UNIVERSITY OF CO-OPERATIVE AND MANAGEMENT, SAGAING

DEPARTMENT OF STATISTICS

MASTER OF APPLIED STATISTICS

ANALYSIS OF ENVIRONMENTAL POLLUTION AND ECONOMIC GROWTH ON PUBLIC HEALTH IN DEVELOPING COUNTRIES, ASIA

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This thesis is submitted to the Board of Examiners in partial fulfillment of the requirement for the degree of Master of Applied Statistics.

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ACCEPTANCE

This is to certify that this paper entitled **"Analysis of Environmental Pollution and Economic Growth on Public Health in Developing Countries, Asia"** submitted as a partial fulfillment towards the degree of Master of Applied Statistics has been accepted by Board of Examiners.

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JULY, 2023

ABSTRACT

When the economy more expansively develops, environmental effects become more and more enlarge. This paper aims to study and analyze the effect of environmental pollution and economic growth on public health in developing countries, Asia. Secondary data from World Bank data during the period from 2011 to 2020 are used. The study is used descriptive statistics to make the comparative analysis of environmental pollution and economic growth on public health in developing countries, Asia. Panel data analysis method is applied to analyze the effect of life expectancy at birth, GDP per capita (PPP), CO_2 and urbanization growth rate of developing countries. The two panel data regression models (fixed effect model and random effect model), Hausman test and the Breusch Pagan Lagrangian multiplier test are used to analyze the panel data which consists of seven developing countries for the period 2011-2020 are used.As the result of the random effect model is more appropriate to carry out this study. For the research objective (1), Bangladesh has the largest emissions of carbon dioxide, while Cambodia has the lowest. It is clear that emissions of carbon dioxide are rising year after year throughout the year. Myanmar emits the second-highest amount of CO_2. Sri Lanka has the highest GDP per capita (PPP) among developing nations and Nepal's GDP per capita (PPP) is the lowest among them. Sri Lankahas highest life expectancy at birthin 2011 and 2020. Among the nations, Myanmar has the lowest birth expectancy. For the research objective (2), according to the results urbanization growth rate is 10 percent, and CO_2 emissions and GDP per capita (PPP) are significant at 1 percent level. Thus, in developing countries in Asia must be reduced CO_2 emission and urbanization growth rate because environmental, atmosphere, hydrosphere and natural resources can be destroyed. It can be suggested that employment opportunities should be more created in especially rural, and this can reduce CO_2 emissions and also reducing the urbanization growth rate. Consequently, urban and rural economies can grow, and develop and CO_2 emission can be reduced. Therefore, the more reduce theCO_2 emission, the more increase the life expectancy at birth of developing countries, Asia.

ACKNOWLEDGEMENTS

Firstly, I would like to convey my sincere thanks to Rector, Dr. Moe Moe Yee of University of Co-operative and Management, Sagaing, for her supportive advices, constructive comments and valuable suggestions for taking responsibilities of the Chairman of Master of Applied Statistics Steering Committee.

I would like express my indebtedness Pro Rector Dr. Kyaing Kyaing Thet, Monywa University of Economics for her valuable comments and suggestions to complete my thesis.

My special thanks go to Professor (Retired) Head of Department of Statistics, Daw Khin Aye Myint, who gave for her kind guidance, valuable advice, patience and encouragement to accomplish this study.

I would like to express my grateful thanks to Daw Khin San Kyi, Professor and Head of Department of Statistics, for her permission to write thesis in this field of the study.

I am very deep thankful to my supervisor Daw Yin Mon Thant, Associate Professor, Department of Statistics for providing me with the opportunity to undertake this study with her incomparable expertise, patient, kind and encouragement in guidance to complete my thesis.

Finally, I would like to convey my sincere thanks to my family who has provided me everything I need for my thesis to be completed and easy life.

Last but not least, the understanding, kindness, encouragement and help of all my colleagues are unforgettable in my life. In fact, they all are driving force for the successful completion of this study.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
ARDL	Autoregressive Distributed Lag
ASEAN	Association of Southeast Asian Nations
BOP	Balance of Payment
CADF	Central America Donors Forum
CIPS	Chartered Institute of Procurement and Supply
CO_2	Carbon dioxide
COVID-19	Coronavirus Disease
ECM	Error Component Model
FDI	Foreign Direct Investment
FEM	Finite Element Method
GDP	Gross Domestic Product
GIS	Geographic Information System
HDI	Human Development Index
LEAB	Life Expectancy at Birth
MFR	Mixed Fixed and Random Coefficients
ML	Maximum Likelihood
OECD	Organization of Economic Co-operation and Development
OLS	Ordinary Least Square
PPP	Purchasing Power Priority
REM	Random Effect Estimation
R&D	Research and Development
SDG	Sustainable Development Goal
UR	Urbanization Rate
U.S	United States
WHO	World Health Organization

CHAPTER 1
INTRODUCTION

In the world, environmental impacts are becoming more and more important when the economy grows speedy. Environmental pollution can seriously damage people's health and result in significant economic losses. According to the World Health Organization (WHO), air pollution can produce numerous dangerous chemicals that damage children's ability to develop and lead to chronic illnesses such as respiratory tract infections. Thus, a deep understanding of the connections between environmental pollution, economic growth, and public health is essential for improving people's health.

As early as the 1970s, foreign scholars analyzed the impact of environmental pollution on public health based on Grossman’s health production function. It has been recognized that there is a stable and balanced relationship between environmental pollution and public health, and environmental pollution has had a huge negative effect on public health and increased the burden of medical expenditures (Zhao et al., 2022).

Global warming is one of the major threats to the world environment and public health.The massive industrial revolution in recent years ran by huge consumption of fossil fuels and consequent quick increase in emissions of carbon dioxide (CO_2) has led to austere global warming (Anwar et al.,2020).Therelationshipbetweeneconomicgrowthandenvironmentalpollutionhasbeen alongstanding global concern since the 1970s (Jiang et al.,2020).

These environmental problems have even become more serious with the effects of climate change and rapid human population growth, particularly in urban areas near coastal systems (Hoang et al.,2019). Deterioration of the environment and CO_2 emissions has been a growing concern in the researcher and policymaker’s community(Bilgili et al.,2021).

Air quality and a healthy environment are compromised by many developing and developed countries for the sake of rapid output growth.In Asia, pollutants affect the economic growth. There is a proof of a global nature of air pollution and its effects on Earth's surface. Environmental pollution was measured using CO_2emanations.Association of Southeast Asian Nations (ASEAN) region is one of

those regions that are considered to be most influenced by climate change because CO_2 emissions and energy consumptions in ASEAN countries are increasing environmental pollution. Specifically, in the ASEAN economies, over the past three decades, there has been rapid urbanization along with industrialization, which is translated in terms of economic growth along with higher consumption and demand for energy.

Developing countries are, in general, countries that have not achieved a significant degree of industrialization relative to the populations, and have, in most cases, a medium to low standard of living. There is an association between low income and high population growth. A developing country also called a less developed country or emerging market has a lower GDP per capita (PPP) than developed countries, with a less mature and sophisticated economy.

In developing countries which are Bangladesh, Cambodia, Laos, Mongolia, Myanmar, Nepal and Sri Lanka the relationship between economic activity and environmental degradation could be more harmful to the environment due to the production structure of these countries (Alvarado andToledo., 2017).

There has been increasing research about the relationship between economic activity and environmental contamination owing to the ongoing deterioration of the environment, which is partly the result of overexploitation of natural resources (Gutti et al. 2012; Cronin and Pandya, 2009).

1.1 Rationaleof the Study

The concept of "environment" has evolved since it started to become a global issue in the early 1970s.At first, it was a kind of global recognition that the Earth's ecosystems are in fact fragile, and that human beings have been contributing much to its degeneration. The social and economic welfare of human beings is closely linked to the environment. Any change in the socioeconomic fields will have an impact on the earth's environment and vice versa, whether positively or negatively, immediately or eventually (Awan,2013).

Humans have faced poor environmental conditions throughout history, but what thinking of as environmental problems became more common and apparent with industrialization and urbanization. In the United States, air and water pollution from factories and dense urban living conditions attracted growing attention throughout the last century, and by the 1960s became recognized as significant problems. The limited

ability of the Earth's atmosphere to absorb greenhouse gas emissions without producing deleterious changes in climate may prove the most significant ecological limit of all, making prevention of global warming a critical challenge (Dunlap & Jorgenson.2012).

The term pollution is a derivation of the word pollutes-which means, to make something dirty or no longer pure, especially by adding harmful or unpleasant substances to it. Furthermore, environmentally minded persons are of the opinion that human activities as well as natural disasters on the environment can pollute the environment beyond reasonable doubts.

When humans overuse an environment's ability to fulfill any single function, environmental problems in the form of pollution, resource shortages, and overcrowding or overpopulation are the results. Separating these three functions and analyzing conflicting uses of provides insight into the evolution of environmental problems over time. More ominously, ecologists and climatologists are concerned that growing use of fossil fuels as prime energy source will generate via increased greenhouse gas especially CO_2 emissions climate change throughout the global ecosystem that may lead to unforeseeable and irreversible ecological consequences, which will prove harmful to humans and other species (America's Climate Choices 2010).

Similar developments have occurred in nations around the world, particularly with increasing industrialization and resource use, resulting in the global spread of local and regional environmental problems. Regarding the relationship between economic growth and environmental pollution, national level analysis provides only a general understanding of how variables are broadly related and thus provide little guidance for policymaking.Increased population, pollution and economic situation, along with present environmental, health, economic and social inequalities have resulted in an increased pressure over natural resources within developing countries in Asia.

Bangladesh is facing the environmental problems including deforestation, land degradation, air pollution, and water contamination as well loss of biodiversity. The poor play a vital role in influencing these aspects of environmental degradation. Poverty leads to deforestation. Bangladesh is also a densely populated small country of South Asia (Tareque et al., 2015).

The major environmental issues and problems in Bangladesh are climate change, natural calamities (lightning, cyclone, flood, flash flood, drought, earthquake, riverbank erosion, and sedimentation), geospatial setting, environmental pollutions (air pollution, water pollution, soil pollution, and noise pollution), (Hasnat et al., 2018).

Despite relatively strong economic growth over the past decade, investment climate constraints, deficiencies in energy and transportation infrastructure, and an opaque regulatory environment have prevented Bangladesh from achieving higher growth.

In Cambodia, population growth and rapid economic growth are causing environmental pollution. Economic development activities have created significant environmental consequences, including air pollution, water pollution, noise pollution and solid waste. And then life expectancy for men is around 54 and for women is 59, which reflects various factors, including high infant mortality rate and low living standards. Mortality due to waterborne diseases in Cambodia is high and is a situation that could be improved through better sanitary conditions and education (Irvine et al., 2006).

In Cambodia, as in other countries, economic development is certainly leading to an increase in the level of air pollution. The concentration of sulphur dioxides, nitric oxides, carbon monoxide and lead, and other substances are emitted from various sources such as vehicles, motorbikes, factories, generators, etc.Cambodia's inability to grow the product basket is explained by low labour productivity, or output per worker, which lags behind most countries globally when at Cambodia's development level. Low labour productivity, at least in part, reflects low human capital.

In Laos, one of the biggest environmental problems today is outdoor air pollution. Data from the World Health Organization (WHO) shows that an estimated 4.2 to 7 million people die from air pollution worldwide every year and that nine out of 10 people breathe air that contains high levels of pollutants.

In Laos, it is mainly agricultural activities and deforestation which contribute to global warming. Warmer temperatures are affecting the world's climate and its marine, river, land and forest eco- systems. Climate change does not stop at the border of Lao People’s Democratic Republic (Lao PDR).The Lao economy faces increased

challenges from a sharp currency depreciation and high inflation, amid a deteriorating global economic environment and slow domestic reforms.

Mongolia is facing desertification, inadequate water supply, and air and water pollution. The presence of the Gobi Desert in the southeastern part of the country and mountains in the northwest provide natural limits to the amount of agricultural land. Mongolia is having a low life expectancy because country is having high consumption of tobacco and alcohol by men, resulting in diseases such as lung and liver cancer and cardiovascular problems, that Mongolian men have a shorter lifespan than women on average.

These anthropogenic factors include overgrazing of livestock, erosion of farmland soils, burning, and climate change. In Mongolia, over 70% of pastureland is now degraded, and the vegetation growth rate has shrunken by a factor of 5. From 2007 to 2010 the forest covered area has decreased by 383,600 hectares.

Mongolia leaders often paid higher than the asking price for merchants' goods while also giving tax breaks to merchants on the value of its goods. Mongol leaders also supplied loans and financial backing to merchants. The Mongols also built and maintained trading infrastructures like roads and bridges. In developing countries in Asia, including Myanmar is facing a double burden of indoor and outdoor environmental air pollution. As in many places, use of fuels for household cooking (kerosene, wood, crop waste), contribute to indoor air pollution. Such fuels cause high exposure to pollutants within the household, particularly for women, children, the elderly.

Myanmar has lost 3,459,475 acres (1.4 million ha) of forests to deforestation. This is because all of Myanmar's economy relies on agriculture, forestry, fishing and mining, all of which require significant cleared land. Illegal logging is also a problem. Banking sector vulnerabilities, military activity against civilians, border restrictions on exports and imports, unstable foreign exchange policies, targeted international sanctions, and ongoing civil disobedience in various industry sectors and government ministries have crippled Myanmar’s international trade and investments.

In Nepal, is facing an inadequate supply of essential drugs and poorly regulated private healthcare providers. Statistically, Nepal also only has 0.67 doctors and nurses per 1,000 people. This is less than the World Health Organizations recommendation of 2.3 doctors, nurses and midwives per 1,000 people. More factors for loss of biodiversity include landslide and soil erosion, pollution, fire, overgrazing,

illegal trade, hunting and smuggling. Non-timber forests are threatened by deforestation, habitat degradation and unsustainable harvesting.

There are numerous causes of pollution across the country, many of which stem from a lack of regulations regarding operations such as factories and construction sites, open burning as well as the fuels used in the many vehicles found in Kathmanduand other cities. People's livelihood is largely affected due to inflation, which is 8 percent on-year basis. The government has zero control over inflation as the country is import-dependent. Due to the increase in prices in the international market, Nepal is forced to procure goods, including fuels, chemical fertilizers, food, etc.

Air pollution and water pollution are challenges for Sri Lanka since both cause negative health impacts. Overfishing and insufficient waste management, especially in rural areas, leads to environmental pollution. Sri Lanka is also faced to climate change impacts such as extreme weather events and sea level rise.Air quality in Sri Lanka is affected by vehicle emissions, organic waste burning, by-products from the agricultural industry, and petroleum refining. Available data indicates that Colombo often experiences high levels of air pollution.

Sri Lanka has been unable to buy goods it needs from abroad. And in May 2022 it failed to make an interest payment on its foreign debt for the first time in its history. This damaged its reputation with lenders, making it even harder to borrow money on the international markets.

The first thing that in one country, economic development was improved achievements in life expectancy at birth. The second indicated that income is a possible socioeconomic determinant of health. The third fact that CO_2 emissions can be reduced life expectancy, especially from the perspective of a sample of developing economies.

The fourth fact that higher income, GDP per capita also implies better access to housing, education, health services and other items which tend to lead to improved health, lower rates of mortality and higher life expectancy. The fifth thing that in order to fulfill people's growing healthcare requirements, handle the economy, and promote health equity, it should be focused to improve people's health and economic conditions.

The sixth thing shows that the depth knowledge of elements influencing health serves as the foundation for this objective as well. The social, health and economic

welfare of human beings are closely linked to the environment. The seventh item that in order to promote the growth of regional public health, it is important to further clarify the effects of regional economic development and environmental pollution on public health in developing countries. When countries started to join efforts to strike a balance between improving the quality of human life and protecting the environment for the sake of future generations, the eighth fact is also become important.

For this and several other reasons, environmental issues now occupy a center stage in academic discourse and other public for both at the national and international levels. Research has also shown that as the population of a country grows increases with attendant pressure on the environment especially in the wake of improved technologies, environmental abuse and pollution is nevertheless heightened with corresponding effects on lives of people and other living organisms, (Ocheri, 2003 and Hausers, 1971).

Therefore, this study investigated the relationship between economic development, environmental pollution and public health across a group of developing economies. The economic development and environmental pollution are represented by GDP per capita (PPP) and CO_2 emissions, while the factor of public health was studied by life expectancy at birth.

The environmental pollution, economic growth and public health are important thing for the human life of stay longing. Therefore, a panel regression model and conducts an empirical analysis on the relationship between the economic development, environmental pollution and public health of developing and neighboring countriesof Myanmar in Asia. Bangladesh, Cambodia, Laos, Mongolia, Nepal, Sri Lanka and including Myanmar is analyzed in this study.

1.2 Objectives of the Study

The objectives of the study are

(i) to study the condition of environmental pollution, economic growth and public health in developing countries, Asia.

(ii) to analyze the effect of environmental pollution and economic growth on public health in developing countries, Asia.

1.3 Methods of Study

In this study, secondary data based on World Bank's data (2011 - 2020) were applied. Reliable online websites, research papers, thesis, reference books and reports are all used to acquire secondary data. Descriptive analysis is used to describe the background characteristics of developing countries, Asia and environmental pollution, economic growth and public health. Environmental pollution is analyzed by using CO_2 emission of developing countries. GDP per capita (PPP) is used as the proxy of the economic growth of countries and urbanization growth rate is also used. To study the public health of countries, life expectancy at birth is used as predictor variable. Panel regression analysis method is applied to analysis the impact of environmental pollution and economic growth on public health developing countries.

1.4 Scope and Limitations of the Study

The study area focuses on developing countries in Asia, namely Bangladesh, Cambodia, Laos, Mongolia, Myanmar, Nepal and Sri Lanka. The main sources of the secondary data are world development indicators, World Bank's data and study period is from year 2011 to year 2020.There are various methods to analyze secondary data, panel regression analysis is used in this study.

1.5 Organization of the Study

In this paper, five chapters are included. Chapter 1 is an introduction on that presents a rationale of the study, objectives of the study, methods of study, scope and limitations of the study and organization of the study. Literature reviews of economic, environmental pollution and health factor of developing countries, Asia are presented in Chapter 2. Theoretical background of panel data analysis model has been described in chapter 3. Empirical analysis of panel data regression models for environmental pollution, economic growth, and public health of developing countries, Asia is includedin Chapter 4. The conclusion is expressed in Chapter 5.

CHAPTER 2
LITERATURE REVIEW

In this chapter, theoretical review and empirical reviews of concerning the indicators are presented. This chapter is included definitions of environmental pollution, economic growth and public health in developing countries in Asia.

2.1 Theoretical Review

The definition and meaning of environmental pollution, economic growth and public health are included in the theoretical review. And also, the definitions of CO_2 emission, GDP per capita (PPP) and life expectancy at birth are showed in this potion.

2.1.1Environmental Pollution

Environmental pollution is defined as the contamination of the physical and biological components of the earth atmosphere system to such an extent that normal environmental processes are adversely affected.

Environment includes water, air, land and all plants and human beings and/or animals living there in and the interrelationships which exist among these or any of them.The term pollution is a derivation of the word pollutes which means, to make something dirty or no longer pure, especially by adding harmful or unpleasant substances to it (Evelyn et al.,2012).

Environmental pollution has major impacts on the disturbance of ecosystem. Although it is very difficult to make our environment free from pollution, it can be reduced by releasing chemical liquids from factories into water bodies after treatment, using vehicles with less fuel combustion, and using pesticide spray in a controlled manner (Asif et al., 2018).

The introduction by man into the environment of substances or energy liable to cause hazards to human health, harm to living resources and ecological systems, damage to structure or amenity or interference with legitimate uses of the environment. The environmental pollution can also be classified further as, Air pollution, water pollution, land pollution, food pollution, noise pollution and radio-active pollution, etc. (Appannagari, 2017).

Pollution is exogenous chemical substances encountered on a suitable place, at the appropriate time and in inadequate quantities. Unfavorable changes in the environment caused by human activities, causing a change in the inflow of energy, radiation levels physic-chemical and microbiological composition of environmental pollution can be defined (Skenderovic et al., 2015).

Climate change, air pollution and COVID-19pandemic might influence mental health, with disturbances ranging from mild negative emotional responses to full-blown psychiatric conditions, specifically, anxiety and depression, stress trauma-related disorders, and substance abuse. The most vulnerable groups include elderly, children, women, people with pre-existing health problems especially mental illnesses, subjects taking some types of medication including psychotropic drugs, individuals with low socio-economic status, and immigrants (Marazziti et al., 2021).

The assessment of whether and to what extent environmental pollution causes birth defects in the population also draws on other evidence, principally toxicological data, data from animal studies, detailed exposure data, and human data from those occupationally exposed to high levels of the chemical (Dolk &Vrijheid, 2003).

Rapid urbanization and the growth of informal settlements due to increasing population coupled with insufficient formal refuse collection capacity has exacerbated plastic pollution with serious consequences on the social-ecological system, i.e., environmental beauty, quality of human life, health, ecological processes, terrestrial wildlife, and marine species (Mugobo et al., 2022).Environmental pollution is the effect caused by undesirable changes in our surroundings that have harmful impacts on plants, animals, and human beings. A substance that causes pollution is known as a pollutant.

Environmental pollution is one of the biggest threats to life as know it. Pollution affects the air breathe, the water drink, and the ecosystems depend on. If pollution severity continues to increase; human, animal, and plant populations will break down as it will not be able to cope with a drastically changing environment. There are factors that affect the rates of dispersal and degradation of pollutants. Itis needed to understand the effects of these factors so know the locations in which pollution will cause the most damage. Today it shall be covering the types of environmental pollution, the effects, and the factors affecting pollutants.

2.1.2 CO_2 Emission

CO_2 emissions are emissions stemming from the burning of fossil fuels and the manufacture of cement; they include carbon dioxide produced during consumption of solid, liquid, and gas fuels as well as gas flaring.

CO_2 emission is a colorless, odorless and non-poisonous gas formed by combustion of carbon and in the respiration of living organisms and is considered a greenhouse gas. Emissions mean the release of greenhouse gases and or their precursors into the atmosphere over a specified area and period of time.

Measurements of the carbon dioxide emissions, either derived from the composition of fuels and the assumption of almost complete combustion, or made directly on the products of combustion, have associated uncertainties that can be substantial (Borthwick, 2011).

Global CO_2 emissions from fossil fuels have significantly increased in the last decades, causing different concerns, i.e., global warming, health impacts, and climate change, which implies economic and environmental complexity (Ghahramani &Pilla., 2021).

The conventional view holds that the rapid growth of CO_2 emissions is primarily due to increasing energy consumption as affluence grows. The impact of population growth on global CO_2 emissions has not received enough attention. Recent studies suggest that population growth has been one of the major factors in causing carbon emissions in both developed and developing countries (Shi, 2001).

The analysis of CO_2 emissions has been conducted through various methods, such as the decomposition model, mathematical model, comprehensive modal emissions model, GIS application analysis and others (Yaacob, 2020).

In the context of global warming, reduction of carbon dioxide emissions in oil and gas processes is an environmental and financial issue for process design and comparison. Environmental impact of a system can be determined by life cycle assessment (Portha et al., 2008).

One of the substantial solutions in facing climatic changes is a reduction of carbon dioxide emission, and the best way to prevent destructive environmental outcomes is capturing and storing this gas. One of the key researches works in the field of carbon capture and storage technology was about analyzing the potential of carbon capture and storage in power plants (Ahmadi et al., 2019).

Reasonable decomposition of an enterprise's carbon emission reduction target is a necessary guarantee to realize overall carbon emission reduction. This is also the key step to achieving the main objective of carbon emission reduction in each production link (Wang & Zhou, 2022).

Emissions refer to CO_2 from burning oil, coal, and natural gas and waste materials for energy use. CO_2 also enters the atmosphere from deforestation and from some industrial processes such as cement production. However, emissions of CO_2 from these other sources represent a smaller share of global emissions, and are not included.

There are both natural and human sources of CO_2emissions. Natural sources include decomposition, ocean release and respiration. Human sources come from activities like cement production, deforestation as well as the burning of fossil fuels like coal, oil and natural gas.

2.1.3 Economic Growth

Economic growth is an increase in the production of economic goods and services in one period of time compared with a previous period. It can be measured in nominal or real (adjusted to remove inflation) terms.

Economic growth is defined as an increase to the tools and products that will be used to meet the human needs in any country or region. A method to measure economic growth rate involves inquiring whether there has been a real increase (excluding price increases) in GDP per capita (PPP) from one year to the other as GDP per capita (PPP) represents the market equivalent of all measurable values produced by one economy (Asmah & Inayah, 2023).

Economic growth, in turn, is important for the prosperity and wellbeing of the economy and its citizens in both advanced economies and in the developing world. It stimulates advances in technology, such as those that will be needed to continue decoupling consumption and production from their environmental impacts. It is also an important factor in enabling other drivers of wellbeing, such as improvements in health, education, and overall quality of life (Everett et al., 2010).

Among the possible sources of economic growth and development, innovation has received a special treatment in the economic literature because it has been more or less linked with the figure of the individual entrepreneur (Dejardin, 2000).

Economic growth was a major professional concern of Simon Kuznets, the founder of the conference. During the last quarter of its life, Kuznets (1971) devoted much of its prodigious energy and talent to the study of economic growth (Jorgenson, 1991).

The process ofeconomic growthby a nation’s wealth increases over time. Although the term is often used in discussions of short-term economic performance, in the context of economic theory it generally refers to an increase in wealth over an extended period.

Economic growth can be defined as the increase or improvement in the inflation-adjusted market value of the goods and services produced by an economy in a financial year. Statisticians conventionally measure such growth as the percent rate of increase in the real and nominal GDP.

Economic growth is the increase in the value of an economy's goods and services, which creates more profit for businesses. As a result, stock prices rise. That gives company’s capital to invest and hire more employees. As more jobs are created, incomes rise. Consumers have more money to buy additional products and services, and purchases drive higher growth. For this reason, all countries want positive economic growth. This makes economic growth the most watched economic indicator.

2.1.4 GDP per Capita (PPP)

Gross domestic product (GDP) per capita (PPP) is the total monetary or market value of all the finished goods and services produced within a country’s borders in a specific time period. As a broad measure of overall domestic production, it functions as a comprehensive scorecard of a given country’s economic health.

GDP per capita (PPP) abbreviated as GDP can be defined as ‘market value’ of the finished goods and provisions that are produced or manufactured locally or nationally in any country within a specific time period. The macroeconomic activity in a country can also be calculated with the support of GDP per capita (PPP) as it also works as measurement tool. GDP per capita (PPP) can also be used to analyze the standard of living of any country (Stonecash et al., 2017).

The GDP per capita (PPP) is one of the measures of national income and output for a given country's economy at a given period of time. The definition of GDP per capita (PPP) is based on the total market value of all final goods and

services produced within the country in a given period of time (normally one year). The evaluation process also involves the sum of value added at every stage of production (the intermediate stages) of all final commodities (goods and services) produced within a country in a given period of time monetarily (Kira, 2013).

GDP per capita (PPP) is the most widely used measure of living standards, it is also a target indicator for policy driven analysis. However, GDP per capita (PPP) falls short of accurately measuring people's wellbeing due to income inequalities among people. GDP per capita (PPP) growth analysis still attracts many researchers (Ilter, 2017).

The GDP per capita (PPP) and the national accounts estimates are fundamentally based on detailed economic census data and other information that is available only once every five years. The challenge lies in developing a framework and methods that take these economic census data and combine them using a mosaic of monthly, quarterly, and annual economic indicators to produce quarterly and annual GDP per capita (PPP) estimates (Landefeld et al., 2008).

Economics is no different. Economists use many acronyms. One of the most common is GDP per capita (PPP), which stands for gross domestic product. It is often cited in newspapers, on the television news, and in reports by governments, central banks, and the business community. It has become widely used as a reference point for the health of national and global economies. When GDP per capita (PPP) is growing, especially if inflation is not a problem, workers and businesses are generally better off than when it is not (Callen, 2008).

Potential GDP per capita (PPP) is a measure of the economy's productive capacity, reflecting "full employment" GDP, the level of GDP per capita (PPP) attainable when the economy is operating at a high rate of resource use. Potential GDP per capita (PPP) can also be defined as the level of output corresponding to a balanced state of economy, characterized by stable inflation (Altar et al., 2010).

GDP per capita (PPP) is in many ways the central measure of an economy. For example, the faster the growth in real GDP per capita (PPP), the faster the growth in jobs. Although the relationship between the measure and inflation is more tenuous, it is generally acknowledged that if the level of real GDP per capita (PPP) exceeds that of potential real GDP per capita (PPP), inflation will increase. The ability to forecast GDP per capita (PPP), and to understand how policy influences the series, is therefore of critical importance to the formulation of monetary and fiscal policy. These

considerations make it all the more important to assess the limitations of the GDP per capita (PPP) measure and to examine possible alternatives (Hobijn & Steindel., 2009).

GDP per capita (PPP) is the final value of the goods and services produced within the geographic boundaries of a country during a specified period of time, normally a year. GDP per capita (PPP) is an important indicator of the economic performance of a country. GDP per capita (PPP),total market value of the goods and services was produced by a country's economy during a specified period of time. It includes all final goods and services that are; those that are produced by the economic agents located in that country regardless of their ownership and that are not resold in any form. It is used throughout the world as the main measure of output and economic activity.

2.1.5 Public Health

Public health is the science of protecting and improving the health of people and their communities. This work is achieved by promoting healthy lifestyles, researching disease and injury prevention, and detecting, preventing and responding to infectious diseases.

Public health is not about individual patients. Its focus is on dealing with diseases and with conditions and problems affecting health and it aims to provide the maximum benefit for the largest number of people.This does not mean that public health ignores the care of individuals. Rather, the concern is to prevent health problems and to extend better care and safety to entire populations (Krug & Dahlberg., 2002).

Public health nutrition as a field of practice is not a recent development for the health workforce dealing with nutrition problems. Populationbased approaches have been the mainstay of nutrition work for decades in many countries. There is, however, evidence that public health nutrition workforce development is increasingly becoming a focus of effort worldwide (Hughes, 2003).

Case definitions play an essential role in the recognition and prevention of disease by the public health community (Seligman & Matte., 1991).The concept of public health was largely equated with the nineteenthcentury 'sanitary idea' of environmental reform and methods of preventive medicine, such as vaccination (Porter, 1999).

Disrespect and abuse (in Brazil called obstetric violence), described by different terms, is increasingly used in social activism, in academic research and public policy formulation, and was recently recognized as a public health issue by the World Health Organization (Diniz et al., 2015).

An overview of the definitions of health and medical applies from an interdisciplinary perspective. There are summarized the core elements of the identified definitions for their holistic understanding in the context of digital public health (Maab et al., 2022).The course of many epidemics can be altered through early public health action, considerable research has been directed towards early detection of epidemics using public health surveillance data (Texier et al., 2016).

According to the World Health Organization (WHO), 'Public health refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole. Its activities aim to provide conditions in which people can be healthy and focus on entire populations, not on individual patients or diseases.'

Public Health is an empiric and multidisciplinary field whose goal is to assure conditions in which people can be healthy. While medicine mainly focuses on treating illness in separate individuals, it is the central goal of public health activities to increase health at the population level. The ruling principle of public health is to deal with the health of the population in its totality. Health interventions on the population level include community hygiene, sanitation, health education, immunization, and promotion of nutrition. Public health covers preventive, curative, and rehabilitative actions. The success of public health depends on adhering to the basic rules of equity, partnerships, and social justice, as well as the mobilization of local, national, and international resources.

2.1.6 Life Expectancy at Birth

Life expectancy at birth indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life.Life expectancy at birth is defined as the average number of years that a newborn may live given a set of mortality rates seen in a calendar year. The first of these averages, is known as life expectancy at birth. It is a widely used summary indicator to describe population health along with longevity (Rabbi, 2013).

Life expectancy at birth is not only a summary measure of mortality, but also an accepted indicator for the development of a country. The sex differential in life expectancy at birth has been the focus of research in both developed and developing countries (Singh & Ladusingh., 2016).

Life expectancy at birth has become an aggregate variable which reflects the influence of a wide variety of indicators (social, economic, environmental, etc.) On the working of modern health systems. On the other hand, the current complex health context, characterized by the constant interrelation of a large number of variables of different types, motivates the causal analysis of these variables which can indicate, among other aspects, the degree to which the resources available to public authorities contribute to the efficient performance of health policies (Martin Cervantes et al., 2019).

An increase or decrease in life expectancy at birth might be due to the changes that take place in the mortality conditions of different age groups over a period of time. A number of decomposition techniques have been developed (Ponnapalli, 2005).The living standard is one of the key variables that significantly affect the trend of particular demographic indicators such as life expectancy. Using certain assumptions, we can express the quality of life and its level, which should affect the development of life expectancy (Simpach & Pechrova., 2013).

The differential in mortality for unnatural causes of death seemed decreasing over the years, but that due to natural causes remained relatively steady. Regardless of gender, people with schizophrenia, bipolar disorder and depression were shown to have shortened life expectancies compared to general population (Pan et al., 2020).Life expectancy at birth was computed according to standard life table methods and compared with the United States general population. Patients' ethnicities were self-reported and are included as a standard part of demographic characterization of the cohort (Waldek et al., 2009).

Life expectancy tells us the average number of years of life a person who has attained a given age can expect to live. Life expectancy estimates from the National Center for Health Statistics provide a reliable snapshot of population health and mortality in the United States Latest Reports.

Life expectancy at birth is defined as how long, on average, a newborn can expect to live, if current death rates do not change. However, the actual age-specific death rate of any particular birth cohort cannot be known in advance. If rates are

falling, actual life spans will be higher than life expectancy calculated using current death rates. Life expectancy at birth is one of the most frequently used health status indicators. Gains in life expectancy at birth can be attributed to a number of factors, including rising living standards, improved lifestyle and better education, as well as greater access to quality health services. This indicator is presented as a total and per gender and is measured in years.

Life expectancy is the statistical age that a person is expected to live until, based on actuarial data. There are many uses for it in the financial world, including life insurance, pension planning, and U.S social security benefits. The term "life expectancy" refers to the number of years a person can expect to live. By definition, life expectancy is based on an estimate of the average age that members of a particular population group will be when the people die.

2.2 Empirical Review

An empirical literature review, also known as a systematic literature review, analyzes previous empirical studies in order to provide an answer to a specific research topic. Rather than drawing information from theories or beliefs, empirical research relies on observations and measurements to arrive at conclusions. To address specific research inquiries, it could involve making a list of people, behaviors, or events that are being researched.

In order to find gaps, convergence, and conflicts that can assist to accurately define, describe, and repeat the process, the researcher searches for empirical studies in a related subject when doing an empirical review.

Empirical articles are most likely to be published in academic scholarly journals and are usually organized following a specific format. Look for these headings when reading an article: Introduction, objective, methods or methodology and finding.

The objectives, the methods used and findings of the papers related to the research study being studied are summarized in following table.

Table 2.1 Empirical Reviews of the Study

Authors	Title	Objective	Methods	Findings
Mohan & Mirmirani, (2007)	An Assessment of OECD Health Care System Using Panel Data Analysis	To examine the factors influencing life expectancy and infant mortality.	Fixed-effects panel data model	The majority of research papers on national health care systems have concentrated on the two commonly accepted outcomes, life expectancy and infant mortality. OECD-focused studies tend to assess cross variations of the health outcomes among individual member nations. The limited number of existing studies that concentrated on the factors influencing life expectancy and infant mortality had some drawbacks.
Sichei & Kinyondo, (2012)	Determinants of Foreign Direct Investment in Africa: A Panel Data Analysis	To identify a number of factors that affect FDI flows in Africa, including, agglomeration economies, natural resources, real GDP per capita (PPP), and international investment agreements.	Dynamic panel data estimation techniques	FDI inflows to Africa depend on agglomeration economies, existence of natural resources, real GDP per capita (PPP) growth, domestic and InternationalFDI policy, among others. Some specific results are noteworthy. First, agglomeration economies are the most significant determinant of FDI inflows to Africa. This result is robust throughout alternative specifications. Second, real GDP per

Authors	Title	Objective	Methods	Findings
				capita (PPP) growth positively influences the location of FDI. Third, the existence of natural resources tends to attract resource seeking FDI.
Aye &Edoja, (2017)	Effect of economic growth on CO_2 emission in developing countries: Evidence from a dynamic panel threshold model	To indicate that economic growth has negative effect on CO_2 emission in the low growth regime but positive effect in the high growth regime with the marginal effect being higher in the high growth regime.	Panel regressions	Economic growth has negative effect on CO_2 emission in the low growth regime but positive effect in the high growth regime with the marginal effect being higher in the high growth regime. Thus our finding provides no support for the Environmental Kuznets Curve (EKC) hypothesis; rather a U-shaped relationship is established. Energy consumption and population were also found to exert positive and significant effect on CO_2 emission. Including financial development indicator in the model did not change the conclusion about EKC hypothesis.

Authors	Title	Objective	Methods	Findings
Bruderl et al., (2019)	Life course research with panel data: An analysis of the reproduction of social inequality	To demonstrate in combination with a classical sociological research question on the reproduction of social inequality.	Analysis of panel data	The higher social origin indeed relates to higher well-being, and that the well-being differential increases with age. Further, unemployment plays no significant role in mediating origin specific effects of age on well-being.
Khan, (2019)	The Effect of Green logistics on Economic growth, Social and Environmental sustainability: An Empirical study of Developing countries in Asia	To investigate the relationship between countries' logistics operational performance and national scale social, economic and environmental indicators in a panel of Asian emerging economies during the period	Panel regression analysis	The most Asian developing countries have poor logistics, trade and transport infrastructure, in fact, most highways and bridges are very old and not suitable for traffic. In addition, since last couple of decades, Asian region particularly developing countries have been suffering from different natural disaster, terrorist attacks and political instability, dragging down economic development and also negatively influencing social and environment performance of countries in terms of lack behind environmental-friendly policies.

Authors	Title	Objective	Methods	Findings
Haseeb et al., (2019)	Impact of Economic Growth, Environmental Pollution, and Energy Consumption on Health Expenditure and R&D Expenditure of ASEAN Countries	To analyze the short-term as well as the long-term impact of economic growth, environmental pollution, and energy consumption on health and R&D expenditures.	Panel regression analysis	Economic growth had a short-term and long-term impact on R&D expenditure, while the impact of economic growth on health expenditure was only realized in long-run.
Falkenstrom et al., (2020)	Using time-lagged panel data analysis to study mechanisms of change in psychotherapy research: Methodological recommendations	To track session by session changes and focus on within-patient associations between predictors and outcomes.	Time-lagged panel models	The main limitation of the methods we outlined is the remaining risk of potential time varying confounders, that is variables that coverage over time on a within person level in both the candidate mechanism and outcome.
Tang et al., (2020)	Impact of Environmental Regulations on Environmental Quality and Public Health in China	To demonstrate the co-benefits of environmental regulations on air quality, water, and public health through a panel Granger causality model and mediation effect model.	Panel regression analysis	The mediation effect model suggest that waste gas treatment could improve air quality, thus reducing public health costs; wastewater treatments could not only reduce public health costs through improvement of the water environment but also increase social welfare. Additionally, air pollution exhibits a greater negative externality impact on health than water pollution. Thus, environmental

Authors	Title	Objective	Methods	Findings
				regulation policies should pay more attention to air pollution control. The findings of this study indicate that environmental regulations have a significant co-benefit on high-quality environmental development and public health.
Ay, (2021)	Air pollution, health and economic growth: A panel data analysis for countries with the highest CO_2 emission	To reduce environmental pollution mean additional costs, it is thought that there will be adverse effects on economic growth.	Panel regression analysis	The positive effect of economic growth on health is enough to eliminate the negative effect of carbon dioxide emissions, we cannot say that the conclusions can support this argument, since the environmental damage caused by growth is far beyond air pollution.
Lin, (2021)	Linking Innovative Human Capital, Economic Growth, and CO_2 Emissions: An Empirical Study Based on Chinese Provincial Panel Data	To study the economic and environmental effects of human capital, previous studies measure human capital based on education	Panel data estimation techniques	The existence of the environmental Kuznets curve considering innovative human capital in the model. It implies that Chinese economic development will eventually support environmental sustainability if China continues to develop its innovative human capital. Among the control variables, economic structure, population density,

Authors	Title	Objective	Methods	Findings
				and energy intensity stimulate environmental degradation by increasing CO_2 emissions. However, FDI has a negative relationship with CO_2 emissions.
Mujtaba, & Shahzad, (2021)	Air pollutants, economic growth and public health: implications for sustainable development in OECD countries	To analysis of environmental pollutants, economic growth, and public health is done using data from 28 OECD economies from 2002 to 2018.	Least squares and the panel vector error correction model	This study provide direction for policymakers, showing how pollution reducing policies improve economic growth by improving the health of people by reducing air pollution related diseases.There is long-run causality from renewable energy and carbon dioxide emissions to healthcare spending. Renewable energy and healthcare spending are positively and significantly related.
Murthy et al., (2021)	The Relationships between CO_2 Emissions, Economic Growth and Life Expectancy	To examine the effect of CO_2 emissions on life expectancy in the D-8 countries (Malaysia, Indonesia, Bangladesh, Nigeria, Egypt, Iran, Pakistan, and Turkey) from 1992 to 2017.	The panel ARDL approach	Due to the fact that environmental degradation can affect life expectancy, the countries should use more renewable energy such as solar, biogas and biodiesel. This can reduce the amount of CO_2emission released into the air and thus save the environment

Authors	Title	Objective	Methods	Findings
Szymczyk et al., (2021)	The Effect of Energy Usage, Economic Growth, and Financial Development on CO_2 Emission Management: An Analysis of OECD Countries with a High Environmental Performance Index	To evaluate the impact of economic growth, energy consumption, energy management,	Panel data analysis method	Positive relationships between economic growth, energy consumption, and the urban population, and CO_2 emissions. Moreover, it is put forward that a negative and significant relationship between financial development and CO_2 emissions exists. Despite displaying a similar negative correlation, the relationship between trade openness and CO_2 emissions is insignificant.
Hong, (2022)	Revealing the Synergetic Development Evolution Mechanism of Economic Growth, Energy Consumption, and Environment	To reveal the mechanism and process of the dynamic evolution of the economy energy environment system and study the variables that determine the speed of system evolution and development	Panel regression analysis	The effect of environmental pollution control began to show in some developed regions of China, due to the migration of polluting enterprises and the pressure of economic development in underdeveloped regions, the negative feedback mechanism of environmental pollution emission and the synergistic effect of economic development, energy consumption, and environmental pollution reduction have not been formed on the whole.

Authors	Title	Objective	Methods	Findings
Saquib et al., (2022)	Impact of Financial Deepening, Energy Consumption and Total Natural Resource Rent on CO_2 Emission in the GCC Countries: Evidence from Advanced Panel Data Simulation	To examine the dynamic nexus between financial deepening, natural resource rent, nonrenewable-energy and renewable-energy consumption and CO_2 emission	Panel unit root,long-run estimation tests	A number of policy recommendations are provided to help the countries overcome on CO_2 emissions while promoting economic growth.
Ali et al., (2022)	Revisiting the impacts of globalization, renewable energy consumption, and economic growth on environmental quality in South Asia	To analyzes the impact of globalization, renewable energy consumption, and economic growth on environmental quality in five South Asian developing economies.	Cross-sectional dependency test and employ a second-generation panel unit root (CIPS and CADF) tests	The empirical results confirm that both globalization and economic growth increase CO_2 emissions in South Asian developing economies. On the other hand, renewable energy consumption significantly improves environmental quality.
Polcyn et al., (2023)	Evaluating the Influences of Health Expenditure, Energy Consumption, and Environmental Pollution on Life Expectancy in Asia	To achieve the best possible health outcomes, Asian countries should also reduce their CO_2 emissions.	Panel root test, Cross sectional tests	The consumption of renewable and eco-friendly resources over non-renewable resources was one of the main reasons for the positive results between total energy consumption and health outcomes. Faster economic growth has also had a significant positive impact on health outcomes. A higher per capita income increases the ability to spend more on

Authors	Title	Objective	Methods	Findings
				healthcare. The findings also revealed a significant negative impact of CO_2 emissions on health outcomes. Finally, the results of this study found a positive association between health expenditure and health outcomes. The more the government spends on general health services, the higher the quality of public health.

Source: (Various Studies)

CHAPTER 3
METHODOLOGY

This chapter describes the approach that was followed in the current study. It contained the research area, research design, research methodology, data analysis procedures.

3.1 Research Area

"Emerging Asia" refers to China, India, Indonesia, Malaysia, the Philippines, Thailand, and Vietnam. "Frontier and Developing Asia" refers to Bangladesh, Cambodia, Lao People's Democratic Republic, Mongolia, Myanmar, Nepal, and Sri Lanka. The study area was developing countries in Asia, are selected namely Bangladesh, Cambodia, Laos, Mongolia, Myanmar, Nepal and Sri Lanka. Therefore, World Bank's data (2011-2020), reliable online websites, research paper, thesis, reference books and reports are focused. This research was conducted in developing countries, Asia.

3.2 Research Design

The research design was conducted secondary data and then using panel data analysis. Data were collected from World Bank's data (2011-2020), reliable online websites, research paper, thesis, reference books and reports.

Descriptive statistics analyses were used to present figures for the findings with tables and charts, diagrams in this research. Descriptive statistics are concerned with conclusion and decision, summarizes the data of observation.

3.3 Panel Data

Time series and cross-sectional data are combined to form panel data. When data are available on repeated cross sections, panel data methods are the econometric instruments used to estimate parameters, compute partial effects of interest in nonlinear models, quantify dynamic linkages, and perform reliable inference. According to Nerlove (2002), the random effects or variance-components models were first used by an English astronomer named George Biddell Airy in an 1861

monograph in which the made explicit use of a variance components model for the analysis of astronomical panel data. These methods were derived from the least squares methods used by Gauss (1809) and Legendre (1805) in the astronomical work, as well as the random effects or variance-components models. In 1953, CR Henderson developed the method-of-moments techniques for analyzing random effects and mixed models; (Hartley and Rao, 1967) devised the maximum likelihood (ML) methods for variance components models. The dynamic panel models started with the famous Balestra-Nerlove models. Panel data analysis grew into its maturity with the first conference on panel data econometrics in 1978 in Paris, organized by Pascal Mazodier.Since then, the field has witnessed ever-expanding activities in both methodological and applied research(Mazodier & Trognon,1978).

Forlinearmodels,thebasisformanypaneldatamethodsisordinaryleastsquaresappli edtosuitablytransformeddata.Thechallengeistodevelop the estimator'sassumptionswithgoodpropertiesunderreasonableassumptions,andtoensureth atstatisticalinferenceisvalid.Maximumlikelihoodestimationplaysakeyroleintheestimati onofnonlinearpaneldatamodels.

Someoftheearliesteconometricapplicationsofpaneldatamethodsweretotheestimationofa griculturalproductionfunctions,wheretheworrywasthatunobservedinputssuchassoilqual ity,technicalefficiency,ormanagerialskillofthefarmerwouldgenerallybecorrelatedwitho bservedinputssuchascapital,labor,andamountofland.

Thenatureofunobservedheterogeneitywasdiscussedearlyinthedevelopmentofpa neldatamodels.Mundlak'sperspectivehashadalastingimpactonpaneldatamethods,andhis insightshavebeenappliedtoavarietyofdynamicpaneldatamodelswithunobservedheterog eneity.

The1980switnessedanexplosioninbothmethodologicaldevelopmentsandapplicationsof paneldatamethods that providedaunifiedapproachtolinearandnonlinearpaneldatamodels,andexplicitlydealtwit hissuesofinferenceincaseswherefulldistributionswerenotspecified.Dynamiclinearmode ls,andtheproblemstheposeforestimationandinference,wereconsidered.

Inthelate1980sandearly1990s,researchersbeganusingpaneldatamethodstotestec onomictheoriessuchasrationalexpectationsmodelsofconsumption.Unlikemacro-leveldata,dataattheindividualorfamilylevelallowsonetocontrolfordifferentpreferences,a ndperhapsdifferentdiscountrates,intestingtheimplicationsofrationalexpectations.Toavo

idmakingdistributionalassumptions on unobserved shocks and heterogeneity, researchers oftenbased estimation on conditions on expected values that are implied by rational expectations.

There are other name for panel data, such as poled data (pooling of time series and cross-sectional observations), micro panel data, longitudinal data (a study over time of a variable or group of subjects), event history analysis and cohort analysis. Although there are subtle variations, all these names essentially connote movement over time of cross-sectional units. In panel data the same cross-sectional unit is surveyed over time. Panel data have spaced as well as time dimension.

A panel data set contains n entitles or subject, each of which includes t observations measured at l through t time period. Thus, the total number of observations is t,ideally, panel data are measured at regular time intervals. Otherwise, panel data should be analyzed with caution. A short panel data set has many entities but few time periods (small t), while a long panel has many time periods (Large t) but few entities (Cameron and Trivedi 2009). Panel data may have group effects, time effects, or the both, which are analyzed by fixed effect and random effect models.

3.4 Panel Data Regression Models

The regression models based on the panel data are called panel data regression models. Panel data models examine group (individual-specific) effect, time effects or both. These effects are either fixed effect or random effect. A fixed effect model examines if intercepts vary across groups or time periods, whereas a random effect model explores differences in error variance.

TheGeneralPanelDataRegressionModelcanbewrittenas;

$$Y_{it} = \beta_1 + \beta_2 X_{1it} + \mu_{it} \quad i = 1, 2, \ldots, N \ : t = 1, 2, \ldots, T \qquad (3.1)$$

Where,

i = individual dimension

t = time dimension

Y_{it} = the response of individual ***i***at time ***t***

β_1 = the unobserved individual-specific, time invariant intercepts

X_{1it} = the explanatory variable ***i*** at a time ***t***

β_2= a vector of regression coefficients

μ_{it} = the error term of individual ***i*** at time ***t***

3.5 Fixed Effect Method

Entities have individual characteristics that may or may not influence the outcome and or predictor variables. The business practices of a company may influence its stock price or level of spending; attitudes or policies towards guns in a particular state may affect its levels of gun violence. Business practices, cultural, or political variables are, most of the time unavailable or hard to measure.

Since individual characteristics are not random and may impact the predictor or outcome variables, it is needed to control for them. In this way, the effect of the predictors will not be influenced by those fixed characteristics. In entity's fixed effects it is assumed a correlation between the entity's error term and predictor variables. However, an entity's fixed effects cannot be correlated with another entity's.

The entity fixed effects regression model is

$$Y_{it} = \alpha_i + \beta X_{it} + u_{it} \quad i = 1 \ldots n;\ t = 1 \ldots T \tag{3.2}$$

Where:

Y_{it}= outcome variable (for entity i at time t)

α_i = the unknown intercept for each entity (n entity-specific intercepts)

X_{it}= a vector of predictors (for entity i at time t)

u_{it}= within-entity error term

Interpretation of the β coefficient: for a given entity, when a predictor changes one unit over time, the outcome will increase and decrease by β units (assuming no transformation is applied). Here, β represents a common effect across entities controlling for individual heterogeneity.

The fixed-effects model controls for all time-invariant differences between the individuals, so the estimated coefficients of the fixed-effects models cannot be biased because of omitted time-invariant characteristics like culture, religion, gender, and race. One side effect of the features of fixed-effects models is that it cannot be used to investigate time-invariant causes of the dependent variables. Technically, time-invariant characteristics of the individuals are perfectly collinear with the person dummies. Substantively, fixed-effects models are designed to study the causes of changes within a person. A time invariant characteristic cannot cause such a change, because it is constant for each person.

Fixed effects are ubiquitous in financial economics studies as a control for correlated omitted variables. Fixed effects are often used for high-frequency groups and often for multiple groupings at once. Computing advances have made it easy for researchers to run fixed effect models, but many researchers have a limited understanding of exactly how fixed effect eliminate omitted variable bias, and their implications for significance tests and interpretations. This manuscript explains the function of fixed effect in OLS models, and the effects on standard errors, sample composition, and interpreting coefficient estimates. While it is emphasized that fixed effect can be a powerful tool for improving identification, it also is explained how it can be introduced new and important problems of the own (Dehaan et al., 2021).

3.6 Random Effect Method

The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model.

The crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regresses in the model, not whether these effects are stochastic or not.

If there have reason to believe that differences across entities have some influence on the dependent variable but are not correlated with the predictors then random effects should be used. An advantage of random effects is that time invariant variables (i.e. gender) can be included. In the fixed effects model these variables are absorbed by the intercept.

Random effects assume that the entity's error term is not correlated with the predictors which allows for time invariant variables to play a role as explanatory variables. In random effects, you need to specify those individual characteristics that may or may not influence the predictor variables. The problem with this is that some variables may not be available therefore leading to omitted variable bias in the model. In the random effects model, the individual specific effect is a random variable that is uncorrelated with the explanatory variables.

A more common approach is to estimate group-specific intercepts, effectively using one parameter per group, and to pool the estimates of all other predictor effects; this definition is suggested by Gelman and Hill, 2007.

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In the linear case, the random-intercept model is given by

$$Y_{it} = \beta_0 + \beta_1 x_{it} + \beta_2 c_{it} + \mu_{it} + \varepsilon_{it} \quad (3.3)$$

where,

Y_{it} = outcome variable (for entity i at time t)

x_{it} = a vector of predictors (for varies between and within clusters)

c_{it} = a variable (for varies only between clusters)

μ_{it} = the error and the random intercept

ε_{it} = overall error term.

3.7 Model Assumptions

The following assumptions are made on model equation (3.1),

(i) Linearity

The model in (3.1) is linear in parameters in β, individual effect β_{li} and error μ_{it} are normally distributed with mean 0 and variance σ_ε^2 ie.

$\mu_{it} \sim N(0, \sigma_\varepsilon^2)$

where, $0 < \sigma_\varepsilon^2 < \infty$

(ii) **Independence**

The $\{X_{i11} \ldots\ldots X_{iTK}\}_{i=1}^{N}$ is independently and identically distributed. The observations are independent across individuals but not necessarily across time. The μ_{it} are independent and identically distributed (*i. i .d*) random variables.

(iii)Strict Exogeneity

The μ_{it} are independent of the exploratory variables X_{it} as well as the individual-specific time invariant intercepts α_i ie. E $(\mu_{it} / X_{i11}, \ldots\ldots X_{iTK}, \alpha_i) = 0$ (mean independence). The idiosyncratic error term μ_{it} is assumed uncorrelated with the explanatory variables of all past, current and future time periods of the same individual. It also assumes that the idiosyncratic error is uncorrelated with the individual specific effect.

(iv) Error Variance

The covariance between the error terms in any two different observations equals to zero ie. $\text{cov}(\mu_{it} . \mu_{is} / X_{it} . \alpha_i) = 0$. $\mu_{it} \neq \mu_{is}$ for all i and s≠ t.

Assumptions about the Error Components

$\varepsilon_i \sim N(0, \sigma_\varepsilon^2)$

$E(\varepsilon_i \varepsilon_j) = 0$ for $i \neq j$

$\mu_{it} \sim N(0, \sigma_\varepsilon^2)$

$E(\mu_{it}\mu_{is}) = E(\mu_{it}.\mu_{it}) = E(\mu_{it}.\mu_{is}) = 0$ for $i \neq j$; $t \neq s$

$E(\varepsilon_i u_{it}) = 0$

that is, the individual error components are not correlated with each other and are not auto correlated across both cross-section and time series units.

$$E(w_{it}) = 0 \qquad (3.4)$$

$$\text{var}(w_{it}) = \sigma_\varepsilon^2 + \sigma_u^2$$

As Equation (3.4) shows, the error term is homoscedastic. However, it can be shown that w_{it} and w_{is} ($t \neq s$) are correlated; that is, the error terms of a given cross-sectional unit at two different points in time are correlated. The correlation coefficient, corr (w_{it}, w_{is}) is

$$F = \text{corr}(w_{it}, w_{is}) = \frac{\sigma_\epsilon^2}{\sigma_\varepsilon^2 + \sigma_u^2} \quad ; \quad t \neq s$$

3.7.1 Fixed Effects Versus Random Effects Model

(i) If t (the number of time series data) is large and n (the number of cross-sectional units) is small, there is likely to be little difference in the values of the parameters estimated by FEM and ECM. Hence the choice here is based on computational convenience. On the score, FEM may be preferable.

(ii) When n is large and t is small, the estimates obtained by the two methods can differ significantly. In ECM $\beta_{1i}' = \beta_1 + \varepsilon_i$, where ε_i is the cross-sectional random component whereas in FEM, β_{1i} treats as fixed and not random. In that case, FEM is appropriate. If the cross-sectional units in the sample are regarded as random drawings, then ECM is appropriate.

(iii) If the individual error component ε_i and one or more regresses are correlated, then ECM estimators are biased, whereas those obtained from FEM are unbiased.

(iv) If n is large and t is small, and if the assumptions underlying ECM hold, ECM estimators are more efficient than FEM.

(v) Unlike FEM, ECM can estimate coefficients of time-invariant variables. The FEM does control for such time-invariant variables, but it cannot estimate them directly, as is clear from the LSDV or within-group estimator models.

If it is assumed that ε_i and X's are uncorrelated, ECM may be appropriate, where as if ε_i and the X's are correlated, FEM may be appropriate. In FEM each cross-sectional units has its own (fixed) intercept value, in all n such values for n cross-sectional units. In ECM, the common intercept represents the mean value of all the (cross-sectional) intercepts and the error component ε_i represents the (random) deviation of individual intercept for this mean value.

3.7.2 Hausman Test

The Hausman specification test compares the fixed versus random effects under the null hypothesis that the individual effects are uncorrelated with the other regresses in the model (Hausman, 1978). If correlated (H_0 is rejected), a random effect model produces biased estimates, violating one of the Gauss-Markov assumptions; so a fixed effect model is preferred. Hausman's essential result is that the covariance of an efficient estimator with its difference from an efficient estimator is zero (Greene, 2003). Hausman test is a good way to choose which model is better for the researches. The test statistic developed by Hausman test has an asymptotic Chi-square distribution.

Test hypotheses is:

Null Hypothesis : The random effect model is appropriate.

Alternative Hypothesis : The fixed effect model is appropriate.

3.7.3 Breusch-Pagan Lagrange Multiplier Test

In statistics, the Breusch-Pagan test, developed in 1979 by Trevor Breusch and Adrain Pagan is used to test for heteroskedasticity in a linear regression model. It was independently suggested with some extension by Cook and Weisberg in 1983 (Cook–Weisberg test). Derived from the Lagrange multiplier test principle, it tests whether the variance of the errors from a regression is dependent on the values of the independent variables. The decision to choose between the pooled OLS and the panel

random effectmodel depends on the probability of chi-squared of the Lagrange Multipliertest. In that case, heteroskedasticity is present (Thant, 2019).

The Breusch-Pagan Lagrange Multiplier test is used to determine whether random effects are significant in panel data models. On the other hand, the Hausman test is used to choose between fixed and random effects models. Both these tests are used extensively with panel data.

This is the basis of the Breusch-Pagan test. It is a chi-squared test: the test statistic is distributed n χ^2 with k degrees of freedom. If the test statistic has a p-value below an appropriate threshold ($p< 0.05$) then the null hypothesis of homoskedasticity is rejected and heteroskedasticity assumed.

If the Breusch-Pagan test shows that there is conditional heteroskedasticity, one could either use weighted least squares (if the source of heteroskedasticity is known) or use heteroscedasticity-consistent standard errors.

CHAPTER 4

EMPIRICAL ANALYSIS OF PANEL DATA REGRESSION MODELS FOR ENVIRONMENTAL POLLUTION, ECONOMIC GROWTH, AND PUBLIC HEALTH IN DEVELOPING COUNTRIES, ASIA

In this section, profiles of developing countries are showed and the demographic conditions of developing countries in Asia are analyzed by descriptive method and the environmental pollution and economic growth on public health by analyzing panel regression analysis method.

4.1 Profiles of Developing Countries in Asia

According to the UN, a developing country is a country with a relatively low standard of living, undeveloped industrial base, and moderate to low Human Development Index). This index is a comparative measure of poverty, literacy, education, life expectancy, and other factors for countries worldwide.

Bangladesh, country of South Asia, located in the delta of the Padma (Ganges) and Jamuna (Brahmaputra) rivers in the northeastern part of the Indian subcontinent. The riverine country of Bangladesh “Land of the Bengals” is one of the most densely populated countries in the world, and its people are predominantly Muslim. As the eastern portion of the historical region of Bengal, the area once formed, along with what is now the Indian state of West Bengal, the province of Bengal in British India.

With the partition of India in 1947, it became the Pakistani province of East Bengal (later renamed East Pakistan), one of five provinces of Pakistan, separated from the other four by 1,100 miles (1,800 km) of Indian territory. In 1971 it became the independent country of Bangladesh, with its capital at Dhaka.

Cambodia is a country on the Indochinese Mainland of Southeast Asia. Cambodia is largely a land of plains and great rivers and lies amid important overland and river trade routes linking China to India and Southeast Asia. The influences of many Asian cultures, alongside those of France and the United States, can be seen in the capital, Phnom Penh, one of a handful of urban centers in the largely rural country. For 2,000 years Cambodia’s civilization absorbed influences from India and China and, in turn, transferred them to other Southeast Asian civilizations.

From the Hindu-Buddhist kingdoms of Funan and Chenla (1st to 8th century) through the classical age of the Angkor period (9th to 15th century), it held sway over territories that are now part of Thailand, Vietnam, and Laos. The Khmer (Cambodian) empire reached its apex in the 12th century, a time marked by the construction of the massive temple complexes known as Angkor Wat and Bayon and the imperial capital of Angkor Thom. Following 400 years of decline, Cambodia became a French colony and during the 20th century experienced the turmoil of war, occupation by the Japanese, postwar independence, and political instability. Between 1975 and 1979 the country was devastated by the reign of the Khmer Rouge, a rural communist guerrilla movement.

Laos is landlocked country of northeast central mainland Southeast Asia. It consists of an irregularly round portion in the north that narrows into a peninsula like region stretching to the southeast. Overall, the country extends about 650 miles (1,050 km) from northwest to southeast. The capital is Vientiane located on the Mekong River in the northern portion of the country. The geologically diverse landscape of Laos, with its forested mountains, upland plateaus and lowland plains, supports an equally diverse population that is united largely through agriculture, particularly the cultivation of rice.

Interactions sometimes hostile, sometimes hospitable with the neighboringKhmer (Cambodian), Siamese (Thai), and Myanmar (Burmese) kingdoms between the 5th and the mid-19th century indirectly imbued Laos with elements of Indian culture, including Buddhism, the religion now practiced by most of the population. Both Buddhist and Hindu lore have shaped the visual, performing, and literary arts of the country. Many of the indigenous and minority peoples of the remote highland slopes and mountainous regions, however, have maintained their own idiosyncratic ritual and artistic traditions.

Mongolia is historically Outer Mongolia, country located in north central Asia. It is roughly oval in shape, measuring 1,486 miles (2,392 km) from west to east and, at its maximum, 782 miles (1,259 km) from north to south. Mongolia's land area is roughly equivalent to that of the countries of western and central Europe, and it lies in a similar latitude range. The national capital, Ulaanbaatar (Mongolian: Ulan Bator), is in the north central part of the country.

Landlocked Mongolia is located between Russia to the north and China to the south, deep within the interior of eastern Asia far from any ocean. The country has a

marked continental climate, with long cold winters and short cool to hot summers. Its remarkable variety of scenery consists largely of upland steppes, semi deserts, and deserts, although in the west and north forested high mountain ranges alternate with lake-dotted basins. Mongolia is largely a plateau, with an average elevation of about 5,180 feet (1,580 meters) above sea level.

The highest peaks are in the Mongolian Altai Mountains (Mongol Altain Nuruu) in the southwest, a branch of the Altai Mountains system. Some three-fourths of Mongolia's area consists of pasturelands, which support the immense herds of grazing livestock for which the country is known. The remaining area is about equally divided between forests and barren deserts, with only a tiny fraction of the land under crops. With a total population of fewer than three million, Mongolia has one of the lowest average population densities of any country in the world.

Myanmar, also called Burma, country, located in the western portion of mainland Southeast Asia. In 1989 the country's official English name, which it had held since 1885, was changed from the Union of Burma to the Union of Myanmar; in the Burmese language the country has been known as Myanmar since the 13th century. The English name of the city that served as the country's capital from 1948 to 2006, Rangoon, also was dropped in 1989 in favor of the common Burmese name, Yangon. In 2005 the government began to shift its administrative center, first to the city of Pyinmana (some 200 miles north of Yangon) and then to Nay Pyi Taw , a newly constructed city near Pyinmana. Nay Pyi Taw was proclaimed the capital of Myanmar in 2006.

Nepal, country of Asia, is lying along the southern slopes of the Himalayan mountain ranges. It is a landlocked country located between India to the east, south, and west and the Tibet Autonomous Region of China to the north. Its territory extends roughly 500 miles (800 kilometers) from east to west and 90 to 150 miles from north to south. The capital is Kathmandu. Nepal, long under the rule of hereditary prime ministers favoring a policy of isolation, remained closed to the outside world until a palace revolt in 1950 restored the crown's authority in 1951 the country gained admission to the United Nations in 1955.

In 1991 the kingdom established a multiparty parliamentary system. In 2008, however, after a decade long period of violence and turbulent negotiation with a strong Maoist insurgency, the monarchy was dissolved, and Nepal was declared a democratic republic. Wedged between two giants, India and China, Nepal seeks to

keep a balance between the two countries in its foreign policy and thus to remain independent. A factor that contributes immensely to the geopolitical importance of the country is the fact that a strong Nepal can deny China access to the rich Gangetic Plain; Nepal thus marks the southern boundary of the Chinese sphere north of the Himalayas in Asia.

Sri Lanka, formerly Ceylon, island country lying in the Indian Ocean and separated from peninsular India by the Palk Strait. It is located between latitudes 5°55′ and 9°51′ N and longitudes 79°41′ and 81°53′ E and has a maximum length of 268 miles (432 km) and a maximum width of 139 miles (224 km). Proximity to the Indian subcontinent has facilitated close cultural interaction between Sri Lanka and India from ancient times. At a crossroads of maritime routes traversing the Indian Ocean, Sri Lanka has also been exposed to cultural influences from other Asian civilizations.

Ancient Greek geographers called it Taprobane. Arabs referred to it as Serendib. Later European mapmakers called it Ceylon, a name still used occasionally for trade purposes. It officially became Sri Lanka in 1972. The distinctive civilization of Sri Lanka, with roots that can be traced back to the 6th century BCE, is characterized by two factors: the preservation of Theravada Buddhism and the development over two millennia of a sophisticated system of irrigation in the drier parts of the country. This civilization was further enriched by the influences of Hinduism and Islam.

4.2 Descriptive Analysis of Developing Countries in Asia

Descriptive analysis is used to describe the background characteristics of developing countries in Asia and compare of the life expectancy at birth in public health, GDP per capita (PPP) and urbanization growth rate in economic development and CO_2 emission in environmental pollution of developing countries, Asia.

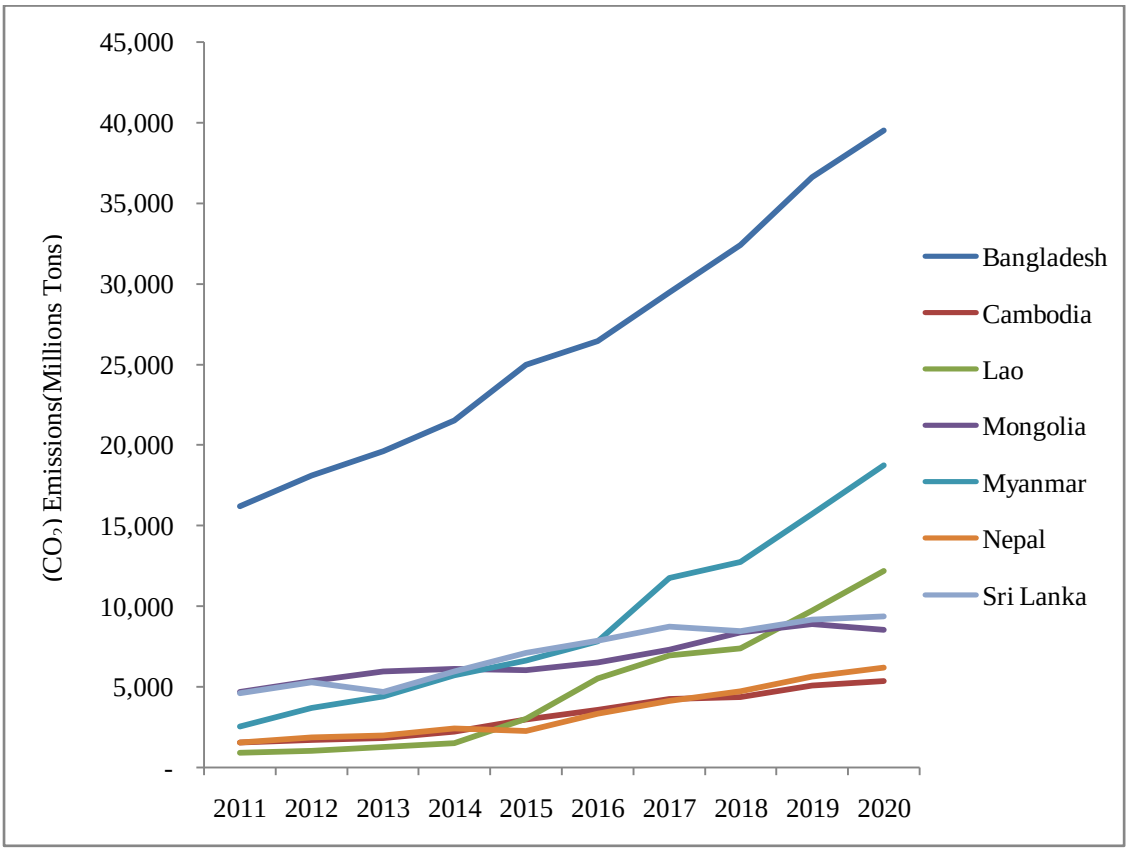
4.2.1 Carbon dioxide emissionin Developing Countries

Carbon dioxide emission is an odorless gas that is highly important to life on Earth. CO_2 emission is also known as a greenhouse gas; an excessive concentration can disrupt the natural regulation of temperature in the atmosphere and lead to global warming.

Global climate change is mostly caused by carbon dioxide emissions. It is widely recognized that the world needs to reduce emissions quickly if it wants to

avoid the worst effects of climate change.But, how this responsibility is shared between regions, countries, and individuals has been an endless point of contention in international discussions.

The following chart describes CO_2 emission in developing countries using World Bank data from 2011 to 2020.



Source: (World Bank Data, 2021)

Figure 4.1 CO_2 Emissions in Developing Countries

The above figure shows that Bangladesh is the highest CO_2emission with over 39511.40 tons among the developing countries and it can be seen that CO_2emission are the increasing year by year during the year of 2011 to 2020. Cambodia is 5349.62 tons and the lowest among them, but CO_2 emission increases from year to another. CO_2 emission of Myanmar is the second highest emission and it has between 15000 tons and 20000 tons. CO_2 emissionof Laos is deeply declined under 5000 tons in 2014 and then is raisedbetween 10000 tons and 15000 tons. CO_2 emissionof Sri Lanka is between 5000 tons and 10000 tons and CO_2 emissionof Mongolia is between 5000 tons and 10000 tons. And also CO_2 emissionof Nepal is less than 10000 tons. According to the data, CO_2 emissions of developing countries, Asia are arising and

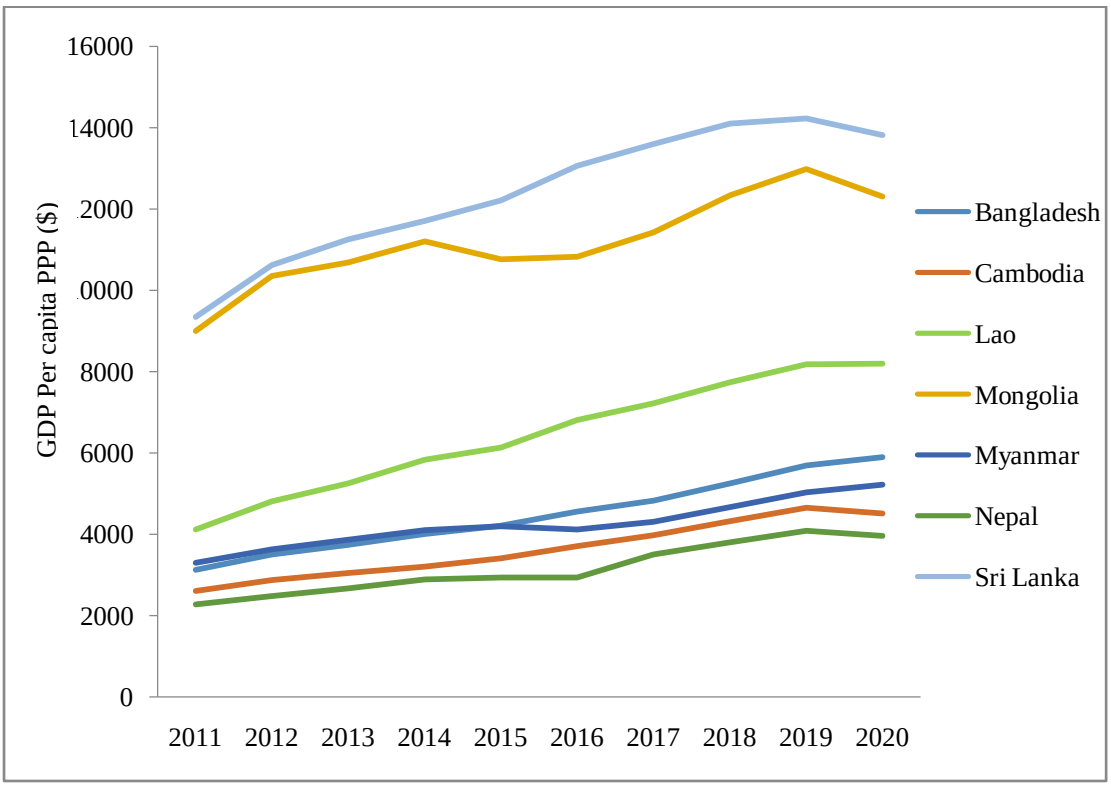
increasing from the various ways year by year. Consumption of CO_2 emissionstill does not fully resolve the responsibility for emissions, however, given that both sides of a trade relationship are to gain financially.

4.2.2GDP per capita (PPP) in Developing Countries

GDP per capita (PPP) and annual growth rate of GDP per capita (PPP) is widely used by economists to gauge the health of an economy.

The GDP per capita (PPP) of Sri Lanka is the highest among Asian developing countries during the study period. Myanmar stands at the 4th position among Asian Developing Countries.

The following chart describes GDP per capita (PPP) in developing countries using World Bank Data from 2011 to 2020.



Source: (World Bank Data, 2021)

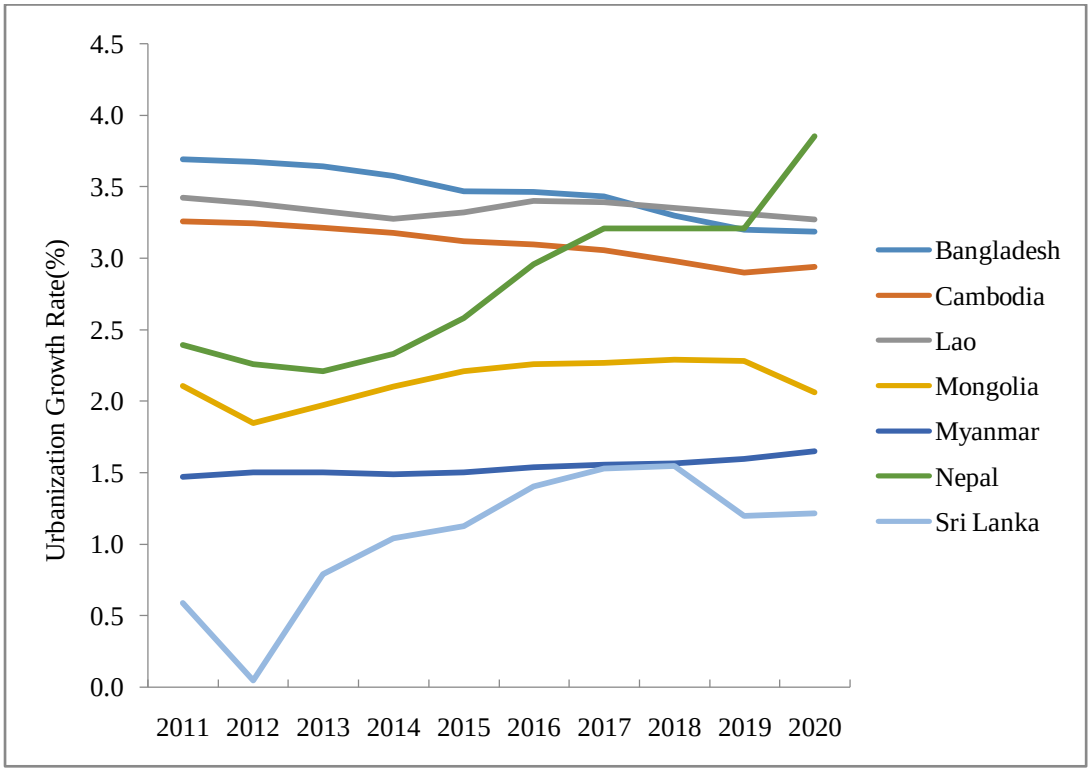
Figure 4.2GDP per capita (PPP) in Developing Countries

The above Figure 4.2 shows that Sri Lanka is the highest GDP per capita (PPP) with over US $ 14214.6512 among the developing countries of Asia and it can be seen that GDP per capita (PPP) are the increasing year by year during the year of 2011 to 2020. Nepal is US$ 3967.8202 and the lowest among them and is deeply declined between US$ 2000 and 4000 in 2016, but GDP per capita (PPP) increases

from year to another. The gross domestic product of Mongolia is between US $ 10000 and US $ 12000 and the gross domestic product of Laos is between US $ 8000 and US $ 10000 and the gross domestic product of Bangladesh is between US $ 6000 and US $ 8000 and the gross domestic product of Myanmar is between US $ 4000 and US $ 6000. And also, the gross domestic of Cambodia is under US $ 6000. According to data, most of the developing countries in Asia are rising in GDP per capita (PPP) year by year but there are highly decreased after 2019 due to COVID-19.

4.2.3 Urbanization Growth Rate in Developing Countries

The following chart describes urbanization growth rate in developing countries using World Bank Data from 2011 to 2020.



Source: (World Bank Data, 2021)

Figure 4.3 Urbanization Growth Rate in Developing Countries

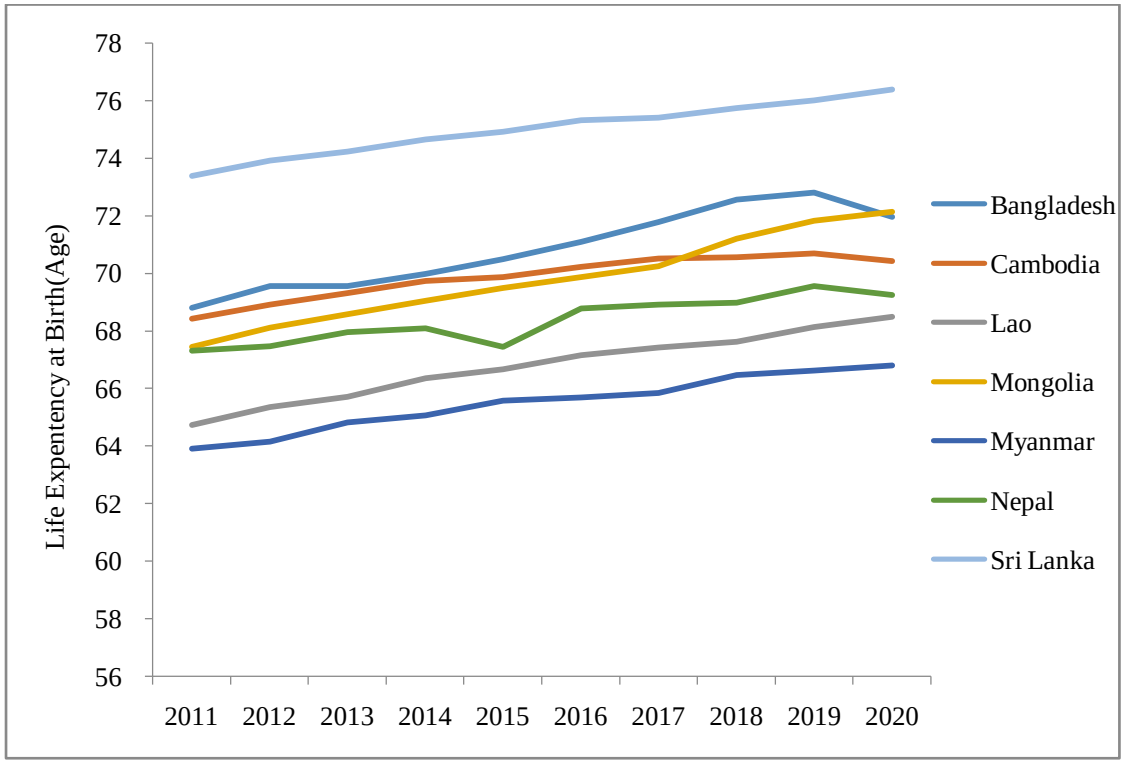
The above Figure 4.3 shows that Bangladesh has between 3.5 and 3.2 percent form first position to third position. Nepal has the greatest rate of urbanization expansion, and from 2019 to 2020, this rate is increasing from fourth position to first position. The lowest among them in 2012 is Sri Lanka, at 0.0 percent, but the rate of urbanization growth is rising each year. Laos has an urbanization growth rate between 3 and 3.5 percent, Cambodia between 2.5 and 3, and Mongolia and Myanmar between

1.5 and 2.5 percent. In third, fifth, and sixth position, respectively, are Cambodia, Mongolia, and Myanmar. Most of the countries are declining annually as a result of COVID-19 except Nepal.

4.2.4 Life Expectancy at Birth in Developing Countries

The average number of years that a newborn could expect to live, if he or she was to pass through life exposed to the sex and age-specific death rates prevailing at the time of his or her birth, for a specific year, in a given country, territory, or geographic area.

The following Figure 4.4 shows life expectancy at birth in developing countries by using World Bank data from 2011 to 2020.



Source: (World Bank Data, 2021)

Figure 4.4 Life Expectancy at Birth in Developing Countries

In the above Figure 4.4, it shows that life expectancy at birth of Sri Lanka is highest during the year of 2011-2020. Myanmar is the lowest life expectancy at birth among the developing countries. And also, in Sri Lanka, life expectancy at birth is sustainable increased within the countries at the periods from 2011 to 2020 without falling. Except Bangladesh, other countries Mongolia, Cambodia, Nepal and Laos are slowly higher with life expectancy at birth at these periods. Life expectancy at birth of Bangladesh fell in 2020, but rose in other due to that country witnessed 28,072 deaths

from COVID-19between March 2000 and December 2021. Until the COVID-19outbreak, there had been a continuous rise in the life expectancy of the country's population.

4.3Analysis of Panel Data Regression Models for Life Expectancy at Birth in Developing Countries

The effects of economic growth factors on life expectancy at birth (LEAB) are studied in the paper. This model is consisting of three explained variable and one explanatory variable. The three explained variable is GDP per capita, CO_2 emission and urbanization growth rate and one explanatory variable is life expectancy at birth. The data is panel data and panel regression model are fixed effect model and random effect model used to analysis the effect of economic growth factor on life expectancy at birth.

4.3.1 The Fixed Effect Model for Life Expectancy at Birth and Economic Growth Factors of Developing Countries

The three explained variable GDP per capita (PPP), carbon dioxide CO_2emission and urbanization growth rate and one explanatory variable (life expectancy at birth) is analyzed by using fixed effect model. In entity's fixed effects it is assumed a correlation between the entity's error term and predictor variables. However, an entity's fixed effects cannot be correlated with otherregresses.

The fixed effect model for life expectancy at birth and economic growth factors (GDP per capita (PPP), carbon dioxide emission and urbanization growth rate) are as follows:

$$\text{LEAB}_{it} = \beta_1 + \beta_2 GDP_{1it} + \beta_3 CO_{2it} + \beta_4 UR_{3it} + \mu_{it}$$

where

i = 1, 2

t = 1, 2,…, 10

LEAB = Life Expectancy at Birth

β_1 = Intercept

GDP = Gross Domestic Product per capita (PPP)

β_2 = Coefficient of Gross Domestic Product per capita (PPP)

CO_2 emission = Carbon dioxide Emission

β_3= Coefficient of Carbon Dioxide Emission

UR = Urbanization Growth Rate

β_4= Coefficient of Urbanization Growth Rate

The following Table 4.1 presents the fixed effect model for economic growth factors and life expectancy at birth in Developing Countries.

Table 4.1 The Fixed Effect Model for Economic Growth Factors and Life Expectancy at Birth in Developing Countries

Variables	Coefficient	Std. error	t	p-value
Constant	64.0904	0.5091	125.88	0.000***
GDP per capita (PPP)	0.0007	0.00008	8.59	0.000***
Urbanization Growth Rate	0.0006	2.2107	0.00	0.098*
CO_2 Emission	-0.0009	0.0002	4.28	0.000***
Sigma u	2.3959			
Sigma e	0.4409			
Rho	0.9673			
F (6,60)	271.44			
p-value	0.0000***			
Number of Groups	7			
Number of Time (years)	10			
Number of Observations	70			

Source: (World Bank Data, 2021)

*****, **, *** statistically significant at 1% level, 5% level and 10% level.

In the fixed effect model, the only three variables are statistically significant but not practically significant. GDP per capita (PPP) is statistically significant at 1 percent level, given the fact probability values (0.000) is smaller than 0.01. Carbon dioxide emission is also significant at 1 percent level, given the fact probability value (0.000) is smaller than 0.01. Urbanization growth rate significant at 10 percent level, given the fact probability value (0.098) is more than 0.1.

The estimated fixed effect within regression model for life expectancy at birth and economic growth actors of developing countries can be expressed as follow:

$$\widehat{\text{LEAB}}_{it} = 64.0904 + 0.0007GDP - 0.0009CO_2 + 0.0006UR \quad (4.1)$$

From the above equation, it is found that GDP per capita (PPP) and urbanization growth rate have positive effect on life expectancy at birth which is theoretically justified and carbon dioxide has negative effect on LEAB.

CO_2emissions have a significantly negative impact on life expectancy, suggesting that higher the carbon dioxide emissions lower the life expectancy. More specifically, a 1% increase of carbon emissions, keeping all other variables constant, decreases life expectancy by 0.012%.

If carbon dioxide emission rises by one year, LEAB will decrease by 0.0009. Therefore, it can be concluded that carbon dioxide emission increases, LEAB will decrease. Similarly, urbanization rate rises by one year, LEAB will increase by 0.0007 US $. Therefore, it can be concluded that urbanization rate increases, GDP per capita (PPP) will increase. The overall model is also significant at 10 percent level. The intercept 64.0904 is the average of seven developing countries.

4.3.2 The Random Effect Model for Life Expectancy at Birth (LEAB) and Economic Growth Factors of Developing Countries

The three explained variable GDP per capita (PPP), carbon dioxide CO_2emission and urbanization growth rate and one explanatory variable (life expectancy at birth) is analyzed by using fixed effect model.Random effects assume that the entity's error term is not correlated with the predictors which allows for time invariant variables to play a role as explanatory variables. In random effects, you need to specify those individual characteristics that may or may not influence the predictor variables.

The random effect model for life expectancy at birth and economic growth factors GDP per capita (PPP), carbon dioxide emission and urbanization growth rate are as follows:

$$\text{LEAB}_{it} = \beta_1 + \beta_2 GDP_{1it} + \beta_3 CO_{2it} + \beta_4 UR_{3it} + w_{it}$$

where

i = 1, 2

t = 1, 2,…, 10

LEAB = Life Expectancy at Birth

β_1 = Intercept

GDP = Gross Domestic Product per capita (PPP)

β_2 = Coefficient of Gross Domestic Product per capita (PPP)

CO_2 emission = Carbon Dioxide Emission

β_3= Coefficient of Carbon Dioxide Emission

UR = Urbanization Growth Rate

β_4= Coefficient of Urbanization Growth Rate

The following Table 4.2 presents the random effect model for economic growth factors and life expectancy at birth in Developing Countries.

Table 4.2 The Random Effect Model for Economic Growth Factors and Life Expectancy at Birth in Developing Countries

Variables	Coefficient	Std. error	Z	p-value
Constant	64.0934	1.2976	49.40	0.000***
GDP per capita (PPP)	0.0007	0.00008	9.03	0.000***
Urbanization Growth Rate	0.0222	0.2007	0.11	0.0912*
CO_2 Emission	-0.0009	0.0002	4.63	0.000***
Sigma u	3.2395			
Sigma e	0.4409			
Rho	0.9818			
Wald	379.65			
p-value	0.0000***			
Number of Groups	7			
Number of Time (years)	10			
Number of Observations	70			

Source: (World Bank Data, 2021)

*****, **, *** statistically significant at 1% level, 5% level and 10% level.

According to the result, in the random effect GLS regression model of all variables are individually, statistically significant. LEAB is significant at 1 percent level, giving the fact the probability values (0.000) are smaller than 0.01. Carbon dioxide emission is significant at 1 percent level, giving the fact the probability valued (0.000) is smaller than 0.01.Urbanization rate is significant at 10 percent level, giving the fact the probability values (0.0912) are more than 0.1. The estimated random effect GLS regression model for life expectancy at birth and economic factors of Developing Countries can be expressed as follows:

$$\widehat{\text{LEAB}}_{it} = 64.0934 + 0.0007GDP - 0.0009CO_2 + 0.0222UR \qquad (4.2)$$

From the above equation, it can be seen that GDP per capita(PPP), and urbanization growth rate have positive effects on LEAB which is theoretically justified and carbon dioxide emission has negative effects on LEAB.

It is observed that if there is carbon dioxide emission and urbanization growth rate, GDP per capita (PPP) will be around 64.0934. If GDP per capita (PPP) rises by one year, life expectancy at birth will increase by 64.0934. Therefore, it can be concluded that when GDP per capita (PPP) increases, life expectancy at birth will be increased. Similarly, when carbon dioxide emission is decreased, life expectancy at birth will increase over 64.0943 year. Therefore, it can be concluded that when carbon dioxide emission rises, life expectancy at birth will be increased. When urbanization growth rate is increased year by year, life expectancy at birth will increase by 64.0934 year. Therefore, it can be concluded that when urbanization growth rate rises, life expectancy at birth will be increased. The only two variables models are also statistically significant at 10 percent level.

4.4 Determining the Appropriate Model of Hausman and Breusch-Pagan Multiplier Test

Hausman Test

The Hausman test is used to determine which model is appropriate fixed effect model or random effect model. According to the result of the Hausman test, Table 4.3 shows that the significant level, p-value 0.9827 is higher than 5 percent level. It means that the null hypothesis is accepted. It can be concluded that the random effect estimation (REM) is more appropriate than the fixed effects estimation. When the p-value for the test is more than 5%, this indicates that the fixed effects model is not appropriate and that the REM specification is to be preferred. The results of Hausman test are shown in Table 4.3.

Table 4.3 The Results of Hausman Test

Variables	Coefficients		(b-B) Difference	Standard Error
	(b) Fixed effect model	(B) Random effect model		
GDP per capita (PPP)	0.0007	0.0007	0.00001	0.00003
Urbanization Growth Rate	0.0006	0.0222	0.0215	0.0642
Carbon dioxide Emission	0.0009	0.0009	-0.00002	0.00006
Chi-square (1)	0.17			
Prob > chi^2	0.9827			

Source: (World Bank Data, 2021)

Breusch Pagan Lagrangian Multiplier Test

When the panel random effect model, the Bteusch-Pagan Lagrange multiplier test is used, the following data are shown in Table 4.4.

Table 4.4: The Estimated Result of the Breusch Pagan Lagrangian Multiplier Test

Variables	Variance	Standard deviation = sqt (Var)
GDP per capita (PPP)	9.4622	3.0761
E	0.1944	0.4409
M	10.4945	3.2395
$chibar^2$ (01)	288.73	
Prob > chi^2	0.0000	

Source: (World Bank Data, 2021)

Depending on the probability of chi-square of the Breusch Pagan Lagrangian multiplier test in the above Table 4.4, it can be concluded that the panel random effect model is accepted. Therefore, the panel random effect model is found to be appropriate.

Based on the results of the Hausman test shown in Table 4.3 and the Breusch Pagan Lagrangian multiplier test shown in Table 4.4, it can be assumed that the random effect model is accepted, therefore, the random effect model is appropriate and it should be implement. Thus, the estimated random effect regression model for

life expectancy at birth and economic factors of developing countries can be expressed as following equation:

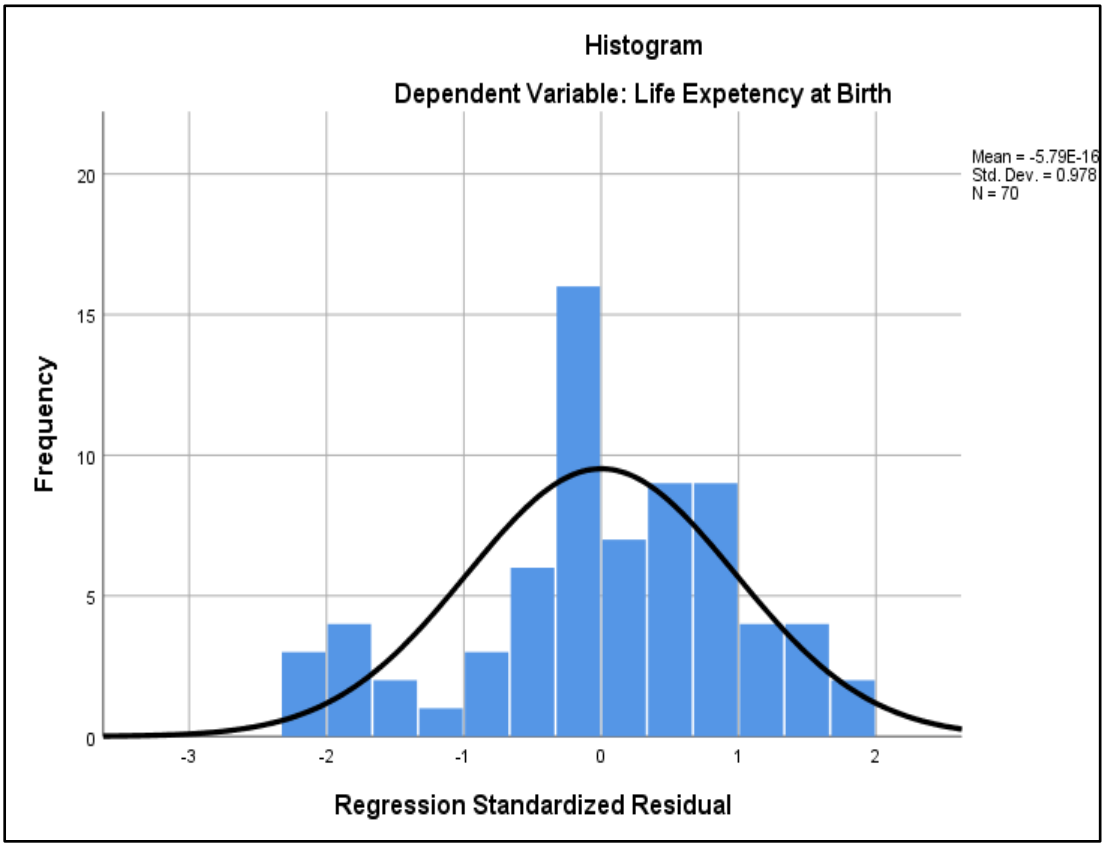
$$\widehat{\text{LEAB}}_{it} = 64.0934 + 0.0007GDP - 0.0009CO_2 + 0.0222UR$$ The equation shows that GDP per capita (PPP), and urbanization growth rate have positive effects on LEAB which is theoretically justified and carbon dioxide emission has negative effects on LEAB.

4.5 Testing for the Assumption

To determine the violation of required assumption from panel data regression model, the following procedures have been used.

(1) Testing for Normality

The following Figure 4.5 shows the histogram for residual plot for the life expectancy at birth of developing countries.

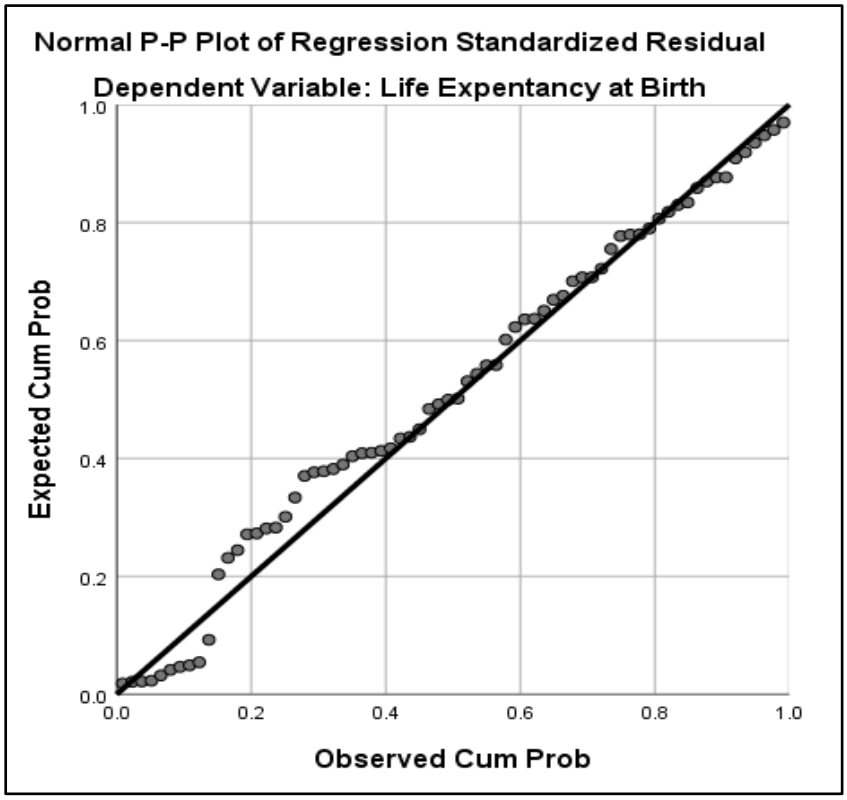


Source: (World Bank Data, 2021)

Figure 4.5 Histogram for Residual

One-Sample Kolmogorov-Smirnov Test is significant (0.000). So, test distribution is not normal.

One of the basic assumptions is that disturbances are normally distributed with zero mean and constant variance. To check whether the disturbances are normally distributed, histogram and Normal P-P plot of the disturbances can be constructed. The histogram of the residual and Normal P-P plot for the gross domestic product of developing countries are shown in Figure 4.5 and 4.6.



Source:(World Bank Data, 2021)

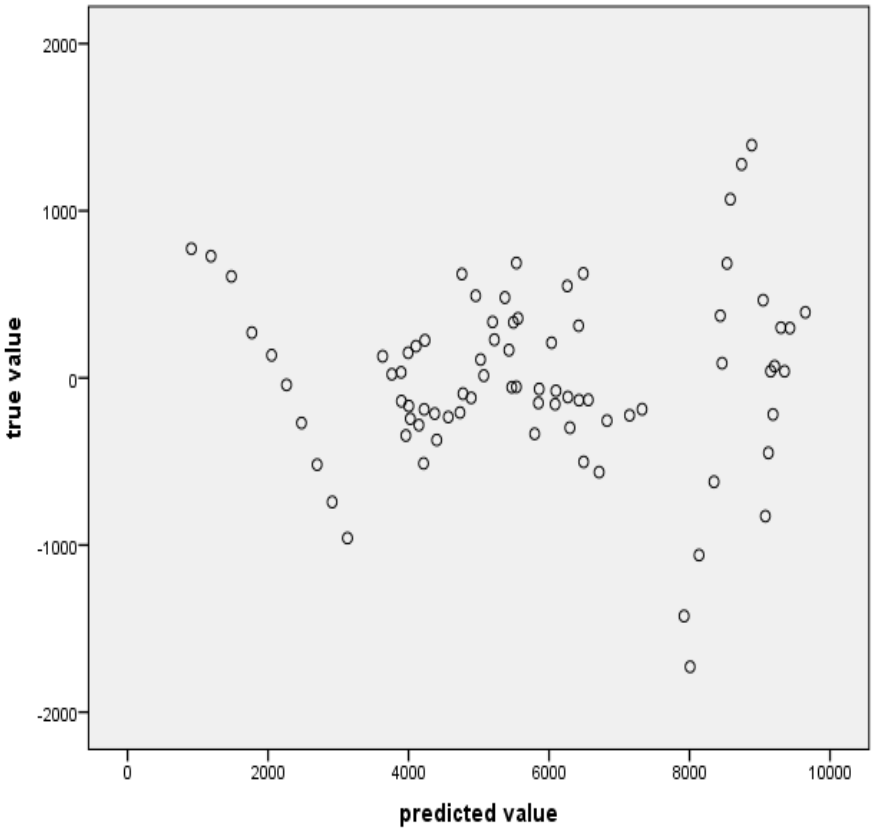
Figure 4.6 Normal P-P Plot of Regression Residuals

The histogram in Figure 4.6 appears to be pile fashioned. Similarly, the normal probability plot is virtually a straight line. Although the graphs do not provide formal statistical test of normality, they do provide a descriptive display. According to histogram and Normal P-P plot, it can be concluded that the normality assumption appears to be generally reasonable.

(2) Testing for the Presence of Heteroscedasticity Problem

These two figures are error plots. The White test is to be used in this study to detect the presence of heteroscedasticity. Another basic assumption of the multiple

regression models is homoscedasticity. In the presence of heteroscedasticity, the regression coefficient becomes less efficient. Heteroscedasticity can often be detected by plotting the estimated Y values against the disturbances. If any patter is displayed, heteroscedasticity is likely present. Figure 4.7 represents the predicted on X axis the residual values on Y axis.



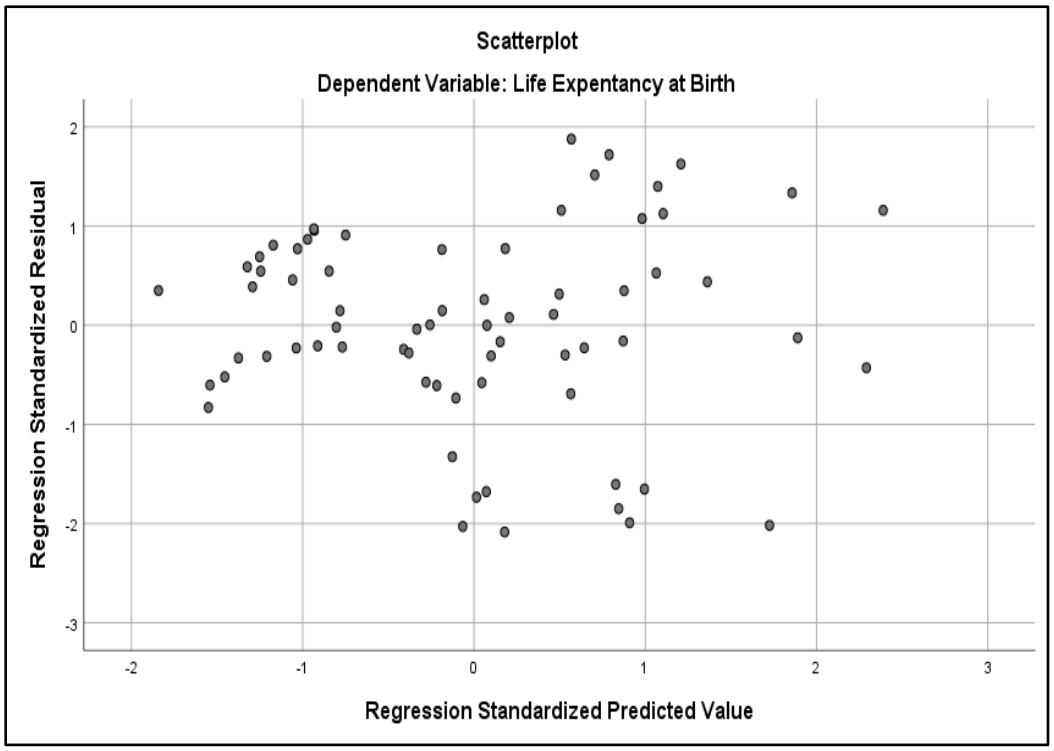
Source: (World Bank Data, 2021)

Figure 4.7 Residual Pattern for Heteroscedasticity

The figure shows that heteroscedasticity appears to be absent because there is no pattern between residual and estimated value. In short, residual pattern in Figure 4.7 tells that the heteroscedasticity or equal variance may exist the error term for regression model of the regression model of the gross domestic product per capita for Developing countries.

(3) Testing for the Presence of Autocorrelation (Random Effect Model)

One of the basic problems of OLS model is that the errors be uncorrelated. Figure 4.8 depicts error patterns that can reveal information about the model by plotting.



Source: (World Bank Data, 2021)

Figure 4.8 The Relationship Residual Plots and Time Scatter Plot

This figure shows that positive autocorrelation is absent. Because there is no pattern in residual plot, two variables i.e., residual and previous residual are not correlated. Although analyzing errors have the same sign, the error can mean of detecting autocorrelation, which is not very reliable. Patterns are seldom as obvious as suggested here. Therefore, the less fallible procedure is needed to determine whether the residual are autocorrelated or not. So, model assumptions are satisfied.

CHAPTER 5
CONCLUSION

This chapter focuses on the conclusion of the thesis related to findings, summarized results for the study, suggestions and recommendations and needs for further study.

5.1 Findings and Discussions

According to the research objective (1), to study the condition of environmental pollution, economic growth and public health in developing countries in Asia, namely Bangladesh, Cambodia, Laos, Mongolia, Myanmar, Nepal and Sri Lanka.

Among the developing nations, Bangladesh has the largest emissions of carbon dioxide, while Cambodia has the lowest. It is clear that emissions of carbon dioxide are rising year after year throughout the year. Myanmar emits the second-highest amount of CO_2 emission.CO_2 emissions in Asia's developing nations are generated in a variety of methods and rising annually. However, since both parties to a trading relationship stand to gain monetarily, the blame for emissions is still partially resolved by CO_2 emission consumption.

Sri Lanka has the highest GDP per capita (PPP) among developing nations. From 2011 to 2020, it can be seen that the GDP per capita (PPP) is rising year after year. Nepal's GDP per capita (PPP) is the lowest among them, yet it grows year after year. Additionally, Cambodia's GDP per capita (PPP) is less than US$6,000. Mongolia has the highest GDP per capita (PPP) at from 2011 to 2020. Other developing nations are declining year over year as a result of COVID-19, and there is expected to be a significant decrease after 2019.

When compared to other emerging nations, Bangladesh stands from first position to third position. Nepal has the greatest rate of urbanization expansion, and from 2019 to 2020, this rate is increasing from fourth position to first position. The lowest among them in 2012 is Sri Lanka but the rate of urbanization growth is rising each year. Laos has second position in urbanization growth rate. Cambodia, Mongolia and Myanmar are third, fifth and sixth position respectively. Most of the countries are declining annually as a result of COVID-19 except Nepal.

The years between 2011 and 2020 observed Sri Lanka's highest life expectancy at birth. Among the nations, Myanmar has the lowest birth expectancy. Additionally, from 2011 to 2020, Sri Lanka's life expectancy at birth is increased steadily across the board without decreasing. Except for Bangladesh, other nations' birth-life expectancies at these times are gradually greater in Mongolia, Cambodia, Nepal, and Laos. Bangladesh's life expectancy at birth decreased in 2020 but increased in other areas as a result of COVID-19deaths that occurred there between March 2000 and December 2021. The population's life expectancy had been steadily increasing up until the COVID-19 outbreak.

Among the Developing Countries in Asia, Sri Lanka, Bangladesh and Mongolia are the highest US $ of GDP per capita (PPP) and Nepal is the lowest GDP per capita (PPP). The life expectancy at birth of Sri Lanka is the highest among member countries and the life expectancy at birth of Myanmar is the lowest. Carbon dioxide emission of Bangladesh has the highest and Cambodia has the lowest. Therefore, Bangladesh and Sri Lanka cover the quality of institutions, infrastructure, health and education, macroeconomic factors. Myanmar and Nepal are now reforming to improve the country’s economic landscape and prospects, education and health.

According to the research objective (2), to analyze the effect of environmental pollution and economic growth on public health in developing countries in Asia, and then it is used the appropriate model of Hausman and Breusch-Pagan Multiplier test. According to the results of Hausman test, standard error in GDP per capita (PPP) is (0.0007), urbanization rate is (0.0007) and carbon dioxide emission is (0.0009). Therefore, according to the estimated result of the Breusch Pagan Lagrangian Multiplier test, standard deviation in LEAB is (3.0761), error is (0.4409) and mean is (3.2395).

Carbon dioxide emission rises by one percent, LEAB will decrease by one year. Therefore, it can be concluded that GDP growth rate increases, carbon dioxide emission will increase. Similarly, urbanization growth rate rises by one percent, GDP per capita (PPP) will increase. Therefore, it can be concluded that urbanization growth rate increases, GDP per capita (PPP) will increase. This paper finds that Bangladesh and Sri Lanka are more strongly economic factors than other countries in developing countries. Nepal is the worst every factor among the countries. It is inequality in economic growth, education and health among countries.

The random effect regression model of all variables are individually, statistically significant. Urbanization growth rate is significant at 10 percent level, giving the fact the probability values (0.0912) are more than 0.1. Carbon dioxide emission is significant at 1 percent level, giving the fact the probability valued (0.000) is smaller less than 0.01. That panel regression analysis for the developing countries in Asia is satisfied.

In this study, the two panel data regression models (fixed effect model and random effect model) are used to analyze the panel data. The panel data which consists of seven developing countries for the period 2011-2020 are used to find impact of economic factors and environmental effect on LEAB.

According to the results for fixed effect model and random effect model, it has been found that the coefficient of carbon dioxide emission is a negative effect on LEAB. Furthermore, the coefficient of urbanization growth rate is a positive effect on LEAB.

Hausman test and the Breusch Pagan Lagrangian multiplier test are good way to choose which model is better for the researchers. The random effect model is more appropriate to carry out this study by using the Hausman test and also the Breusch Pagan Lagrangian multiplier test.

5.2 Summarized Results for the Study

Summarized results forBangladesh, Cambodia, Laos, Mongolia, Myanmar, Nepal and Sri Lanka are as follow in this potion.

Gross Domestic Product per capita (PPP) and CO_2 emission of Bangladesh are the highest of among developing countries in Asia. And also, urbanization growth rate of Bangladesh is existing between 3 and 3.5 percent. Life expectancy at birth of Bangladesh is second highest of developing countries; Asia and it return fells 2020.

Gross Domestic Product per capita (PPP) of Cambodia stands at the 6th position among developing countries, Asia. CO_2 emission is the lowest other countries. And urbanization growth rate of Cambodia exists at the 3rd position of among countries. Life expectancy at birth of Cambodia is slowly higher at these periods.

Laos is at the 3rdposition of Gross Domestic Product per capita (PPP) and CO_2 emission is deeply declined in 2011 and returned in 2014. Urbanization growth rate of

Laos is the second highest and life expectancy at birth of Laos stands at the position of 5th of other developing countries, Asia.

Mongolia is the second highest of Gross Domestic Product per capita (PPP) and CO_2 emission other countries in developing countries, Asia. Urbanization growth rate of Mongolia is the 5th position of countries and also Mongolia is the 4th position of life expectancy at birth.

Gross Domestic Product per capita (PPP) of Myanmar stands at the 4th position among developing countries, Asia. CO_2 emission of Myanmar is the second highest emission of other countries and urbanization growth rate of Myanmar is 6th position of among other countries. Life expectancy at birth of Myanmar is the lowest in developing countries, Asia.

Nepal is the lowest of Gross Domestic Product per capita (PPP) among them and is deeply declined in 2016, CO_2 emission of Nepal is 5th position of developing countries, Asia and urbanization growth rate of Nepal is the highest of other nations. Life expectancy at birth of Nepal is also slowly higher than others.

Gross Domestic Product per capita (PPP) of Sri Lanka is the highest in developing countries in Asia, CO_2 emission in Sri Lanka is at the 3rd position, and urbanization growth rate of Sri Lanka is the lowest and returned declined in 2019. Life expectancy at birth of Sri Lanka is the highest value among countries during the year 2011-2020.

Business opportunities should create Sri Lanka in lowest GDP per capita and also should make to improve economic growth and labor force participation rate. And then, citizens of Sri Lanka must make to growth productivity of the nation, export quality of nation, and agriculture and livestock production. Government must build accurate policies and job fair programs for the nation of Sri Lanka.

Every country must reduce carbon dioxide emission for environmental pollution because it can destroy not only atmosphere but also natural environment and eco system. Thus, Bangladesh is that happen the highest emission, people should reduce greenhouse gas and the burning of fossil fuels like charcoal, oil and natural gas. In Myanmar, citizens must reduce emission of carbon dioxide due to the second highest of developing countries, Asia. Myanmar and Sri Lanka is the highest CO_2 emission in among countries thus these two countries must make in reducing carbon dioxide emission of that nation therefore citizens should make doesn’t damage in the

world.In the reducing the environmental pollution, urbanization growth rate consist of important part of globalization.

It is summarized results for all seven countriesthat the first thing for all seven developing countries, economic development improved achievements in life expectancy at birth. The second fact indicated that income is a possible socioeconomic determinant of health. The third fact is that CO_2 emissions reduced the life expectancy. The fourth fact that higher income, GDP per capita (PPP) also implies better access to housing, education, health services and other items which tend to lead to improved health, lower rates of mortality and higher life expectancy. The fifth thing that in order to fulfill people's growing healthcare requirements, handle the economy, and promote health equity, it should be focused to improve people's health and economic conditions.

The sixth point indicates that this goal also rests on a thorough understanding of the factors that affect health. Environmental factors have a significant impact on our social, physical, and economic well-being. The seventh point states that more clarification is required regarding the impacts of regional economic development and environmental pollution on public health in emerging nations in order to encourage the expansion of regional public health. The eighth reality also became crucial when nations joined forces to find a balance between raising human welfare standards and preserving the environment for coming generations.

For all seven countries, public health is a significant development goal and one of the priorities of government work all over the world. The concentration of population into cities and towns, known as urbanization, is a worldwide trend for all factors of socioeconomic life including life expectancy at birth. And the process of urbanization itself is a process of economic development and modernization. The most importance thing is to control the environmental pollution.

Therefore, according to these results, facts and figure, it can be clearly seen that the relationship between CO_2 emissions, public health, and economic growth developing countries in Asia over the period 2011-2020.

5.3Suggestions and Recommendations

A country’s life expectancy at birth plays an important role for any country for health and living standard of country. The high age levels in the host country indicate a high level of health and socioeconomic condition. On the other hand, increasing life expectancy at birth reflects improving population of a country. Gains in life expectancy at

birth of a country can be attributed to a number of factors of that country, including living standards, improved lifestyle and better education, as well as greater access to quality health services. And also, people can only work if they remain in good health. So, the government should promote to take health care to an individual of the country.

Urbanization growth rate is one of the important economic factors for affecting GDP per capita (PPP). Urbanization growth rate can harm not only economic growth of a country but also health and education. The conventional view holds that the rapid growth of CO_2 emissions is primarily due to increasing energy consumption as affluence grows. The impact of population growth on global CO_2 emissions has not received enough attention. Recent studies suggest that population growth has been one of the major factors in causing carbon emissions in both developed and developing countries.

It can be suggested that if carbon dioxide and urbanization growth rate rises, GDP per capita (PPP)can be attractive by for the good of country. It is important to highlight the relationship between economic growth and economic factors for developing countries. Therefore, every person in developing countries has to strive to achieve economic progress through investment on social sectors such as: health, education and social safety nets and etc. The government should also concentrate to be higher the reducing carbon dioxide emission in developing countries.

CO_2 emission harm to health and reduced to LEAB for all citizens. Thus, all of the developing countries, Asia should be control and protect increasing the emission of CO_2 emission. If government and its citizens control and follow the ways to protect the country from the CO_2 emission, LEAB will increase up to present.

In developing countries in Asia, government should undertake the sectors of agricultural and livestock.As there are many vacant land, fallow land and virgin land, it will be more benefits profitable if responsible persons can develop relevant crops to be grown according to the season in those areas. In those places, factories should be built to make production convenient, and provide quality crops that can be exported abroad.

Every government of developing countries, Asia, especially Myanmar should to assist the various types of land by conducting soil tests.As Myanmar is agro-based country, it is needed to support the agricultural sector. Most of farmers need technology and also qualified labor and mordenized machines. Farming techniques are required to understand how farmers’life should develop in order to reach the

market, and paddy farmers must receive instruction in how to use modern technology in agriculture.

Government organization and non-government organization such asriceexporters from Myanmar Rice Federation and the rice export promotion committee should encourage for support the export-quality rice and price control on the growing global market. Due to advanced technologies, paddy farmers may sell the crops for anaffordable price, which allows them to increase income and improve the living conditions of citizen. If the life of citizens will increase income and improve the living conditions, the life expectancy at birth of citizens can more increase. Employment opportunities should be createdin especially rural, and this can reduce CO_2 emissions and also reducing the urbanization growth rate. Consequently, urban and rural economies can grow, and develop and CO_2 emission can be reduced. Therefore, the more reduce theCO_2 emission, the more increase the life expectancy at birth of developing countries, Asia.

5.4 Needs for Further Study

Thestudycanbeseenastheanalysisincombinationwiththespecificpracticeofdeveloping countriesisveryinterestinginordertoconsideringfurtherresearchrelatingto other indicators,suchas national income, foreign direct investment, balance of payment indicator.Thecombinationofqualitativeresearchandquantitativeresearchwillmaketheresultsofthestudymoreinterestingtoclarifytheimpactsof associations, countriesthoughthisfuturestudywillrequirethecomplexityandbeyondthescopeofaconventionalthesis. Moreover, the further study needs to transform variables to be more suitable assumption.

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APPENDIX-A

Table (1) Life Expectancy at Birth (Age)

Sr. No	Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Bangladesh	68.81	69.55	69.57	69.99	70.49	71.09	71.79	72.57	72.81	71.97
2	Cambodia	68.42	68.92	69.30	69.74	69.87	70.22	70.52	70.56	70.69	70.42
3	Laos	64.74	65.36	65.72	66.36	66.67	67.17	67.43	67.63	68.14	68.50
4	Mongolia	67.44	68.11	68.59	69.05	69.50	69.87	70.24	71.20	71.82	72.14
5	Myanmar	63.90	64.14	64.82	65.06	65.56	65.69	65.84	66.47	66.61	66.80
6	Nepal	67.31	67.47	67.97	68.09	67.46	68.78	68.91	68.98	69.56	69.25
7	Sri Lanka	73.38	73.91	74.24	74.65	74.93	75.33	75.40	75.75	76.01	76.39

Table (2) Urbanization Growth Rate (in percent)

Sr. No	Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Bangladesh	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.3	3.2	3.2
2	Cambodia	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	2.9	2.9
3	Laos	3.4	3.4	3.3	3.3	3.3	3.4	3.4	3.4	3.3	3.3
4	Mongolia	2.1	1.8	2.0	2.1	2.2	2.3	2.3	2.3	2.3	2.1
5	Myanmar	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.7
6	Nepal	2.4	2.3	2.2	2.3	2.6	3.0	3.2	3.2	3.2	3.9
7	Sri Lanka	0.6	0.0	0.8	1.0	1.1	1.4	1.5	1.5	1.2	1.2

Table (3) Carbon dioxide Emissions (Millions Tons)

Sr. No	Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Bangladesh	16,210.3	18,132.3	19,621.3	21,512.2	24,998.9	26,433.7	29,451.0	32,425.3	36,632.6	39,511.4
2	Cambodia	1,546.0	1,694.7	1,807.3	2,235.5	2,991.9	3,548.9	4,254.3	4,372.5	5,086.6	5,349.6
3	Laos	905.5	1,022.5	1,266.4	1,490.3	3,019.8	5,506.1	6,925.9	7,361.9	9,703.5	12,180.2
4	Mongolia	4,685.6	5,359.3	5,953.1	6,109.7	6,032.7	6,513.4	7,285.1	8,353.2	8,875.9	8,517.9
5	Myanmar	2,555.8	3,686.5	4,401.7	5,745.6	6,628.9	7,846.9	11,749.0	12,741.3	15,719.7	18,731.0
6	Nepal	1,548.9	1,876.1	1,972.5	2,404.1	2,252.7	3,348.1	4,127.1	4,713.3	5,638.9	6,188.6
7	Sri Lanka	4,593.2	5,262.4	4,689.9	5,934.4	7,099.7	7,861.3	8,721.9	8,474.6	9,179.8	9,370.5

Table (4) GDP Per capita (PPP) $

Sr. No	Country	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
1	Bangladesh	3119.9	3493.9	3734.7	3997.3	4216.7	4558.6	4830.8	5246.9	5697.9	5897.6
2	Cambodia	2605.5	2867.5	3051.0	3198.7	3411.6	3708.4	3972.7	4318.4	4652.7	4510.4
3	Laos	4106.3	4793.8	5241.8	5828.4	6126.4	6798.4	7211.3	7726.6	8171.0	8189.1
4	Mongolia	8998.7	10346.0	10685.7	11198.3	10769.3	10832.5	11431.5	12340.2	12983.8	12305.7
5	Myanmar	3302.0	3631.6	3872.5	4104.8	4200.9	4120.7	4312.9	4665.1	5033.4	5218.0
6	Nepal	2264.3	2474.1	2656.4	2887.6	2931.6	2925.5	3495.5	3808.2	4087.6	3967.8
7	Sri Lanka	9347.2	10618.6	11243.8	11706.8	12208.0	13056.6	13584.2	14081.6	14214.7	13813.0

Table(5) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2 Emission in Bangladesh

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Bangladesh	3119.93	68.81	3.7	1,621,030,843.8
2012	Bangladesh	3493.923	69.55	3.7	1,813,234,051.1
2013	Bangladesh	3734.73	69.57	3.6	1,962,131,959.8
2014	Bangladesh	3997.29	69.99	3.6	2,151,218,588.3
2015	Bangladesh	4216.72	70.49	3.5	2,499,890,452.5
2016	Bangladesh	4558.56	71.09	3.5	2,643,367,279.1
2017	Bangladesh	4830.78	71.79	3.4	2,945,099,375.9
2018	Bangladesh	5246.92	72.57	3.3	3,242,529,818.4
2019	Bangladesh	5697.95	72.81	3.2	3,663,260,803.0
2020	Bangladesh	5897.59	71.97	3.2	3,951,140,059.2

Table(6) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2 Emission in Cambodia

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Cambodia	2605.49	68.42	3.3	154,596,657.1
2012	Cambodia	2867.54	68.92	3.2	169,472,815.3
2013	Cambodia	3051.00	69.30	3.2	180,731,204.0
2014	Cambodia	3198.67	69.74	3.2	223,551,398.7
2015	Cambodia	3411.58	69.87	3.1	299,191,799.2
2016	Cambodia	3708.38	70.22	3.1	354,886,575.3
2017	Cambodia	3972.72	70.52	3.1	425,432,345.4
2018	Cambodia	4318.38	70.56	3.0	437,247,858.6
2019	Cambodia	4652.71	70.69	2.9	508,660,034.9
2020	Cambodia	4510.37	70.42	2.9	534,962,446.5

Table (7) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and, CO_2 Emissions in Laos

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Lao	4106.34	64.74	3.4	90,553,725.9
2012	Lao	4793.83	65.36	3.4	102,246,514.0
2013	Lao	5241.85	65.72	3.3	126,641,399.2
2014	Lao	5828.38	66.36	3.3	149,034,265.8
2015	Lao	6126.44	66.67	3.3	301,981,466.3
2016	Lao	6798.36	67.17	3.4	550,611,898.7
2017	Lao	7211.26	67.43	3.4	692,590,388.1
2018	Lao	7726.62	67.63	3.4	736,190,614.9
2019	Lao	8170.96	68.14	3.3	970,347,278.7
2020	Lao	8189.15	68.50	3.3	1,218,017,371.3

Table(8) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2 Emissions in Mongolia

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Mongolia	8998.69	67.44	2.1	468,555,956.9
2012	Mongolia	10346.01	68.11	1.8	535,934,327.2
2013	Mongolia	10685.72	68.59	2.0	595,311,743.5
2014	Mongolia	11198.32	69.05	2.1	610,973,053.6
2015	Mongolia	10769.25	69.50	2.2	603,265,515.8
2016	Mongolia	10832.48	69.87	2.3	651,342,330.6
2017	Mongolia	11431.50	70.24	2.3	728,510,797.2
2018	Mongolia	12340.22	71.20	2.3	835,315,801.5
2019	Mongolia	12983.80	71.82	2.3	887,590,200.7
2020	Mongolia	12305.72	72.14	2.1	851,785,934.1

Table(9) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2 Emissions in Myanmar

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Myanmar	3301.96	63.90	1.5	255,575,976.5
2012	Myanmar	3631.58	64.14	1.5	368,650,275.3
2013	Myanmar	3872.50	64.82	1.5	440,167,932.2
2014	Myanmar	4104.84	65.06	1.5	574,557,441.1
2015	Myanmar	4200.88	65.56	1.5	662,894,650.6
2016	Myanmar	4120.74	65.69	1.5	784,693,649.9
2017	Myanmar	4312.95	65.84	1.6	1,174,896,714.6
2018	Myanmar	4665.13	66.47	1.6	1,274,130,856.6
2019	Myanmar	5033.37	66.61	1.6	1,571,966,391.5
2020	Myanmar	5218.02	66.80	1.7	1,873,098,834.8

Table(10) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2 Emissions in Nepal

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Nepal	2264.33	67.31	2.4	154,894,531.2
2012	Nepal	2474.08	67.47	2.3	187,608,282.6
2013	Nepal	2656.36	67.97	2.2	197,249,647.3
2014	Nepal	2887.63	68.09	2.3	240,410,478.6
2015	Nepal	2931.62	67.46	2.6	225,265,620.4
2016	Nepal	2925.53	68.78	3.0	334,812,183.2
2017	Nepal	3495.53	68.91	3.2	412,710,533.8
2018	Nepal	3808.16	68.98	3.2	471,334,385.2
2019	Nepal	4087.61	69.56	3.2	563,891,699.4
2020	Nepal	3967.82	69.25	3.9	618,864,517.3

Table(11) GDP Per capita (PPP), LEAB, Urbanization Growth Rate and CO_2Emissionsin Sri Lanka

Year	Country	GDP(PPP)	LEAB	UR(%)	CO_2 Emission
2011	Sri Lanka	9347.19	73.38	0.6	459,321,859.8
2012	Sri Lanka	10618.57	73.91	0.0	526,241,232.6
2013	Sri Lanka	11243.81	74.24	0.8	468,994,235.4
2014	Sri Lanka	11706.82	74.65	1.0	593,439,610.6
2015	Sri Lanka	12208.01	74.93	1.1	709,970,283.3
2016	Sri Lanka	13056.64	75.33	1.4	786,127,535.0
2017	Sri Lanka	13584.19	75.40	1.5	872,192,433.7
2018	Sri Lanka	14081.62	75.75	1.5	847,461,575.3
2019	Sri Lanka	14214.65	76.01	1.2	917,975,856.2
2020	Sri Lanka	13812.96	76.39	1.2	937,048,732.7

Country	Code
Bangladesh	= 1
Cambodia	= 2
Laos	= 3
Mongolia	= 4
Myanmar	= 5
Nepal	= 6
Sri Lanka	= 7

APPENDIX (B)

```
Fixed-effects (within) regression               Number of observations     =        70
Group variable: country                         Number of groups           =         7

R-sq:                                           Obs per group:
     within  = 0.8577                                         min =        10
     between = 0.4392                                         avg =      10.0
     overall = 0.4865                                         max =        10

                                                F(3,60)           =    120.55
corr(u_i, Xb)  = -0.2458                        Prob > F          =    0.0000

------------------------------------------------------------------------------
        leab |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gdpppp |   .0007079   .0000824     8.59   0.000     .000543    .0008727
          ur |    .000648   2.2106597     0.00   0.098     .420734    .4220305
       co2m |  - .0008708   .0002034     4.28   0.000     .000464    .0012775
       _cons |   64.09036   .5091216   125.88   0.000     63.07197    65.10876
-------------+----------------------------------------------------------------
     sigma_u |   2.395866
     sigma_e |  .44085764
         rho |  .96725006   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(6, 60) = 271.44                     Prob > F = 0.0000

estimates store random

. hausman fix .
                ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |       fix        random       Difference          S.E.
-------------+----------------------------------------------------------------
      gdpppp |    .0007079    .0006961       .0000118        .0000291
          ur |    .0006482    .0221757       .0215275        .064162
       co2m |    .0008708    .0008937      -.0000229        .0000643
------------------------------------------------------------------------------
           b = consistent under Ho and Ha; obtained from xtreg
           B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      0.17
                Prob>chi2 =      0.9827
```

```
Random-effects GLS regression                   Number of observations =        70
Group variable: country                               Number of groups  =         7

R-sq:                                           Obs per group:
     within  = 0.8577                                         min =        10
     between = 0.4409                                         avg =      10.0
     overall = 0.4886                                         max =        10

                                                Wald chi2(3)      =     379.65
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000
------------------------------------------------------------------------------
        leab |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      gdpppp |   .0006961   .0000771     9.03   0.000      .000545    .0008471
          ur |   .0221757   .2006508     0.11   0.0912    .3710927    .4154442
        co2m |   -.0008937   .0001929     4.63   0.000     .0005156    .0012718
       _cons |   64.09344   1.297552    49.40   0.000     61.55029     66.6366
-------------+----------------------------------------------------------------
     sigma_u |  3.2395138
     sigma_e |  .44085764
         rho |  .98181691   (fraction of variance due to u_i)
------------------------------------------------------------------------------

Breusch and Pagan Lagrangian multiplier test for random effects

        leab[country,t] = Xb + u[country] + e[country,t]

        Estimated results:
                     |       Var     sd = sqrt(Var)
             ---------+-----------------------------
                leab |   9.462197      3.076068
                   e |   .1943555      .4408576
                   u |   10.49445      3.239514

        Test:   Var(u) = 0
                           chibar2(01) =   288.73
                        Prob > chibar2 =   0.0000
```