Social Sciences Research
Nnamdi Azikiwe University, Awka, Nigeria

SSR
Volume 12 Issue 2
112-136

https://journals.aphriapub.com/index.php/SSR/about

Nexus Between International Trade, Economic Growth And Environmental Sustainability In Nigeria

Callistus Tabansi Okeke[1] and Kingsley Chike Okoli [2]

[1,2]Department of Economics, Faculty of Social Sciences, Nnamdi Azikiwe University Awka, Anambra State, Nigeria
callytabansiokeke@gmail.com[1] , kch.okoli@unizik.edu.ng[2]
+233 803 388 6081[1], +234 818 161 3713[2]

Abstract:

This study examined the nexus between international trade, economic growth and environmental sustainability in Nigeria. Vector Autoregressive (VAR) Model was adopted for this research to reveal insights into the dynamic interactions between Gross domestic product growth rate (GDPGR), Trade intensity ratio (TIR) and Environmental performance index (EPI) in Nigeria. The key objectives pursued in this study are; to analyze the relationship between international trade and economic growth in Nigeria, to examine the impact of international trade on environmental sustainability in Nigeria and to examine the dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria. The result showed that there is co – integration amongst the key variables (GDPGR, TIR and EPI) and therefore an existence of a long – run relationship between them in the model. It was also revealed that international trade does not exert a significant influence on economic growth in Nigeria within the short-run dynamic structure. The VAR results further revealed that the GDPGR variable itself does not respond significantly to its past values, indicating a weak autoregressive structure. Similarly, the results from the EPI equation revealed that international trade does not significantly influence environmental sustainability in the short run and exchange rate appears to play more dominant role than trade, suggesting that currency fluctuations may have immediate effects on environmental quality, likely through their influence on the cost of imported green technologies and raw materials and that environmental degradation was more likely in countries lacking strong regulatory institutions: a condition which arguably characterises Nigeria's environmental governance. Another critical insight from the VAR results is the relatively high R-squared values across most equations, especially for TIR (0.94), EPI (0.96), and EXCHR (0.97), indicating that the model explained a significant portion of the variations in these variables. These results justify the

need for green trade policies, sustainable industrial development, and environmentally-conscious trade agreements in Nigeria, strengthening of institutional frame work and deliberate investment in infrastructure, to enable the revelation of any true nexus between international trade, economic growth and environmental sustainability.

Keywords: International Trade, Economic Growth and Environmental sustainability.

Introduction

The discussion of the nexus between international trade, economic growth and the environmental sustainability has taken center stage, because the environment and economic planks of sustainability are twin strategies that are explicit in accelerated achievement of goal six (6): clean water sanitation, goal ten (10): reduced inequality and goal eleven (11): sustainable cities and communities of the Sustainable Development Goals (SDGs).

International trade is obviously recognized as an engine for economic growth, variety diversification, income and employment generation as well as poverty reduction (UNCTAD, 2021). The nucleus of international trade is embedded in the principle of comparative advantage which leads to specialisation. Where countries under competitive conditions, will specialize and export products that it can produce at the lowest relative cost, which underpins the exchange of goods and services between nations of the world (Ji, Dong, Zheng & Bu, 2022). Developing countries exchange goods and services between themselves ie horizontal transaction and also with developed nations ie vertical transaction. Economic and technological diffusions take place faster in vertical transactions with its associated problems like widening of inequalities both across and within countries, acceleration of environmental degradation, international dominance of the richest countries may be expanded and some countries of the world may be left further behind.

The rapid expansion of global trade in the last few decades has raised concerns about its impact on environmental sustainability. Especially when the onus to formulate and enforce environmental policies usually exists only at the national level. This throws up a key concern about dearth of provisions for environmental protection in most international

trade agreements. In addition, the position of United Nations Conference on Trade and Development (UNCTAD) is that diversification and industrialization are pivotal in long – run for countries to reduce their vulnerability to the adverse growth effects of commodity price volatility (UNCTAD, 2021). Yes, the study may be tempted to ally with the above submissions, but at what cost to the environment in long – run? Especially in the face of explanation adduced by Bah, Abdulwakil and Azam (2020), that international trade induced economic growth is both a cause and solution to environmental degradation, as explained by the environmental Kuznets curve (EKC) hypothesis, which suggests that at low levels of income, a positive relationship exists between economic growth and environmental degradation. However, environmental degradation starts to decline as more income is attained. Hence beyond a turning point, the relationship follows a negative one indicating an inverted U-shaped curve. Furthermore, Bataka (2021), alludes that environmental degradation is the opportunity cost for trade-dependent economic growth.

The linkages of the dynamics of exporting primary products especially agricultural produce, minerals, crude oil etc and importation of finished products like computers, electronics, processed textile materials, refined petroleum products etc by the developing nations like; Nigeria Ghana, Democratic Republic of Congo (DRC), Rwanda etc from their developed counter parts like America, Japan, China amongst others are having remarkable impact on the sustainability of the economic growth and environment preservation of these developing nations. Although, the developing exporting nations gain in variety of goods, foreign exchange, development, technologies etc, but what they lose in terms of environmental damages and depreciation amongst others negatives associated with exporting primary product may outweigh the economic benefits they gain by importing finished products from these developed nations. It will make a better sense, if we decompose international trade into import and export and analyze them individually by focusing on the tariffs used as government policy to protect infant substitution industries from well-developed technologies of the developed nations with their cheap products and quick foreign exchange earned from sales of primary products vis a vis environmental sustainability with the intention to understand the magnitude of the value of benefits from international trade on the altar of environmental sustainability.

Statement of the Problem

The differences in environmental costs in total production cost of goods and services between developed and developing nations is what pollution-intensive industries target (Dinda, 2006). With free movement of capital amongst countries due to international trade, pollution-intensive industries can easily shift their activities from the developed countries with strict environmental regulation which increases the total cost of production to less developed countries with relatively low environmental regulation, which will lower total production costs, this notion made Cole and Elliott (2003) to christened less developed countries "havens for pollution-intensive production".

The World Trade Organization (WTO) estimates that 20–30 percent of total carbon emissions are connected to trade-related activities such as production and transportation, (WTO, 2021). Which particularly harms Less Developed Countries (LDCs) and their populations, even when study done by UNCTAD (2021), alluded that they are the smallest contributors to greenhouse gas emissions.

Then the question at this juncture is how can developing nations balance the economic gains from trade against the reality that trade shifts environmental impacts, sometimes increasing and sometimes decreasing total external costs?

International trade, when executed sustainably, has the potential to become a powerful tool for economic growth and environmental protection, helping to spread green technologies and practices globally. This study is therefore embarked upon to contribute to the body of knowledge on the understanding of the inter-dynamism between the economic growth attained via the importation of cheaper finished goods from developed nations, the unemployment created as a result of closure of domestic substitution industries due to such importations and quick foreign exchange earned from exporting unprocessed primary products to the developed economies to achieve seemingly economic growth, while gauging the depth or degree of sacrifices by these developing nations on the altar of economic and environmental sustainability, using Nigeria as a case study.

Research Questions

To resolve the problem as stated in above, this study answered the following research questions:

i. What is the relationship between international trade and economic growth in Nigeria?
ii. How does international trade impact on environmental sustainability in Nigeria?
iii. What is the dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria?

Objectives of the Study

The main aim of the study is to examine the inter-relationship between international trade, economic growth and environment sustainability in Nigeria. However, the specific objectives which this study pursued are;

i. To analyze the relationship between international trade and economic growth in Nigeria.
ii. To examine the impact of international trade on environmental sustainability in Nigeria.
iii. To examine the dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria.

Research Hypotheses

To test the specific objectives of this study, the following null hypotheses have been specified.

Hypothesis 1:

There is no significant relationship between international trade and economic growth in Nigeria.

Hypothesis 2:

There is no significant impact of international trade on environmental sustainability in Nigeria.

Hypothesis 3:

There is no significant dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria.

Literature Review

International Trade

International trade positions countries to make a more efficient allocation of all resources, including the natural, stimulate growth and income level, promotes production efficiency via specialization, exploitation of economies of scale, technology transfer and enhanced competition. It also creates new opportunities for sales (i.e. exports), but also making available to producers the widest range of inputs at the highest quality and lowest prices (i.e. imports). Global Trade Liberalization and the Developing Countries (GTLDC) alluded that joining the global value chain is a powerful channel through which developing nations can achieve rapid growth and development (GTLDC, 2001). But, handing down of skewed trade policies that does not only appear to ensure unhindered trading, but also coarse dissenting voices against its environmental sustainability. For instance, landmark court rulings and proclamations by the world trade organization that favoured trade practices against environmental preservation like; in 1991, The Mexican government argued that, the U.S. Marine Mammal Protection Act prohibited tuna fishing methods that killed large numbers of dolphins, and banned tuna imports from countries that used such fishing methods was in violation of the rules of the General Agreement on Tariffs and Trade (GATT) (De Paula, 2021). He further alluded again that, in 1999, the World Trade Organization ruled that the U.S. could not prohibit shrimp imports from countries using fishing methods that killed endangered sea turtles.

The obvious stipulations of both GATT and WTO rules that the process by which a product is produced is not an acceptable cause for trade restrictions, that only if the product itself is harmful can a country impose controls (De Paula, 2021). For example, if pesticide residues at dangerous levels are detected on fruit or vegetables, import of those products can be banned. But if the overuse of pesticides is causing environmental damage in the producing areas, the importing nation has no right to act. Similarly, if rainforests are being destroyed by unrestricted logging, it is not permissible for countries to impose a ban on the import of unsustainably produced timber.

It is therefore imperative to agree with the fact that the process and production methods (PPM) rule removes an important potential weapon for international environmental protection. If a nation fails to act to protect its own environment, other countries have no trade leverage to promote better environmental practices (Siebert,1996). This further buttress that only if a specific multinational environmental agreement (MEA), such as the Convention on International Trade in Endangered Species (CITES), is in place are import restrictions permissible.

Health and safety issues arising in trade are not always easily resolved at either the domestic or international levels. Domestic regulations that prohibit the sale of, for example, a toxic pesticide, do not apply internationally. "Goods that are restricted in domestic markets, on the grounds that they present a danger to human, animal or plant life or health, or to the environment, may often be legally exported. This may cause a problem for the importing country, where information is lacking on whether and why the product is banned: exporters may make false declarations, customs authorities (particularly in developing countries) may lack adequate product testing facilities.

For this research, trade intensity ratio (TIR) will be use to proxy international trade in Nigeria.

Trade intensity ratio is the ratio of total trade (export + import) to GDP. The choice of trade intensity is because beyond the facts that it measures the relative importance of international trade in a country's economy; it also emphasizes the actual level of trade activity relative to the economy.

ENVIRONMENT:

Trade expansion may also have direct or indirect beneficial effects on the environment. According to the theory of comparative advantage, trade causes countries to become more efficient in their use of resources, thereby conserving resources and avoiding waste. Trade liberalization may also involve removal of distortionary subsidies and pricing policies, improving the efficiency of resource allocation. For example, widespread subsidies on chemical fertilizers and pesticides promote environmentally harmful farming methods.

Eliminating these subsidies would promote both economic efficiency and environmental sustainability.

Trade may also encourage the spread of environmentally friendly technology. In energy production, for example, many developing nations are heavily dependent on old, inefficient, high-polluting power plants. Trade can facilitate the replacement of these plants with modern, highly efficient combined cycle facilities.

Nigeria Environmental Law and Policy

The basis of environmental policy in Nigeria is contained in the 1999 constitution of the Federal Republic of Nigeria. In section 20 of the constitution, the state is empowered to protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria. Thus, pursuant to this, the federal and state governments are expected to come up with laws aim at preserving the quality of the environment. The federal government has promulgated various laws and regulations, although aggressive environmental policy and laws began after 1988. These laws according to Adegoroye (1995) were geared primarily either toward safety or the protection and conservation of the economically important natural resources. There were virtually no laws on industrial pollution and hazardous wastes since industrialization was considered a key indicator of development. Thus, the absence of a law regulating the impact of the activities of big corporations was considered unnecessary as it was posited that it could slow down the process of development. Some of these laws during this era were:

i. Oil pipeline Act 1956
ii. Forestry Act. 1958
iii. Destruction of Mosquitoes Act 1958
iv. Minerals Act 1958 Cap. LFN 1990
v. Mineral oil (safety) Regulations 1963 Cap.350 LFN 1990
vi. Oil in Navigable waters Act 1968 Cap. 339 LFN 1990
vii. Endangered species Act Cap. 108 LFN 1990
viii. Quarries Act Cap. 385 LFN 1990
ix. Sea Fisheries Act Cap. 385 LFN 1990

The consideration of laws regulating the impact of the activities of big corporations was considered unnecessary because of the dearth of public awareness concerning environmental protection and development, and Nigerian government seemingly slow realization of the interdependence of environment and development.

The shock of sudden discovery of dumped toxic waste in 1988 at Akoko village in Delta state brought to fore the need for efficient environment policies and regulations. No wonder in the view of Ogbalu (1994) environmental laws during the period after 1988 was a "product of national emergency". However, the action of the Nigeria government in responding to this national embarrassment was decisive and quick. The creation of the Federal Environmental Protection Agency (FEPA) by Decree 58 of 1988 set FEPA as the sole body charged with the responsibility of protecting the environment. The decree gave the agency broad enforcement powers to act, even without warrants, in bringing violators, to book. They have the power to gain entry, inspect, seize and arrest with stiff penalties of a fine and or jail term on whoever obstructs the enforcement officers in the discharge of their duties or make false declaration of compliance (Adegoroye, 1995). Under FEPA, National Policy of the Environment was launched on 27th November 1989 and it described guideline and strategies for achieving the policy goal of sustainable development. Some of the emerging environmental laws that came out under the guidance of FEPA were:

i. National Guideline and standard for environment pollution control in Nigeria (1991).
ii. National affluence limitation Regulations S.1.8 of 1991.
iii. Pollution Abatement in Industries facilities littering waste regulations S.1.9 of 1991.
iv. Environmental Impact Assessment (EIA) Decree No 56 of 1992 Cap. E12, LFN 2004.
v. Hydrocarbon oil refineries Act, cap H5, LFN, 2004. vi. Oil in Navigable Waters Act cap 06, LFN 2004.
vi. Associated Gas Re-injection Act cap 20 LFN 2004.
vii. The Endangered species Act, cap E9, LFN 2004 ix. Sea Fisheries Act, cap S4, LFN 2004 etc.

Ibaba (2010) noted that the environmental laws in Nigeria have not in any way contributed to sustainable development and reduction of the rapid rate of environmental degradation. This he adduces to the lack of enforcement of the laws which is the most fundamental cause of inability of the legislation to protect the environment. Equally Adibe and Essaghah (1997) observed that, industrial operators (other than in the petroleum sub sector) are apparently not guided by any environmental legislation and where such legislations exist, conformance with them are not systematically monitored and effectively enforced (Ibaba, 2010:46).

The supposed inability of FEPA to enforce environmental laws and compliance in the country was a major reason for the creation of the National Environmental Standards and Regulations Enforcement Agency (NESREA) in 2007. The NESREA Act repealed the Federal Environmental Protection Agency Act and became the primary law on environmental protection. However, this frequency in changing of names of the environmental protection agency has thrown up a question; is the poor performance of these bodies in the names or their inability to enforce the various provisions of the act?

Environmental Consequences of International Trade:

Resource Exploitation; Many industries involved in international trade rely heavily on natural resources. The extraction of these resources, such as mining for minerals or deforestation for timber and agriculture, disrupts ecosystems.

Pollution; pollution is the contamination of air with the persistent emission of greenhouse gases (GHGs), fumes or odours and dust into the atmosphere (Stern, Common & Barbier, 1996). Industrial activities associated with trade often result in substantial pollution. This includes the release of toxic chemicals into the air and water bodies, severely impacting local environments and the health of both human and animal populations. For instance, the textile industry, significant in global trade, is notorious for discharging untreated wastewater into rivers, leading to water pollution.

Loss of Biodiversity; The destruction of natural habitats for industrial purposes, a common byproduct of trade-related activities, is a leading cause of biodiversity loss. When forests are cleared or wetlands drained for agriculture or industrial projects, the unique flora and fauna of these ecosystems are often irreversibly lost.

A significant portion of the environmental impact of international trade comes from the logistics and transportation sector. The movement of goods across the globe predominantly relies on fossil fuels, contributing to greenhouse gas emissions. Shipping, which accounts for a major part of global trade transportation, is a significant contributor to global carbon emissions. Likewise, air transport, though faster, emits a much higher amount of carbon dioxide per ton of cargo. The cumulative effect of these emissions is a substantial increase in the carbon footprint of international trade, exacerbating the global climate crisis.

Trade-Offs Between Economic Growth and Environmental Preservation:

There is evidence that international trade drives both economic growth and environmental degradation (Asongu, Nting & Nnanna, 2019). However, the opportunity cost for trade-induced economic growth is environmental degradation (Bataka, 2021). Therefore, developing countries are willing to lower environmental standards to encourage economic growth. Dinda (2006) suggests that the differences in environmental costs in total production cost between developed and developing is what pollution-intensive industries target. With free movement of capital amongst countries due to international trade, pollution-intensive industries can easily shift their activities from the developed countries with strict environmental regulation which increases the total production costs to less developed countries with relatively less environmental regulation, which lower total production costs.

The economic growth underpinning the progress in global development has unfortunately been conducted in an environmentally unsustainable way. 4 out of 9 planetary boundaries have been surpassed and the world is on its way towards a 2.7 degrees warm-up by 2100, (Stockholm University, 2022). As a result, the world is increasingly facing the consequences

of extreme weather as well as risks and impacts associated with; increasing temperatures, desertification, loss of biodiversity, land and forest degradation, ocean acidification, sea level rise, and salinization. In addition to threatening the lives, health, and well-being of all living organisms on the planet, human-induced climate change also risks countering decades of efforts to reduce poverty. Estimates indicate that between 32 and 132 million people globally risk falling into poverty due to the impacts of climate change by 2030 (World Bank, 2020). The weather and climate extremes have ecological, economic, and societal impacts such as biodiversity loss, as well as negative impacts on flows of goods and services both within countries and across borders.

Ending extreme poverty whilst achieving trade-supported inclusive economic growth and simultaneously meeting climate and environmental objectives is a complex task. International trade and a healthy environment play differently, yet crucial, roles in contributing to poverty reduction. This relationship should not be understood as a zero-sum game. Indeed, trade-led sustainable economic growth can be achieved while at the same time tending to our environment and climate. Policy makers, the private sector, civil society and other stakeholders need to simultaneously address the triple challenges of climate change, environmental degradation and poverty. Easing the cross-border trade of environmental goods and services

Sustainability:

The four pillars of sustainability are; Human, Economic, Social and Environment. But, for this research we will focus on the economic and environmental pillars

For this research, Gross Domestic Product (GDP) growth rate will be used to proxy economic pillar of sustainability in Nigeria. GDP growth rate measures the percentage change in the total value of goods and services produced within Nigeria.

Again, Environmental performance Index (EPI) will be used to proxy environmental pillar of sustainability in Nigeria. EPI scores countries on a scale of 0 to 100, with higher scores indicating better environmental performance.

Inflation Rate (INFR):

Inflation is the persistent increase in the general price level of an economy. It is also seen as general rise in the prices of goods and services. It is used is this research as a moderating variable, because it explains how the price level in an economy affects international trade which is a key variable of this research.

Exchange Rate (EXCHR):

Exchange rate is the relative price of a domestic currency in relation to that of other foreign currencies. Exchange rate is used as a moderating variable in this research because, it serves as a measure to ascertain payments in international trade. It is measured in Naira per US dollars.

3.0 RESEARCH METHOD:

Theoretical Framework:

Sustainable development theory:

This study was anchored on the frame work of sustainable development theory, which emphasized the need to balance economic, social, and environmental considerations to achieve development that meets the needs of the present without compromising the ability of future generations to meet their own needs. The theory involves intergenerational equity; That is considering the needs, well-being, promotion of fairness and justice of citizens of both current and future generations. The theory further seeks the integration of economic, social and environmental dimensions and their interconnectedness.

The concept of sustainable development gained widespread recognition with the publication of the Brundtland Commission's report, also known as "our common future" and was published on October 1987 by the United Nations through the Oxford University Press. This publication was in recognition of Gro Harlem Brundtland, the former Norwegian Prime Minister's role as Chair of the World Commission on Environment and Development (WCED, 1987).

The targets of Brundtland Report were universality and interdependence of nations in the search for a sustainable development path. The report sought to recapture the spirit of the Stockholm Conference which had introduced environmental concerns to the formal

political development circle. *Our Common Future* placed environmental issues firmly on the political agenda; it aimed to discuss the environment and development as one single issue.

Econometric model specification

To address the specific objectives of this study, the following functional relationship was specified with key variable identified as factors within the context of the topic.

GDPGR = f (TIR, EPI, INFR, EXCHR) …….. 3.1

The functional equation 3.1, when transformed into an econometric model, thus

$GDPGR = \beta_0 + \beta_1 TIR + \beta_2 EPI + \beta_3 INFR + \beta_4 EXCHR + \mu_t$ … …… 3.2

Where:

RGDPGR: Real Gross Domestic Product Growth Rate.

TIR: Trade Intensity Ratio.

EPI: Environmental Performance Index.

INFR: Inflation Rate.

EXCHR: Exchange Rate

μ_t: Stockastic Error Term.

β_0: Intercept Term.

β_1- β_4: Coefficients of the Explanatory Variables.

To illustrate the VAR modelling approach adopted for this study, equation 3.2 is restated as (3.3), (3.4) and (3.5) respectively to examine the multivariate time series models which reveals how current observations of a variable relates to past observations of itself and past observations of other variables in the system.

$GDPGR = \Phi_0 + \Phi_1 TIR_{t\ 1} + \Phi_2 EPI_{t\ 1} + \Phi_3 INFR_{t\ 1} + \Phi_4 EXCHR_{t\ 1} + \mu_{Gt}$ …….3.3

$TIR = \alpha_0 + \alpha_1 GDPGR_{t\ 1} + \alpha_2 EPI_{t\ 1} + \alpha_3 INFR_{t\ 1} + \alpha_4 EXCHR_{t\ 1} + \mu_{Tt}$ ……..3.4

$EPI = \boldsymbol{\delta}_0 + \boldsymbol{\delta}_1 TIR_{t\ 1} + \boldsymbol{\delta}_2 GDPGR_{t\ 1} + \boldsymbol{\delta}_3 INFR_{t\ 1} + \boldsymbol{\delta}_4 EXCHR_{t\ 1} + \mu_{\delta t}$ ……..3.5

4.0 DATA ANALYSIS, PRESENTATIONS AND DISCUSSIONS OF FINDINGS:

Descriptive Analysis:

The descriptive statistics presented in appendix 1 indicate that the gross domestic product growth rate (GDPGR) in Nigeria during the period of twenty-four years (2000 - 2023) has minimum and maximum values of 0.0179 and 0.153300 respectively, with mean and standard deviation values of 0.050513 and 0.036304, implying that the GDPGR deviates from both sides of the mean by 0.014209. This suggest that GDPGR in Nigeria is relatively not widely dispersed during the period under study. GDPGR is positively skewed with a long right leg at 0.430176 and its kurtosis value at 4.286833 which is greater than 3, signifies that it is leptokurtic, suggesting a peaked distribution curve. The jarque – Bera with a probability value of 0.301775 shows that it is normally distributed.

The mean value of trade intensity ratio (TIR) time series is 73.77958. It lies between a minimum value of 16.45000 and a maximum value of 140.8000, with a standard deviation of 37.61151. It is positively skewed with a long right tail at 0.052688, while the kurtosis value at 1.916229 which is less than 3, signifies that it is platykurtic, suggesting a flat distribution curve. The jarque – Bera with a probability value of 0.552760 shows that it is normally distributed.

The time series of environmental performance index (EPI) has a mean value of 2.219835. It lies between a minimum value of 1.689959 and a maximum value of 3.207088, with a standard deviation of 0.444640. It is positively skewed with a long right tail at 0.968969, while the kurtosis value at 2.838886 which is less than 3, signifies that it is platykurtic, suggesting a flat distribution curve. The jarque – Bera with a probability value of 0.150954 shows that it is normally distributed.

The mean value of inflation rate (INFR) time series is 0.131279. It lies between a minimum value of 0.053900 and a maximum value of 0.246600, with a standard deviation of 0.044614. It is positively skewed with a long right tail at 0.496743, while the kurtosis value at 3.188024 which is greater than 3, signifies that it is leptokurtic, suggesting a peaked distribution curve. The jarque – Bera with a probability value of 0.599785 shows that it is normally distributed.

The time series of environmental performance index (EPI) has a mean value of 217.1176. It lies between a minimum value of 101.6973 and a maximum value of 633.8300, with a standard deviation of 132.3031. It is positively skewed with a long right tail at 1.596936, while the kurtosis value at 5.134144 which is greater than 3, signifies that it is leptokurtic, suggesting a peaked distribution curve. The jarque – Bera with a probability value of 0.000625 shows that it is not normally distributed.

Correlation Matrix:

Table 4.1: Summary of Correlation Matrix.

	GDPGR	TIR	EPI	INFR	EXCHR
GDPGR	1.000000				
TIR	0.807544	1.000000			
EPI	0.535694	0.841152	1.000000		
INFR	-0.185877	-0.275217	-0.151067	1.000000	
EXCHR	-0.570560	-0.802312	-0.674151	0.627756	1.000000

Source: Author's computation using E – View version 10.

Following the result of table 4.1, the coefficients of the variables are less than the 0.95 threshold, an indication that there is no multicollinearity of the variables with themselves and the elements of the diagonal matrix are all identity showing correct correlation matrix. GDPGR has strong relationship with TIR and EPI at 0.81 and 0.54 respectively. This indicates that gross domestic product growth rate, trade intensity ratio and environmental performance index are proportional and their time series are moving together in the same direction. On the other hand, GDPGR has a weak negative correlation with INFR at 0.186 while having a strong negative correlation with EXCHR at 0.571. Also, TIR has a strong positive relationship with EPI at 0.84 and negative correlation with INFR and EXCHR at -0.28 and -0.80 respectively. It is also captured that EPI has negative relationships with INFR and EXCHR at -0.15 and -0.67 respectively. This shows that environmental performance index to inflation rate and exchange rate move in inverse direction.

Unit Root Test:

Table 4.2: Unit Root Analysis.

Variable	ADF Critical Value @ 5%	ADF Test Statistic	Order of Integration
GDPGR	– 4.859812	– 5.347598	I(0)
TIR	– 3.622033	– 4.188945	I(0)
EPI	– 3.632896	– 6.498964	I(1)
INFR	– 3.004861	– 5.976771	I(1)
	– 1.956406	4.083392	I(0)

Source: Author's compilation using E – View version 10.

From table 4.2, it was observed that GDPGR, TIR and EXCHR are integrated at level (0), while EPI and INFR are integrated at order one (1). An indication that the variables are stationary at these their various orders of integration.

Co – integration Test:

Because the variables (GDPGR, TIR, EPI, INFR and EXCHR) under study are stationary at different orders of integration (ie) their orders of integration are discordance ie I(0) and I(1). Ezie (2022), stipulates that under the situation of discordance order of integration that bound test is most appropriate for carrying out co – integration testing.

Table 4.3: Summary of Bound test:

			Asymptotic : n=1000	
F-statistic	13.09490	10%	3.03	4.06
k	4	5%	3.47	4.57
		2.5%	3.89	5.07
		1%	4.4	5.72

Source: Author's compilation using E – View version 10.

The F – statistic (13.09490) is greater than the asymptotic (critical bounds) at 5% for both the lower bound *I*(0) (3.47) and upper bound *I*(1) (4.57). The result shows that there is co

– integration amongst the key variables and therefore an existence of a long – run relationship between the key variables (GDPGR, TIR and EPI) of the model.

Vector Autoregressive (VAR) Technique.

Vector Autoregressive (VAR) Model was adopted for this research because the key variables of the functional relation Gross domestic growth rate (GDPGR), Trade intensity ratio (TIR) and Environmental performance index (EPI) have the tendency of influencing each other as in the words of (Ezie, 2022).

Table 4.4: Summary of VAR Results.

College	GDPGR	TIR	EPI	INFR	EXCHR
GDPGR (-1)	0.258385	294.9458	2.391887	0.382455	-232.2604
	[0.46207]	[1.31577]	[1.51348]	[0.87431]	[-0.40028]
GDPGR (-2)	0.000546	109.9603	0.237102	0.422578	1434.469
	[0.00121]	[0.60806]	[0.18597]	[1.19746]	[3.06445]
TIR (-1)	-0.000177	-0.207268	0.000713	0.001138	0.500859
	[-0.11464]	[-0.33480]	[0.16328]	[0.94222]	[0.31256]
TIR (-2)	-0.000152	-0.051659	-0.000257	8.71E-05	-1.396746
	[-0.17745]	[-0.15017]	[-0.10601]	[0.12973]	[-1.56856]
EPI (-1)	0.025675	40.16230	0.749260	-0.090726	-266.0965
	[0.19017]	[0.74208]	[1.96364]	[-0.85903]	[-1.89943]
EPI (-2)	0.022871	12.62384	-0.075521	0.055737	240.2723
	[0.24466]	[0.33687]	[-0.28584]	[0.76218]	[2.47698]
INFR (-1)	0.312875	80.84740	-0.685830	0.233811	484.3666

	[0.92960]	[0.59922]	[-0.72100]	[0.88804]	[1.38691]
INFR (-2)	-0.202406	125.8498	1.316094	-0.639002	-469.9135
	[-0.75495]	[1.17097]	[1.73690]	[-3.04677]	[-1.68913]
EXCHR (-1)	-0.000338	-0.120509	0.003488	0.001404	0.647910
	[-0.59014]	[-0.52473]	[2.15412]	[3.13267]	[1.08989]
EXCHR (-2)	0.000212	-0.050491	-0.003791	-0.000674	0.734520
	[0.39739]	[-0.23653]	[-2.51926]	[-1.61750]	[1.32934]
C	-0.032813	-39.23929	0.417710	-0.039121	1.376523
	[-0.32456]	[-0.96820]	[1.46189]	[-0.49465]	[0.01312]
R-squared	**0.638258**	**0.941876**	**0.964763**	**0.826780**	**0.968666**
Adj. R-squared	**0.309401**	**0.889036**	**0.932730**	**0.669307**	**0.940181**
	1.940838	**17.82506**	**30.11754**	**5.250297**	**34.00571**

Source: Author's compilation using E – View version 10

Table 4.4 summarises the VAR results, which offer insights into the dynamic interactions between the GDP Growth Rate (GDPGR), Trade Intensity Ratio (TIR) and Environmental Performance Index (EPI).

From the GDPGR equation, the coefficients of TIR in both the first and second lags are negative and statistically insignificant, suggesting that international trade does not exert a significant influence on economic growth in Nigeria within the short-run dynamic structure. Specifically, TIR (-1) records a coefficient of –0.000177 with a t-value of –0.115, while TIR (-2) shows a coefficient of –0.000152 and a t-value of –0.177. These results point to a lack of immediate growth-enhancing effects from trade openness, and cast doubt on the short-

run validity of classical trade-led growth propositions in the Nigerian context. This outcome contradicts the findings of Were (2015), who, using data from Kenya, found a statistically significant positive relationship between trade and economic growth in the long run, implying that the benefits of trade openness may be country-specific and contingent on complementary macroeconomic conditions and institutional frameworks.

Similarly, the results from the EPI equation reveal that international trade does not significantly influence environmental sustainability in the short run. The coefficient of TIR(-1) is 0.000713 (t = 0.163), while that of TIR(-2) is –0.000257 (t = –0.106), both being statistically insignificant. This finding suggests that although trade activities may expose Nigeria to environmentally intensive production and consumption patterns, such effects are not immediate or linear in nature. Contrastingly, Managi, Hibiki, and Tsurumi (2009), in a study involving OECD and non-OECD countries, discovered that trade openness could either improve or degrade environmental quality depending on the country's stage of development and environmental policy stringency. In particular, their results showed that environmental degradation was more likely in countries lacking strong regulatory institutions; a condition which arguably characterises Nigeria's environmental governance.

Moreover, the VAR results reveal that the GDPGR variable itself does not respond significantly to its past values, indicating a weak autoregressive structure. GDPGR (-1) has a coefficient of 0.258 and a t-value of 0.462, while GDPGR (-2) is virtually zero and insignificant. This suggests that Nigeria's growth process is not strongly self-reinforcing, and that other variables outside trade, such as investment, fiscal policy, and political stability, may be playing more significant roles. This inference finds support in the study by Balogun, Tella, Adelowokan, Ogede, and Adegboyega, (2024), who used ARDL and Granger causality techniques to demonstrate that Nigeria's growth is more influenced by domestic investment and government expenditure than by international trade. They also noted that trade openness may even exacerbate volatility in GDP unless supported by appropriate industrial and trade policies.

Still on the environmental front, the role of the exchange rate appears more dominant than trade. The coefficients of EXCHR (-1) and EXCHR (-2) in the EPI equation are 0.003488 (t =

2.154) and –0.003791 (t = –2.519), respectively, both of which are statistically significant. This suggests that currency fluctuations may have immediate effects on environmental quality, likely through their influence on the cost of imported green technologies and raw materials. This observation is broadly consistent with the empirical evidence provided by Kivyiro and Arminen (2014), who analysed environmental quality in Sub-Saharan Africa and found that real exchange rate volatility significantly affected CO_2 emissions and environmental outcomes by altering trade balances and domestic production patterns.

Another critical insight from the VAR results is the relatively high R-squared values across the three equations; for TIR (0.94), EPI (0.96), and EXCHR (0.97), indicating that the models explain significant portions of the variations in these variables. However, the GDPGR equation has a relatively lower adjusted R-squared of 0.31, reflecting the limited role of lagged macroeconomic variables in explaining output fluctuations in Nigeria. This further reinforces the argument that trade openness alone is insufficient for explaining economic performance in developing economies unless accompanied by robust domestic economic policies and institutional reforms. This assertion aligns with the findings of Yusuff, Adekanye and Babalola (2020), who observed that while trade liberalisation promotes growth in the long run, its effect is largely muted or delayed in countries characterised by infrastructure deficits, trade policy inconsistencies, and institutional weaknesses.

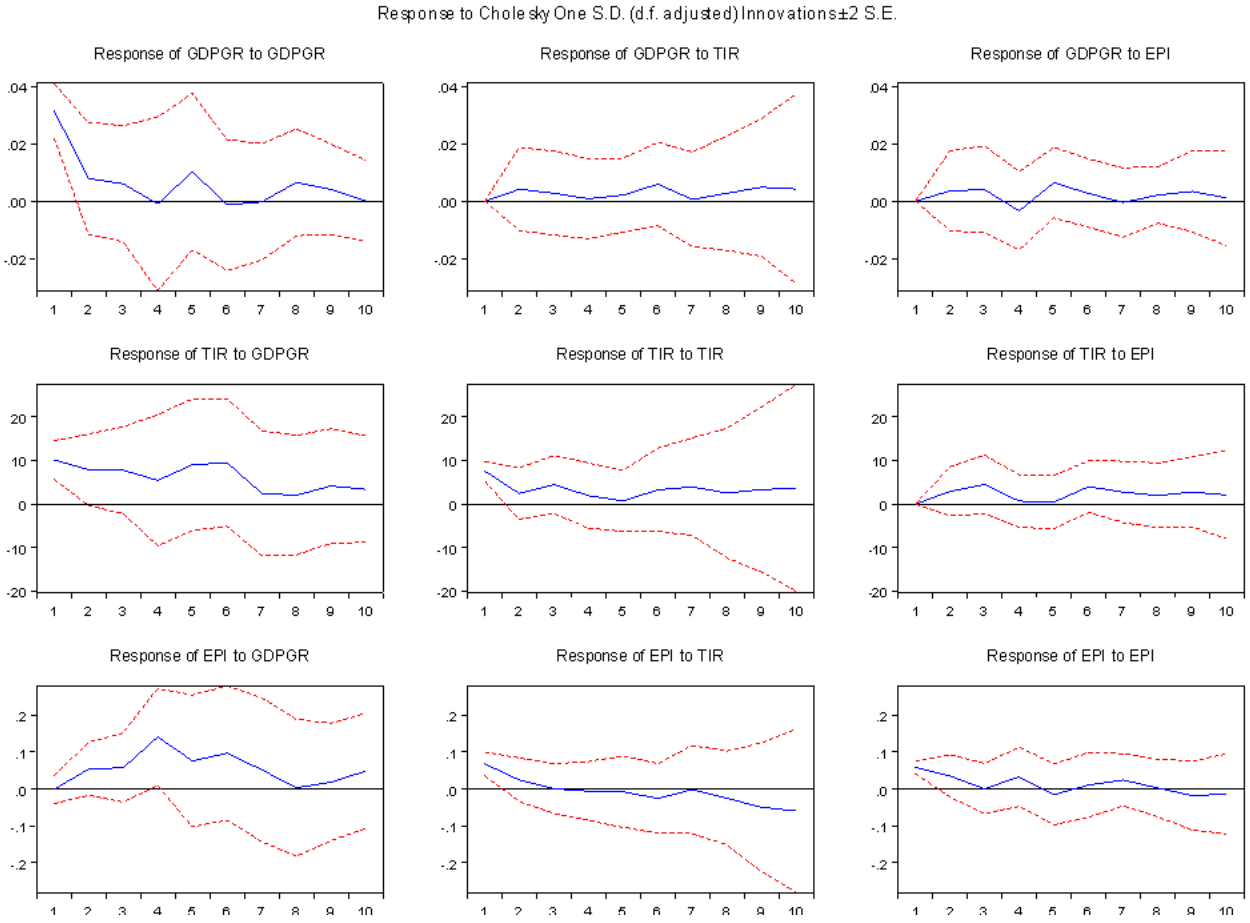
In sum, the VAR estimates support the view that international trade, while potentially beneficial, does not exert significant short-run effects on either economic growth or environmental sustainability in Nigeria. This positions the Nigerian case within a broader debate in the literature concerning the conditional benefits of trade liberalisation. The findings of this study deviate from the classical and neoclassical trade-growth postulates, which assert automatic gains from openness. Instead, the results resonate with the structuralist and dependency perspectives, which argue that without strong institutional frameworks, trade can reinforce structural weaknesses and environmental externalities.

Hence, while international trade remains a critical part of Nigeria's macroeconomic strategy, its actual impact on growth and the environment depends not only on trade

volumes, but also on the quality of domestic policies, regulatory capacity, technological innovation, and institutional development.

Impulse Response Function (IRF).

The study employs the impulse response function to determine the influence of the evolution of the model's variables GDPGR, TIR and EPI to shocks, which are found in the figure (4.1). The impulse response is seen to lie between 5% significant level using response to Cholesky one S.D (d.f. adjusted) innovation $\pm$ 2 S.E.



Source: Author's compilation using E – View version 10

Figure 4.1: Result of Impulse Response Test.

Variance Decomposition (VD).

The study employs the variance decomposition to explain the degree of variability in the GDPGR that is explained by TIR and EPI in the model and the degree of their relationship. This is contained in appendix 2.

In line with this study research questions 3 and hypotheses 3 respectively;

Research Question 3: *What is the dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria?*

Hypothesis 3: *There is no significant dynamic variance decomposition between international trade, economic growth and environmental sustainability in Nigeria.*

The study therefore deduced that;

- In Period 1, GDP growth rate (GDPGR) is fully explained by its own shocks (100%).
- From Period 2 to Period 10, the contribution of TIR (Trade) to GDPGR variance increases gradually from 1.48% to 6.19%.
- By Period 10, TIR explains 6.19% of the variation in GDPGR, while exchange rate (EXCHR) accounts for a higher share (17.25%), and environmental sustainability (EPI) explains about 5.82%.

Interpretation: International trade (TIR) has a modest but growing explanatory power on economic growth in Nigeria over time. Although GDPGR is still largely influenced by its own past shocks, the fact that TIR explains over 6% by the 10th period suggests some level of significance, partially rejecting Hypothesis 3.

The **Impulse Response Function** further supports this finding by showing a positive response of GDPGR to one standard deviation shock in TIR, although the magnitude is not substantial and the effect stabilizes after a few periods. This suggests a short- to medium-term growth-enhancing effect of trade, consistent with endogenous growth theory.

- Surprisingly, GDPGR has a dominant influence on TIR, explaining 64–67% of its variance across time. EPI (Environmental Performance Index) gradually contributes up to 9% by Period 10.
- TIR is not highly self-explanatory (i.e., past values of TIR contribute less over time), suggesting it is heavily influenced by GDP and to some extent by environmental sustainability (EPI).

Interpretation: The direction of influence appears reverse — economic growth impacts trade more than trade drives growth, and EPI influences trade modestly. However, the impact of TIR on EPI is better analyzed using the next decomposition.

The **IRFs** show that a shock to TIR leads to a short-run improvement in EPI, followed by a slight decline, confirming the transitory nature of trade's environmental effects.

- Initially, EPI is mostly self-explanatory (42.03% in Period 1) and heavily influenced by TIR (57.92% in Period 1).
- Over time, TIR's contribution declines from 57.92% (Period 1) to 10.56% (Period 10).
- GDPGR's contribution rises to 38.73%, while exchange rate (EXCHR) becomes increasingly important, explaining 27.37% of the EPI by Period 10.

Interpretation: Initially, international trade exerts a strong impact on environmental sustainability, but this influence diminishes over time. Nonetheless, its early contribution is high enough to reject the null of no significant dynamic variance decomposition (Hypothesis 3), especially in the short term. In the long run, exchange rate and GDP become more influential for environmental performance.

- GDPGR significantly influences TIR (up to 67%) and EPI (38.73%).
- TIR influences both GDPGR (6.19%) and EPI (10.56%) by Period 10.
- EPI also influences TIR (up to 9.03%) and GDPGR (5.82%).

Interpretation: GDPGR impacts TIR strongly, but has moderate impact on EPI. While, TIR impact on both GDPGR and EPI in period 10 is slightly. Again, EPI impact is slightly on both TIR and GDPGR.

The **IRFs** reinforce these findings by illustrating that a shock to GDPGR significantly influences both TIR and EPI, confirming enough reason to reject the null of no significant dynamic variance decomposition (Hypothesis 3).

5.0 CONCLUSIONS AND RECOMMENDATIONS:

From the results of this study, it is indicative that international trade does not exert a significant influence on economic growth in Nigeria within the short-run dynamic structure. The results from VAR analysis point to a lack of immediate growth-enhancing effects from

trade openness, and cast doubt on the short-run validity of classical trade-led growth propositions in the Nigerian context.

Moreover, the VAR results reveal that the GDPGR variable itself does not respond significantly to its past values, indicating a weak autoregressive structure. This suggests that Nigeria's growth process is not strongly self-reinforcing, and that other variables outside trade, such as investment, fiscal policy, and political stability, may be playing more significant role

Similarly, the results from the EPI equation reveal that international trade does not significantly influence environmental sustainability in the short run. This finding suggests that although trade activities may expose Nigeria to environmentally intensive production and consumption patterns, such effects are not immediate or linear in nature. Still on the environmental front, the role of the exchange rate appears more dominant than trade. This suggests that currency fluctuations may have immediate effects on environmental quality, likely through their influence on the cost of imported green technologies and raw materials. The results also showed that environmental degradation was more likely in countries lacking strong regulatory institutions: a condition which arguably characterises Nigeria's environmental governance.

Another critical insight from the VAR results is the relatively high R-squared values across the three equations; for TIR (0.94), EPI (0.96), and EXCHR (0.97), indicating that the models explain significant portions of the variations in these variables. However, the GDPGR equation has a relatively lower adjusted R-squared of 0.31, reflecting the limited role of lagged macroeconomic variables in explaining output fluctuations in Nigeria. This further reinforces the argument that trade openness alone is insufficient for explaining economic performance in developing economies unless accompanied by robust domestic economic policies and institutional reforms. In sum, the VAR estimates support the view that international trade, while potentially beneficial, does not exert significant short-run effects on either economic growth or environmental sustainability in Nigeria.

These position the Nigerian case within a broader debate in the literature concerning the conditional benefits of trade liberalisation. The findings of this study deviate from the

classical and neoclassical trade-growth postulates, which assert automatic gains from openness. Instead, the results resonate with the structuralist and dependency perspectives, which argue that without strong institutional frameworks, trade can reinforce structural weaknesses and environmental externalities.

These results justify the need for green trade policies, sustainable industrial development, and environmentally-conscious trade agreements in Nigeria, strengthening of institutional frame work and deliberate investment in infrastructure, to enable the revelation of any beneficial nexus between international trade, economic growth and environmental sustainability.

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Appendixes:

Appendix 1: Summary of Descriptive Statistics Result.

	GDPGR	TIR	EPI	INFR	EXCHR
Mean	0.050513	73.77958	2.219835	0.131279	217.1176
Median	0.056150	78.95000	2.088243	0.127100	155.5871
Maximum	0.153300	140.8000	3.207088	0.246600	633.8300
Minimum	-0.017900	16.45000	1.689959	0.053900	101.6973
Std. Dev.	0.036304	37.61151	0.444640	0.044614	132.3031
Skewness	0.430176	0.052688	0.968969	0.496743	1.596936
Kurtosis	4.286833	1.916229	2.838886	3.188024	5.134144
Jarque-Bera	2.396145	1.185663	3.781563	1.022369	14.75540
Probability	0.301775	0.552760	0.150954	0.599785	0.000625
Sum	1.212300	1770.710	53.27604	3.150700	5210.821
Sum Sq. Dev.	0.030314	32536.39	4.547216	0.045779	402594.7
Observations	24	24	24	24	24

Source: Author's computation using E – View version 10

Appendix 2: Variance Decomposition

Variance Decomposition of GDPGR:

Period	S.E.	GDPGR	TIR	EPI	INFR	EXCHR
1	0.031533	100.0000	0.000000	0.000000	0.000000	0.000000
2	0.034089	90.92279	1.476711	1.080908	0.244325	6.275267
3	0.036863	80.43384	1.830706	2.154553	0.480274	15.10063
4	0.037778	76.64568	1.788279	2.876501	0.839277	17.85026
5	0.039988	75.02455	1.874208	5.155910	1.531096	16.41424
6	0.040647	72.71778	3.961448	5.439638	1.742303	16.13883
7	0.040675	72.62552	3.974608	5.447322	1.742350	16.21020
8	0.041775	71.27999	4.198882	5.419101	1.884336	17.21770
9	0.042425	70.06363	5.356723	5.900044	1.948716	16.73089
10	0.042930	68.42855	6.194360	5.824895	2.302997	17.24919

Variance Decomposition of TIR:

Period	S.E.	GDPGR	TIR	EPI	INFR	EXCHR
1	12.64047	64.44721	35.55279	0.000000	0.000000	0.000000
2	15.63018	67.13009	25.63114	3.440157	0.006319	3.792297
3	19.00923	61.84576	22.81271	7.845827	4.485563	3.010138
4	20.54992	59.87517	20.36510	6.809840	7.544516	5.405372
5	22.63739	65.26896	16.88110	5.650776	6.250833	5.948329
6	25.15140	67.06024	15.34721	7.096889	5.488065	5.007594
7	25.72937	64.99594	16.98303	7.921791	5.294890	4.804346
8	26.08709	63.82134	17.45429	8.256257	5.245552	5.222555
9	26.84359	62.63039	17.99084	8.829994	4.971159	5.577617
10	27.41495	61.56412	19.00598	9.037337	4.781398	5.611161

Variance Decomposition of EPI:

Period	S.E.	GDPGR	TIR	EPI	INFR	EXCHR
1	0.089118	0.048125	57.92348	42.02839	0.000000	0.000000
2	0.149324	13.25080	23.32596	20.44664	8.171363	34.80523
3	0.172337	21.03244	17.51324	15.35096	18.68023	27.42313
4	0.244244	43.75188	8.778682	9.426427	15.64582	22.39719
5	0.263030	46.08330	7.656540	8.465516	15.93101	21.86364
6	0.282657	51.68725	7.506546	7.470058	13.79543	19.54072
7	0.292361	51.45613	7.020676	7.677978	13.45639	20.38883
8	0.307296	46.58379	7.029150	6.954357	14.73923	24.69347
9	0.322788	42.54115	8.775623	6.628565	16.46712	25.58754
10	0.347021	38.73424	10.56482	5.906736	17.41961	27.37460

Cholesky Ordering: GDPGR TIR EPI INFR EXCHR

Source: Author's compilation using E – View version 10