NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF ECONOMICS

ENVIRONMENTAL DEGRADATION AT VARIOUS STAGES OF ECONOMIC DEVELOPMENT: AN EMPIRICAL ANALYSIS ON TESTING THE EKC HYPOTHESIS IN SELECTED AFRICAN COUNTRIES

MSc. THESIS

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Declaration

During the time that I spent conducting this study, God Almighty blessed me with the gifts of wisdom, strength, and good health. I want to thank him by devoting my effort to him. I also want to dedicate it to my late father for all the love and support he gave to my siblings and me, as well as to my wonderful family who has been there for me throughout my entire life as a solid support system, and lastly, I want to thank my supervisor for all the hard work and time she put in despite her busy schedule

CHIBUIKEM DIBOR-ALFRED

02/08/2022

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02/08/2022

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Abstract

Environmental Degradation at Various Stages of Economic Development: An Empirical analysis on testing the EKC Hypothesis in Selected African Countries

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July, 2022, 131 pages

The study examined environmental degradation at various stages of economic development: an empirical analysis on testing the EKC hypothesis in selected African countries from (1977- 2019). Analyses based on data gleaned from the World Bank and Nigeria's Central Bank included an Augmented and Philip Peron Unit Root Test, as well as a Dickey-Fuller GLS Unit Root Test. The ARDL and the rest of the ARDL bound tests were employed in the thesis to look for long-term relationships between the variables studied. Analysis of long-term relationships was conducted utilizing several econometric approaches, such as the Normality test, serial correlation LM, heteroskedasticity test, CUSUMsq for the stability of data, and ARDL model for analysis. When it comes to the Kuznets curve, the study found that the U-shape rather than the traditional inverted U-shape was present, contrary to the general Environmental Kuznets Curve concept. There is a significant relationship between the number of carbon emissions that are produced per person in Nigeria and the country's GDP. And this correlation is supported by the fact that Nigeria's economy is strongly reliant on oil, and so requires more Carbon emissions per capita as income rises. The other countries of South Africa, Mauritius, and Seychelles should be aware that as income rises, carbon emissions fall. The report proposes that the UN green objective should be incorporated into Nigeria's and the other three selected nations' economic policy frameworks to ensure that economic growth leads to improvements in environmental quality. Economic progress necessitates a cautious approach by policymakers in dealing with the potentially disastrous side effects of energy use and foreign direct investment.

Keywords: carbon emission, environmental Kuznets curve, economic development, GDP per capita

ÖZ

Environmental Degradation at Various Stages of Economic Development: An Empirical analysis on testing the EKC Hypothesis in Selected African Countries

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Çalışma, ekonomik kalkınmanın çeşitli aşamalarında çevresel bozulmayı inceledi: EKC hipotezini (1977-2019) seçilen Afrika ülkelerinde test etmeye ilişkin ampirik bir analiz. Dünya Bankası ve Nijerya Merkez Bankası'ndan toplanan verilere dayanan analizler, Artırılmış ve Philip Peron Birim Kök Testi ile Dickey-Fuller GLS Birim Kök Testini içeriyordu. ARDL ve ARDL sınır testlerinin geri kalanı, çalışılan değişkenler arasında uzun vadeli ilişkiler aramak için tezde kullanılmıştır. Normallik testi, seri korelasyon LM, değişen varyans testi, verilerin kararlılığı için CUSUMsq ve analiz için ARDL modeli gibi çeşitli ekonometrik yaklaşımlar kullanılarak uzun vadeli ilişkilerin analizi yapıldı. Kuznets eğrisi söz konusu olduğunda, çalışma, genel Çevresel Kuznets Eğrisi kavramının aksine, geleneksel ters U şeklinden ziyade U şeklinin mevcut olduğunu buldu. Nijerya'da kişi başına üretilen karbon emisyonu sayısı ile ülkenin GSYİH'sı arasında önemli bir ilişki vardır. Ve bu korelasyon, Nijerya ekonomisinin güçlü bir şekilde petrole bağımlı olması ve dolayısıyla gelir arttıkça kişi başına daha fazla Karbon emisyonu gerektirmesi gerçeğiyle destekleniyor. Diğer Güney Afrika ülkeleri, Mauritius ve Seyşeller, gelir arttıkça karbon emisyonlarının düştüğünün farkında olmalıdır. Rapor, ekonomik büyümenin çevresel kalitede iyileştirmelere yol açmasını sağlamak için BM yeşil hedefinin Nijerya'nın ve seçilen diğer üç ülkenin ekonomik politika çerçevelerine dahil edilmesini önermektedir. Ekonomik ilerleme, enerji kullanımı ve doğrudan yabancı yatırımın potansiyel olarak feci yan etkileriyle uğraşırken politika yapıcıların temkinli bir yaklaşımını gerektirmektedir.

Anahtar Kelimeler: karbon emisyonu, çevresel Kuznets eğrisi, ekonomik kalkınma, kişi başına düşen GSYİH

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ABBREVIATIONS

ADF	Augmented Dickey Fuller
ARDL	Autoregressive Distributed Lag Model
GDP	Gross Domestic Product
PP	Philips-Peron
EKC	Environmental Kuznets's Curve
MDGs	Millennium Development Goals
WCS	World Conservation Strategy
CBN	Central Bank of Nigeria
CO2	Carbon Dioxide
GNP	Gross National Product
HDI	Human Development Index
WDI	World Data Indicator

CHAPTER I

Introduction

Since the beginning of time, people have endeavored to make their surrounding environment a little bit better by utilizing infrastructural achievements, in the hopes that these will, in turn, lead to growth and possible development; we have witnessed this progression from the Stone Age down to the technological prowess of Generation Z. However, the subject of sustainable development persists. It's a worldwide issue because every country wants to reach these heights, but it comes at a price to the mother country. On the other hand, this study examines how socioeconomic and cultural factors affect the well-being of people living in various stages of development in African countries that are experiencing significant environmental deterioration, as measured by Kuznets' curve. Because of environmental deterioration and reckless use, the health of our planet is in jeopardy. This has resulted in a tremendous issue all over the world, which has far-reaching repercussions not only for our economic and political well-being but also for the health of our planet. Carbon emissions have been connected to persistently unfavorable changes in natural systems throughout the last century as a result of man's inventiveness, as well as proactive institutions and public policies. Reducing the levels of pollution is a priority on the United Nations development agenda, and responsible countries all over the globe are working together to cut emissions through ambitious legislation and collaborative action per this idea of global responsibility. It would appear that all of these efforts have been for nothing as pollution tends to be more prevalent in the world's more impoverished places. The available research implies that wealthy countries have adopted a more proactive approach to averting environmental degradation than less developed countries.

1.1 Background of the study

There has been a great deal of disagreement in economics on whether or not better environmental conditions lead to increased economic activity. In accordance with the Environmental Kuznets Curve (EKC) theory, GDP per capita and environmental quality measures such as CO_2 emission concentrations have an inverted U-shape connection (Gross Domestic Product per capita). The standard of living in country first declines, but after it reaches a certain degree of development; the standard of living starts to steadily improve. The EKC theory was intriguing for a short while because it asserted that it could establish a pollution-free world even at extremely low levels of wealth. This was one of the reasons why it seemed to be enticing. On the other hand, this assertion has been disproven by the evidence. Environmental factors become less of a factor as the economic expansion continues; compared to how significant they were at the beginning of the expansion; yet, this pressure does not lessen as the expansion continues. According to the EKC hypothesis, countries must wait until their GDP per capita reaches a specific level before they can engage in further environmental development and better living standards. This is because the higher the GDP per capita, the more money a country has to invest in these areas. As a direct result of this, organizations are obligated to provide a hand in mitigating the negative effects that increased economic activity might have on the surrounding natural environment. Institutions, according to a wide variety of experts, have the potential to play an essential part in reducing the negative consequences of economic growth on the surrounding environment. According to Yandle's argument, an increase in the overall environmental quality can be attributed to having competent institutions in place that are capable of putting into effect the existing environmental legislation. There have only been a handful of studies done that have investigated the institution's impact on EKC, and each one of them was rather limited. In particular, in Nigeria, academics have generally been remiss in their attention to the significance of institution quality when it comes to issues of environmental sustainability and economic expansion. Specifically, this thesis aims to find out what role institutions play in economic development in Nigeria and other African countries, in line with the EKC hypothesis.

The sustainability of the environment will be threatened if the bulk of the world's economies continues to develop at their current rates. In the name of progress, human beings have caused a lot of damage to the natural world, People, animals, and plants are put at risk. As a result of governments around the world liberalizing, privatizing, and globalizing their economies, the global economy has grown. The environment has been strained by an increase in demand for water, forest land, and air. As public commodities, environmental materials receive little or no protection from the severe rivalry that occurs in the sector because of their quick manufacturing. As a result of the current and potential future effects of various environmental factors, long-term issues may occur. A sustainable economy can meet the current generation's needs without jeopardizing those of future generations, according to economists. As a direct result of this, every nation prioritizes increasing its GDP to better gauge its level of economic progress (GDP). The gross domestic product (GDP) of a country is measured by the total amount of products and services that are manufactured and sold inside that country in a given year. Deficiencies in natural resources are not factored into GDP. As a result of this competition, environmental and resource effects are often disregarded by governments, corporations, and individuals alike (Khed, 2016). In light of this, even though the production of these goods is a major contributor to rising atmospheric carbon dioxide emissions, which in turn leads to global warming (Harrington and McConnel, 2003), a scenario in which CO2 emissions grow in tandem with industrial output is still a possibility. It is a tragedy that people do not give any thought to how they may give something back to the environment in exchange for what it has given them. Is it possible for production and economic growth to continue sustainably even if the installed capacity of environmental resources is being depleted, degraded, or exhausted? Controlling expansion is therefore essential, although this can be accomplished by making use of the restricted economic scale that is currently available.

The generation of greenhouse gases, the loss of biodiversity, and the deforestation of land are just three examples of the accelerating environmental deterioration that has occurred throughout human history. (Nick and Richard 1999) state that there has been an increase in the amount of environmental devastation as a direct effect of FDI. Because of this, it is vital to take the appropriate action to have an understanding of how the effects of private investment on natural resources are caused. The viability of any global economy depends on both inbound direct investments from other nations and the existence of robust markets on a per-person basis. (Hung and Shaw (2006) said that environmental deterioration and economic expansion have been linked, which is supported by previous studies. There has been proof of this correlation. The Environmental Kuznets Curve (EKC) forecasts an early increase in environmental deterioration and pollution, while the Environmental Kuznets Curve (EKC) also anticipates a later increase in environmental resources as a result of economic expansion (2004). Both the Environmental Kuznets Curve and the Kuznets Hypothesis demonstrated that GDP per capita had an impact on the overall state of the environment (also known as the EKC) (EKC). Even if there is no correlation between environmental quality and GDP per capita, there may still be a positive effect.

When looking at the progression of human development, two patterns are important to point out. In the past, certain regions and countries' rates of economic growth diverged significantly from one another. While there has been an overall improvement in health and educational achievement, there has been a concurrent widening of the income gap between different populations within individual countries. Despite the decline in overall poverty, one-quarter of the population of the world continues to live in extreme poverty. It is projected that there were More than 1.4 billion people are projected to be living in extreme poverty in emerging economies. In 2008, as stated in the Millennium Development Goals Report (2012). By the year 2015, those residing in Southern Asia and Sub-Saharan Africa will account for 75 percent of the total number of people living in extreme poverty. The second problem is that as the world's population and wealth increase, Soil and water quality deteriorates along with forest cover and carbon dioxide emissions, among other things. In addition, natural resources are being overexploited. Population expansion, economic development, and social progress are all likely to put pressure on the planet's limited natural resources shortly. There's a chance that these conditions will jeopardize the welfare of developing countries. Poverty is shown to have its downsides (Dasgupta, 2015). While the demographic change is still underway in many emerging countries (low fatality and low mortality). As the world's population grows, natural resources are depleted faster and the environment's quality is degraded faster. Unsustainable growth may be hindered if high birth rates and environmental degradation are linked. The MDGs have fallen short of their goals in terms of economic and environmental sustainability over the long term. In the context of Seychelles, the connection between economic activity and deforestation has been stronger over time. This is because the country has a long history of depending on the export of primary commodities. The production pattern of the country leads the amount of land covered with vegetation to decrease as output increases. The primary goal of this study is to examine ways, in which the economy of various African countries is being negatively impacted, as well as how the quality of the environment and the economy are evolving and how these trends can be compared across nations. As evidenced by this proposal, to achieve development and better efficiency, which in turn supports urbanization, it is required to grow national production at a consistent rate (Henderson, 2003). It is recommended that those in charge of environmental policy look into the possibility of increasing the number of protected areas, nature reserves, and commercial policy measures that are available to combat the expansion of the agricultural frontier. A contentious issue that has been debated in South Africa for a considerable amount of time is how closely high environmental standards should be tied to rising GDP. When a developing nation sets high importance on economic growth and industrialization, it is common for the quality and quantity of that nation's natural resources to also be harmed. The acceleration of the growth of the gross domestic product (GDP) of a country must be the primary emphasis of growth-oriented development programs. Nevertheless, this growth shouldn't come at the price of the surrounding ecosystem in any way. It is impossible to classify as development any kind of innovation that, in the process of being produced, hurts the surrounding ecosystem.

In 1980, the United Nations' World Conservation Strategy (WCS) made use of Brundtland's for the first time; a concept of long-term, sustainable growth has been introduced. Increased industrialization in South Africa results in pollution and waste products, necessitating the implementation of environmental protection measures. If the environment is to be recognized as a resource, then its economic value must be recognized as well. When it comes to growth and development, environmental considerations must be balanced against economic interests to achieve reasonable growth and development without causing unnecessary harm to an already fragile environment.

As a result, the current environmental policies in place in South Africa are intended to make the most of the country's limited resources to their full potential. The participation of the government in the drafting and implementation of appropriate legislation has become increasingly important in this context. According to the GEAR plan, environmental changes are easier to implement when macroeconomic stability is maintained (growth, employment, and redistribution). Because of the country's extreme poverty and high unemployment, South Africa, a third-world country, places a high value on economic development as a means of alleviating the country's difficulties. Another factor to consider for a country with limited financial resources is the desire to earn higher rates of return.

This thesis made use of secondary data from the Nigerian Central Bank's Statistics Bulletin and also as well as worldwide data indicators. A total of 1977 to 2019 worth of data will be used in the research. Throughout this inquiry, data from the years 1977 through 2019 will be used. The anticipated number of observations for yearly data is 43, hence a sample with 43 variables is necessary.

1.2 Statement of the problem

Several environmental issues plague Sub-Saharan Africa, including dwindling habitat, deteriorating soil, eroding landscapes, pollution, and an increase in bug infestations. An underlying misunderstanding of the nature and potential solutions to these problems has hindered attempts to solve them. Conventional wisdom holds that the people of this region are ecologically irresponsible and in need of rescue from the rest of the globe. It attributes all of the region's environmental problems to the rapid growth of the region's population as well as widespread poverty. There is no concrete data to suggest that people in Africa are especially concerned about that until recently, the world community showed little interest in improving environmental quality. The conservation of the environment in sub-Saharan Africa is unquestionably a topic that calls for additional investigation and needs to be incorporated into a comprehensive plan for the region's long-term economic development. It will be difficult to come up with a strategy like this. Nearly every country in this region was losing ground in the final years of the twentieth century on nearly every measure of progress. Before this period of economic difficulty and international marginalization, progress was seen as merely a matter of implementing a Western-formulated plan in the years immediately following independence in the 1960s and early 1970s. As a result of ill-advised policies, the area is today plagued by political instability, an inability to successfully manage its economies, and an increasingly hostile foreign economic environment. It has gotten increasingly difficult to avoid overexploiting natural resources and harming the environment as simply survival has grown increasingly challenging. Examining these predispositions to environmental deterioration can help us better comprehend the entire scope of the problem. This will make it possible to conduct an in-depth analysis of the environmental issues that have been caused by humans in both rural and urban locations, as well as to suggestively compare those issues to those that have been caused simply by nature. When this is accomplished, it will be feasible to examine the issue of environmental protection as a part of the region's sustainable development and to provide recommendations on what roles both the state and international aid should play. We have a unique opportunity to improve the lives of people in this region, as well as their environment, by rethinking our development approach in light of current conditions.

Because of the region's aging population, high foreign debt, and lack of true democracy, environmental degradation is a serious concern in Sub-Saharan Africa. Many social services, particularly in education and health care, were greatly expanded throughout the region when colonial rule was ending. This resulted in a dramatic decrease in newborn mortality and quick population growth. Sub-Saharan Africa's population has more than doubled (570 million) in the last 25 years, and it will more than double again in the next 25 years if the current growth rate continues. If the number of children grows by this much in such a short period, it will place an increased load on those who are responsible for caring for them. Migration to the metropolis (especially by adult males) and other initiatives to supplement family income through non-farm employment have resulted from this. To compensate for the lack of available labor, more labor-saving but environmentally damaging shortcuts have been implemented on the farms in question. Even in forested areas, cleared land is regularly exploited, even though leaving it to lie fallow would increase productivity and reduce environmental deterioration. Lands that are difficult to clear and cultivate have been added to the agricultural landscape in dry land regions.

In addition to the sharp devaluation of national currencies, this has resulted in the layoff of a significant section of the workforce. Survival agriculture became more commonplace in both urban and rural locations as living conditions deteriorated. Many families were obliged to use wood and charcoal as a source of home energy as the cost of imported energy items rose rapidly. There is little doubt that these changes have a huge impact on the environment throughout the entire region. The failure of most African governments to implement the necessary economic reforms has also been a major concern. A one-party or military administration was justified and celebrated by the international community following independence. Over time, these regimes have gotten increasingly corrupt, administering the economics of their countries without regard to transparency or accountability. Many countries have been plagued by political instability and public alienation due to this, which has hampered both economic and environmental preservation efforts. Economics can't change without more decentralization and democracy in the political process, according to a rising body of opinion.

Much of the discussion on Sub-Saharan African countries has made significant progress toward focusing on the tremendous poverty in the region. No one disputes that poverty has spread across the globe. More than 265 million people are predicted to be living in poverty between 1985 and 2000 by the World Bank. In 1990, the region's GDP per capita had fallen to $340, making it one of the world's least developed areas due to population increase and a collapsing economy. They claim that poverty and overpopulation are inextricably linked and that the two together will inevitably lead to increased land fragmentation, overexploitation of agricultural and grazing land, more frequent famines, shorter life expectancies, and significant environmental harm. They are right. A Kuznets curve is used to examine the link between Carbon emissions and income in this thesis. Data from four African nations will be analyzed, namely Nigeria, Seychelles, South Africa, and Mauritius.

1.3 Purpose of the study

This research examines the long-term effects of environmental and economic factors consolidation. Long-term economic goals can be predicted using a model that incorporates these qualities throughout time and looks at how they interact. Dickey and Fuller (1981), Philips and This study used Dickey and Fuller (1981), Philips and Peron (PP) unit root tests with data from numerous African countries, including Nigeria, Mauritius, and South Africa. The Augmented Dickey-Fuller unit root test will be replaced by the Philip-Peron measures in our analysis of the results and verification of the appropriate integration of the variables employed. This study's variables will be linked using a linear model to show how they are related. Our research found a substantial correlation between environmental and economic conditions and long-term economic growth. So, countries that put more effort into integrating economic and environmental aspects have higher rates of sustainable development.

1.4 Research Questions

The following concerns are addressed in this thesis:

i. To what extent have decades of environmental degradation caused by industrial activity reduced the value of economic resources?
ii. How can economic growth be achieved without causing harm to the environment if specific measures are taken?

There are two ways to look at the connection between long-term economic growth and environmental degradation.

iii. What is the crucial relationship between economic deterioration and economic development?
iv. What's the link between economic decline and different stages of economic growth?

1.5 Research Hypothesis

The study question is based on this fact. As a result of our investigation's objectives, we've arrived at the following hypothesis:

H_0: In selected countries, there is no significant link between economic degradation and economic development.

H_1: The many stages of economic development have a strong connection to the deteriorating state of the global economy.

1.6 Significance of Research

While the EKC theory has been tested empirically, this study also investigates the connection between rising prosperity and improved environmental damage (CO_2 and Co Waste), determining the tipping point at which CO_2 and CO Waste begin to decrease, as well as analyzing the relationship between CO Waste emission and CO_2 emission to determine whether or not CO Waste causes CO_2 emission. The West African sub-region has lately made the shift from an economy based on agriculture to an industrialized economy to attain high levels of economic growth and development.

This was done to meet the challenges of achieving these goals. West Africa is known as a "pollution haven" because developed economies take advantage of the region's lax environmental laws and policies to establish their industries there and engage in practices that are detrimental to the environment. This is partly because residents do not have access to the financial resources necessary to launch their businesses. As a consequence of this, it is of the utmost importance to ascertain, by the predictions of the EKC hypothesis, whether or not improvements in environmental quality are feasible following significant increases in economic growth. West Africa is concerned about environmental pollutants (such as CO_2 and Co Waste) since the amounts of these pollutants may increase as a result of development. Additionally, they are pollutants, which is something that every economy on the planet, not just the one in West Africa, is striving very hard to minimize.

1.7 Objective of the study

In this study, the overall goal is to investigate the link between increased economic activity and environmental degradation, with a particular focus on carbon emissions as the subject of that investigation. Researchers used a model known as the Environmental Kuznets Curve to conduct their investigation (EKC). Per capita income and environmental quality are linked in the form of an inverted U, according to this hypothesis. CO_2 emissions were employed in this study as a proxy for environmental conditions. Globalization is a major factor in this study's attempt to investigate the link between economic expansion and environmental deterioration because of its rapid spread. The study found an inverted U-shaped association between rising wealth and increased carbon emissions, although the nature of this relationship is less obvious when considering changes in forest coverage. While prior findings have been validated, the integration of globalization into the research indicates a direct link between rising levels of globalization and environmental degradation. Studying the effects of economic degradation at various points in the development cycle on the quality of the environment and economy in various African countries, as well as making relevant comparisons across these countries, is also an important part of the research process.

1.8 Limitations of the study

Some of the control variables that could have been utilized in the study were not publicly available. Even so, the tests did show that the study's variables and robust methodology are appropriate.

1.9 Contribution to the study

Studies have sought to address the limits of past contributions by employing fresh datasets, new functional forms, and more advanced econometric methodologies, but the results have been mixed. An inverted U-shaped graph has been proposed by some academics, but others have rejected this traditional concept. The researchers chose four African countries with high GDP per capita as the focus of their research. These countries' wealth and CO2 emissions were compared using the ARDL estimating approach. Economics and environmental degradation will benefit from the research, which will expand our understanding of both.

1.10 An Overview of the Research

The investigation is being broken up into six distinct parts so that it can be read with greater ease. An overview of the research's historical context may be found in the first chapter, which is then followed by an introduction to the investigation itself. In addition to that, a conception and development of the research hypothesis that will be examined to obtain outcomes that are consistent with the purposes that have been set can be found in this chapter. In addition to that, it explains the overall structure and organization of the investigation, as well as information on the significance, scope, objective, research questions, and constraints of the study itself.

The second chapter provides a discussion of the related literature, which includes both studies, both empirical and theoretical, on the relationship between economic development and environmental degradation in Africa and around the world. The research gap was identified after carrying out an exhaustive analysis of a large body of previously published literature, and this examination will continue until the gap was closed.

The third chapter would concentrate more on conceptual frameworks related to the study, and it would include more in-depth material on each country (Nigeria, Mauritius, Seychelles, and South Africa). The effects of increased economic activity on their surroundings as well as the measures they are doing to mitigate these effects

The data and research methodology are covered in the fourth chapter, along with a detailed explanation of how the data are sourced, as well as a definition of the data and estimation methodologies that will be employed in the research effort.

A comprehensive detailed data analysis can be found in Chapter 5, together with details on the research periods and the sources used. This section also includes a section should include an explanation of the study's sample design, statistical and econometric methodologies, and the research goal or model definition.

The sixth chapter's concentration is on reporting the findings of the study, in contrast to the purposes served by the preceding chapters. Some recommendations for public policy are also included in the conclusion of the study. As soon as a research endeavor is over, the bibliographic references that were used in it are usually made available to readers alphabetically according to their last name.

1.11 Definition of terms

CO_2 Emission:

Activities such as burning fossil fuels and making cement produce carbon dioxide emissions, often known as CO2 emissions, which are a waste product of these processes. Carbon dioxide is emitted as a result of burning solid, liquid, and gas fuels, as well as through waste gas flare-ups. Nitrogen oxides and sulfur oxides are two more types of pollutants that can be found in the air.

CO_2:

CO2 is an invisible, odorless, and inflammable gas that can be found in the atmosphere. It is produced in the processes of respiration, the breakdown and combustion of organic molecules, and the reaction of acids with carbonates.

Millennium Development Goals (MDG):

To help the poorest in the world, the world's eight Millennium Development Goals have been established with measurable targets and explicit dates. The historic millennium proclamation was signed by 189 countries during the United Nations Millennium Summit in 2000. Goals ranging from universal primary education to avoiding child and maternal mortality were created at the time with a projected completion date of 2015.

Gross Domestic Product (GDP):

The term "gross domestic product" (GDP) refers to the total amount of money or market value that is represented by all of the finished goods and services that are produced within the borders of a nation within a specified amount of time (GDP.

CHAPTER II

Literature Review

Degradation of the environment has been a big worry for people all over the world for many years, and its significance has only grown in the most recent few decades. In industrialized countries, various forms of industrialization have been proved to have negative effects on Mother Nature; even though economic development has placed harmful pressure on Mother Nature, the pace of economic progress and the desire for it have not slowed down. A study of the relevant literature might be carried out to have a better understanding of the research that came before it on the topic. It is essential to perform a comprehensive review of the relevant literature before settling on a topic for academic investigation. On the issue of the subject matter of the study, books, periodicals, newspapers, and other sources of knowledge can be received in a variety of settings, including but not limited to bookshops, libraries, and the internet, amongst other locations. This section devotes a lot of attention to dissecting how a growing economy affects the natural world at a variety of different phases of development. Numerous research inquiries have been carried out to achieve a deeper comprehension of this topic as well as the literature that is associated with it. Numerous research has been carried out to investigate the connection that exists between the deterioration of the environment and the growth of the economy. The accomplishments of environmental sustainability can be attributed to the efforts of a large number of academics and industry experts who have willingly donated their time, energy, and knowledge to the cause. In this chapter, the findings of the research are discussed, and they are backed up by a wide range of scholarly works and topics that are pertinent to the topic at hand. In particular, the research that is being done for this chapter is looking for theoretical and empirical studies on the subject matter that is being considered. This section of the study effort includes both theoretical and empirical reviews. Additionally, relevant theories on EKC have been appropriately integrated into this paper to further improve the paper's contribution to the body of literature and its knowledge of the topic at hand.

2.1 Theoretical Literature

2.1.1 Environmental Kuznets's Curve

Simon Kuznets proposed the Environmental Kuznets Curve in 1955, and it is a hypothesized idea. At the beginning of an economic expansion, he claimed, the disparity in household income continues to widen until it reaches its highest degree, after which it begins to decline. Using the notion of the Kuznets Curve, (Grossman and Kruger 1992) were the first researchers to examine the association between pollution levels and per capita income. Ecological Knowledge Correlation (EKC) asserts that pollution levels rise as a country grows up to a certain point, but then begin to fall as the population grows larger. This is illustrated by the inverted U-shape of a typical Kuznets curve.

2.1.1.1 How Ecological quality and economic growth are intertwined

By utilizing the environmental Kuznets curve, one can observe that there may be a connection between economic expansion and environmental quality (EKC). According to the EKC hypothesis, over-exploitation of natural resources, as well as rising levels of pollution, are the result of an initial focus on economic development that is centered on output and revenue. Environmental concerns rise when the economy is at a certain turning point, and people want the government to take action against pollution, such as changing the method of economic growth and reorganizing the structure of the industry. As a result, economic growth and pollution levels have an inverted U-shape relationship. Recently, the EKC model has introduced new variables, such as international commerce and industrial structure, education, political democracy as well as social corruption. To investigate the EKC theory, other researchers employ a wide range of contaminants and quantitative testing approaches. EKC relationships between countries and pollutants are not always the same because of the variety of economic and industrial frameworks.

Environment and resource use harm economic growth, as well. Despite this, resource exhaustion is a major threat to the long-term viability of an economy. On the other hand, there is a correlation between the expansion of the economy and an increase in the demand for high environmental standards, which in turn has an impact on the expansion of the economy. As pollution levels rise, it has an effect not only on production but also on consumption, which frequently demonstrates a negative marginal utility while simultaneously exhibiting a positive marginal output.

2.2 Environmental Kuznets Curve Theory's Detractors (EKC)

The standard environmental Kuznets curve has been called into doubt by several critics, both as a depiction of what occurs throughout the development process and as a policy prescription. This is the case for both of these aspects. Some pessimistic opponents argue that the cross-sectional evidence for the environmental Kuznets curve is little more than a snapshot of a dynamic process. They assert that because globalization encourages a "race to the bottom" in environmental norms, the curve will eventually climb to a horizontal line, which will indicate the highest levels of pollution that are already present. Others who are pessimistic think that, despite rising incomes, industrial society will never stop producing new toxins that are not controlled and have the potential to be harmful. According to them, even if some sources of pollution are reduced, the overall environmental dangers from these new pollutants may continue to climb. This is indicated by the line that says "new toxics," which you can see in the previous paragraph. Both schools of pessimism make plausible claims; yet, neither has presented a significant amount of empirical data to back their arguments. Numerous theoretical articles have been written about the broad relationship that exists between monetary growth and the quality of the surrounding environment. The primary objective of those works was to generate transition routes for pollution, abatement effort, and development based on several different hypotheses for social welfare functions, pollution harm, abatement costs, and capital productivity (Dasgupta, 2002). This body of theoretical work has demonstrated that as a society's income increases, a Kuznets curve for the environment can emerge if a few plausible conditions are met. These conditions are as follows: the marginal utility of consumption is constant or falling; the disutility of pollution is rising; the marginal damage of pollution is rising, and the marginal cost of mitigating pollution is rising. In the majority of theoretical models, it is assumed that there are public agencies that regulate pollution and that these organizations have complete information regarding the benefits and costs of pollution control. In addition to this, they presume that the negative effects of pollution are local rather than transnational. In the second scenario, there is the minimal local impetus to "internalize" the externality because of how it affects the community. (Lopez, 1994) makes use of a general theoretical model to demonstrate that the social cost will be decreased if producers pay the social cost, and the author cites this finding as one of his main findings. If there is a cost associated with producing additional pollution, then the relationship between emissions and revenue will be determined by the specifics of the technology and personal preferences. If preferences are homothetic, which means that income increases lead to equal increases in what is consumed, and then an increase in income leads to an increase in consumption. If preferences are not homothetic, then an increase in consumption does not result from an increase in income. An uptick in production will inevitably result in a rise in levels of pollution. The response, on the other hand, will be different if preferences are not homothetic and the proportion of household expenditure on particular products shifts as income increases. The degree to which relative risk aversion is present, in addition to the elasticity of substitution in production between conventional inputs and pollution, will determine the influence that pollution has on growth. (Candia, 2011) highlights an additional issue that results from the EKC research, and that pertains to the factors that were applied to assess the relationship between growth and the environment. Economic growth is the characteristic that has been discovered that is most similar to development, even though the two concepts are not identical. Economic growth is quantified through income, which is then measured as the gross domestic product (GDP). The Gross Domestic Product (GDP), on the other hand, is a measure of a country's production rather than its income; hence, its utility as a proxy for income has been called into question. Several academics substitute consumption for income in their calculations. The problem that they are confronted with is the fact that data on consumption is based on particular items, such as foods, drinks, and so on, with no counterpart for pollution or the environment. When charting the EKC, the Y-axis indicates the levels of pollution, while the X-axis indicates the GDP per capita of the country. Despite efforts to identify other variables that reflect income, no successful findings have been found, and the GDP continues to be the best alternative.

We looked into the reasoning behind including a per capita variable in our study. It would be accurate to say that the rate of population increase is one of the important aspects of this model. On the other hand, the GDP per capita disregards the fact that the expansion of the population is more closely related to an exponential function than it is to a homogenous one. According to what is written, a linear function is assumed to begin in grade 1. Since it is dependent on the progression of the population, this function is going to have an impact on the shape of the curve as well as the probable path that a rising economy is going to follow. A larger amount of pollution is expected to be emitted in the future as a result of factors such as migration to urban centers and the concentration of populations in certain areas, in addition to the natural increase in the world's overall population. According to (Panayotou, 2003), the height of the EKC will increase when the density levels reach increasingly high levels. According to this line of reasoning, a nation with an expanding economy has a further distance to travel before it reaches the point where things begin to change. According to Carson (2010), a perspective of the issue that is gloomier is that the belief in an autonomous EKC relationship gave rise to illusory confidence that growth by itself would be beneficial for the environment. As a direct consequence of this oversight, environmental economists misplaced their attention for at least a decade on factors that might have contributed to shifts in the quality of the environment inside a nation. As a profession, we were able to divert our attention away from what was truly important while we discussed the correlation between money and pollution. First, and probably most importantly, it made it easier to assume that developing countries should be able to disregard their environmental concerns until they improve and become affluent. This is perhaps the most important effect. However, we now know that developing countries may take various activities (Dasgupta, 2002) to enhance their environmental conditions and that these efforts can have hugely beneficial implications for the welfare of their societies if they are taken. Second, as a group, we paid relatively little attention to the roles that population and technology play in the IPAT equation, although these are the other two elements. Third, for every dozen EKC papers, there may be one that takes a serious look at how changes in the regulatory structures and incentive systems that are currently in place across different political jurisdictions could be used to improve environmental quality in locations where the population is growing, incomes are improving, and technology from around the world may be potentially available. According to Grossman (Krueger, 1994), the theoretical framework that underpins the Environmental Kuznets Curve (EKC) speculates that environmental quality is going to be achieved by reaching high levels of economic growth. However, in the first stages of development, the environment will have deteriorated; there will be a turning point after which the environmental quality will improve. Grossman (Krueger, 1994) states that the EKC speculates that environmental quality is going to be achieved by reaching. Grossman and Krueger demonstrated that the negative slope of the curve indicates that countries that are experiencing a growth pattern, after having reached the turning point, have adequate income to buy products that are more energy-efficient and would export pollution-intensive products to other countries that are unable to produce them. In this particular scenario, it is presumed that the wealthy nations will ship these goods to the developing nations via international trade. However, if all of the countries want to start the process of growth, the countries that are left won't allow other countries, especially the poorer countries, to export the products that produce a lot of pollution since they will be trying to develop themselves. The following equation represents the empirical functions derived from Grossman and Krueger (1994) and Bradfort (2000) respectively.

2.3 Economic Development: A Theoretical Framework

The framework's first part introduces the two most popular theories of economic development: neoclassical and endogenous growth models. It then goes through some of the key implications of growth theory while using an environmental resource in manufacturing. The focus of the efforts is on how the shape of landscape contamination affects the best solution and the role of discounting. This leads to some conclusions about the most effective environmental taxes. The theory of resource scarcity and its potential consequences are discussed, as well as the implications of growth theory for long-term economic growth. Also, we review the standard theory of economic growth that does not include natural resources in the first two subsections below to set the stage for the discussion of growth models that include natural resources in the following sections. We shall use notions that are thought to be the basis for the interplay between people's activities and the environment in this study. There are related theories of institutional and political economy to neoclassical and ecological economics. The literature review in this paper looks at a variety of interpretations of the grand theory, which is the basis for several practical theories that are used to assess environmental destruction. Environmental Kuznets Curves, Impact

Theory, and the Treadmill Theory of Production, to name a few, are among the applicable ideas presented in this work.

2.3.1 Neoclassical Growth Model

Economic growth models look at how a hypothetical economy evolves when the quantity and/or quality of different inputs to the manufacturing process changes. A constant-sized workforce utilizing produced capital creates output equal to national income in the simplest scenario. The neoclassical model predicts that as the quantity of capital employed increases, production grows at a slower pace. When saving equals depreciation, the capital stock is in equilibrium and hence stable in size, and thus unchanging in size. Continuing technical advancement, according to neoclassical growth theory, is the source of continued economic expansion. The functional connection between productive inputs and outputs varies as technical knowledge increases. With the same number of inputs, more output may be generated in larger numbers or of higher quality. In the basic model, we're looking at, technological advancement boosts the equilibrium per capita capital stock and production levels by shifting the output function higher. Increases in the level of technical knowledge, on the surface, seem to boost the rate of return on capital, thereby countering the falling returns on capital that would otherwise stifle expansion. The convergence of economic performance over time is a key conclusion of the neoclassical growth model. When nations have equal access to technical advancement, their equilibrium growth rates should be the same. Furthermore, poorer countries' real growth rates should be quicker than wealthier countries', since impoverished countries may accomplish growth faster than the global pace of technological advancement during the "catching up" period. We'd expect to see a negative association between growth rates and income levels. However, if technological development rates fluctuate between nations for any reason, equilibrium growth rates will change. Countries will converge to a similar level of production per person if their "fundamentals" (savings and depreciation rates, technical advancement, and population increase) are equal. In these situations, differences in real living levels cannot remain forever. However, if any of these principles vary among countries, the equilibrium levels of output per person could be permanently different. In this scenario, a sort of convergence described as "conditional convergence" happens. Each country's growth rate will converge to its equilibrium level, which will be proportional to its underlying speed of technological improvement. Because of changes in other fundamentals such as savings and depreciation rates, equilibrium levels of income per capita will fluctuate.

The method of scientific proof of observation is the same in neoclassical economics as it is in physics. The theory of neoclassical economics is based on mathematical equations and requires empirical proof (Brahmachari 2016). The goal of the neoclassical economic growth theory is to explain the factors that determine economic growth as well as the relative contributions of other factors. In 1956, Professor Robert Solow used the Cobb Douglas production function to develop the neoclassical theory of economic growth (Gardoová 2016). Environmental problems are caused by a lack of a market for environmental goods, according to a neoclassical economic thought tradition (Arrow, 1974), which is nearly identical to the Austrian economist Von Mises' (O'Neill, 2001) belief that environmental problems are caused by preferences. On the market, there are no environmentally friendly products. Meanwhile, as a result of market failure, environmental issues arise. Until then, (Pigou 1920) admits that the market mechanism has negative externalities in addition to benefits.

Environmental and sustainable development issues are seen as working based on several basic assumptions in the neoclassical economic growth theory:

i. To solve problems involving non-market environmental goods, rational market valuation is used.
ii. Internalization and incentive policies can be used to overcome externalities and some problems associated with market failure.
iii. To achieve sustainable development, some types of capital can be replaced with other types of capital (Richard P.F.Holt, and Steven Pressman 2009) Environmental issues are one of the consequences of the manufacturing process, according to neoclassical economics.

As a consequence, environmental economics arises as a neoclassical reaction to externalities that occur as a result of economic activity. The ontological framework built by neoclassical economics gave birth to environmental economics (Hussen, 2004). As a result, the theoretical concepts are not intended to question neoclassical economics, but rather to enhance the key ideas of neoclassical economic theory. Both Neoclassical Economics and Ecological Economics are based on the concept of conservationism, which leads to a utilitarian understanding; both share the same viewpoint as a result of this utilitarian intersection. The focus of this principle is on humans as normative entities who benefit from the utilities they use. If the neoclassical economy prioritizes consumer sovereignty above efficiency, while the ecological economy prioritizes individual and societal health sustainability, these two viewpoints take a different approach. (Common and Stagl, 2005) The Environmental Kuznets Curves are an essential notion that helps support the neoclassical understanding of economics (EKC). The Environmental Kuznets Curve (EKC) was developed in the tradition of neoclassical economic ideas to scientifically examine the neoclassical economist's stance that sustainable economic development is a solution to population and environmental concerns (Hussen 2004). In addition, according to Beckerman (1992), the Environmental Kuznets Curve (EKC), which was made famous by the World Development Report published by the World Bank in 1992, is primarily used to support the idea that increased economic activity would result in an improvement in environmental quality. The Inverted U Shape Curve, which relates economic inequality and income per capita, is represented by the Kuznets Curve statement that economic inequality first raises parabolic ally, growing until it reaches the maximum point and then falling, as stated by (Kuznets 1955). According to Grossman and Kruger (1992), the Environmental Kuznets Curve, the analogy of Kuznets Curves may also be used to relate per capita income and environmental concerns. So far, environmental degradation is thought to be linked to economic development phases (Andrée 2019). The Environmental Kuznets Curve (EKC) was then established as one of the theories proposed to explain the link between per capita income and environmental issues. The term Kuznets Curve characterizes the U curve because the form of the curve resembles the letter U, which is taken from the Kuznets Curve and depicts the link between economic growth and inequality (Ginevicius, and Romualdas 2017). The Kuznets curve has been frequently used to determine the link between income and environmental impact. CO_2 and SO_2 are two forms of pollutants that may harm the ecosystem (Grossman and Kruger 1992), who were the first to construct the U curve that relates SO_2 emissions and wealth. The U-shaped curve describes the statistical phenomenon of the relationship between income and environmental damage, (Yurttagüler, 2017). Early on, there is a rise in per capita income, which leads to increased environmental harm. At a certain point (threshold level) or turning point, there is an increase in per capita income. The amount of environmental damage, on the other hand, is decreasing. The stages in the EKC, according to (Ginevicius, and Romualdas 2017), are the pre-industrial stage of the U curve sees an increase in per capita income as well as significant environmental damage, until it progresses to the industrial economy stage, where the trend of damage declines but per capita income continues to rise until it reaches a turning point in the post-industrial economy stage, where the trend of damage declines but per capita income continues to rise.

2.3.2 Endogenous Growth Models

There are two significant flaws in the neoclassical growth model. First, the evidence does not match the projected convergence outcomes. Second, the models can only account for continuous economic progress provided external technology innovation is present. The theory does not explain technical advancements, nor does it explain why the pace of technological growth varies from country to country. These findings prompted efforts to indigenize technological development, which explains technological advancement as the result of choices made by organizations and people within the growth model. Endogenous growth theory is the term given to the body of work that emerged (Paul Romer, 1980).

The relationship between capital and output in endogenous growth models may be expressed as Y AK =. In contrast to the neoclassical paradigm, capital, K, is defined more widely. It is made up of both manufactured and knowledge-based assets. Endogenous growth theorists have shown that the A term in the preceding formula is a constant under plausible assumptions, allowing growth to continue forever as capital accumulates. In the neoclassical paradigm, decreasing returns to capital finally bring expansion to a halt. Assume, however, that the process of collecting capital promotes technical advancement and so compensates for the falling returns. The important point is that technical knowledge may be considered a kind of capital. It is gathered via research and development and through other knowledge creation activities. There are two main qualities of technical knowledge. To begin with, it is a public good: the stock of this sort of capital does not shrink over time. This is noteworthy because it implies that knowledge may be kept over time, even while it is in use. Second, it provides positive externalities in production: while the business undertaking research and development reap advantages from the information obtained, so do others - the gains that the corporation reaps when it learns and innovates are only partly seized by it (William Nordhaus, 1980). The research and development process has positive economic spillovers; thus, the societal advantages of innovation outweigh the private benefits to the original creator. These externalities help to propel the development process forward. Firms that invest in fresh capital are more likely to introduce innovative processes and products. The promise of temporary monopoly revenues for successful technologies provides an incentive to dedicate resources to innovation. As a result, increasing K entails increasing a composite stock of capital and disembodied technical knowledge. As a result, production may grow as a constant percentage (A) of the composite capital stock, and declining returns are avoided. In an endogenous growth model, the economy may maintain a constant rate of growth because the falling returns to produced capital are precisely compensated by the technological growth external impact that we discussed before. The savings rate has a long-lasting effect on the growth rate of the economy; not only does a higher savings rate raise the economy's equilibrium level of income, but it also accelerates the rate at which the economy grows.

The pace of economic growth is positively connected to the size of the economy in various forms of the endogenous growth model. The quantity of the technical knowledge externality will be more as the number of firms develops, and consequently, the growth rate will be higher. Two exciting options follow. The potential economic growth rate grows when more enterprises cluster in one location, enhancing knowledge generation and transfer. Second, increasing trade volume and trade liberalization may enhance growth rates. Success is self-perpetuating in our environment, and convergence is never essential. Governments may manage the economic environment to increase the rate of knowledge development since technological innovation is now endogenous to the growth process. This may encourage trade liberalization or increased openness; it may justify investment in education or training, and intellectual property rights regimes (which offer incentives to develop while perhaps constraining the pace with which innovation is distributed) become extremely relevant.

2.4 Characteristics of Developed and Developing Economies

To suggest a country is developed is not based just on large structures or military might, as non-economic minds see. In economics, several factors determine whether a nation is classified as developed or developing. This section provided interesting detail on the characteristics of developed and emerging countries.

2.4.1 Developed Economies

A developed economy has a very high level of economic activity, as defined by high income per capita, Gross Domestic Product (GDP), high level of industrialization, developed infrastructure, technological advancement, high human development, good health, and a standard educational system.

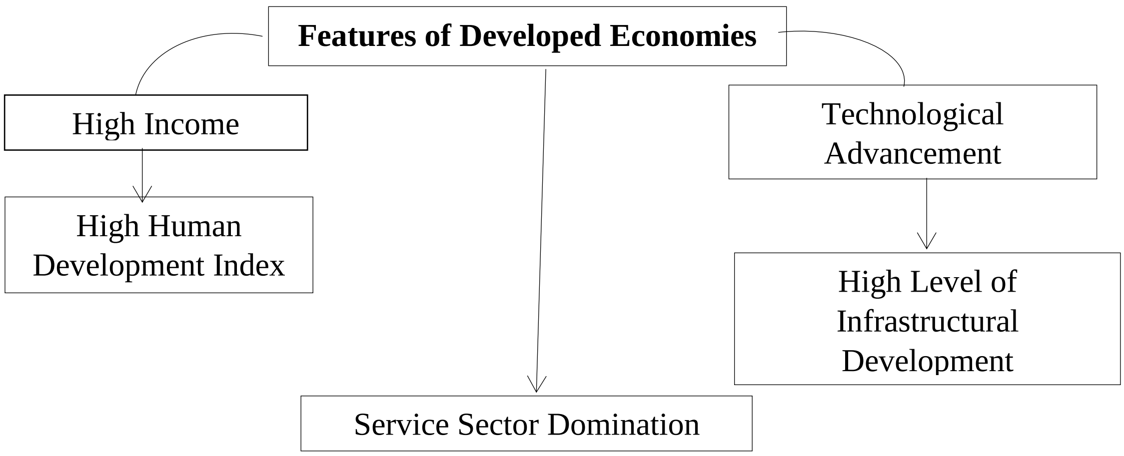

Figure 1: Author's compilation

High Income: For a country to be considered a developed economy or nation, it must have a high level of income, and this type of income is a proxy for Gross Domestic Product per capita, which is used to evaluate the country's income level. The amount of GDP per capita used to estimate or describe a developed country is $12,376 and above, according to the World Bank database indicator (2020). Switzerland has the highest per capita income in the world, at $83,580.

High Human Development Index: It is an UN-initiated measure. This indicator is used to assess a country's level of human development. The HDI is a statistic that ranges from 0 to 1; the higher it is, the more developed the economy is. GDI and GNP typically only provide information on a country's income and productivity. The HDI assesses how much revenue has been converted into social development criteria such as health and education. Additionally, the prevalence of child mortality, the capacity to obtain a high-quality education, and the number of years spent in school were all taken into consideration as well. HDI can also change based on the children's ability to apply what they've learned in school to real-world situations. A country's HDI can be calculated based on any or all of these factors and many more. HDI encompasses more than GDP or GNP. Citizens can trust it since it's suited to their needs. High levels of education, literacy, and health care should be the norm in any modern society. Whenever we talk about the HDI, we think of things like high-quality health care, low child mortality rates, and high levels of education and literacy.

Technological Advancement: The technical progress that has been made is typically easy to detect in a developed nation. The amount of industrialization and technology they possess, such as the internet, electric automobiles, and other forms of contemporary technology, is growing steadily.

Service Sector Domination: The service economy is a metric that indicates a country's total output of service-related goods and activities. These services may include transportation, dining establishments, services for businesses, and software that is made available to the general public. The citizens of developed nations are prioritized in the provision of an increased number of these services. The reason for this is that the provision of these services will, in the long run, contribute to economic expansion. A rise in economic production is likely to result from the provision of products and services of high quality.

High Level of Industrialization: The employment and manufacturing rates are quite high in developed nations. An enhanced economy is reliant on business, as opposed to developing economies, which are mostly dependent on agriculture. The more industrial setups there are, the greater the economic growth.

Modern technology is available to those living in developed countries. The country's facilities and breakthroughs in technology are also readily available to the general public. Such nations have strong manufacturing rates and exports outweigh imports in terms of total exports. Profits will rise as a result of a greater export rate, ensuring that the economy continues to expand. Increased industrialization will be the result of this consistency. As a result, industrial output is a key indicator of a country's progress.

2.4.2 Developing Economies

Developing countries or economies of the world are countries that are still in the stages of trying to mitigate the following anti-economic growth issues such as low per capita income, very high fertility rate which incurs high population growth rate, political instability, high level of corruption, high rate of unemployment, etc. Developing countries or economies of the world are countries that are still in the stages of trying to mitigate the following anti-economic growth issues shown in the diagram below.

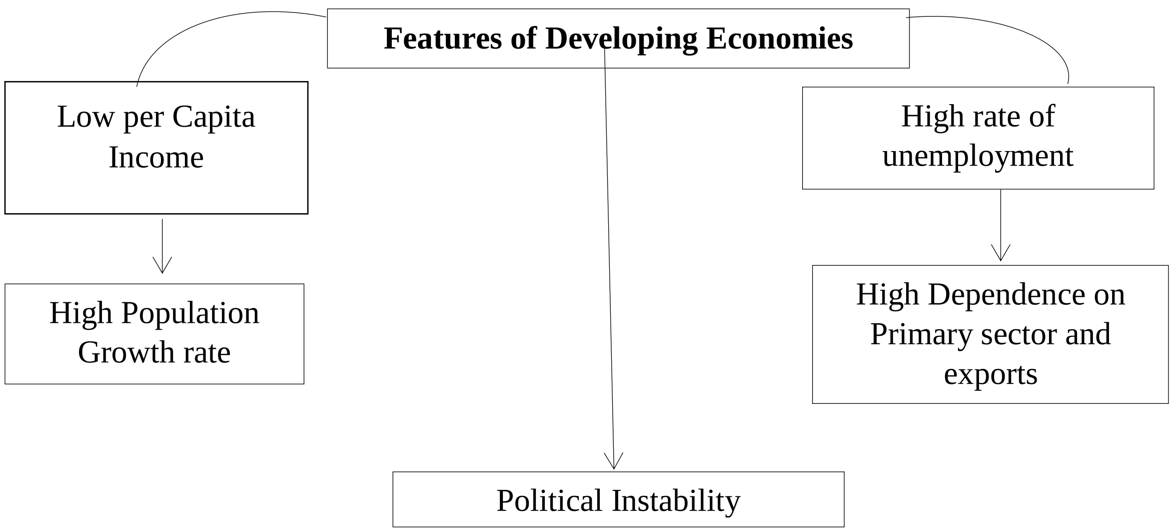

Figure 2: Author's Compilation

Low Per Capita Real Income: **The relatively low levels of real per-capita income that developing nations typically have is one of the most distinctive characteristics of these types of economies. They have a relatively low amount of real income distributed throughout their population. Which leads to low levels of savings and investments. This is a problem for them. It indicates that the typical person does not receive sufficient income to be able to invest or save money. They blow every dollar they make on their lifestyle. As a result, it establishes a cycle of poverty, from which the vast majority of the people finds it difficult to break free. In developing countries, a disproportionate number of residents live below the international threshold for poverty, known as absolute poverty.**

High Population Growth Rate: **One such feature that is typical of emerging nations is that they either have big populations or rapid rates of population growth. In many cases, this is due to a lack of family planning alternatives as well as the assumption that having more children could result in a higher labor force for the family, which would then allow the family to earn more money. This rise in population over the past few decades may be attributable to increased birth rates and decreased mortality rates as a result of improvements in health care.**

High Rates of Unemployment: **Unemployment rates tend to fluctuate significantly throughout the year in rural areas. Nevertheless, unemployment is a more complex problem that requires policies that go beyond the typical solutions. It is not uncommon to find these kinds of countries classed as developing countries, which are characterized by significant challenges such as high unemployment rates.**

Political Instability and Corruption: **Most countries face this issue of instability of the government due to how corrupt and biased the system is countries like Nigeria, Yemen, and the likes have some of the regions ransomed to bandits, and popular insurgence groups, and these, in turn, will affect the development of the economy where there is no peace there will not be free movements of businesses and economic activities that will affect the development of the economy where there is no peace there will not be free movements of businesses and economic activities that will affect the development of the economy where there is no peace there will**

High Dependence on primary sector and Exports: **In countries with a low per capita income, over three-quarters of the population lives in rural areas. The composition of demand shifts in response to growing income levels, which, in turn, drives expansion first in the industrial sector and then in the service sector. Because the primary sector is responsible for a sizeable share of the nation's total output, it also accounts for a significant proportion of the nation's total exports. Copper, for instance, makes up almost two-thirds of Zambia's total exports. Also, the country of Nigeria depends on oil as its largest export.**

2.5 Empirical Literature

According to **Coondoo, D, & Dinda s. (2008):** A temporal examination of cross-country distribution patterns of carbon dioxide emission and income was presented by both Coondoo and Dinda. They used panel data to study the association between income inequality and carbon emissions among countries. A Lorenz and specific concentration curve analysis was used to support the claim that income distribution is unequally distributed. As a result of the empirical test, researchers were able to look at the co-integrating vectors that showed statistically significant correlations. Most of the countries studied in this study had an average emission level that was significantly affected by the degree of income inequality between them.

Also, **Halicioglu, F. (2009):** He looked into a variety of sectors of Turkey's economy, including its CO2 emissions, energy consumption, and exports and imports, as part of his investigation. Using time-series data from 1960 to 2005, he attempted to investigate the dynamic causal linkages between carbon emissions, energy consumption, income, and international commerce in the context of the country of turkey. For co-integration, he used the ARDL and the ARDL bound test. The results of the bound test showed that the variables had two types of long-term associations. Energy consumption, income, and international trade all had a significant impact on carbon emissions in the initial long-term relationship model. While the second long-term analysis indicated that income was linked to carbon emissions, energy consumption, and international trade, the first type of analysis was more straightforward. Wealth, energy use, and foreign trade were all shown to be important contributors to Turkey's carbon emissions, according to Halicioglu's research. The third most important element was the amount of energy consumed.

Then, **Akpan, U.F & Chuku, A. (2011):** When Akpan and Chuku conducted their analysis of economic growth, they avoided the premise that environmental degradation follows an inverted U-shaped trajectory. This study contributes to the current debate over the existence of the EKC in Nigeria and the policy implications of this notion by using the ARDL and annual time series data from 1960 to 2008. As a proxy for environmental degradation, the study used the number of carbon emissions produced by each person in the study. According to the findings, the EKC hypothesis was found to be incorrect, and an N-shaped relationship better describes the current situation in

Nigeria when compared to the available data. They concluded, based on their findings, that the EKC hypothesis should not be used as a policy guide to address environmental concerns in Nigeria.

Also between 1980 and 2011, **Mrabet, Z., AlSamara, M., & Hezam Jarallah, S. (2017):** The ecological footprint (EF) was used in Qatar as a gauge of the environmental degradation that happened in that country between the years 1980 and 2011. In this particular piece of research, the environmental Kuznets curve theory, sometimes referred to as the EKC hypothesis is studied. According to the findings of an autoregressive distributed lag (ARDL) estimate with structural breaks, the variables of interest have a relationship over the long run. Additionally, there was a considerable shift in the co-integration vector in the year 1996. Following the completion of the data analysis, this result was uncovered as a result of the investigation. In Qatar, the EKC hypothesis is not supported by the findings of a study that investigated the short-run and long-run effects of income elasticity. The researchers concluded that Qatar does not fit the model. The fact that the influence of income over a longer period, in particular, is bigger than the effect over a shorter period reveals that the EF and real GDP per capita have a monotonic relationship. In addition, the price of oil and the degree to which commerce is open have a positive and a negative influence, respectively, on the impact that human activity has on the environment throughout a lengthy period. We employ the Toda–Yamamoto causality tests and the estimate with regime technique to conduct a more in-depth investigation of the reliability of the findings. Our goal is to ensure that the findings are accurate. The Toda-Yamamoto causality test shows that a person's environmental footprint is strongly influenced by their wealth and the price of oil. Using two time periods (1980–1996 and 1997–2011), the results of the estimation show that real GDP has a greater impact on the EF in the second regime than in the first, correlating with the ARDL estimations. Comparing the two times, these findings were discovered.

Later, **Aslan, A., Destek M.A & Okumus., I (2018):** According to their findings, the EKC hypothesis was supported by data gathered from across the United States using a bootstrap rolling window estimate approach An inverted U-shaped Environmental Kuznets curve was hypothesized to be a valid outcome of the team's investigation. This was accomplished by conducting a comprehensive study of the relationship between economic growth and environmental pollution in the United States from 1966 through

2013. Using the bootstrap rolling window estimate approach, we were able to detect any potential alterations in the causal relationships under investigation as well as collect parameters for the sub sample periods. According to the findings, the rate of economic growth had a tendency to increase during the sub sample periods that spanned from 1932 to 1996; on the other hand, it had a tendency to decrease during the sub sample periods that spanned from 1996 to 2013, and this trend was consistent across all sub sample years. As a consequence of this, the Kuznets curve representing environmental protection in the United States of America looks like an upside-down letter U. This provides additional evidence that a curve of this kind does in fact exist.

To examine fossil fuels relationship with environmental quality, **Gokmenoglu, K. K., & Taspinar, N. (2018):** The extensive utilization of fossil fuels, in particular petroleum, natural gas, and coal, has been a defining element of the growth of industry throughout the entirety of human history. This is especially true in more recent times. The human race has attained unparalleled levels of economic progress and reached historic levels of affluence as a direct result of the use of fossil fuels. Nevertheless, these advancements have been made at the expense of the environment. The use of fossil fuels is not the only element that has contributed to the deterioration of the environment; other aspects of the development of the economy have also played a role. (Alcántara and Padilla 2005; Intergovernmental Panel on Climate Change (IPCC) 2013) These variables include things like rapid population expansion, technological advances in transportation, new lifestyles, rising needs and expectations among residents, and international trade. The long-term equilibrium link between carbon dioxide (CO_2) emissions, income growth, energy consumption, and agricultural production is the subject of this study. As a consequence of this, the presence of a hypothesis that we refer to as the agriculture-induced environmental Kuznets' curve (EKC) is investigated in the context of Pakistan during the years 1971–2014. Evidence that the variables in the conducted model have a relationship that is stable over the long term and has reached equilibrium was provided by the co-integration test that was performed by Maki (2012) under multiple structural breaks. According to the findings of a causality test (Toda-Yamamoto, 1995), there are bidirectional causative linkages between factors such as gross domestic product, energy use, agricultural production, and CO_2 emissions. According to the findings of fully modified ordinary least squares (FMOLS), gross domestic product (GDP) has elastic positive impacts on CO_2

emissions, while energy use and agricultural value added have inelastic positive impacts on CO2 emissions. However, squared GDP has an inelastic and negative effect on CO2 emissions. This study provides evidence that the agriculture-induced EKC hypothesis is valid in Pakistan and demonstrates how it may be used as a template for the development of effective environmental policies in other agriculturally developing countries.

According to **Destek, M.A., & Sarkodie S.A (2019)** the environmental Kuznets curve for the ecological imprint, in addition to the function of energy and financial development, are both objects of inquiry at this time. The consequences of climate change provide a threat to development that is respectful of the environment. The environmental Kuznets curve theory is crucial to the process of defining policies and generating solutions relevant to climate change. It was discovered that the EKC hypothesis was an effective way to examine historical patterns of economic growth, energy consumption, financial development, and environmental impact in a newly industrialized nation from 1977 to 2013. Analytical methods included the Augmented Mean Group (AMG) estimator and the panel causality approach. Both of these approaches are suitable for panels that are dependent on one another but also heterogeneous. According to the research, rising economic output is associated with an expanding ecological footprint in the form of an upside-down U. Analytical methods included the Augmented Mean Group (AMG) estimator and the panel causality approach. Both of these approaches are suitable for panels that are dependent on one another but also heterogeneous. According to the research, rising economic output is associated with an expanding ecological footprint in the form of an upside-down U.

To access Nigeria environmental degradation status **Ayobamji, A.A., & Kalmaz, D.B (2020)** carried on an investigation of the reasons that contributed to Nigeria's environmental degradation is being carried out once more. FMOLS and DOLS were used in Ayobamji's and Kalmaz's long-term investigation to assess the effects that were noticed. Regression techniques were first applied to the subject matter in this study, which takes pleasure in being the first of its kind. Economic growth was found to have a positive impact on CO2 emissions both in the short and long term, according to the study. Furthermore, it has been proven that energy consumption has a beneficial effect on CO2 emissions over time, whereas foreign direct investment has a negative effect.

Also, **Demissew Beyene, S. & Kotosz, B (2020):** Using research on East African countries, this article looks at the Kuznets curve idea and how it applies to the environment. In their research, they tested the EKC hypothesis on 12 East African countries, which were put into groups using the pooled Mean Group (PMG) Approach from 1990 to 2013. The results show that the relationship between per capita income and CO_2 emissions, which are a proxy for environmental degradation, has the shape of a bell. This means that the original inverted U-shaped curve has been stretched out. Based on what they found, they can say that CO_2 emissions are not caused by economic activity in East African countries.

Researching between the year 1971 and 2012, **Bah, M.M., Abdulwakil, M.M., & Azam, M. (2020)** conducted an investigation on the relationship between the Kuznets Curve Hypothesis and income disparity in Sub-Saharan African countries, the researchers found a correlation between these two variables. Between 1971 and 2012, ten nations in sub-Saharan Africa with average incomes were studied to see if the EKC hypothesis held up. Using panel co-integration data, researchers checked whether environmental degradation proxies indicated by greenhouse gas emissions were linked long-term to crucial indicators for both middle-class groups. That's why we did it: to demonstrate the existence of a link between the two. The empirical evidence suggests that countries in sub-Saharan Africa should continue their efforts to boost economic growth while limiting environmental damage.

According to **Gyamfi, B.A., Adedoyin, F.F, Bein M.A & Bekun F.V (2021):** Their research concentrated on growing countries that are responsible for a substantial percentage of the world's activity because the Environmental Kuznets curve (EKC) hypothesis is essential to comprehending the connection that exists between economic activity and environmental deterioration. Within the scope of this study, the PMG-ARDL estimator and heterogeneous causation tests were utilized to establish the direction of long- and short-term causality, respectively. Instead of an N-shaped curve, an inverted U-shaped environmental Kuznets curve was discovered in the nations that were analyzed. There is a positive association between carbon emissions and both renewable and nonrenewable sources of energy; however, short-term data do not show any correlation between economic growth and either renewable or nonrenewable sources of energy and CO_2 emissions. The testing of causality revealed that there is a connection between GDP and GDP^2 that works in both directions. According to the findings of the study, an increase in the utilization of renewable energy sources in the seven nations that were investigated could contribute to a reduction in pollutant emissions.

Later, **Ongan, S. Isik., C., & Ozdemir D (2021):** The theories of economic development and environmental deterioration, along with an application of decompositions: a case study of the environmental Kuznets curve in the United States In this study, the Kuznets curve for the environment of the United States of America is evaluated. The purpose of this paper was to investigate the potential ways in which the per capita income series (a variable) could be segmented into its rising and falling values. Co-integrating the variables required the application of the ARDL approach, which was implemented in the study project. The findings demonstrated that the decomposed model discovers and detects the pre-existing but conceded validity of the environmental Kuznets curve hypothesis, whereas the un-decomposed model is incapable of doing so. This was demonstrated by the fact that the un-decomposed model did not produce the same results. When it comes to possessing this capability, it appears that the model that has been deconstructed is preferable to the one that has not had it decomposed.

In point of fact **A.A Alola & Ihan Ozturk (2021)** examined the rate of economic growth cannot move quickly enough. Because of this, a potential trade-off between income and environmental deterioration that is believed to be attainable at a maximum level of income is accounted for here. In light of this, the current study assessed the validity of the income-environmental degradation (Environmental Kuznets Curve, EKC) theory, specifically in light of the risk to investment in the United States throughout the period of 1984–2017. This research used energy carbon emissions as a dependent variable and a proxy for environmental quality because burning fossil fuels is the primary source of greenhouse gases (GHG) in the United States. In addition to the co-integration methodologies and the autoregressive distributed lag (ARDL) approach, the research looked at the output of renewable energy sources as an additional explanatory variable. Importantly, the research showed that the EKC hypothesis is correct for the United States, although the risk-to-investment trade-off was deemed to be insignificant. In addition, both in the short and long terms, the generation of renewable energy has an affect that is statistically significant and positive on the quality of the environment. In a nutshell, the findings of the study can be summed up as follows: the highest levels of wealth may have the potential to ensure environmental sustainability, but doing so is likely to come at the expense of increased investment risk. As a consequence of this, depending on the success of the nation's sustainable development goals, this insight ought to set off a potential policy mechanism that lessens the risk associated with investments (SDGs).

In accordance with **Hussain, M., & Dogan, E. (2021):** Environmental scientists have placed a significant amount of emphasis, since since the environmental Kuznets curve (EKC) theory was first proposed, on the connection that exists between the environment and economic expansion (Grossman and Krueger, 1995). EKC has developed into a phenomenon that is occurring on a global scale, and multiple researchers have contributed to the body of knowledge by participating in a variety of panel and single-country investigations. Web of Science has produced 3014 research-based papers over the course of the preceding two decades, which have received 78,319 citations (Dogan et al., 2020). Nevertheless, substantial technological and economic advancements have been proved to have caused dramatic climatic change during the course of this time period (Wang and Dong, 2019). On the one hand, structural and conceptual shifts in developed nations have led to the transition of high carbon-intensive sectors into low carbon industries. These shifts have resulted in the reduction of greenhouse gas emissions (Shahbaz et al., 2018). On the other hand, there is not a lot of evidence to support that environmental technology and the quality of institutions have much of an impact on environmental contamination. In a framework that is based on the environmental Kuznets curve, the current study attempts to add to the information that is already available by examining ecological footprints as a proxy for the environment in BRICS economies by using environment-related technology, institutional quality, and energy consumption. This study was conducted in Brazil, Russia, India, China, and South Africa. Using data ranging from 1992 to 2016, an augmented mean group estimator, a cross-section augmented autoregressive distributive lag model, and a common correlated effects mean group are utilized in order to estimate long- and short-term relationships. The use of econometric methodologies of the second generation demonstrates that both IQ and ERT have a detrimental effect on ecological footprints, which translates to a reduced level of environmental destruction. There is little data to support the EKC hypothesis, which states that an increase in economic activity will lead to an increase in pollution. The economies that make up the BRICS group need to work on elevating the standard of their governing bodies and increasing their financial commitment to the development of environmentally friendly technology. When it comes to the consequences the findings have for policy, they hold up under investigation.

2.6 Research Issues and Research Gaps are discussed in this section

The research obstacles and gaps that were found in the empirical literatures that were reviewed in the section before this one largely served as the inspiration for the article's aims and objectives for the research being conducted. The studies on the link between environmental deterioration and trending movement at each level of economic development, using CO2 emission as a proxy for environmental deterioration and the environmental Kuznets curve theory as the foundation for this analysis are dispersed due to the fact that they have been carried out by multiple researchers over the years under varied circumstances. This analysis serves as the foundation for the aforementioned dispersion. Previous researchers in this field have made use of a variety of comparable criteria to assist in determining the influence that carbon emissions have on a country's growth in industrialization and GDP per capita. The bulk of the factors that can be attributed to changes in CO2 emissions, GDP per capita, and the application of the Kuznets curve were investigated in this study. Numerous studies have been conducted to investigate the effects of carbon emissions and nitrogen emissions on economic growth and development, as well as the role that policies guided by the EKC hypothesis can play in promoting the growth of an economy in a manner that is environmentally responsible. As a result, the purpose of this study is to determine whether or not there is a connection between CO2 emissions and a country's per capita income as the country begins the process of industrialization. The results for the countries of Nigeria, South Africa, Seychelles, and Mauritius will be analyzed.

A Brief Synopsis of the Available Literature

Table 1.1: A Synopsis of the Research Conducted

Author	The Purpose of this Research	Date and Country	Methodology	Results
Coondoo and Dinda (2008)	An investigation of cross-country trends of carbon dioxide emissions and income was conducted in this study.	Africa, America, Asia, Europe	Lorenz an specfic concentration curve, Johansen's Co-Integration	inter-country income equality has a significant effect on the mean emission.
Halicioglu (2009)	The report aims to examine Turkey's carbon emissions, energy consumption, income, and foreign trade, among other things.	Turkey (1960-2005)	ARDL bound tests and ARDL	The study's findings revealed that income is the most important factor in understanding Turkey's CO2 emission levels.
Akpan and Chuku (2011)	The Study had the assumption that environmental degradation follows an inverted U-shaped trajectory in	Nigeria (1960-2008)	ARDL	The findings resected the conversional EKC hypothesis and disregard kuznets curve as the only guide to

	relation to economic growth			solving enviromental problems in Nigeria.
Mrabet, Alsamara, and hezan (2017)	Studying the ecological footprint used to quantify environmental degradation in Qatar was the goal of this research.	Qatar (1980-2011)	ARDL	The results demonstrated that the ecological footprint of a country is strongly influenced by its real GDP (EF)
Aslan and Destek (2018)	The study made use of bootstrap rolling window to estimat the EKC hypothesis in the United States.	United States of America (1966-2013)	Bootstrap Rolling Window Estimation Method	The trends in the United States showed confirmation of the existence of the Inverted U-shaped.

Gokmenoglu and Taspinar 92018)	The study investigates the long-run equilibrium relationship between CO2 emission and agriculture-induced EKC hypothesis	Pakistan (1971-2014)	FMOLS	According to the results of the analysis GDP has an elastic positive impact on CO2 emission indicating the presence of agriculture-induced EKC hypothesis in Pakistan.
Destek and Sarkodie (2019)	To Investigate EKC for ecological footprint	11 newly Industrialized countries (1977-2013)	Augmented mean Group Estimator and heterogeneous panel causality method	In this study, economic growth and ecological footprint were found to be causally linked in both directions.
Ayobamji and Kalmaz (2020)	The research aimed to examine the determinants of environmental degradation in Nigeria.	Nigeria (1971-2015)	FMOLS and DOLS	In the long-run energy consumption had positively impact on CO2 emission FDI had a negative impact on

				CO_2 emission.
Bah and Abdulwakil (2020)	The study looked to analysis EKC hypothesis and Income heterogeneity in sub-Saharan Africancountries	10 middle Income sub-Saharan countries (1971-2012)	Panel Co-integration	The results suggested that there is a positive and signifcant impact on EKC hypothesis; and to continue their efforts to spur economic growth while minimizing environmental damage at the same time.
Demissew, Beyene, and Kotosz (2020)	The paper aimed at testing the EKC hypoheseson an empirical study of selected East African Countries	Selected 12 East- African countries (1990-2013)	Pooled Mean Group (PMG)	The results showed that economic activities in East-African countries don't lead to CO_2 emission.

Alola and Ozturk (2021)	The current study investigated the validity of the income-environmental degradation (Environmental Kuznets Curve, EKC) theory, particularly in light of the risk to investment in the US.	United States Of America (1984-2017)	ARDL	the study concluded that while environmental sustainability is possible at the highest level of wealth, it is likely to come at the expense of investment risk.
Gyamfi, Adedoyin, Bein, and Bekun (2021)	The research aimed to understand the relations and also estimate importance of EKC hypotheses to mitigating environmental degradation problems	7 countries	ARDL	The study suggested increased use of renewable energy to mitigate pollutant emissions in the E-7 countries.

CHAPTER III

Conceptual Framework

3.1 Introduction

The Environmental Kuznets Curve1 (EKC) notion is frequently used to discuss how the environment deteriorates as people get older. Learn more about (Dasgupta and Mäler, 1995) and Arrow et al (1995). According to the EKC, a country's environmental degradation will increase during its initial phase of economic growth, but will decrease as further development occurs once it achieves a particular level of revenue. There is a possibility that the government has been heavily involved in reforms, pollution control, and resource management initiatives. As seen below, environmental harm and output are related in a quadratic fashion. It is detrimental to future generations to use all available resources in order to maintain current growth rates. To ensure that future generations can satisfy their resource demands without being gravely affected by our incapacity to manage our natural resources properly, we must act now. Even if the world's economy is down, there are a lot of things that make it tough for individuals to live a nice life, and in today's world, there are a lot of different challenges, difficulties, and possibilities that can happen. The Earth and its natural resources are under attack from a wide variety of human activities, including pollution, resource depletion, and other types of environmental harm that are now so visible that disruptions occur virtually every day. People who use their power to get resources from the environment for their own benefit instead of the benefit of other people cause the environment to be damaged. So, people's cultures and economic activities are changing quickly, as are their cultural behaviors and ways of making money. There is no longer a threat to the future when people try to make their lives, families, or businesses better. In part, being able to look to the future with hope is based on our ability to set up the conditions that will allow us to deal with today's environmental problems. This means that there must be a smart and well-coordinated balance between long-term socioeconomic development and the protection of human life and the planet's natural resources. Whilst earth is made of diverse creatures, humans would always be a primary factor in the existence of the environment and everything else is just a secondary thing. As such, ecological balance must be restored if there is a mismatch between humans' production methods and the environment's resources, as this would be discussed here.

3.2 Environmental Degradation's Economic Consequences in Nigeria

Nigerians that are actively involved in the manufacturing process reside in rural regions and do activities like raise animals, cultivate food, fish, and hunt. More than half of Nigerians would be able to survive if the country had a healthy atmosphere. This demonstrates the importance of maintaining a clean atmosphere. Finally, there is a trade-off between the environment and how much a person can develop and learn. Those with less developed economies appear to be more ready to harm the environment than countries with more established economies. They prioritize economic expansion over environmental protection, arguing that the former should come first. Developed countries, on the other hand, have a lower level of environmental tolerance since they have more money (Fidel, 2015). It has gotten worse as Nigeria's population has risen to around 180 million. Many causes have led to Nigeria's demise, most notably the behavior of wealthy international oil companies and the poor people that live in their service areas. Many governments have been reluctant to acknowledge the environmental damage caused by multinational corporations since they get their money from oil. As a result, a significant amount of money has been lost in the region as a result of issues with farming and other economic activity. This isn't the first time this has happened. The health of the inhabitants in the neighborhood has also been damaged. People in Nigeria are knocking down oil pipelines, spreading waste all over the place, and generating a lot of noise every day. Aside from the destruction of the ecology, carbon emissions from aging automobiles, generators, and industrial machinery have also had a role. The majority of Nigeria's manufacturing operations are hazardous to the environment. Weak regulations and widespread poverty have exacerbated the situation. The Environmental Kuznets Curve is being used to determine how terrible the environment is for the economy (EKC). Because environmental degradation and economic growth are incompatible, our findings will aid policymakers in devising more effective environmental protection strategies.

Rapid economic expansion, according to the classist, causes pollution and excessive consumption, both of which are harmful to people's well-being. They feel that the ideas behind economic growth should be reexamined since there is a possibility that they will have a detrimental effect on the lives of individuals. It was once believed that the golden road to economic progress could not be accomplished without putting people through a significant deal of pain in order to get there. This would hasten the phases and rate of economic development, but at the price of the environment and human health. According to Brown et al. (2015), the costs of pollution often surpass the benefits of current economic development. When natural resources are exhausted, cities grow more densely inhabited, and rural concerns such as deforestation become more common, eco-balance is required.

Malthus, another classicist concerned with population increase and its impact on the environment, believed that population growth is always higher than the population's ability to support itself. This implies that "humanity is essentially space-constrained" (Weil, 2009). Because he could see into the future, Malthus predicted that human demands would outstrip available resources, leading in resource exploitation and, eventually, environmental disaster.

The Nigerian economy grew at a rate of 6% per year between 2013 and 2014, when the recession hit (Central Bank of Nigeria, 2016). However, resource depletion and overuse have also contributed to this increase. When it comes to foreign income, crude oil exploration and exportation account for more than 90% of Nigeria's GDP growth (Central Bank Nigeria, 2016). In addition, these mining activities have been linked to the flaring of gas and the combustion of fossil fuels, which has resulted in the emission of chlorofluorocarbons and carbon monoxide into the atmosphere. Despite this, there is ample evidence to suggest that the environment is in jeopardy. The consumption of commodities and nonrenewable resources, population growth (which is highest in Africa), and the depletion of resources all work together to make this possibility a reality (via mining, desertification, and land degradation). As a direct consequence of this, the focus is on Nigeria and the growth constraints or thresholds that, if exceeded, could cause damage to the environment.

3.2.1 An Overview of Nigeria’s Growth Environment

Nigeria has likewise stressed the bottom-up approach to environmental concerns. A variety of projects concentrating on both the local and national levels have been launched in this respect. To name one example of progress, due to the enormous levies levied by oil companies for gas flaring, there was a substantial decrease in gas flaring. It also suggested that initiatives aimed at preserving or reducing water pollution in

Nigeria were more successful than those aimed at lowering air pollution in the country as a whole. Another area in which the campaign has been shown to be successful is in convincing people that environmental impact analyses must be carried out before any new industrial or large-scale project can be initiated (National Environmental Standards and Regulations Enforcement Agency [NESREA], 2011; World Development Indicators [WDI], 2015). In spite of ongoing efforts to clean them up, cities continue to be marred by industrial and human waste, which also contributes to the pollution of the air. The continued presence of toxic industrial and human waste, chemicals, and oil spills continue to poison the water, while neighborhoods are plagued by noise and other forms of pollution. Even though the Federal Ministry of Environment has been in operation in Nigeria since May 1999, there is still a great deal of work that needs to be done on the country's environment before it will be possible to realize a cleaner environment that is more conducive to national sustained socioeconomic progress. It's also true that the Ministry cannot accomplish it alone; it needs the collaboration and help of all parties concerned. A short look at some of Nigeria's natural resources hints at what these impacts may be. The state or pattern of agroforestry in Nigeria is a good predictor of environmental quality in any nation. An agroforestry initiative in Nigeria's sensitive zones and degraded land is intended to stimulate tree planting, reseeding, and reforestation. The method involves controlling forest exploitation as well as planting trees in the areas that have been decertified. The initiative that is being implemented by the government of Nigeria is intended to promote self-sufficiency in wood and other forest resources, with the ultimate goal of achieving the 25 percent forest cover that has been set by the United Nations Food and Agricultural Organization (UNFAO). This will also dramatically improve the ecological integrity of the ecosystem, which is another reason why it is essential, and it will significantly decrease the repercussions of climate change.

According to Kuznets, EKC estimates in Nigeria are based on the cubic function of economic growth, which leads to more money for individuals (Kuznets, 1955). You may find out more by checking out the resources listed below: (Panayotu, 2003). Policies that make it easier for everyone to share in the profits provided by the environment may encourage people to buy more environmentally friendly products. The evaluation and refusal to consume more than is absolutely necessary, as well as the reduction of waste, recycling, and the replacement of products that may be reused, are all components of the 6Rs, which may be beneficial to Nigeria's ecology (Yang et al., 2013). Because of growing economic activity, an unstable ecosystem has developed which pollutes the air and water and puts the population in danger from environmental hazards. This activity also contributes to the loss of biodiversity (Allen and Barnes, 1995; Rudel, 1989). This study is only a few pages long, yet it demonstrates quite clearly that the Malthusian theory that population expansion leads to environmental stress is correct. It is evident, given the rapid rate of deforestation taking place across the nation, that (via production and consumption). Overall, the current growth environment nexus in Nigeria shows that the country's capacity to address environmental concerns brought on by economic activity appears to be inadequate. This conclusion is drawn from the fact that the nexus exists. As a result, despite the governments' best attempts to keep environmental concerns from obstructing economic progress; other pressing issues have further exacerbated environmental degradation. People's survival instincts, political upheavals, societal advancement, and a desire for material items are all factors in this. There is no question that emissions and trash will continue to be created as a result of economic activity since it is impossible to reach zero emissions. As a result, Nigeria's government must include environmental rules and policies into the country's overall economic growth strategy. There is a way to help people in Nigeria generate more money and live better lives by employing the most effective techniques in economic activities and procedures that are also protective of the natural environment.

3.3 The Case Study of Mauritius Regarding Carbon Dioxide Emissions and Economic Development

Mauritius is an energy-dependent country, and when fuel is consumed, GHGs are emitted. As a result, it is vital to evaluate the impact of lowering energy usage on the economy. Mauritius too has an open economy, with commerce having a substantial influence on society and the economy. The movement of products and services made in Mauritius for use in other areas of the globe, as well as commodities imported for use in Mauritius, is referred to as trade. Pollution happens during both the production and consumption of these commodities and services. Carbon dioxide is emitted as a result of the trading of these products and services. Economic development, energy consumption, CO2 emissions, and commerce are all closely intertwined. The dynamic link between these factors has received scant study in Mauritius. The study's findings should help policymakers think about how to cut emissions from companies that create goods and services that are exported without damaging the economy. By examining this nexus for Mauritius theoretically, the researcher seeks to fill a gap.

Carbon dioxide emissions have long been related to a country's capacity to produce products and services, as well as climate change. On the other hand, an expansion of the economy calls for a greater consumption of energy, which in turn leads to an increase in the production of carbon dioxide and other harmful pollutants. In point of fact, in accordance with the "EKC" hypothesis, the "inverted U" shape of a relationship may be shown between economic growth and pollution indicators (a measure of environmental quality). Therefore, the EKC hypothesis works under the assumption that there is a connection between environmental impacts and economic growth throughout the course of time. The rate of resource depletion and replenishment is starting to fall behind schedule as economic growth quickens and waste production rises in both quantity and toxicity. This is due to the fact that the pace at which resources are used up and replaced has slowed down. At higher levels of development, there is a leveling off and a steady decrease in the amount of environmental damage caused as a result of shifts in the organizational structures of businesses and services, as well as an increased awareness of the environment, advancements in technology, and increased financial investment in environmental protection. When the income reaches the EKC threshold, according to the projections, environmental changes will start to take place. This is one way to illustrate the transition from a clean economy based on agriculture to a dirty one based on industry, and then finally to a clean economy based on providing services (Arrow et al., 1995). When a specific quantity of money is earned, then and only then will there be a reduction in emissions. As more money is created, the wealth of the economy grows along with it. On the other hand, the idea makes no reference to the passage of time. The EKC is a tendency that has been observed over a prolonged period of time and illustrates the expansion of an economy over time. It illustrates how society and the economy have developed throughout the course of time. This pattern of progress is observable in cross-country cross-sectional data, which displays countries whose income levels vary depending on emissions. It is something that ought to be clear if all nations subscribe to the same

EKC, which is what has occurred. Some nations are extremely poor, while others are still in the process of developing, and still others are rather prosperous. This suggests that the EKC is going through a period of decline. The EKC is predicated on the assumption that income and emissions do not differ between countries; hence, an inverted-U-shaped empirical EKC should be predicted for every given cross-country data set on income and emissions.

3.3.1 Carbon Dioxide Emissions and Economic Growth in Mauritius

Mauritius obtains the majority of its electricity from nations such as Trinidad & Tobago and Suriname. In 2010, imported fossil fuels accounted for 83% of the country's total primary energy demand, up from 66% in 1993. This is a significant shift. Simultaneously, the proportion of primary energy consumption derived from local sources fell from 34% to 17%. In 2010, gasoline, diesel oil, kerosene, fuel oil, and coal accounted for 83.4 percent of the country's total primary energy requirements. The remainder was derived from foreign-sourced fossil fuels such as gasoline, diesel oil, and kerosene (29.2 percent). The remainder of the primary energy required was derived from locally available sources such as bagasse and hydroelectric power (CSO, 2010). Regardless matter how crucial energy is to economic progress, the production and use of energy pollutes the air. CO2 emissions from Mauritius' energy industry accounted for 61% of the country's total GHG emissions in 2011, which totaled 2,206 thousand tons (CSO, 2012). The transportation sector accounted for up to 25% of total GHG emissions, with the manufacturing sector responsible for the remaining 9%. 337,000 tons. The variables are pointing to a long-term friendship.

If you have a greater amount of money, then your CO2 emissions will be higher. This provides evidence that the growth of the economy has a detrimental effect on the natural world. The term "emission intensity (ratio") refers to the ratio of per capita emissions. This may be used to explain these data in terms of CO2 emissions per person (Baek et al. 2009). However, the ratio might be seen as an indication that an economy has not yet attained its full potential. This is beneficial to the environment since CO2 emissions rise when individuals have more money. There has been a lot of pollution in our nation, but it hasn't yet hit the EKC tipping threshold. People have more money, thus their incomes grow. They discovered that Mauritius was unable to reduce its carbon output. Over the previous three decades, a lot of CO2 has been emitted. As a result, the cost of degradation remains unchanged. In the long run, this implies that both economic and human activities are expanding. Pollution is having a greater impact on the country's ecosystems than previously imagined.

3.4 Seychelles' Economic Growth and Environmental Degradation

The Seychelles' biodiversity decline and extinction goes well beyond environmental concerns. In order to maintain economic productivity and consumption, biological resources must be protected or replenished. These causes lead to biodiversity loss, posing economic and environmental difficulties. The biodiversity of the Seychelles provides a plethora of economic benefits. Fisheries, forestry, and tourism are just a few of the numerous industries that rely on biological resources for the basic ingredients they need to operate. Ecosystems have a vital role in both human and industrial production and consumption because, among other things, they act as a sink for pollutants and wastes and as a barrier to erosion of beaches and watersheds. The biodiversity of the Seychelles has a high intrinsic value, as evidenced by local, scientific, and tourism interest, and its components may provide a wide range of future economic activity options, including recreational, pharmacological, industrial, and agricultural applications, many of which are currently unknown. These commodities and services account for the great majority of the overall economic worth of biodiversity in the Seychelles. Natural resources, both sustainable and non-sustainable, are depleted or changed into new forms as a result of economic activity, which has an impact on the Seychelles' own means of production. Furthermore, pollutants and effluents are thrown into the environment, having a significant influence on the island country's biodiversity and ecosystem (for example from tourism, urban settlement, industry and manufacturing). The Seychelles' economy is incapable of financing such long-term expenditures, much alone a downward spiral of biodiversity loss and deteriorating economic conditions. The Seychelles' lack of flat land puts strain on the more environmentally sensitive, steeper hills, causing water and sewage disposal issues. The rest of the terrain is covered with steep wooded slopes. On the islands, high-end hotels and restaurants consume a significant amount of fresh water. Waste disposal is becoming increasingly difficult owing to its influence on local water quality. Septic tanks and soak pits are two methods for disposing of waste. These tanks may be difficult to reach for maintenance and repairs due to their location and population density. As a result, the water quality in the inland basins may suffer significantly as a result.

Finally, the Seychelles' economic well-being is based on its ability to manage its environment efficiently. The environment is under growing strain in order to fulfill society's ever-increasing aspirations for a higher quality of life. The Seychelles lacks the land surface area necessary to offer the infrastructure and services associated with five-star hotel rooms. As a result, the natural resources of the islands are in jeopardy. The Seychelles has a strong constitutional commitment to environmental protection, as well as a well-developed environmental legislation framework. Despite the fact that the EIA Regulations and the Environmental Protection Act are thorough, there are not enough resources to put them into effect. Despite this, the Environmental Assessment and Pollution Control (EAPC) Department is constantly introducing modifications to boost efficiency, therefore the implementation of the EIA Regulations is improving. Civil society is currently not engaging in the process for a number of reasons; the quality of EIA reports varies; there is no system of external review; and the quantity of information contained in environmental management plans filed as part of the EIA process is insufficient. There is little question that the EAPC Department's EIA operations have affected the development process and increased developer environmental consciousness. Keeping the Seychelles' marketing as "clean as it gets" means making sure that the EIA process is supported at the highest levels of government and that all government agencies contribute.

3.5 Environmental Degradation in South-Africa

There is widespread worry over land degradation, which threatens biodiversity and the livelihoods of those who rely on natural resources. As a result, progress toward the SDGs and the abolition of poverty induced by climate change is impeded. There are a range of policies and programs in existence across the globe to address the linked biophysical and socioeconomic aspects that lead to rising land degradation. There are three crucial aspects to consider when discussing land degradation: first, the physical and social causes; second, the implications of historically unequal land tenure and resource allocations; and third, the interrelated processes that take place at the national and global levels. In order to accomplish this, we make use of a framework that is founded on the theory of structuration, and in order to exemplify our ideas, we use instances from the process of rangeland management in the Eastern Cape region of South Africa. In this article, we show how land degradation can only be comprehended by taking a multi-scale and multi-biological approach, which is exactly what we did. Changes in climate, rules governing land tenure, and post-apartheid reforms are all factors that contribute to the degradation of land in South African rangelands that is caused by the encroachment of woody vegetation. However, contemporary South African land use policies are not directly linked to those that prioritize the conservation of ecosystems and biodiversity or the mitigation of climate change. They are aimed to correct previous land inequities and improve rural livelihoods. Finally, authorities in South Africa must reconcile political pledges to enhance the lives of local communities with international aims to combat degradation, carbon emissions, and the Sustainable Development Goals (SDGs).

Although South Africa is an outlier, governments all over the world are grappling with the conundrum of how to prevent environmental deterioration while at the same time resolving issues that have persisted for a long time over unequal access to land and resources. In a broader sense, this explores the worldwide problem of striking a balance between the goals of reducing poverty and greenhouse gas emissions. In South Africa, there are many different perspectives on the topic of land degradation (Scholes, 2009; Palmer & Bennett, 2013). But there is one thing that all of these problems have in common: the ability of ecosystems to create value is declining. According to Scholes, the ability of a dry or semi-arid environment to supply a variety of services, such as grazing, fuel, lumber, crops, fresh water, wild-harvested foods, biodiversity habitats, and tourist possibilities, is "slowly" diminishing. These services include: grazing, fuel, lumber, crops, fresh water, wild-harvested foods, biodiversity habitats, and tourist possibilities (2009).

The proliferation of woody plants is a characteristic feature of degraded communal land in South Africa. In savannahs, an increase in the number of trees and shrubs results in a decreased output of water and total vegetation, as well as shifts in the fire regimes, biodiversity, and capacity to store carbon. The activities and services provided by an ecosystem are subject to change in proportion to the number of trees and shrubs that are there (Buitenwerf et al., 2012; Auken, 2009). On grasslands, the growth of woody plants can degrade the soil and lead to the formation of deserts (Schlesinger et al., 1990). In spite of the fact that woody plants may store carbon, according to a policy brief published by the South African government, the widespread presence of such plants should be regarded as land degradation (Department of Environmental Affairs, 2019). Constant encroachment has a negative effect on biodiversity, the ability of rangelands to govern water supplies, as well as the total amount and value of ecosystem services. There is a one-to-one connection between the growth of woody cover and amounts of annual precipitation (MAP) that can reach up to 650 millimeters. After that point, rainfall is no longer a concern (Sankaran et al., 2005). Under the terms of the existing environmental accords, individuals have a great deal of leeway to engage in activities that are beneficial to the land. In addition to other things, South Africa has signed a number of international agreements pertaining to climate and the environment. The prevention, reduction, and reversal of land degradation are all helped along by these treaties. The preservation of wetland areas, biodiversity, and climate change are just few of the many difficulties we face today (IPBES, 2018). The destruction that has been caused to the rangelands of South Africa has made it significantly more challenging to have a conversation about how to achieve the Sustainable Development Goals set forth by the United Nations (SDGs).

CHAPTER IV

Methodology

4.1 Introduction

This component of the research effort focuses on providing an in-depth discussion of the many approaches, processes, and strategies that were utilized in order to obtain the essential information for the study. This section also gives an in-depth assessment and description of the numerous statistical approaches that were used to conduct the analysis of the secondary data that was gathered throughout the course of this research.

4.2 Types of Data and Sources

Traditionally, most research works data are acquired by two foremost sources; the primary source for data acquisition, and the secondary source for data gathering. The later was the appropriate option for the author of this study. The Author made use of secondary data and he utilized the World Bank Data Base which is an online open source to gather data. The study was carried out to cover a time period of 43years, commencing in 1977 and ending in 2019 for four different African countries; data gathered were annual time series data. Data sourced for the purpose of this research are CO2 emission used as a proxy for environmental degradation, GDP per capita and GDP per capita-squared, Price of oil and Terms of Trade.

4.3 Variables and the Measurement of Variables

Secondary data were obtained from the World Bank Development Indicators database for the purpose of this investigation. The data collected for this study were organized into dependent factors and independent variables for the purpose of the study. As our dependent variable, we used CO2 emissions as a stand-in for environmental degradation, and our independent variables included GDP per capita, GDP per capita squared the price of oil, and terms of trade.

4.3.1 CO_2 Emission

CO2 is a colorless, odorless incombustible gas that is produced by respiration, the breakdown and combustion of organic molecules, and the interaction of acids with carbonates the environment. Emissions of carbon dioxide, more commonly referred to as CO2 emissions, are those that are produced as a byproduct of the combustion of fossil fuels and the production of cement. Carbon dioxide emissions also include the carbon dioxide that is produced during the consumption of solid, liquid, and gas fuels, as well as gas flaring.

4.3.2 GDP per capita

The Gross Domestic Product per Capita (GDPpc) is calculated by dividing the country's GDP in a fiscal year by its entire population. Countries with a small population have higher GDP per capita than those with a huge population, that's why countries used in this study in the case of Mauritius and Seychelles seems to have larger GDP per capita than the likes of Nigeria and South-Africa who have larger population. Unless under extremely unusual circumstances, such as when the country is extremely wealthy and technologically sophisticated. Nigeria has the greatest GDP per capita in Africa (due in part to the fact that it is the world's biggest black nation and a major crude oil exporter).

4.3.3 GDP per capita-squared

The GDP per capita (GDPpc) is computed by dividing a country's GDP in a fiscal year by its whole population squared. The GDP per capita was squared for this study in order to characterize the link between CO2 emissions and sustainable development in greater detail.

4.3.4 Price of Oil

Oil prices are commonly discussed in terms of a barrel of light, sweet crude oil at its current spot price. The price of oil that can be traded on the spot market between buyers and sellers of crude oil and gas oil. The World Bank's database provided the information on the price of oil.

4.3.5 Terms of Trade

The terms of commerce are the ratio of export prices to import prices, and are defined as the relative price of exports in terms of imports. It may be thought of as the quantity of import products a country can buy for each unit of export goods. Manufacturing enterprises in Nigeria import the majority of its raw materials, and the government is entirely reliant on the earnings from crude oil exports as a key source of revenue. From 1977 to 2019, data for Terms of Trade was obtained from the World Bank database for all four countries used in this study.

4.4 Model Specification

The Autoregressive Distributed Lag Model was used to estimate the short-run and long-run model connection between the dependent variable, CO_2 emission, and the independent variables Income per capita, income per capita-squared, price of oil, and terms of trade and the bound test for co-integration. The ARDL bound test was performed to see if the variables were co-integrated in the long-run, and if they were, the Error Correction Model (ECM) was used to see how fast they adjusted to disequilibrium in the short-run. In addition, the E-views computer software was used to execute all tests in this study, including the Unite root test, ARDL bound test, ARDL long-run, short-run model, residual diagnostic test, stability test.

In addition to this, we used the Histogram Normality test, the Breusch-Godfrey serial correlation test, the Breusch-pagan-Godfrey heteroskedasticity test, the Jargue-Bera normality test, and the Variance Inflation Factor (VIF) to fix the multicollinearity in the model and evaluate the reliability of it. The CUSUMSQ test was carried out so that we could validate the reliability of the model at a significance level of 5 percent.

The following is a list of the operational variables and model specifications that are suitable for the ARDL that was utilized in this paper:

$$\Delta \mathbf{lnCO_2t} = \boldsymbol{\alpha}_{0j} + \sum_{i=1}^{p} \boldsymbol{\beta}_{ij}\Delta \mathbf{lnINC}_{t-1} + \sum_{i=1}^{q1} \boldsymbol{\beta}_{2J}\mathbf{lnINC^2t}_{-1} + \sum_{i=1}^{q2} \boldsymbol{\beta}_{3j}\Delta \mathbf{lnPOIL}_{t-1} + \sum_{i=1}^{q3} \boldsymbol{\beta}_{4j}\mathbf{lnTOT}_{t-1} + \boldsymbol{\mu}_i + \boldsymbol{\varepsilon}_{it} \qquad (1)$$

Where; CO_2 = Carbon Emission

INC = Gross Domestic Product per capita

INC^2 = Gross Domestic Product per capita squared

POIL = Price of Crude Oil

TOT = Terms of Trade

i = Number of variables in the Model.

j = is the number of time lags.

p = Dependent Variable Lag Values.

q = Regressor Variable Lag orders.

μ_i = Error terms.

ε_{it} = Vector of the Error terms.

4.5 Unit Root Analysis

The unit root test is a criterion that must be met before any research project can make use of the ARDL model. It also establishes whether or not the data are stable. The unit root must be statistically significant at 1 percent, 5 percent, or 10 percent at any level or beginning difference for the ARDL model to be applicable. This requirement can apply to any initial difference. The analysis was carried out by utilizing the ARDL bound test in conjunction with ARDL. As a direct consequence of this, the process of locating the unit root came first. Our findings have been validated by utilizing the augmented Dickey Fuller (ADF), the Dickey-Fuller Generalized Least Squares (DLS), and the Philips-Perron (PP) models in order to guarantee that the variables that were investigated were appropriately integrated. The unit root was investigated using the following two distinct case studies:

i. The constant Scenario and,
ii. The Constant and Trend Scenario

This was utilized to show how stationary the variables are, demonstrating that the constant with trend scenario is the most acceptable in my research since it explains numerous changes as well as political and socio-political causes that may have produced changes in the variables.

4.5.1 Augmented Dickey-Fuller Test

For the purpose of putting their theory to the test, Dickey and Fuller (1979) designed and built a computer program that can determine whether or not a variable is exposed to an a priori random walk, as well as whether or not the variable possesses a unit root. In order to illustrate the applicability and significance of the extended Dickey–Fuller test, Hamilton (1994) provides four case studies. The assumption underlying the null hypothesis is that the variable in question possesses only a single unit root at each and every point along the distribution. This is true regardless of the specific circumstances. The significant differences between the two methods are whether or not a drift term is included in the null hypothesis, and whether or not a constant term and a temporal trend are included in the regression that is used to build the test statistic in the second strategy. Both of these aspects play a role in determining whether or not a drift term is included in the null hypothesis. It's basically the same method as the Dickey–Fuller test, however this time it's used on the model rather than the other way around like in the earlier test.

4.5.2 Dickey-Fuller GLS Test

In time series modeling, it has been usual practice to utilize augmented Dickey-Fuller and Phillips-Peron tests to assess whether or not a series contains a unit root. However, new tests are now available that feature statistical qualities that are considerably superior to those of the older tests. Elliott, Rothenberg, and Stock (ERS) developed an efficient test in their econometric study from 1996 by changing the Dickey-Fuller test statistic with a generalized least squares (GLS) explanation. This led to the production of an accurate test. As a consequence of this, an effective test was developed. They show that their modified test is superior to the standard Dickey-Fuller test in terms of power and small sample numbers by demonstrating how their test was adjusted. These researchers brought them up to date on their methodology. In particular, Elliott et al research from 1996 reveals that their "DF-GLS" test "has considerably increased power when an uncertain mean or trend is present." [Citation needed] [Further citation required] The series that is going to be tested is regressed on a constant and linear trend with GLS trending, and the residual series is used in a typical Dickey-Fuller regression. There are two different kinds of DF-GLS: GLS trending and GLS demeaning. Both of these methods are comparable to how the conventional Dickey-Fuller test can be performed with or without a trend term. The only event that takes place during the first stage of regression with GLS demeaning is the occurrence of a constant; the residual series is then used as the regress and in a Dickey Fuller regression. In the Strata implementation of the DF-GLS test (Baum, 2000), the GLS trending option is set as the default, and the GLS demeaning option is picked when the no trend option is used. The Dickey-Fuller generalized linear model was used in this research, and the constant and constant with trend scenarios were analyzed to ensure that the stationary of the data was properly displayed in a variety of contexts. These analyses supported the findings of the unit-root test section of this research work.

4.5.3 Philip-Peron Test

In statistical analysis, the Phillips–Perron test is a type of test for determining whether or not a unit root exists. It was called after two statisticians who worked together in the field of statistical analysis: Peter C. B. Phillips and Pierre-Perron. Both of these men are known as Peter C. B. Phillips and Pierre-Perron. As a consequence of this, when conducting an analysis of time series, the first order of integration is utilized in order to investigate the possibility of rejecting the alternative hypothesis. This hypothesis asserts that a time series cannot be integrated utilizing the first order of integration. In this particular instance, a different strategy is utilized as opposed to the test of the null hypothesis that is commonly referred to as the Dickey–Fuller test.

$$yt = c + \delta t + a\, yt - 1 + e(t) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad \text{(eq1)}$$

The value is only allowed to be one under the null hypothesis. The versions of the test that apply to series with varying growth characteristics are designed to restrict the drift and deterministic trend coefficients of series, c and, to zero in order to constrain the growth characteristics of series to zero. This is done in order to achieve the goal of bringing the series' growth characteristics to zero. Modified the tests make use of Dickey-Fuller statistics in order to take into consideration the serial correlations that occur throughout the process of innovation (t).

4.6 ARDL Bound Test and ARDL Model

When it is not clear which of two processes—trend or initial difference—is responsible for producing the data that make up a time series. In order to show that delayed values of variables in a univariate equilibrium correction system are relevant, a sort of ARDL modeling known as stationary, bound testing is utilized. More importantly, Haug (2002) asserts that the ARDL bounds testing technique is better suited to and produces better results when a small sample size is used. This is due to the fact that in the short run, both the short-run parameters and the long-run parameters are computed simultaneously, which makes the procedure more accurate.

4.6.1 An Overview of the ARDL bound test and the ARDL model

When it comes to assessing the progression of scientific processes over time, autoregressive distributed lag (ARDL) models play a crucial role. However, as we extend their usefulness by adding richness in dynamic specifications (through multiple lags of variables, either in levels or differences, or lags of the dependent variable), we begin to challenge our ability to draw meaningful inferences from coefficients alone. This is because multiple lags of variables, either in levels or differences, or lags of the dependent variable make it more difficult to draw conclusions. Variables have the potential to show up in a number of different time periods, take on a number of different shapes, and even be filtered by the dependent variable's lagging values. The immediate influence of a variable is what the coefficients tell us about, but they don't tell us anything about the long-run effect of the variable.

There is a method that is more suitable. Instead of carrying out labor-intensive operations in order to develop a closed-form or algebraic solution, we can rely on the power of computing to simulate the over-time response in the dependent variable of some model, given a corresponding change in an x variable. This allows us to avoid the necessity of carrying out the aforementioned tasks. We frequently refer to these "changes" in xx variables, as well as the related response in y variables, as a "counterfactual response this so-called "counterfactual response is actually just a simulated reaction to a "shock" that we are in charge of. The use of dynamics contributes to the simulation of these alternative realities. In a broader sense, however, it is designed to make it as simple as possible to use single-equation ARDL models and to derive conclusions based on such models. The ARDL-bounds testing process, which is a helpful co-integration test developed by Pearson, Shin, and Smith (2001), can be more easily implemented by users thanks to this tool. We illustrate the usefulness of these functions through examples. After a brief discussion of the ARDL model in the general sense, we estimate a collection of these models and demonstrate both the challenges of the ARDL model in the abstract and the solutions of dynamic in particular.

In the field of economics, a significant amount of both theoretical and empirical research has been centered on the econometric analysis of long-run linkages. When the variables in the long-run relation of interest are stationary in trend, the standard procedure has been to remove the trend from the series and then model the de-trended series using either stationary distributed lag or autoregressive distributed lag (ARDL) models. This is done even in the case where the variables in the relation of interest are trend stationary. The conventional asymptotic normal theory is then utilized for the purposes of carrying out estimation and inference concerning the model's long-run features. (Hendry, Pagan, and Sargan 1984) and (Wickens and Breusch, 1988) for exhaustive reviews of the relevant literature. When the variables are difference stationary, also known as integrated of order I (1) for short, the analysis becomes significantly more difficult. Recent research on co-integration has focused on analyzing the long-run relationships between I (1) variables, and its fundamental premise is, at least implicitly, that in the presence of I (1) variables, the traditional ARDL approach is no longer applicable. This basic premise underpins the majority of the research on co-integration that has been published in recent years. As a consequence of this, a wide variety of alternative estimating and hypothesis testing approaches have been specifically created for the analysis of I (1) variables.

$$\mathbf{y_t = \alpha_0 + \alpha_1 t + {}_{i=j}\sum^{p} \emptyset_i y_{t-I} + \beta^{*1} x_t + \sum_{i=0}^{p} \beta^{i}{}_{t} + \Delta X_{t-1} + \mu_t} \quad \textbf{(1)}$$

$$\mathbf{\Delta X_t = P_1 \Delta X_{t-1} + P_2 \Delta X_{t-2} + \ldots + P_s \Delta X_{t-s} + \varepsilon_{it}} \quad \textbf{(2)}$$

Where x_t is the k-dimensional I (1) variables that are not co-integrated among themselves, μ_t and ε_t are serially uncorrelated disturbances with zero means and constant variance-covariance's, and P_1 are k x k coefficient matrices such that the vector autoregressive process in ΔX_{t-1} is stable. We also assume that the roots of $\sum_{i=0}^{p} \beta^{i} = 0$ all fall outside the unit circle and there exists a stable unique long-run relationship between y_t and x_t.

The following is an illustration of one possible construction of the ARDL portrayal of the relationship between commercial activity and economic expansion:

$$\mathbf{lnCO_2 = \beta_0 + \beta_1 lninc + \beta_2 lninc^2 + \beta_3 lnPoil + \beta_4 lnTOT + \mu}$$

In this part of the study, the data collected for the research were tested with the ARDL bound test to check for co-integration between the variables. The ARDL bound test is a testing method that is used to check for co-integration between the variables. In the ARDL bound test, we reject the null hypothesis that there is no long-run relationship or co-integration when the F-statistics is greater than the upper bound I(1) at both the 5 percent level of significance and the 10 percent level of significance. This happens when the F-statistics is compared to the upper bound at both the 5 percent level of significance and the 10 percent level of significance. In addition, once the ARDL bound test has been completed, we move on to doing the short-run and long-run form analyses in order to determine the outcome of the research. Also in the short run, the error correction term (ECT) is assessed, and in order for the model to be approved, it needs to comply with the requirement that states that it must lie between 0 and 1, as well as be statistically significant and have a negative value.

4.7 Residual Diagnostics and Stability Test

Researchers are able to ascertain the dependability of the models and variables that are used for regression by utilizing a test known as the residual diagnostic test. This test gives researchers the opportunity to assess how accurate the models that are being used are. In addition to the diagnostic tests that have already been discussed, additional diagnostic tests are being utilized in this investigation in order to evaluate the dependability of the model that was employed. This category includes the tests known as the white (heteroskedasticity) test, the residual normality test (Serial correlation) test, and the autocorrelation test. Each of these tests is an example of a type of statistical analysis known as heteroskedasticity. Calculating the degree to which the values in the data are autocorrelated can be done by plotting a chart of the residuals values against the expected values and displaying the value of the residuals values against the projected values. The comparison of the probability value to the F-statistics that were obtained leads to the rejection of the null hypothesis and the drawing of the conclusion that the model contains heteroskedasticity.

The CUSUM-square test was performed in addition to the residual diagnostics test to ensure the data's stability. The graph's two red lines reflect the stability and significance level at 5%, while the blue line depicts data mobility. When the blue line is between the two red lines, it indicates that the variables are stable at 5% significance.

CHAPTER V

Findings

5.1 Introduction

This chapter is divided into four sections, each of which summarizes the study findings. The next section addresses the relationships of CO_2 emissions as a proxy for environmental degradation to economic development, and this effect is graphically evaluated. The first section of this article covers descriptive statistics and data analysis techniques in considerable depth. The second segment discusses the stationary test of a data set, and the third section looks at and discusses co-integration. The fourth session looks at and discusses co-integration. In the very last and concluding section, we will discuss a variety of topics, including regression analysis, diagnostic tests, and tests to determine whether data or results are stable. In spite of this, the presentation was carried out in a manner that was consistent with the goals of the research, and the testing was executed effectively with the help of the EViews computer software.

5.2 Descriptive Statistics

In this part, we investigated the possibility that increased carbon emissions are linked to worsening environmental conditions. In this section, we'll learn more about the relationship's trajectory. This study's descriptive statistics were generated using EViews to make them more accessible to scholars who already have some familiarity with the data. It's easy to see how this study's findings compare to earlier studies, which have found that CO_2 emissions and other independent factors have decreased over time. The results are summarized in a table below.

Nigeria

Table1: Descriptive Statistics for **NIGERIA**

	lnCO2	lnINC	lnINC2	lnPOIL	lnTOT
Mean	-0.26079	6.890273	47.96815	3.447884	3.527714
Median	-0.23572	6.773538	45.88082	3.322515	3.572346
Maximum	0.336472	8.038835	64.62286	4.630643	4.195697
Minimum	-0.67335	5.599162	31.35062	2.490723	2.821379
Std. Dev.	0.217999	0.709936	9.866138	0.638829	0.357478
Skewness	0.227295	0.151756	0.236762	0.42737	-0.08813
Kurtosis	3.062689	1.599132	1.579291	1.94843	2.413149
Jarque-Bera	0.377292	3.681069	4.018061	3.290182	0.672702
Probability	0.828079	0.158733	0.134119	0.192995	0.714372
Sum	-11.2141	296.2817	2062.63	148.259	151.6917
Sum Sq. Dev.	1.99599	21.16836	4088.308	17.14028	5.3672
Observations	43	43	43	43	43

Author’s computation (using Eviews12)

On the basis of the data and the time period that was investigated, it has been hypothesized that the average CO2 emission is -0.26079. On the other hand, estimates put Nigeria's GDP per capita and GDP per capita squared at a mean of 6.890273 and 47.96815 respectively. These figures are based on national statistics. The average price of oil in Nigeria is given as 3.447884, while the average terms of trade are given as 3.527714. Both of these numbers are given correspondingly. The GDP per capita can reach a maximum of 64.62286, which, according to the chart that was just presented, is considered to be a high level for a country that falls into this category. The results for Skewness are all positive and shift to the right, with the exception of LTOT, which produces negative results and moves in the other direction, to the left. All kurtosis are platykurtic because their Kurtois values are less than 3, specifically 1.599132, 1.579291, 1.94843, and 2.413149 for LINC, LINC2, LPOIL, and LTOT correspondingly; the only exception is LCO2, which has a value of 3.062689 and is mesokurtic.

The results of the descriptive statistics on CO2 emission and other independent variables over the time period chosen for the study, which is from 1977 to 2019, are quite spectacular. This is especially the case when compared to the findings of earlier studies.

South-Africa

Table2: Descriptive Statistics for **SOUTH_AFRICA**

	lnCO2	**lnINC**	**lnINC2**	**lnPOIL**	**lnTOT**
Mean	2.113095	8.284733	68.85833	3.447884	3.764026
Median	2.111425	8.219838	67.56573	3.322515	3.756538
Maximum	2.265921	9.083745	82.51442	4.630643	4.055257
Minimum	2.009555	7.336351	53.82204	2.490723	3.401197
Std. Dev.	0.059892	0.476249	7.88631	0.638829	0.169179
Skewness	0.204732	- 0.035114	0.043795	0.42737	-0.19352
Kurtosis	2.573437	1.94058	1.887524	1.94843	2.182888
Jarque-Bera	0.626395	2.019751	2.231118	3.290182	1.464623
Probability	0.731105	0.364264	0.327732	0.192995	0.480796
Sum	90.86308	356.2435	2960.908	148.259	161.8531
Sum Sq. Dev.	0.150656	9.526142	2612.143	17.14028	1.202098
Observations	43	43	43	43	43

Author's computation (using Eviews12)

The descriptive statistics for South-Africa shows the value for the mean for variables CO2 emission, GDP per capita, GDP per capita- squared, price of oil, and terms of trade; values shown as 2.113095, 8.284733, 68.85833, 3.447884, and 3.764026 respectively. The max GDP per capital logged for South-Africa is 9.083745. The descriptive statistics shows that for the Jarque-Bera all variables for South-Africa a normally distributed because all probability values exceeds 0.5 % level of significance so the null hypothesis can be rejected.

All skewness variables for all variables are positive and shifts to the right. The Kurtosis values also shows that the vriables for South-Africa are playkurtic because they are lesser than 3

Seychelles

Table3: Descriptive Statistics for **SEYCHELLES**

	lnCO2	**lnINC**	**lnINC2**	**lnPOIL**	**lnTOT**
Mean	1.82272	8.758403	77.23641	3.447884	4.494263
Median	1.790091	8.933123	79.80069	3.322515	4.48074
Maximum	2.622492	9.6936	93.96587	4.630643	5.054971
Minimum	0.438255	6.951198	48.31915	2.490723	3.966511
Std. Dev.	0.642049	0.734385	12.52434	0.638829	0.30397
Skewness	-0.542255	-0.659123	-0.530702	0.42737	-0.007472
Kurtosis	2.037628	2.454853	2.249768	1.94843	2.025468
Jarque-Bera	3.766659	3.645971	3.026888	3.290182	1.70197
Probability	0.152083	0.161543	0.22015	0.192995	0.426994
Sum	78.37694	376.6113	3321.165	148.259	193.2533
Sum Sq. Dev.	17.31351	22.65151	6588.083	17.14028	3.880718
Observations	43	43	43	43	43

Author’s computation (using Eviews12)

The table above shows results of the descriptive statistics carried out for the third selected country for this research work Seychelles. The tables shows results for the mean median maximum and minimum numbers and also a description of a normality test using the Jarque-Bera technique to test if variables are normally distributed or not. The results shows that all probability values for LCO2, LINC, LINC2, LPOIL, and LTOT are above 0.05 so the null hypothesis was rejected; because all variables are normally distributed. The mea values are represented as 1.82272, 8.758403, 77.23641, 3.447884, 4.494263 respectively for LCO2, LINC, LINC2, LPOIL, LTOT. The Skewness for Seychelles is -0.542255, -0.659123, -0.530702, are negative and shifts t the left except for LTOT which is positive and shifts right-ward 0.42737. The Kurtosis shows that the data are playkurtic because they are lesser than 3.

Mauritius

Table4: Descriptive for Statistics for **MAURITIUS**

	lnCO2	**lnINC**	**lnINC2**	**lnPOIL**	**lnTOT**
Mean	0.434121	8.175382	67.47258	3.447884	4.372356
Median	0.405465	8.214979	67.48589	3.322515	4.394449
Maximum	1.193922	9.32441	86.94462	4.630643	4.663439
Minimum	-0.69315	6.795594	46.1801	2.490723	4.01998
Std. Dev.	0.615007	0.806742	13.0676	0.638829	0.174923
Skewness	-0.32306	-0.21021	-0.09862	0.42737	-0.33861
Kurtosis	1.663561	1.798884	1.767306	1.94843	2.3251
Jarque-Bera	3.948028	2.901469	2.792202	3.290182	1.637787
Probability	0.138898	0.234398	0.24756	0.192995	0.440919
Sum	18.6672	351.5414	2901.321	148.259	188.0113
Sum Sq. Dev.	15.88583	27.33499	7172.01	17.14028	1.285126
Observations	43	43	43	43	43

Author’s computation (using Eviews12)

The table 4 also contained information after the descriptive statistics analysis for Mauritius was carried out the mean for LCO2 was 0.434121, for LINC 8.175382, and for LINC2 was 67.47258, LPOIL and LTOT was 3.447884 and 4.372356 respectively. The skewness for LCO2 -0.32306

LINC -0.21021, LINC2 -0.09862, LPOIL 0.42737, LTOT -0.33861 are negative except for LPOIL is positive and moves right-wards. The kurtosis for all variables LCO2,LINC, LINC2, LPOIL, LTOT are 1.663561, 1.798884, 1.767306, 1.94843, and 2.3251 respectively are playkurtic because they are less than 3.

The jarque-Bera test for normality distribution as tells us that variables are normally distributed as criteria for reject of the null hypothesis that states that residual variables are not normally distribution, all probability exceeds 5% level of significance. The Maximum value is 9.32441 for LINC and LINC2 is 86.94462.

5.3 Stationary Test

In this study, the stationary test otherwise known as the unit root test will be performed in two scenarios the constant and the constant with trend and this unit-root analysis will be carried using three criteria the Augmented Dickey Fuller (ADF), the Dickey-Fuller GLs, and the Philips-Perron (PP).

The unit root results are presented in the tables below. During the unit root test, the equation comprised possible outcomes for both the intercept and the intercept and trend situations.

Table 5: Unit-Root Test CONSTANT WITH TREND

	Nigeria			SOUTH-AFRICA			SEYCHELLES			MAURITIUS		
Variables	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*
lnCO2	-8.38736	-7.93399	-7.71247	-8.38736	-3.14221	7.712468	-6.09937	-6.09937	-81.181	-5.828764	-3.109269	-5.82816
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(0)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnINC	-4.883136	-5.00305	-4.83105	-4.88314	5.003046	4.831053	-4.82075	-4.37985	-4.88699	-5.125795	-4.828003	-5.08533
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnINC2	-4.838528	-4.95731	-4.78131	-4.83853	-4.95731	-4.78131	-5.06592	-4.80285	-5.01454	-5.333297	-5.11654	-5.33851
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnPOIL	-5.857514	-6.00309	-5.84038	-5.85751	-6.00309	-5.84058	-5.85751	-6.00309	-5.84058	-5.837514	-5.11654	-5.84059
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnTOT	-6.533433	-6.69934	-6.71793	6.533433	-6.69936	-6.71793	-8.1533	-8.30587	-8.1333	-6.522864	-5.708899	-8.00602
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****

The *, **, ***, represents 1%, 5%, 10% level of significance

The results of the unit root test are displayed in the table located above. They show that the level of integration of all the variables is at level I(0), and at first differences. During the Dickey-Fuller GLS, the level of carbon dioxide (CO2) for South Africa was integrated at level, while all of the other variables were integrated at first differences. The findings show that variables were integrated at I(0) and I(1), which showed mixed outcomes of variables. Results from the unit root test run at constant with trend show that the null hypothesis implying that the series has a non-stationary level should be rejected. Results from the unit root test run at level and at first difference at 5% level of significance show that variables are stationary at level.

Table 6: Unit-Root Test CONSTANT WITHOUT TREND

	Nigeria			**SOUTH-AFRICA**			**SEYCHELLES**			**MAURITIUS**		
Variables	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*	*ADF*	*DF*	*PP*
lnCO2	-8.174300	-7.639746	-7.561233	-8.174300	-1.864801	-6.717091	-6.081252	-6.891424	-7.502318	-3.112931	-2.936979	-5.896667
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(0)*****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnINC	-4.943186	-4.984569	-4.912470	-4.943186	-4.773629	-4.426411	-4.615111	-2.976375	-3.126390	-5.188308	-4.157814	-5.15001
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnINC2	-4.897708	-4.941145	-4.863675	-4.962228	-4.810524	-4.397922	-4.883652	-3.550429	-2.646365	-5.404004	-4.664424	-5.408617
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(0)****	**I(1)****	**I(1)****	**I(1)****
lnPOIL	-5.929423	-4.941145	-5.914839	-5.929423	-5.978831	-5.914839	-5.929423	-5.978831	-5.914839	-5.929423	-5.978831	-5.914839
Integration	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****
lnTOT	-2.806642	-1.999627	-2.790185	-6.523992	-1.800956	-7.988643	-8.241524	-8.076315	-8.241524	-6.367092	-4.707614	-6.426272
Integration	**I(0)****	**I(0)****	**I(0)****	**I(1)****	**I(0)*****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****	**I(1)****

The *, **, ***, represents 1%, 5%, 10% level of significance

The Unit root test above shows the results for four countries Nigeria, South-Africa, Seychelles, and Mauritius respectively. The just like in the scenario with trend shows that variables are stationary at level I (0) and first differences I(1) and also some variables are stationary at 5% and 10% level of significance. Hence, the study shows to disregard the Null hypothesis stating that series are non-stationary and the acceptance of the alternative variable that series are stationary at level and first difference with 5% and 10% level significance properly represented in the table above.

5.4 ARDL Bound Test

Table7 : ARDL Bound Test			
Country	F-statistics	Lower Bound	Upper Bound
Nigeria	5.016652	3.47	4.57
South-Africa	7.106749	3.47	4.57
Seychelles	8.609487	3.05	3.97
Mauritius	20.283560	3.47	4.57

Author's computation (using Eviews12)

In order to determine whether or not the data set under consideration had instances of co-integration, the authors of this study applied the ARDL Bound test, which was established on the basis of the ARDL methodology. We have rejected the null hypothesis, which states that there is no co-integration and, as a result, there is no long-run effect on the independent variables toward the dependent variables, if the F-statistics is greater than both the lower bound I (0) and the upper bound I(1). A combined F-test that was significant against the null hypothesis of there being no co-integration relationship was expressed as (**H_0: $\beta_0 = \beta_1 \ldots\ldots = \beta_{k=0}$**), was utilized to see if there was a co-integration relationship between CO2 emissions and the other variables for each country. The findings that were revealed after using the statistical analysis software EViews to the assembled data set. According to the results, the F-statistics for the ARDL bound test for each nation (Nigeria, South Africa, Seychelles, and Mauritius) are as follows: 5.06652, 7.106749, 8.609487, and 20.283560, respectively. Since all of the F-statistics for the countries were higher than the lower and upper bound at the 5 percent level of significance, the null hypothesis was found to be false. This leads us to believe that the CO2 emission levels and the other variables in our research are intertwined. In order to assess the nature of the connection that exists between CO2 emissions and the remaining free variables in our model, we need to perform the computation that determines the long-term outcome.

5.5 ARDL Long-Run Test

NIGERIA

Table 8

Long-run ARDL results

Variable	Coefficient	Std. Error	T-statistics	Prob.
lnINC	-8.486973	2.256776	-3.760662	0.0019
lnINC2	0.623559	0.163916	3.804149	0.0017
lnPOIL	-0.513232	0.283719	-1.808943	0.0905
lnTOT	-0.697381	0.25564	-2.727982	0.0156

Author's computation (using Eviews12)

The data above for the country Nigeria is the Long-run ARDL results the data shows the relationship between the dependent variable CO2 emission, GDP per capita a proxy used for income and income-squared, price of Oil, and terms of trade. The results show that in the long run all variables have effect on CO2 emission and are statistically significant at 5 percent level of significance.

lnINC; is a variables used in this study and it has a negative coefficient, but statically significant relationship to CO2 emission. This means that a 1% increase in GDP per capita (income) will bring about a -848% decrease in CO2 emission. In a country with large population like Nigeria and with a lot of the political insecurity going on its can be said that the above data maybe have been affected by this. The lnINC2 has a positive and a long-run significance meaning that in the long-run a 1% increase in GDP per capita will cause a 62 percentage increase in carbon-dioxide emission in the country. Also the long-run results for lnPOIL and lnTOT also shows that in the long-run they both are significant but affects are negative meaning. That in the long-run 1% increase in lnPOIL will give rise to a 51% decrease of CO2 emission and also a 1% increase in lnTOT will result to a 69 percent decrease to the dependent variables CO2 emission.

SOUTH-AFRICA

Table 9

Long-run ARDL results

Variable	Coefficient	Std. Error	T-statistics	Prob.
lnINC	9.95268	5.7597	1.727986	0.0954
lnINC2	-0.592625	0.345573	-1.714903	0.0978
lnPOIL	-0.011076	0.075096	-0.147488	0.8838
lnTOT	0.920638	0.38273	2.405449	0.0233

Author’s computation (using Eviews12)

The table above shows the long-run relationships between the independent and dependent variables. In the long-run lnINC has a positive and significant effect on CO2 emission in South-Africa meaning that for a 1% increase in lnINC the CO2 emission will rise by 995%. And for lnINC2 it has a negative but significant relationship statistically, for a 1 percent increase in lnINC2 CO2 emission will decrease by 59 percent. lnTOT shows a positive and a significant results at 5% level of significance the results shows that for every 1% increase in lnTOT CO2 emission in South-Africa would go up by 92%.

SEYCHELLES

Table 10

Long-run ARDL results

Variable	Coefficient	Std. Error	T-statistics	Prob.
lnINC	11.96965	4.869649	2.45801	0.0250
lnINC2	-0.8629	0.32071	-2.69058	0.0155
lnPOIL	-0.55395	0.157335	-3.52083	0.0026
lnTOT	-0.06963	0.260005	-0.26779	0.7921

Author’s computation (using Eviews12)

In the table above representing Seychelles the results shows that lnINC, lnINC2, and lnPOIL are all statistically significant at 5% level of significance. The lnINC will see that the long-run relationship is positive as income increases by a percentage the rate of CO2 emission will increase by 1196%. But at income-squared the relationships because negative as we see that a 1% increase in the income-squared will results to a 86 percentage decrease in carbon-dioxide emission. lnPOIL shows that in the long-run there is a negative but significant relationship between the independent and dependent variable. For a percentage increase in lnPOIL the rate of CO2 will decrease by 55%.

MAURITIUS

Table 11

Long-run ARDL results

Variable	**Coefficient**	**Std. Error**	**T-statistics**	**Prob.**
lnINC	3.02505	0.982941	3.077549	0.0068
lnINC2	-0.20716	0.058449	-3.544284	0.0025
lnPOIL	0.138141	0.041939	3.293872	0.0043
lnTOT	0.88772	0.363512	2.442063	0.0258

Author’s computation (using Eviews12)

In the table above for Mauritius we see the long-run relationships for the independent variables and dependent variable which is CO2 emission in the country. We see that lnINC has a positive and statistically significant relationship with CO2 emission. That is for every percentage increase in income CO2 emission will increase by 302%. While at vINC2 a 1% increase will results to a 20 percent decrease in CO2 emission. lnPOIL and lnTOT has a positive and significant relationship in the long-run and statistically significance. For a 1% change in lnPOIL and lnTOT will cause a 13% and 88% change in CO2 emission.

5.6 ARDL Short-Run Test and Error Correction Model

NIGERIA

Table 12

Short-run ARDL results

Variable	**Coefficient**	**Std. Error**	**T-statistics**	**Prob.**
ΔlnCO2 (-1)	0.729384	0.097215	7.502756	0.0000
ΔlnINC (-1)	3.332265	1.090116	3.056799	0.0050
ΔlnINC2	0.325413	0.072037	4.517336	0.0004
ΔlnPOIL (-1)	0.71639	0.135219	5.297982	0.0001
ΔlnTOT	-0.265406	0.113663	-2.33502	0.0338
C	29.31671	5.207793	5.629394	0.0000
ECM	-0.89774	0.159268	-5.636677	0.0000
Adjusted R-squared	0.583966		Durbin-Watson	2.134
F-statistics	3.972435		Prob (F-statistic)	0.0024

Author's computation (using Eviews12)

In the table above we see said results for the short run relationship in Nigeria in the relationship between income and income-squared are positive and statistically significant as 1% increase in income or income squared the rate at which CO2 emission increases is at 79% and at over 300% respectively. This is normal as in the short-run the expected sign between income and CO2 should be (+) as income increases in the short-run, industrialization will expand and this will result to environmental degradation such as air pollution, and water pollution, land, and noise pollution. For lnPOIL(-1) as price of oil increases by a percentage in the lagged year the CO2 emission will increase also by 71% and this results are statistically significant. For lnTOT, a 1% increase in terms of trade will result to a negative percentage change in the CO2 emission by 26.54%. The Error correction model which analyses the rate of speed of adjusted to equilibrium in the short-run shows that the speed of the adjustment to equilibrium in the short-run is 89% and is statistically significant at 0.05 level of significance. The Durbin Watson at 2.134 shows there is no multi-collinearity problem in the analysis.

SOUTH-AFRICA

Table 13

Short-run ARDL results

Variable	**Coefficient**	**Std. Error**	**T-statistics**	**Prob.**
ΔlnCO2 (-1)	0.729384	0.097215	7.502756	0.0000
ΔlnINC (-2)	-3.382813	1.058806	-3.194932	0.0035
ΔlnINC2 (-1)	-0.205782	0.067894	-3.030933	0.0053
ΔlnPOIL	-0.002997	0.020487	-0.146302	0.8848
ΔlnTOT	0.24914	0.072496	3.436578	0.0019
C	-11.58111	3.884693	-2.981215	0.0060
ECM	-0.270616	0.042368	-6.387331	0.0000
Adjusted R-squared	0.846546		Durbin-Watson	2.051204
F-statistics	18.92899		Prob (F-statistic)	0.0000

Author’scomputation(usingEviews12)

In the short-run results for south-Africa shows that as income increases at 1% the rate of CO2 emission continues to diminish at 338% and also at income-squared it decreases by 20% at a statistically significant probability value of 0.00305 and 0.0053 respectively. At lnTOT a 1% percentage change or increase in terms of trade will result to a 24.9% change and or increase in CO2 emission in South-Africa. The ECM shows the speed of adjustment to equilibrium and for South-Africa the speed of adjustment to equilibrium is 27% and is significant at 5%.

SEYCHELLES

Table 14

Short-run ARDL results

Variable	**Coefficient**	**Std. Error**	**T-statistics**	**Prob.**
ΔlnCO2 (-1)	0.340219	0.123613	2.752302	0.0136
ΔlnINC (-3)	-15.639080	2.863285	-5.461935	0.0000
ΔlnINC2 (-3)	0.950760	0.165229	5.754196	0.0000
ΔlnPOIL (-1)	0.561700	0.096805	5.802393	0.0000
ΔlnTOT	-0.045938	0.169748	-0.270628	0.7899
C	29.316710	5.207793	5.629394	0.0000
ECM	-0.659781	0.080695	-8.176193	0.0000
Adjusted R-squared	0.583966		Durbin-Watson	2.633999
F-statistics	7.722415		Prob (F-statistic)	0.000012

Author's computation (using Eviews12)

The table above shows the short-run analysis for Seychelles; the results for the income and income-squared shows that the 3rd lag of the lnINC and lnINC2 are significant to CO2emission a proxy used for environmental degradation. The results indicates that a 1% percentage change in lnINC will result to a 1563% decrease in CO2 emission and that when income begins to increase the rate of CO2 emission will increase also cause an inverted-U Kuznet's curve different from the traditional shape of the Kuznets curve. The lnPOIL(-1) shows that a 1% percentage change in the price of oil will results in the 56.1% change in the carbon-oxide emission in Seychelles. The error correction model shows that the speed of adjustment to equilibrium for the country in the long-run is 65% and the ECM is statistically significant.

MAURITIUS

Table 15

Short-run ARDL results

Variable	Coefficient	Std. Error	T-statistics	Prob.
ΔlnCO2 (-1)	0.234337	0.083404	2.809652	0.0121
ΔlnINC	5.214595	0.816378	6.387476	0.0000
ΔlnINC2	-0.315302	0.051662	-6.103166	0.0000
ΔlnPOIL	0.124642	0.026031	4.788291	0.0002
ΔlnTOT	0.300666	0.089448	3.361368	0.0037
C	-16.28811	1.45943	-11.16059	0.0000
ECM	-0.940345	0.08848	-11.19289	0.0000
Adjusted R-squared	0.873821		Durbin-Watson	2.103881
F-statistics	17.01467		Prob (F-statistic)	0.0000

Author’s computation (using Eviews12)

The results shows that the income and income-squared results agrees with the EKC hypothesis that as income increases that CO2 emission will increase and then start to diminish after the turning point above the diagram. The lnINC shows that a percentage changes in lnINC will results to a 521% change in CO2 emission which is positive. And for lnINC2 a 1% change in income squared will lead to a 31% change diminishing for CO2 emission. The lnPOIL and vTOT results also shows that a percentage change in each will result to a 12.4% and a 30% increase in CO2 emission in Mauritius. The ECM shows that the speed to adjustment to equilibrium is about 94%.

5.7 Residual Diagnostics Test

Utilizing Breush-Pagan-Godfrey to check for heteroskedasticity, the serialcorrelation-LM test using Breush-Godfrey to verify if there is auto-correlation, and the Normality test to assess the distribution of error terms, we can arrive at a diagnosis. All of this will be proved in order to show the robustness of our research model's underlying assumptions. The following is a summary of the findings.

Table 16

Residual Diagnostics Test						
	Normality Test		**Heteroskedasticity**		**Serial Correlation-LM Test**	
Country	**T-statistics**	**P-value**	**F-statistics**	**P-value**	**F-statistics**	**P-value**
Nigeria	0.044304	0.978092	0.332239	0.9896	0.203818	0.6586
South-Africa	0.421556	0.809954	0.332239	0.9896	0.083838	0.7745
Seychelles	0.433262	0.797215	1.206170	0.3511	3.090239	0.0752
Mauritius	1.307363	0.520075	1.450282	0.2214	0.900474	0.4272

Author's computation (using Eviews12)

The outcome presentation in table above shows the accuracy of the model in comparison to the comprehensive diagnostic test that was carried out for the study of serial correlation, heteroskedasticity, and JB normality. The results of the serial correlation-LM test, which were found in the table and showed non-significant rates of probability, indicate that the data in question do not demonstrate the presence of a problem related to serial correlations. for all countries Nigeria, South-Africa, Seychelles, and Mauritius. If the p-value at the 5% level of significance is less than 0.05, we reject H_0 and accept H_1, concluding that there is no serial correlation; otherwise, accept H_0 as explained by Gujarati (2004). Therefore, we reject the null hypothesis since the p. value is more than 0.05 at 0.6586, 0.7745, 0.0752, 0.4272 for Nigeria, South-Africa, Seychelles, and Mauritius respectively. For the Heteroskedasticity test see that the null hypothesis are rejected for all countries as the probability value is higher than the bench mark 5% level of significance. The normality test for residual distribution shows that all variables are normally distributed in this study reason being that the probability value for all variables for each selected countries are greater than 0.05 level of significance in this research work.

5.8 Stability Test

The stability test section of this Thesis intends show the CUSUM and the CUSUMSQ tests which evaluations helps to display the consistency of the regressors long-run coefficients. The assessed coefficients are said to be stable if the CUSUM and CUSUMSQ statistical tests plan to stay with the 5 percent level of significance.

NIGERIA

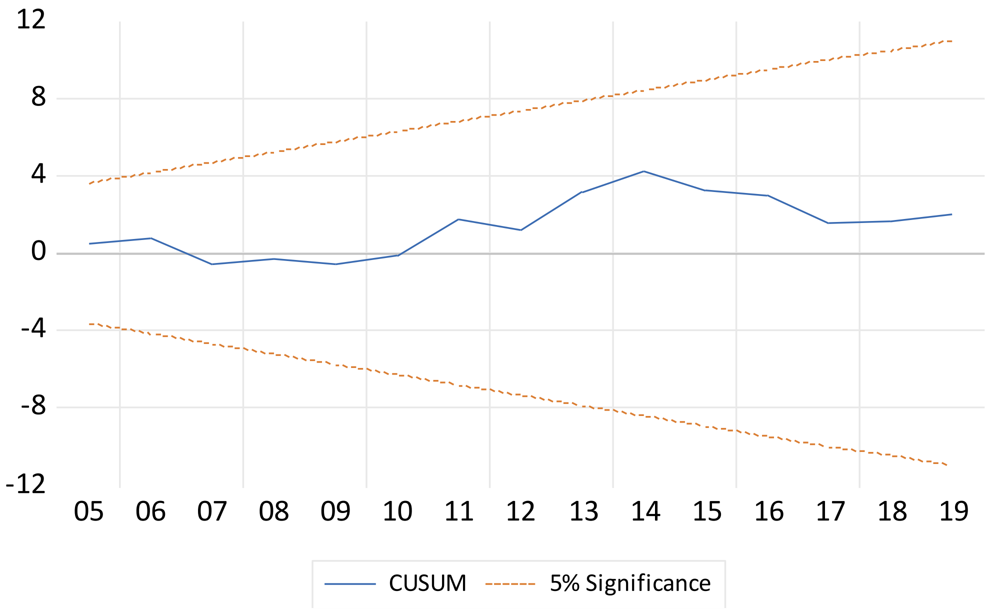

Figure 3

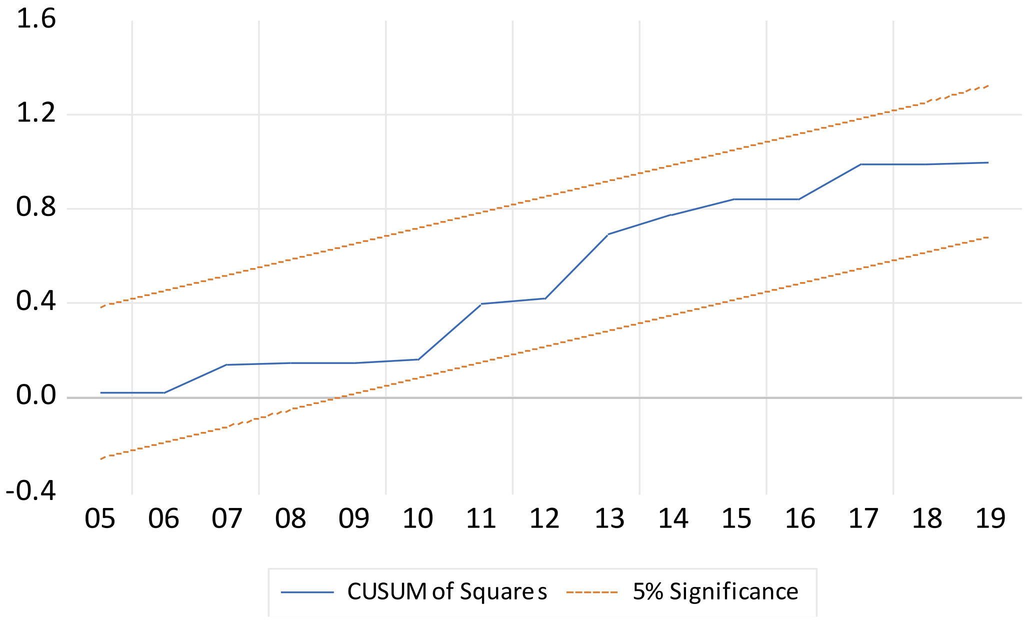

Figure 4

SOUTH-AFRICA

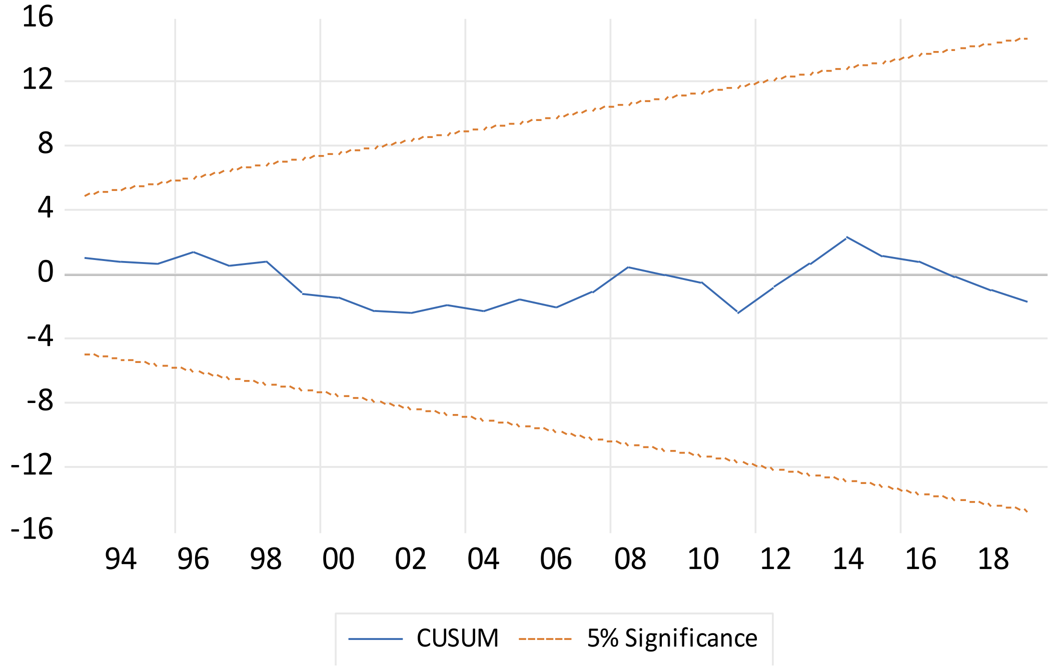

Figure 5

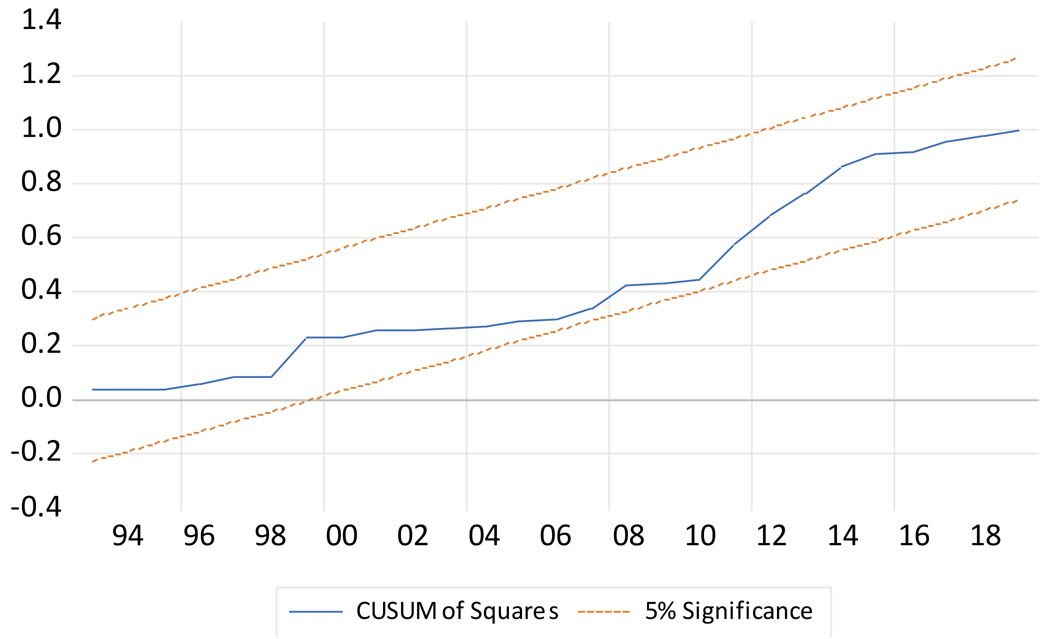

Figure 6

SEYCHELLES

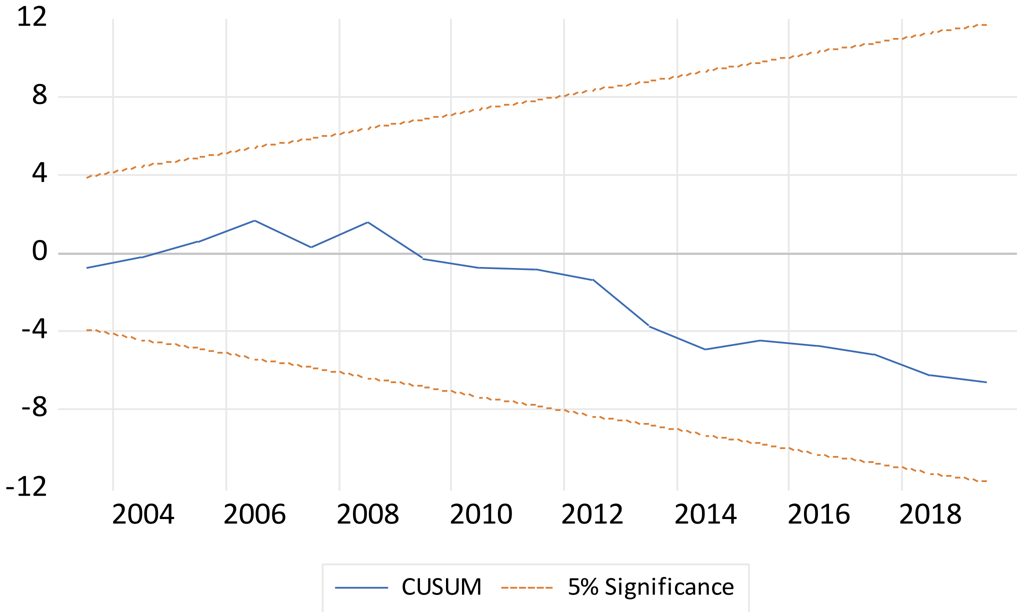

Figure 7

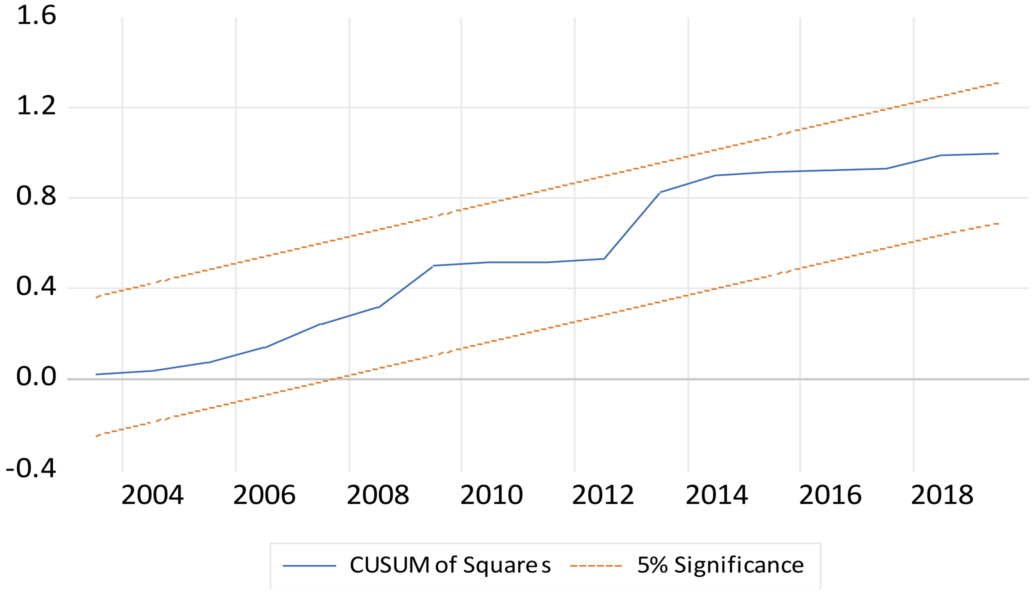

Figure 8

MAURITIUS

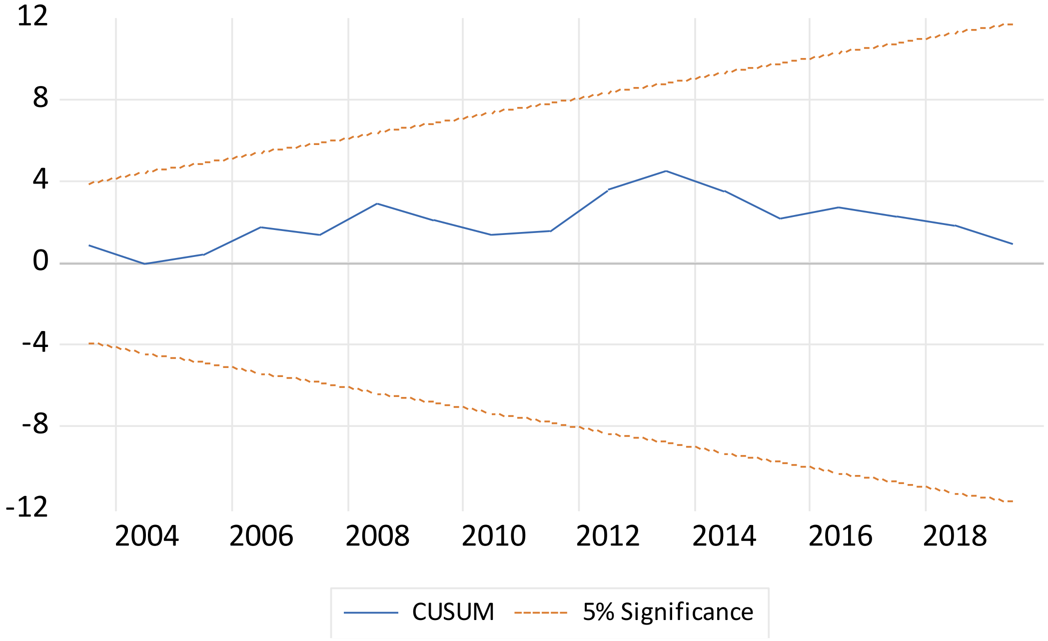

Figure 9

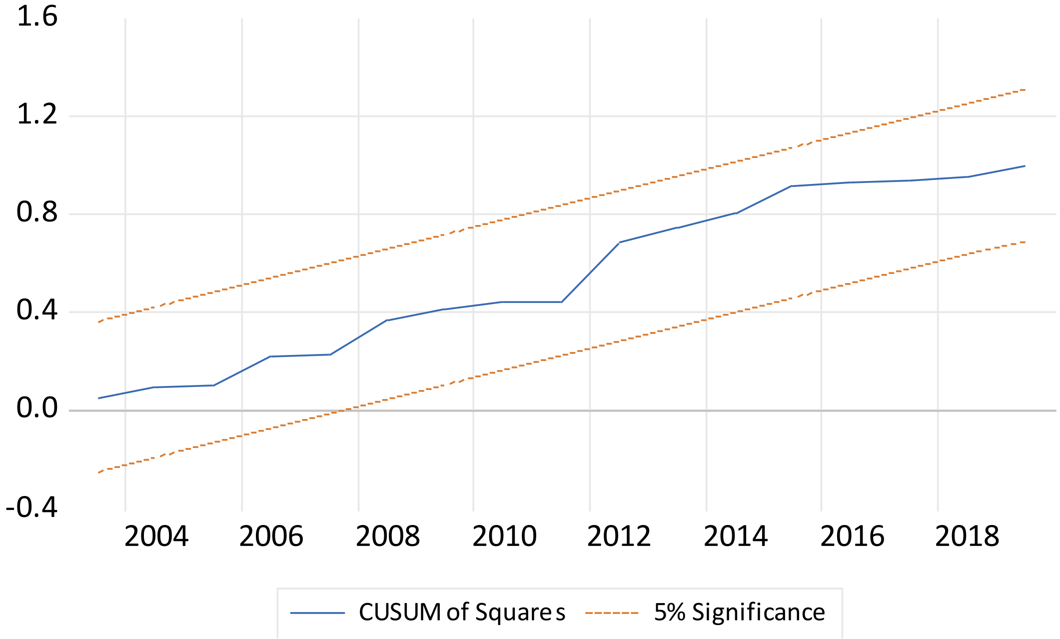

Figure 10

The tables above show the results for the CUSUM and CUSUMSQ test carried out in the study the results above shows that the regressors are stable and within the line of stability which is indicated by the two red lines. Hence all variables used for this study are stable at 5% level of significance.

5.9 Discussion of Results and Link to Research Hypothesis

In this fifth chapter of this the study the results of the ARDL bound test and ARDL model were interpreted, the residual diagnostic test also was given and the stability of the data were out to the test. The reason for these sections is to give a summary for each country's results and to link the results to the EKC hypothesis tested for the first chapter and also see if the research objectives and questions were attended to properly. Below are discussions of the results for Nigeria, South-Africa, Seychelles, and Mauritius accordingly;

5.9.1 Nigeria

The long-run relationship emissions of carbon dioxide and income a proxy for environmental degradation showed that in Nigeria as income is increasing the CO2 emission decreases until it gets to the turning point and starts to sprout upwards there could be a lot of factor that could cause this U-shaped curve which is quite different from the normal inverted U-shaped Kuznets curve. The reason why the results for Nigeria differs from the rest of the countries is that Nigeria is a country that is heavily dependent on crude oil and its natural as that the consumption of crude oil will bring about environmental degradation in the country. So the Kuznets curve for Nigeria is U-shaped because as crude oil usage of prices increases the GDP will also increase because of the country's heavy dependent on crude-oil.

H_0: In selected countries, there are no significant link between economic degradation and economic development.

No. This null hypothesis when tested against the results for Nigeria should be rejected because the results should that there is a statistically significant relationship or link between economic degradation and various stages of economic development

H_1: There is a significant relationship between economic degradation and various stages of economic development.

Yes. The alternative hypothesis will be accepted because it shows that there is a negative but significant relationship between income and environmental degradation and it becomes positive as income increases to income-squared.

5.9.2 South-Africa, Seychelles, Mauritius

For this remain three countries used for the analysis we saw that they but had same signs which was as income was increase the CO2 emission was also increasing until it got to the turning point were in starts to diminish as income moved to income-squared this conformed to theory for EKC which had an inverted U-shaped graph. Show that the EKC hypothesis can be heavily utilized by these countries for environmental friendly policies.

H_0: In selected countries, there are no significant link between economic degradation and economic development.

No. This null hypothesis when tested against the results for these three countries should be rejected because the results should that there is a statistically significant relationship or link between economic degradation and various stages of economic development

H_1: There is a significant relationship between economic degradation and various stages of economic development.

Yes. The alternative hypothesis will be accepted because it shows that there is a positive but significant relationship between income and environmental degradation and it becomes negative as income increases to income-squared which conforms to theory that Environmental Kuznets curve is usually or more often an inverted U-shaped curve.

CHAPTER VI

Conclusion and Recommendations

Introduction

This sixth chapter of the study will include a summary of the thesis, empirical findings, policy suggestions, and limitations of the study.

6.1 Summary

This study analyzed the degradation of the environment during various stages of economic growth in Nigeria, Seychelles, South-Africa and Mauritius: and overview of the Kuznets curve. The research employed the estimation techniques i.e., ARDL, where LCO2 which is the dependent variable as a proxy variable to measure environmental degradation and income and income-squared, as the independent variables, and price of oil, and terms of trade were used as control variables.

This thesis utilized secondary data with a yearly frequency spanning a time frame of 43 years from1977 to 2019. Data for GDP per capita, price of oil, terms of trade was sourced from World Bank Database indicators. While data for CO2 emission was gotten from CountryEconomy.com.

6.2 Findings

The empirical findings of the Augmented Dickey-Fuller, and the Philips-Peron and Dickey-Fuller GLS test showed that the variables are stationary at level difference and also somewhere stationary at first difference.

The ARDL long form and bound test reveal that the F-statistics was greater than the lower band and upper band showing that there is a long run relationship among the variables. The findings of the linear Autoregressive Distributed Lags model show a long-run direct relationship between Incomes, Income-squared and CO2 emission as a proxy for environmental degradation with a 1% percentage in income caused a -848% change in CO2 emission and a 1% percentage rise in income-squared causes a 62% increase in CO2 emission. Also, the long-term findings for lnPOIL and lnTOT demonstrate that they are both important in the long run, but the effects are negative. In the long term, a 1% increase in lnPOIL results in a 51% reduction in CO2 emissions, whereas a 1% increase in lnTOT results in a 69% reduction in the dependent variable CO_2 emissions. In the ARDL short-run, the link between income and income-squared is positive and statistically significant in Nigeria, as a 1% rise in income or income squared increases CO_2 emissions by 79 percent and over 300 percent, respectively. For lnPOIL(-1) as the price of oil rises by a percentage in the lag year, CO_2 emissions rise by 71 percent, and this finding is statistically significant. For lnTOT, a 1% increase in terms of trade results in a negative percentage change in CO_2 emissions of 26.54 percent.

In the long run, lnINC has a positive and considerable influence on CO_2 emissions in South Africa, which means that a 1% increase in lnINC increases CO_2 emissions by 995 percent. And for lnINC2, there is a statistically significant negative association; a 1% increase in lnINC2 reduces CO_2 emissions by 59%. At a 5% level of significance, lnTOT provides a positive and significant result, indicating that for every 1% rise in lnTOT, CO_2 emissions in South Africa will increase by 92%. The short-run results for South Africa demonstrate that when income grows by 1%, the rate of CO_2 emission falls by 338 percent and income-squared decreases by 20%, with statistically significant probability values of 0.00305 and 0.0053, respectively. At LTOT, a 1% percentage change or rise in terms of trade results in a 24.9 percent change and or increase in CO_2 emissions in South Africa.

The lnINC will notice that the long-run connection is positive because as wealth grows by a percentage, so does the rate of CO_2 emission by 1196 percent. However, at income-squared, the connections are negative, as we can see that a 1% rise in income-squared results in an 86 percent drop in carbon-dioxide emissions. lnPOIL demonstrates that the independent and dependent variables have a negative yet substantial association in the long term. The rate of CO_2 will drop by 55% for every percentage rise in lnPOIL. In the short-run study for Seychelles, the income and income-squared results demonstrate that the third lag of the lnINC and lnINC2 are important to CO_2emission, a proxy for environmental deterioration. The results show that a 1% change in lnINC results in a 1563% drop in CO_2 emissions, and that when wealth rises, the rate of CO_2 emissions rises as well, resulting in an inverted-U Kuznets curve, which differs from the typical form of the Kuznets curve. According to the lnPOIL(-1) model, a 1% change in the price of oil leads in a 56.1 percent rise in carbon-oxide emissions in Seychelles.

Between Mauritius, we observe long-run connections for the independent factors and the dependent variable, which are the country's CO2 emissions. We can observe that lnINC has a statistically significant positive association with CO2 emissions. That is, for every 1% increase in wealth, CO2 emissions will rise by 302%. While at lnINC2, a 1% increase resulted in a 20% reduction in CO2 emissions. In the long term, there is a positive and statistically significant link between lnPOIL and lnTOT. A 1% change in lnPOIL and lnTOT results in a 13% and 88% increase in CO2 emissions, respectively. The results reveal that the income and income-squared results coincide with the EKC hypothesis that as income rises, CO2 emissions rise and then begin to fall after the turning point shown in the diagram. The lnINC demonstrates that a percentage change in lnINC resulted in a positive 521 percent change in CO2 emissions. In addition, for lnINC2, a 1% change in income squared results in a 31% reduction in CO2 emissions. According to the lnPOIL and lnTOT findings, a percentage change in each will result in a 12.4 percent and a 30% rise in CO2 emissions in Mauritius, respectively.

6.3 Policy recommendation

It is recommended that countries like Nigeria and others in Africa first address the problem of corruption in their systems before attempting to effectively adopt policies that will, in turn, lead to an improvement in the quality of the environment. This study first suggests that, while environmental sustainability is conceivable at the highest level of wealth, it is likely to come at the price of investment risk. As a consequence, depending on the success of the country's sustainable development goals, this observation should trigger a possible policy mechanism that decreases investment risk (SDGs).

Second, based on the findings above, this study suggests that the governments of the selected nations embrace the UN plans for environmental sustainability. Responsible governments must strengthen their commitment to make institutions more responsive and effective in the preservation and enforcement of environmental laws and regulations, so that the quality of the environment is not completely lost in the face of economic development. The empirical findings imply that it is beneficial for Sub-

Saharan African governments to maintain their attempts to stimulate economic growth while limiting environmental harm.

Thirdly, to that end, the UN green aim must be included into Nigeria's mainstream economic and also the economic mainstream of the other three selected countries policy framework in order to ensure that economic growth leads to improvements in environmental quality. Policymakers must tread carefully in terms of how they respond proactively to the devastating consequences of energy consumption and foreign direct investment on the road of economic success.

Finally, as industrialization proceeds, investment in research and development for various ways to aid the country or save the environment would be beneficial in helping to reduce severe and devastating carbon dioxide emissions into the environment.

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APPENDIX A

UNIT ROOT TEST- NIGERIA

*CONSTANT WITH TREND SCENARIO- **Augmented Dickey-Fuller Test***

Null Hypothesis: lnCO2 has unit root

Exogenous: Constant with Trend

Lag Length:1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.387359	0.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

Null Hypothesis: lnINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.883136	0.0016
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: $\ln INC^2$ has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.838528	0.0018
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.857514	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-6.533433	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

CONSTANT WITH TREND SCENARIO- ***Dickey-Fuller***

Null Hypothesis: InLCO^2 has unit root

Exogenous: Constant with Trend

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-7.933994
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC) has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.003046
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.957314
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.003090
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.699358
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

*CONSTANT WITH TREND SCENARIO- **Philip-Peron***

Null Hypothesis: INCO2 has unit root

Exogenous: Constant with Trend

Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. T	Prob.
Phillips-Peron Test Statistics		-7.71	0.0000
Test critical values:	1%	-4.19	
	5%	-3.52	
	10%	-3.19	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.831053	0.0018
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis:InLINC^2 has unit root

Exogenous: Constant with Trend

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.781310	0.0021
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.840581	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: D(LTOT) has unit root

Exogenous: Constant with Trend

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-6.717933	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

UNIT ROOT TEST- SOUTHAFRICA

CONSTANT WITH TREND SCENARIO- ***Augmented Dickey-Fuller Test***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.387359	0.0000
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.883136	0.0016
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.838528	0.0018
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.857514	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-6.533433	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

*CONSTANT WITH TREND SCENARIO- **Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.142208
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis:InINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.003046
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.957314
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.003090
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

CONSTANT WITH SCENARIO- ***Philips-Peron***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Bandwidth: 10 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistic		-7.712468	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistic		-4.831053	0.0018
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant with Trend

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistic		-4.781310	0.0021
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.840581	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-6.717933	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

UNIT ROOT TEST- MAURITIUS

CONSTANT WITH TREND SCENARIO- ***Augmented Dickey-Fuller Test***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=4)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.828764	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: D(LINC) has a unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.125795	0.0008
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.333297	0.0004
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.857514	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-6.522864	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

*CONSTANT WITH TREND SCENARIO- **Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.109269
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.828003
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.116540
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.003090
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.708899
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

*CONSTANT WITH TREND SCENARIO –**Philips-Peron***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.828764	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.085326	0.0009
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant with Trend

Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.338505	0.0004
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.840581	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-8.006023	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

UNIT ROOT TEST- SEYCHELLES

CONSTANT WITH TREND SCENARIO- ***Augmented Dickey-Fuller Test***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-6.099369	0.0001
Test critical values:	1% level	-4.205004	
	5% level	-3.526609	
	10% level	-3.194611	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

	T-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-4.820752	0.0019

Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.065920	0.0010
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.857514	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.153297	0.0000

Test critical values:	1% level	-4.198503
	5% level	-3.523623
	10% level	-3.192902

*CONSTANT WITH TREND SCENARIO- **Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.028915
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.379851
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InINC^2 has a unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.802853
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.003090
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

Null Hypothesis: InTOT has unit root

Exogenous: Constant with Trend

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-8.305866
Test critical values:	1% level	-3.770000
	5% level	-3.190000
	10% level	-2.890000

*CONSTANT WITH TREND SCENARIO- **Philips-Peron***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant with Trend

Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-8.181033	0.0000
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InINC has unit root

Exogenous: Constant with Trend

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.886993	0.0016
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant with Trend

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.014538	0.0011
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant with Trend

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.840581	0.0001
Test critical values:	1% level	-4.198503	
	5% level	-3.523623	
	10% level	-3.192902	

UNIT ROOT TEST- NIGERIA

*CONSTANT SCENARIO- **Augmented Dickey-Fuller Test***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.174300	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.943186	0.0002
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: $\ln INC^2$ has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.897708	0.0003
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.929423	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-2.806642	0.0659
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

*CONSTANT SCENARIO- **Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-7.639746
Test critical values:	1% level	-2.624057
	5% level	-1.949319
	10% level	-1.611711

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.984569
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

	T-Statistic

Elliott-Rothenberg-Stock DF-GLS test statistic		-5.978831
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.999627
Test critical values:	1% level	-2.621185
	5% level	-1.948886
	10% level	-1.611932

*CONSTANT SCENARIO –**Philips-Peron***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Bandwidth: 8 (Newey-West automatic) using Bartlett kernel

	Adj. T-Stat	Prob.

Phillips-Peron Test Statistics		-7.501233	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.912470	0.0002
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.863675	0.0003
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.

Phillips-Peron Test Statistics		-5.914839	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-2.790185	0.0683
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

UNIT ROOT TEST- SOUTH AFRICA

*CONSTANT SCENARIO- **ADF***

Null Hypothesis: InCO2 has a unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.174300	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.943186	0.0002
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on SIC, maxlag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.962228	0.0002
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.929423	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*CONSTANT SCENARIO- **Dickey-Fuller GLS***

Null Hypothesis: InCO2 has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.864801
Test critical values:	1% level	-2.621185
	5% level	-1.948886
	10% level	-1.611932

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.773629
Test critical values:	1% level	-2.624057
	5% level	-1.949319
	10% level	-1.611711

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.810524
Test critical values:	1% level	-2.624057
	5% level	-1.949319
	10% level	-1.611711

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.978831
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-1.800956
Test critical values:	1% level	-2.621185
	5% level	-1.948886
	10% level	-1.611932

CONSTANT SCENARIO- ***PP***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-6.717091	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.426411	0.0010
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-4.397922	0.0011
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.914839	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Bandwidth: 25 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-7.988643	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

UNIT ROOT TEST- MAURITIUS

*CONSTANT SCENARIO- **ADF***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-3.112931	0.0336
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

	T-Statistic	Prob.
Augmented Dickey-Fuller test statistic	-5.188308	0.0001

Test critical values:	1% level	-3.600987
	5% level	-2.935001
	10% level	-2.605836

CONSTANT SCENARIO- ***Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, max lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-2.936979
Test critical values:	1% level	-2.624057
	5% level	-1.949319
	10% level	-1.611711

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.157814
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.664424
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.978831
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-4.707614
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

*CONSTANT SCENARIO- **PP***

Null Hypothesis: InCO2) has unit root

Exogenous: Constant

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.896667	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.150007	0.0001
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.408617	0.0001
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.914839	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Bandwidth: 4 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-6.426272	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

UNIT ROOT TEST- SEYCHELLES

*CONSTANT SCENARIO- **ADF***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 1 (Automatic - based on AIC, max lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-6.081252	0.0000
Test critical values:	1% level	-3.605593	
	5% level	-2.936942	
	10% level	-2.606857	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.615111	0.0006
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: $InINC^2$ has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, max lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-4.883652	0.0003
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-5.929423	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic	Prob.
Augmented Dickey-Fuller test statistic		-8.241524	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

*CONSTANT SCENARIO- **Dickey-Fuller***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-6.891424
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InINC has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic

Elliott-Rothenberg-Stock DF-GLS test statistic		-2.976375
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InINC^2 has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-3.550429
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-5.978831
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on AIC, maximum lag=1)

		T-Statistic
Elliott-Rothenberg-Stock DF-GLS test statistic		-8.076315
Test critical values:	1% level	-2.622585
	5% level	-1.949097
	10% level	-1.611824

*CONSTANT SCENARIO- **PP***

Null Hypothesis: InCO2 has unit root

Exogenous: Constant

Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-7.502318	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InINC has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-3.126390	0.0321
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

Null Hypothesis: InINC^2 has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-2.646365	0.0920
Test critical values:	1% level	-3.596616	
	5% level	-2.933158	
	10% level	-2.604867	

Null Hypothesis: InPOIL has unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-5.914839	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

Null Hypothesis: InTOT has unit root

Exogenous: Constant

Bandwidth: 0 (Newey-West automatic) using Bartlett kernel

		Adj. T-Stat	Prob.
Phillips-Peron Test Statistics		-8.241524	0.0000
Test critical values:	1% level	-3.600987	
	5% level	-2.935001	
	10% level	-2.605836	

ADRL Bound Test- NIGERIA

F-Bounds Test				Null Hypothesis: No levels relationship
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.016652	10%	3.03	4.06
K	4	5%	3.47	4.57
		2.5%	3.89	5.07
		1%	4.4	5.72

SOUTH-AFRICA

F-Bounds Test				Null Hypothesis: No levels relationship
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	7.106749	10%	3.03	4.06
K	4	5%	3.47	4.57
		2.5%	3.89	5.07
		1%	4.4	5.72

SEYCHELLES

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.609487	10%	2.68	3.53
K	4	5%	3.05	3.97
		2.5%	3.4	4.36
		1%	3.81	4.92

MAURITIUS

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	20.28356	10%	3.03	4.06
K	4	5%	3.47	4.57
		2.5%	3.89	5.07
		1%	4.4	5.72

ARDL LONG RUN

NIGERIA

Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINC	-8.486973	2.256776	-3.760662	0.0019
LINC2	0.623559	0.163916	3.804149	0.0017
LPOIL	-0.513232	0.283719	-1.808943	0.0905
LTOT	-0.697381	0.255640	-2.727982	0.0156

EC = LCO2 - (-8.4870*LINC + 0.6236*LINC2 -0.5132*LPOIL - 0.6974*LTOT)

SOUTH-AFRICA

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINC	9.952680	5.759700	1.727986	0.0954
LINC2	-0.592625	0.345573	-1.714903	0.0978
LPOIL	-0.011076	0.075096	-0.147488	0.8838
LTOT	0.920638	0.382730	2.405449	0.0233

EC = LCO2 - (9.9527*LINC -0.5926*LINC2 -0.0111*LPOIL + 0.9206*LTOT)

SEYCHELLES

Case 4: Unrestricted Constant and Restricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINC	11.96965	4.869649	2.458010	0.0250
LINC2	-0.862896	0.320710	-2.690580	0.0155
LPOIL	-0.553950	0.157335	-3.520829	0.0026
LTOT	-0.069627	0.260005	-0.267790	0.7921
@TREND	0.229869	0.051753	4.441671	0.0004

EC = LCO2 - (11.9696*LINC -0.8629*LINC2 -0.5539*LPOIL -
0.0696*LTOT +
0.2299*@TREND)

MAURITIUS

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LINC	3.025050	0.982941	3.077549	0.0068
LINC2	-0.207160	0.058449	-3.544284	0.0025
LPOIL	0.138141	0.041939	3.293872	0.0043
LTOT	0.887720	0.363512	2.442063	0.0258

EC = LCO2 - (3.0251*LINC -0.2072*LINC2 + 0.1381*LPOIL +
0.8877*LTOT)

ARDL SHORT-RUN TEST

NIGERIA

ARDL Error Correction Regression

Dependent Variable: D(LCO2)

Selected Model: ARDL(1, 4, 4, 6, 1)

Case 5: Unrestricted Constant and Unrestricted Trend

Date: 04/18/22 Time: 06:21

Sample: 1977 2019

Included observations: 37

ECM Regression

Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	29.31671	5.207793	5.629394	0.0000
@TREND	-0.009166	0.002190	-4.184405	0.0008
D(LINC)	-4.276786	0.928676	-4.605252	0.0003
D(LINC(-1))	4.458848	0.781443	5.705916	0.0000
D(LINC(-2))	3.357962	0.884132	3.798031	0.0018
D(LINC(-3))	1.271061	0.648179	1.960971	0.0687
D(LINC2)	0.325413	0.072037	4.517336	0.0004
D(LINC2(-1))	-0.325707	0.059560	-5.468576	0.0001
D(LINC2(-2))	-0.258642	0.066740	-3.875351	0.0015
D(LINC2(-3))	-0.102111	0.048049	-2.125135	0.0506
D(LPOIL)	0.087898	0.094153	0.933565	0.3653
D(LPOIL(-1))	0.716390	0.135219	5.297982	0.0001
D(LPOIL(-2))	0.548741	0.131644	4.168362	0.0008
D(LPOIL(-3))	0.419269	0.097027	4.321154	0.0006
D(LPOIL(-4))	0.285600	0.069115	4.132271	0.0009
D(LPOIL(-5))	0.264934	0.064950	4.079065	0.0010
D(LTOT)	-0.265406	0.113663	-2.335020	0.0338
CointEq(-1)*	-0.897740	0.159268	-5.636677	0.0000

R-squared	0.780427	Mean dependent var	-0.008681
Adjusted R-squared	0.583966	S.D. dependent var	0.089277
S.E. of regression	0.057584	Akaike info criterion	-2.564633
Sum squared resid	0.063003	Schwarz criterion	-1.780943
Log likelihood	65.44571	Hannan-Quinn criter.	-2.288346
F-statistic	3.972435	Durbin-Watson stat	2.134404
Prob(F-statistic)	0.002396		

SOUTH-AFRICA

Dependent Variable: LCO2
Method: ARDL
Date: 04/18/22 Time: 06:43
Sample (adjusted): 1980 2019
Included observations: 40 after adjustments
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (5 lags, automatic): LINC LINC2 LPOIL LTOT
Fixed regressors: C @TREND
Number of models evaluated: 2592
Selected Model: ARDL(1, 3, 3, 0, 0)
Note: final equation sample is larger than selection sample
Huber-White-Hinkley (HC1) heteroskedasticity consistent standard errors and covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LCO2(-1)	0.729384	0.097215	7.502756	0.0000
LINC	-0.455155	0.748816	-0.607834	0.5484
LINC(-1)	3.332265	1.090116	3.056799	0.0050

LINC(-2)	-3.382813	1.058806	-3.194932	0.0035
LINC(-3)	3.199060	0.749380	4.268944	0.0002
LINC2	0.034936	0.046367	0.753474	0.4577
LINC2(-1)	-0.205782	0.067894	-3.030933	0.0053
LINC2(-2)	0.206077	0.066806	3.084719	0.0047
LINC2(-3)	-0.195604	0.046737	-4.185191	0.0003
LPOIL	-0.002997	0.020487	-0.146302	0.8848
LTOT	0.249140	0.072496	3.436578	0.0019
C	-11.58111	3.884693	-2.981215	0.0060
@TREND	-0.002340	0.001100	-2.126482	0.0428
CointEq(-1)*	-0.270616	0.042368	-6.387331	0.0000

R-squared	0.893763	Mean dependent var	2.113674
Adjusted R-squared	0.846546	S.D. dependent var	0.060122
S.E. of regression	0.023552	Akaike info criterion	-4.402289
Sum squared resid	0.014976	Schwarz criterion	-3.853403
Log likelihood	101.0458	Hannan-Quinn criter.	-4.203829
F-statistic	18.92899	Durbin-Watson stat	2.051204
Prob(F-statistic)	0.000000		

MAURITIUS

ARDL Error Correction Regression

Dependent Variable: D(LCO2)

Selected Model: ARDL(3, 1, 1, 5, 5)

Case 5: Unrestricted Constant and Unrestricted Trend

Date: 04/18/22   Time: 07:14

Sample: 1977 2019

Included observations: 38

ECM Regression

Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.28811	1.459430	-11.16059	0.0000
@TREND	0.077708	0.007005	11.09266	0.0000
D(LCO2(-1))	0.234337	0.083404	2.809652	0.0121
D(LCO2(-2))	0.245730	0.067022	3.666429	0.0019
D(LINC)	5.214595	0.816378	6.387476	0.0000
D(LINC2)	-0.315302	0.051662	-6.103166	0.0000
D(LPOIL)	0.124642	0.026031	4.788291	0.0002
D(LPOIL(-1))	-0.013802	0.018194	-0.758583	0.4585
D(LPOIL(-2))	0.018647	0.019480	0.957218	0.3519
D(LPOIL(-3))	0.054337	0.020596	2.638267	0.0173
D(LPOIL(-4))	0.101029	0.019332	5.226124	0.0001
D(LTOT)	0.300666	0.089448	3.361368	0.0037
D(LTOT(-1))	-0.663814	0.109422	-6.066546	0.0000
D(LTOT(-2))	-0.691765	0.086575	-7.990385	0.0000
D(LTOT(-3))	-0.268977	0.081058	-3.318309	0.0041
D(LTOT(-4))	-0.289002	0.075914	-3.806946	0.0014
CointEq(-1)*	-0.940345	0.088480	-11.19289	0.0000
R-squared	0.928385	Mean dependent var		0.044052
Adjusted R-squared	0.873821	S.D. dependent var		0.075184
S.E. of regression	0.026706	Akaike info criterion		-4.106150
Sum squared resid	0.014978	Schwarz criterion		-3.373546
Log likelihood	95.01685	Hannan-Quinn criter.		-3.845495
F-statistic	17.01467	Durbin-Watson stat		2.103881
Prob(F-statistic)	0.000000			

* p-value incompatible with t-Bounds distribution.

SEYCHELLES

ARDL Error Correction Regression

Dependent Variable: D(LCO2)

Selected Model: ARDL(1, 5, 4, 5, 0)

Case 4: Unrestricted Constant and Restricted Trend

Date: 04/19/22 Time: 02:36

Sample: 1977 2019

Included observations: 38

ECM Regression

Case 4: Unrestricted Constant and Restricted Trend

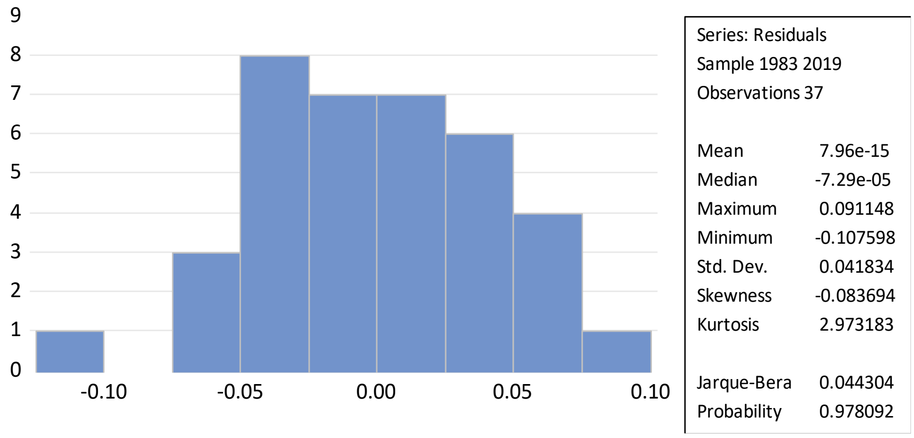
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-25.88571	3.169561	-8.166971	0.0000
LCO2(-1)	[illegible]	[illegible]	[illegible]	[illegible]
D(LINC)	1.227755	3.949121	0.310893	0.7597
D(LINC(-1))	4.952507	4.348183	1.138983	0.2705
D(LINC(-2))	3.129217	4.334308	0.721965	0.4801
D(LINC(-3))	-15.63908	2.727034	-5.734831	0.0000
D(LINC(-4))	0.740965	0.240590	3.079789	0.0068
D(LINC2)	-0.094971	0.219922	-0.431839	0.6713
D(LINC2(-1))	-0.219160	0.240835	-0.910001	0.3755
D(LINC2(-2))	-0.097538	0.242235	-0.402658	0.6922
D(LINC2(-3))	0.950760	0.158519	5.997765	0.0000
D(LPOIL)	0.116973	0.070062	1.669572	0.1133
D(LPOIL(-1))	0.561700	0.092240	6.089530	0.0000
D(LPOIL(-2))	0.293592	0.084305	3.482493	0.0029
D(LPOIL(-3))	0.103781	0.071001	1.461678	0.1621
D(LPOIL(-4))	0.457658	0.071730	6.380307	0.0000
CointEq(-1)*	-0.659781	0.080695	-8.176193	0.0000

R-squared	0.840390	Mean dependent var	0.050876

Adjusted R-squared	0.731565	S.D. dependent var	0.187659
S.E. of regression	0.097227	Akaike info criterion	-1.527971
Sum squared resid	0.207969	Schwarz criterion	-0.838461
Log likelihood	45.03145	Hannan-Quinn criter.	-1.282649
F-statistic	7.722415	Durbin-Watson stat	2.633999
Prob(F-statistic)	0.000012		

RESIDUAL DIAGNOSTICS TEST

NIGERIA



Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 1 lag

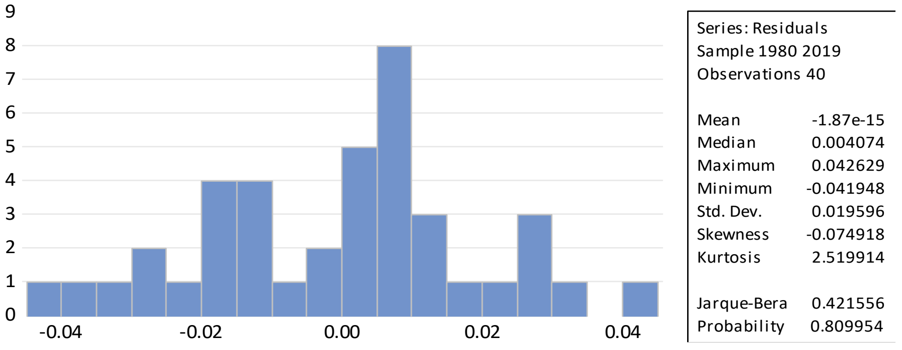
F-statistic	0.203818	Prob. F(1,14)	0.6586
Obs*R-squared	0.530932	Prob. Chi-Square(1)	0.4662

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	0.332239	Prob. F(21,15)	0.9896
Obs*R-squared	11.74636	Prob. Chi-Square(21)	0.9462
Scaled explained SS	1.904670	Prob. Chi-Square(21)	1.0000

SOUTH-AFRICA



Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 1 lag

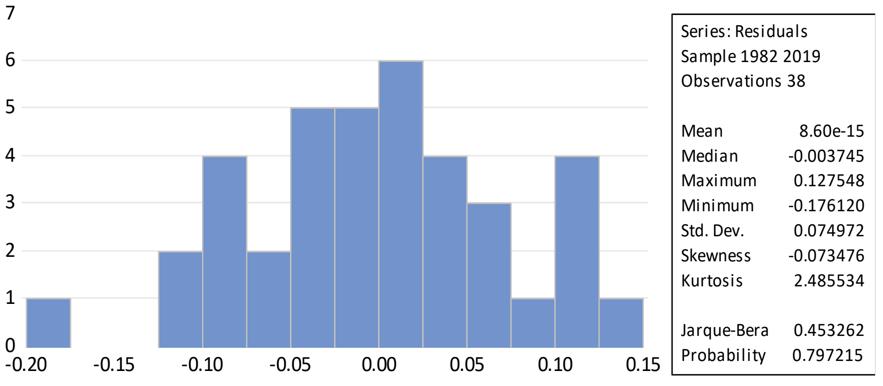
F-statistic	0.083838	Prob. F(1,26)	0.7745
Obs*R-squared	0.128567	Prob. Chi-Square(1)	0.7199

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	0.332239	Prob. F(21,15)	0.9896
Obs*R-squared	11.74636	Prob. Chi-Square(21)	0.9462
Scaled explained SS	1.904670	Prob. Chi-Square(21)	1.0000

SEYCHELLES



Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

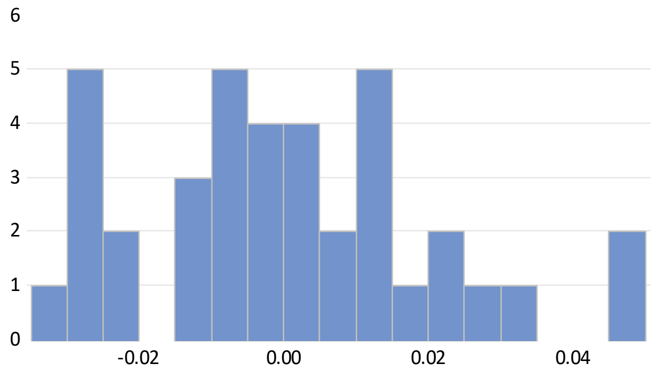
F-statistic	3.090239	Prob. F(2,15)	0.0752
Obs*R-squared	11.08843	Prob. Chi-Square(2)	0.0039

Heteroskedasticity Test: Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity

F-statistic	1.206170	Prob. F(20,17)	0.3511
Obs*R-squared	22.29118	Prob. Chi-Square(20)	0.3249
Scaled explained SS	3.313724	Prob. Chi-Square(20)	1.0000

MAURITIUS



Series: Residuals	
Sample 1982 2019	
Observations 38	
Mean	3.32e-17
Median	-0.000570
Maximum	0.047249
Minimum	-0.032116
Std. Dev.	0.020120
Skewness	0.445580
Kurtosis	2.822062
Jarque-Bera	1.307563
Probability	0.520075

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.900474	Prob. F(2,15)	0.4272
Obs*R-squared	4.073345	Prob. Chi-Square(2)	0.1305

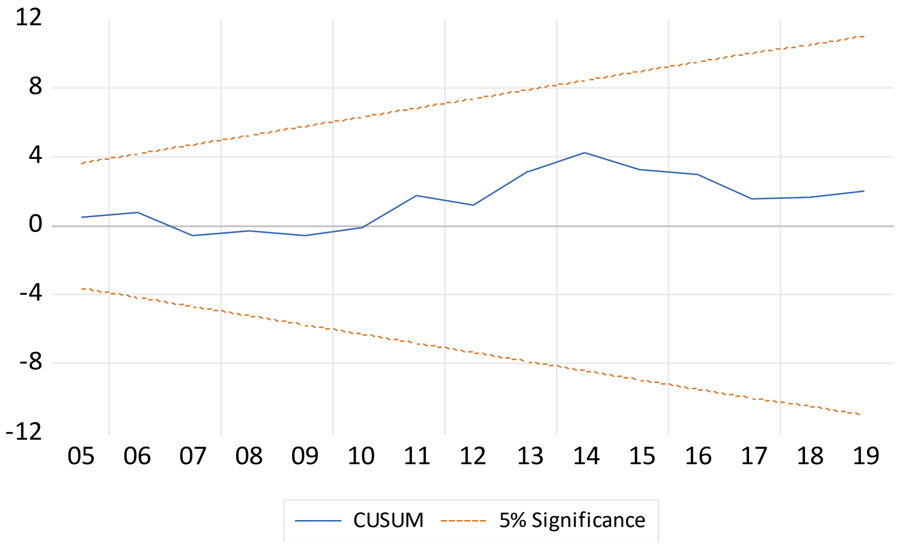
Heteroskedasticity Test: Breusch-Pagan-Godfrey

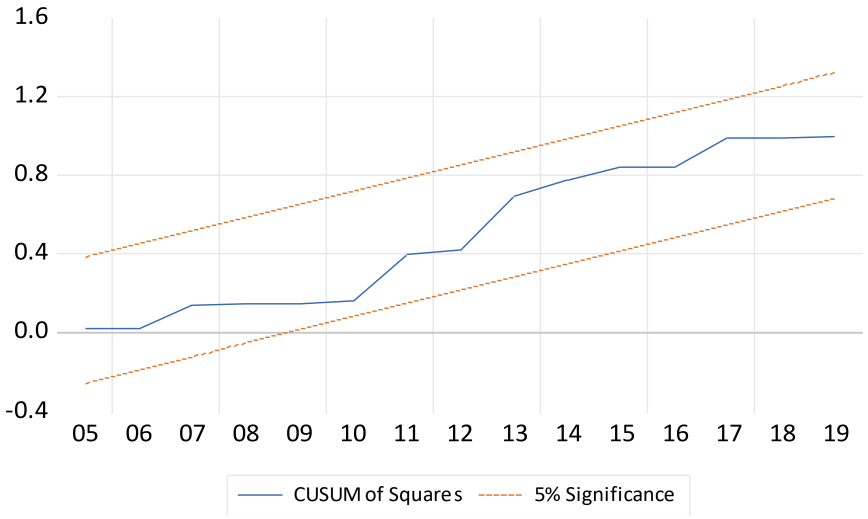
Null hypothesis: Homoskedasticity

F-statistic	1.450284	Prob. F(20,17)	0.2214
Obs*R-squared	23.95825	Prob. Chi-Square(20)	0.2442
Scaled explained SS	4.368365	Prob. Chi-Square(20)	0.9999

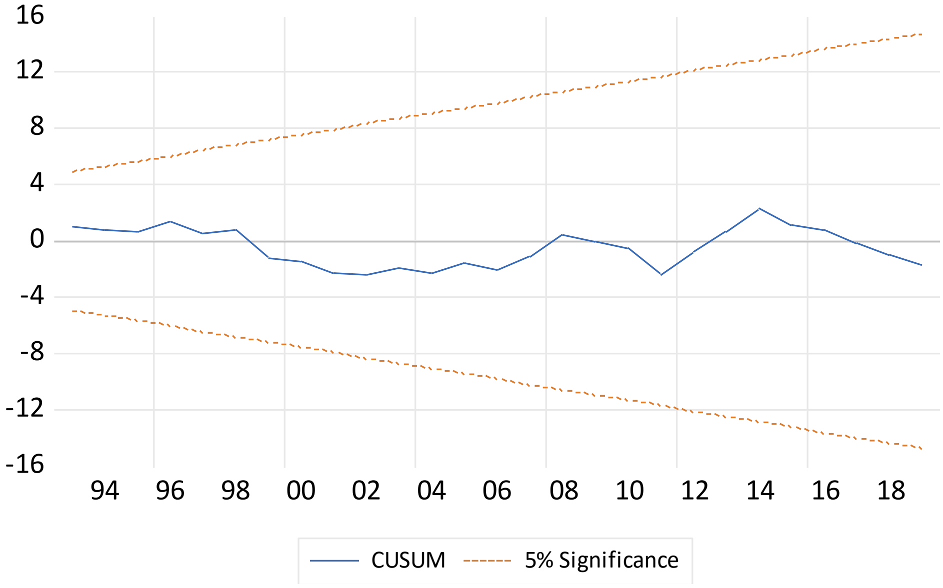
STABILITY TEST

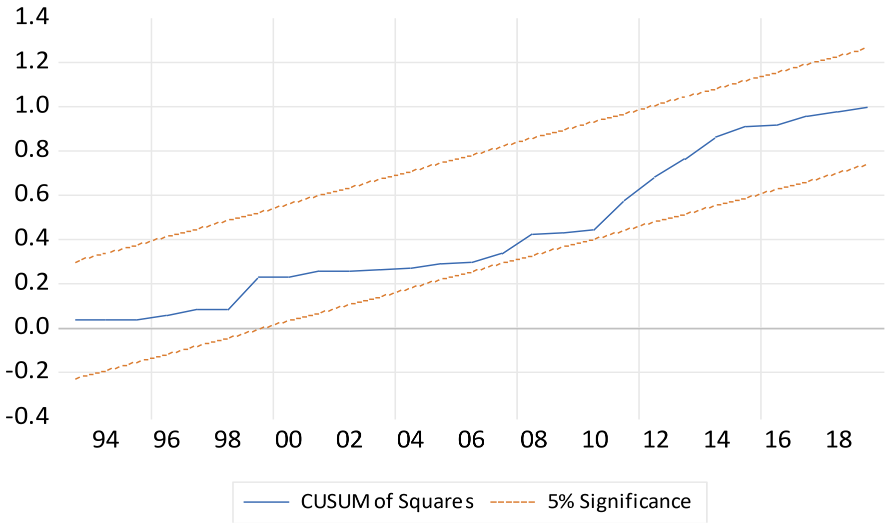
NIGERIA



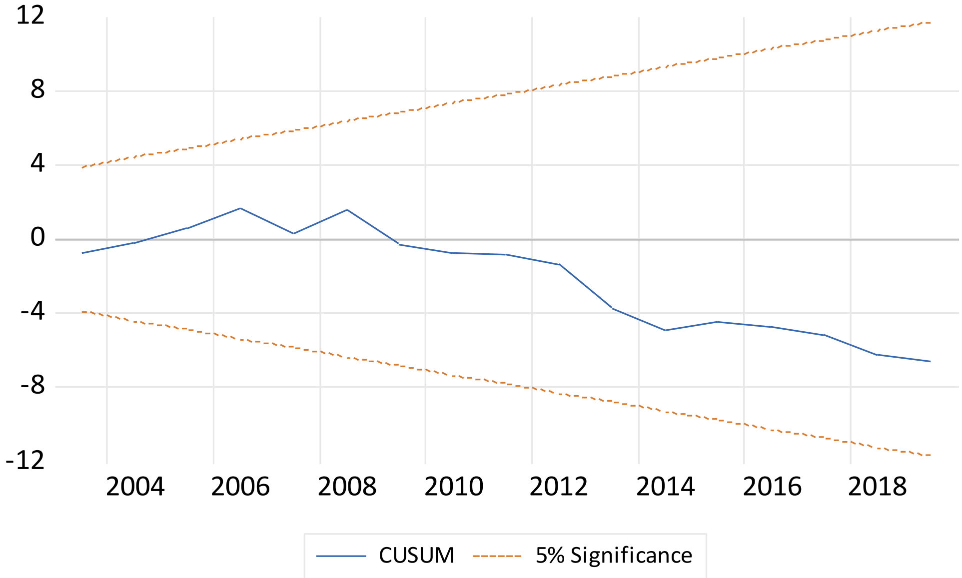


SOUTH-AFRICA





SEYCHELLES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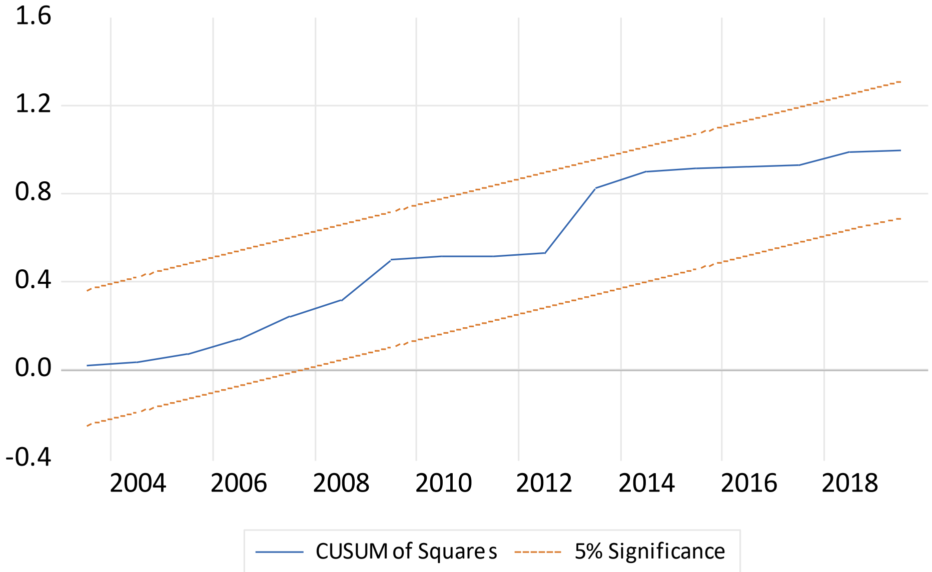
8
4
0
-4
-8
-12
2004
2006
2008
2010
2012
2014
2016
2018
CUSUM
5% Significance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1.2
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-0.4
2004
2006
2008
2010
2012
2014
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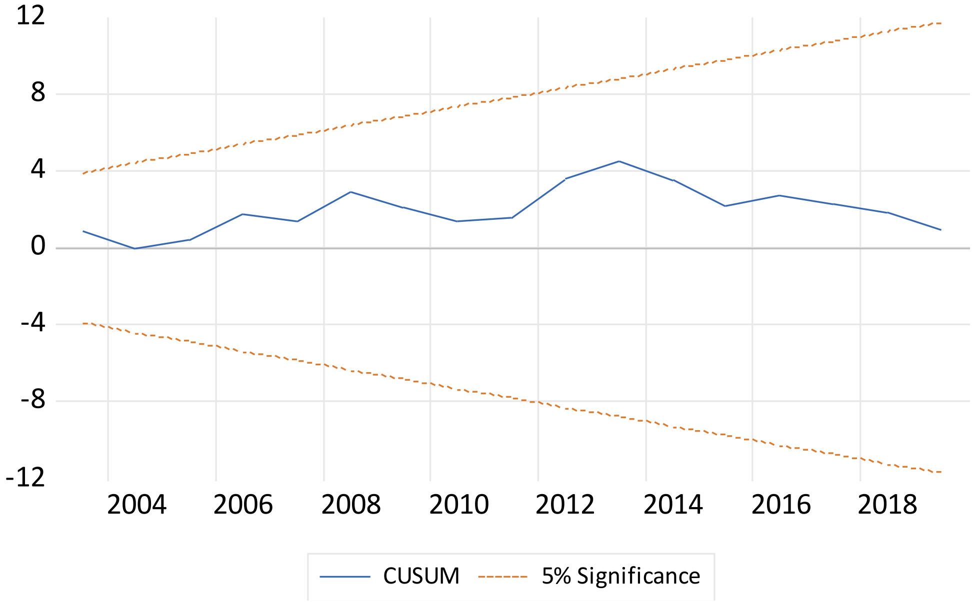
2018
CUSUM of Squares
5% Significance

MAURITIUS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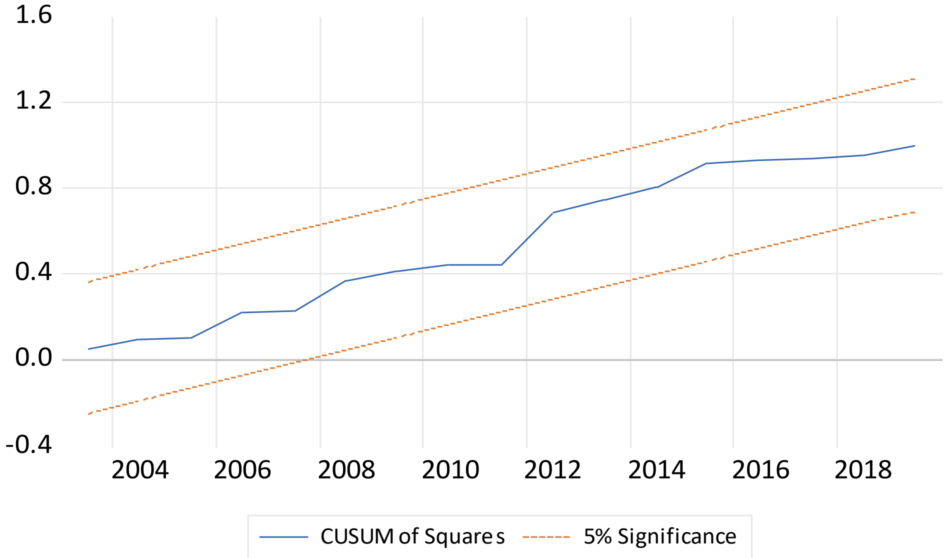
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2004
2006
2008
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2016
2018
CUSUM of Squares
5% Significance

APPENDIX X- TURNITIN REPORT

Alfred Dibor

ORIGINALITY REPORT

13%	9%	8%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	annalsofrscb.ro Internet Source	1%
2	Submitted to Yakın Doğu Üniversitesi Student Paper	1%
3	www.researchgate.net Internet Source	1%
4	Submitted to Eastern Mediterranean University Student Paper	1%
5	link.springer.com Internet Source	1%
6	doc.uments.com Internet Source	<1%
7	Submitted to Higher Education Commission Pakistan Student Paper	<1%
8	repository.nwu.ac.za Internet Source	<1%
9	pubs.aeaweb.org	

APPENDIX- CURRICULUM VITAE

CHIBUIKEM DIBOR-ALFRED

Address: 12, Oshindeinde, Cresent Okota, Lagos State, Nigeria

Tel: +905338828486, +234 9065940332 | Email: chibuikem.Dibor-alfred@outlook.com

CAREER OBJECTIVE

• To work in an environment where my potential and capabilities will be developed and utilized toward the overall organization's aims and objectives. • Motivated and well-coordinated individual seeking employment with a manufacturing company to help set production objectives and implement strategies to accomplish those goals. Maintaining, designing, and running production systems is something that drives me.

CORE COMPETENCIES

- Microsoft Office Suites
- Account Management
- Financial Management
- Business Management
- Office Administration
- Business Development
- Investment Management
- Client's Relationship
- Asset Management
- Fund Management
- Relationship Management
- Leadership Management
- Customer Satisfaction
- Financial Reporting
- Financial Analysis

ACADEMIC QUALIFICATIONS

Near East University, Turkish Republic of North Cyprus | **February 2021 - July 2022**

- M.Sc. Economics - Top 1% of graduating class with 3.71/4.00 CGPA.

Crawford University Igbesa, Ogun State, Nigeria **| 2015 - 2019**

- B.Sc. (Hons) Economics - Second Class Upper Division (4.02/5.00)

Evangel College, Ojo, Lagos State, Nigeria **| 2011 - 2014**

- West African Senior School Certificate Examination

PROFESSIONAL QUALIFICATION

- Accounting Technicians Scheme (ATS 2) **| In-view**

PROFESSIONAL EXPERIENCE

ENGIE ENERGY ACCESS, Lagos State, Nigeria | **October 2020 - Present**

- Position Held: Payment Support Intern.

Key Responsibilities

- Handled the day-to-day financial transactions for customers.
- Maintained a positive, empathetic, and professional attitude toward customers at all times.
- Completed a range of financial transactions, including processing invoices, and payments, creating accounts, and maintaining records.

- Inspected paid and unpaid invoices including cleared payment inquiries and check voiding to maintain accurate files and records according to company standards.
- Developed and maintained a filing system for financial information, records and documents to ensure easily available information.

C&I LEASING PLC, Lagos State, Nigeria |
July 2018 - October 2018

- Position Held: Intern (Corporate Communications)/Executive Assistant to Vice Chairman.

Key Responsibilities

- Handled board room meeting schedules, and petty cash disbursement.
- Managed daily newspaper analysis and daily report upload to the Company's intranet.
- Developed, reviewed, and improved administrative systems, policies, and procedures.
- Handled office tasks such as filing, generating reports and presentations, setting up for meetings, and reordering supplies.
- Monitored media coverage and reports on events within and outside the company including facts behind the figures at Nigerian Stock Exchange and N7bn Bond Listing at FMDQ.

IROKO CAPITAL PARTNERS, Lagos State, Nigeria |
July 2017 - September 2017

- Position Held: Intern (Asset Management and Portfolio Management).

Key Responsibilities

- Managed the financial statement analysis for selected companies.
- Managed daily price movement analysis and updated the company database.
- Monitored farm input materials for the firm's Agro Portfolio Company Mabeni Farms.
- Produced daily stock balances of both feed input raw materials and finished feed output.

- Managed daily reconciliations of stock movement for input procurement and trend analysis for the firm's proprietary investments.

ACADEMIC PROJECTS

- **Master's Thesis** - Environmental Degradation at Various Stages of Economic Development: An Empirical Analysis using the EKC Hypothesis in Selected African Countries.
- **Undergraduate Project** - The Effect of Exchange rate fluctuation on the Industrial Output in Nigeria.

NYSC PROGRAMME

- Certificate Obtained - Certificate of National Service **| November 2019 - October 2020**

LEADERSHIP EXPERIENCE

- President - The Nigerian Economics Students' Association Crawford University **| 2019**
- Vice Chairman - The Student Representative Council Crawford University **| 2019**
- Vice President - The Nigerian Economics' Students' Association Crawford University **| 2018**

AWARD OBTAINED

- Most Influential Student - Nigerian Economics Students' Association Crawford University **| 2019**

PROFESSIONAL SKILLS

- Experienced with office management software like MS Office.
- Effectively handle a broad range of diverse interpersonal contacts.
- Critical thinking skills and excellent written and oral communication skills.
- Active problem solving, effective interpersonal skills, and strong multi-tasking skills.
- Excellent leadership, time management, and team management skills to effectively motivate others.

REFERENCES

- Available on Request.

APPENDIX- ETHICS COMMITTEE FORM

YAKIN DOĞU ÜNİVERSİTESİ

BİLİMSEL ARAŞTIRMALAR ETİK KURULU

22.06.2022

Dear Alfred Dıbor

Your project "**Environmental Degradation at Various Stages of Economic Development: An Empirical Analysis Using the EKC Hypothesis in Selected African Countries**" has been evaluated. Since only secondary data will be used the project it does not need to go through the ethics committee. You can start your research on the condition that you will use only secondary data.

Assoc. Prof. Dr. Direnç Kanol

Rapporteur of the Scientific Research Ethics Committee

Direnc Kanol

Note: If you need to provide an official letter to an institution with the signature of the Head of NEU Scientific Research Ethics Committee, please apply to the secretariat of the ethics committee by showing this document.