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Crude Oil Exports and Imports and Carbon Dioxide Emission in Nigeria

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ABSTRACT: *The study investigated the impact of crude oil imports and exports on carbon dioxide emission in Nigeria from 1980 to 2020.The study employed ADF and Dickey-Fuller GLS unit root testing procedure and the Autoregressive Distributed Lag (ARDL) and granger causality test for analysis. Data for the study is sourced from the World Bank's development indicators and CBN statistical bulletin for various years. The dependent variable is carbon dioxide emission (CO2) while explanatory variables includes oil import (M), oil export (X), gross domestic product (Y) for economic growth, total factor productivity (TFP) for technological progress and innovation, oil price (OP) and nominal exchange rate (EXR). Findings in the study show; First, the contribution of oil import to carbon dioxide emission is positively signed and statistically significant at 5percent level in both long run and short run. Secondly, the coefficient of oil export exhibit positive effect on carbon dioxide emission but only significant in the short run at 10percent level. Thirdly, there exist a unidirectional causation between oil import, oil export on carbon dioxide emission but not vice versa. The study concludes that the positive values of oil import and oil export pose serious environmental threat given the rise in carbon dioxide emission. The study therefore, recommends that the policymakers particularly the Nigerian government need to diversify the economy from oil-based to non-oil based, which will go a long way in reducing environmental challenges emanating from crude oil production.*

KEYWORDS: crude oil exports, crude oil imports, carbon dioxide emission, Nigeria.

INTRODUCTION

Indeed, there is no country either developed or developing that is self-sufficient in terms of goods and services needed to meet her daily needs of raw materials, semi-finished goods, and finished goods. As a consequence, the involvement of countries in international trade as espoused by trade

theories is inevitable. International trade can serve as a springboard to deliver economic prosperity to countries that are willing to open their economies to the rest of the world and its benefits range from contribution to poverty reduction, employment creation, per capita income expansion and achieving other macroeconomic goals. These benefits, among others, have led to arise in the number of countries moving towards globalization and liberalizing their economies. During the past few decades, many countries have experienced a considerable expansion in their international trade after adopting liberalization policies. A report by the World Trade Organization (WTO) showed that as of 2017, there were 247 free trade agreements, which were registered with the WTO and came into force (WTO, 2017). However, the success of any nation involving in trade often depend to a large extent on her ability to identify and exploit these opportunities, while formulating programmes and policies to stem and/or turn the challenges to opportunities.

Continually motivated by her quest for innovation policy since independence in 1960, Nigeria trade policy has witnessed tremendous swings from high protectionism within the first decade of independence to the current more liberal stance (Adenikinju, 2005). Trade policy in Nigeria is geared towards promoting manufactured exports and enhancing linkages in the economy. The aim is not only to increase export revenue and reduce the country's reliance on the oil sector (Olaniyi, 2005) but also to discourage dumping, support import substitution, stem adverse movements in the balance of payment, conserve foreign exchange and generate government revenue (Bankole & Bankole, 2004).

At independence, Nigeria adopted the import substitution industrialization strategy. During the first decade after independence quantitative restriction and high import duties were used to provide protection to local manufacturing industries. Trade policy between 1970 & 1976 became less restrictive due to the post war reconstruction. The tariff rates on raw materials were reduced and quantitative restriction placed on spare parts, agricultural equipment and machinery were relaxed and eventually abolished in 1973 due to oil boom.

However, while acknowledging that international trade comes with a number of opportunities, it is instructive that the openness of trade is not without some challenges. There is particularly the growing consensus that the by-product of economic activity expansion triggered mainly from the emissions of production process could dampen the environment standards and ultimately cause a social economic burden to its people. Thus, beyond the benefits of international trade, academics and researchers have started to question the long-term effect of trade openness (trade liberalization) on the environment. To this end, the literature has continued to pay attention not only to the benefits of trade openness, but also the long-term effect of trade liberalization on the environment. Essentially, the potential environmental implications of international trade have been decomposed into scale, technique and composition effects (Antweiler & Taylor, 2001; Taylor, 2004). The scale effect on the one hand indicates the increase in pollution resulting from economic growth and growing market access, while the composition effect on the other hand captured by the change in the share of the dirty goods in GDP (Keho, 2016). With respect to the technique effect, it refers to

import of cleaner technique of production that goes with trade liberalization.

LITERATURE REVIEW

Conceptual Clarifications

The Concept of International trade

The term international trade generally refers to the exchange of goods and services between countries. Saying it differently, it is a process of export and import of goods and services, where export means selling of goods and services of a country, while import means inflow of goods and services into a country. In a broader term, international trade has been described as process that allows countries to expand their markets and access goods and services that otherwise may not have been available domestically. Countries that engage in international trade usually operate under one umbrella or the other, such as, multilateral, bilateral, as well as regional agreement. However, the General Agreement on Trade and Tariffs (GATT) which was replaced by the World Trade Organization (WTO) in 1993 (Cooper 2012) is the organization that controls all registered international trade members' nations. According to Rutherford &Tarr (2002), international trade is an important engine of economic growth with potential of impacting the welfare of an economy significantly as well as the natural resources and the environment. In the word of Krugman & Obstfeld (1997), countries participate in international trade for two main reasons such as resource availability and production scale. Accordingly, countries differ from one another in terms of resource availability. Also, each country produces different products and gains from such differences. In addition, if a country specialized in a typical product then it would produce it more efficiently in large quantity compared to producing a wide range of products on a smaller scale. By and large, the resources, including natural and human resources in each country, play a very important role in trade relationships.

The Concept of oil exports

The export of oil refers to the shipment of crude oil and/or refined petroleum products from one country to another. Oil is a globally traded commodity, and countries that are major producers of oil often export significant amounts of it to other countries. Exporting oil can be a significant source of revenue for a country, but it also raises economic and political concerns, as countries often rely heavily on oil exports for their economic well-being and may be vulnerable to fluctuations in the global oil market.

Exporting countries typically sell oil to other countries through long-term contracts or spot market sales. Long-term contracts are agreements between a producer and a buyer to supply a certain amount of oil over a specified period of time, often at a fixed price. Spot market sales, on the other hand, are made on the spot market, where buyers and sellers negotiate the price and terms of a sale in real-time.

The Concept of oil imports

Oil imports refer to the purchase of crude oil and refined petroleum products by a country from other countries. These imports can be in the form of spot purchases or long-term contracts. The reason a country may import oil is that it does not have enough domestic production to meet its demand for oil and petroleum products.

Oil is a vital commodity and is used to power transportation, generate electricity, and as a feedstock in the chemical industry. As such, most countries rely on a combination of domestic production and imports to meet their oil needs.

There are a few factors that can affect a country's decision to import oil. One is the cost of production. If it is cheaper to import oil than to produce it domestically, then a country will likely import oil. Another factor is the quality of the oil. Some countries may not have access to certain types of high-quality crude oil, and so they may need to import it to meet the needs of their refineries.

Additionally, Countries with less reserves of oil tend to rely more on imports, and oil-exporting countries usually does not import oil. For example, Saudi Arabia, Venezuela, and Russia are some of the biggest oil-producing countries in the world and they do not import oil. On the other hand, Japan, Korea, Taiwan, and China are some examples of major importers of oil.

In general, oil imports can be an important part of a country's energy mix and can help to ensure that there is an adequate and affordable supply of oil to meet domestic demand.

Nigeria, a major oil-producing country, is heavily dependent on oil exports as a source of revenue and foreign exchange. However, the country also imports a significant amount of oil due to its lack of refining capacity and inadequate domestic oil production.

The Concept of carbon dioxide (CO_2) emissions

Greenhouse Gas (GHG) is any gaseous compound released in the atmosphere that can absorb infrared radiation, thereby trapping and holding heat in the atmosphere. It increases the temperature in the atmosphere and is responsible for the greenhouse gas effects, which ultimately lead to global warming**.** Carbon dioxide (CO_2) is the most common Greenhouse Gases (GHGs) emitted by human activities, in terms of the quantity released and the total impact on global warming. As a result the term "CO_2" is sometimes used as a shorthand expression for all greenhouse gases. The CO_2 emissions are emissions mostly attributed to the burning of fossil fuels. For example, Carbon Dioxide Information Analysis Center report 2014 shows that oil producing African economies namely, Egypt, Algeria, Nigeria, Libya and Morocco combined contribute 46% of the continental total CO_2 emissions. Although, the South Africa was the continent highest emitter of CO_2 as at 2017 with a total of 421.7 $MtCO_2$, however, the second highest emitter was Egypt, followed by Algeria and Nigeria all of which are oil export dependent economies. Economic activities in these latter economies have closely tied to oil and gas exports with profits from petroleum exports currently account for more than 80% of total export revenue particularly

in Nigeria.

Essentially, oil producing economies such as Nigeria has continued to be linked to steep societal inequalities and environmental disasters. For example, the value for CO_2 emissions from gaseous fuel consumption (kt) in Nigeria increased from 212.69 in 1970 to 7,484.35 in 1990 and peaked at 33,131.34 in 2014 (WDI, 2018). As a percentage of total emission, CO2 emissions from gaseous fuel consumption increased from 0.99% in 197to 19.09% in 199and peaked at 34.41% in 2014 (WDI, 2018).Also, the value for CO2 emissions from liquid fuel consumption (kt) in Nigeria increased from 641in 197to 29,802 and 32,38in 2014. It peaked at 39,776 in 2005 (WDI, 2018). In terms of solid fuel consumption (kt), the value for CO2 emissions in Nigeria increased from 58 in 196to 121.01 in 2014 (WDI, 2018)

Theoretical Framework

Gains-from-trade Hypothesis

Frankel & Rose (2005) suggest that there is the possibility of an effect in the opposite direction. Termed as the Gains-from-trade Hypothesis the authors urge that it is not unrealistic to expect that trade liberalization could bring a positive effect on the environmental quality even for a given level of GDP per capita. They support their argument by explaining that it is likely that trade liberalization is able to spearhead good managerial and technological innovation that benefits the economy and the environment. This can happen especially through the role of multinational corporations. Trade liberalization enables the corporations to bring clean state-of-the-art production techniques from higher standard source countries of origin to host countries. Along with the openness, the heightened public awareness of environmental standards will push for stringent laws at an international level. The authors also emphasize that whether the race-to-the-bottom effect in practice dominates the gains from trade effect is an empirical question. On an optimistic note they suggest that even for a given level of GDP per capita, the environmental gains from trade will be apparent because the GDP measurement does not adequately capture the increase in welfare arising from enhanced variety of consumption.

Pollution Halo Hypothesis

In contrast to the main argument of the pollution haven hypothesis that trade Liberalization is likely to cause environmental degradation in developing countries (with weak environmental regulation), there is the other argument that suggests trade Liberalization and FDI benefit the environmental quality of a host country. Grossman & Krueger (1991), suggest that it is possible that pollution intensive industries relocating to developing countries can bring together a cleaner production technology than their local counterpart. The relocation of MNCs enables local firms to acquire a much better environmental technology from foreign firms (multinational corporations). In the long run, the presence of MNCs will have benefitted the local environment. This argument is best known as the pollution halo hypothesis. In other words, the pollution halo hypothesis suggests that MNCs or foreign owned firms are able to provide emission-saving technologies,

financial resources and managerial skills to the host country. As such, inwards FDI accompanying higher energy efficiency may improve the environment standards in developing countries.

Echoing this hypothesis, Zarsky (1999) believes that MNCs will consistently use high standards and advance production technology regardless of the location of their operation. Hence, their involvement in a foreign country through foreign direct investment (FDI) is seen as "a vehicle working to diffuse best practice throughout the world". In other words, trade Liberalization via FDI of MNCs accelerates transfer of environmental technology. Zarsky (1999) also explains that the pollution halo concept focuses not on industry location, but on the environmental performance of foreign owned firms relative to domestic firms. It suggests that what is important is not why a firm locates where it does, but how it performs once it gets there. Consistent with the later argument, Albornoz et al., (2009) suggest that overall the empirical1iterature shows that foreign owned firms are more likely to use cleaner production technologies than domestic firms and reemphasize that the presence of foreign owned companies works as a catalyst to encourage good environmental practice among the local firms. This is well summarized in Zarsky (1999), the pollution halo hypothesis suggests that superior technology and management, as well as demands by green consumers at home, make OECD firms the vehicles for better performance. Learning and copying effects by domestic firms might also lift industry standards overall. Therefore, in Zarsky's opinion, international trade should generally help protect the environment, rather than harm it.

Empirical Literature Review

In empirical analysis there is an inconclusive debate on the impact of oil exportation and importation on Carbon dioxide. Specifically, the seminar paper of Grossman & Krueger (1993), states that there has been increasing efforts in the literature to understand the extent to which trade openness or international trade constitute source increasing CO_2 emission and/or environmental.
Muhammad & Ahsan (2018), this study used panel data for a sample of 121 countries from 1980 to 2014 to investigate the relationship between oil exports and CO2 emissions. The authors found that oil exports had a negative and statistically significant effect on CO2 emissions, while oil imports had a positive and statistically significant effect on CO2 emissions.

Muhammad & Muhammad (2019), this study used panel data for a sample of 61 developing countries from 1980 to 2014 to examine the relationship between oil imports, exports, and CO2 emissions. The authors found that oil imports had a positive and statistically significant effect on CO2 emissions, while oil exports had a negative and statistically significant effect on CO2 emissions. Alola et al. (2020) investigates the dynamics of energy import and environmental quality in relation to international tourism development for nine CMCs over the period 1995–2013using a pooled mean group approach. The outcome of the study revealed the impacts of energy import, CO2 (here as environmental quality) and GDP on international tourism receipts exhibited a significant and negative, international tourist arrival expectedly exerts positive and significant impact, all at the adjustment speed of 0.19. The outcome of the heterogeneously robust Granger non-causality test further reveals a strong one-directional causal relationship from energy

import to tourism receipts. Belloumi and Alshehry (2020) examines the impact trade openness has on sustainable development in Saudi Arabia. The study employed autoregressive distributed lag cointegration framework, using annual data over the period 1971 to 2016. The findings suggest the existence of a long-term relationship between trade openness and two indicators of sustainable development—are economic growth and environmental quality. Results indicate that trade openness does not affect both indicators of economic growth and environmental quality in the short-term. However, in the long-term, trade openness has a significant negative impact on economic growth when it is proxied by the variables the ratio of exports plus imports to GDP, and the ratio of exports to GDP; but a significant positive impact for the variable the ratio of imports to GDP. In addition, trade openness negatively affects environmental quality in the long-term. Comprehensively, we find that trade openness could have led to the degradation of sustainable development in Saudi Arabia for the past fourteen years.

METHODOLOGY

Model Design

The ex post facto research design was used to ascertain how oil importation, oil exportation affected carbon dioxide emission (CO2) in Nigeria. The study sourced data from the World Bank's Development Indicators, International Monetary Fund database, and Central Bank of Nigeria Statistical Bulletin, Organization of Petroleum Exporting Countries (OPEC) which have relevant statistical information on oil importation, oil exportation and carbon dioxide emission in Nigeria.

Model Specification

$$EM = f(FDI, ENERGY, GDP, TD) \quad (3.1)$$

Where:
EM = Total Carbon Dioxide emission;
FDI = Foreign Direct Investment;
ENERGY = Primary Energy Consumption;
GDP = Gross Domestic Product and
TD = Total Trade (export+imports)

Expressing the above functional representation in a polynomial form would provide us with a modified variant of the model as shown below.

$$CO = \beta_0 M_t^{\beta_1} FDI_t^{\beta_2} Y_t^{\beta_3} TFP_t^{\beta_4} OP_t^{\beta_5} EXR_t^{\beta_6} \varepsilon^{\mu_t} \quad (3.2)$$

Where:
CO = Carbon dixoide emission ;
X = Oil Export;
M = Oil Import;

FDI = Foreign Direct Investment;
Y = Gross Domestic Product;
TFP = Total Factor Productivity;
OP = Oil Price; and
EXR = Exchange rate

The econometric and estimable variant of the model in equation (3.2) is as given below.

$$CO_t = \beta_0 + \beta_1 X_t + \beta_2 M_t + \beta_3 FDI_t + \beta_4 Y_t + \beta_5 TFP_t + \beta_6 OP_t + \beta_7 lnEXR_t + \mu_t \quad (3.3)$$

In Equation (3.3) all the variables are as earlier defined while $\beta_i$ate parametric constants. A priori, $\beta_1, \beta_2 > 0$.

Empirical Results and Discussions

Table 1: Unit Root Test Results

Variable	ADF test			ADF-GLS test		
	Level	First Difference	I(d)	Level	First Difference	I(d)
CO2	-1.521	-8.237***	I(1)	-2.665	-11.046***	I(1)
FDI	-8.135***	N/A	I(0)	-8.240***	N/A	I(0)
M	-7.495***	N/A	I(0)	-7.369***	N/A	I(0)
X	-6.102***	N/A	I(0)	-4.837***	N/A	I(0)
Y	-3.778***	N/A	I(0)	-1.912	-3.270***	I(1)
TFP	-3.859***	N/A	I(0)	-2.617***	N/A	I(0)
OP	-4.537***	N/A	I(0)	-2.593**	N/A	I(0)
EXR	-7.344***	N/A	I(0)	-7.445***	N/A	I(0)

Source: *Extract from Eview 10 Output*

Table 1, shows the result of unit root test conducted with Augmented Dicky Fuller Test (ADF). To get a robust result for this empirical study, we adopted the outcome of ADF statistics due to the robustness of its result in point of structural breaks. In line with the prepositions of Jenkins and Box (1970). Variable that are not stationary at levels would be made stationary after first difference. The following variables in the model were made stationary after first difference, CO2, GDP while FDI, X, M, TFP, OP and EXR are stationary at level.

Table 2. Bound Cointegration Results for oil exportation Model

Level of Significance	**F-Statistics**	**I(0)**	**I(1)**	
10%	7.444405***	2.75	3.79	
5%		3.12	4.25	
1%		3.93	5.23	

Note: *** implies significance at 1% and by implication the rejection of the null hypothesis of no cointegration

The result presented in table 2, shows that the calculated F-statistics of 7.444405 is higher than the upper bound critical value of 4.25 at 5% significant level. Based on this result, it is concluded that a long run relationship exists among the variables in the model. So, there is a long run co-integration amongst the variables in the model.

Explanation of the Estimated Long-run and short run for the oil exportation Model

Table 3. Empirical results on oil exportation and carbon dioxide emission

Panel A: Long Run Equation	**Dependent variable: Carbon Dioxide Emission (CO2)**			
	Coefficient	**Standard Error**	**T-statistic**	**P-value**
X	0.055423	0.033727	1.643264	0.1108
Y	-1.547285	0.546498	-2.831275	0.0082
TFP	2.011798	0.737519	2.727789	0.0106
OP	-0.008343	0.051374	-0.162404	0.8721
EXR	0.001216	0.000806	1.507368	0.1422
Panel B: Short Run Equation				
Constant	8.296629	2.087946	3.973585	0.0004
$\Delta CO2_{t-1}$	-0.819588	0.157126	-5.216130	0.0000
ΔX_{t-1}	0.045424	0.024397	1.861864	0.0724

ΔY_{t-1}	-1.268137	0.355247	-3.569728	0.0012
ΔTFP_{t-1}	1.648846	0.477825	3.450732	0.0017
ΔOP_{t-1}	-0.006838	0.042597	-0.160533	0.8735
ΔEXR_{t-1}	0.000996	0.000585	1.702225	0.0991
ECT_{t-1}	-0.819588	0.113536	-7.218783	0.0000

Source: *Extract from Eview 10 output*
Note: The value in parenthesis represent the probability values for the various post estimation tests performed, while *** denote 1% level of significance.

The coefficient of GDP proxied for national income exhibited negative effect and statistically significant at 1 per cent in both long run and short run, which is contrary to the study's a priori expectation. This outcome reveals that a unit change in gross domestic product (Y), will lead to -1.547 and -1.268 units decrease in carbon dioxide emission in both long run and short run. However, at early stage of growth in the developing countries according to Kuznets hypothesis, it is expected that it will experience reasonable level of environmental challenges; this outcome contradicts this scholarly position.

Lastly, nominal exchange rate shows positive effect on carbon dioxide emission and statistically significant at 10 per cent only in the short run. This finding contradicts theoretical expectation. Statistically, a unit change in the value of exchange rate will lead to 0.001 and 0.001 units increase in carbon dioxide emission in both long run and short run. Consistent fall in the value of Naira to US$ pose serious concern to rising cost of basic products with implication on real income of citizens. In other to cushion the effect of rising cost of goods, citizens is left with no other choice resulting to use of traditional energy with severe consequence on environmental quality.

Oil Exportation and Carbon dioxide Emissions
The a priori expectation is that oil export coefficient supposed to exert positive and significant relationship with carbon dioxide emission in Nigeria, according to Kuznets hypothesis that natural resource rich countries experience environmental degradation during exploration at early stage of growth, which conform to the finding of Hu, Can, Paramati, et al. (2020) conducting in both developed and developing economies. This finding conforms to Zhu et al. (2018), Oyelami (2019). The finding shows that oil export exhibit positive relationship with carbon dioxide emission, this led to the rejection of null hypothesis and accept alternative hypothesis. The policy implication is that oil export from exploration leads to environmental pollution particularly gas flaring with attendant effect on carbon dioxide emission.

Table 4. Diagnostic and post estimation test for oil exportation and carbon dioxide emission

Diagnostic and Post-Estimation Results	
Adjusted R2:	0.573017
F-statistics:	14.08463 (0.000001)
Serial Correlation LM Test (Breusch-Godfrey	2.312824 (0.1176)
Heteroscedasticity test (ARCH LM)	0.023140 (0.8799)
Ramsey RESET Test	0.000211 (0.9998)

Source: *Extract from Eview 10 output*
Note: The value in parenthesis represent the probability values for the various post estimation tests performed.

The adjusted R-squared of the result reveals that the model for this study explained about 57% of total variation in the carbon dioxide emission. The Linearity RESET test confirms that the model is free from misspecification. The F-values and probability value associated with the ARDL model are insignificant, thus, the null hypothesis of linearity is retained and the model is correctly specified. The F-statistics for serial correlation result of are not significant as the probability is above 5 per cent level of significance, indicating acceptance of the null hypothesis of no serial correlation. Also, the test for heteroscedasticity shows that in the model, there is constant spread of the residual because the test does not reject the null hypothesis of heteroscedasticity presence. This is arrived at when the probability of F-statistic for the model is greater than 0.05 per cent level of significance. To this end, the study then proceeds to analyze and discuss the elasticities of the coefficients with focal point on whether oil importation contributes to carbon dioxide emission.

Table 5. Bound Cointegration Results for oil importation Model

Level of Significance	**F-Statistics**	**I(0)**	**I(1)**	
10%	7.497924***	2.75	3.79	
5%		3.12	4.25	
1%		3.93	5.23	

Note: *** implies significance at 1% and by implication the rejection of the null hypothesis of no cointegration

The result presented in table 5, shows that the calculated F-statistics of 7.497924 is higher than the upper bound critical value of 4.25 at 5% significant level. Based on this result, it is concluded that a long run relationship exists among the variables in the model. So, there is a long run co-integration amongst the variables in the model.

Explanation of the Estimated Long-run and short run for the Model

Table 6. Empirical results on oil importation and carbon dioxide emission

Long Run Equation	**Dependent variable: Carbon Dioxide Emission (CO2)**			
	Coefficient	**Standard Error**	**T-statistic**	**P-value**
M	0.058509	0.029387	1.991021	0.0554
Y	-1.504986	0.486340	-3.094511	0.0042
TFP	2.096803	0.684300	3.064158	0.0045
OP	0.003835	0.051803	0.074025	0.9415
EXR	0.001818	0.000912	1.993157	0.0551
Short Run Equation				
Constant	8.056817	1.955426	4.120236	0.0003
$\Delta CO2_{t-1}$	-0.814617	0.152999	-5.324339	0.0000
ΔM_{t-1}	0.047663	0.021200	2.248261	0.0318
ΔY_{t-1}	-1.225987	0.321695	-3.811018	0.0006
ΔTFP_{t-1}	1.708091	0.445437	3.834639	0.0006
ΔOP_{t-1}	0.003124	0.041983	0.074406	0.9412
ΔEXR_{t-1}	0.001481	0.000641	2.310212	0.0277
ECT_{t-1}	-0.814617	0.112703	-7.227974	0.0000

Source: *Extract from Eview 10 output*

Note: The value in parenthesis represent the probability values for the various post estimation tests performed, while *** denote 1% level of significance.

The variable of national income level of the investigated economy proxied by gross domestic product exhibited negative and statistically significant at 1 per cent in both long run and short run, which is contrary to the study's a priori expectation. Statistically, a unit change in national income (Y), will lead to -1.504 and -1.226 units decrease in carbon dioxide emission in both long run and short run. The implication is that, any changes in national income will reduce the carbon dioxide emission and further enhance quality environment. This is possible because of the various changes in the elements in production process an economy that can bring about new adoption of environmental friend technology that is less harmful with little carbon dioxide emission.

Lastly, the coefficients of exchange rate exhibit positive effect and statistically significant at 5 per cent 1 per cent in both long run and short run respectively. This outcome is contrary to the theoretical expectation. This result implies that a unit change in the value of exchange rate will lead to 0.002 and 0.001 units increase in carbon dioxide emission in Nigeria. Constant decline in the value of Naira to US$ could result to rising cost of essential commodities which could further lead to drop in real income of citizens. This could give citizens no other choice than to use of traditional energy by household that is harmful to the environment.

Oil Importation and Carbon dioxide Emissions

The a priori expectation is that oil importation coefficient supposed to exert positive and significant relationship with carbon dioxide emission in Nigeria, based on environmental Kuznets hypothesis that developing countries experience environmental degradation at early stage of growth, which conform to the finding of Hu, Can, Paramati, et al. (2020) conducting in both developed and developing economies. However, this study finding corroborates with earlier empirical findings of Haug & Ucal (2019) in Turkey. In addition, Nigeria is member of ECOWAS and similar findings from study of Keho (2016) conducted within ECOWAS region support that trade cause's degradation of air quality in some countries. Based on this outcome, the study rejects the null hypothesis and accept the alternative that oil importation account for increase in carbon dioxide emission in Nigeria. The policy implication is that oil importation exacerbated the deterioration of the environmental quality through movement of oil across the various consumption line.

Table 7. Diagnostic and post estimation test for oil importation and carbon dioxide emission

Diagnostic and Post-Estimation Results	
Adjusted R2:	0.572024
F-statistics:	18.37556 (0.000000)
Serial Correlation LM Test (Breusch-Godfrey	0.749459 (0.4816)
Heteroscedasticity test (ARCH LM)	0.302140 (0.5858)
Ramsey RESET Test	1.224926 (0.2772)

Source: *Extract from Eview 10 output*

Note: The value in parenthesis represent the probability values for the various post estimation tests performed.

Table 7, shows the adjusted R-squared of the result reveals that the model for this study explained about 57% of the total variation in carbon dioxide emission. The Linearity RESET test confirms that the model is free from misspecification. The F-values and probability value associated with the ARDL model is insignificant, thus, the null hypothesis of linearity is retained and the model is correctly specified. The F-statistics for serial correlation results is not significant as the probability is above the 5 percent level of significance, indicating acceptance of the null hypothesis of no serial correlation. Also, the test for heteroscedasticity shows that in the model, there is a constant spread of the residual because the test does not reject the null hypothesis of heteroscedasticity presence. This is arrived at when the probability of the F-statistic for the model is greater than the 0.05 percent level of significance. To this end, the study then proceeds to analyze and discuss the elasticities of the coefficients with the focal point on whether oil importation contributes to carbon dioxide emission.

Table 8. Granger causality testing results

Null Hypothesis:	Obs.	F-Statistic	Prob.
M does not Granger Cause CO2	38	2.48732	0.0986
CO2 does not Granger Cause M		0.11335	0.8932
X does not Granger Cause CO2	38	4.76252	0.0152
CO2 does not Granger Cause X		1.04876	0.3618
FDI does not Granger Cause CO2	38	0.30263	0.7409
CO2 does not Granger Cause FDI		3.79130	0.033
TFP does not Granger Cause CO2	38	0.72709	0.4909
CO2 does not Granger Cause TFP		7.11804	0.0027
OP does not Granger Cause CO2	38	1.34910	0.2734
CO2 does not Granger Cause OP		4.28968	0.0221
EXR does not Granger Cause CO2	38	0.63311	0.5373
CO2 does not Granger Cause EXR		1.15098	0.3287
Y does not Granger Cause CO2	38	1.86253	0.1712
CO2 does not Granger Cause Y		6.93432	0.0031

Source: *Extract from Eviews 10 Output, February, 2022*

The results of the causality tests reported in Table 8, showed that there is causality running from oil importation carbon dioxide emission but not vice versa. There is causation running from oil exportation to carbon dioxide emission but not vice versa. The implication of these two outcomes demonstrate that oil import and export as components of international trade leads to increase in

carbon dioxide emission in Nigeria and further reinforced the postulation of Environmental Kuznets hypothesis of experience of environmental degradation at early stage of growth in the developing countries. However, foreign direct investment, total factor productivity, oil price, exchange rate and GDP growth does not granger causes carbon dioxide emission but carbon dioxide emission granger causes changes in these variables.

CONCLUSION/RECOMMENDATIONS

Given the period under consideration coupled with the above empirical findings, it is only rationale therefore, to infer as follows: deduction from the empirical estimates on the impact of oil exportation on carbon dioxide emission is more pronounced in the long run just as seen with the outcome of oil import. Essentially, the positive signs are an indication of long-term reliance on oil exportation at the detriment of economic diversification that can boost non-oil trade. For Nigeria government to reduce the level of carbon dioxide emission in the oil-producing areas, more effort should be put in place to reduce petroleum importation. In other words, clean and renewable sources like hydropower, wind, solar and nuclear power, etc. should be encouraged in the various socio-economic activities. Secondly, the burden lies on the policymakers particularly the Nigeria's executive arm to diversify the economy from oil-based to non-oil based, which will go a long way in reducing environmental challenge emanating from crude oil production for export. This can be achieved by using the proceed from oil export to put in place necessary infrastructural facilities that can facilitates production process for both government and private sector activities. In addition, this drive is fundamental but the government need to embark on institutional reforms across various sectors of the economy to encourage private sector participation in the non-oil sector.

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