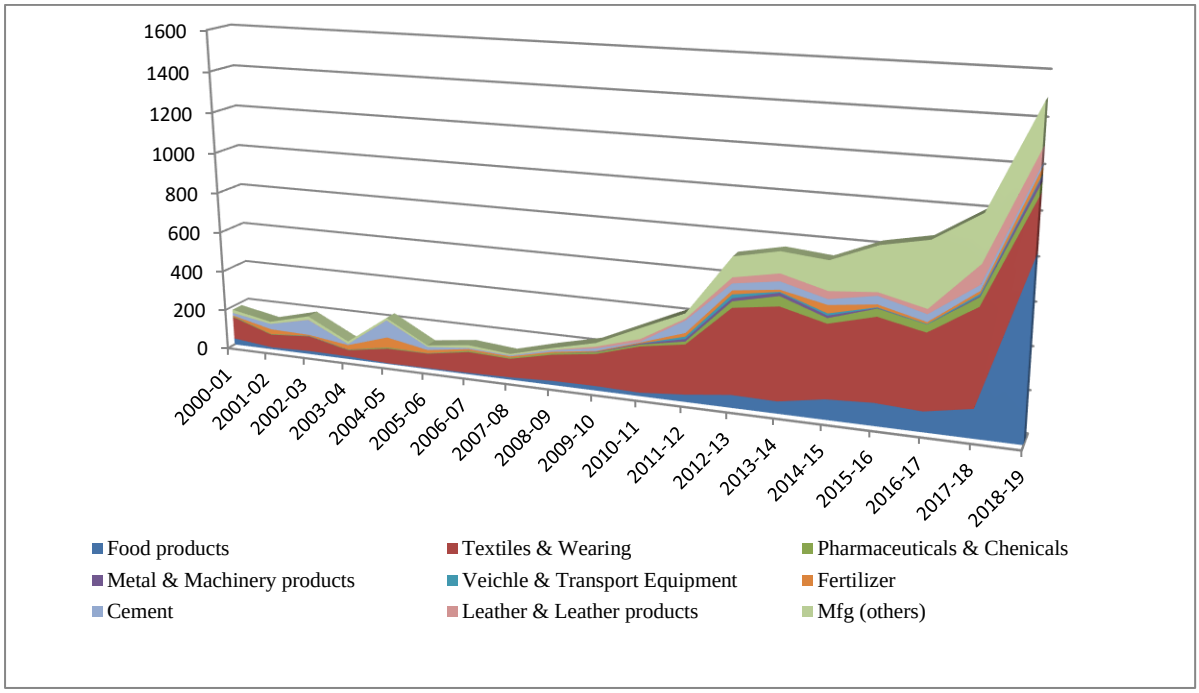
Figure 5.1.3.1 above shows the trend of FDI inflow in the manufacturing sector. In this sector, the rise in FDI inflow initially occurred at a constant rate, followed by an acceleration until FY 2019-20. However, in FY 2019-20, both the net FDI inflow and the FDI inflow in the manufacturing sector waned significantly.

5.1.3.1.1 Net FDI inflow in Sub-Sectors of Manufacturing Sectors

The manufacturing sector consists of several sub-sectors, including food products, textiles and apparel, pharmaceuticals and chemicals, metal and machinery products, vehicles and transport

equipment, fertilizers, cement, leather and leather products, and others (FDI Survey Report, 2019).

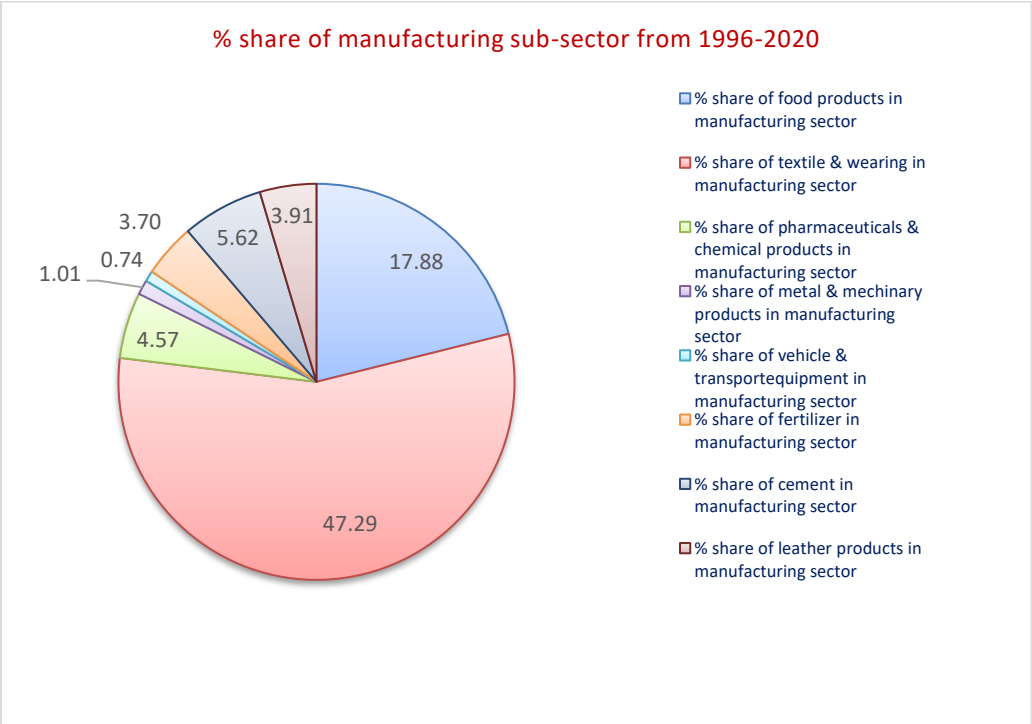
Figure-5.1.3.1.1 Net FDI inflow in manufacturing sub-sectors in Bangladesh from FY1996-97 to FY2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Among these sub-sectors, the dominant sector in terms of FDI recipients is textiles and apparel. From FY 1996-97 to FY 2019-20, textiles and apparel attracted more FDI than other sub-sectors, amounting to USD 9,924.4 million. The next dominant sector was food products, which drew USD 1,774.2 million. The third, fourth, fifth, and sixth positions were held by cement, leather, pharmaceuticals, and fertilizers, respectively. The FDI inflows in these sectors were USD 557.44 million, USD 388.13 million, USD 453.08 million, and USD 366.73 million, respectively.

Figure-*5.1.3.1.2* Percentage share of manufacturing sub-sectors in Bangladesh from FY1996-97 to FY2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Pie chart 5.1.3.1.2 above demonstrates the contribution of sub-sectors within the manufacturing sector from FY 1996-97 to FY 2019-20. From the chart, we can see that among the sub-sectors, the textile industry alone accounts for 47.29 percent of the total FDI inflow in the manufacturing sector. The second largest sector is food products, which has a percentage share of 17.88 percent. The shares of the remaining sectors—cement, pharmaceuticals, leather, fertilizers, meal products, and vehicle equipment—are 5.6 percent, 4.57 percent, 3.91 percent, 1.01 percent, and 0.74 percent, respectively.

Analyzing the above chart, we can conclude that a major share of manufacturing FDI has moved to two industries: textiles and food products. The total percentage share of these two industries is around 68 percent, while the remaining 32 percent is distributed among the other eight industries.

5.1.3.2 Power Gas & Petroleum Sector

The power, gas, and petroleum sector is a highly capital-intensive industry. As Bangladesh is a labor-abundant country, capital is scarce here. To meet the excess demand for capital in the power sector, the Government of Bangladesh relies on foreign investment. In the power sector, public investment accounts for 47 percent, private investment for 45 percent, joint ventures for 4 percent, and imports for 2 percent. The trend of FDI inflow in the power sector is shown below:

Table-5.1.3.2 FDI inflow in the Power, gas & petroleum Sector in Bangladesh from FY 1996-97 to FY 2019-2020

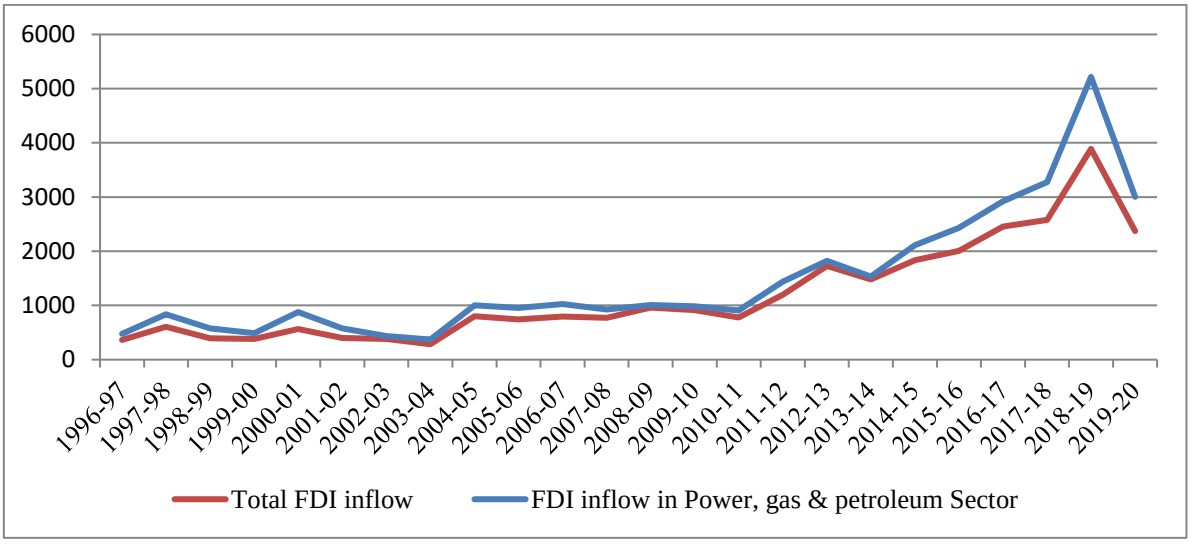
Year	Total FDI inflow (in million USD)	FDI inflow in Power, gas & petroleum Sector (in million USD)	% of total FDI inflow in the Power, gas & petroleum Sector
1996-97	366.85	109.09	29.73695
1997-98	603.30	230.45	38.19824
1998-99	394.10	180.87	45.89444
1999-00	383.22	106.57	27.80909
2000-01	563.93	313.78	55.64166
2001-02	400.93	176.12	43.92787
2002-03	379.18	58.07	15.31463
2003-04	284.16	87.44	30.7714
2004-05	803.78	198.40	24.68337
2005-06	744.61	209.32	28.11136
2006-07	792.74	229.93	29.00447

2007-08	768.9	157.92	20.53843
2008-09	960.59	46.89	4.881375
2009-10	913.02	73.66	8.067731
2010-11	779.04	127.19	16.3265
2011-12	1194.88	244.94	20.49913
2012-13	1730.63	93.67	5.41248
2013-14	1480.34	50.43	3.40665
2014-15	1833.87	279.98	15.26717
2015-16	2003.53	430.16	21.47011
2016-17	2454.81	467.93	19.06176
2017-18	2580.44	696.5	26.99152
2018-19	3888.99	1328.65	34.1644
2019-20	2370	632.15	26.673

Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Table 5.1.3.2 above shows the trend of FDI inflow in the power, gas, and petroleum sector. In Bangladesh, the second-largest FDI recipient sector is power, gas, and petroleum. From FY 1996-97 to FY 2019-20, the amount of FDI inflow in this sector totaled USD 6,530.11 million, which is 22.78 percent of the total net FDI inflow. This sector received the highest amount of FDI in FY 2018-19, amounting to USD 328.65 million. The lowest FDI inflow in this sector was reported as USD 50.00 million in FY 2013-14, which represented only 3.40 percent of the total FDI inflow in the power sector.

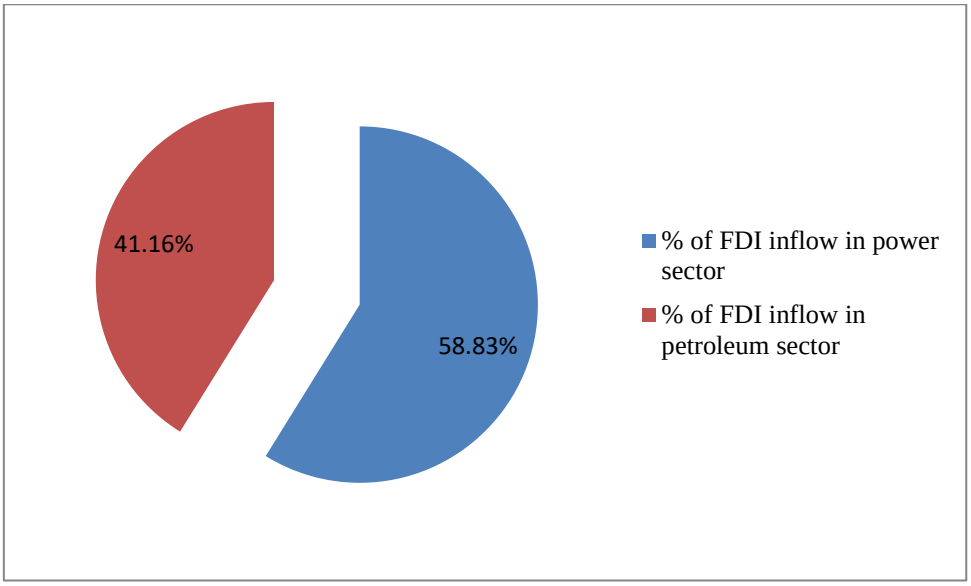
Figure-5.1.3.2 FDI inflow in the Power, gas & petroleum sector in Bangladesh from FY1996-97 to FY2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure 5.1.3.2 above shows the trend of FDI inflow in the power, gas, and petroleum sector. From the figure, we can see that from FY 1996-97 to FY 2003-04, FDI inflow in the power, gas, and petroleum sector increased at a constant rate. After that, except for FY 2019-20, an increasing trend in FDI inflow has been observed in this sector. The power, gas, and petroleum sector consist of two sub-sectors: the power sector and the gas and petroleum sector. The trend of these sub-sectors is provided in the annexure (Figure B).

Figure-*5.1.3.3* Percentage share of sub-sectors in Power, gas & petroleum sector in Bangladesh from FY 1996-97 to FY 2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Pie chart 5.1.3.3 above shows the sub-sectoral contribution of FDI inflow in the power, gas, and petroleum sector. Of the two sub-sectors, the power sector received the highest amount of FDI, accounting for 58.83 percent of the total FDI inflow in the power, gas, and petroleum sector. The percentage share of the gas and petroleum sector is 41.16 percent.

5.1.3.3 Agriculture Sector

Bangladesh is an agricultural country. The economy of Bangladesh depends directly or indirectly on agriculture. The contribution of agriculture to GDP is 13.36 percent (Economic Review, 2020). The trend of FDI inflow in the agriculture sector is shown below:

Table-5.1.3.4 FDI inflow in the agriculture sector in Bangladesh from FY1996-97 to FY2019-2020

Year	Total FDI inflow(in million USD)	FDI inflow in agriculture Sector(in million USD)	% of total FDI inflow in the agriculture Sector
1996-97	366.85	0.26	0.070874
1997-98	603.30	2.33	0.386209

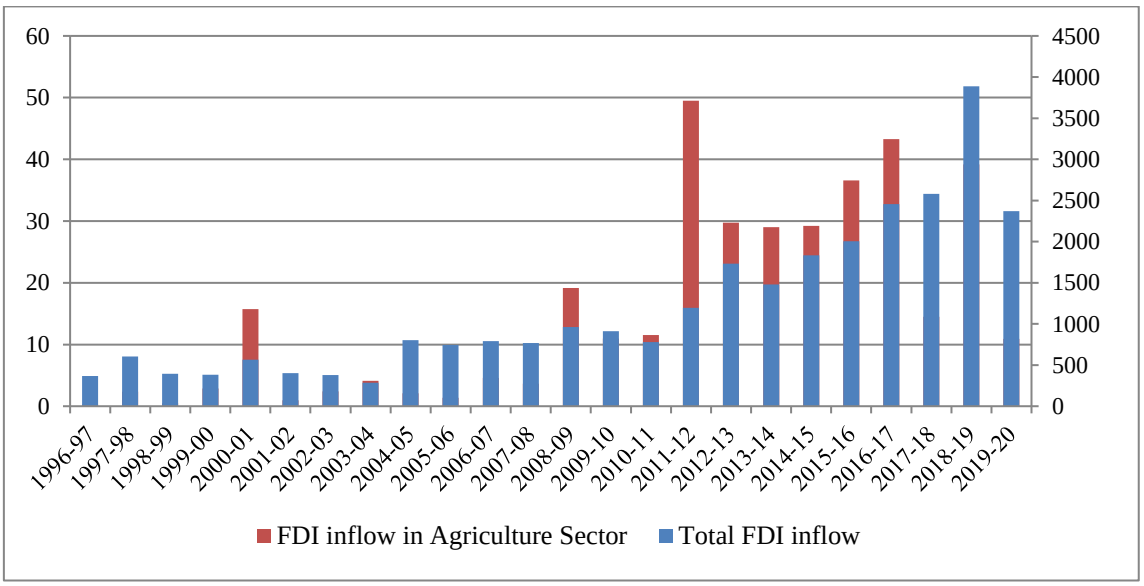
1998-99	394.10	0.46	0.116722
1999-00	383.22	2.88	0.751527
2000-01	563.93	15.72	2.78758
2001-02	400.93	0.95	0.236949
2002-03	379.18	2.41	0.635582
2003-04	284.16	4.11	1.446368
2004-05	803.78	2.07	0.257533
2005-06	744.61	1.37	0.183989
2006-07	792.74	4.57	0.576482
2007-08	768.9	3.65	0.474704
2008-09	960.59	19.14	1.992525
2009-10	913.02	10.95	1.199317
2010-11	779.04	11.53	1.480027
2011-12	1194.88	49.50	4.142675
2012-13	1730.63	29.72	1.717294
2013-14	1480.34	28.99	1.958334
2014-15	1833.87	29.22	1.593352
2015-16	2003.53	36.57	1.825278
2016-17	2454.81	43.26	1.762255
2017-18	2580.44	14.5	0.56192
2018-19	3888.99	39.19	1.007717
2019-20	2370	10.89	0.459494

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Foreign direct investment in agriculture, compared to other sectors, is very trivial. Table 5.1.3.4 above shows the trend of FDI inflow in the agriculture sector. From FY 1996-97 to FY 2019-20, the total amount of FDI inflow in the agriculture sector was USD 364.24 million, which is only 1.27 percent of the total FDI inflow. Except for FY 2000-01, the amount of FDI in this

sector was around only USD 4 million from FY 1996-97 to FY 2007-08. This sector received the highest amount of FDI in FY 2010-11, totaling USD 49.50 million. Although the amount of FDI inflow is slightly increasing, the percentage share of the agriculture sector hovers around 1 percent.

Figure-5.1.3.4 FDI inflow in the agriculture sector in Bangladesh from FY1996-97 to FY2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure 5.1.3.4 shows the trend of FDI inflow in the agriculture sector. From the figure, it is clear that the inflow of FDI in the agriculture sector is very insignificant. Initially, the amount was very low. After that, the amount of FDI inflow in this sector began to grow. The sector received its highest amount of FDI in FY 2011-12.

5.1.3.4 Trade & Commerce Sector

Another important sector that received a significant amount of FDI is the trade and commerce sector. The trend of FDI inflow in this sector is depicted below:

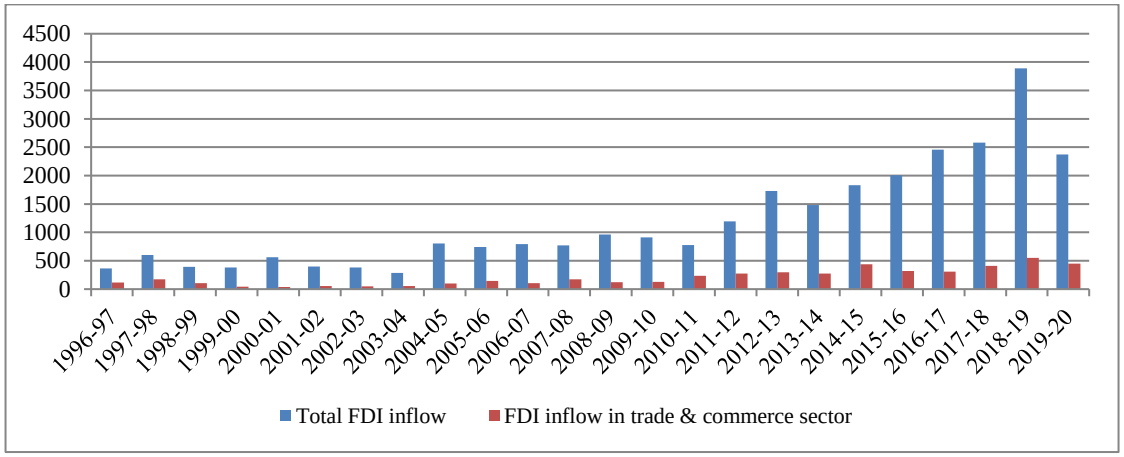
Table-5.1.3.5: FDI inflow in the trade & commerce sector in Bangladesh from FY1996-97 to FY2019-2020

Year	Total FDI inflow(in million USD)	FDI inflow in Trade & Commerce Sector(in million USD)	% of total FDI inflow in the Trade & Commerce Sector
1996-97	366.85	118.39	32.27205
1997-98	603.30	173.16	28.70214
1998-99	394.10	105.32	26.72418
1999-00	383.22	44.12	11.51297
2000-01	563.93	35.25	6.250776
2001-02	400.93	55.30	13.79293
2002-03	379.18	49.24	12.98592
2003-04	284.16	55.31	19.46439
2004-05	803.78	101.80	12.66516
2005-06	744.61	142.19	19.0959
2006-07	792.74	103.84	13.09887
2007-08	768.9	171.26	22.27338
2008-09	960.59	122.53	12.7557
2009-10	913.02	128.80	14.10703
2010-11	779.04	234.82	30.14223
2011-12	1194.88	272.75	22.82656
2012-13	1730.63	295.05	17.0487
2013-14	1480.34	276.86	18.70246
2014-15	1833.87	436.88	23.82284
2015-16	2003.53	320.93	16.01823
2016-17	2454.81	309.73	12.61727
2017-18	2580.44	411.01	15.9279
2018-19	3888.99	550.21	14.14789
2019-20	2370	447.40	18.87764

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From the *table-5.1.3.5* we see that in FY 1996-97 the net inflow of FDI in trade and commerce sector is USD 118.39 million which is 32 percent of total net FDI inflow. In the next year though FDI inflow in this sector has increased to USD 173.16 million but the percentage share of FDI inflow in this sector has fallen to 28 percent. FDI inflow in this sector waned from FY 1998-99 to FY 2009-10 where the percentage share hovered around 10 to 20 percent. Since FY 2010-11, FDI inflow in trade and commerce began to grow overall. From FY 1996-97 to FY 2019-20 the amount of FDI is USD 4962.15 million which is around 17.77 percent of total FDI inflow.

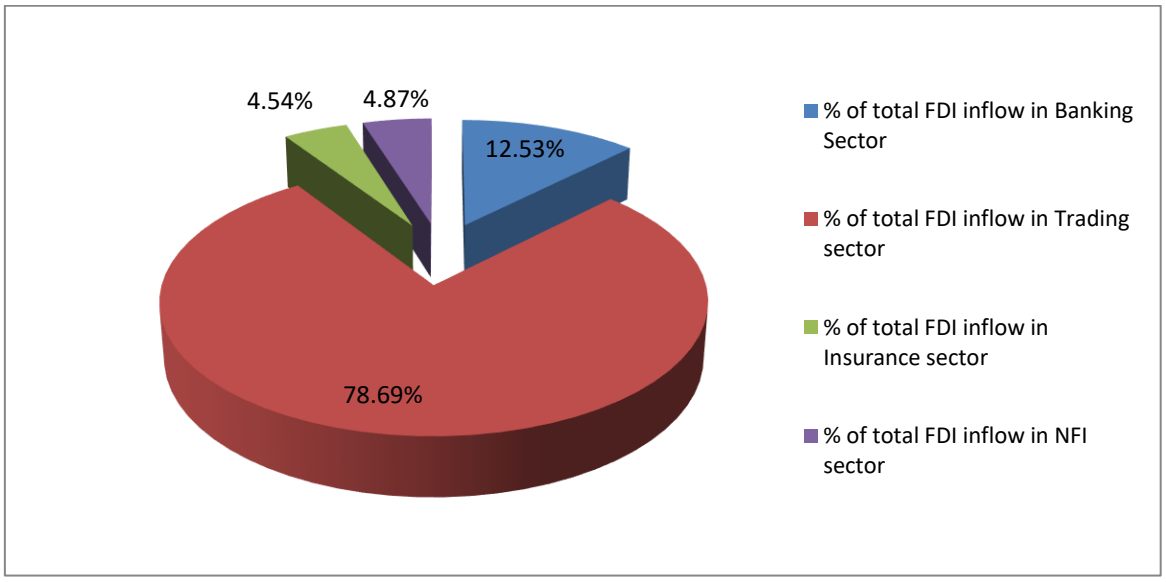
Figure-*5.1.3.5* FDI inflow in the trade & commerce sector in Bangladesh from FY1996-97 to FY2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From the figure-5.1.3.5 we observe that the inflow of net FDI in the trade and commerce is not satisfactory till FY 2006-07. After that the amount of FDI inflow in this sector has begun to grow up. The sector received its highest amount of FDI in FY 2018-19. The trade and commerce sector has four sub-sectors and these are: banking, trading, insurance and non-bank financial institution (NBIF). The sub-sectoral trend of FDI inflow of trade and commerce sector has given in the annexure (figure-C.).

Figure-*5.1.3.5.2* Percentage share of sub-sectors in trade & commerce sector in Bangladesh from FY 1996-97 to FY 2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

The pie chart given above shows the sub-sectoral contribution of FDI inflow in trade and commerce sector. Among the four sub-sectors the banking sector has got the highest amount which is 78.69 percent of total FDI inflow in trade and commerce sector. The next dominant sector in terms of percentage share is trading sector and the share of this sub-sector is 12.53 percent. The contribution of insurance and NBFI are 4.54 percent and 4.87 percent respectively.

5.1.3.5 Transport & telecommunication Sector

Table-5.1.3.6 FDI inflow in the transport & telecommunication sector from FY 1996-97 to FY 2019-2020

Year	Total FDI inflow (in million USD)	FDI inflow in Transport & Telecommunication Sector (in million USD)	% of total FDI inflow in the Transport & Telecommunication Sector
1996-97	366.85	1.46	0.397983
1997-98	603.30	7.25	1.201724

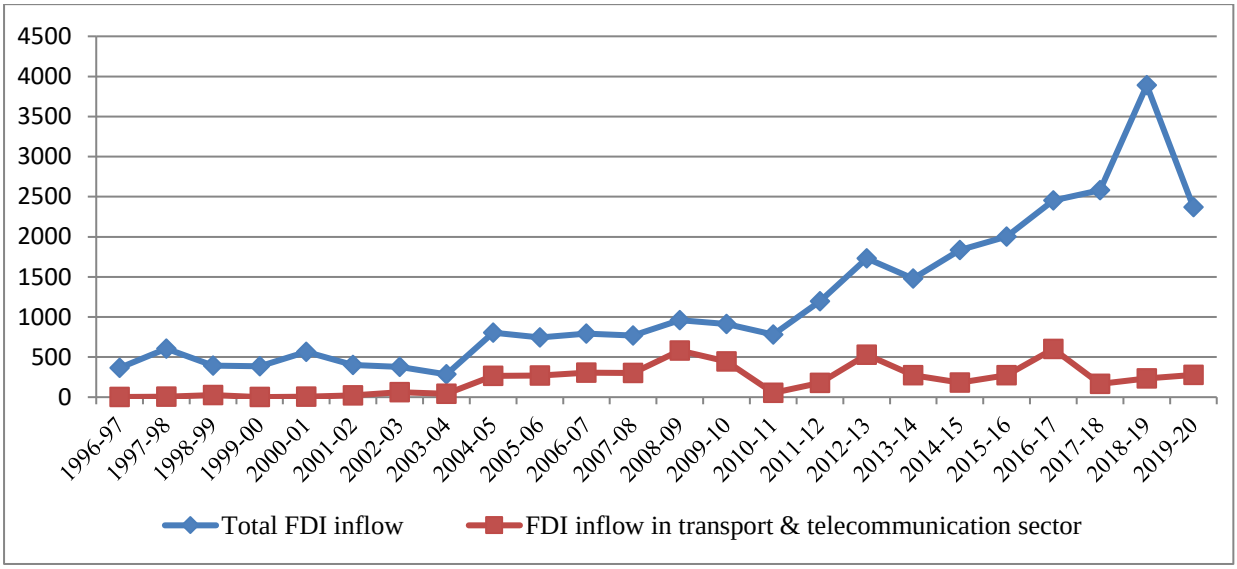
1998-99	394.10	24.50	6.216696
1999-00	383.22	0.47	0.122645
2000-01	563.93	5.40	0.957566
2001-02	400.93	20.71	5.16549
2002-03	379.18	61.74	16.2825
2003-04	284.16	43.76	15.39977
2004-05	803.78	263.96	32.83983
2005-06	744.61	269.01	36.12764
2006-07	792.74	305.12	38.48929
2007-08	768.9	299.92	39.00637
2008-09	960.59	579.62	60.34
2009-10	913.02	445.99	48.84778
2010-11	779.04	54.50	6.99579
2011-12	1194.88	179.04	14.98393
2012-13	1730.63	527.09	30.45654
2013-14	1480.34	272.54	18.41064
2014-15	1833.87	183.20	9.989803
2015-16	2003.53	273.61	13.6564
2016-17	2454.81	601.28	24.49395
2017-18	2580.44	166.1	6.436887
2018-19	3888.99	232.47	5.977645
2019-20	2370	277.86	11.72405

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From the *table-5.1.3.6* we see that in FY 1996-97 the net inflow of FDI in transport and telecommunication sector was only USD 1.46 million which was just about 0.39 percent of total net FDI inflow. From FY 1996-97 to FY 2001-02, though the sectors saw the quantity of

FDI has increased slightly but still the overall percentage share was hovering around less than 1 percent. This sector has got highest amount of FDI in FY 2016-17 and the amount of FDI is USD 601.28 million. From FY 1996-97 to 2019-20 the total amount of FDI in this sector is USD 4962.15 million which is 17.77 percent of total FDI inflow.

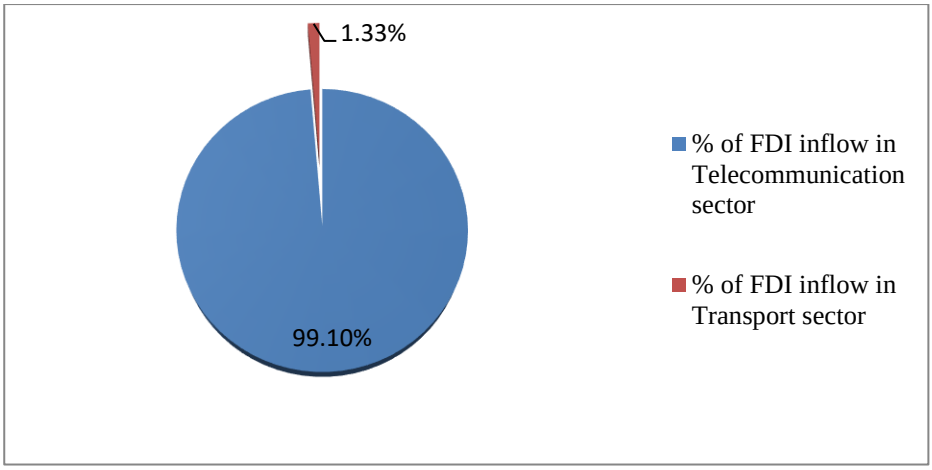
Figure-5.1.3.6 FDI inflow in the transport & telecommunication sector in Bangladesh from FY 1996-97 to FY 2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From the figure-5.1.3.6 we observe that the inflow of net FDI in the transport and telecommunication sector is not satisfactory till FY 2003-04. After that the amount of FDI inflow in this sector has begun to increase. The sector received its highest amount of FDI in FY 2016-17. The transport and telecommunication have two sub-sectors and these are: telecommunication sector and transport sector.

Figure-*5.1.3.6.1* Percentage share of sub-sectors in transport & telecommunication sector in Bangladesh from FY 1996-97 to FY 2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

The pie chart-5.1.3.6.1 given above shows the sub-sectoral contribution of FDI inflow in the transport and telecommunication sector. Among the two sub-sectors, the telecommunication sector has received the highest amount of FDI, accounting for 99.10% of the total FDI inflow in the transport and telecommunication sector. The percentage share of the transport sector is very negligible, at only 1.33%.

5.1.3.6 Service Sector

The service sector plays an important role in achieving high economic growth in many developing countries, and Bangladesh is no exception in this regard. In FY 2019-20, the contribution of the service sector to Bangladesh's GDP was around 52% (Bangladesh Economic Review, 2020). The Government of Bangladesh has implemented various policies to improve this sector, encouraging both domestic and foreign direct investments to accelerate its growth. The trend of foreign direct investment inflow in the service sector is shown below:

Table-5.1.3.7 FDI inflow in the service sector in Bangladesh from FY1996-97 to FY2019-2020

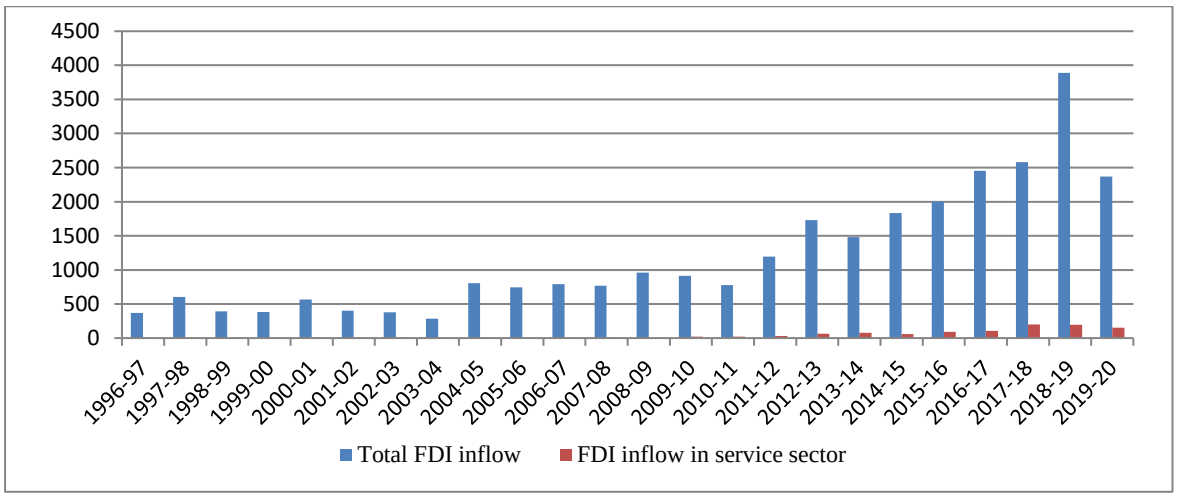
Year	Total FDI inflow (in million USD)	FDI inflow in Service Sector (in million USD)	% of total FDI inflow in the Service Sector
1996-97	366.85	2.57	0.700559
1997-98	603.30	6.97	1.155312
1998-99	394.10	6.94	1.760974
1999-00	383.22	3.32	0.866343
2000-01	563.93	9.83	1.743124
2001-02	400.93	3.86	0.962762
2002-03	379.18	11.50	3.03286
2003-04	284.16	2.60	0.914977
2004-05	803.78	2.04	0.253801
2005-06	744.61	1.07	0.143699
2006-07	792.74	1.82	0.229583
2007-08	768.9	7.02	0.912993
2008-09	960.59	7.77	0.808878
2009-10	913.02	19.68	2.155484
2010-11	779.04	20.39	2.617324
2011-12	1194.88	32.60	2.728307
2012-13	1730.63	65.18	3.766259
2013-14	1480.34	77.39	5.227853
2014-15	1833.87	57.00	3.108181
2015-16	2003.53	92.83	4.633322
2016-17	2454.81	104.44	4.254504
2017-18	2580.44	199.76	7.741315
2018-19	3888.99	197.33	5.074068

2019-20	2370	154.61	6.523629

Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From Table 5.1.3.7, we observe that the amount of FDI inflow in the service sector is quite low. From FY 1996-97 to FY 2019-20, the total net FDI inflow in this sector was USD 1,088.52 million, which accounts for only 3.79% of the total net FDI inflow. The sector received its highest amount of FDI in FY 2017-18, totaling USD 199.76 million. Currently, the share of FDI in this sector is around 6%.

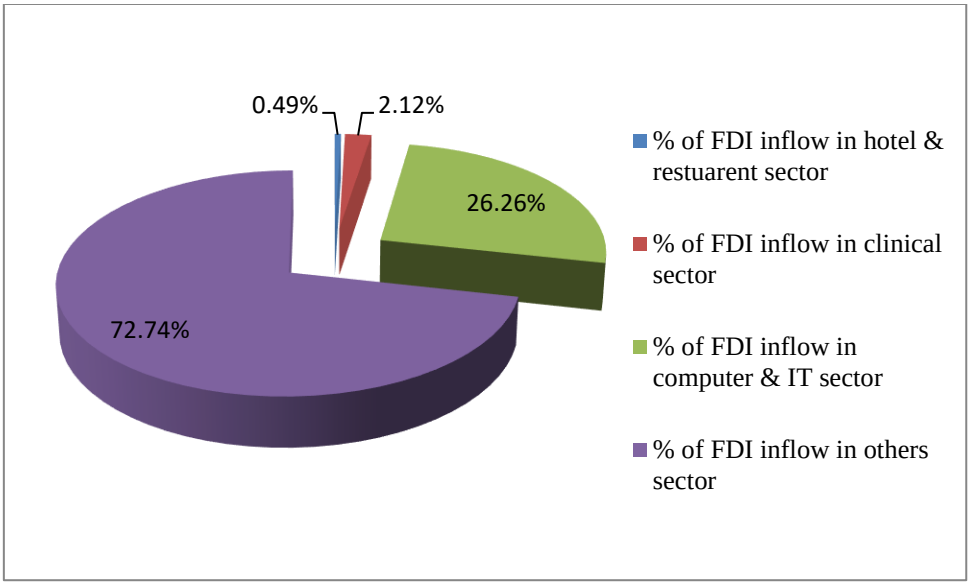
Figure-*5.1.3.7* FDI inflow in the service sector in Bangladesh from FY1996-97 to FY2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

From Figure 5.1.3.7, we see that initially, the inflow of FDI in the service sector is quite trivial. The amount of FDI in this sector has been increasing since FY 2012-13. The service sector comprises four sub-sectors: computer & IT, hotel & restaurant, clinical services, and others.

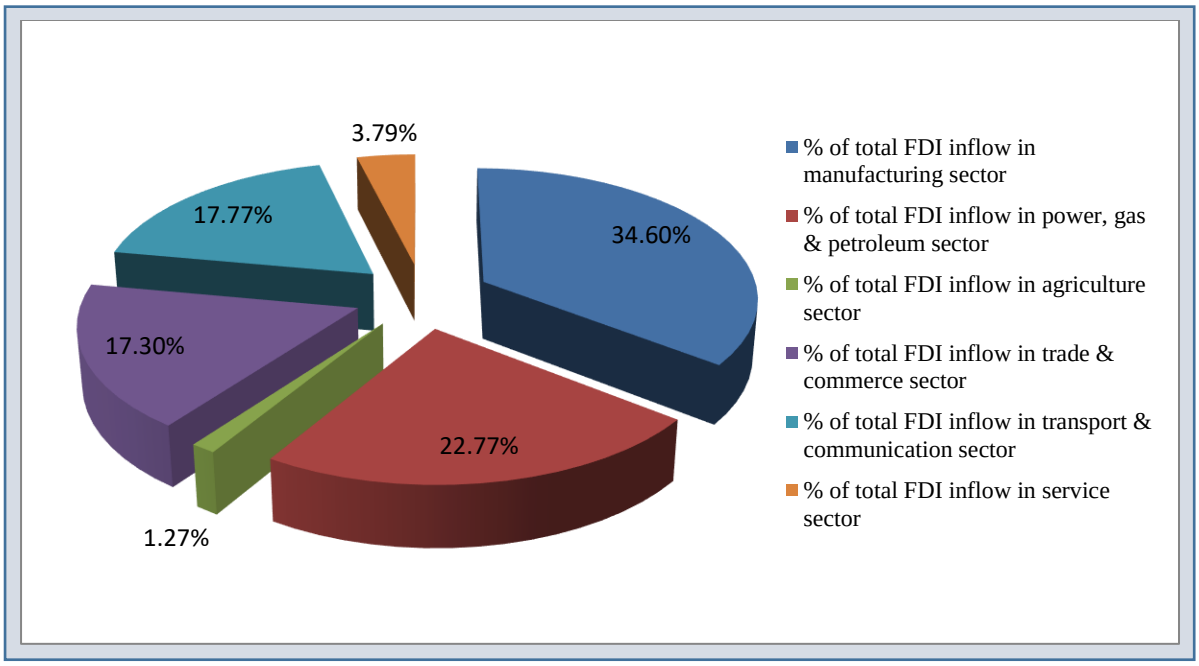
Figure-*5.1.2.5* Percentage share of sub-sectors in service sector in Bangladesh from FY 1996-97 to FY 2019-20



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

The above pie diagram (Figure 5.1.2.5) reveals the sub-sectoral contribution of FDI inflow in the service sector. Among the four reported sub-sectors, the one that received a hefty share of 72.74 percent of FDI is computer and IT. In contrast, the hotel and restaurant sector appeared to be overlooked in terms of its share, securing a mere 0.049 percent of total FDI. The clinical sector, on the other hand, performed slightly better than the hotel and restaurant sector, accounting for 2.12 percent.

Figure-5.1.3 Percentage share of sector wise net FDI inflow in Bangladesh from FY1996-97 to FY 2019-2020



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

The pie chart (Figure 5.1.3) given above shows the percentage share of sector-wise FDI inflow from FY 1996-97 to FY 2019-20. The total net FDI that Bangladesh has received during this period is USD 28,675.84 million. Approximately 70 percent of this amount has been distributed among only four sectors: manufacturing, power, gas and petroleum, trade and commerce, and transport and communication. Among these sectors, the manufacturing sector has received 34.06 percent, the power, gas, and petroleum sector has received 22.12 percent, the trade and commerce sector has received 17.30 percent, and the transport and communication sector has received 17.77 percent of the total net FDI inflow. The remaining 30 percent has been distributed among the other sectors, such as agriculture, services, construction, and others.

From the above analysis of the sector-wise trend of net FDI inflow in Bangladesh, it is observed that FDI inflow remains concentrated in only a few sectors. Although various initiatives have been taken to attract foreign investment, the inflow into the economy is still not satisfactory.

5.1.4 Industrialization, FDI and Environmental Pollution

An unprecedented change has been observed in the industrial sector of Bangladesh over the last three decades. The growth rate of the industrial sector increased from 10 percent in 2000 to 35.35 percent in 2020 (Economic Review, 2020). Favorable trade and investment policies of the government have made this remarkable change possible. In this regard, foreign investment has played a partially significant role in the rapid industrial growth of the country.

By analyzing the data from multiple sources, it is evident that FDI inflow in Bangladesh is not yet satisfactory. Since the 1980s, the government of Bangladesh has adopted many investment-friendly trade policies to increase the amount of FDI inflow into the economy. The government has offered various incentives to attract FDI, including tax exemptions, royalties, multiple-entry visas, easy work permits for foreigners, credit facilities for foreign investors, and reinvestment capital facilities (Industrial Policy, 2016). Although the government is working hard to attract a large amount of FDI, the inflow remains very low. The contribution of FDI inflow to GDP is hovering around only 1 percent. While the contribution of FDI is limited, a significant concern is that most of this FDI is highly concentrated in polluting industries. From the analysis of sector-wise FDI inflow in Bangladesh, we see that a large portion of FDI is concentrated in polluting industries such as textiles, food products, leather, cement, fertilizers, and the power sector. These industries are significantly responsible for environmental pollution. Thus, we may opine that the positive change in the industrial growth rate and foreign investment stimulates economic growth on one hand, but on the other hand, it accelerates environmental pollution in the country. To examine the impact of industrial activities on the environment, industries have been divided into four categories: 1) green industries, 2) orange-A category industries, 3) orange-B category industries, and 4) red category industries (Environment Conservation Act, 1995). Among these, the production activities of green and orange-A category industries do not negatively affect the environment. In contrast, orange-B

and red category industries are primarily responsible for environmental degradation. Examples of these types of industries include food, textiles, cement, fertilizers, pharmaceuticals, and tanneries (Khatun, 2016). The Department of Environment (DoE) has declared 1,317 industries as polluting industries. Among these, the most polluting industries are textiles, leather, tanneries, pharmaceuticals, fertilizers, cement, food products, paper and pulp, and sugar. These polluting industries discharge 35,000 cubic meters of wastewater per day (Belal et al., 1998). The waste released by these industries creates severe air and water pollution. The food industry contributes 38.7% to air pollution and 12.1% to water pollution. The contributions of the cement and textile industries to air pollution are 16.6% and 10.5%, respectively (ADB, 2004; Islam et al., 2001). The production processes of pharmaceuticals, fertilizers, and metal industries contribute to water pollution, with contributions of 15.5%, 14%, and 6.6%, respectively (ADB, 2004; Islam et al., 2001). Textile industries discharge 40,000 cubic meters of wastewater per day, while tanneries discharge 4,000 cubic meters of wastewater per day (Belal et al., 1998).

5.1.5 Conclusion

In light of the above discussion, we may conclude that the red and orange-B category industries are significantly responsible for environmental pollution. However, these are the largest FDI recipient industries, and they have also played a significant role in attaining high economic growth for the country. A major share of export earnings in Bangladesh comes from these industries, with the textile industry being the best example in this respect. Around 84.21 percent of export earnings come from the textile industry (Bangladesh Economic Review, 2019). The contributions of leather, leather goods, and pharmaceuticals are also noteworthy. Therefore, the main challenge for the government is to ensure a high industrial growth rate through FDI while maintaining a pollution-free and healthy environment. To fulfill these targets, the government emphasizes environment-friendly investment practices to reduce the pollution

level in the country. To regulate pollution in the red and orange-B category industries, the government also recommends introducing ETP, CETP, and 3R in the production process. Additionally, the government encourages both domestic and foreign investment to establish green industries that can help reduce pollution from red category industries.

CHAPTER SIX

Results and Discussion

6.1. Introduction

The main purpose of this chapter is to analyze the outcomes from the quantitative and qualitative methods used to satisfy the objectives: (1) to assess the impact of lax environmental policies on FDI inflows in Bangladesh, and (2) to examine the effect of FDI inflow on pollution levels in Bangladesh. To achieve these objectives, the study has formulated two hypotheses, which are outlined below:

Hypothesis-1:

H_0: Lax environmental policy has negative impact on FDI inflow in Bangladesh

H_1: Lax environmental policy has positive impact on FDI inflow in Bangladesh

Hypothesis-2:

H_0: FDI inflow has negative impact on pollution level in Bangladesh

H_1: FDI inflow has positive impact on pollution level in Bangladesh

To test these hypotheses, the study employs both quantitative and qualitative methods. This chapter is divided into two sections to explain the results: Part A and Part B. The outcomes of the quantitative and qualitative analyses are presented in Part A and Part B, respectively.

Part-A

Outcome of the Quantitative Analysis

6.2. Quantitative Analysis Outcomes

To satisfy the study's objectives: — to examining the impact of lax environmental policies on FDI inflows in Bangladesh and the effect of FDI inflows on pollution levels in Bangladesh— a quantitative technique is used. For the quantitative analysis, all data have been checked and some missing values have been identified. Hence a 3MA has been used to deal with the missing values. Then augmented dickey fuller (ADF) test has been applied to find out whether all variables are stationary or not. ADF test helps us to make formal diagnosis which is warranted for further statistical analyses. To find out whether the variables of interest are correlated in the long-run, Johansen's co-integration test has been performed. After finding long-run relationship among variables, VECM is employed to estimate the long-run equilibrium relationships among the variables. Finally, the Granger causality test is conducted to examine causal relationships among the variables, revealing a unidirectional causal relationship. Data analysis was conducted using EViews 12.

6.2.1. Augmented Dickey-Fuller (ADF) test

Table-6.2.1.1 **ADF test for all variables- I(0)**

Variables	t-statistics	probalility
FDI_{inflow}	-0.647173	0.9699
Carbone dioxide emissions (CO2)	-1.638765	0.7621
Electricity consumption (EC)	-1.588831	0.7825
GDP per capita (GDPPC)	3.5014941	1.0000
Inflation GDP deflator (INGDPD)	-6.009362	0.0000

Trade openness (TO)	-2.145200	0.5080

The table-6.2.1.1 give above shows that only INGDPD is stationary at the levels form. All other variables (FDI, CO2, EC, GDPPC, and TO) are non-stationary, meaning they have unit roots and likely require differencing or transformation to achieve stationarity for further time-series analysis.

Table-6.2.1.2 **ADF test for all variables - I(1)**

Variables	t-statistics	probalility
FDI_{inflow}	-1.175840	0.9013
Carbone dioxide emissions (CO2)	-6.573918	0.0000
Electricity consumption (EC)	-6.501168	0.0000
GDP per capita (GDPPC)	-5.024762	0.0009
Inflation GDP deflator (INGDPD)	-6.009362	0.0000
Trade openness (TO)	-7.802602	0.0000

The table-6.2.1.2 given above shows that except FDI inflow all variables, are stationary at the first difference (I(1))

Table-6.2.1.3 **ADF test for all variables - I(2)**

Variables	t-statistics	probability
FDI_{inflow}	-5.625304	0.0002
Carbone dioxide emissions (CO2)	-6.573918	0.0000
Electricity consumption (EC)	-6.501168	0.0000
GDP per capita (GDPPC)	-5.024762	0.0009
Inflation GDP deflator (INGDPD)	-6.009362	0.0000

Trade openness (TO)	-7.802602	0.0000

From above tables-6.2.1.3, we observed that FDI_{inflow} become stationary after second difference. Since VCEM doesn't provide accurate result in I (2), so we have to convert I (2) into I (1) to apply VCEM.

6.2.2 Johansen cointegration test

The Johansen cointegration test results reveal the presence of cointegrating relationships among the variables, indicating that they are in long-run equilibrium.

Table-6.2.2.1 **Unrestricted Cointegration Rank Test (Trace Test):**

Hypothesized No. of Cointegrating Equations (CEs)	Eigenvalue	Trace Statistic	Critical Value (0.05)	p-value	Interpretation
None	0.936819	294.5144	95.75366	0.0000	Reject null: at least 1 cointegrating relationship exists.
At most 1	0.832695	175.7591	69.81889	0.0000	Reject null: at least 2 cointegrating relationships exist.
At most 2	0.728415	98.87773	47.85613	0.0000	Reject null: at least 3 cointegrating relationships exist.
At most 3	0.472700	42.82807	29.79707	0.0009	Reject null: at least 4 cointegrating relationships exist.
At most 4	0.278964	15.30869	15.49471	0.0533	Fail to reject: no more than 4 cointegrating relationships.
At most 5	0.028535	1.244850	3.841465	0.2645	Fail to reject: no more than 5 cointegrating relationships

The Trace test assesses the null hypothesis that there are at most r cointegrating relationships against the alternative that there is more than r. r represents the number of cointegrating relationships. The results indicate the presence of 4 cointegrating equations at the 5% significance level, as the null hypotheses are rejected up to "At most 3." However, for the "At most 4" case, the p-value of 0.0533 slightly exceeds 0.05, meaning the null hypothesis cannot be rejected.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue Test)

The Max-Eigenvalue test evaluates the null hypothesis that there are exactly r cointegrating relationships, against the alternative that there is r+1 cointegrating relationships.

Table-6.2.2.2 **Unrestricted Cointegration Rank Test (Maximum Eigenvalue Test)**

Hypothesized No. of Cointegrating Equations (CEs)	Eigenvalue	Trace Statistic	Critical Value (0.05)	p-value	Interpretation
None	0.936819	118.7553	40.07757	0.0000	Reject null: at least 1 cointegrating relationship exists.
At most 1	0.832695	76.88136	33.87687	0.0000	Reject null: at least 2 cointegrating relationships exist.
At most 2	0.728415	98.87773	47.85613	0.0000	Reject null: at least 3 cointegrating relationships exist.
At most 3	0.472700	27.51937	21.13162	0.0055	Reject null: at least 4 cointegrating relationships exist.

At most 4	0.278964	14.06384	14.26460	0.0537	Fail to reject: no more than 4 cointegrating relationships.
At most 5	0.028535	1.244850	3.841465	0.2645	Fail to reject: no more than 5 cointegrating relationships.

The Max-Eigenvalue test similarly indicates the presence of four cointegrating equations, as the null hypotheses are rejected up to "At most 3." However, for "At most 4," the p-value is 0.0537, which slightly exceeds the 0.05 threshold, leading us to fail to reject the null hypothesis.

Both the Trace Test and Max-Eigenvalue Test suggest that there are four cointegrating relationships at the 5% significance level. This indicates the existence of long-term equilibrium relationships among the variables, although not all of them are cointegrated.

These findings are critical when modeling the system, as a Vector Error Correction Model (VECM) would be suitable for capturing both the short-term dynamics and long-term relationships between the variables.

6.2.3 Vector Error Correction Estimation

Table-6.2.3.1 Long run relationship from VCEM model

Variable	Coefficient	t-statistics	Standard errors
CO2 (-1)	2140.354	0.56219	3807.16
EC(-1)	7.273136	1.54350	4.71209
GDPPC(-1)	-0.637405	0.45302	-1.40701
INFGDPD(-1)	-60.75906	-19.0414	3.19089
TO(-1)	-35.12850	-1.97115	17.8213

FDI_{inflow}(-1)	1.0000		
C			-142.1522
R-squared			0.789627
Adj. R-squared			0.747552
F-statistic			18.76727

Here,

CO2 = Carbone dioxide emission (proxy variable of lax environmental policy)

EC = electricity consumption (proxy variable of infrastructure quality)

GDPPC = GDP per capita (proxy variable of market size)

INFGDPD = Inflation GDP deflator (proxy variable of macroeconomic stability)

TO = trade openness

FDI_{inflow} = foreign direct investment inflow

D(FDIinflow)= - 0.551901523194*(1.0000× FDIinflow (−1) + 2140.354* CO2(−1) + 7.2731* EC (−1)− 0.6374* GDPPC(−1) − 60.7591*INFGDPD(−1) − 35.1285*TO (−1) − 142.1522)

Table 6.2.3.1 illustrates the long-run relationship among FDI inflow, carbon dioxide emissions (CO2), GDP per capita (GDPPC), inflation (GDP deflator), trade openness (TO), and electricity consumption (EC). The coefficients indicate how each variable influences FDI inflows in the long run.

According to Table 6.2.3.1, the large positive coefficient of CO2 emissions (2140.354) indicates a significant long-term relationship between CO2 emissions and FDI inflows in Bangladesh. However, the low t-statistic (0.56219) suggests that this relationship may not be

statistically significant. If deemed meaningful, it implies that higher CO2 emissions are associated with increased FDI inflows, which may support the pollution haven hypothesis. This could indicate that foreign investors are drawn to Bangladesh due to its lenient environmental regulations, permitting higher emissions.

A positive coefficient of energy consumption indicates that it has a direct positive relationship with FDI inflows. As energy consumption increases, foreign investments also increase, potentially due to higher industrial activity driven by FDI. However, with a t-statistic of 1.54350, this relationship is not strongly significant statistically.

The negative coefficients of GDP per capita (-0.6374) and the inflation GDP deflator (-60.7591) suggest a negative relationship between these variables and FDI inflow. This implies that higher GDP per capita and higher inflation reduce FDI in the long run. However, the t-statistics for these variables (-1.4070 and -19.0414) indicate that this relationship is not strongly significant.

Additionally, the coefficient of trade openness (-35.1285) suggests a negative relationship between trade openness and FDI in the long run. The corresponding t-statistic (-1.9712) makes this result marginally significant.

R-squared (0.7896) means that about 79.96% of the variance in FDI inflows can be explained by the long-run relationship with CO2 emissions, electric power consumption, GDP per capita, inflation, and trade openness. Adjusted R-squared (0.7476) indicates that 74.76% of the variance is explained after accounting for the number of predictors. F-statistic (18.76727) indicates that the model as a whole is statistically significant and explains a significant portion of the variation in FDI inflows.

Table-6.2.3.2 **Short run relationship from VCEM model**

Variable	Coefficient	t-statistics	Standard errors	p-value
D(CO2 (-1))	3185.022	0.40436	7876.60	0.6864
D(EC(-1))	35.46114	2.90676	12.1996	0.0040
D(GDPPC(-1))	-0.046668	-0.01591	2.93276	0.9873
D(INFGDPD(-1))	-11.70938	-1.79577	6.52054	0.0740
D(TO(-1))	-94.96830	-3.25315	29.1927	0.0013
$D(FDI_{inflow}(-1))$	-0.311463	-2.45376	0.12693	0.0150
C	-68.17082	-0.64112	106.330	0.5221
R-squared	0.789627			
Adj. R-squared	0.747552			
F-statistic	18.76727			

D(FDIinflow) = - 0.311462824154*D(FDIinflow (-1)) + 3185.02240178*D(CO2(-1)) + 35.4611376236*D(EC(-1)) - 0.0466678069632*D(GDPPC(-1)) - 11.7093822966*D(INFGDPD (-1)) - 94.9682979285*D(TO(-1)) - 68.1708159506

Table 6.2.3.2 illustrates the short-run relationship among FDI inflow, carbon dioxide emissions, GDP per capita, inflation (GDP deflator), trade openness, and electricity consumption.

According to table 6.2.3.2 the positive coefficients of CO2 emissions and energy consumption indicate that, in the short run, CO2 emissions and energy consumption are positively related to FDI inflow. However, the large standard errors and small t-statistics and high p-value (0.6864) of CO2 emission suggest that this estimate is not statistically significant. And this relationship

is not meaningful in the short term. But the low p-value (0.0040) of energy consumption confirms the significance of this relationship in the short term.

The negative coefficients of GDP per capita and the inflation GDP deflator suggest a negative relationship between these variables and FDI inflow. This implies that higher GDP per capita and higher inflation reduce FDI in the short run. The very high p-value (0.9873) of GDP per capita indicates that this relationship is insignificant. But, the p-value (0.0740) of inflation is close to the significance threshold (0.05), it indicates that inflation might have a marginally significant short-term effect on FDI inflows.

Additionally, The Coefficient of trade openness is -94.96830 and t-statistics is -3.25315. This negative and statistically significant coefficient indicates that an increase in trade openness is associated with a decrease in FDI inflows in the short term. The low p-value (0.0013) suggests a strong short-term relationship between trade openness and FDI inflows.

The coefficient of FDI inflow is -0.311463 and t-statistic is -2.45376. This negative coefficient suggests that previous changes in FDI inflows have a dampening effect on current FDI inflows in the short run. This means that if FDI inflows increased in the previous period, they are likely to decrease in the current period, and vice versa. The relationship is statistically significant, with a p-value of 0.0150.

R-squared is 0.789627 which indicates that 78.96% of the variance in FDI inflows is explained by the changes in the independent variables. Adjusted R-squared is 0.747552 that shows adjusting for the number of variables, about 74.76% of the variance in FDI inflows is explained by the model. The high F-statistic (18.76727) suggests that the overall model is statistically significant and explains the short-term variation in FDI inflows well.

From the above analysis, we conclude that in the long-run equilibrium, FDI is positively related to CO2 emissions and electric power consumption, but negatively related to GDP, inflation, and trade openness. In the short run, CO2 emissions and energy consumption are positively related to FDI inflow. Electric power consumption positively affects FDI, while inflation and trade openness have a negative impact. The positive (though statistically insignificant) relationship between CO2 emissions and FDI inflows provides some support for the pollution haven hypothesis. This suggests that foreign investors may be attracted to Bangladesh due to its less stringent environmental regulations, allowing them to operate in a manner that results in higher emissions, thereby implying a link between lax environmental policies and higher FDI inflows. Since CO2 emissions are positively related to FDI inflows (though statistically insignificant), this could indicate that FDI in Bangladesh contributes to increased pollution levels. The positive relationship between energy consumption and FDI inflows could also further reinforce this, as more industrial activity (often fueled by foreign investment) leads to higher energy usage and, consequently, higher emissions. Inflation appears to significantly deter FDI inflows, indicating that macroeconomic stability is a key determinant of FDI. The negative relationship between GDP per capita and FDI inflows may reflect Bangladesh's status as a developing country that attracts investment due to its relatively lower costs rather than its wealth or advanced economy.

6.2.4. Granger Causality Results

The Granger causality test results from the VEC (Vector Error Correction) model allow us to interpret the causal relationships between the variables in the short term. In this case, the dependent variable is D (FDI inflow), which represents the change in FDI (Foreign Direct Investment). The test examines whether each of the other variables can predict changes in FDI. Granger Causality Results are given below:

Table-6.2.4.1 **Pairwise Granger Causality test:**

Causality Direction		**F-statistics**	**P-values**
Carbone dioxide emissions (CO2)	FDI inflow	0.51386	0.4775
FDI inflow	Carbone dioxide emissions (CO2)	2.77548	0.1033
GDP per capita (GDPPC)	FDI inflow	0.29496	0.5900
FDI inflow	GDP per capita (GDPPC)	11.1999	0.0018
Inflation GDP deflator (INGDPD)	FDI inflow	0.00117	0.9729
FDI inflow	Inflation GDP deflator (INGDPD)	0.00298	0.9567
Trade openness (TO)	FDI inflow	0.41883	0.5211
FDI inflow	Trade openness (TO)	2.98440	0.0916
Electricity consumption (EC)	FDI inflow	2.05989	0.1588
FDI inflow	Electricity consumption (EC)	4.28604	0.0448

Table 6.2.4.1 presents the results of the Granger causality test, illustrating the bidirectional causal relationships between the time series. From the table, we observe that the p-value for CO2 emissions is 0.4775, which is greater than 0.05. This means that changes in CO2 emissions

do not Granger-cause changes in FDI inflows. In other words, past values of CO2 emissions do not help predict future values of FDI. This suggests that changes in pollution levels or environmental laxity do not influence foreign direct investment flows. Thus, relaxed environmental regulations, as reflected by increased CO2 emissions, do not appear to attract FDI inflows.

The p-value of 0.1033, while higher than the 0.05 threshold, is close to significance. This indicates a weak or marginal relationship between FDI inflows and CO2 emissions. Although the result is not statistically significant, it suggests that FDI inflows may contribute to rising pollution levels, potentially due to industrial activities linked to foreign investment. However, this effect is not strong enough to establish a robust causal link.

For GDP per capita, the p-value is 0.5900, which is greater than 0.05. This indicates that changes in GDP per capita do not Granger-cause changes in FDI inflows. Hence, past values of GDP per capita cannot predict future values of FDI, implying that economic growth alone does not attract FDI inflows. On the other hand, the p-value of 0.0018 is highly significant, showing that FDI inflows Granger-cause GDP per capita. This confirms that FDI inflows positively contribute to economic growth in Bangladesh.

In the case of inflation, both directions have p-values well above 0.05, indicating no Granger causality between inflation and FDI inflows. This suggests that inflation neither predicts nor is a consequence of FDI inflows.

For trade openness, the p-value is 0.5211, which is above 0.05. Therefore, we cannot reject the null hypothesis, meaning that past values of trade openness cannot be used to predict future FDI inflows. Trade openness does not Granger-cause FDI, indicating that increased trade liberalization does not directly attract more foreign investment. While the p-value of 0.0916 is

close to significance, it does not strongly suggest that FDI inflows significantly influence trade openness. However, there may be a weak association.

Regarding electric power consumption, the p-value is 0.1588, which is also above 0.05. This indicates that electricity consumption does not Granger-cause FDI inflows. However, the p-value of 0.0448 indicates that FDI inflows Granger-cause electric power consumption. This suggests that foreign investment leads to increased energy consumption, which could have environmental implications over time, potentially resulting in higher pollution levels.

The analysis shows no strong Granger-causal relationship between FDI inflows and CO2 emissions, though the near-significance of the FDI-to-CO2 emission direction ($p = 0.1033$) suggests a potential weak or indirect link, rather than a strong causal connection in the short term. Proxy variables such as GDP per capita, inflation, trade openness, and electric power consumption generally do not Granger-cause FDI inflows, indicating that these factors, including any environmental laxity associated with them, are not strong predictors of FDI inflows. However, FDI inflows significantly impact GDP per capita (economic growth) and electric power consumption, which could contribute to increased environmental stress over time.

The results suggest that FDI inflows Granger-cause some of these variables (notably GDP and electric power consumption), but none of them Granger-cause FDI. Therefore, the relationships in this dataset are largely unidirectional.

Thus, the quantitative analysis confirms that there is no evidence that lax environmental policies (as proxied by CO2 emissions) attract FDI inflows to Bangladesh, indicating that foreign investors are not significantly influenced by environmental regulations when making investment decisions. While the relationship between FDI inflows and CO2 emissions is not statistically significant, it is close to the threshold, hinting at a potential weak link. This

suggests that FDI inflows may contribute to environmental degradation in the long run, though the evidence is not strong enough to draw definitive conclusions.

However, FDI inflows do significantly boost economic growth (GDP per capita) and increase electric power consumption, which could put additional pressure on environmental resources. Although FDI does not immediately increase pollution levels, its impact on energy consumption and economic activity suggests that it may indirectly contribute to environmental challenges over time. This analysis highlights that, while there is no strong direct evidence of FDI worsening pollution through lax environmental policies, the broader economic effects of FDI could have environmental consequences in the future.

Part-B

Outcome of the Qualitative Analysis

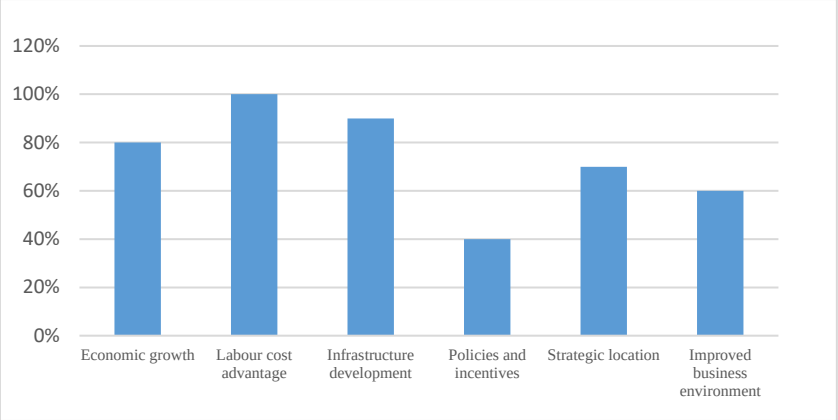
6.3. Qualitative Analysis Outcomes

To satisfy the objectives of the study, namely the impacts of lax environmental policy on FDI inflow in Bangladesh and the impacts of FDI inflow on pollution levels in Bangladesh, the study has used a qualitative method. Specifically, the study employed the Key Informant Interview (KII) technique. A summary of the informants' interviews is provided below

6.3.1 Summary of the informants' interview

The issue of FDI in Bangladesh's economy has been a priority since the 1980s. Although FDI inflows in Bangladesh have been increasing since 1971, the amount remained very low until the 1990s. Most experts believe that FDI has significantly contributed to the country's high economic growth. They attribute the rising trend in FDI inflows to factors such as cheap labour cost, infrastructure quality, political stability, favorable investment policies, and investment-friendly trade practices. Some experts have also suggested that geopolitical factors may influence the rising trend of FDI inflows into the country. In addition to these factors, experts have emphasized another key element that could significantly impact foreign investors' decisions: Bangladesh's lax environmental policies. Such policies can make it easier for industries to operate with fewer restrictions, potentially encouraging more FDI inflow. Experts' opinions regarding the rising trend in FDI inflows in Bangladesh are illustrated in Figure 6.3.1.1.

Figure-6.3.1.1 Expert Opinion Regarding Rising Trend of FDI inflow in Bangladesh.



Source: Compiled by the author based on primary survey data

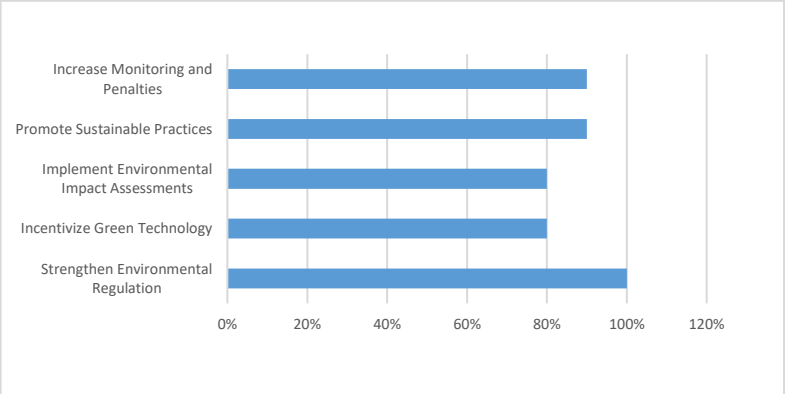
According to Figure 6.3.1.1, 100% of experts believe that low labor costs are the primary reason for the rising trend of FDI inflows in Bangladesh. In addition to the labor cost advantage, infrastructure development is another key factor contributing to this growth, as noted by approximately 90% of experts. Furthermore, 40% of experts consider policies and various incentives as important reasons for the increasing FDI. Additionally, 70% of experts highlight Bangladesh's strategic location, while 60% point to an improved business environment as contributing factors to the rising trend of FDI in the country. However, while such factors may attract investors looking for lower operational costs, they can also lead to significant environmental degradation. A few experts believe that FDI in polluting sectors such as textiles, food products, and cement is likely to negatively impact pollution levels in Bangladesh. These industries, categorized as "red" by the Environmental Conservation Rules of 1997, are major sources of pollution. Without stringent environmental regulations, increased activity from these investments could result in higher emissions, waste, and environmental degradation.

Some experts also note that the Bangladeshi government has provided various types of incentives for investors, including tax exemptions, royalties, multiple-entry visas, and easy work permits. By attracting foreign investment through such incentives, resource-intensive or polluting industries—particularly in sectors like manufacturing, mining, and energy—may

expand. According to experts, these investment-friendly policies could potentially accelerate pollution levels in the country near future if environmental regulations are not strictly enforced. If the focus remains solely on economic growth without strong environmental safeguards, it could lead to increased emissions, waste, and overall environmental degradation.

Experts also suggest that, to reduce pollution while promoting foreign investment, the Government of Bangladesh should adopt several strategies. These include strengthening environmental regulations, incentivizing green technology, implementing environmental impact assessments, promoting sustainable practices, and increasing monitoring and penalties. The experts' opinions regarding pollution reduction strategies while promoting FDI are illustrated in Figure 6.3.1.2.

Figure-6.3.1.2 Expert Opinion Regarding Pollution Reduction Strategies While Promoting FDI

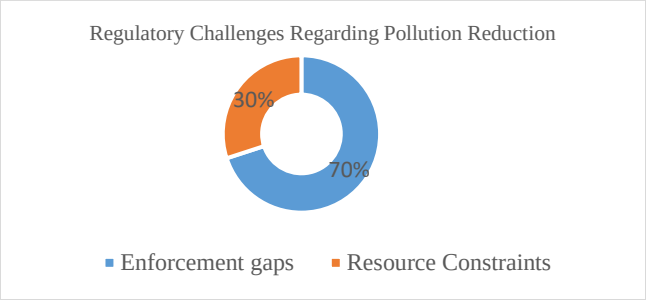


Source: Compiled by the author based on primary survey data

According to Figure 6.3.1.2, 100% of experts suggest that the government should strengthen environmental regulations while promoting FDI. Additionally, 90% of experts believe that promoting sustainable practices, along with increasing monitoring and penalties, should be prioritized. Furthermore, 80% of experts recommend introducing incentives for green technology and implementing environmental impact assessments.

However, in practice, existing regulations often face challenges in effectively reducing pollution from red-category industries (highly polluting sectors). These challenges include enforcement gaps, where weak enforcement and monitoring lead to non-compliance, regulatory gaps, and resource constraints. Some regulations may be outdated or insufficiently stringent, while limited resources for regulatory agencies, such as the Department of Environment, can hinder their ability to effectively oversee and address pollution issues. The experts' opinions regarding regulatory challenges in pollution reduction strategies while promoting FDI are illustrated in Figure 6.3.1.3.

Figure-6.3.1.3 Expert Opinion Regarding Regulatory Challenges in Reducing Pollution



Source: Compiled by the author based on primary survey data

According to Figure 6.3.1.3, 70% of experts believe that enforcement gaps, and 30% mention resource constraints as the two main obstacles to reducing pollution from red-category industries (highly polluting sectors). Overall, while regulations are in place, their effectiveness can be compromised by these factors, necessitating stronger enforcement and updates to better address pollution from red-category industries.

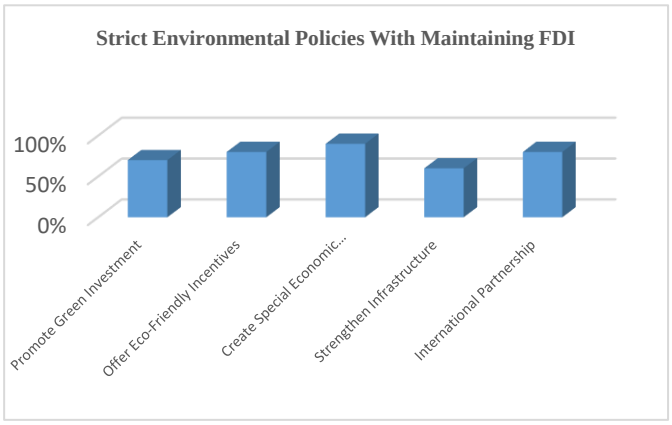
Some experts argue that FDI has a mixed impact on Bangladesh's economy and environment. In their view, on one hand, FDI boosts economic growth by creating jobs, enhancing infrastructure, and transferring technology, which can increase productivity and industrial capacity. On the other hand, overreliance on FDI in certain sectors may lead to economic

imbalances, such as the exploitation of local resources or reduced competitiveness of local businesses.

Regarding environmental issues, they believe that with proper regulations, FDI can introduce cleaner technologies and promote sustainable development. However, in the absence of strong environmental safeguards, FDI can contribute to increased pollution, resource depletion, and ecological damage, especially in industries like manufacturing or energy. Overall, they emphasize that a balanced approach is needed to maximize economic benefits while minimizing environmental harm.

According to experts, in certain cases, pollution reduction initiatives might hamper the inflow of foreign direct investment. To balance strict environmental policies with maintaining FDI inflows, the government can promote green investments, offer eco-friendly incentives, create special economic zones, strengthen infrastructure, and foster international partnerships. The experts' suggestions regarding balancing strict environmental policies with maintaining FDI are illustrated in Figure 6.3.1.4

Figure-6.3.1.4 Expert Suggestion Regarding Strict Environmental Policies with Maintaining FDI



Source: Compiled by the author based on primary survey data

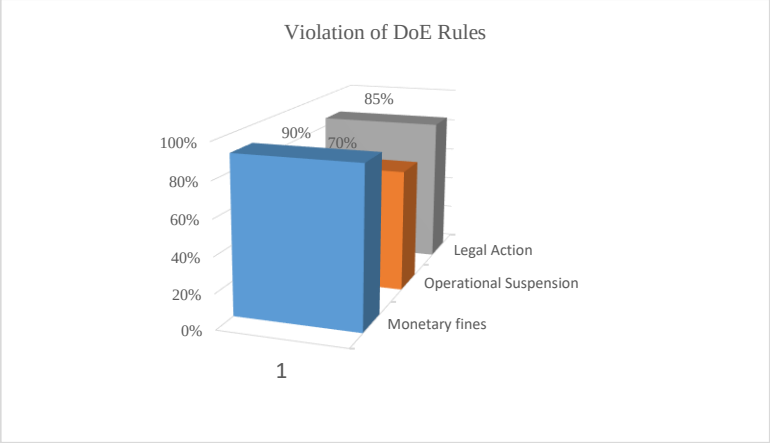
According to Figure 6.3.1.4, 90% of experts indicated that special economic zones should be established to balance strict environmental policies with maintaining foreign direct investment

inflows. Additionally, 80% of experts believe that eco-friendly incentives should be provided and that international partnerships should be strengthened. Meanwhile, 70% of experts emphasize the importance of green investment, and 60% stress the need for infrastructure development.

According to experts, ineffective enforcement of environmental policies, laws, and acts could increase the inflow of FDI into Bangladesh. Notably, the Government of Bangladesh adopted the National Environmental Policy in 1992, with the main objective of protecting the natural environment for human well-being (MoEF). Although negative environmental effects have been discussed in various forums in Bangladesh since the 1980s, effective remedial actions were only taken after the enactment of the Environmental Conservation Act of 1995 and the Environmental Conservation Rules of 1997.

To achieve the objectives of these policies, they must be supported by specific legal instruments, such as laws, rules, and regulations. To this end, the Ministry of Environment and Forest (MoEF) established the Department of Environment (DoE) in 1989 to effectively implement these laws, acts, and rules. The DoE is responsible for the enforcement of these policies. If a firm or industry violates the rules of the DoE in Bangladesh, it may face monetary fines, operational suspension, remediation costs, and legal action, which could lead to additional fines or imprisonment for responsible individuals. The following figure 6.3.1.5 illustrates the experts' suggestions regarding violations of DoE rules.

Figure-6.3.1.5 Experts Suggestions Regarding the Violation of DoE Rules



Source: Compiled by the author based on primary survey data

According to Figure 6.3.1.5, 90% of experts suggested that monetary fines should be imposed for violations of DoE rules. Additionally, 80% of experts mentioned the need for legal action, while 70% opined that operational suspension should be employed for such violations.

Experts also highlight the coordination failures between the National Trade Policy, National Investment Policy, and National Environmental Policy. The National Trade Policy and National Investment Policy often prioritize economic growth, attracting foreign investment, and boosting trade, which may sometimes overlook environmental considerations. Conversely, environmental policies focus on reducing pollution and protecting natural resources, which can impose restrictions or additional costs on industries. Balancing these policies is crucial to ensure that economic development does not come at the expense of environmental sustainability. Effective integration and coordination between these policies can help mitigate conflicts and promote both economic and environmental goals.

6.4 Conclusion

From the analysis using both quantitative and qualitative techniques, we found that lax environmental policies have not significantly influenced FDI inflows into Bangladesh. Furthermore, these FDI inflows have not notably contributed to rising pollution levels in the

country yet now. A brief summary of the results from the quantitative and qualitative analysis is presented in Table 6.3.1.

Table-6.4.1 **Summary of the results from the quantitative and the qualitative techniques:**

Research Objectives	***Outcome of the Quantitative Analysis***	***Outcome of the Qualitative Analysis***
Specific Objective-1: Lax environmental policy has positive impact on FDI inflow in Bangladesh	The study found statistically insignificant (α=5%) relationship between lax environmental policies and FDI inflows in Bangladesh.	Most of the experts believe that lax environmental policies are not a significant factor influencing the rising trend of FDI inflows in Bangladesh. Rather, cheap labor and less stringent foreign investment policies are main contributors to the FDIs.
Specific Objective-2: Whether FDI inflow has positive impact on the pollution level in Bangladesh	The study also found statistically insignificant relationship between FDI inflows and pollution levels in Bangladesh. This indicates that the rising trend of FDI inflows has not significantly contributed to increased pollution levels in the country.	In this case, many experts have argued that the current trend of FDI inflows has not yet significantly contributed to an increase in pollution levels in the country. However, they warn that if the current trend continues, it may lead to increased local pollution, including air, water, and soil pollution, in the near future.

Source: Author's compilation from secondary data and KIIs

From Table 6.4.1, we see that both techniques used to analyze the study data yielded the same results, indicating consistency between the quantitative and qualitative analyses. Based on the findings of the study, the relationship between lax environmental policies and FDI inflows in Bangladesh is found to be insignificant. This suggests that while Bangladesh has attracted foreign direct investment, it is not primarily driven by relaxed environmental regulations. Other factors, such as market potential, labor costs, and economic stability, may be more significant in influencing FDI inflows.

Similarly, the study indicates that FDI inflows have not yet had a significant impact on pollution levels in Bangladesh. However, there is a concern that as FDI continues to grow, particularly in sectors with environmental implications, it could eventually contribute to increased pollution. Experts emphasize the need for proactive measures to prevent such an outcome.

CHAPTER SEVEN

CONCLUSION &

POLICY RECOMMENDATION

7.1. Conclusion

This study aims to investigate two primary objectives: the impact of lax environmental policies on foreign direct investment (FDI) inflows in Bangladesh, and the effect of FDI inflows on pollution levels within the country. To address these objectives, both quantitative and qualitative methodologies were employed. The quantitative analysis utilized the Johansen cointegration test, the Vector Error Correction Model (VECM), and the Granger causality test. In complement, Key Informant Interviews (KII) were conducted for the qualitative analysis to provide deeper insights into the research questions.

The results of the Johansen cointegration test indicate a long-run cointegrating relationship between lax environmental policies, proxied by CO2 emissions, and FDI inflows in Bangladesh. This finding suggests that, over time, CO2 emissions and FDI inflows are interlinked. The study also accounts for other determinants of FDI inflows, including market size, macroeconomic stability, infrastructure quality, and trade openness. The Johansen test confirms that these variables exert a long-term influence on FDI inflows, implying that environmental policies are just one factor among several that affect FDI inflows into Bangladesh.

The VECM results reveal that, in the long run, FDI inflows are positively correlated with CO2 emissions and electric power consumption, but negatively correlated with GDP, inflation, and trade openness. In contrast, the long-term relationships of CO2 emissions, electric power consumption, and GDP per capita are either weak or statistically insignificant. Inflation, in particular, demonstrates a significant long-term negative impact on FDI inflows, while trade openness exhibits a marginally significant negative relationship.

In the short run, the results indicate that electric power consumption has a positive and significant effect on FDI inflows, while trade openness negatively and significantly influences

FDI inflows. CO2 emissions and GDP per capita, however, do not exhibit significant short-term effects on FDI inflows. Inflation, while marginally significant, also negatively impacts FDI inflows in the short term. Additionally, past changes in FDI inflows have a negative and significant impact on current FDI inflows, suggesting the presence of a short-term correction mechanism.

Thus, the VECM results suggest that FDI inflows are influenced by a combination of economic and environmental factors. While there is some weak evidence that lax environmental policies (reflected in higher CO2 emissions) may attract FDI, this relationship is not statistically robust. Moreover, macroeconomic factors such as inflation and energy consumption emerge as critical determinants of FDI inflows, with inflation acting as a significant deterrent.

The Granger causality test reveals no significant causal relationships between FDI and CO2 emissions, inflation, or trade openness. However, FDI exhibits a near-significant influence on trade openness. The analysis does show that FDI inflows significantly impact GDP per capita and electric power consumption.

The qualitative findings, based on Key Informant Interviews (KII) with 12 experts, reveal additional insights. Most respondents emphasized that low labor costs are a major factor contributing to the rising trend of FDI inflows in Bangladesh. In addition to low labor costs, factors such as market size, lax environmental policies, and geopolitical considerations were also identified as key determinants of FDI inflows.

Despite FDI representing only about 5 percent of total investment, the experts raised concerns that a substantial portion of this FDI is concentrated in polluting industries. They warned that if the government fails to enforce existing environmental regulations effectively, local pollution levels could rise in the near future, particularly as FDI increases in environmentally sensitive sectors.

The study's findings suggest that the relationship between lax environmental policies and FDI inflows in Bangladesh is statistically insignificant. This indicates that while the country has been successful in attracting foreign investment, relaxed environmental regulations are not the primary driving factor. Instead, variables such as market potential, low labor costs, and economic stability appear to play more significant roles in influencing FDI inflows.

Similarly, the study finds that FDI inflows have not yet significantly impacted pollution levels in Bangladesh. However, there is concern among experts that, as FDI continues to grow—especially in environmentally sensitive industries—there is potential for increased pollution. Consequently, experts highlight the importance of proactive measures to mitigate this risk. Therefore, based on the findings, this study does not strongly support the pollution haven hypothesis, which posits that lax environmental policies in developing countries attract polluting industries from developed nations, resulting in heightened pollution levels in host countries.

7.2 Policy Recommendation

The study concludes that the pollution haven hypothesis (PHH) does not hold in the case of Bangladesh, indicating that weak environmental regulations are not the primary driver attracting polluting industries. Based on these findings, the following recommendations are proposed to support Bangladesh in sustaining industrial growth while ensuring environmental sustainability:

- ***Strengthening Environmental Enforcement***: Although lax environmental regulations are not a key factor in attracting FDI, it remains essential to enhance the enforcement and monitoring of existing environmental laws to prevent potential environmental degradation as FDI inflows increase. The government should establish clear environmental performance benchmarks for foreign-invested companies, particularly

those operating in environmentally sensitive sectors, to safeguard against compromising environmental health in pursuit of economic growth.

- ***Enhancing Environmental Regulations***: Bangladesh should continue to strengthen its environmental regulatory framework to ensure it remains resilient and robust, thereby mitigating any future risk of becoming a pollution haven. Sector-specific environmental standards should be developed and implemented for high-polluting industries such as textiles, leather, and manufacturing, encouraging the adoption of cleaner production practices.
- ***Diversifying FDI into Environmentally Friendly Sectors***: Given that a significant proportion of FDI currently targets polluting industries, efforts should be made to shift FDI towards less environmentally harmful sectors, such as technology, services, and renewable energy. This can be achieved by fostering a conducive business environment and offering targeted incentives to attract investments in sectors with lower environmental footprints.
- ***Promoting Clean Technologies through Incentives***: The government should incentivize industries to invest in cleaner, more efficient technologies by offering tax breaks, grants, or low-interest loans. Attracting FDI in sectors such as renewable energy, eco-tourism, and technology would align with Bangladesh's long-term sustainable development goals.
- ***Supporting Green Innovation***: Providing subsidies or financial incentives for firms that adopt green technologies or engage in environmental research and development would stimulate innovation. Industries should also be encouraged to incorporate biodegradable and eco-friendly packaging, particularly in export-driven sectors like garments and seafood.

- ***Promoting Energy Efficiency***: The observed positive relationship between FDI and electric power consumption highlights the need to focus on energy-efficient solutions. Promoting FDI in industries that develop or deploy low-carbon technologies will help mitigate the environmental consequences of rising energy demands associated with economic expansion.
- ***Strengthening Enforcement Mechanisms***: To ensure compliance with environmental regulations, more robust enforcement mechanisms are necessary. The government should consider introducing digital monitoring tools to track pollution levels in industrial zones, enabling prompt intervention when pollution thresholds are breached.

By prioritizing sustainable practices, enhancing regulatory enforcement, and fostering green growth, Bangladesh can achieve its development objectives while mitigating the environmental risks typically associated with the pollution haven hypothesis.

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Appendix

Questionnaire

Key Informant Interview

Name of the Informant:

Date & time of the interview:

Broad questions for the informants:

1. The inflow of FDI in Bangladesh has been increasing steadily. In 1973, the net FDI flow was only USD 2 million, but by 2020, it had climbed to USD 2,350 million. What influential factors do you think are responsible for the increase in FDI in Bangladesh?
2. Do you think that lax environmental policies facilitate FDI inflow in Bangladesh?
3. Most of the FDI inflows in Bangladesh have been concentrated in polluting industries, such as textiles (47%), food products (17.88%), fertilizers (3.70%), cement (5.62%), pharmaceuticals (4.57%), and leather (3.91%), which belong to the red category according to the Environmental Conservation Act of 1997. Do you think this FDI may have a positive effect on pollution levels in Bangladesh?
4. The government has provided various incentives in the form of tax exemptions, royalties, multiple-entry visas, easy work permits for foreigners, credit facilities for foreign investors, and reinvestment capital facilities, among others, to attract foreign investment. Do you think these investment-friendly environmental policies are accelerating pollution levels?

5. If so, what initiatives should our government take to reduce pollution levels in Bangladesh?
6. If the government adopts strict investment and environmental policies, the inflow of FDI may decrease. In that case, what measures could be taken to increase FDI inflow while also reducing pollution levels in the country?
7. In Bangladesh, there are 25 foreign companies in the power sector. Of these, 7 are gas-based, 6 are coal-based, 5 use liquid fuel, 2 are dual fuel, 4 are solar, and 1 is wind-based. This means that out of the 25 companies, 20 operate conventional power plants while 5 are renewable. The government has been encouraging foreign investors to invest in coal-based power plants. Do you think this investment-friendly policy of the government may accelerate the pollution levels in the country?
8. In the National Environmental Policy 2018, the government has emphasized the use of renewable energy. However, at the same time, the government has set a target to increase coal-based power generation from 2% to 35% by 2041. Do you think this contradictory policy may raise the pollution levels in Bangladesh?
9. What do you think is the overall impact of this FDI on our economy and environment as a whole?
10. In reality, are the existing regulations playing an effective role in reducing the pollution from those 'red category' industries?
11. If any firm or industry violates the rules of the DoE, what kind of compensation or penalty is that firm liable to pay?
12. Do you think there is any conflict between the National Investment Policy/Trade Policy and the National Environmental Policy regarding pollution issues?

Thank you very much for your valuable time and support

Table-3.8.2: Summary of characteristics of participants in key informant interviews

Date	**Name of the Informant**	**Position/Title**	**Organization/Institution**
28.09.2021	Dr. Qazi Kholiquzzaman Ahmad	Environmental Economist & Chairman, Governing Council	Dhaka School of Economics (DScE)
01.10.2021	Professor Dr. M. Nurul Islam	Professor & Energy Expert	Bangladesh University of Engineering and Technology (BUET)
10.06.2024	Dr. Shamim Ahmad	Director	Department of Environment (DoE)
27.09.2021	Mr. Abdus Sobhan	Former Deputy Director, DoE	Department of Environment (DoE)
18.09.2021	Dr. Ehsanul Kabir	Post-Doctoral Researcher	Centre for Environment, University of Langester, UK
19.09.2021	Md. Tauhidul Alam	Assistant Professor	Dhaka School of Economics
21.09.2021	Ms. Fatema Begum	Assistant Secretary	Planning Commission
30.09.2021	Md. Mozzamel Haque	General Manager	Bangladesh Export Processing Zones Authority (BEPZA)
23.09.2021	Md. Shoriful Islam	Deputy General Manager Dhaka Export Processing	Dhaka Export Processing Zones (DEPZ)
12.06.2024	Mohammad Saiful Islam	Environmental Chemist	Matarbari Power Plant

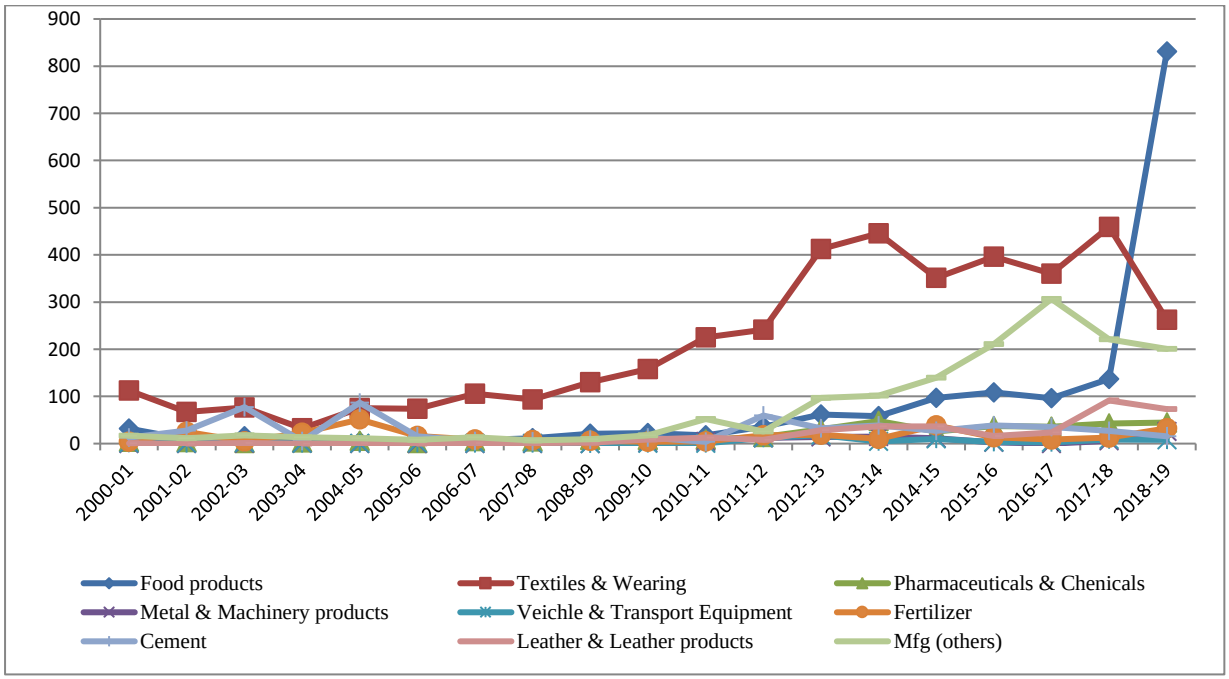
18.06.2024	Nazmul Hasan Bhuyan	Environmental Chemist	Rampal Power Plant
21.06.2024	Md. Imtiaz Hossein	Manager	Daeyu Bangladesh Ltd.

Table-A1: Total FDI inflow in Bangladesh from 1973-2019

Year	FDI inflow (million US &)
1973	2
1974	2
1975	2
1976	5
1977	7
1978	8
1979	-8
1980	9
1981	5
1982	7
1983	0
1984	-1
1985	-7
1986	2
1987	3
1988	2
1989	0
1990	3
1991	1
1992	4
1993	14
1994	11
1995	92
1996	232
1997	575
1998	576
1999	309
2000	579
2001	354
2002	335
2003	350
2004	460
2005	845
2006	792
2007	666
2008	1086
2009	700
2010	913
2011	1136
2012	1293
2013	1599
2014	1551
2015	2235
2016	2333
2017	2152
2018	3613
2019	1597

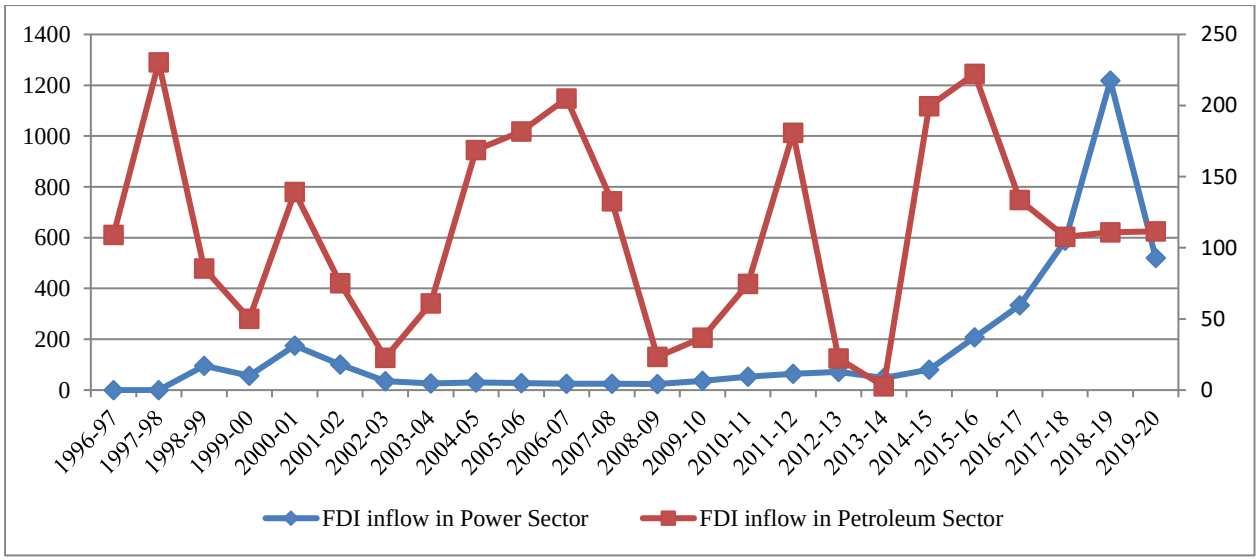
Source: UNCTAD

Figure-A: **Sub-sectorial trend of manufacturing FDI inflow (USD in million) from FY 1996-97 to FY 2019-20**



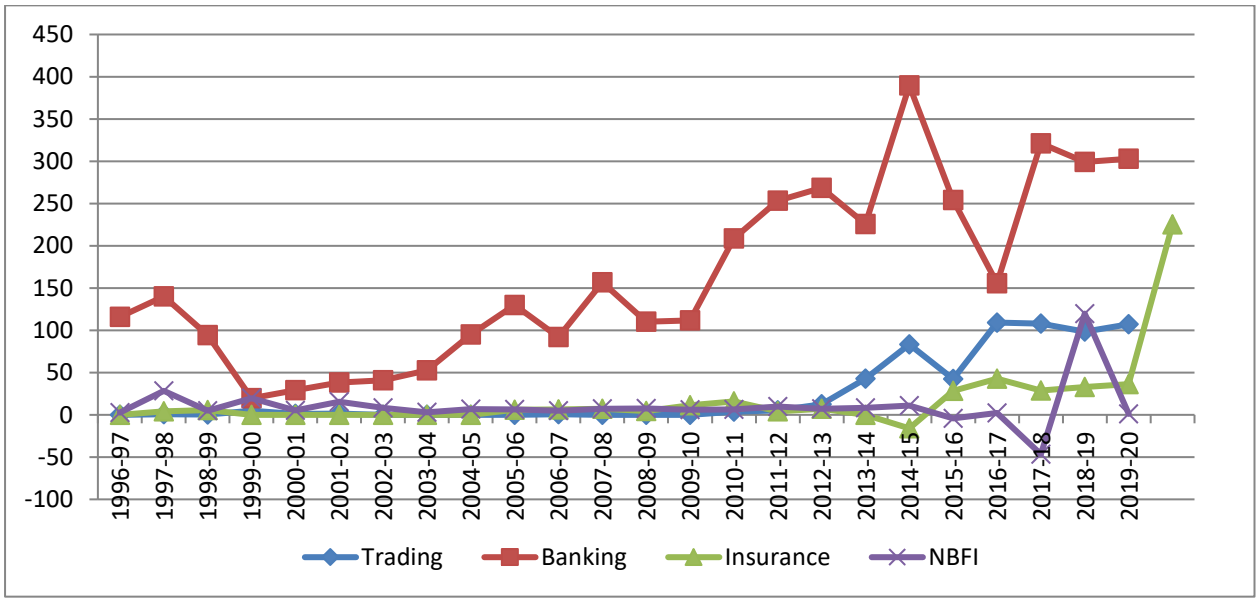
Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure-B: **Sub-sectorial trend of FDI inflow in power, gas and petroleum sector (USD in million) from FY 1996-97 to FY2019-20**



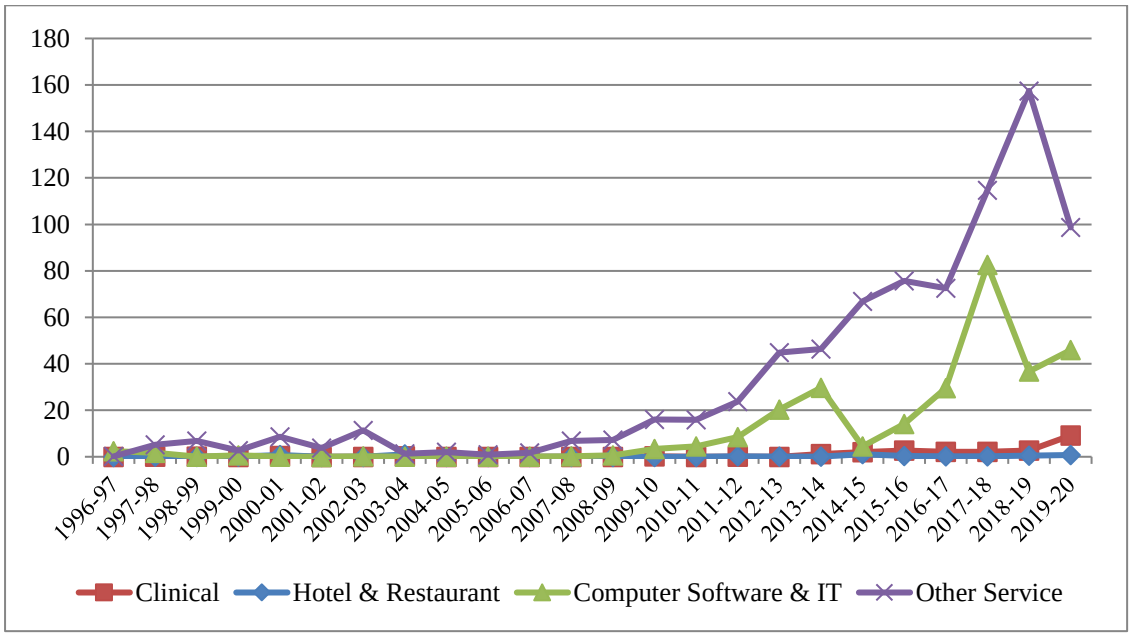
Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure-C: **Sub-sectorial trend of FDI inflow in trade & commerce sector (USD in million) from FY 1996-97 to FY2019-20**



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Figure-D: **Sub-sectorial trend of FDI inflow in service sector (USD in million) from FY 1996-97 to 2019-20**



Source: Authors calculation based on data that has been extracted from UNCTAD & World Bank sites

Augmented Dickey-Fuller Unit Root Test on D(CO2_EMISSION__METRIC_TON_PER_CAPITA_)

Null Hypothesis: D(CO2_EMISSION__METRIC_TON_PER_CAPITA_) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.573918	0.0000
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(CO2_EMISSION__METRIC_TON_PER_CAPITA_
,2)
Method: Least Squares
Date: 10/14/24 Time: 15:48
Sample (adjusted): 1975 2020
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CO2_EMISSION__METRIC_TON_PER	-0.998409	0.151874	-6.573918	0.0000
C	0.003270	0.004009	0.815510	0.4193
@TREND("1973")	0.000207	0.000146	1.422495	0.1621

R-squared	0.501279	Mean dependent var	-0.000188
Adjusted R-squared	0.478083	S.D. dependent var	0.017756
S.E. of regression	0.012828	Akaike info criterion	-5.811384
Sum squared resid	0.007076	Schwarz criterion	-5.692124
Log likelihood	136.6618	Hannan-Quinn criter.	-5.766708
F-statistic	21.61029	Durbin-Watson stat	1.981329
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(ELECTRIC_POWER_CONSUMPTION__KWH_PER_CAPITA_)

Null Hypothesis: D(ELECTRIC_POWER_CONSUMPTION__KWH_PER_CAPITA_) has a unit
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.501168	0.0000
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(ELECTRIC_POWER_CONSUMPTION__KWH_P
ER_CAPITA_,2)
Method: Least Squares
Date: 10/14/24 Time: 15:51
Sample (adjusted): 1975 2020
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(ELECTRIC_POWER_CONSUMPTION_	-0.990543	0.152364	-6.501168	0.0000
C	0.510751	3.201871	0.159517	0.8740
@TREND("1973")	0.230912	0.120082	1.922962	0.0611

R-squared	0.495696	Mean dependent var	0.092034
Adjusted R-squared	0.472240	S.D. dependent var	14.23744
S.E. of regression	10.34308	Akaike info criterion	7.573506
Sum squared resid	4600.111	Schwarz criterion	7.692765
Log likelihood	-171.1906	Hannan-Quinn criter.	7.618181
F-statistic	21.13303	Durbin-Watson stat	1.999812
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(FDI_NETFLOW__MILL_US_$_,2)

Null Hypothesis: D(FDI_NETFLOW__MILL_US_$_,2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 7 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.625304	0.0002
Test critical values:	1% level	-4.219126	
	5% level	-3.533083	
	10% level	-3.198312	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI_NETFLOW__MILL_US_$_,3)
Method: Least Squares
Date: 10/14/24 Time: 15:54
Sample (adjusted): 1983 2020
Included observations: 38 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI_NETFLOW__MILL_US_$_(-1),2)	-14.85174	2.640167	-5.625304	0.0000
D(FDI_NETFLOW__MILL_US_$_(-1),3)	13.10618	2.600110	5.040623	0.0000
D(FDI_NETFLOW__MILL_US_$_(-2),3)	11.72222	2.433437	4.817146	0.0000
D(FDI_NETFLOW__MILL_US_$_(-3),3)	10.39897	2.242471	4.637284	0.0001
D(FDI_NETFLOW__MILL_US_$_(-4),3)	7.736856	1.836269	4.213356	0.0002
D(FDI_NETFLOW__MILL_US_$_(-5),3)	5.755319	1.370447	4.199592	0.0002
D(FDI_NETFLOW__MILL_US_$_(-6),3)	2.980335	0.778509	3.828259	0.0007
D(FDI_NETFLOW__MILL_US_$_(-7),3)	1.579045	0.368085	4.289897	0.0002
C	-88.21351	97.29697	-0.906642	0.3723
@TREND("1973")	5.955678	3.517036	1.693380	0.1015

R-squared	0.952181	Mean dependent var	-11.63321
Adjusted R-squared	0.936810	S.D. dependent var	794.2631
S.E. of regression	199.6585	Akaike info criterion	13.65203
Sum squared resid	1116178.	Schwarz criterion	14.08297
Log likelihood	-249.3885	Hannan-Quinn criter.	13.80535
F-statistic	61.94865	Durbin-Watson stat	2.084498
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(INFLATION_GDP_DEFLATOR)

Null Hypothesis: D(INFLATION_GDP_DEFLATOR) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.84432	0.0000
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INFLATION_GDP_DEFLATOR,2)
Method: Least Squares
Date: 10/14/24 Time: 15:56
Sample (adjusted): 1975 2020
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATION_GDP_DEFLATOR(-1))	-1.417156	0.119649	-11.84432	0.0000
C	-4.248284	4.749845	-0.894405	0.3761
@TREND("1973")	0.125586	0.170459	0.736749	0.4653

R-squared	0.766607	Mean dependent var	-1.229918
Adjusted R-squared	0.755752	S.D. dependent var	31.04990
S.E. of regression	15.34532	Akaike info criterion	8.362492
Sum squared resid	10125.60	Schwarz criterion	8.481751
Log likelihood	-189.3373	Hannan-Quinn criter.	8.407167
F-statistic	70.61933	Durbin-Watson stat	2.226741
Prob(F-statistic)	0.000000		

Augmented Dickey-Fuller Unit Root Test on D(TRADE_OPENNESS)

Null Hypothesis: D(TRADE_OPENNESS) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.802602	0.0000
Test critical values:	1% level	-4.170583	
	5% level	-3.510740	
	10% level	-3.185512	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TRADE_OPENNESS,2)
Method: Least Squares
Date: 10/14/24 Time: 15:57
Sample (adjusted): 1975 2020
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(TRADE_OPENNESS(-1))	-1.168790	0.149795	-7.802602	0.0000
C	1.154195	1.020726	1.130760	0.2644
@TREND("1973")	-0.029993	0.036471	-0.822369	0.4154

R-squared	0.586166	Mean dependent var	0.009923
Adjusted R-squared	0.566918	S.D. dependent var	4.972083
S.E. of regression	3.272076	Akaike info criterion	5.271720
Sum squared resid	460.3787	Schwarz criterion	5.390979
Log likelihood	-118.2496	Hannan-Quinn criter.	5.316395
F-statistic	30.45323	Durbin-Watson stat	2.072432
Prob(F-statistic)	0.000000		

Johansen Cointegration Test

Date: 09/20/24 Time: 15:29
Sample (adjusted): 1978 2020
Included observations: 43 after adjustments
Trend assumption: Linear deterministic trend
Series: Y_FDI X1_CO2 X2_ELECTRIC_POWER X3_GDP X41_INFLATION X5_TRADE
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.936819	294.5144	95.75366	0.0000
At most 1 *	0.832695	175.7591	69.81889	0.0000
At most 2 *	0.728415	98.87773	47.85613	0.0000
At most 3 *	0.472700	42.82807	29.79707	0.0009
At most 4	0.278964	15.30869	15.49471	0.0533
At most 5	0.028535	1.244850	3.841465	0.2645

Trace test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.936819	118.7553	40.07757	0.0000
At most 1 *	0.832695	76.88136	33.87687	0.0000
At most 2 *	0.728415	56.04967	27.58434	0.0000
At most 3 *	0.472700	27.51937	21.13162	0.0055
At most 4	0.278964	14.06384	14.26460	0.0537
At most 5	0.028535	1.244850	3.841465	0.2645

Max-eigenvalue test indicates 4 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I):

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
-0.001781	-3.810936	-0.012950	0.001135	0.108182	0.062547
0.003962	-11.20944	0.027137	-0.003053	0.063705	-0.151262
-0.000427	-20.37647	0.126107	-0.007972	-0.017181	-0.630805
0.000449	64.75771	-0.117435	-0.000837	-0.000302	-0.323064
5.80E-05	-138.1228	0.057467	0.002401	0.001686	0.081904
-4.42E-05	4.835433	0.051603	0.016251	-0.030572	0.066954

Unrestricted Adjustment Coefficients (alpha):

D(Y_FDI)	309.9671	-555.9571	48.51062	-8.270704	2.264932	-2.156215
D(X1_CO2)	-0.000319	0.002650	-0.001908	0.002348	0.006722	-0.000726
D(X2_ELECTR	-1.613301	2.581753	-4.573376	5.950139	1.428597	-0.986880
D(X3_GDP)	-2.930184	-15.50401	23.91398	-27.29183	-10.70412	-1.378073
D(X41_INFLAT	-11.06032	-5.115287	0.096262	0.164536	0.834035	0.125396
D(X5_TRADE)	0.420731	0.123291	1.344025	1.828931	0.737207	0.063117

1 Cointegrating Equation(s): Log likelihood -806.4260

Normalized cointegrating coefficients (standard error in parentheses)

Johansen Cointegration Test

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
1.000000	2140.354	7.273136	-0.637405	-60.75906	-35.12850
	(3807.16)	(4.71209)	(0.45302)	(3.19089)	(17.8213)

Adjustment coefficients (standard error in parentheses)

D(Y_FDI)	-0.551902
	(0.18582)
D(X1_CO2)	5.67E-07
	(4.3E-06)
D(X2_ELECTR	0.002873
	(0.00373)
D(X3_GDP)	0.005217
	(0.01683)
D(X41_INFLAT	0.019693
	(0.00197)
D(X5_TRADE)	-0.000749
	(0.00103)

2 Cointegrating Equation(s): Log likelihood -767.9853

Normalized cointegrating coefficients (standard error in parentheses)

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
1.000000	0.000000	7.090890	-0.694808	-27.66664	-36.44328
		(2.45642)	(0.29878)	(2.10287)	(11.6128)
0.000000	1.000000	8.51E-05	2.68E-05	-0.015461	0.000614
		(0.00095)	(0.00012)	(0.00081)	(0.00448)

Adjustment coefficients (standard error in parentheses)

D(Y_FDI)	-2.754426	5050.702
	(0.19719)	(537.507)
D(X1_CO2)	1.11E-05	-0.028496
	(1.0E-05)	(0.02820)
D(X2_ELECTR	0.013101	-22.79181
	(0.00889)	(24.2286)
D(X3_GDP)	-0.056205	184.9580
	(0.03945)	(107.528)
D(X41_INFLAT	-0.000572	99.48967
	(0.00299)	(8.15914)
D(X5_TRADE)	-0.000261	-2.985398
	(0.00251)	(6.83333)

3 Cointegrating Equation(s): Log likelihood -739.9605

Normalized cointegrating coefficients (standard error in parentheses)

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
1.000000	0.000000	0.000000	-0.276376	-9.025547	-2.099421
			(0.29021)	(1.99502)	(9.93352)
0.000000	1.000000	0.000000	3.18E-05	-0.015237	0.001027
			(0.00011)	(0.00078)	(0.00389)
0.000000	0.000000	1.000000	-0.059010	-2.628880	-4.843378
			(0.02334)	(0.16047)	(0.79899)

Adjustment coefficients (standard error in parentheses)

D(Y_FDI)	-2.775142	4062.226	-12.98377
	(0.19488)	(1052.30)	(5.78885)
D(X1_CO2)	1.19E-05	0.010376	-0.000165
	(1.0E-05)	(0.05561)	(0.00031)
D(X2_ELECTR	0.015054	70.39744	-0.485778
	(0.00827)	(44.6534)	(0.24564)
D(X3_GDP)	-0.066417	-302.3245	2.632917
	(0.03550)	(191.666)	(1.05438)
D(X41_INFLAT	-0.000613	97.52819	0.016554

Johansen Cointegration Test

	(0.00301)	(16.2361)	(0.08932)		
D(X5_TRADE)	-0.000835	-30.37188	0.167388		
	(0.00232)	(12.5036)	(0.06878)		

4 Cointegrating Equation(s): Log likelihood -726.2008

Normalized cointegrating coefficients (standard error in parentheses)

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
1.000000	0.000000	0.000000	0.000000	-28.44008	25.16399
				(2.37056)	(9.94497)
0.000000	1.000000	0.000000	0.000000	-0.013000	-0.002115
				(0.00066)	(0.00276)
0.000000	0.000000	1.000000	0.000000	-6.774134	0.977714
				(0.36436)	(1.52855)
0.000000	0.000000	0.000000	1.000000	-70.24680	98.64609
				(4.46920)	(18.7492)

Adjustment coefficients (standard error in parentheses)

D(Y_FDI)	-2.778855	3526.634	-12.01250	1.669437
	(0.19581)	(3075.62)	(7.80692)	(0.38618)
D(X1_CO2)	1.29E-05	0.162419	-0.000440	4.79E-06
	(1.0E-05)	(0.16029)	(0.00041)	(2.0E-05)
D(X2_ELECTR	0.017725	455.7148	-1.184530	0.021764
	(0.00705)	(110.662)	(0.28090)	(0.01389)
D(X3_GDP)	-0.078670	-2069.681	5.837919	-0.123785
	(0.02939)	(461.582)	(1.17165)	(0.05796)
D(X41_INFLAT	-0.000539	108.1832	-0.002768	0.002161
	(0.00302)	(47.4386)	(0.12041)	(0.00596)
D(X5_TRADE)	-1.35E-05	88.06549	-0.047392	-0.012146
	(0.00189)	(29.7150)	(0.07543)	(0.00373)

5 Cointegrating Equation(s): Log likelihood -719.1689

Normalized cointegrating coefficients (standard error in parentheses)

Y_FDI	X1_CO2	X2_ELECTRIC	X3_GDP	X41_INFLATI	X5_TRADE
1.000000	0.000000	0.000000	0.000000	0.000000	36.79206
					(11.1401)
0.000000	1.000000	0.000000	0.000000	0.000000	0.003201
					(0.00166)
0.000000	0.000000	1.000000	0.000000	0.000000	3.747401
					(1.34410)
0.000000	0.000000	0.000000	1.000000	0.000000	127.3673
					(18.3913)
0.000000	0.000000	0.000000	0.000000	1.000000	0.408862
					(0.25270)

Adjustment coefficients (standard error in parentheses)

D(Y_FDI)	-2.778724	3213.796	-11.88234	1.674876	-2.711274
	(0.19582)	(6888.93)	(8.21714)	(0.40076)	(5.65574)
D(X1_CO2)	1.33E-05	-0.765980	-5.40E-05	2.09E-05	0.000178
	(8.9E-06)	(0.31329)	(0.00037)	(1.8E-05)	(0.00026)
D(X2_ELECTR	0.017808	258.3931	-1.102433	0.025195	0.069127
	(0.00697)	(245.056)	(0.29230)	(0.01426)	(0.20119)
D(X3_GDP)	-0.079291	-591.1988	5.222784	-0.149487	-1.725356
	(0.02830)	(995.478)	(1.18741)	(0.05791)	(0.81728)
D(X41_INFLAT	-0.000491	-7.015988	0.045162	0.004163	-1.522699
	(0.00296)	(104.007)	(0.12406)	(0.00605)	(0.08539)
D(X5_TRADE)	2.93E-05	-13.75965	-0.005027	-0.010375	0.030968
	(0.00181)	(63.7198)	(0.07601)	(0.00371)	(0.05231)

Vector Error Correction Estimates

Vector Error Correction Estimates
Date: 09/19/24 Time: 20:51
Sample (adjusted): 1978 2020
Included observations: 43 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
Y_FDI(-1)	1.000000
X1_CO2(-1)	2140.354 (3807.16) [0.56219]
X2_ELECTRIC_POWER(	7.273136 (4.71209) [1.54350]
X3_GDP(-1)	-0.637405 (0.45302) [-1.40701]
X41_INFLATION(-1)	-60.75906 (3.19089) [-19.0414]
X5_TRADE(-1)	-35.12850 (17.8213) [-1.97115]
C	-142.1522

Error Correction:	D(Y_FDI)	D(X1_CO2)	D(X2_ELEC	D(X3_GDP)	D(X41_INFL	D(X5_TRADE)
CointEq1	-0.551902 (0.18582) [-2.97001]	5.67E-07 (4.3E-06) [0.13147]	0.002873 (0.00373) [0.77102]	0.005217 (0.01683) [0.30998]	0.019693 (0.00197) [10.0032]	-0.000749 (0.00103) [-0.72849]
D(Y_FDI(-1))	-0.311463 (0.12693) [-2.45376]	1.35E-06 (2.9E-06) [0.45960]	-5.13E-05 (0.00254) [-0.02015]	-0.015629 (0.01150) [-1.35942]	-0.010194 (0.00134) [-7.58030]	0.001659 (0.00070) [2.36150]
D(X1_CO2(-1))	3185.022 (7876.60) [0.40436]	-0.573230 (0.18289) [-3.13430]	37.64441 (157.918) [0.23838]	446.4283 (713.404) [0.62577]	103.9730 (83.4468) [1.24598]	-31.81701 (43.5875) [-0.72996]
D(X2_ELECTRIC_POW	35.46114 (12.1996) [2.90676]	-0.000150 (0.00028) [-0.53081]	-0.536866 (0.24459) [-2.19497]	-0.596768 (1.10494) [-0.54009]	0.127729 (0.12925) [0.98827]	0.163615 (0.06751) [2.42358]
D(X3_GDP(-1))	-0.046668 (2.93276) [-0.01591]	-4.82E-05 (6.8E-05) [-0.70852]	-0.017075 (0.05880) [-0.29040]	-0.413177 (0.26563) [-1.55547]	0.077954 (0.03107) [2.50894]	0.013465 (0.01623) [0.82968]
D(X41_INFLATION(-1))	-11.70938 (6.52054) [-1.79577]	1.64E-05 (0.00015) [0.10815]	0.092332 (0.13073) [0.70628]	-0.082184 (0.59058) [-0.13916]	0.139717 (0.06908) [2.02254]	0.004224 (0.03608) [0.11706]
D(X5_TRADE(-1))	-94.96830 (29.1927) [-3.25315]	1.59E-06 (0.00068) [0.00235]	0.075632 (0.58529) [0.12922]	-2.910549 (2.64406) [-1.10079]	0.051492 (0.30928) [0.16649]	-0.423032 (0.16155) [-2.61864]
C	-68.17082 (106.330)	0.000417 (0.00247)	0.513167 (2.13181)	4.572385 (9.63059)	1.753145 (1.12649)	-0.174313 (0.58841)

Vector Error Correction Estimates

	[-0.64112]	[0.16880]	[0.24072]	[0.47478]	[1.55629]	[-0.29624]
R-squared	0.789627	0.366512	0.276621	0.298550	0.891497	0.400818
Adj. R-squared	0.747552	0.239814	0.131946	0.158260	0.869796	0.280982
Sum sq. resids	16392749	0.008838	6589.284	134476.1	1839.896	501.9926
S.E. equation	684.3714	0.015891	13.72098	61.98528	7.250412	3.787168
F-statistic	18.76727	2.892808	1.912008	2.128088	41.08161	3.344711
Log likelihood	-337.3141	121.5186	-169.2024	-234.0451	-141.7740	-113.8481
Akaike AIC	16.06112	-5.279934	8.241970	11.25791	6.966235	5.667355
Schwarz SC	16.38878	-4.952269	8.569635	11.58558	7.293900	5.995020
Mean dependent	-21.59335	-5.23E-05	0.200199	2.806340	2.293668	0.038560
S.D. dependent	1362.090	0.018226	14.72691	67.56153	20.09328	4.466267

Determinant resid covariance (dof adj.)	2.70E+09
Determinant resid covariance	7.85E+08
Log likelihood	-806.4260
Akaike information criterion	40.01981
Schwarz criterion	42.23155
Number of coefficients	54

Estimation Proc:
==========
EC(C,1) 1 1 Y_FDI X1_CO2 X2_ELECTRIC X3_GDP X4_INFLATION X5_TRADE

VAR Model:
==========
D(Y_FDI) = A(1,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(1,1)*D(Y_FDI(-1)) + C(1,2)*D(X1_CO2(-1)) + C(1,3)*D(X2_ELECTRIC(-1)) + C(1,4)*D(X3_GDP(-1)) + C(1,5)*D(X4_INFLATION(-1)) + C(1,6)*D(X5_TRADE(-1)) + C(1,7)

D(X1_CO2) = A(2,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(2,1)*D(Y_FDI(-1)) + C(2,2)*D(X1_CO2(-1)) + C(2,3)*D(X2_ELECTRIC(-1)) + C(2,4)*D(X3_GDP(-1)) + C(2,5)*D(X4_INFLATION(-1)) + C(2,6)*D(X5_TRADE(-1)) + C(2,7)

D(X2_ELECTRIC) = A(3,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(3,1)*D(Y_FDI(-1)) + C(3,2)*D(X1_CO2(-1)) + C(3,3)*D(X2_ELECTRIC(-1)) + C(3,4)*D(X3_GDP(-1)) + C(3,5)*D(X4_INFLATION(-1)) + C(3,6)*D(X5_TRADE(-1)) + C(3,7)

D(X3_GDP) = A(4,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(4,1)*D(Y_FDI(-1)) + C(4,2)*D(X1_CO2(-1)) + C(4,3)*D(X2_ELECTRIC(-1)) + C(4,4)*D(X3_GDP(-1)) + C(4,5)*D(X4_INFLATION(-1)) + C(4,6)*D(X5_TRADE(-1)) + C(4,7)

D(X4_INFLATION) = A(5,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(5,1)*D(Y_FDI(-1)) + C(5,2)*D(X1_CO2(-1)) + C(5,3)*D(X2_ELECTRIC(-1)) + C(5,4)*D(X3_GDP(-1)) + C(5,5)*D(X4_INFLATION(-1)) + C(5,6)*D(X5_TRADE(-1)) + C(5,7)

D(X5_TRADE) = A(6,1)*(B(1,1)*Y_FDI(-1) + B(1,2)*X1_CO2(-1) + B(1,3)*X2_ELECTRIC(-1) + B(1,4)*X3_GDP(-1) + B(1,5)*X4_INFLATION(-1) + B(1,6)*X5_TRADE(-1) + B(1,7)) + C(6,1)*D(Y_FDI(-1)) + C(6,2)*D(X1_CO2(-1)) + C(6,3)*D(X2_ELECTRIC(-1)) + C(6,4)*D(X3_GDP(-1)) + C(6,5)*D(X4_INFLATION(-1)) + C(6,6)*D(X5_TRADE(-1)) + C(6,7)

VAR Model - Substituted Coefficients:
==========
D(Y_FDI) = - 0.551901523194*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) - 0.311462824154*D(Y_FDI(-1)) + 3185.02240178*D(X1_CO2(-1)) + 35.4611376236*D(X2_ELECTRIC(-1)) - 0.0466678069632*D(X3_GDP(-1)) - 11.7093822966*D(X4_INFLATION(-1)) - 94.9682979285*D(X5_TRADE(-1)) - 68.1708159506

D(X1_CO2) = 5.67255912822e-07*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + 1.35456559854e-06*D(Y_FDI(-1)) - 0.573230085519*D(X1_CO2(-1)) - 0.000150361225447*D(X2_ELECTRIC(-1)) - 4.82479211694e-05*D(X3_GDP(-1)) + 1.63746618412e-05*D(X4_INFLATION(-1)) + 1.59120310599e-06*D(X5_TRADE(-1)) + 0.00041676197457

D(X2_ELECTRIC) = 0.00287250920741*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) - 5.12871454061e-05*D(Y_FDI(-1)) + 37.644410918*D(X1_CO2(-1)) - 0.536866091618*D(X2_ELECTRIC(-1)) - 0.0170749663838*D(X3_GDP(-1)) + 0.0923317051244*D(X4_INFLATION(-1)) + 0.0756318703949*D(X5_TRADE(-1)) + 0.513167166987

D(X3_GDP) = 0.00521724086745*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) - 0.0156287321477*D(Y_FDI(-1)) + 446.428342876*D(X1_CO2(-1)) - 0.596768447497*D(X2_ELECTRIC(-1)) - 0.41317673215*D(X3_GDP(-1)) - 0.0821836724417*D(X4_INFLATION(-1)) - 2.91054854918*D(X5_TRADE(-1)) + 4.57238524907

D(X4_INFLATION) = 0.0196930878229*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) - 0.0101936802275*D(Y_FDI(-1)) + 103.973036673*D(X1_CO2(-1)) + 0.127729343914*D(X2_ELECTRIC(-1)) + 0.0779538239005*D(X3_GDP(-1)) + 0.139717488503*D(X4_INFLATION(-1)) + 0.0514924846521*D(X5_TRADE(-1)) + 1.75314467791

D(X5_TRADE) = - 0.000749118190934*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X4_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + 0.00165876265784*D(Y_FDI(-1)) - 31.8170095174*D(X1_CO2(-1)) + 0.163615269725*D(X2_ELECTRIC(-1)) + 0.0134650738663*D(X3_GDP(-1)) + 0.00422403733656*D(X4_INFLATION(-1)) - 0.423031640545*D(X5_TRADE(-1)) - 0.1743129886

System: UNTITLED
Estimation Method: Least Squares
Date: 09/24/24 Time: 15:58
Sample: 1978 2020
Included observations: 43
Total system (balanced) observations 258

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.551902	0.185825	-2.970010	0.0033
C(2)	-0.311463	0.126933	-2.453763	0.0150
C(3)	3185.022	7876.604	0.404365	0.6864
C(4)	35.46114	12.19955	2.906758	0.0040
C(5)	-0.046668	2.932763	-0.015913	0.9873
C(6)	-11.70938	6.520539	-1.795769	0.0740
C(7)	-94.96830	29.19270	-3.253153	0.0013
C(8)	-68.17082	106.3301	-0.641124	0.5221
C(9)	5.67E-07	4.31E-06	0.131470	0.8955
C(10)	1.35E-06	2.95E-06	0.459597	0.6463
C(11)	-0.573230	0.182889	-3.134302	0.0020
C(12)	-0.000150	0.000283	-0.530815	0.5961
C(13)	-4.82E-05	6.81E-05	-0.708521	0.4794
C(14)	1.64E-05	0.000151	0.108153	0.9140
C(15)	1.59E-06	0.000678	0.002347	0.9981
C(16)	0.000417	0.002469	0.168804	0.8661
C(17)	0.002873	0.003726	0.771018	0.4416
C(18)	-5.13E-05	0.002545	-0.020153	0.9839
C(19)	37.64441	157.9182	0.238379	0.8118
C(20)	-0.536866	0.244589	-2.194972	0.0293
C(21)	-0.017075	0.058799	-0.290395	0.7718
C(22)	0.092332	0.130730	0.706275	0.4808
C(23)	0.075632	0.585285	0.129222	0.8973
C(24)	0.513167	2.131815	0.240718	0.8100
C(25)	0.005217	0.016831	0.309985	0.7569
C(26)	-0.015629	0.011497	-1.359419	0.1755
C(27)	446.4283	713.4042	0.625772	0.5321
C(28)	-0.596768	1.104945	-0.540089	0.5897
C(29)	-0.413177	0.265628	-1.555472	0.1213
C(30)	-0.082184	0.590582	-0.139157	0.8895
C(31)	-2.910549	2.644058	-1.100789	0.2722
C(32)	4.572385	9.630591	0.474777	0.6354
C(33)	0.019693	0.001969	10.00321	0.0000
C(34)	-0.010194	0.001345	-7.580304	0.0000
C(35)	103.9730	83.44682	1.245980	0.2142
C(36)	0.127729	0.129245	0.988271	0.3242
C(37)	0.077954	0.031070	2.508937	0.0129
C(38)	0.139717	0.069080	2.022537	0.0444
C(39)	0.051492	0.309275	0.166494	0.8679
C(40)	1.753145	1.126489	1.556291	0.1211
C(41)	-0.000749	0.001028	-0.728491	0.4671
C(42)	0.001659	0.000702	2.361500	0.0191
C(43)	-31.81701	43.58748	-0.729958	0.4662
C(44)	0.163615	0.067510	2.423579	0.0162
C(45)	0.013465	0.016229	0.829677	0.4077
C(46)	0.004224	0.036083	0.117063	0.9069
C(47)	-0.423032	0.161546	-2.618640	0.0095
C(48)	-0.174313	0.588409	-0.296245	0.7673

Determinant residual covariance 7.85E+08

Equation: D(Y_FDI) = C(1)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) +
7.27313559255*X2_ELECTRIC_POWER(-1) - 0.637404937031
*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) -

35.1284974926*X5_TRADE(-1) - 142.152228964) + C(2)*D(Y_FDI(-1)) + C(3)*D(X1_CO2(-1)) + C(4)*D(X2_ELECTRIC_POWER(-1)) + C(5)*D(X3_GDP(-1)) + C(6)*D(X41_INFLATION(-1)) + C(7)*D(X5_TRADE(-1)) + C(8)

Observations: 43

R-squared	0.789627	Mean dependent var	-21.59335
Adjusted R-squared	0.747552	S.D. dependent var	1362.090
S.E. of regression	684.3715	Sum squared resid	16392749
Durbin-Watson stat	2.020209		

Equation: D(X1_CO2) = C(9)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC_POWER(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + C(10)*D(Y_FDI(-1)) + C(11)*D(X1_CO2(-1)) + C(12)*D(X2_ELECTRIC_POWER(-1)) + C(13)*D(X3_GDP(-1)) + C(14)*D(X41_INFLATION(-1)) + C(15)*D(X5_TRADE(-1)) + C(16)

Observations: 43

R-squared	0.366512	Mean dependent var	-5.23E-05
Adjusted R-squared	0.239814	S.D. dependent var	0.018226
S.E. of regression	0.015891	Sum squared resid	0.008838
Durbin-Watson stat	2.155090		

Equation: D(X2_ELECTRIC_POWER) = C(17)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC_POWER(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + C(18)*D(Y_FDI(-1)) + C(19)*D(X1_CO2(-1)) + C(20)*D(X2_ELECTRIC_POWER(-1)) + C(21)*D(X3_GDP(-1)) + C(22)*D(X41_INFLATION(-1)) + C(23)*D(X5_TRADE(-1)) + C(24)

Observations: 43

R-squared	0.276621	Mean dependent var	0.200199
Adjusted R-squared	0.131946	S.D. dependent var	14.72691
S.E. of regression	13.72098	Sum squared resid	6589.284
Durbin-Watson stat	2.406629		

Equation: D(X3_GDP) = C(25)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC_POWER(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + C(26)*D(Y_FDI(-1)) + C(27)*D(X1_CO2(-1)) + C(28)*D(X2_ELECTRIC_POWER(-1)) + C(29)*D(X3_GDP(-1)) + C(30)*D(X41_INFLATION(-1)) + C(31)*D(X5_TRADE(-1)) + C(32)

Observations: 43

R-squared	0.298550	Mean dependent var	2.806340
Adjusted R-squared	0.158260	S.D. dependent var	67.56152
S.E. of regression	61.98528	Sum squared resid	134476.1
Durbin-Watson stat	2.251257		

Equation: D(X41_INFLATION) = C(33)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC_POWER(-1) - 0.637404937031*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + C(34)*D(Y_FDI(-1)) + C(35)*D(X1_CO2(-1)) + C(36)*D(X2_ELECTRIC_POWER(-1)) + C(37)*D(X3_GDP(-1)) + C(38)*D(X41_INFLATION(-1)) + C(39)*D(X5_TRADE(-1)) + C(40)

Observations: 43

R-squared	0.891497	Mean dependent var	2.293668
Adjusted R-squared	0.869796	S.D. dependent var	20.09328
S.E. of regression	7.250412	Sum squared resid	1839.896
Durbin-Watson stat	2.368034		

Equation: D(X5_TRADE) = C(41)*(Y_FDI(-1) + 2140.35423636*X1_CO2(-1) + 7.27313559255*X2_ELECTRIC_POWER(-1) -

0.637404937031*X3_GDP(-1) - 60.7590580621*X41_INFLATION(-1) - 35.1284974926*X5_TRADE(-1) - 142.152228964) + C(42) *D(Y_FDI(-1)) + C(43)*D(X1_CO2(-1)) + C(44)*D(X2_ELECTRIC_POWER(-1)) + C(45)*D(X3_GDP(-1)) + C(46)*D(X41_INFLATION(-1)) + C(47)*D(X5_TRADE(-1)) + C(48)

Observations: 43

R-squared	0.400818	Mean dependent var	0.038560
Adjusted R-squared	0.280982	S.D. dependent var	4.466267
S.E. of regression	3.787169	Sum squared resid	501.9926
Durbin-Watson stat	2.618229		

Pairwise Granger Causality Tests
Date: 10/06/24 Time: 14:04
Sample: 1973 2020
Lags: 1

Null Hypothesis:	Obs	F-Statistic	Prob.
X5_TRADE does not Granger Cause Y_FDI	44	0.41883	0.5211
Y_FDI does not Granger Cause X5_TRADE		2.98440	0.0916
X4_INFLATION does not Granger Cause Y_FDI	44	0.00117	0.9729
Y_FDI does not Granger Cause X4_INFLATION		0.00298	0.9567
X3_GDP does not Granger Cause Y_FDI	44	0.29496	0.5900
Y_FDI does not Granger Cause X3_GDP		11.1999	0.0018
X2_ELECTRIC does not Granger Cause Y_FDI	44	2.05989	0.1588
Y_FDI does not Granger Cause X2_ELECTRIC		4.28604	0.0448
X1_CO2 does not Granger Cause Y_FDI	44	0.51386	0.4775
Y_FDI does not Granger Cause X1_CO2		2.77548	0.1033
X4_INFLATION does not Granger Cause X5_TRADE	46	0.12997	0.7202
X5_TRADE does not Granger Cause X4_INFLATION		6.74913	0.0128
X3_GDP does not Granger Cause X5_TRADE	46	0.51412	0.4772
X5_TRADE does not Granger Cause X3_GDP		0.46447	0.4992
X2_ELECTRIC does not Granger Cause X5_TRADE	46	0.64133	0.4276
X5_TRADE does not Granger Cause X2_ELECTRIC		0.30395	0.5843
X1_CO2 does not Granger Cause X5_TRADE	46	0.07035	0.7921
X5_TRADE does not Granger Cause X1_CO2		0.26375	0.6102
X3_GDP does not Granger Cause X4_INFLATION	46	6.40151	0.0151
X4_INFLATION does not Granger Cause X3_GDP		0.18165	0.6721
X2_ELECTRIC does not Granger Cause X4_INFLATION	46	0.16974	0.6824
X4_INFLATION does not Granger Cause X2_ELECTRIC		0.00810	0.9287
X1_CO2 does not Granger Cause X4_INFLATION	46	0.10719	0.7450
X4_INFLATION does not Granger Cause X1_CO2		0.16188	0.6894
X2_ELECTRIC does not Granger Cause X3_GDP	46	7.85763	0.0076
X3_GDP does not Granger Cause X2_ELECTRIC		0.27427	0.6032
X1_CO2 does not Granger Cause X3_GDP	46	4.27912	0.0446
X3_GDP does not Granger Cause X1_CO2		0.04842	0.8269
X1_CO2 does not Granger Cause X2_ELECTRIC	46	0.66024	0.4210
X2_ELECTRIC does not Granger Cause X1_CO2		0.01302	0.9097