TARR BONOKAI JACKSON

ASSESSING THE ECONOMIC AND HEALTH SUSTAINABILITY CORRIDOR: LINKING GREEN GROWTH, RENEWABLE ENERGY CONSUMPTION, FINANCIAL DEVELOPMENT, AND AIR POLLUTION IN ASIA

MSc. THESIS

FEBRUARY,2023

NEAR EAST UNIVERSITY

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Approval

After rigorous scrutiny of the thesis submitted by **TARR BONOKAI JACKSON** titled "**ASSESSING THE ECONOMIC AND HEALTH SUSTAINABILITY CORRIDOR: LINKING GREEN GROWTH, FINANCIAL DEVELOPMENT, RENEWABLE ENERGY CONSUMPTION, AND AIR POLLUTION IN ASIAN ECONOMIES.**" It has been confirmed that this thesis met the acceptable view, and it is absolutely suitable, both in content and in value, as a thesis for the degree of Master of Educational Sciences.

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Declaration

I certify that all data, sources, analyses, and findings contained in this thesis entitled "Assessing the economic and Health Sustainability Corridor: Linking Green Growth, Financial Development, Renewable Energy Consumption, and Air Pollution in Asian Economies" are original and were obtained and presented per the Institute of Graduate Studies requirements at Near East University. I also attest that any non-original material used in this investigation has been appropriately credited and referenced per these guidelines and standards of behaviour.

TARR BONOKAI JACKSON

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TARR BONOKAI JACKSON

Abstract

Assessing the Economic and Health Sustainability Corridor: Linking Green Growth, Renewable Energy Consumption, Financial Development, and Air Pollution in Asian Economies.

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Green growth, financial development, energy consumption, and environmental sustainability are all intertwined in convoluted ways that have been the topic of discussion in the current body of academic research. Many believe that a nation's energy supply is one of the essential factors in its long-term success. On the other hand, similar to the situation in the majority of emerging nations, the economies of Asia need to figure out a method to both advance economic growth and safeguard the surrounding environment. In terms of achieving Sustainable Development Goals 7, 12, and 13, which are all tied to the United Nations' 2030 Agenda on Sustainable Development, addressing issues that are brought on by concerns related to climate change has emerged as an essential priority for environmental policy. When taking into consideration the Sustainable Development Goals established by the United Nations, which include "mitigation of climate change," "clean and responsible energy usage," and "sustainable economic development" (UN-SDGs-7, 12–13), this thesis assesses the economic and health sustainability corridor, linking green growth, renewable energy consumption, financial development, and air pollution in Asian economies. This thesis's empirical study is based on data gathered by a Panel between 2010 and 2019, and it examines the relationship between those years. The sophisticated econometric methods such as DFE and the Dumitrescu-Hurlin causality test, in addition to the newly released Second-generation Panel modeling of Mean Group (GM) and Pooled Mean Group (PMG) estimate approaches. Based on the experiential investigation, Green growth, financial development, and consumption of renewable energy all have positive short- and long-term influences on lowering air pollution in Asian countries, and the calculated variables are all part of a short- and

long-run equilibrium co-integration relationship. Green growth, financial development, and consumption of renewable energy all have positive short- and long-term influences on lowering air pollution in Asian countries. According to the findings of this study, "green growth," "financial development," and "renewable energy consumption" are the three variables that have the most impact on lowering levels of air pollution. Goals 7, 12, and 13 of the Sustainable Development Agenda will be more successful if other obstacles are removed, such as weak policy, inefficient administration of resources, prevalent corruption, and cumbersome bureaucracy.

***Keywords*:** Financial Development, Green Growth, Air Pollution, Renewable Energy Consumption, Asian Economies,

Özet

Ekonomik ve Sağlık Sürdürülebilirlik Koridorunun Değerlendirilmesi: Asya Ekonomilerinde Yeşil Büyüme, Yenilenebilir Enerji Tüketimi, Finansal Kalkınma ve Hava Kirliliğini Birbirine Bağlamak.

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Yeşil büyüme, finansal gelişme, enerji tüketimi ve çevresel sürdürülebilirlik, mevcut akademik araştırmalarda tartışma konusu olan dolambaçlı şekillerde iç içe geçmiş durumda. Birçoğu, bir ülkenin enerji arzının, uzun vadeli başarısında temel faktörlerden biri olduğuna inanıyor. Öte yandan, gelişmekte olan ülkelerin çoğundaki duruma benzer şekilde, Asya ekonomilerinin hem ekonomik büyümeyi ilerletmek hem de çevreyi korumak için bir yöntem bulması gerekiyor. Birleşmiş Milletler'in 2030 Sürdürülebilir Kalkınma Gündemi'ne bağlı olan Sürdürülebilir Kalkınma Hedefleri 7, 12 ve 13'e ulaşılması açısından, iklim değişikliği ile ilgili endişelerin getirdiği sorunları ele almak, çevre politikası için temel bir öncelik olarak ortaya çıkmıştır. . Birleşmiş Milletler tarafından belirlenen "iklim değişikliğinin azaltılması", "temiz ve sorumlu enerji kullanımı" ve "sürdürülebilir ekonomik kalkınma" (BM-SDGs-7, 12–13) içeren Sürdürülebilir Kalkınma Hedefleri dikkate alındığında, bu tez, Asya ekonomilerinde yeşil büyüme, yenilenebilir enerji tüketimi, finansal gelişme ve hava kirliliğini birbirine bağlayan ekonomik ve sağlık sürdürülebilirliği koridorunu değerlendiriyor. Bu tezin ampirik çalışması, 2010-2019 yılları arasında bir Panel tarafından toplanan verilere dayanmaktadır ve bu yıllar arasındaki ilişkiyi incelemektedir. DFE ve Dumitrescu-Hurlin nedensellik testi gibi gelişmiş ekonometrik yöntemler ve ayrıca Ortalama Grup (GM) ve Havuzlanmış Ortalama Grup (PMG) tahmin yaklaşımlarının yeni yayınlanan İkinci nesil Panel modellemesi. Deneyimsel araştırmaya dayalı olarak, Yeşil büyüme, finansal gelişme ve yenilenebilir enerji tüketiminin Asya ülkelerinde hava kirliliğinin azaltılması üzerinde kısa ve uzun vadeli olumlu etkileri vardır ve hesaplanan değişkenlerin tümü kısa ve uzun vadeli bir sürecin parçasıdır. denge eş bütünleşme ilişkisi. Yeşil büyüme, finansal gelişme ve yenilenebilir enerji tüketimi, Asya ülkelerinde hava kirliliğini azaltmada kısa ve uzun

vadeli olumlu etkilere sahiptir. Bu çalışmanın bulgularına göre, "yeşil büyüme", "finansal gelişme" ve "yenilenebilir enerji tüketimi" hava kirliliği seviyelerinin düşürülmesinde en fazla etkiye sahip olan üç değişkendir. Sürdürülebilir Kalkınma Gündemi'nin 7, 12 ve 13. Hedefleri, zayıf politika, kaynakların verimsiz yönetimi, yaygın yolsuzluk ve hantal bürokrasi gibi diğer engeller kaldırılırsa daha başarılı olacaktır.

Anahtar Kelimeler: *Finansal Gelişme, Yeşil Büyüme, Hava Kirliliği, Yenilenebilir Enerji Tüketimi, Asya Ekonomileri.*

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Abbreviations

TRNC: Turkish Republic of North Cyprus

MNE: Ministry of National Education

GHG: Greenhouse Gases

SIC: Schwarz-Bayersian Information Criterion

SDG: Sustainable Development Goal

AIC: Akaike Information Criterion

EPRA: Electric Power Regulatory Authority's

KMO: Kaiser-Meyer-Olkin

FCM: Fuzzy Cognitive Map

SESAME: Sustainable Energy System Analysis Modeling Environmental

ECT: Error Correction Term

VECM: Vector Error Correction Model

EP: Environmental Performance

EPA: Environmental Protection Agency

UN: United Nations

NGOS: Non-governmental Organizations

GDP: Gross Domestic Product

UNDP: United Nation Development Program

WHO: World Health Organization

MENA: Middle East and North Africa

EU: European Union

NRE: Non-Residential External

CGE: Consultative Group of Experts

SMES: Small and Medium-sized Enterprises

PMG-ARDL: Pooled Mean Group-Autoregressive Distributed Lag

OLS: Ordinal Logistic Regression

APEC: Asia-Pacific Economy Cooperation

IEA: International Energy Agency

COP27: 27TH Conference of the Parties

EKC: Environmental Kuznets Curves

CIPS: Cross Sectional I'm Pesaran and Shin

CADF: Cross Sectional Augmented Dickey-Fuller

COVID-19: Coronavirus Disease

ARDL: Autoregressive Distributed Lag

FMOLS: Fully Modified Ordinary Least Square

FDI: Foreign Direct Investment

BRICS: Brazil, Russia, India, China and South Africa

AMG: Augmented Mean Group

OECD: Organization for Economic Co-operation and Development

CHAPTER I

Introduction

Background of the Study

Human economic and social activities have been the principal source of a tremendous rise in the number of carbon emissions emitted into the atmosphere since the beginning of the industrial revolution. The fundamental justification for releasing greenhouse gases into the atmosphere is the substantial dependence on carbon emissions (such as gas, coal, and oil) to hasten the process of economic expansion. This significant dependence is the primary cause of harm to the ecosystem. As a direct end result of the enormous amount emissions of gases that are a contributor to the warming of the planet produced by the environment, the planet's surface is in danger of being threatened by dangerous weather phenomena such as severe weather, including droughts, melting glaciers, floods, increasing sea levels, and extreme temperatures. These types of weather events directly result from global warming (GHG). These events have directly contributed to the precarious state that the planet Earth finds itself in at the moment (Usman et al., 2021). There will always be some human existence somewhere on this globe. The primary contributors to the deterioration of the atmosphere and the acceleration of climate change are human activities that release carbon dioxide into the atmosphere (Ozturk, 2017).

Energy is a significant component in driving global economic and human growth, making it essential to achieving Sustainable Development Goals (Wang et al., 2020). It is common knowledge that renewable and nonrenewable energy sources play a considerable role in decisive socioeconomic progress in a region. This is because these energy sources encourage a wide variety of economic production activities, boosting overall productivity and quality of life (Sowah Jr, J. K., & Kirikkaleli, 2022). The urbanization and industrialization of humans have been dependent, to a large extent, on the ever-increasing use of nonrenewable energy such as natural gas and coal, oil during the last three decades (Sowah Jr, J. K., & Kirikkaleli, 2022). However, a more significant expansion of energy usage for human development and economic prosperity has undoubtedly contributed to the contamination of the environment in many nations (Ozsolak, &Aslan, 2021). The widespread use of nonrenewable fossil

fuels results in greenhouse gases (GHG) and emissions of carbon dioxide (CO2). Thus, it is one of the principal causes of ecological harm (Liu, 2022).

When discussing the global climate system and its accompanying components like precipitation and temperature, the term "climate change" has traditionally been used to refer to long-term, significant changes (Kirikkaleli & Sowah, 2021). The Climate Change Intergovernmental Panel (IPCC) has issued reports confirming what many world leaders, scientists, and other stakeholders have known for some time: climate change is a grave threat to our ability to grow sustainably and to continue as a species. As more time passes, climate change poses a more severe risk to the well-being of humans and the planet's natural balance. In the next twenty years, a rise in global temperature of 1.5 degrees Celsius (2.7 degrees Fahrenheit) would almost certainly result in several catastrophic climatic events (IPCC, 2022). Since dangerous carbon emissions reached record highs between 2010 and 2019, a new historical study on climate change conducted by the United Nations (UN, 2022) issues a dire warning that it is "now or never" for scientists to minimize global warming to 1.5 degrees Celsius. The study was published in 2022. Following the middle of the 20th century, the most significant noticeable effect humans have had on the climate has been the increase in global temperature that greenhouse gases have produced. According to the Paris Agreement from 2015 and a recent study conducted by the United States Environmental Protection Agency, it is imperative to restrict the amount of warming that the planet experiences to no more than 2o Celsius by 2100 (or 1.5 degrees Celsius by 2030) in order to avoid causing irreparable damage to the natural world.

The growing climate change and global warming issues have brought to light further the connection between increased economic expansion, increased energy use, and increased pollution. There has been much study on the energy-growth connection. The research reveals conflicting findings across nations due to variations in energy usage patterns and modeling approaches (Kirikkaleli & Sowah, 2020). The Environmental Kuznets Curve (EKC) is a theoretical model that examines the relationship connecting economic expansion and pollution. It shows that pollution levels rise in tandem with economic expansion up to a certain point, beyond which they fall (Cheikh, Zaied, & Chevallier, 2021; Boukhelkhal, 2022). Other research has shown, however, that the environmental Kuznets curve may not apply to all

contaminants or all nations. (Zhang, & Lee 2022, S. Y., & Kirikkaleli, D. (2021) are only two examples of the recent literature exploring the connection among economic expansion, energy utilization, and pollutant emissions. Most early research ignored the differential control of renewable and non-renewable energy consumption on climate change and growth, instead focusing on the link between total energy consumption, climate change, and economic expansion. By breaking down the two energies into their component parts, we may get insight into the contributions of both to global warming and economic development.

Even though the beginning of the industrial revolution has been linked to the beginning of an economic expansion, it wasn't until the latter half of the century that had just passed that the economic expansion got moving. Consequently, the pace at which carbon emissions are released into the atmosphere has picked up a substantial amount of speed. Because of this, experts, activists, and governments have been looking for solutions that would safeguard the environment without impeding the development of economic growth. As a direct outcome of this concept, an increasing number of economists all around the globe are attempting to construct economic models that put less of an emphasis on the minimal quantity of carbon required for growth (Roberts & Stalker, 2020). In order to keep the standard of life at a satisfactory level, it is essential to maintain a level of consistency in producing energy from renewable sources. Many believe that renewable energy sources, including "wind, biomass, solar activity, geothermal energy, etc.," are sustainable. This is because these sources generate power by using natural resources. This is because renewable energy sources can never run out of energy and, natural resources will always be available.

The fact that corporations rely so heavily on renewable energy helps keep the fossil fuel market stable, prior research has supported the concept of environmentally responsible energy use and financial and economic improvement. Because other researchers have shown interest in this subject in the past, this hypothesis was a natural extension of prior studies (Yazdi & Dariani, 2019; Alam & Murad, 2020; Shahbaz et al., 2018). According to finance-led growth, the existence of a significant number of financial institutions that are also of a high-quality is one of the important markers of economic progress. The buildup of useful financial resources and the categorization of financial data are both results of advancement in the financial sector. Both of these

developments make it possible to make the most resourceful use of new financial capital.

Prudent financial management might come in handy in this situation. Second, the financial industry's globalization has made the risk distribution process much more manageable. Because of this, financing was increased, the cost of equity was reduced, and economic expansion was fueled. As a direct product of this, improved wealth drives economic expansion, which affects the amount of energy used. This organization has the potential to influence environmental policies and practices. The ease of access to information and the free flow of ideas are two aspects that impact a nation's economic freedom. These avenues provide light on whether or not economic development occurred. To maintain the development of sustainable energy for individuals as well as businesses, several different factors are required. The creation of novel technology, the enforcement of intellectual rights, and the payment of bribes are all examples. The demand for renewable energy is affected by several variables, including market openness, the capacity to conduct business in other markets, and the mobility of money. The fast industrialization and exploitation of natural resources as a means of driving economic expansion are the root causes of the diminution of resources and the worsening of the environment (Fraccascia et al., 2018).

Sustainable development aims to increase the number of pleasant social and economic outcomes while simultaneously decreasing the number of unfavorable effects on the natural atmosphere. The advantages are outlined in the following publications from (An et al., Merino-Saum et al., 2021) Green growth, according to its convoluted definition, is economic growth that prioritizes environmental sustainability without compromising people's access to renewable natural resources or their quality of life. This is a wrong concept to pin down precisely because of the complexity of the term. To put it another way, green development places emphasis on the preservation of the natural environment. China is leading the charge for "green" economic development as a participant in the global "green" movement (Zhao et al., 2022). The supremacy of natural gas in the nation's energy consumption has been detrimental to the development of the economy, as well as to green growth and the environment. However, significant progress has been achieved throughout the country

in these areas. The backing of renewable energy sources is given a high priority in China's 13th Five-Year Plan.

Wind, biomass, and hydropower are the only three forms of energy that do not pollute the air and can be used by humans. There are other cases of geothermal and solar power (Qin et al., 2022; Tan et al., 2021). Concern is growing among academics and researchers regarding the outcomes of the government's initiative to encourage the use of renewable energy sources. This is because more evidence regarding the connection between green energy and economic growth is becoming available. These researchers are concerned about the government's attempts to promote green energy and its potential consequences. The use of green energy is required in order to achieve sustainable development, put an end to the degradation of the environment, and transition to the use of green energy. Research into how air pollution impacts financial development, how green growth affects air pollution and the role that renewable energy consumption plays in each of these areas would be of tremendous use to the economies of Asia. Because of this, the study that is proposed has significant consequences for both theoretical frameworks and practical applications.

The correlation involving economic expansion, environmentally friendly growth, renewable energy sources, and pollution in the air has garnered more attention as the risk of climate change and global warming has increased. The research provides conflicting outcomes across nations owing to varying energy usage patterns and modeling methodologies (Shen et al., 2020). The investigation of the relationship connecting economic expansion and energy availability has garnered a great deal of interest. In addition, colossal research has focused on the connection between population expansion and pollution. This association is recognized as the Environmental Kuznets Curve (EKC) (Sowah, J. K., & Kirikkaleli, D. 2022). Many studies have also shown that pollution levels increase with economic growth in anticipation of a threshold level is reached, after which economic growth begins to turn down. Contrary, as several prior studies have shown, the environmental Kuznets curve may only apply to some types of pollutants or all nations (Kirikkaleli, D., and Sowah Jr., J. K. 2022). These findings were published in Environmental Science and Technology.

Expanding economies have been the subject of recent research, increasing energy utilization, and greater pollution levels as a direct result of this relationship (Ahmed, Z., & Kirikkaleli, D., Liu, M., Chen, Z., Sowah Jr, J. K., 2022). Total energy use, alterations to the climate, and the growth of the economy were the key focuses of the first study. However, more study is needed if we completely understand how different renewable and nonrenewable energy sources influence economic growth and the rate of global warming. By separating the two energy sources, we can get new insights into the comparative potential of mitigating climate change and encouraging economic growth with these two types of energy. This study makes an effort to fill the gap in the case of selected Asian economies, including Japan, the Korean Democratic People's Republic, Saudi Arabia, Singapore, Bangladesh, China, Indonesia, Iraq, Iran, India, Lebanon, Malaysia, Myanmar, Pakistan, Qatar, the Philippines, Thailand, the United Arab Emirates, Jordan, Vietnam, Turkiye, Bahrain, Brunei Darussalam, Cambodia, Mongolia, Sri Lanka, Tajikistan, Yemen, Syria Uzbekistan, and Lao People's Democratic Republic for the period 2010 to 2019. These countries in Asia were chosen because, as a whole, it is widely accepted that their regions are those on the planet that would suffer the most severe consequences as a direct result of climate change. In addition, these locations were chosen since there has only been a limited amount of study conducted on some Asian countries, which led to a lack of relevant data for those countries.

Statement of the Research Problem

This thesis is focused on Asian economies because the continent is largely involved into industrialization thus contributing greatly to pollution. As a result of poor regulatory framework by the government to manage ever growing pollution. The interconnectedness between energy consumption, the environment, and the unrelenting pursuit for economic expansion in a world with finite resources and infinite needs is very important to understand. People's lives are becoming more energy-intensive and consumer-focused, pushing up the demand for energy all over the globe due to a larger global population and quicker economic growth in developing countries. As shown by the research conducted by (Mesagan, 2020, and Rafindadi & Usman, 2019, Mahmood, 2020), that energy consumption is highly connected to universal pollution which this study focuses on. The motive for this is the use of fossils fuels which results in high levels of carbon emissions.

Research Objectives

The general objective is to identify the most effective strategy for reducing the ecological pollution in the Asian economies region through improved regulatory systems. The specific and main objectives research includes the following:

Main Research Objectives

The major objectives of this investigation is to evaluate the economic and health sustainability corridor by drawing connections between green growth, renewable energy consumption, financial development, and air pollution in economies located in Asia.

Specific Research Objectives

The following is a list of some particular objectives the research aims to accomplish:

To scrutinize the association between the financial development and air pollution in Asian economies.

To establish the affiliation between consumption of renewable energy and air pollution in Asian economies.

To scrutinize the effects of green growth and air pollution in Asian economies.

To recommend robust policies aiming at mitigating air pollution in Asian economies.

Research Hypothesis

The following is a list of hypotheses that have been created as part of this study:

There is a significant correlation between financial development and air pollution.

There is direct relationship green growth and air pollution.

Renewable energy consumption has a significant affiliation with air pollution.

Innovation of the Research

Due to the huge curiosity within the sustainability of the environment and financial sectors, this study used the PMG, Westerlund, Dumitrescu & Hurlin second generation methodologies to analyze the variables and identifies some of the major factors in improving the ecosystem and curbing emission.

Concepts and theories

The study conducted the concept of the neoclassical theory, growth theory, neutrality and conservational theory in other to make the thesis more unique.

Future study

The study further recommend that future studies could use more variables and include more Asian countries in other to have more data in analyzing problems affecting the continent. Furthermore, future studies may use PMG first generation in analyzing the data of the region.

Limitation of the study

The research only focuses on Asian economies and does not incorporate countries outside Asia, limiting its broader implications. Furthermore, the study is limited to four variables, which makes it much more difficult in understanding of Asian Economies. Furthermore, this causes it to provide a partial view of the affiliation linking financial development, renewable energy consumption, green growth, and air pollution in countries affected in Asia and not worldwide.

Definition of Key Terms

Green Growth: It is the process of supporting economic expansion and progress while conserving the natural capital that supplies necessary resources and ecosystem services for human life. This is done in order to achieve sustainable development. The best way to do this is to encourage more investment and innovation, which will, in turn, stimulate sustained economic expansion and the development of new business opportunities. It is vital to raise expenditure levels as well as creative output. This objective can only be accomplished if it is pushed to its limits. It is essential to distinguish between "sustainable development" and "green growth."

Instead, it suggests a flexible and pragmatic approach to addressing the social ramifications of greening the development dynamic of economies while simultaneously making tangible, quantifiable progress across its economic and environmental pillars. This would be the best way to address the social ramifications of greening the development dynamic of economies. In other words, it replaces the previous strategy with a more realistic and adaptable one. Put another way, and it is more of an answer to how to go from this location to that location.

Although, the objective is to make the transition toward a development model that is less harmful to the environment as easy as possible. Plans for sustainable development have as their primary objective the assurance that natural assets may attain their full economic potential in an environmentally and socially responsible manner. This is referred to as "inclusive and sustainable economic growth." This is the goal of our "green development" strategy. This potential includes providing basic necessities like clean air and water and the biodiversity necessary for sustained food production and human health. These services and this resiliency in biodiversity are necessary to maintain the production of food and people's health. Air and water free of contaminants are two examples of vital life support services. One of the considerations that go into determining whether or not a development program is ecologically responsible is whether or not it takes into account the fact that natural resources cannot be continually regenerated.

Financial Development: Simultaneous growth in all elements of the financial sector at the same time, including the financial markets, financial institutions, and financial goods. The steadily increasing effectiveness of monetary operations as a direct result of the broadening of the scope of financial transactions as well as the ongoing process of technological advancement within the financial industry. The term "the constantly improving efficacy of financial operations" is a direct result of this phenomenon. It is shown by the removal of financial repression, the improvement of financial structures, the production of financial tools, and the diversification of financial institutions to respond to advancements in economic activity. All of these things point to the fact that financial repression has been removed. To be successful in this endeavor, one has to devise a strategy to avoid incurring the "costs" that are imposed by the monetary system. As a direct result of this process, financial contracts,

markets, and intermediaries were formed, which ultimately resulted in a reduction in the costs associated with acquiring information, enforcing contracts, and doing business.

Air pollution: The term "air pollution" refers to the accumulation in the atmosphere of substances or particles that are known to be harmful to the health of living organisms, including humans, animals, and plants. In addition to that, it is destructive to the structures. The term "pollutant" refers to a wide range of substances that may be found in the atmosphere. They may exist as gases, as particles of solid matter, or as drops of liquid all at the same time. The pollution that enters our planet's atmosphere might go there through several different pathways. Most of the world's pollution issues result from human activity and are present as emissions from factories, vehicles, aircraft, and aerosol cans. People are mostly to blame for these issues. Smoke from cigarettes that a third-party inhales is considered part of the pollution released into the atmosphere. An additional name for various sorts of pollutants people create is "anthropogenic sources." Some types of air pollution, such as the smoke from wildfires and the ash from volcanoes, result from natural environmental occurrences.

These are known as "natural sources," and there are many different kinds of natural sources. Large cities typically have the highest rates of air pollution because this is where emissions from a diverse range of sources are concentrated, so the rates tend to be higher in these places. There are times when the only things that can stop the spread of air pollution are things like mountains or large structures. The cloudy manifestation of air pollution often gives the impression that the atmosphere is hazy. This is what we refer to as smog. The word "smog" was created when the words "smoke" and "fog" were combined to form a single word. Large cities in nations whose economies are either still developing or are still considered underdeveloped typically have higher levels of air pollution than those whose economies have already developed their towns. The World Health Organization (WHO) lists the cities of Beijing, China; Lima, Peru; Karachi, Pakistan; New Delhi, India; and Cairo, Egypt, as some of the most polluted places in the world.

However, many industrialized nations face challenges connected to poor air quality. The city of Los Angeles in California is sometimes referred to by its

nickname, "Smog City." The majority of people think of air pollution as being the smoke that is produced by large factories or the exhaust that is produced by vehicles. However, numerous additional forms of air pollution may be found inside buildings. It is easy to contaminate a house's air by employing heating methods that entail burning chemicals like kerosene, wood, or coal. Ashes and smoke make breathing difficult and may also stick to items like walls, food, and clothing. Radon gas, which may be found in the environment and is linked to an increased risk of cancer, may also build up to deadly amounts inside buildings.

After being released from the planet's surface, radon may eventually make its way into the atmosphere. It is possible to reduce radon concentrations by using relatively low-cost equipment that needs the installation of skilled workers. Insulation is one example of a building material that, together with other construction materials, can potentially be hazardous to people's health. Ventilation, also known as air movement, is a second component that helps spread dangerous mold inside homes and rooms. This aspect is also referred to as air movement. Mildew may form a single colony inside a house if the environment is suitable for its growth: damp, calm, and dark places, such as between the walls. Mold may quickly spread throughout a house when its spores become airborne and then dispersed by wind. As a consequence of breathing in the spores, humans can get unwell.

Economic Growth: Increasing the number of goods and services produced per person over time is one definition of economic growth that appears in enough sources that I need to know which one to mention specifically. Due to the abundance of periodicals, I am trying to decide which one to reference. The definition of economic growth offered by the Oxford Dictionary is strikingly similar: "Economic growth is defined as the manufacturing of goods and services per household over a set period." One may also look up a related word in the Cambridge Dictionary. Growth is "an increase in a nation's or region's economy, notably through goods and services produced by the nation or region," as defined here. Please refer to the following footnote for more definitions. Taking these and other definitions into account, as well as the economics literature as a whole, I provide the following: We speak about economic growth when there is a growth in the quantity and quality of a society's economic goods and services. The most helpful definition for me is one that is broader

in scope than the norm. Talk about "products" instead of "goods and services" and "value" instead of breaking down price and quality into separate parts if you want to save space. The transition from zero to one is the most dramatic change in quantity during a product's introduction to the market. Some instance of the kinds of new things and services that allowed for many of the most significant shifts in historical trajectory include the introduction of medicine, vaccinations, computers, and the telephone.

Fossil Fuel: Fossil fuels are produced from dead creatures and plant materials. These fuels are composed of carbon and hydrogen; when burnt, they create energy in the form of heat. They can be discovered in the crust of the earth. It is possible to use a wide variety of fossil fuels, some examples of which are coal, oil, and gas. Coal may often be found in rock formations that are composed of sedimentary rock. This kind of deposit may be identified by the presence of rock layers and the skeletal decomposition of animals and plants that lived in the area in the past but have since perished. More than half of the weight of a coal deposit must be composed of fossilized plant matter. At first, oil was discovered in its stable condition, trapped between sedimentary rock layers such as shale. This discovery was a significant scientific breakthrough. The topic at hand may be subjected to high temperatures to produce the viscous oil necessary for gasoline production. It is not uncommon for pockets of natural gas to be discovered on top of oil reservoirs. These pockets often include oil. In addition, it is possible to find it in the sedimentary rock layers that do not contain oil. Regarding its chemical composition, natural gas is mainly composed of methane.

According to research carried out by the National Academies of Sciences, charcoal, petroleum, and natural gas provide 81% of the United States' need for sources of energy. This kind of energy is used in various applications, including the heating and powering of buildings, the driving of cars, and the operation of manufacturing equipment. Since fossil fuels are a resource that does not regenerate, we will be forced to continue consuming them when they run out. It is unrealistic to expect new coal, oil, and natural gas supplies to appear after waiting millions of years for their development. In addition, the combustion of fossil fuels is responsible for more than 75 percent of the emissions produced by human activities in the last 20 years. Researchers from various fields, including science and engineering, are putting

a lot of effort into finding ways to lessen our reliance on fossil fuels while also lowering the adverse effects their burning has on the environment. They place a significant amount of importance on taking measures that will cut down on carbon dioxide emissions. The use of fossil fuels is connected with several potential dangers, and researchers from all over the globe are putting in a significant amount of effort to determine how these dangers might be reduced. They aim to ensure that in the not-too-distant future, people will have access to appropriate energy sources and an environment favorable to the continuation of life and prosperity. The infrastructure required for the mass sale of automobiles fueled by natural gas is now being aggressively developed by the United States Department of Energy. In addition, they are working on developing coal and oil extraction processes that are less harmful to the environment. Academicians at Stanford University in California have been employing more environmentally friendly technology in their quest to find a method of burning fossil fuels that reduces the harmful effects of such activity on the surrounding ecosystem. Using natural gas, as opposed to coal, results in approximately fifty percent fewer carbon dioxide emissions. This presents one potential solution. The researchers at Stanford are also working on a procedure known as "carbon capture and sequestration," which requires extracting CO2 from the air and storing it in underground reservoirs. This process is said to be a "green" way to reduce greenhouse gas emissions. A group of academicians from the University of Bath and Stanford University has taken the first step toward developing a plastic that is less harmful to the environment by combining carbon dioxide and sugar. The researchers at both universities made this discovery.

Environmental Regulations: Environmental rules are in place to protect people and wildlife from the harmful impacts of industrialization and urbanization. In areas where there is a high cost to comply with environmental regulations, low public awareness of the health risks of noncompliance, and low trust in the data used to create rules. Research carried out by RAND aimed at developing ways to collect both interpretable and quantifiable information about the costs and benefits of environmental laws.

Renewable Energy consumption: The output of sun and the wind are examples of "renewable energy," which refers to any kind of power that may be renewed in a

natural way throughout time. Examples of energy sources that fall under this category include a large quantity of different types of biomass, the rays of the sun, geothermal heat, wind, tides, and water. This specific source of energy can never be exhausted since it is always being replenished. When we refer to "alternative energy," we are referring to any kind of power generation that is capable of replacing fossil fuels. It is a catch-all term for a variety of alternative energy sources that aren't the norm and don't negatively impact the natural environment to a substantial degree. The phrase "alternative" is often used whenever "fossil fuels" is contrasted with another term. The term "alternative energy" is often defined in such a way that the emphasis is placed on the fact that it does not in any way affect the natural environment. This distinction is significant to establish when comparing the impact of different energy sources on the surrounding ecosystem.

Climate change: The gradual but observable shift that takes place over an extended period in a particular region's average temperatures and weather patterns is what has meant to be called "climate change."It's most probable that when you hear someone talking about "climate change," what they're actually referring to is either the climate of a specific location or the climate of the whole world. As climate change proceeds, it is projected that accurate forecasting of weather patterns will become more difficult. Because of the unpredictability of the weather, it may be challenging to maintain and cultivate crops in regions where agriculture is the predominant economic activity. This is because the temperatures and quantities of precipitation that were predicted in the past can no longer be depended upon. This is owing to the fact that climate change has rendered these predictions obsolete. Some of the most severe weather occurrences connected to climate change include floods, heavy rain, and winter storms. Researchers have found a connection between climate change and a wide range of extreme weather events, one of which is an increase in the frequency and intensity of hurricanes. The terms "climate" and "weather" are often used interchangeably, and most people know that their meanings are almost identical. On the other hand, the weather might change from the beginning of the year or from one year to the next, while the climate is evaluated over a longer period.

The difference between the two can be seen in the fact that the climate is measured. When evaluating climate, it is common practice to utilize a very long time

range. It is impossible to produce accurate climate assessments without using data that has been gathered over lengthy periods of time. It is possible to produce an accurate picture of the climate of a location by utilizing the average temperatures, rainfall levels, and wind patterns that are encountered throughout each season. This may be done by using the data for the region in question. It is not feasible to make broad statements about the weather since it changes so much from location to location. A desert is one kind of terrain that is regarded to have a dry climate. This is due to the fact that deserts often get very little to no precipitation during the course of an entire year. This is because there is not a significant amount of precipitation that falls throughout the year, either in the form of rain or snow. This is the cause of this phenomenon. Tropical regions are characterized by a combination of high temperatures and high levels of humidity. Both of these aspects may be expected to be present. Alternately, climates that are classified as temperate are distinguished from those of the other categories by having warm summers and winters that are much cooler.

The term "green growth" refers to the process of fostering economic expansion without negatively impacting the quality of the surrounding environment. This is done by taking care of natural capital and providing people with the resources and environmental services they need to live. The concept of "green growth," which is often referred to as "sustainable development," is gaining in popularity. It is essential to increase investment and innovation in order to accomplish this goal because doing so will both contribute to the continuation of economic development and result in the creation of new economic possibilities. If this objective is to be achieved, it is essential that this objective be accomplished by increasing investment and innovation. This goal can only be achieved if it is taken to its extremes in order to be successful. It is essential that the phrases "green growth" and "sustainable development" be differentiated from one another in order to prevent any misunderstandings. In its place, it proposes a pragmatic and adaptable strategy for achieving concrete, measurable progress across its economic and environmental pillars, all while taking into complete account the social consequences of greening the growth dynamic of economies.

In other words, it replaces the previous strategy with one that is more realistic and adaptable. In other words, it supplants the preceding method with one that is more

applicable to the actual world and more realistic overall. To phrase it another way, it is primarily a response to the issue of how one may get from this area to that one. To put it another way, the goal is to make it as simple as possible to shift toward a style of growth that is less detrimental to the surrounding ecosystem. The goals of sustainable development plans are to guarantee that natural assets may reach their full economic potential in a way that is responsible to the environment as well as to society. Putting in place methods that are environmentally friendly is one way to achieve this goal. This is the goal that we have set for "green development," and we want to accomplish it. This potential includes the delivery of necessary services for life support, such as clean air and water, as well as the resiliency in biodiversity that is needed to sustain both the production of food and the health of the people. These are both vital to maintaining a sustainable society. Among these services are also: The provision of clean air and water are two examples of essential services that are necessary for maintaining life. One of the things that programs for ecologically responsible development take into consideration is the fact that natural resources cannot be continuously replenished; as a result, this is one of the things that they investigate.

Research Structure

This research is broken down into six (6) Chapters; chapter 1 includes the study's Introduction, Problem Statement, and Background. Chapter 2 includes a survey of the theoretical literature. Chapter 3 looks at the study's theoretical framework, empirical analysis, and the specification of the models. While Chapter 4 outlines the appropriate methodology, including the data sources, estimating methodologies, and other things. In Chapter 5, the study's findings are presented, and the discussion of results. Chapter 6 provides a conclusion and suggestions for further study and policy.

CHAPTER II

Literature Review

Introduction

This section highlights theories that are associated to the studies and also examines and linked empirical theories involving financial development, renewable energy consumption, green growth, and the links between these four factors and air pollution. This section also makes use of studies that were conducted in the past as well as those that are now being conducted in order to emphasize and analyze the link between the various factors. In addition, theories associating the independent variables with air pollution were investigated in order to develop hypotheses, which are important for estimating and verifying the underlying correlations between the variables.

Nexus between Air Pollution and Consumption of Renewable Energy

The atmosphere's state directly influences the quantity of energy that is generated, and this influence is proportional to the severity of the situation. Many case studies have suggested a relationship between the two factors. It has been established that the relevance of research results gained from evaluating a single time series is exceptionally high in the framework of ecological sustainability strategy. This has been the case ever since it was first brought up. As a result of Bangladesh's transition to renewable energy sources, the country's environmental conditions reportedly improved, as stated by Ma & Alam (2021), who based their conclusions on data collected between 1973 and 2014. (Ma & Benjamin, 2020) research examining Canada and Australia found a long-term association between several aspects of the two countries. The information used in this research was collected between 1960 and 2015. Researchers compared Canada and Australia and discovered that Australia had a stronger connection between renewable energy and lower levels of carbon dioxide emissions. However, Canada had a weaker connection between the two.Canada had a clear advantage over Australia in this regard. In addition, Sulaiman et al. 2020 showed that the ARDL test and data spanning 1980–2009 validated the EKC hypothesis as a prevalent theory in Malaysia.

They also establish that using renewable energy sources led to reducing carbon dioxide emissions, another one of their discoveries. An empirical investigation carried out in Tunisia, using the ARDL and the causality approach, showed a causal connection between RE and emissions that only goes in one direction (Ben & Belloumi, 2017). (Yazdi & Beygi, 2018), Carried out research in the form of a panel time series and discovered that using renewable energy sources leads to a reduction in the quantity of GHG (Greenhouse Gas) Emissions. As a direct consequence of this turn of events, the EKC theory was found credible in African countries' eyes. However, when using the PMG/ARDL approach and looking at the 38 oil-rich nations from 1960-2018, (Sadik-Zada & Gatto, 2021) found no evidence to support the inverted U-shaped EKC theory. Their outcomes were published in the journal Energy and Environmental Economics. The scientists tried to uncover a connection between renewable energy and carbon dioxide emissions in Asian countries using a PMG/ARDL model using data from 1980 to 2014. However, they were unsuccessful in their attempt (Yazdi & Dariani, 2019). Additionally, using renewable energy sources has enhanced the overall quality of the atmosphere in sixteen of the EU's member states (Victor et al., 2019).

Many studies have been done over the last twenty years, and they have all come to the same conclusion: increased usage of fossil fuels is related to increased carbon dioxide emissions in both wealthy nations and developing countries. As a result, a growing number of governments and politicians are coming around to the idea that renewable energy is an essential strategy that can satisfy the energy needs of the general population while reducing carbon dioxide emissions. Recent research has seen a considerable increase in attention paid to the correlation between renewable energy and CO2 emissions. It was found that the percentage of total energy consumption that came from renewable sources was inversely proportionate to the amount of carbon dioxide emissions produced in the United States between 1960 and 2007. This may be shown with only one example (M. Jaforullah, 2015). Studies carried out in China and India between 1972 and 2011 showed that CO2 emissions and the use of renewable energy have a link that works in both directions. However, they only found evidence of unidirectional causation in this connection in China.

This suggests that the association is exclusively active in China. Consistent with this result, studies conducted and published by (Al-Mulali, S.A. Solarin, & I. Ozturk, 2016), as well as research conducted and published by (S. Ra, R. Salim and H. Bloch, 2015) they have shown that between 1980 and 2012, CO2 emissions in Kenya decreased thanks to renewable energy sources. According to the findings of yet another research, the 11 developing nations have effectively reduced the amount of carbon dioxide emissions they produce (A. Sinha, E. Dogan, S.R. Paramati, 2017). Following the implementation of reforms in Turkey's banking industry, there was a subsequent increase in energy consumption, which ultimately increased the country's total carbon dioxide emissions (N.G. Resatoglu, A. Samour, A.Z. Isiksal, 2019). Extensive research carried out in several different regions of the globe has led researchers to the same conclusion: using renewable energy sources results in a pollution reduction. It has been shown that in the long term, the quantity of renewable energy used per capita and the numbers of carbon emissions created per capita, for example, are positively cointegrated in six countries in Central America.

This was revealed by looking at the correlation between the two variables (N. Apergis & J.E. Payne, 2012). Despite this, we were able to establish a link between the combustion of fossil fuels and the release of CO2 into the atmosphere; as a result, we realized that the transition to a system that relies on energy derived from renewable sources would be good for the world. It has been shown that using renewable energy positively affects CO2 emissions (R.A. Salim, S. Ra, 2012). According to another study's findings, using sustainable energy sources in the United States may not cut down on carbon dioxide emissions (Y. Wolde-rufael, K. Menyah, 2010). The researchers did discover a link between CO2 emissions in India and the use of renewable energy sources, but it was only in one direction. It was discovered that this connection only goes in one direction. Since the beginning of the 1990s, academics from around the world have been looking at the consequences of air pollution on the communities most adversely impacted by it. Studies on the cause of air pollution on human health, the many routes people are exposed to it, and the means necessary to combat it have increased in frequency in recent years. As an example, the findings from the European Quality of Life Survey were analyzed and considered (Signoretta et al., 2019).

There was a association between worse levels of outdoor air quality and lower overall levels of psychological well-being. After establishing a connection between the two aspects, the researchers concluded. Researchers (Vopham et al., 2018) examined the medical records of around 56,000 individuals for their research on hepatocellular cancer. In the United States, the development of hepatocellular carcinoma has been linked to exposure to levels of ambient particulate matter 2.5 (PM2.5), according to the findings of this research. Many studies have examined how China's expanding industry, rising energy usage, and rising air pollution have affected the country's ecosystem (S., & Linhua, L. 2017). For their study, the researchers looked at regions of China that were both affluent and destitute. They concluded that higher levels of economic activity are connected with higher pollution levels. Researchers are increasingly evaluating the geographical and temporal distribution of air pollution; as a result of a rise in the number of pollutant monitoring sites as well as a variety of data sources that are now accessible. (Zhao et al. 2022) taking the country's five most polluted places as an example, researchers discovered that air quality in southern China is much higher than in the northern regions.

According to a study that collected information from 363 cities around China, the North China Plain has the highest level of O3 pollution in the nation (Zeng et al., 2019). Researchers looked at the spread of air contaminants in Los Angeles that were caused by traffic (Tessum et al., 2018). According to the research findings, which used passive sampling devices (PSD), the most heavily traveled thoroughfares and downtown districts are likely to have the highest concentrations of these toxins. In addition, several researchers in the scientific community have hypothesized that airborne contaminants might cross national lines. (Tsilika & Halkos, 2019), It is hypothesized that corresponding source and receptor systems are responsible for cross-border air pollution. They provide an example of a group consisting of 49 different countries. If this is the case, then nearby nations might be at risk of air pollution caused by a country that is farther away. Studies investigating the relationship between these two factors and levels of air pollution have placed significant emphasis on the use of alternative forms of energy. The expenses of managing air pollution might be reduced by as much as 71 percent in India and 17 to 35 percent in China if more people switched to using renewable energy sources, according to studies by Boudri et al. (2004). (Alvarez-Herranz et al., 2017) studied

air pollution data from 1990 to 2012 across 17 OECD nations and found that using renewable energy sources was negatively correlated with pollution levels.

According to the findings of (Yousefi et al. 2018), Green initiatives in Tehran are aided by the government's regulations that encourage the use of renewable energy. According to reports, using cleaner fuels significantly reduces PM10 emissions (Dong et al., 2019). Even though there is a growing curiosity in many aspects of renewable power, further empirical research is required to determine whether or not advancements in renewable energy technology could aid in alleviating China's air quality issue. The most recent research is an exception to this rule (Xie et al., 2018). The authors conducted research in the Jing-Jin-Ji area to determine the possible impact that a tax on sulfur dioxide (SO2) and an increase in the employment of renewable energy sources may have on three types of air pollution emissions. The researchers discovered that the latter component contributed to the reduction of the former component. We expand on their work by conducting an empirical investigation into the relationship between the growth of renewable energy technologies and growing levels of air pollution.

In addition, since there are seasonal shifts in the patterns of wind, pollution in the air has the potential to spread quickly from one province to another. In light of this, it is essential to investigate the geographical settings of the many factors that contribute to air pollution whenever one investigates the factors themselves. However, to our knowledge, research has yet to include a geographical context in their examinations of the relationship between renewable energy and local air pollution in China.

Nexus between Air Pollution and Financial Development

Academics agree that the improvement of financial conditions plays an essential part in fostering economic progress (E.S. Shaw, 1973, R.I. McKinnon, 1973). There is a growing consensus among most people that the advancement of knowledge in the field of finance is essential to the expansion of the economy. This is because it makes it possible to make the most efficient use of capital, which in turn makes it possible to amass capital via the pooling of savings and the mobilization of those resources. Through its encouragement of innovative technological development in the energy supply business, the financial sector is essential in energy emission monitoring.

This demonstrates the potentially beneficial and essential role that economic development, sometimes known as "the degree to which banks and stock markets may give money for projects," may play in the fight against environmental degradation, primarily by the decrease of emissions of carbon dioxide (P. Sadorsky, 2010).

This may prove that there are feasible funding possibilities for productive undertakings and enterprises, and it may be used in that capacity. According to this theory, the growth of economies results in a reduction in the amount of harm done to the surrounding environment. Increasing the money supply may also stimulate research and development, draw in foreign direct investment, and speed up economic activity; these factors contribute to improved environmental quality via more green expenditure (L. Charfeddine, 2018, A. Tamazian, B.B. Rao, 2010, F. Hayat, M.D.S. Pirzada, A.A. Khan, 2018). When there is a healthy financial sector, there is an improvement in the efficiency of the energy sector, a reduction in energy emissions, and borrowing rates are cut (A. Tamazian, B.B. Rao, 2010, A. Tamazian, J. Chousa, K. Vadlamannati, 2009). However, (L. Charfeddine, 2017) You might argue that if there is a rise in the size of the economy and a matching rise in the industrial sector, this may lead to an increase in pollution and other forms of environmental harm. There is a disagreement between academic research and facts over how expanded banking would affect the amount of carbon dioxide emissions and the economy's growth. For the most part, studies conducted in the past have been unable to give clear evidence concerning the type or direction of any causal relationship between economic expansion, financial success, and CO2 emissions. Numerous studies, such as one conducted by Sadorsky (2011) for nine countries in Central and Eastern Europe and another conducted by Al-Mulali &Che Sab (2012) for states in Sub-Saharan Africa, have found evidence of a unidirectional causal association between expanding markets and stable finances.

Several studies, such as (I. Ozturk, J. Gow, M. Salahuddin, 2015) and (A. Matar, T. Yasmin, H.A. Bekhet, 2017), create a chain of events leading to increased money supply and CO2 production. These outcomes are consistent with the findings of previous research. Many businesses stand to gain from a prosperous economy, which the expansion of socioeconomic opportunities could help. It is quite conceivable for these clandestine activities to have reverberating consequences not

just on one another but also on the natural world (Sarkodie & Strezov, 2019). During the early stages of economic expansion, increased per capita incomes accompanied an increase in pollution levels. However, after reaching a certain income threshold, pollution levels begin to level off. According to the findings of a few pieces of research on the environmental damage caused by burgeoning economic growth, this is the case (Grossman & Krueger, 1995; Sarkodie & Strezov, 2019). The inverted U-shaped environmental Kuznets curve is the conceptualization of this phenomenon (EKC). In recent years, research has focused on several macro development factors to determine the potential effects that they may have on pollution. These factors include the expansion of industrial production, changes in land use, the transition to renewable energy sources, and environmental laws and regulations.

Initially, financial markets are linked to higher carbon emissions; however, (Dogan et al., 2020) found that emissions fell after financial institutions and markets reached a certain threshold. This contrasts the initial correlation connecting financial markets and higher carbon emissions. (Sharif et al., 2020) show that tourism is associated with positive environmental externalities by examining the issue of pollution from the point of view of industrialization. When land is mainly used for agricultural purposes, it is substantially more helpful in decreasing N2O emissions (Haider et al., 2020). The growing reliance on coal as a primary energy source is one of the primary contributors to the rising levels of sulfur emissions (Mingran et al., 2018). (Chen & Chen, 2019) determined, with the use of a space-reduction approach, that shifting away from coal and instead turning to natural gas or electricity would decrease SO2 emissions by 612,000 tons in the construction sector. The cumulative emissions reduction effect of environmental legislation was investigated by C., Song, B.,& Du, L. (2022), who was the first person to realize that the structure of the energy system as well as the usage of energy had an influence on the amount of pollution in the natural environment. This was discovered due to their finding that environmental legislation can reduce emissions cumulatively.

The expansion of the gross domestic product, energy use, and carbon dioxide emissions will be examined in further detail below; several studies have been carried out, making use of a wide variety of econometric approaches. Despite these efforts, more definitive findings have yet to be found. Research has been carried out in a range

of nations, including those that are detailed further below: Pakistan, by (Mirza & Kanwal, 2017); North Africa, by (Kais & Sami, 2016); and BRICS. Turkey, Bangladesh, Egypt, Indonesia, Iran, South Korea, Mexico, Nigeria, Pakistan, the Philippines, and Vietnam by (Shahbaz et al.,2016b); Pakistan, by (Mirza & Kanwal, 2017). According to the conclusions of the research, there is a connection between the sustained use of energy, the growth of the economy, and the emissions of carbon dioxide. The findings of this study demonstrate the long-term and short-term linkages between the financial development of Malaysia and the country's emissions of carbon dioxide (Islam et al., 2013). (Boutabba, 2014) demonstrated that financial development contributed to CO2 emissions in India, and (Islam et al., 2013) corroborated both of these connections. However, empirical research carried out by (Omri et al., 2015) in 12 MENA (Middle East and North Africa) nations found no correlation between burning of fossil fuel and the rate of economic expansion.

As was just discussed, there is evidence that economic development may have severe environmental consequences over the long term, yet, there is no correlation between economic growth and CO2 emissions. Additionally, it was revealed by Riaz and Abbasi (2016) believe that economic expansion is essential in the process of reducing emissions of CO2 in economically weaker nations. This was shown to be the case in developing countries like Pakistan. According to (Shahbaz et al., 2016c), the expansion of Pakistan's economy has a detrimental effect on the country's ecosystems. Economic prosperity, except in the United Arab Emirates (UAE), is the leading cause of increased carbon dioxide emissions (Bekhet et al., 2017). Carbon dioxide (CO2) emissions and economic expansion were shown to go hand in hand in the countries of the South Mediterranean region (Kahouli, 2017).

This relationship can only go in one direction (SMCs). Growing economies have been shown to lower carbon dioxide (CO2) emissions in Pakistan and Bangladesh, but this effect has yet to be seen in India, according to Khan et al. (2017)a. Khan et al. (2017) provide compelling evidence of the inverse causal link between economic growth and CO2 emissions in Asia. This connection is found to be prevalent across the region. According to the research findings, economic activity development resulted in decreased CO2 emissions in ninety nations (Riti et al., 2017). According to the findings of an empirical investigation, there is not any connection between the

alterations that have taken place in Kuwait's financial sector and the rise in CO2 emissions (Salahuddin et al., 2017). Studies show no connection between financial instability in Saudi Arabia and CO2 emissions (Baloch et al., 2018).

Nexus between Air Pollution and Green Growth

We are going to need to include cutting-edge energy infrastructure if we are going to succeed in achieving the Millennium Development Goal. The economy's growth, new jobs, the efficient functioning of transportation networks, and the successful running of businesses are all intricately connected to energy (Karekezi et al., 2012). Although global agreements to battle climate change inflict hardship on economies, many of these economies are caught between two opposing goals: promoting economic development and limiting energy usage in order to minimize carbon dioxide emissions. Because of this, if we want to achieve our objective of sustained economic growth, we must devote a more significant amount of attention to the linked nature of energy, economics, and environmental problems. The United Nations and the Paris Climate Change Conference have identified green growth, support for sustainable development, the use of alternative energy sources, and the limiting of global warming as four of the most critical objectives of sustainable development (Renewable Global Status Report 2017). Discussions on environmental protection and sustainable development objectives would benefit significantly from more empirical research into the connection between green growth and carbon dioxide emissions and other crucial elements. The primary goals of sustainable development were to emphasize expanding the economy in a manner that did not harm the environment and to prevent the global average temperature from rising by more than 2 degrees Celsius beyond its pre-industrial level. Both of these objectives were quite ambitious in scale. More research is needed to determine the relationship between ecologically sustainable growth, better economic output, lower carbon emissions, and greater total energy consumption.

More and more studies in recent years have incorporated "green growth" as an essential variable to examine in determining the nature of the link between economic expansion and emissions nexus. Sohag et al. (2019) conducted up-to-date research examining the connections between eco-friendly development, economic growth, and carbon dioxide emissions. In recent years, evidence has been documented that rising

energy use has contributed to increasing environmental pollution, notably from certain nonrenewable sources. This evidence was recorded in response to a question posed by a member of the public (Huang et al., 2020, Chien, Anwar, et al., 2021). Because of this, a significant number of researchers have shown an interest in working toward the goal of finding a treatment for this particular kind of ED (C.-H. Nguyen, Ngo, Pham, Nguyen, and Huynh, 2021, Chien, Chau, et al., 2021; Chien, Pantamee, et al., 2021; Li, Chien, Kamran, et al., 2021).

The over use of traditional energy sources like fossil fuels is a major cause of air pollution, according to Shen et al. (2020), which affects both developed and developing nations. They used a regional method to measure developments in REN, fossil fuel consumption, and air pollution in China's economy between 2011 and 2017. Researchers found that although renewable energy and green innovation were on the rise globally, they were becoming less closely associated with the use of fossil fuels in their local regions. This was the case notwithstanding a general upward trend in using green technology and renewable energy sources worldwide. Many people believe that the growing use of fossil fuels in China's energy sector is to blame for the deterioration of air quality in the country's major cities. While the study's authors were aware of the importance of environmental levies, they still need to include them. This research satisfies that need by examining how environmental taxes may be coupled with other strategies to prevent environmental deterioration, such as reducing reliance on fossil fuels while increasing reliance on renewable energy and cutting-edge ecological technology. The combined effort is designed to halt further environmental deterioration.

Awodumi and Adewuyi (2020) conducted research to determine the impact of the use of NREN on the cultural and economic expansion of several African nations involved in oil production. As a result of this study, we concluded that the influence of NEN use on EG and CE emissions is very variable among the investigated economies. In the area of research focused on the deterioration of the environment, scientists have typically given less consideration to innovation's role (Koloba, 2020). As part of its evaluation of the ecosystem's current state of health, the research that is now being conducted will consider ecological developments. In addition, Sharif et al. (2019) used heterogeneous panel estimates to conduct research on a worldwide sample

to investigate the connections between the use of REN, NEN, and CE. The researchers conducting this study looked at data collected from 74 different countries between 1995 and 2015 as part of the analysis they performed for this study. The authors observed that some titles, such as REN, have significant negative effects on the environment, in contrast to NEN, which has a significant positive effect on the ED.

After seeing that NEN significantly affected ED, the researchers arrived at this conclusion. The data included in the research came from a wide variety of countries, each of which has its own unique set of environmental challenges, which may or may not affect the conclusions as a whole. Despite the fact that Asia is home to the most polluted regions and the most severe environmental issues, most of this study's attention has been directed to the economies of Asian countries. Banday and Aneja (2020) examined trends in REN, NEN, and carbon emissions across the BRICS economies during 1990-2017 by using bootstrap panel causality to analyze the data. The period 1990–2017 was covered by the data set used for this investigation. The data demonstrated a clear association between GDP and CO2 emissions for economies in India, Brazil, China, and Africa; however, no such correlation could be detected for the economy of Russia. The issue of the deterioration of the environment has been examined, but the facet of innovation that is connected to it has been disregarded. Because of this, we concluded that it was important to include ecological innovation in our assessment of pollution and other forms of environmental damage.

Destek and Sinha (2020) investigated the validity of the Environmental Kuznets Curve (EKC) for ecological footprints using renewable energy, network externalities, and trade openness as the key explanatory variables from 1980 to 2014 for 24 OECD states. Their research focused on the validity of the EKC from the perspective of ecological footprints. The EKC hypothesis, which seeks to explain the links between ecological footprints and EG, is false by the results of their research. Increases in the consumption of renewable energy, on the other hand, have the effect of minimizing negative impacts on the environment. In contrast, increases in the consumption of nonrenewable energy sources increase the demand for energy (ED). The current research, which explores the link between environmental deterioration and environmental taxes, fills this information vacuum by focusing on the interaction

between the two. Environmental taxes have not received much attention up to this point, although they have a considerable impact on the environment's performance.

In addition, Sharif et al. (2019) used heterogeneous panel estimates to research a worldwide sample to investigate the connections between the use of REN and NEN, and CE. The researchers conducting this study looked at data collected from 74 different countries between 1995 and 2015 as part of the analysis they performed for this study. The authors observed that some titles, such as REN, have significant negative effects on the environment, in contrast to NEN, which has a considerable positive effect on the ED. This finding was made because NEN significantly affects the ED. All sorts of countries with unique environmental problems provided data for this research. The implications of these problems for the study's findings must be balanced. The current study has focused chiefly on Asian economies, even though these countries have the most fantastic pollution rates and critical environmental concerns. Banday and Aneja (2020) used bootstrap panel causality to examine the changes in BRICS nations' REN, NEN, and carbon emissions from 1990 to 2017. This study spanned the years 1990-2017. The data revealed a correlation between GDP and CO2 emissions for the economies of India, Brazil, China, and Africa, but not Russia. The problem of environmental degradation has been studied, but the innovative response to it has yet to be noticed. This led us to conclude that ecological innovation should be included in evaluating the effects of pollution and other environmental harm.

Summary of Literature review

Table 1.1: Summary of Literature review

Author	**Periods**	**Methdology**	**Results**
Chunark et al., 2017	2015 Power Industry Development Strategy (2015 -2036)	Asia-Pacific Integrated Model/Computable General Equilibrium (AIM/CGE)	The usage of renewable sources of power has the potential to lower carbon dioxide emissions and boost economic expansion.
Bento & Moutinho,2016	1960-2011	TodaYamamoto/ARDL Model	Using renewable sources of energy reduces CO2 emissions

			per person both immediately and in the long run.
Ito, 2017	2002-2011	GMM/PMG	Renewable energy helps enhance environmental quality and boosts economic development.
A.K.Tiwari, 2011	1960-2009	Use of a Structural Vector Autoregressive (SVAR) Model	Renewable energy use is associated with higher economic development and lower carbon dioxide emissions.
B. Wang, B. Zhang , Z. Wang, 2017	1970-2012	FMOLS/DOLS Granger causality test /ARDL model /VECM	Reduced carbon dioxide emissions are directly correlated to increased usage of renewable energy.
Shahzad et al. (2017)	(1971–2011)	ARDL bound test and Granger causality	An increase in both short- and long-term CO2 emissions may be attributed to FD. CO2 was produced in a mutually exclusive manner by FD and EC.
Nasreen et al. (2017)	(1980–2012)	ARDL bounds test	Long-term pollution was affected adversely by financial stability, whereas it was favourably affected by production and energy usage.
Katircioglu and Taspinar (2017)	(1960–2010)	Both the Error Correction Model (ECM) and the Dynamic Ordinary Least Squares	Although FD mitigated the immediate effects of economic growth on pollution, it also reduced the long-term impact of that growth.
Mesagan and Nwachukwu (2018)	(1981–2016)	Granger causality is tested using ARDL bound.	The level of environmental quality was evaluated based on EC, FD, revenue, and commerce. While the link between EC and its environment is one of reciprocal causation, the relationship between FD and its

			environment is not of the same kind.
Salahuddin et al. (2018)	(1980–2013)	ARDL bound test	Usage of electricity, along with economic and population expansion, has contributed to both immediate and long-term increases in pollution.
Mesagan et al. (2018b)	(1981–2016)	Autoregressive distributed lag (ARDL) model	The two nations' CO2 emissions were caused by EC. In South Africa, pollution was found to be caused by commerce, but in Nigeria, trade and pollution were shown to have mutually causative relationships.
Charfeddine and Kahia (2019)	(1980–2015)	Analysis of Panel Vector Autoregressive (PVAR)	The expansion of FD as well as renewable EC and CO2 emissions were all positively affected by it, although to a very little degree.
Ali et al. (2019)	(1971–2010)	ARDL bounds test	CO2 emissions were strongly impacted in a favorable direction by EC, FD, and expansion.
Ridzuan et al. (2020)	(1980–2014)	ARDL bounds test	Long-term CO2 emissions rose sharply in Thailand and Indonesia due to fossil fuel use, but not in Malaysia.
Mesagan and Olunkwa (2020)	(1981–2017)	Fully Modified OLS and Dynamic	Africa as a whole, not just Nigeria, Algeria, or Morocco, was hit by a pollution catastrophe due in part to EC. The combined effects of EC and investment greatly reduced Africa's emissions.
Ibrahiem (2020)	(1990–2017)	Dumitrescu- Hurlin causality and PMG	Electricity/ICT usage was only shown to be causally related to carbon dioxide

			emissions in one direction, suggesting that increasing production substantially affects energy consumption.
Ganda (2019)	2000–2014	GMM approach	Carbon emissions may be lowered by using renewable energy and funding research and development.
Lin and Zhu (2019a)	2000–2015	The dynamic panel regression model	Considering how crucial innovation is to climate change, it's no surprise that high levels of CO2 emissions spur developments in renewable energy technology.
Balsalobre, Cantos, Alvarez-Herranz, & Shahbaz (2017b)	1990–2014	Generalized least square method	Correcting pollution over time is a measure of energy innovation.
Sohag (2019a)	1987–2017	Cross-sectional autoregressive distributed lags method	Carbon emissions hardly budge in response to technological progress.
W. Chen and Lei (2018)	1980–2014	Panel quantile regression	Enhanced technical capacity may explain the rising rates of CO2 emissions in major emitters.
Lin and Zhu (2019b)	2000–2015	Linear regression method	Developing innovative technologies for renewable energy sources may help reduce greenhouse gas emissions.

Source: (Author's Computation)

CHAPTER III

Theoretical Framework

Introduction

This chapter provides an overview of the many theories that are related to the research and also provides detailed explanations of the empirical literature that is associated with the thesis as well. This research also provides an overview of the conceptual framework and a detailed discussion of the links between the variables.

Neoclassical Theory

The neoclassical growth theory is a field of economic thought that explains how labor, capital, and technology may combine to provide a constant economic growth rate. Reports by the National Bureau of Economic Research, Robert Solow and Trevor Swan, were responsible for inventing and establishing the model of long- run economic development in 1956. Initially, the model relied on exogenous population growth to determine the pace of growth, but in 1957, Solow included technological progress. According to the idea, shifting the ratio of labor to capital in the production function leads to a temporary equilibrium condition. The growth of a nation's economy is crucial to the success of this theory, which also holds that technical progress is necessary for continued economic expansion. The three components of a flourishing economy are outlined by neoclassical growth theory. These are people, money, and gadgets. On the other hand, long-term equilibrium does not need any of these three things, as made evident by neoclassical growth theory. According to this growth idea, a nation's GDP rises when its citizens save and invest more money. Furthermore, the interaction between capital and labor determines an economy's production. Lastly, it is believed that technology will boost the production capacities of labor by augmenting worker productivity.

Growth Theory

It is generally believed that increased energy consumption would directly lead to an upward spiral in total economic activity. The acceleration of economic expansion will be influenced by adopting public policies that reduce the energy required and used.

Conservation Theory

The assumption behind this theory is that the energy consumption level is proportional to an economy's expansion. If this theory is correct, then energy conservation efforts, such as eliminating energy subsidies, will not impact the rate at which the economy expands. On the other hand, it has been shown that a nation's economic expansion rate is directly correlated to the amount of energy used in that nation.

Neutrality Theory

This hypothesis asserts that there is no causal connection between the factors under consideration. Adopting energy-saving strategies will not impact economic expansion, and a rise in economic activity will not result in a corresponding shift in energy consumption.

Empirical Literature

The empirical research has investigated various alternative methods that can be used to study pollution. One of these routes is the consumption of energy. Drawing inspiration from works such as Rafindadi (2016), Mesagan et al. (2018b), Rafindadi et al. (2018), Mesagan (2015). These empirical studies provided supporting evidence for the widespread and detrimental effects of human energy use on the natural world and explained their findings in terms of the EKC. In other words, not only did these studies offer support for the hypothesis that human energy use has an adverse impact on the natural world, but they also provided evidence research such as that conducted by Saaty and Ramanujam, (1981) demonstrates that less developed nations produce less pollution as a result of their reduced demand for energy. Using the ARDL, Jayanthakumaran et al. (2012) analyzed the situations in China and India.

Karatasou and Santamouris (2019) investigated the relationship between RE and socioeconomic status in the United States using a latent regressor analysis technique. According to the findings of their investigation, there is a strong connection between the two of them. According to the study's findings, bigger homes had lower monthly energy bills on average than smaller homes. However, the number of housing units and appliances in a house had a significant impact on RE, and the family's

socioeconomic standing significantly influenced these effects. Research in Italy and Germany, such as those by Mele et al. (2021) and Magazzino et al. (2021b), focused on population growth and pollution as their primary areas of investigation. In addition, these studies investigated the association between energy consumption and air pollution. Mele et al. (2021) revealed that carbon pollution rose in the forecasting model even though Italy was in a time of low growth by using a technology called machine learning. This was the case even though Italy was not growing economically. The findings of this research stood in sharp contrast to the other pieces of information that were accessible. For example, a quantum machine learning model developed by Magazzino et al. (2021b) discovered that biomass energy dramatically reduces CO2 emissions. On the other hand, Germany's pollution issue is exacerbated by the country's economic success and advances in renewable energy technologies.

Results showed that both China and India increased their energy consumption and CO2 emissions. Omri's (2013) supplementary explanation, built on a model of simultaneous equations, demonstrated that energy is the root cause of environmental degradation. Using a causal analysis, Tang and Tan (2015) expanded our research into Vietnam and found that energy usage was a significant contributor to environmental deterioration. Our findings are pretty comparable to this one. The PMG framework was also used by Rafindadi et al. (2018), who looked at the GCC's resource-rich nations. When applying the ARDL framework to the situation in Japan, they found that energy consumption was the primary factor in the country's carbon emissions. Similar results were found by Mesagan et al. (2018b) in both South Africa and Nigeria, which were consistent with those found by Mesagan (2015). The CRR and FMOLS models used the Maki-cointegration test with structural breakdowns (Rafindadi & Usman, 2019). They concluded that there was an inelastic as well as an elastic relationship between energy usage and pollution.

Olunkwa and Mesagan, (2020) found out, through a panel study, that power utilization has a significant effect on the pollution that occurs in Africa. Recent research by Xu et al. (2021) adapted the STIRPAT model to be used in the Chinese setting. According to the study's findings, sulphur pollution was significantly exacerbated by the production of electricity from coal. In contrast, the use of natural gas had the potential to mitigate the issue. In addition, beginning in the middle of the

2000s, there has been a general increase in empirical studies investigating the effects of the financial sector. Shahzad et al. (2017), Nasreen et al. (2017), Katircio glu and Taspinar (2017), Mesagan and Nwachukwu (2018), Salahuddin et al. (2018), Jalil and Feridun (2011), Sadorsky (2011), Shahbaz et al. (2013), Rafindadi (2015), Rafindadi and Ozturk (2016), Early findings from several of these studies pointed to a clear connection between economic expansion and increased energy consumption. Sadorsky (2011) discovered, with the aid of dynamic panel architecture, that affluence positively and appreciably impacted the amount of energy consumed.

The findings of Rafindadi (2015) and Shahbaz et al. (2013) corroborate a feedback effect between energy consumption and financial development in Pakistan and Germany, respectively. These findings lend credibility to the conclusion that was presented earlier. In a similar vein, Rafindadi and Ozturk (2016) used the ARDL method to discover that Japan's rising power demand is a direct result of the country's growing economy. They came to this conclusion after discovering that Japan's economy is growing faster than it was in the past. Therefore, further study may evaluate the associated influence on environmental pollution by proving a solid connection between the financial and energy nexus.

Mesagan and Nwachukwu (2018) also examined the Nigerian situation and concluded that there is a fundamental link between power and environmental pollution but no causal association between pollution and economic development. It was also discovered that prominent pollution causes come from the energy and banking sectors. According to studies such as the ones conducted by Charfeddine and Kahia (2019), Salahuddin et al. (2018), positive effects of financial development and energy utilization on CO2 emissions were seen. Yin et al. (2019) observed, via decoupling the components that contribute to pollution, that while China's economic expansion improved water quality, it also increased SO2 emissions. Ehigiamusoe and Lean (2019) conducted their research with a bigger sample size of 122 countries and discovered that both indicators are connected with greater pollution levels. However, they discovered that economic expansion in high-income nations resulted in lower pollution levels. It made pollution in countries with middle incomes and low incomes substantially worse.

The role of information technology was investigated by Magazzino (2021a, b), who then pulled everything together (ICT). The researchers Magazzino et al. (2021a) employed machine learning to investigate the rise in electricity use and output across OECD nations. They concluded that information and communication technology (ICT) significantly affected both of these factors. According to the study's results, rising income levels and energy use are both significant factors in the production of greenhouse gases. (Magazzino, 2021b) cast an investigative spotlight on 16 countries that make up the European Union. Although the usage of energy and information and communications technology had just a linear connection to carbon emissions, it was proven that an increase in output significantly influenced the amount of energy used. Mesagan (2021b) calls attention to the situation in Sub-Saharan Africa by analyzing the system GMM framework on the region's overall production and consumption patterns. According to the empirical study findings, the manufacturing process is a substantial contributor to the destruction of the environment.

Up to this point, researchers have explored Grossman and Krueger's (1991) revolutionary EKC theory to determine whether real income growth and environmental degradation are connected. Studies that have provided evidence supporting the EKC theory have observed that as an economy develops, it gains the financial ability to control the expansion of ecological footprint statistics. This capability was not possible during the early era of low economic development and was not available to the economy. Policy on Resources, Yasin, et al. (2020) used the Generalized Method of Moments (GMM) and found support for the EKC hypothesis holding for a panel of less-developed countries over the long-term using ecological footprint as a proxy for environmental quality. This was done by using ecological footprint as a measure of environmental impact.

Since the EKC hypothesis' estimated elasticity value for the squared component of economic growth was substantially lower than expected, Zeraibi et al. (2021) concluded that economic development inevitably results in a rise in the numbers associated with ecological footprints. However, the EKC hypothesis has been the topic of discussion in the past, and it has been said that this idea does not hold for all economies. According to the conclusions of this study, continued economic development may leave behind a more significant ecological footprint than

one that is lower. In this respect, Ajmi and Inglesi-Lotz (2020) said that the EKC hypothesis for ecological footprint does not apply to Tunisia. They were referring to the fact that the country has a small ecological footprint. After all, a correlation has been shown between increased economic activity and deterioration in the quality of the natural environment in the United States. This is significant because the EKC hypothesis cannot be accurate for Tunisia, given the U-shaped link between economic development and environmental deprivation. It has been recognized that there is a relationship between China's and India's economic growth and ecological footprint; this discovery does not support the EKC theory for either of these countries. Like this, Yilanci and Pata (2020) concluded that the EKC hypothesis did not hold water in China.

Danish et al. (2019) evaluated human capital development and EF in low-income states using yearly data from Pakistan between 1971 and 2014. Their research focused on the years 1971 through 2014. According to the results, the only thing that needs to be done to reduce a country's projected ecological footprint is to increase that nation's human capital. According to the authors, better management of natural resources may help prevent further deterioration of environmental quality, and investments in human capital via education may help increase awareness of the harmful impacts of environmental degradation. Similarly, Iorember et al. (2021) and Pata and Caglar (2021) discovered that greater levels of human capital led to fewer predicted effects on the environment throughout a longer period. According to Ahmed and Wang (2019), emerging nations like India have decreased their ecological footprint due to gains in their human capital. This is attributed to the fact that developing countries have become more educated. They counted this as one of their findings after carrying out their investigation. The authors of the research claim that their results do not give any indication of a causal feedback impact on ecological footprints. On the other hand, research that Kassouri and Altntas (2021) carried out involving 13 countries in the Middle East and North Africa (MENA) found a negative association between the growth of human capital and the growth of economic freedom.

According to the authors, an increase in human capital may be connected to more significant economic prospects and social well-being, enhancing environmental

demand and the carbon footprint that goes along with it. As a direct result of this, it is abundantly evident that it is impossible to predict the effects that human capital growth will have on the surrounding environment. According to the findings of several studies, there is also a relationship between economic development and environmental issues, especially those prevalent in developing nations. According to Yasin et al. (2020), a study that has suggested that financial growth harms environmental well-being, the development of the financial sector may diminish the long-term ecological footprint statistics of less-developed countries. This finding was based on the hypothesis that financial growth harms environmental well-being. As a consequence, the authors suggested that the growth of the financial sector is a more conceivable road to environmental sustainability in emerging nations than in countries that are already prosperous. The authors of this study hypothesized that in developing countries, the financial sectors might be so underdeveloped that they cannot boost demand for ecological resources. As a result, a lack of progress in the sector may not lead to more giant environmental footprints, even though the authors hypothesized that a lack of progress in the sector could lead to more giant environmental footprints. In contrast, Mrabet and Alsamara (2017) observed that economic expansion in Qatar has a detrimental influence on the environment. Specifically, they discovered that economic growth in Qatar increases Qatar's ecological footprint both in the short and long term. Sarkodie and Destek (2019) conducted a study that was quite similar to this one on 11 nations that had recently undergone industrialization and utilized the Augmented Mean Group (AMG) estimator to investigate the correlation between economic growth and environmental effect.

It was discovered that financial progress and ecological footprint were positively correlated for Singapore but were found to be negatively correlated for China and Malaysia. The correlation was statistically insignificant for the remaining panel countries, including the Philippine Islands, India, Brazil, Mexico, Republic of Korea, South Africa, Thailand, and Turkey. The researchers found conclusions that were just as diverse as the nation’s themselves. Research conducted by Naqvi et al. (2021) indicated that a nation's GDP does not influence the ecological footprint it leaves behind, although this is a commonly held view. This category includes nations with incomes that are low, lower, and in the middle of the pack. The ecological footprints left behind may become even more significant as the economy continues to

develop and the need for natural resources continues to increase. Wang et al. researched and analyzed the energy consumption and carbon dioxide emissions of the member states of APEC, as well as the nations' potential for reduction (2017). The authors found a significant negative link between energy performance and energy intensity. According to the findings, APEC members with lower energy intensities were more likely to have worse energy performance. A drop in energy intensity is connected to changes in input costs, and an increase helps reduce the number of activities that involve patents.

People who live in these regions often have the misconception that most climates are reasonably comparable to one another and that there is a one-to-one correlation between energy use and GDP. The research conducted by Zhou et al. (2017) aimed to evaluate the link between the energy mixes of APEC countries and their levels of energy efficiency while conducting congestion evaluations. According to the data, the level of energy congestion is positively impacted by the amount of energy used and the industrial value added as a proportion of GDP. Researchers discovered that a higher GDP per capita makes traffic congestion worse. When a certain level of economic development is accomplished, this factor contributes to the protection of the natural world for the long term by elevating the general population's standard of living and the demand for renewable resources (Zaidi et al.,2019a). Calculating the energy intensity of a nation's economy is one way that progress may be quantified in terms of energy efficiency on a global scale. The ratio of primary energy supply to GDP is the measure of energy intensity. This measurement may also be referred to as the energy ratio.

Not all of the United Nations' Sustainable Development Goals (SDGs), especially those relating to energy, are being accomplished by the deadlines set for them. Access to energy at an affordable price is one of the most significant Sustainable Development Goals (SDGs), along with reducing the adverse effects of air pollution on health, which is part of SDG-3 and addressing environmental issues, which is the overall goal of SDG-3. The International Energy Agency's Sustainable Development Scenario illustrates the evolution of a primary energy system. It outlines the steps necessary to go in the direction of achieving these objectives (IEA, 2020b). The ubiquitous availability of energy and its high energy intensity have enhanced economic

possibilities, but they have made an already precarious position for ecological sustainability much worse.

According to the findings of a study conducted by Raheem et al. (2020), the development of GDP had a minor influence on carbon dioxide (CO2) emissions; nevertheless, the interaction of these emissions with ICT resulted in a reduction in pollution in the G7 countries over the medium and long term. Ibrahiem (2020), who arrived at the same verdict, discovered that the increasing riches and pollution in Egypt directly affected the country's economic progress. The Polish researchers Kazak et al. (2018) have shown a correlation between several sustainable development criteria and energy use. The findings, which focused on areas with a semi-rural or rural atmosphere, demonstrated a correlation between households' sewage treatment plants, flat useable areas, collected municipal wastes, and electricity use. This establishes a link between residential energy consumption and the growth of environmentally conscious practices. In the research that Karatasou and Santamouris (2019) conducted, they used the latent regressor approach to investigate the relationship between RE and socioeconomic status in the United States. It was found that the size of the household had a positive impact on the amount of energy that was used in residential buildings.

On the other hand, a person's socioeconomic standing significantly impacts RE through the number of privately owned appliances and the square footage of their house. Numerous studies have been conducted in Italy and Germany to investigate the potential linkages between economic growth and the deterioration of the natural environment. Mele et al. (2021) used machine learning, yet their findings are different from what would be expected based on the data. They discovered that the forecasting model predicted increased amounts of carbon emissions at an era in Italy's history when the country's economy was expanding slowly. Magazzino et al. (2021b) demonstrated that biomass energy is highly successful in minimizing CO2 emissions using a quantum machine learning model. However, money and the development of renewable energy technology are significant factors that determine the increase in pollution in Germany. In the last part of the report, Magazzino et al. (2021) investigate the effects of the use of information technology (ICT).

Valadkhani (2019) researched to investigate the effects of EC on a country's pollution level. The period covered by the data collection was from 1965 to 2016, and

the number of countries included in the sample was sixty. In a similar vein, the research piece suggested that various energy sources may have varying ramifications on the overall quantity of CO2 emissions and that this variety mandates an in-depth investigation of the possible repercussions associated with each source. The quantity of carbon dioxide (CO2) emissions that are created by different types of energy sources, such as oil, coal, gas, hydropower, and other renewable, were investigated in this article. It was suggested that the natural wealth level of the nation might have an influence, depending on the sources, on the CO2 emission created by the use of energy. The data, which included over 2600 observations from 60 different countries, revealed that national governments face a trade-off between transitioning to alternative fuels and maintaining a certain income level while aiming for a specific level of economic growth. The data also showed that this trade-off exists.

The wide variation in CO2 emission levels is a significant problem for public policy that arises as a direct result of the potential for the use of fuel to increase the amount of energy used in various sections of the country. This begs the question of how economies should compute the energy demand in their own nation to prevent one side of the equation from destroying the other side. Alarenan et al. (2019) contributed to that discussion by examining the impact of the EC in Saudi Arabia on economic efficiency and other macroeconomic parameters. As a result of the substantial correlation that exists between income and EC, it is possible to develop a modeling strategy that can analyze the probable future paths that both variables will take. In turn, one may use these data to evaluate the possible magnitude of a country's or region's contribution to the total amount of CO2 emissions in the atmosphere. It is possible to determine a country's GDP per capita based on its energy use, which provides decision-makers with valuable information. In the long run, a country may benefit from this collaboration because it may function as a model for both economic and environmental policy (Narayan, 2016).

Energy consumption is only a reflection of the dynamic between resource demand and emissions, which includes emissions into the atmosphere as just one side of the equation. According to the research conducted by Rahman in 2020, EU policies have had a detrimental influence on the economies of the G7 and the UK, which has led to increased total emission levels. According to the findings of Shahbaz et al. (2013),

who used an ARDL model to arrive at their conclusions, rising total energy consumption led to a rise in carbon emissions in China, India, Turkey, and Indonesia. The authors of the research, Destek et al. (2016), chose ten countries from Central and Eastern Europe to participate in their investigation of the relationship between CO2 emissions and the EU between the years 1991 and 2011. The findings provide empirical support for the reliability of the EKC hypothesis about the aforementioned nations. According to the findings of a study that used the FMOLS technique (fully modified ordinary least squares), the European Union (EU) is likely to blame for some of the recent increases in carbon dioxide in the atmosphere.

Furthermore, Dong et al. (2017) used the Granger causality and AMG estimator to investigate the connection between natural gas and carbon emissions in the EU from 1985 to 2016. The study included the period from 1985 to 2016. The two people spent much time discussing their partnership. They concluded that the EU had a negative influence on carbon dioxide emissions because there was a two-way causality between the two, which caused them to arrive at their conclusion. Destek and Aslan (2020) employed the AMG estimator and panel bootstrap causation to investigate the multivariate link between disaggregated REC, EG, and climate change across the G-7 nations in research from 1991 to 2014. The paper was published in 2020. According to the results, a growing dependence on hydroelectricity as a source of power in Italy and the UK plays a role in the deterioration of the environment. However, an increase in countries like the United States, France, Germany, and Japan using biomass to generate power leads to a decrease in the amount of carbon dioxide discharged into the environment.

Pata (2018) also utilized an ARDL model to find that various power sources have both positive and negative effects on carbon emissions. According to the study done by Chen et al. (2019), coal and other energy sources helped reduce China's carbon emissions between 1995 and 2012. Although energy consumption and emissions are critical to any financial activity, the analysis did not emphasize this fact. They began studying these countries in 1982 and proceeded through 2013, looking at ten expected to be economically powerful in 2019.

They use panel data of the second generation in order to investigate the connection between real income, foreign direct investment, export-oriented production, and EFP.

The rising demand for energy and the economy's expansion negatively impacts the environment. Both combating climate change and preserving the environment stand to profit from economic growth (Destek & Sarkodie, 2019). Increases in GDP are associated with considerable increases in CO2 emissions (Ren et al., 2021). When determining the relationship between GDP and CO2 emissions, Panayotou (1994) developed the widely used Environmental Kuznets Curve (EKC). This model proposes a link between GDP and CO2 emissions in the form of an upside-down U. According to the research findings, the increase in CO2 emissions that occurred throughout the industrialization era as a consequence of economic expansion may have had a detrimental effect on the climate. However, once a nation enters the post-industrial age, it will be able to reduce its CO2 emissions as a consequence of economic development; this is in contrast to the pre-industrial period. In their study of yearly data from 1980 to 2013, Destek, Ulucak, and Dogan (2018) employed approaches for analyzing panel data of the second generation that take into account the cross-sectional dependency of countries.

Increases in GDP are linked to significant jumps in carbon dioxide emissions (Ren et al., 2021). Panayotou (1994) created the widely used Environmental Kuznets Curve to analyze the correlation between GDP and CO2 emissions (EKC). The model predicts an inverted U-shaped relationship between GDP and carbon dioxide emissions. The study suggests that the climate may have suffered due to the rise in CO2 emissions that accompanied the age of industrialization and subsequent economic growth. However, in contrast to the pre-industrial era, CO2 emissions may be reduced due to a country's economic success as it enters the post-industrial era. Destek, Ulucak, and Dogan (2018) used methods for evaluating second-generation panel data that account for the cross-sectional reliance of nations in their analysis of annual data from 1980 to 2013.

The use of fossil fuels has been connected to the deterioration of the environment, and a U-shaped connection exists between the consumption of nonrenewable energy sources and the gross domestic product of a country. Further investigation by Erdogan et al. (2019) revealed a positive correlation between carbon emissions and economic growth in the BRICS-T nations from 1992 to 2016. The period covered by this study was from 1992 to 2016. According to the empirical study

findings, when economies grow, their levels of carbon dioxide emissions also increase. Abbasi (2021) used CS-ARDL, Dumitrescu, and Hurlin Granger causality to investigate the short-term and long-term correlations between GDP and CO2 emissions. The authors focused on both short-term and long-term correlations. As a direct result, we successfully developed long-term and short-term cooperating solutions.

Balsalobre-Lorente et al. (2018) investigated the impacts of energy consumption and NR on the ecological sustainability of five nations in Europe between 1985 and 2016. Clean energy and using natural resources are beneficial to sustainable development, as shown by the findings of a panel data analysis. Zafar, Shahbaz, (2019), and others analyzed the ecological footprint left by the United States. The researchers identified a connection between these elements using an ARDL methodology. According to the findings of the study, they are reducing the amount of waste produced by natural resources requires educating people on how to modify their dietary patterns, reducing the amount of fishing done and the amount of erosion that occurs, conserving water and electricity, and incorporating energy-efficient acceptable items into their daily routine. Research conducted by Victor et al. (2019) looked at the relationship between NR rent and carbon emissions in sixteen different European countries. Using the PMG-ARDL technique, they came to the conclusion that NR rent is one of the factors that lead to the rise in pollution in some locations.

The amount of additional energy utilized in various sections of the country due to disparities in fuel consumption has substantial repercussions for policy, resulting in varying levels of carbon dioxide emissions. This raises the question of how economies may most accurately measure the demand for energy inside their borders while preventing one side of the equation from dominating the other. In order to contribute to this discussion, Alarenan et al. (2019) analyze the impact of the EC on economic efficiency and other macroeconomic factors in Saudi Arabia. Due to the high connection between income and EC, a forecasting model may be developed to analyze the anticipated future paths that both variables will take if they continue on their current paths. With energy consumption, the country's income per capita may be expected, and these results can be applied in the decision-making process for future policies. The beneficial benefits of this relationship for a country will continue to be

felt for a considerable length of time since it has the potential to serve as a model for future economic and environmental policies (Narayan, 2016).

Multiple pieces of empirical research (Tamazian, 2009 for BRIC nations; Rao and Tamazian, 2010 for evolution countries; Shahbaz, 2013 for Indonesia; Feridun and Jalil, 2010 for China) prove that FDI helps cut down on greenhouse gas emissions. There is additional evidence suggesting a connection between economic expansion and rising levels of carbon emissions (Acaravci and Ozturk (2013) for Turkey). Using multivariate Granger causality, Pao and Tsai (2011) find an inverse bond between foreign direct investment and emissions. The idea of a "pollution haven," according to which nations with lax environmental regulations are more likely to attract foreign direct investment, has also been investigated in connection to pollution management (see, for instance, Eskeland and Harrison, 2003; Albornoz et al., 2009). This is frequently the case as a result of the fact that foreign direct investment may be combined with novel approaches, such as cutting-edge technology for the removal of pollutants, in order to meet or exceed the stringent criteria established by the environmental authorities of the nation that is acting as the host. In order to gain entry into the markets of industrialized countries, businesses engaging in foreign direct investment (FDI) in the export sector will need to demonstrate compliance with the environmental product standards of such nations (Zhang and Fu, 2008). This may be the case, yet research conducted by Yuxiang and Chen (2010) reveals that regulations governing China's financial industry promote enterprises to utilize cutting-edge technology that cuts carbon emissions.

As measured by domestic lending to the private sector, more excellent financial development was shown to be related to lower levels of carbon emissions in a study carried out across 129 countries by Al-Mulali et al. (2015b) using the cointegration method. Using system-GMM, Hao et al. (2016) demonstrated a correlation between increased government spending and increased carbon emissions in 29 of China's provinces. In particular, they found a correlation between a larger ratio of loans to deposits and lower levels of carbon emissions. The authors hypothesized that if there was a more excellent ratio of loans to deposits, there would be a corresponding increase in carbon emissions; this finding lends credence to their theory. According to what Shahbaz(2013b) discovered, providing domestic loans to

the private sector resulted in financial growth, which, in turn, assist in reducing carbon emissions in Malaysia. Shahbaz et al. (2018), who used a bootstrapping bound testing approach to examine the impact of financial development, foreign direct investment, and energy innovation on carbon emissions in France, provide evidence for the negative role that financial development (domestic credit to the private sector) plays on carbon emissions. In their study, the authors looked at the impact of financial development, foreign direct investment, and energy innovation on carbon emissions in France. Their study investigated how changes in France's economy, foreign direct investment (FDI), and innovations in energy influenced the country's overall carbon footprint.

Abbasi and Riaz (2016) used the Autoregressive Distributed Lag model (ARDL) to find that growth in Pakistan's stock market turnover, stock market capitalization, total credit, and private sector credit during the period of financial liberalization resulted in a decline in the country's greenhouse gas emissions (1988–2011). They used ARDL to examine how China's growing economy affected carbon output. Their research showed that increasing the ratio of liquid liabilities to GDP and the ratio of private sector loans to GDP were indicators of financial growth, decreasing carbon emissions. This is analogous to how Jalil and Feridun (2011) utilized ARDL to investigate how China's economic growth affects carbon emissions. Nasreen et al. (2017) used ARDL to find that economic growth enhances environmental quality in Pakistan, India, Nepal, Sri Lanka, and Bangladesh. Emissions of carbon dioxide can only go up as the economy expands. Recent research by Xing et al. (2017) using ARDL to investigate the effects of China's economic growth on the country's carbon footprint found that growth contributed to lower emissions.

Researchers could make this conclusion due to their earlier finding that increased economic activity resulted in lower emissions. Yuxiang and Chen (2010) used GMM as a research method to investigate how China's economy's expansion affects the country's carbon emissions. 2010 was the year when their study was made public. It has been shown that a simultaneous rise in the percentage of bank loans to GDP, private loans to GDP, and non-private loans to GDP may result in a reduction in emission intensity. Using the ARDL, Maji et al. (2017) were able to conclude that growth in Malaysia's financial sector (credit given by private banks to the private

sector) leads to a decrease in emissions in Malaysia's industrial and construction sectors. The researchers determined this after observing a correlation between the two factors. The evidence presented in the form of the data made it very evident that this was the situation Charfeddine and Ben Khediri(2016) researched the United Arab Emirates. They demonstrated this by integrating the Gregory-Hansen Cointegration model with the Granger causality model. This allowed them to demonstrate that an increase in GDP was connected with a U-shaped drop in carbon emissions. The findings of their investigation were published in a journal called Scientific Reports. Gokmenoglu and Sadeghieh (2019) observed that economic expansion in Turkey between 1960 and 2011 was associated with a short-term drop in that country's carbon emissions. This finding was made about the period between 1960 and 2011. The second part of the empirical investigation reveals that lower levels of carbon emissions are associated with higher levels of wealth.

Conversely, Toth and Szigeti (2016) proved that a growing human population is not the primary driver of environmental deterioration. Instead, they discovered that increased population size caused changes in consumption patterns. According to data collected between 1970 and 1980 and presented by Begum et al. (2015), the population increase in Malaysia is a little danger to the nation's natural resources. This conclusion may be drawn from the data. According to the findings, their anticipated population rise would likely increase greenhouse gas emissions. Recent research conducted by several organizations, such as Dong et al. (2018) and Mendonca et al. (2020), has uncovered a connection between individuals and the environments in which they live. They concluded that there is a statistically significant link between the variables after analyzing over a more extended period, allowing them to gather more data. It was proved that increases in GDP had no meaningful impact on the pace of environmental deterioration. It was also shown that urban inhabitants left a more robust ecological footprint than rural ones (Wood & Garnett, 2009).

Researchers in the United Kingdom have been looking into the long-term effects that various factors, including the country's natural resources, energy use, economic growth, population, and industrial value added, have on CO2 emissions. However, they have yet to find any patterns that can be considered conclusive. This may be because of the chosen samples (coming from a particular region or nation),

periods, factors, or analytical procedures. As was just said, the primary finding of the research indicates that there is some evidence, based on experience, that there is a connection between the two criteria. The panel and time series investigations that Adedoyin and Zakari,(2020) conducted Kirikkaleli et al. (2020), and Abbasi et al. (2020) all included the United Kingdom as a participant (2021a,b). The dynamic links between developing economic activity, escalating CO2 emissions, and other factors in the United Kingdom must be better understood. Little is known about these linkages.

However, changes to the economic system and the conversion of trash into energy might help reduce CO2 emissions. In their investigations into the elements that contribute to the degradation of the environment, a considerable number of academics have, on more than one occasion, substituted CO2 emissions for other variables. This is something that they have done very often. Carbon dioxide emissions are just one indicator of the harm that is being casued to the environment. Due to the all-encompassing nature of EP, researchers have moved their focus in recent years to utilizing it as a barometer of environmental issues. This is because EP encompasses a wide range of factors. After Al-Mulali and Ozturk (2015) stated that EP is a sufficiently complete metric to understand the ecological implications of human activities, it is being used as an environmental indicator for the first time in academic literature. This is a significant step forward in the field of environmental studies. This is because Al-Mulali and Ozturk (2015) said that EP is a statistic that considers everything. In their study of the EKC across 93 countries, Al-Mulali et al. (2015) looked at panel data with EP serving as the dependent variable. The researchers concluded that the EKC is exclusive to high and upper-middle-income nations. The results also show that although energy use and economic activity are bad for the environment, a growing economy is good for environmental protection and enhancement. Recent finds in Qatar by Charfeddine (2017) show that the EP is comprehensive. The authors draw a U-shaped link between GDP and EP, with financial development, commerce, and energy use all positively contributing to EP.

Their investigation revealed the levels of CO2 in the atmosphere had a significant bearing on the results. To investigate the expansion of the EP and find out why it is happening, they analyzed the data from 15 MENA countries, the same as

Charfeddine and Mrabet (2017) did. Non-oil exporting countries on the panel were found to have a U-shaped connection between GDP and EP, whereas oil exporting countries on the panel had an inverted U-shaped correlation between GDP and EP. Not only that, but they found that an increase in energy consumption aided EP. Mrabet et al. (2017) discovered no relationship between GDP and EP in Qatar, suggesting no connection between the two. To sum up, trade's negative impact somewhat offset oil prices' favorable impact on EP in Qatar. The BRICS nations do not have EKC, according to Dogan et al. (2020). Using a worldwide panel of 150 countries, Wang et al. (2013) found data that corroborated conclusions similar to those already established. Katircioglu (2018) found that a decrease in the number of the world's most popular tourist sites was associated with a stable EKC.

As shown by the research (Hassan, 2019), there is a reverse U-shaped relationship between EP and GDP development in Pakistan. The BRICS nations and India show an EKC between GDP per capita and education levels, as do Ahmed and Wang (2019). Panel data from 27 countries were used by Uddin et al. (2017) to examine the linear relationship between income and EP. It was observed that EP is impacted both positively by GDP (gross domestic product) and negatively by the rise of the banking sector. Figge et al. (2017) state that a rise in economic growth does not affect EP; however, globalization does. According to the authors, economic development may capture some of the consequences of globalization in other studies; thus, it is essential to take this into consideration while investigating the ramifications of globalization on the environment.

According to Rudolph and Figge (2017), globalization and economic development are unrelated. A positive correlation was discovered between EP and economic growth, the non-linear component of economic development, and energy usage. By analyzing data from the United States, Solarin et al. (2018) discovered that both GDP and energy had a positive marginal influence on EP. The authors based their work on these results. There was a discussion of the BRICS and the EKC. Studying the impact on economies along the Belt and Road, Saud et al. (2020) discovered that globalization and economic growth boost EP in particular countries but reduce EP in others. These results are from a study due to be released in 2020.

Economic expansion (loan to the private sector) and rising carbon emissions in India were studied by Sehrawat et al. (2015) using ARDL and VECM. They concluded that there is a link between the two and that it does lead to higher levels of carbon emissions. Financial development (domestic lending to the private sector) was shown to exacerbate carbon emissions in India in research conducted by Shahbaz et al. (2015) using the Bayer-Hanck cointegration test and ARDL. Using the Bayer-Hanck cointegration test and ARDL, the authors of this research were able to deduce the relationship between India's economic growth and carbon emissions. Shahbaz et al. (2016) employed NARDL to look into the unequal impact of Pakistan's economic growth on its carbon emissions and found similar results. The stock market and the index of financial development based on banks were determined to harm environmental quality. NARDL released these results.

In India, Boutabba (2014) used ARDL and the Granger causality test to find that increasing levels of financial growth (domestic loans to the private sector) correspond with increasing levels of carbon emissions; this relationship is one-way. A rise in financial growth, as measured by domestic credit given by banks to the private sector, is associated with a rise in carbon emissions from the transportation, oil, and gas sectors in Malaysia, as reported by Maji et al. (2017). Al-Mulali et al. (2015a) employed the cointegration test and FMOLS to examine the connection between financial development and carbon emissions in 129 nations. They found that financing to the private sector at home was associated with increased pollution levels. They utilized this result as a stand-in for economic progress and discovered that it was correlated with increased pollution. Greater financial depth (the ratio of loans and deposits to GDP) was linked to higher carbon emissions in a study of 29 Chinese provinces conducted by Hao et al. (2016) using the system-GMM.

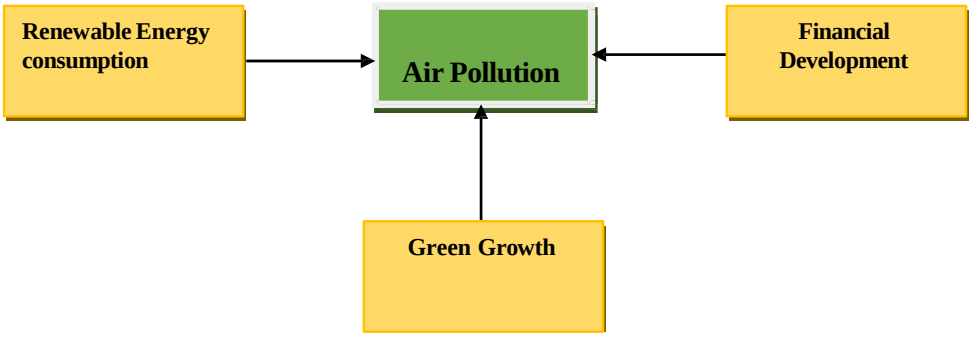
There was also evidence of a U-shaped relationship between economic growth and carbon dioxide emissions. Between 2000 and 2015, Acheampong (2019) analyzed the impact of economic development on carbon emissions in 46 nations throughout sub-Saharan Africa using the system-generalized approach of moments. These nations were located all across the African continent. The research concluded that money, domestic credit to the private sector, and banks' domestic credit to the private sector lead to increased carbon emissions when several financial development indicators are

utilized. In contrast, FDI, liquid liabilities, and domestic loans to the private sector from the banking sector all help bring down emissions. These results were uncovered when it was discovered that private sector lending from banks and domestic credit from broad money contribute to increased carbon emissions.

According to the study's findings, foreign direct investment (FDI) does not affect energy utilization or emissions, although it does assist in slowing economic growth and lowering carbon emissions. While the first three signs of economic expansion—broad money, domestic credit to the private sector by banks, and domestic credit to the private sector by the financial sector—all work to slow economic growth and decrease emissions, total money works to slow energy consumption and boost emissions. The determinant of economic growth on carbon emissions in 122 countries was analyzed by Ehigiamusoe and Lean (2019) using FMOLS and DOLS for the period 1990-2014. Overall, they determined that economic growth contributed to higher carbon emissions. A paper based on their findings was just published in Environmental Research Letters. High-income nations saw a drop in their carbon emissions after the study's findings were released, as expected. Meanwhile, countries with poor and moderate incomes saw a rise in their carbon emissions.

Figure 1.1: Conceptual framework

Conceptual framework



The growth of the global economy may worsen several problems, one of which is global warming. In order to determine the same level of gross domestic product (GDP), more energy consumption would be required (Sadorsky, 2010). Scientists

from all over the globe have investigated the potential connection between expanding economies and increased carbon emissions, but their conclusions have needed to be more coherent and consistent (Boutabba, 2014). According to the study conducted by Abbasi and Riaz(2016), expansion of the financial sector is connected with increased rather than decreased levels of carbon dioxide emissions. It has also been shown that the growth of the financial sector has significantly affected ecosystems (Shahbaz, 2016).

According to the findings of Bekhet et al. (2017), the other countries of the Gulf Cooperation Council, except the United Arab Emirates, produce relatively high levels of emissions, the primary cause of which is the financial sector. The authors of research carried out by Kahouli (2017) and afterward corroborated by Tariq et al. (2017) concluded that economic growth and emissions are connected in both directions. The researchers saw a consistent trend in various settings, but it was always in the same place. According to the study conducted by Baloch (2018), the example of Saudi Arabia demonstrates that the unpredictability of economic development does not produce a rise in carbon emissions. The research conducted by Riti (2017), on the other hand, indicates that a rising economy may assist in reducing carbon dioxide (CO2) emissions. However, Salahuddin (2017) discovered that economic development in the case of Kuwait had no impact whatsoever on the country's emission levels. The four basic ideas supporting the energy development nexus have been the subject of much scholarly investigation (growth, conservation, feedback, and the neutrality hypothesis). These projections support the theory that rising populations need more energy use (Shahbaz et al., 2012; Alper & Oguz, 2016). The theory of economic growth states that energy consumption shifts cause GDP variations.

The conservation hypothesis shows how economic expansion depends on energy availability; therefore, if we can improve efficiency and productivity, we may be able to lessen our impact on the natural world. According to the feedback theory, an expanding economy and an accompanying rise in energy consumption are mutually reliant on one another. When renewable energy sources are generated and used, there is a decreased dependency on fossil fuels. Therefore, developments in energy technology may contribute to the economy's expansion. The relationship between renewable energy and economic expansion has been the subject of many previous

empirical investigations (Azlina et al., 2014; Halkos & Tzeremes, 2014, Ocal and Aslan, 2013). Bhattacharya et al. (2016), Destek (2016), Amri (2017), Saad and Taleb (2018), and Troster et al. (2018) all delve deeply into the connection between renewable energy adoption and economic development (2018). Alvarez-Herranz et al. (2017), Liu and Bae (2018), Pata (2018), Lorente and Alvarez-Herranz (2016), and Hao et al. (2021) are just some of the researchers who have stressed the importance of economic development, technological progress, and the use of renewable energy sources in enhancing environmental quality.

In order to succeed in achieving the Millennium Development Goal, we must recognize the significance of the role played by the current energy infrastructure. Energy substantially influences the economy's growth, the production of new jobs, the distribution of goods, and international commerce (Karekezi et al., 2012). International agreements to address climate change are a step in the right direction. However, they burden national economies, which must decide whether to prioritize economic development or energy conservation in their attempts to limit carbon dioxide emissions. Since the economy, energy, and the environment are all intertwined, tackling each individual will not get us very far toward achieving sustainable economic growth. According to the Renewable Global Status Report 2017, the United Nations and the Paris Climate Change Conference have established several sustainability goals. These goals include the reduction of global warming, promoting sustainable development, using alternative energy sources, and green growth (Renewable Global Status Report 2017). This year's Renewable Global Status Report emphasizes the following four areas: (Renewable Global Status Report 2017). More empirical research is required on the connection between green growth and carbon dioxide emissions, as well as other essential factors, to shed additional light on the conversation surrounding environmental protection and sustainable development goals. This will make it possible to have a deeper comprehension of the challenges at hand.

The fundamental objectives of sustainable development were to prioritize environmentally friendly economic growth and to forestall a rise in the average world temperature of more than 2 degrees Celsius over its pre-industrial level. Both of these objectives were quite ambitious in terms of their breadth. More research must be done

on the linkages between energy use, carbon dioxide emissions, the economy's growth, and ecologically sustainable growth. Recent research on the connection between economic development and emission reductions has placed a significant amount of emphasis on the concept of "green growth." Sohag et al. (2019) and Hao et al. (2021) are two of the most recent studies investigating the links between environmentally friendly growth, energy consumption, GDP growth, and CO2 emissions. Both of these studies were published in 2019.

Specification of the Model

The term "model specification" refers to the method of choosing the variables that will be implemented in a particular model (MacCallum, 1995). It could be beneficial to include all relevant variables in the model definition; however, doing so might cause the statistical power of the model to decrease. Consequently, to investigate the relationships between air pollution, green growth, consumption of renewable energy sources, and financial development in Asian nations, we have developed the econometric model formulation that will be discussed further below.

$$API=F[FDI,REC,GGI] \quad (1)$$

API is an indicator of air pollution and is therefore specified as a dependent variable in the preceding equation. When discussing the index of financial development, however, we use the term FDI to refer to the independent factors. The Renewable Utility Renewable Energy Consumption Index (REC) and the Green Growth Index (GGI) are two measures of environmental performance. In effort to remove the prospect of heteroscedasticity, the natural log is applied to every one of these variables' sets of data. The empirical formula might be expressed as follows:

$$API=\beta_{(0)}+\beta_1 〖FDI〗_{iq}+\beta_2 〖REC〗_{iq}+\beta_3 〖GGI〗_{iq}+\mu \quad (2)$$

Where β0 and β1-3 are the intercept and coefficients of the variables respectively, and i indicates the country and q represent time period.

CHAPTER IV

Methodology

Introduction

This section of the study thoroughly explains the multiple methods, processes, and procedures used to collect the data necessary for the analysis. The research paper was prepared in such a way as to achieve its goals. Here, we'll also review the statistical methods used to evaluate the data collected during the research. These statistical approaches were used in order to evaluate the information that was acquired. In the process of analyzing the study's data, several methods were used.

Methods of Sampling from the Population

The individuals or locations that will serve as the focus of a research endeavour are referred to as the "population" of the study (Chu & Ke, 2017). This indicates that the number of individuals that make up a study population might range from tens of thousands to millions. Researching the whole population presents a challenging set of challenges due to the presence of such elements. Consequently, several sample procedures are created to account for these complexities (Chu & Ke, 2017).

In this particular study, the research population consisted of thirty-one (31) nations whose economies are located in Asia. On the other hand, due to the significance of employing secondary data, only thirty-one (31) Asian nations were chosen to participate in this investigation since the other countries lacked the necessary secondary data to carry out this research. As a consequence of this, secondary data from thirty-one (31) Asian economies were gathered and analyzed to determine the nature of the links that exist between independent factors and dependent variables.

Sources of the Data

The objective of this study is to analyze the links between Financial Development, Renewable Energy Consumptions, Green Growth and Air Pollution within thirty-one (31) Asian economies namely, Japan, the Korean Democratic People's Republic, Saudi Arabia, Singapore, Bangladesh, China, Indonesia, Iraq, Iran, India, Lebanon, Malaysia, Myanmar, Pakistan, Qatar, the Philippines, Thailand, the

United Arab Emirates, Jordan, Vietnam, Turkiye, Bahrain, Brunei Darussalam, Cambodia, Mongolia, Sri Lanka, Tajikistan, Yemen, Syria Uzbekistan, and Lao People's Democratic Republic for the period 2010 to 2019. To attain this, annual data (secondary data) of financial development index (FDI) and renewable energy consumption (REC) were collected from database of World Bank Development indicators (WDI) and green growth index (GGI) and air pollution index (API), were collected from Organization for Economic Co-operation and Development (OECD) in order to make this work successful.

Definition of the variables

Table 2.1: Definition of the variables

Variables	Definition	Sources
Renewable energy consumption index (REC)	The proportion of a year's total energy consumption that originates from Environmentally friendly sources.	World Development Indicators (WDI)
Index of Financial development(FDI)	The pace of loan increases, capitalization of stock markets, savings, etc.	World Development Indicators (WDI)
Index of Green growth index(GGI)	"Relating to promoting economic growth and development while guaranteeing that natural assets maintain their capacity to provide the resources and environmental services upon	Organization for Economic Coperation and Development (OECD Statistics)

	which our quality of life depends. It is also about encouraging creative thinking and financial risk-taking that leads to steady expansion, keeps economies growing, and gives birth to new possibilities. (OECD, 2011).	
Air pollution index (API)	When it comes to air pollution, fine particulate matter (PM2.5) is the worst offender. The risk of respiratory and cardiovascular diseases increases dramatically with prolonged contact (WHO, 2018).	Organization for Economic Co-operation and Development (OECD Statistics)

Econometric Model

Panel Unit Roots

The panel unit root test is used to ascertain the patterns of integration and cross- sectional interdependence shown by the variables in question before selecting an econometric model to apply in the empirical research. Before settling on an econometric model to use, this step was carried out. In addition to the panel unit root test that Im, Pesaran, and Shin produced, we also employed the cross-sectional augmented Dickey-Fuller test that Pesaran(2004, 2007) created. Both of these examinations came out positive. In order to work accurately, both the CIPS and the CADF tests place a significant amount of weight on the presumption that there is a cross-sectional dependency. In this experiment, the alternative hypothesis is evaluated in contrast to the null hypothesis, which postulates the existence of a unit root. Each

variable is non-stationary at the level, but at the first level, when it becomes stationary, if it is necessary at that level, it is non-stationary. At this level, each variable is non-stationary. This finding supports the hypothesis that, over time, these variables are considerably cointegrated by providing evidence that the hypothesis is consistent with the data. First-generation panel unit root tests should not be relied upon since the sample data include cross-sectional dependencies that make them invalid. As a result of the cross-sectional dependency shown by Pesaran(2007), the unit root test of the second generation was applied to the data in this study.

The equation in its most basic form, ε_σq with functioning as the independent variable, is written as follows:

$$\varepsilon\_\sigma q=(1-\varepsilon\_(\sigma\ ))\ \tau\_\sigma+\tau\_\sigma\ \varepsilon\_(\sigma,z-1)+N=1,\ldots,O;N=1,\ldots..,Q \quad (3)$$

Where ε_σqmeans the error term, which may be expressed as the function of the common factor's hidden function.

$$\varepsilon\_(\sigma q\ )=N\_\sigma\ K\_q+\mu\_\sigma q \quad (4)$$

As ε_σqrepresents a variable that differs depending on the nation, and as a result, we get the following equation 5 from the previous one (Equation 3).

$$\nabla\varepsilon\_\sigma q=\beta\_\sigma+\partial\_\sigma\ \varepsilon\_(\sigma,z-1)+N\_\sigma\ K\_q+\mu\_\sigma q \quad (5)$$

Therefore, we use a method called the CADF panel unit root test to check for trends in the data.

$$\nabla\varepsilon\_\sigma q=\beta\_\sigma+\partial\_\sigma\ \varepsilon\_(\sigma,z-1)+d\_\sigma\ \ [\![\nabla\alpha]\!]\ \_q+\mu\_\sigma q \quad (6)$$

The integration order is determined using the OLS estimator∂_σ, which is predicated on the null hypothesis that there is no stationary association with each series in equation (6). The econometric expression for CADF t in statistics is given by the following equation (7).

k_k (T,K)= (∇∃y´_θ M¯_(m kθ-1))/(π_σ (y´_θ M¯_(m^k θ-1)) (7)

The following CIPS tests need critical values and simulations, all of which are derived from the aforementioned basic equation (7).

CIPS(T,K)= k¯= T^(-1) ∑_(σ=1)^K▒ 〖k_σ (T,K) 〗 (8)

Westerlund Cointegration Test

In the presentation of Granger's causality analysis that was done by Westerlund (2007), the need for identifying whether or not the variables in question are stationary about one another in order to evaluate the possibility of variable cointegration is stated. This is because one has to know whether or not the variables in question are co-integrated. In order to complete a test for panel cointegration, Westerlund (2007) suggests beginning with the presumption that cointegration does not take place (the "null hypothesis"). In this particular idea, it is presumed that the panels have no connection. As a consequence of this, the Westerlund panel cointegration test does not require a standard component; rather, it presupposes the existence of error correction for both individual panel members (Gt & Ga) and the panel as a whole. In other words, the test does not require a standard component because it assumes the existence of error correction. This is a result of the fact that it is based on the concept that the presence or absence of a standard component is only one of many confounding variables that may alter the test findings. This is because it is predicated on the idea that the presence or absence of a standard component is only one of many. This is the case because the test was intended to consider the presence or absence of a standard component as only one of many different ways to determine whether or not a standard component is present. As a result, this is the reason for the current situation. In other words, the test was designed with the possibility of a non-standard component (Pt and Pa) in mind. The strategy is notable because it lays a greater emphasis on structure than on residual dynamics; consequently, it is resistant to the influence created by confounding factors. As a result, the strategy is unique (Zhang et al., 2022; Ibrahim et al., 2022). The following equation represents the econometric model utilized for the cointegration test that Westerlund, (2007) carried out in its mathematical form.

Panel ARDL Approach

The maximum likelihood estimate (MLE) was applied, and the groups that were determined to exist were referred to as "Mean's Group (MG)," "Pooled Mean Group (PMG)," and "Dynamic Fixed Effect (DFE)" by Pesaran (Pesaran, 1999). In the next part, we will talk about the PMG model, an error correction model that falls into that category due to its use of panel regression.

〖API〗_ik=ρ_t+∑_(f-1)^q1▒〖λ_ij 〖FDI〗_(ik-t)+ 〗 ∑_(f-1)^q2▒〖μ_ij 〖REC〗_(ik-t)+∑_(f-1)^u3▒〖θ_ij Q_(ik-t)+ ϵ_(ik) 〗〗

Where Z is a positive integer representing the total number of nations taken into account, to express the passage of one year, we write f=1, 2, 3, 4,..., t. The delay times are denoted by the symbol [f]. Lag variables are denoted by [t] for the dependent variable and I for the independent ones. There are many indices being examined in this study, including the Air Pollution Index (API), Green Growth Index (GGI), Renewable Energy Consumption Index (REC), Financial Development Index (FDI), and I, an error term with a "fixed influence" on the other indices. As a means of rearranging equation (2), Pesaran, Shin, and Smith rewrote it as follows (Pesaran et al., 1999):

〖API〗_ik=ρ_t+δ 〖API〗_(ik-1)+ϕ_α B_(ik-1)+∑_(f-1)^(q-1)▒ϱ_f1 〖API〗_(ik-2)+∑_(s=1)^(j-2)▒ϖ_jq^ι B_(ik-2)+ϵ_ik

Whereγ= -2[2-∑_(f=1)^q▒ω_jq],δ_jq=∑_(s=1)^j▒δ_jq ,ω_jq

=-∑_(z=m+1)^q▒〖ω_mn,〗 ψnumbes from 2 to F-1,and δ_jq

=-∑_(z=m+1)^t▒ω_mn ,ψ=numbers from 2 to J-1.

Equation 5 is modified using the error correction algorithm and parameters that categorize the levels.

〖API〗_ik=ϑ_j { 〖API〗_(ik-1)-φ_1 B_(ik-1) }+∑_(f-1)^(q-1)▒ϱ_f1 〖API〗_(ik-2)+∑_(s=2)^(j-2)▒〖ϖι_jq B_(ik-2) 〗+ϵ_ik

The estimates are calculated and given in the following way as a direct result of this, which is as follows:

γ _CJP=(∑_(J=1)^U▒ε_k)/U,η_Wcjp=(∑_(j=1)^U▒o_k)/U,ω_wcjp=(∑_(j=1)^U▒π_k)/U,and=λ_wcjp=(∑_(j=1)^U▒λ_i)/U

Where, w=0, ----------, q – 1, γ_CJP=φ

〖API〗_ik= ϕ_1+η_ι [〖API〗_(i,χ-1)-γ_1 〖FDI〗_(j,k-1)-γ_2 〖REC〗_(j,k-1)-γ_3 〖GGI〗_(j,k-1)]

+∑_(f-1)^(q-1)▒τ_j^i ϕ |API_ik |k-1+ ∑_(f=0)^(q-1)▒〖ϑ_1^i ϵ ϕ|FDI_ik |k-1〗 +∑_(f=0)^(q-1)▒δ_2ϵ^(i) ϕ| 〖REC〗_ik |k-1+∑_(f=0)^(q-1)▒ϑ_1^i ϵϕ| 〖GGI〗_ik |k-1

The PMG estimator considers short-term fluctuations but bases its results on the assumption of long-term stability. In the context of the panel ARDL method, the following estimate (the "MG estimator") is provided. Use this calculator to narrow your search by country. In contrast, the PMG approach requires consistent and sporadic participation from a wide range of people. The series length was used to assess the "estimator's" consistency and dependability. As the last component of an estimating procedure known as the "ARDL approach," the "DFE estimator" is a valuable tool. The DFE method employs homogeneity restrictions in the immediate and far future.

Panel Causality Tests

Although the panel ARDL coefficients can give valuable insights, they do not indicate the causal link between the indicators that are the subject of the investigation. Additional knowledge of the causal relationship is required if policymakers are going to be able to develop successful policies. In order to determine whether or not there

was a link between the series, Dumitrescu and Hurlin (2012) came up with the "Granger Casualty test." The purpose of this examination was to conclude whether or not there was a connection between the series. In circumstances in which "T > N or T N," the test can discern between "heterogeneous and imbalanced panels" (Dumitrescu & Hurlin, 2012). The Monte Carlo simulation illustrates how reliable the statistics are in models that only use tiny datasets. The "heterogeneous linear model" was the primary focus of our attention throughout this particular investigation.

ρ _(i,k)=b_i+∑_(k-1)^μ▒δ_(i)^μ Z_(i,k=n)+∑_(k-1)^μ▒ ⟦ σ^(μ) i ⟧

Y_(ik=n)+ϵ_(i,k)

In the equation shown above, Z and Y are observable variables for k time and nations. It is expected that both σ_(i)=(σ_(i,……)^1 σ_(i)^N)and bi remain the same throughout. In the context of this method of testing for non-causation, the "null hypothesis" states that there is no connecting link between any of the panels. In comparison, the alternative hypothesis operates on the presumption that there is at least one cause associated with the panels. This hypothesis is expressed in the following form:

H_o=σ_i=0 for ϱ_i=1,…….μ

H_o [σ_(i= b_i=1,2,…..μ)⦈(σ_(i≠b_i=) μ_(1)+1,μ_2+2…..,to μ)]

CHARPTER V

Study Findings and Discussion of Test Results

Introduction

This chapter will examine the evaluation of all of the tests conducted for this research, as well as the sources used for those tests. Testing on Panel Unit Roots, Results from Panel Cointegration tests, Results from a Panel Causality Analysis and Utilizing an ARDL Panel Method are some of the tests that were conducted in the course of the research for this thesis.

Tests on Panel Unit Roots

It was found via this investigation that the correlation matrices vary widely from one another. Slope heterogeneity effects were considered in all of the models, which indicates that Asia's economies are all at the same level of development and sophistication. This study's conclusion was written as a paragraph summarizing the study's findings. The next step in our investigation is ensuring each variable maintains its previous value. In light of this, we used a right panel robust stationary test of the cross-sectional Pesaran and Shin (CIPS) and augmented Dickey-Fuller (CADF) unit-root tests. In contrast to the PP and KPSS stationarity tests, the CADF and the CIPS unit root tests have been shown to function very well when applied to panel data that a heterogeneity model with autoregressive coefficients accompanies.

In addition to this, it has excellent control over cross-sectional dependency. Both the CIPS and the CADF unit-root tests have been experiment tally proven to work effectively with panel datasets, taking into consideration the objections that have been leveled against them. The variables became stable at I with a significant difference of 5% when the first difference was applied with constant and trend to the estimated model. The analysis shows that the GGI and FDI approximate variables were stationary at levels [I (0)] for CIPS unit root tests. On the other hand, all CIPS and CADF unit-root test variables were not fixed at levels [I (0)]. When evaluating CADF unit root tests, this indicated that variables like GGI, REC, FDI, and API in the economies of Asia all have the same steady trends of I (1). These patterns are represented in Table 2 and can also be found in the table.

Unit Root Test Results

Table 3.1: Unit Root Test Result

Unit Root Test Results				
Variables	**Level**		**First Difference**	
	CIPS	**CADF**	**CIPS**	**CADF**
GGI	-5.12*	-1.190 [0.0]*	-2.569*	-2.569 [0.00]*
REC	-1.870	-1.731 [0.225]	-2.512*	-2.181 [0.02]*
FDI	-3.24*	--4.87 [0.03]*	-2.243*	-2.243 [0.01]*
API	-1.374	-8.752 [0.61]	-3.863*	-1.922 [0.00]*
Please Note: *,** and *** signify1%, 5% and 10% levels of significance.				

Source: (Author's Computation)

Results from Panel Cointegration Test

Once the Pesaran CIPS and CADF unit-root tests have been shown to have stationary qualities, the cointegration strategy may be implemented. When the results of the Pesaran CIPS unit root test are considered, GGI and FDI become stationary at a level. This eliminates the possibility of using OLS as a technique for determining whether or not the two variables are cointegrated. In order to do this, Westerlund (2012) developed a methodology known as cointegration. The results of Westerlund's (2012) cointegration test are shown in Table 3. The cointegration test developed by Westerlund (2012) is a reliable means of detecting and correcting errors. They used statistical estimators of fit quality, such as the Schwarz Bayesian Information Criterion (SIC), as well as the Akaike Information Criterion, to locate the optimal lag time between the variables (AIC). When there is a constant intercept but no apparent trend, the AIC criteria are used to choose the model that is the best fit for the data (Kirikkaleli et al., 2021).

Table 3 presents a comparison between the Z-value estimations made by Westerlund (2012) and the significant values discovered both within each group (Gt and Ga model) and generally speaking (Pt and Pa model). Ga (-2.118, P<1.00) and Pa (1.-980, p <0.976) some factors, including cross-section dependency, serial correlation, and heterogeneity, point to the possibility of cointegration being present. This illustrates that the calculated variables are connected in dynamic cointegration equilibrium over the short and the extended period. And at a conclusion, we find that Pa/T = (1.-980)/11 = -0.18 is the value of the coefficient of the lagged error correction term (ECM) in our model. Equilibrium long-run cointegration with the calculated variables in Asian economies is thus represented in Table 3 and suggests that any short-run disequilibrium will be addressed at 18% annually.

Westerlund panel cointegration results

Table 4.1: Westerlund panel cointegration results

Westerlund panel cointegration results			
Statistic	Value	Z-Value	P-Value
Gt	-4.332	-14.259	0.000
Ga	-2.118	5.074	1.000
Pt	-9.779	-1.867	0.031
Pa	-2.024	1.-980	0.976
Notes: ** refer significant at 1%.			

Source: (Author's Computation)

Utilizing an ARDL Panel Method

To evaluate the short- and long-term connection between air pollution, green growth, consumption of renewable energy, and financial advancement, the author first verified the co-integration of the sequence by utilizing the Pooled Mean Group (PMG) estimator. This was done so that the author could evaluate the relationship. Estimations of the P-ARDL obtained via the use of the PMG, MG, and DFE techniques are shown in Table 3. The findings of the Hausman specification test indicate that the "homogenous constraint" in the "long-term balance" is significant; hence, it is recommended that the coefficients be computed using PMG estimation as the method of choice.

The findings indicate that green growth negatively impacts air pollution in the short and long term, with a 1% increase in green growth decreasing air pollution by 0.956% in the short run and 0.136% in the long run, respectively. The conclusions of the first inquiry have been verified by a second investigation (Sowah & Kirikkaleli, 2022). To efficiently enforce environmental rules, sustainable development is vital. In this light, regulatory implementation demonstrates how significant green growth is in supporting economic growth and development while ensuring that natural assets continue to provide the resources and environmental services that are essential to our well-being. The development of the economy in a way that is accountable to the environment is sometimes referred to as "green growth." It is predicated on the notion that economic growth must be decoupled from the use of resources and their harmful environmental consequences for as long as that expansion continues to be the primary goal. As a result of this, the ideas of low-carbon or sustainable development, as well as the green economy, are very closely connected to the notion of green growth. The move to renewable energy sources is a crucial component of environmentally responsible growth. The proponents of green growth say that when correctly implemented, green policies may create job prospects in industries such as green agriculture, sustainable forestry, and renewable energy sources. Suppose the appropriate laws are put into place. In that case, the shift toward a more environmentally friendly economy might result in the creation of 24 million new jobs throughout the globe by the year 2030 (Tobias, 2017). If we do not transition to a green economy, heat stress may cause the loss of 72 million full-time jobs by the year 2030. Additionally, higher temperatures would reduce the number of hours people could spend working in various industries, the majority of which would be agriculture (UN labor agency, 2018). Even though there is some empirical evidence to the contrary, the author of this thesis contends that investment in green growth technologies can help millions more people escape poverty, provide better livelihoods, and have a positive impact on the environmental quality in Asian economies (Mertens et al., 2021; Griffith-Jones & Ocampo, 2018).

According to the PMG estimate, it was also discovered that long-term consumption of renewable energy had a negative impact on environmental air pollution, with a 1% increase in renewable energy consumption resulting in a 1.07% reduction in environmental air pollution for every 1% increase in renewable energy consumption. This discovery supported the conclusions that Liu et al. (2023) and Kirikkaleli and

Adebayo had previously discovered (2020). Using renewable energy sources results in the creation of new energy at a quicker pace than the rate at which the source is depleted. To provide just two examples, the sun and the wind are two of the numerous natural sources of energy that exist in the natural world. There are many different types of alternative sources of energy. In most nations, the cost of renewable energy sources has decreased, and their employment potential is three times more than that of fossil fuels. When the burning of fossil fuels creates electricity, greenhouse gases such as carbon dioxide are released into the atmosphere. This makes the issue of climate change much more complicated.

It is necessary to transition away from fossil fuels, which are responsible for the vast bulk of emissions, and toward renewable energy sources to achieve long-term success in the fight against air pollution. The PMG projections for the use of renewable energy result in an increase of 2.011 % in air pollution for the same 1 % short-term volatility. Those less fortunate in the rural parts of Asia's economy depend on renewable energy sources such as biomass for basic survival needs such as cooking, lighting, and warmth. These necessities are met with the help of biomass. The release of greenhouse gases is a natural consequence of biomass conversion to power. Large-scale expansions of forest and bio energy plantations have the potential to cause deforestation, changes in land use, and increased air pollution. As a consequence, the usage of these resources should be strictly regulated in order to minimize these unfavourable results.

In addition, the PMG's P-ARDL estimates for financial development demonstrate a temporary link to air pollution levels in the atmosphere, which is a pleasant surprise. For every 1% shift in financial development, there is a decrease in linked air pollution of 1.020 % in the short term and 9.11 % in the long run, respectively. Additional evidence for this may be found in Mia et al. (2022) and Adebayo (2022). The expansion of a nation's financial sector is directly proportional to the number of companies in that nation that are engaged in the buying and selling of financial claims. Growth in the financial industry may be attributed to reduced adverse effects caused by information, enforcement, and transaction costs brought about by financial instruments, markets, and intermediaries. Because of this, the financial sector can perform better the critical functions it plays in the economy.

It does this through increased investment and productivity, which in turn creates more income; it does this by allowing risk management for poor and vulnerable populations, making them less sensitive to shocks. Both of these factors contribute to a reduction in poverty and inequality. Since this is the case, the investment in resources that may be used to produce fossil fuels adds to the deterioration of air pollution in the nations of Asia. These findings imply that more than the development of the financial sector alone will be required to solve the air pollution problem; additional elements are required. Furthermore, the increased technological progress that facilitates and encourages foreign capital inflows into investments in green technologies may eventually reduce air pollution.

Lastly, the PMG ARDL estimate shows that the constant term has a positive relationship within the MG 11.107% in the long term, while the PMG has a negative relationship in the long term as -3.413% and the DFE also shows a negative relationship in the long term as -1.321%. This result further coincide with the following researcher (Isiksal, A. Z., & Assi, A. F. 2022), Naimoğlu, M. (2022), Tajaddini, R., & Gholipour, H. F. (2021), Isiksal, A. Z., Assi, A. F., Zhakanov, A., Rakhmetullina, S. Z., & Joof, F. (2022), Olayungbo, D. O., & Quadri, A. (2019).

Model Results [PMG-ARDL]

Table 5.1: Model Results [PMG-ARDL]

Model Results [PMG-ARDL]						
Variable	MG		PMG		DFE	
	Long term	Sort Run	Long term	Sort term	Long term	Sort term
ECT	-1.183 [0.00]*		-0.680 [0.00]		-0.767 [0.00]*	
FDI	-3.279 [0.72]		-9.11 [0.03]*		-0.305 [0.00]*	
REC	-11.37 [0.02]*		-1.07 [0.00]*		-0.148 [0.07]*	
GGI	18.78 [0.01]*		-0.136 [0.00]*		-0.359 [0.02]*	
FDI		-10.61		-1.020		-0.234

	[0.07]	[0.00]	[0.00]*
REC	-9.536 [0.08]*	-2.011 [0.04]*	-0.015 [0.89]
GGI	-5.322 [0.03]*	-0.956 [0.05]*	-0.219 [0.01]*
Constant	11.107 [0.00]*	-3.413 [0.008]*	-1.321 [0.006]*
Hausman	0.412 [0.824]		2.671 [0.007]*
Observations	279	279	279
Notes: ECT: Error Correction Term. *, 5% is the threshold for statistical significance. The coefficient's value is not in parentheses.			

Source: (Author's computation)

Results of a Panel Causality Analysis

Table 5 explains the results of the causality test conducted by Dumitrescu and Hurlin (2012). The table also provides the results of the causality test. It was first proposed that the causality test results should inform efforts to improve environmental conditions in Asian countries. Determining the nature of the relationship between environmental variables and air pollution required the application of the Granger causality panel techniques. The causality test estimator developed by Dumitrescu- Hurlin (2012) is a standardized edition of the Granger causality panel procedures. This research on Asian economies looks at the effects of three distinct factors: green growth, renewable energy consumption, and financial development. It was shown that all three of these variables are linked to air pollution that is mutually reinforcing. Forecasts that are both positive and significant for green growth, financial development, and consumption of renewable energy give reliable and trustworthy projections for the reduction of air pollution in countries with Asian Economies. Therefore, if Asian countries are serious about helping the environment, they should emphasize using renewable energy sources, sustainable economic growth, and overall economic development. The results in Table 5 demonstrate that this conclusion is consistent with the findings obtained from the empirical study by (Wang, Chang, Sari, Sowah, & Cai, 2020).

Dumitrescu & Hurlin panel causality results

Table 5.1: Dumitrescu & Hurlin panel causality results

Dumitrescu & Hurlin panel causality results				
Hypothesis	W-stat	Z-bar	Z-bar tilde	Conclusion
AP-FDI	5.648	18.30 [0.00]*	6.88 [0.00]*	Bidirectional
FDI- AP	2.517	5.975 [0.00]*	1.68 [0.09]*	
AP- GGI	6.722	22.52 [0.00]*	8.66 [0.00]*	Bidirectional
GGI- AP	4.213	12.65 [0.00]*	4.50 [0.00]*	
AP- REC	2.762	3.502 [0.00]*	6.61 [0.00]*	Unidirectional
REC- AP	3.415	10.05 [0.90]	4.30 [0.60]	
Please Note: ** refer significant at 1%.				

Source: (Author's computation)

CHAPTER VI

Conclusion and Recommendation

Introduction

Improvements in environmental quality have the potential to be of great aid in the movement toward better environmental sustainability. This study examines the elements that contribute to air pollution in Asian nations, including green growth, financial development, use of renewable energy, and air pollution. After analyzing the empirical data provided in the previous chapter, this chapter will summarize the study's results, make policy judgments, and recommend ideas for more research.

Study's Conclusion

One of the most significant concerns for environmental policy in the modern era is to solve the issues presented by air pollution, particularly if one intends to attain the goals linked with Sustainable Development Goals 7, 12, and 13. Considering its significance, the fundamental objective of this research project was to analyze the effect that green growth, consumption of renewable energy sources, and financial development had on the level of air pollution in Asian economies. Air pollution still significantly affects the nation, as it is in many other Asian countries. As a consequence of this, government officials in Asia have been conducting in-depth research on the many factors that have the potential to contribute to a reduction in the region's dangerously high levels of air pollution. To analyze the relationship between the estimated variables, this thesis uses panel data covering Asian economies from 2010 to 2019. Assessing the influence on air pollution must consider several factors, including renewable energy sources, green development, and economic expansion. The research presented in the thesis produced new models based on the applicability of various fields to accomplish the study's objectives. Improved accuracy was achieved by the use of second-generation Panel modeling of Pesaran CIPS and CADF unit-root tests, Mean Group (GM) and Pooled Mean Group (PMG) estimation techniques, Degrees of Freedom for Error (DFE), and the Dumitrescu-Hurlin causality test. In a nutshell, the findings indicate the following: The Pesaran CIPS and CADF unit-root tests were never stationary at I(0), but after applying the first difference, all the series were integrated at I(1), and none of the series were discovered at I(2); the

expected variables have both a short-run and a long-run equilibrium co-integration connection.

Green growth has a detrimental effect on air pollution in the short run as well as the long run, with a 1% increase in green growth resulting in a decrease in air pollution of 0.956% in the short run and 0.136% in the long run; Renewable energy negatively impacts air pollution, with a 1% increase in renewable energy consumption leading to a 1.07% reduction in air pollution. Additionally, financial development has a link with the air pollution that is only short-term. In the medium and long term, a 1% shift in financial development will result in a 1.02% and a 9.11% reduction in relational air pollution. Infers that green growth, use of renewable energy, and financial development have contributed substantially to the reduction of air pollution in Asian countries. The results of this thesis are supported by the findings of further research conducted by Liu et al. (2023), Kirikkalleli and Adebayo (2020), Mia et al. (2022), and Adebayo (2022).

Policy suggestions and recommendation

If Asia's economies find answers to the difficulties presented by climate change, which continues to raise a range of concerns, they will have to work together more than they have in the past. These nations may, among other things, speed the transition of the energy sector toward a more substantial share of renewable sources, which may have ramifications for the policies implemented in these countries. This may have repercussions for the policy. The transition to using renewable energy sources has the potential to bring in an era friendlier to the natural world. More energy can be generated on its own and, over time, will be more beneficial to the growth of economic activity. In addition to this consequence, this is arguably the most cost-effective strategy to lessen the harmful impact that fossil fuels have on the environment, which should result in an improvement in energy efficiency. Because of technological innovation's impact on reducing air pollution, several knowledgeable individuals in the scientific community are at the forefront of expanding the financial sector that embraces technological innovation.

In order to achieve professional talent recruiting strategies commensurate with structural growth, the governments of the nations that make up Asian economies

should devise human resource policies that are both one-of-a-kind and highly effective in response to the technical requirements of the energy sector. Alterations are required in order to bring about an improvement in the technical efficacy of institutions. The findings imply that governments should encourage technological innovation in clean energy because it contributes to developing efficient and affordable energy sources. The phrase "clean energy" refers to energy sources that do not emit harmful pollutants into the environment. In order to lower the number of institutional barriers that stand in the way of implementing energy demand and supply, the government should work to strengthen its energy strategy and policy direction. The regulation of the energy market, the installed capacity of renewable, the effective execution of investments in research and development, as well as public education and awareness of renewable, are all aspects that may help overcome these difficulties. In an energy market with fair playing fields, the objective of energy regulatory bodies may be to encourage renewable energy generation rather than the production of other types of energy. Institutions in Asia must use education to transmit the social component of embracing reble energy sources to ensure the region's long-term prosperity.

Furthermore, this strategy has the potential to result in an improvement in energy efficiency. Emerging nations in Asia should look for other funding sources to support their energy development initiatives. These activities might include energy transitions and building infrastructure for renewable energy sources. This topic is of the highest importance for developing countries in Asia because of the high cost of investing in renewable energy sources. The following is a list of the long-term repercussions that will occur as a direct result of the growing environmental air pollution that has been generated as a direct result of the economic boom in Asian countries: The findings of this study project indicate that an increase in the use of fossil fuels hurts the standard of the environment. Because of this, Asia's countries must ensure that their economies' expansion is supported by the growth that is less harmful to the environment and by renewable energy sources. Environmental quality may deteriorate if the tendency of Asian countries to have excessive population growth is not handled in an ecologically appropriate manner by the region's governments.

If Asian nations are serious about keeping their commitments to reduce greenhouse gas emissions and boost their use of renewable energy sources, they will need to

address the following challenges: strengthening the enforcement of the polluter-pays and user-pays principles; taking into account the effects of environmental damage caused by activities that take place outside the country; improving environmental policies by utilizing economic tools; and maintaining a close eye on the results of these policies. Policymakers can use this result to prioritize policies that support research and development, green innovation, clean technologies, green funding, and renewable energy sources in order to reduce CO2 emissions and, as a result, meet the Goals for Sustainable Development (SDGs) outlined in the United Nations 2030 Agenda, particularly SDG 7 and SDG 13 in their respective cases.

This thesis is one of the few papers that have been produced up to this point on the economic and health sustainability corridor. The argument focuses specifically on the connections between green development, the usage of renewable energy sources, and air pollution in Asian nations. Future researchers may choose to use different indicators for technological innovation than we did, employ different methods, integrate different linked variables into energy and air pollution studies, and concentrate their attention on different sample groups to overcome the limitations of our own research. All these things combined would allow them to circumvent the problems mentioned above. Further research may use time series approaches in light of our focus on macro-level environmental issues. In addition, research might be carried out for well-established countries and growing nations to validate the findings over a more extended period.

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Appendices

NEAR EAST UNIVERSITY

SCIENTIFIC RESEARCH ETHICS COMMITTEE

14.12.2022

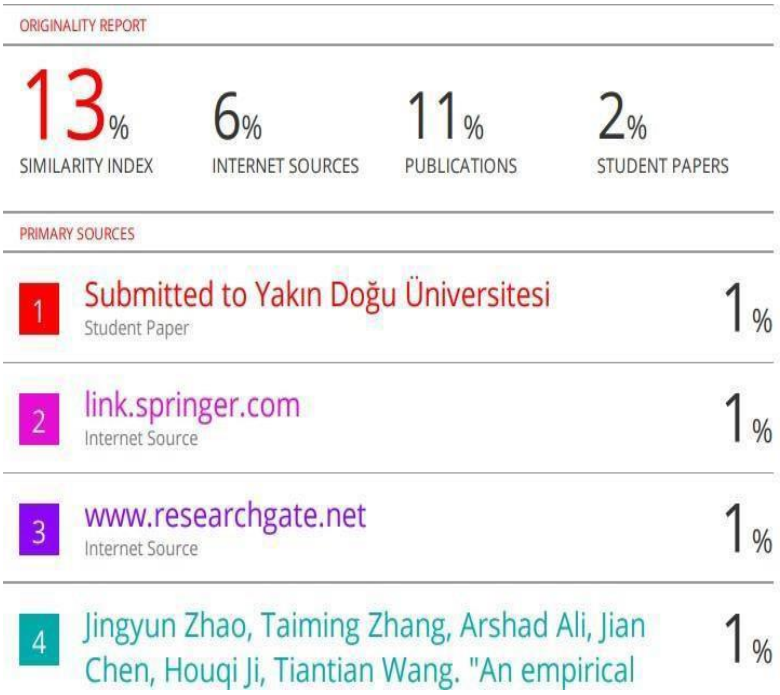
Dear Tarr Bonokai Jackson

Your project **"Assessing the economic and health Sustainability corridor: Linking green growth, renewable energy consumption, financial development, and air pollution in Asian Economies."** has been evaluated. Since only secondary data will be used the project does not need to go through the ethics committee. You can start your research on the condition that you will use only secondary data.

Prof. Dr. Aşkın KİRAZ

The Coordinator of the Scientific Research Ethics Committee

Turnitin Similarity Report



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