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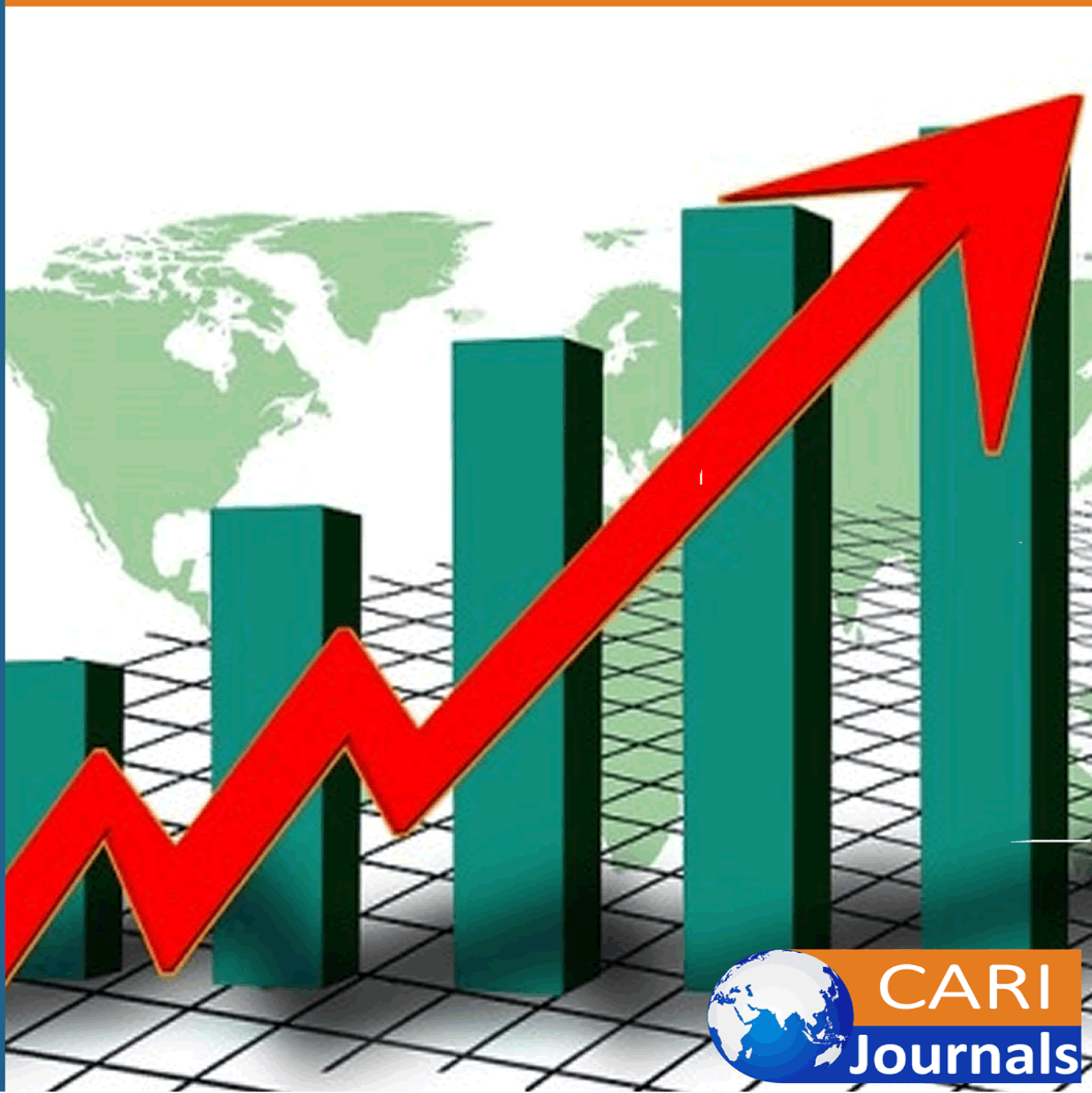

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Impact of Refined Crude Oil Imports on Carbon Dioxide Emission (C02) in Nigeria

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Abstract

Purpose: The study investigated the impact of refined crude oil imports on carbon dioxide emission in Nigeria covering the period 1980 to 2020.

Methodology: The study employed preliminary test of Augmented Dickey Fuller and Dickey-Fuller GLS unit root testing procedure while the main estimation technique is the Autoregressive Distributed Lag (ARDL). Data for the study is sourced from the World Bank's development indicators and Central Bank of Nigeria statistical bulletin for various years. The dependent variable is carbon dioxide emission (CO2) while explanatory variables include refined oil imports (M), 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: Findings in the study show that the contribution of refined oil imports to carbon dioxide emission is positively signed and statistically significant at 5 percent level in both long run and short run. There exists a unidirectional causation between oil import, and carbon dioxide emission. The study concludes that the positive values of refined oil imports pose serious environmental threat given the rise in carbon dioxide emission.

Unique Contribution to Theory, Policy and Practice: The study therefore, recommends amongst others that the policymakers particularly the Nigeria's executive arm of government need to diversify the economy from oil-based to non-oil based. Also, the country's refineries should be de-regulated to reduce the over dependency on the importation of the refined crude oil imports alongside with the establishment of Government Agencies that will strictly monitor the refined crude oil production process which will go a long way in reducing the over reliance on refined crude oil importation as well as the environmental challenges emanating from refined oil consumption.

Keywords: *Refined crude Oil Imports, Carbon Dioxide Emission, ARDL, Nigeria*

INTRODUCTION

In Nigeria, the position of refined crude oil as the mainstay of the economy cannot be over-emphasized. Refined crude oil plays a vital role in shaping the economic and political destiny of the country. Thus, Nigeria's economy is basically an open economy with international transactions constituting an important proportion of her aggregate economic activities. Over the years, the degree of openness of the economy has grown considerably. Globally, refined crude oil is the largest source of energy today as; it powers the global economy and its industrialization processes. The import of petroleum products in Nigeria has been unstable since the 1980s, with motor gasoline being the largest among the products imported over the years. The periods 1989-1993 and 1994-1998 appeared to be associated with the lowest imports of petroleum products in the country. This development could be associated with the civil unrest and prevailing loss of business confidence that characterized the economy during the periods (Monday et al., 2018). Thus, impact of the importation of refined oil is causing environmental degradation in the economy.

In Nigeria, average growth rate of import for the period of 1981 to 2020 stood at 12.79 per cent which is less than export at 9.93 per cent. This is an indication that the growth of import supersedes export and could further imply that Nigeria is an import dependent country. This variance could also be linked with earlier finding by Haug and Ucal (2019) that increase in imports push up CO_2 emissions per capita. For instance, average growth rate of carbon dioxide is -1.65 per cent within the corresponding period above, portray decrease in CO_2 emission (increase in environmental quality).

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 and carbon emitted from cars and other machines 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, Copeland & 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.

Since independence, Nigeria's trade policy has witnessed tremendous swings from high protectionism within the first decade of independence to the current more liberal stance (Adenikinju, 2005). 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). However, while acknowledging that international trade comes with several opportunities, it is instructive that the openness of trade is not without some challenges. Essentially, the potential environmental implications of international trade have been decomposed into scale, technique, and composition effects (Antweiler, Copeland & Taylor, 2001; Taylor, 2004; Zhu et al., 2018). The extent to which trade may reduce or increase CO_2 emissions may be sensitive to whether a country has a comparative advantage in cleaner or dirty industries.

However, the impact of refined oil imports on carbon dioxide emission in Nigeria can be measured with several proxies. On this premise, this paper seeks to empirically investigate the impact of refined oil imports on carbon dioxide emission in Nigeria. Interestingly, no study has investigated the impact of refined oil imports on carbon dioxide emission in Nigeria. These issues give credence to this study.

Literature Review

Conceptual Clarifications

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 (2009), 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.

Refined crude oil imports

Refined crude oil imports refer to the purchase of 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 capacity 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 refined crude oil needs.

There are a few factors that can affect a country's decision to import refined crude oil. One is the cost of production. If it is cheaper to import refined crude 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 refined crude oil, and so they may need to import it to meet the domestic needs.

Additionally, Countries with less reserves of crude oil tend to rely more on imports, and oil-exporting countries usually does not import refined crude 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 refined crude oil. In general, refined crude 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 refined crude oil due to its lack the capacity to refine crude oil and also unable to produce the quantity require domestically.

In recent years, the government of Nigeria has implemented several policies to try to reduce the country's dependence on refined crude oil imports. For example, in 2016, the government announced a policy of deregulation and liberalization of the downstream oil sector, with the goal of attracting private investment to the sector and increasing refining capacity. However, there has been limited success in implementing these policies, and Nigeria's refining capacity remains low.

Some research has pointed out that fuel subsidy policies implemented by Nigerian government led to increase in refined crude oil imports, which is one of the main reasons behind Nigeria's recurrent budget deficit. Along with these policies, lack of maintenance and upgradation of existing refineries, inadequate investment in refining sector and bureaucratic red tape also contribute to Nigeria's dependence on refined crude oil imports.

Additionally, there are studies indicating that illicit activities, including smuggling and illegal bunkering, also play a significant role in the high level of refined oil imports in Nigeria. These activities are driven by the large price differentials between domestic and international oil prices, which are created by government subsidies and price controls.

In conclusion, Nigeria's dependence on refined oil imports is a multifaceted problem that is driven by a combination of factors, including lack of refining capacity, government policies, inadequate investment, and illicit activities. Addressing these challenges will require a comprehensive approach that addresses both the supply-side and demand-side issues that contribute to the problem.

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 Literature Review

2.1.1 The Factor Endowments Hypothesis (FEH) and Pollution Havens Hypothesis (PHH)

Theory on the trade and environment relationship has also recognized two main factors that influence the pollution intensity of production and hence trade. The factors are known as factor endowments of production and stringency of environmental regulation. Both are described precisely in the FEH and PHH, respectively. Both hypotheses suggest that the more exposed a country to international trade, the more significant the role of trade on the country's composition of production, hence the intensity of pollution. The FEH in particular suggests that trade patterns are determined by the relative abundance of factor endowments in the country. Countries that possess relatively abundant capital are likely to specialize in producing capital-intensive goods while countries with labour abundance will produce labour-intensive goods.

In general, the pollution intensive industries are relatively capital intensive (Antweiler et al., 2001). What this portends is that a capital abundant developed country would have a comparative advantage in pollution intensive industries, even if it applies relatively tough environmental laws. This means pollution intensive products are likely to be produced in developed countries. This hypothesis is the foundation of the Heckscher-Ohlin theory of international trade. In regard to the trade-environment relationship, countries in the North which possess capital abundant factors are expected to export relatively more pollution intensive goods and countries in the South which possess labour abundant factors are expected to export labour intensive goods that are often regarded as less-pollution intensive goods. The hypothesis is in opposition to the PHH which states that trade patterns will be influenced by the stringency of environmental regulation.

Other than labour and capital that formed the traditional factors of production, some believe that the environment should also be considered as a factor of production, using the same argument as in the case of labour and capital. Hence one can suggest that a country with environment abundance (natural absorptive capacity) will have comparative advantage in the production of pollution intensive industry. This is due to the environment abundance which implies that it cost less to pollute in the country. The PHH argument on the trade-environment linkage relies on the issue of environmental regulation. PHH theorizes that the choice of location for the manufacturing operation is significantly influenced by the stringency of environmental regulation enforced in the country. If the costs of compliance with environmental regulation differ across countries then ceteris paribus, one may expect relocation of pollution intensive industries to locations where the costs of compliance are lower (Kirkpatrick & Scrieciu, 2008).

A country with less stringent environmental policy will attract more manufacturers to set up their factory which gives them the 'privilege' to emit pollution and other externalities. The insight of the

PHH is that for poor countries, people are less concerned about environment standards compared to their desire for the benefit gained from economic activity expansion. Therefore, for less developed countries, many expect that due to a lack of economic opportunity, the trade-led economic expansion is vital in improving living conditions and pursuing other macroeconomics goals. The policy-makers that subscribe to this hypothesis may also concur and collude with the EKC connotation that environment standards could be improved in due course when the fruits of economic benefits of trade have been fully reaped.

2.1.2 Porter Hypothesis

In the words of Frankel & Rose (2005), "Porter Hypothesis claims that environmental regulation stimulates productivity- together with the positive effect of income on trade". Basically, the Porter Hypothesis argument depends on the technique effect of trade liberalization on the environment. Increased trade liberalization leads to stiff competition. This will push producers to enhance their research and development (R&D) capability which is geared towards high productivity. This competition ultimately makes the producers more innovative and willing to put significant amounts of expenditure into R&D. Furthermore, the presence of multinational companies in developed and developing countries will likely make an effort to have a high standard of environmental quality as a common agenda. Thus developing countries will benefit and push towards high productivity and greener technology which ultimately will be improving overall environment quality. Porter & van (1995) summarize that even though the common assumption is to relate environmental regulation to rising costs and risks to growth, it can be seen as a drive factor to stimulate innovation and productivity.

Empirical Review

Ayres and Kneese (1969) showed that pollution (gaseous, liquid or solid) is inherent to the production and consumption activity of an economy and a trade-off exists between the forms of pollution. The effects of environmental externality on production and consumption were analysed by Grubel (1975) using modified Hecksher–Ohlin (HO) model (the HO model states that each country has a comparative advantage in the good which is relatively intensive in the use of the country's relatively abundant factor). If the environmental costs are not reflected in the domestic production of the commodities in the trading countries, it will increase production of commodities normally imported and decrease the production of exports. Using a two-country, two-goods and two-factor (labor and environment) general equilibrium model, Pethig (1976) derived different interpretations of the theorems of comparative advantage with respect to environmental scarcity. He analyzed three specific trade patterns: between developing countries; between developing and developed country; and between developed countries. In case of trade between two developing countries (where supply of environmental services greater than demand), neither the comparative nor the absolute size of the country's capacity of environmental services (or EAC) has an impact on the pattern of trade. Francisco & Lúcio (2015), the study examines the relationship between oil

imports, oil dependence, and carbon dioxide emissions in a sample of developing countries using annual data from 1980 to 2012. The study finds that oil imports and oil dependence have a positive and statistically significant relationship with carbon dioxide emissions in developing countries.

Al-Mulali et al. (2022) examines the impact of oil prices on economic growth in oil-exporting and importing countries from 1980 to 2019. The researchers found that oil exports are associated with higher carbon dioxide emissions, while oil imports are associated with lower emissions.

Chen et al. (2019) , the study used a life-cycle assessment approach to estimate the carbon footprint of global oil trade. The researchers found that the carbon footprint of oil exports is generally higher than that of oil imports, due to differences in the production and transportation processes.

Bashir & Tukur (2020), the study investigates the relationship between oil exports, oil imports, and carbon dioxide emissions in a sample of developing countries using annual data from 1971 to 2016. The study finds that oil exports and oil imports have a positive and statistically significant relationship with carbon dioxide emissions in developing countries.

Methodology

Model Design

The ex post facto research design was used to ascertain how refined crude oil imports 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 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.

$$CO = \beta_0 X^{\beta_1} M_t^{\beta_2} FDI_t^{\beta_3} Y_t^{\beta_4} TFP_t^{\beta_5} OP_t^{\beta_6} EXR_t^{\beta_7} \varepsilon^{\mu_t} \quad (3.2)$$

Where:

CO = Carbon dixoide emission ;

M = Oil Import;

FDI = Foreign Direct Investment;

Y = Gross Domestic Product;

TFP = Total Factor Productivity;

ROP = Refined Crude Oil Price; and

EXR = Exchange rate

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

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

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)
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)
ROP	-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, M, TFP, ROP and EXR are stationary at level.

Table 2: Bound Test

Bound Cointegration Results

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 2, 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 3. 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
ROP	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
ΔROP_{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.

The result of this study also revealed that total factor productivity (TFP) exerts positive effect and significant at 1 per cent level in both long run and short run, which is against the study a priori expectation. This implies that a unit change in total factor productivity will lead to 2.098 and 1.708 units increase in carbon dioxide emission. TFP in this study as a measure of technological progress and innovations will worsen environmental quality because of methods of production. Essentially, Nigeria is still a developing economy, with high demand for technological progress and innovations, thus it is expected the country will continue to experience relative level of carbon dioxide emission.

This study also controlled for refined crude oil prices (ROP) given the reliance of the investigated economy on proceeds from oil –exports as the main source of her foreign earning which in turn is likely to be susceptible to changes in oil prices. Accordingly, finding revealed that oil price within the period of the study exhibited positive effect and statistically insignificant in both long run and short run, though the sign agrees to the study a priori expectation. The coefficient shows that a unit change in oil price, will lead to 0.004 and 0.003 units increase in carbon dioxide emission in both long run and short run. The implication is that rise in oil price drives crude oil production in the domestic economy where oil is the major source of foreign exchange earnings; however, the production process is deleterious to environmental quality.

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.

Refined Crude Oil Imports and Carbon dioxide Emissions

The a priori expectation is that refined oil imports 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 et al. (2020) conducting in both developed and developing economies. However, this study finding corroborates with earlier empirical findings of Kanemoto & Tonooka (2009) in Japan and 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 refined crude oil imports account for increase in carbon dioxide emission in Nigeria. The policy implication is that refined crude oil importation exacerbated the deterioration of the environmental quality through movement of oil across the various consumption line.

Table 4. Diagnostic and post estimation test for refined crude oil imports 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 represents 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 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 analyse and discuss the elasticities of the coefficients with the focal point on whether refined crude oil imports contribute to carbon dioxide emission.

Conclusion/Recommendation

Given the period under consideration coupled with the above empirical findings, it is only rationale therefore, to infer as follows: First, the dynamics of the impact of refined crude oil imports on carbon dioxide emission tends to vary for different time horizons and the study outcome signify that carbon dioxide emission is negligible during the short run compared to long run probably because of the possibility of Nigeria government still engaging in the refined crude oil importation to meet local demand in the long run. For Nigeria government to reduce the level of carbon dioxide emission in the oil-producing Countries, more effort should be put in place to reduce petroleum importation by diversifying the economy from oil-based to non-oil based. Also, the country's refineries should be de-regulated to reduce the over dependency on the importation of the refined crude oil imports alongside with the establishment of Government Agencies that will strictly monitor the refined crude oil production process which will go a long way in reducing the over reliance on refined crude oil importation as well as the environmental challenges emanating from refined oil consumption.

In other words, clean and renewable sources like hydropower, wind, solar and nuclear power, etc. should be encouraged in the various socio-economic activities.

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