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RESEARCH PAPER

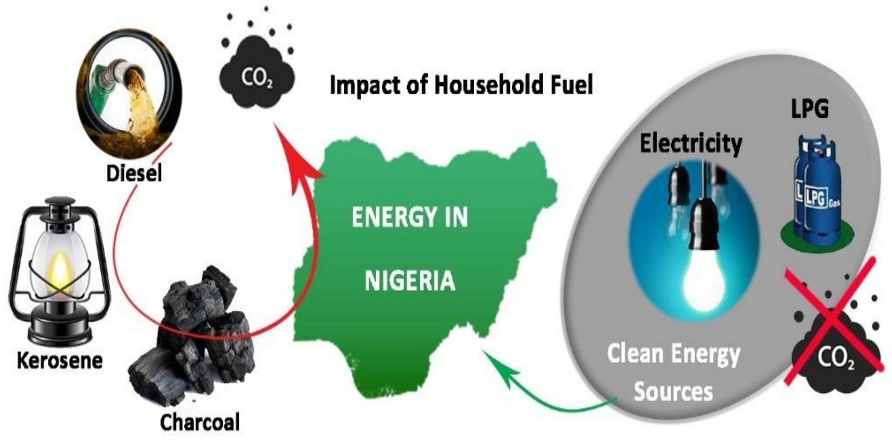
Impact of household fuel expenditure on the environment: the quest for sustainable energy in Nigeria

Yakaka Bukar Maina [1,*], Babagana Kyari [2], Mohammed Abba Jimme [3]
[1] Department of Economics, Faculty of Social Sciences, University of Maiduguri, Nigeria
[2] Department of Agricultural Economics, Faculty of Agriculture, University of Maiduguri, Nigeria
[3] Department of Geography, Faculty of Social Sciences, University of Maiduguri, Nigeria

Highlights

- There is the need to improve the income of the consumer because higher income level in the long run results to low CO_2 emission.
- LPG use should be encouraged in order to help improve the air quality of the environment.
- There is the need to improve the income of the consumer because higher income level in the long run results to low CO_2 emission.
- The ongoing hydroelectric dams in Nigeria should be completed.

Graphical Abstract



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Abstract

This study analyzed the impact of household fuel expenditure as a means of identifying a sustainable energy. Secondary data were used obtained from National Bureau of Statistics (NBS) on general household survey carried out in 2016. The study employed descriptive statistics, Ordinary Least Squares (OLS) and Consumer Lifestyle Approach (CLA) models. The results revealed that electricity and Liquefied Petroleum Gas (LPG) are the two clean energy sources. However, it was discovered that households dedicate greater share of their income on dirty fuels. A total of 135,631 kg of CO_2 is emitted monthly with an average of 38 kg per household. The urban households were found to emit more CO_2 than the rural households. Furthermore, family size, income and educational level have positive effect on CO_2 emission, while, younger household heads emit less CO_2. The Kuznet hypothesis is also found to be applicable to Nigerian households. The present research recommended that the policy of cut one tree and plant five to be reinforced, electricity supply through solar and hydro sources should be improved, income of the consumer should be augmented and LPG production and supply should also be increased and made affordable to households.

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* Corresponding author: y.b.maina@gmail.com (Y.B. Maina)

1. Introduction

The negative externality of CO_2 emission arising from the household fuel use has lately become a focal point of research by energy and environmental economists. This is because the household sector alone contributes to about 59% of the world's CO_2 emission. The agency further adds that relying on solid biomass fuels for cooking and space heating contributes to about 25% of the global emissions of CO_2 and about 50% of the anthropogenic emissions of black carbon. Hence, the high concentrations of Greenhouse Gases (GHG) in the atmosphere released through energy exploitations and other sources are the causes of environmental unsustainability Climate Change (CC) (Lin and Raza, 2019).

The household sector in developing countries such as Nigeria is not left out for CO_2 emission through their unsustainable energy use. Thus, such must be addressed for a sustainable environment to be achieved (Parikh et al., 2009). Similarly, in the north-east zone of Nigeria alone, the household sector emitted about 14,705 kg of CO_2 per month in 2013, with an average of 20.40 kg, which is more than half of the 36 kg of CO_2 emission per household in the USA from electricity consumption.

Moreover, Nigeria's household sector's negative externality is generated using various dirty energy sources of both solid and fossil fuels. This is because the country has been experiencing an epileptic power supply for many years now. The sector no longer relies on it for domestic use. Hence, it has resorted to alternative energy sources such as Petrol and diesel for lighting homes while Firewood, Charcoal, Kerosene, and LPG for cooking (Parikh et al., 2009).

Similarly, the expenditure pattern of energy demand for solid and fossil fuels has an enormous influence on the environment. Although solid fuels such as Fuel wood and Charcoal are viewed as carbon neutral, the CO_2 emission from burning them is being trapped by trees in the carbon cycle (Kavi and Brinda 2005). This is because, on average, one acre of new forest can sequester about 2.5 tons of CO_2 annually, while young trees absorb about 5.8 kg of CO_2. Trees reach their most productive stage of carbon storage at about ten years, at which point they are estimated to absorb 22 kg of CO_2 per year. However, in Nigeria, trees are indiscriminately cut down without replacement, which has resulted in a high rate of deforestation and desertification. The country is now losing about 350,000 to 400,000 hectares of land per year, resulting in a high concentration of CO_2 in the atmosphere.

Therefore, it is important to understand the expenditure pattern of fuel types and their resulting negative externality in Nigeria towards achieving a sustainable environment. The reason being that Nigeria is a member country on rectifying climate change policies (Vermeulen et al., 2012); it acceded during the Kyoto protocol in 2004 and a signatory in the Paris agreement on CO_2 emission reduction target in December 2017. Hence, this study will inform policy decisions, especially based on CO_2 emissions from the household sector, which has not been done much before. Earlier studies considered CO_2 emission from both solid and fossil fuel demand but only considered the households of Nigeria's northeast zone (Lin and Raza, 2019). While in another study, household direct CO_2 emissions in Nigeria were determined from electricity and Charcoal, but his research did not capture CO_2 emission from other sources of fuels used for cooking and lighting (Ojo and Chuffor, 2013). Thus, it necessitates the need for further study. Therefore, this study looks at CO_2 emission from solid and fossil fuel expenditure among households in Nigeria to proffer ways to achieve sustainable development. Thus, the present study's objectives include the pattern of spending of fuel choices according to zones and based on rural and urban dichotomy, contributing to the negative externality of CO_2 emission in Nigeria and the determinants of CO_2 emission for rural and urban households in Nigeria.

1.1. Literature review

Many studies have been conducted on the empirical findings of energy demand's contribution or use to the negative externality of CO_2 emission. All the studies reveal that the pattern of energy expenditure influences CO_2 emission (Chang, 2019). The other research shows that there is a disparity of CO_2 emission by

Households in India just like their consumption pattern differs (Murthy, et al.; 1997). In general, the CO_2 emission by urban households is 2.2 times more than that of rural households.

Thus, urbanization, change in the population through rural-urban migration have influenced on CO_2 emission. In the other study, India's major CO_2 emitters are coal and lignite, which contribute about 53.7% (697MT), followed by petroleum products and natural gas with 29.7 and 7.2%, respectively (Kumar and Viswanathan, 2007). The study further added that household size also affects India's CO_2 emission, where larger family size uses less dirty fuel. Moreover, the more the household members are educated, the less use of contaminated fuel. However, households with more clusters consume less clean and dirty energy due to less fuel demand for cooking services. Therefore, India's major CO_2 emitters are coal and lignite, which contribute about 53.7% as 697MT, followed by petroleum products and natural gas with 29.7 and 7.2%, respectively. Also, the high-income urban households account for 10% of the emission of about 4,099kg per capita per year, while rural low-income groups account for only 150 kg per capita (Parikh et al., 2009).

In 2011, the demand for LPG for cooking and electricity for lighting was found to have increased with an increase in income with larger households consuming less cooking fuel that emits more particulate matter, hence less global warming. However, expenditure on cooking fuels like firewood was positive at 1%, but it is evident that income had a declining influence on pollution over time in rural and urban India (Kumar and Viswanthan, 2007).

In China, the richer households are moving up the energy ladder by substituting away from dirty home heating fuels such as coal and increasing consumption of cleaner fuels such as electricity and coal gas. LPG, on the other hand, is less convenient, and coal is far dirtier. They also showed that household CO_2 emissions are particularly high in the study area's northern region, reflecting the cold temperatures and government heating policy. Moreover, direct energy consumption and CO_2 emission are rising faster in urban households than in rural households. This implies that the higher the income, the more energy consumption and CO_2 emission structure vary. Furthermore, the household sectors will be responsible for increasing CO_2 emission by 10-25 times through total final energy. However, a low CO_2 emission will be achieved from the household sector if consumption expenditure changes from consumption of low CO_2 material products and transport to service-oriented goods (Lin and Raza, 2019; Parikh et al., 2009).

In Great Britain, CO_2 emissions by different socio-demographic factors showed that emissions are strongly correlated with income, with the richest households emitting three times higher than the poorest households. Home-owners (with mortgages) emit two to three times more than those renting. Households with employed head emit two-three times more than unemployed households. Similarly, CO_2 emissions are higher for those with larger households (both in terms of physical size and number of occupants, particularly adults), the middle-age group (35-60), and those that are economically active and of a higher occupational and socio-economic class, and those in more rural locations (Allinson et al., 2016).

The African perspective on emissions from electricity use shows that providing 3.4 million South African households with the power source would add only a small amount of emission. Hence, the projected emissions associated with increasing electricity access for low households would contribute only 0.09% to total emissions in 2020 (Tait and Winkler, 2012). On the contrary, a study shows that Petrol has the highest demands of 2,141.4 kg per month and is the major CO_2 emitter with a total of 5,139.367 kg (Akinleye, 2009). On the other hand, Charcoal was the dirtiest because it emitted more CO_2 of 2,735 kg against the 745 kg used. Also, household income, household size, household head gender, literacy ratio, and motorization significantly impact urban and rural carbon emissions in Nigeria (Green and Stern, 2017).

2. Materials and Methods

2.1. Study area

The study was conducted in Nigeria. The country lies between latitudes 9º 08' 20'' N of the equator and longitudes 8º 67' 53'' E of the Greenwich meridian. Stretched in the corner of the Gulf of Guinea, western coast of Africa, Nigeria occupies 923,768 sq. km (356,669 sq. mi), extending 1,127 km (700 mi) East to West and 1,046 km (650 mi) North to South. In comparison, the area occupied by Nigeria is twice more than the state of California. It is bordered by Chad on the Northeast, by Cameroon on the East, by the Atlantic Ocean (Gulf of Guinea) on the South, by Benin (formerly Dahomey) on the West, and by Niger on the North West and North, with a total boundary length of 4,900 km (3,045 mi), of which 853 km (530 mi) is coastline. The country comprises 36 states and had a combined population of 140,431,790 as at the end of 2006 (NPC, 2006), projected to rise to 186,053,387 by the end of 2019.

2.2. Data type and variables

A secondary data set was used for the study, obtained from the National Bureau of Statistics (NBS) database on the General Household Survey, Panel 2015-2016. A total of 5000 households were interviewed across the country. The relevant information collected in the survey includes household socio-economic characteristics, information on the farm, non-farm enterprise, income-generating activities, food consumption expenditure, and other non-food expenditure. This paper considered six-energy sources i.e (LPG, Charcoal, Diesel, Electricity, Fuel wood, Kerosene, and Petrol) and six independent variables. Table 1 presents how each of the variables is measured.

Table 1. Energy Conversion Factor for the Various Fuels.

Fuel type	Unit	CO_2 emission per unit (Kg)
Petrol	1 liter	2.4
LPG	1 liter	0.16
Diesel	1 liter	2.7
Kerosene	1 liter	2.6
Charcoal	1 kg	3.67
Firewood	1 kg	1.73
Electricity	1 kwh	0.10lbs (2.204lbs=1kg)

Table 1 presents the various conversion factors of energy sources. The conversion factors given by the US Environmental Protection Agency Clean energy (2013) were used, although some modifications were done to conform to the energy compositions of Nigeria. Hence, energy types were converted into equivalent liter or kg per CO_2 emission. Moreover, the monthly household expenditure on the various energy sources was divided by their respective prices and was further converted into quantities. The amounts estimated were then multiplied by the different conversion factors to obtain the various CO_2 emissions based on Table 1.

2.3. Model specification and method of estimation

Consumer Lifestyle Approach (CLA) was used to estimate direct negative externality. The CLA is given as:

CO_2_ direct = F_ m x CO_2_ coefficient……………………Equation (1),

Where;

F_m = matrix of energy consumption (Firewood, Charcoal, kerosene, petroleum, diesel and LPG). Thus, F_m is a 1×7 vector-matrix. CO_2 coefficient is a 1×7 matrix of CO_2 coefficients for fuels.

To determine the socio-economic factors affecting CO_2, the study utilized the Ordinary Least Squares (OLS) regression model to estimate the relationship specified in Equation (2). Estimated similar model using data on selected Indian households (Kavi and Viswanathan, 2013).

$Y = f(X_1, X_2, X_3, X_4, X_5, U)$ …………………. (2),

Where;

Y = Is the amount of CO_2 emitted by either rural or urban households in kg

X_i = Household Income: Measured in (N)

X_2 = Age of household head: Measured by the number of years

X_3 = Sex of respondent: Dummy 1=male and 0= female

X_4 = Household size: Measured by the number of people living under the same roof

X_5 = Educational Level: Measured by the number of years spent in formal education

e = Error term

2.4. A priori expectation

The coefficients of Age, Family size, and household head female would positively affect the educational level, and household monthly Income would negatively affect CO_2 emission for both rural and urban households.

3. Results and Discussion

In order to determine the impact of household fuel choices as a quest for environmentally sustainable energy sources, the household's expenditure pattern for various fuels and their contribution to the negative externality through their CO_2 emission was assessed. Table 2 presents the mean expenditure share of the six energy sources considered by zones and based on rural and urban households. It can be observed that Petrol is the most demanded by all the zones (Li et al., 2016).

Table 2. Mean Expenditure on Energy Sources in Nigeria.

Zone	North-C	North-E	North-W	South-E	South-S	South-W	Urban	Rural	Total
Kerosene	340	76	145	752	741	848	1602	1300	2903
Gas	54	1	1	113	351	254	546	229	775
Electricity	545	147	216	690	768	942	2217	1092	3308
Firewood	208	425	633	47	95	73	606	875	1481
Charcoal	96	55	24	1	7	24	149	58	207
Petrol	1287	593	710	718	1444	1367	5947	172	6119
Diesel	47	56	11	24	54	127	202	117	319

Source: Generated by Stata 13 from the NBS 2016 data.

It is sufficient to say that it was the most requested by households in Nigeria, with a mean monthly expenditure of N6119. This energy source is used for lighting that is generated through the tiger brand of generators etc. Moreover, out of Petrol's total money, a higher share of N5947 was paid by urban dwellers. Also, the southwest was found to have allocated the highest percentage, followed by the north-central. This could be because the number of urban centers in these zones is higher than, for instance, northeast and West with the least allocation of budget shares for these energy sources. The second most demanded energy was electricity with a total mean monthly expenditure of N3308, with a higher share allocation by the urban than rural households. Electricity is mostly used for lighting homes, just like Petrol. However, it is often used for cooking and ironing clothes. Still, due to the epileptic nature of power supply in Nigeria, many households have resorted to alternative energy sources (Arshad and Ali, 2017). Among the zones, southwest is again found to have allocated the highest share, followed by south-south. The justification could be that the higher the urban zone, the more electrical appliances such as washing machines, televisions, refrigerators. However, most rural households are not connected to the national electricity grid, resulting in less expenditure (Tait and Winkler, 2012). The other reason is that the power holding company prefers to supply light to areas where monthly payments bills have not defaulted.

Regarding energy for cooking, kerosene was the first among cooking and the third among all the energy sources studied. This agrees with the findings of other researchers (Kavi and Brinda, 2005). Similarly, Fuelwood was found to be the fourth most demanded energy source. This could be because most Fuelwood is fetched from nearby bushes. Hence, a lot is consumed instead of demanded (effective). However, the mean monthly expenditure for rural households is found to be the highest, which is in line with the results of a study by (Ojo and Chuffor, 2013). The mean monthly shares stood atN606 and N875 for urban and rural households, respectively.

Furthermore, LPG, Diesel, and Charcoal were the least demanding in budget share allocation with the mean monthly expenditure of N775, N319, and N207. Similarly, urban households allocated more expenditure share for all the three energy types. However, the low expenditure for LPG could be due to the high installation cost. That of diesel could be because most of the households that use power generating plants, only a few use the type that uses diesel due to its high purchase cost and cost of maintenance. Moreover, the overall least fuel in terms of mean expenditure is Charcoal. Its low share could be because it is made from burning wood slowly in an oven with little air. This process turns it into carbon, and it is then left to turn into Charcoal. Hence, those using Fuelwood could also process Charcoal from it without actually demanding for it. The urban was found to have allocated more expenditure than rural households. This could be because it performs multiple functions, used in local pressing stones for ironing clothes, for warming rooms during harmattan season, mainly tiled or cement floors where Fuelwood, which is regarded as the most efficient after LPG could not be used and also for cooking (Kavi and Brinda, 2005). The results in Table 3 indicate that Petrol emitted the most CO_2 into the atmosphere with 74,630 kg making it the dirtiest among all the energy sources demanded by households. Also, the households in the urban areas and the three zones allocated the highest expenditure share in Table 3 emitted the most negative externality.

Table 3. CO_2 Emissions/KG.

Zone	North-C	North-E	North-W	South-E	South-S	South-W	Urban	Rural	Total
Kerosene	4499	1010	1913	9935	9790	9790	21169	17181	38350
Gas	44	1	1	92	285	207	444	186	630
Electricity	139	37	55	175	195	239	563	277	841
Firewood	1827	3736	5568	411	837	644	5327	7695	13022
Charcoal	1752	1002	431	24	130	446	2724	1061	3785
Petrol	15697	7227	8664	8756	17618	16667	56813	17817	74630
Diesel	647	773	150	328	737	1738	2109	2264	4373
Total CO_2	20605	13786	16782	19721	29592	29731	89149	46481	135631

Source: Generated by Stata 13 from the NBS 2016 data.

This finding is in line with the results of (Allinson et al.; 2016). Furthermore, kerosene was the second in total CO_2 emission of 38,350 Kg, although it was the third, based on the energy share allocation. However, Petrol has the highest expenditure and, consequently, high negative externality monthly. It does not mean that the higher the mean monthly expenditure, the more the negative externality.

Nevertheless, based on the compositions of the energy type and the conversion factor that determined the CO_2 emission per liter, elaborating more, for instance, electricity was the second in terms of demand/mean budget share allocation of N3308. Surprisingly, its CO_2 emission puts it as the second to the last with just 841 kg making it the cleanest of all the energy sources. Similarly, although LPG was the third to the previous in terms of mean monthly expenditure share, it was found to have emitted the least CO_2 of 630 Kg. Thus, these two energy sources are the cleanest among all the energy sources examined. This agrees with the results of a study conducted by (Ojo and Chuffor, 2013). However, Charcoal was the least in terms of expenditure share, but it was not the least in CO_2 emission. N207 was spent as the mean monthly expenditure; however, it emitted almost eighteen times the quantity used. This shows that it is among the top dirty fuels used by households in Nigeria. The reason could be that it is pure carbon.

Fig. 1 presents the graphical relationship between the mean monthly expenditure of the energy types and their respective CO_2 emissions. The most noticeable energy types in terms of low CO_2emission are electricity and LPG. Although their mean expenditure varies, they emitted low negative externality. Surprisingly, Charcoal, on the other hand, has the lowest mean monthly expenditure. Still, it emitted five times CO_2 than the actual Kg used. In contrast, the remaining energy sources, kerosene, Fuelwood, Petrol, and diesel, emitted 8,11, 8, and 7% times CO_2 than their actual kg used by the households in Nigeria. This further confirms them as dirty fuels. Fig. 2 depicts the distribution of CO_2 emission based on rural and urban areas and zones in Nigeria.

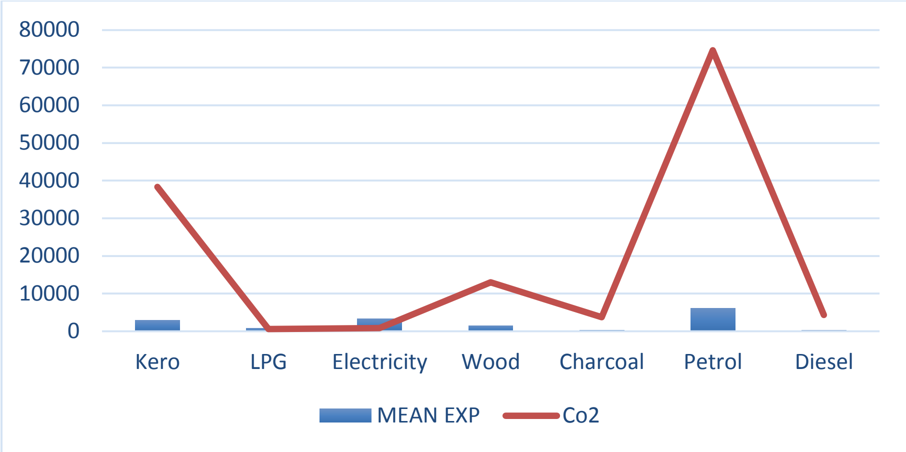

Fig. 1. The Relationship between Mean Energy Expenditure and CO_2 emission.
Source: Generated by Stata 13 from the NBS 2016 data.

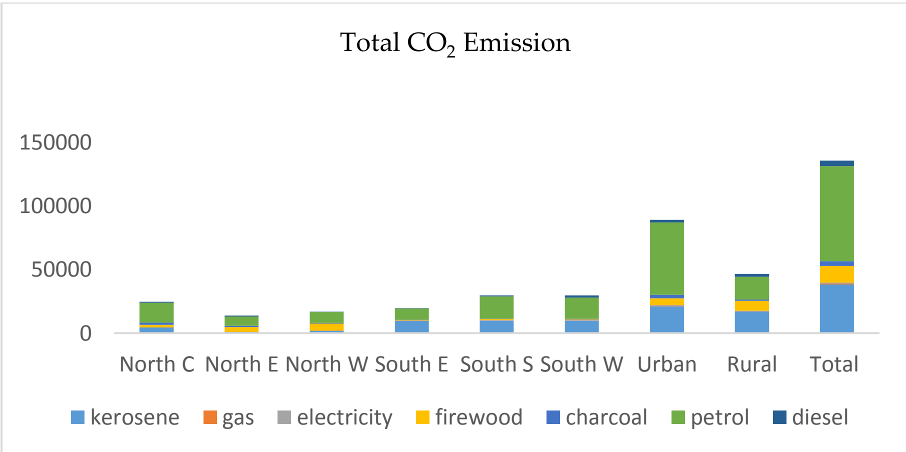

Fig. 2. Distribution of CO_2 Emission by Zones and Rural/Uban Dichotomy.
Source: Generated by Stata 13 from the NBS 2016 data.

It can be observed that the urban area emitted two times more negative externality than the rural households with a total of 8,9149 kg and 4,6481 kg of CO_2 emission, respectively. This corresponds with the findings (Murthy, et al., 1997), which shows that CO_2 emission is rising faster in urban households. The results also showed that southwest, south-south, and south-central emitted the most CO_2, respectively. In general, a total of 135,631 kg is emitted in a month by the household sector in Nigeria, with an average of 38 kg. This is higher than the 12.5 kg of CO_2 reported for India's rural households (Parikh et al., 2009). This finding is contrary to other researchers (Ojo and Chuffor, 2013); that Nigerian households emit an insignificant amount of CO_2.

To understand the determinants of CO_2 emission between the urban and rural households, the Ordinary linear regression technique was employed, and the results are presented in Table 4.

Income (x_1): Analyses of the results show that the coefficients of monthly household income (X_1) were positive for rural and urban households. This implies that the higher the income levels, the more the CO_2 emission. This agrees with the findings of (Kumar and Viswanathan, 2007) and a prior expectation. However, the rise in CO_2 depends on the households' income level, as postulated by the environmental Kuznets hypothesis.

The results in Fig. 3 indicate that the pollution (CO_2 emission) keeps increasing from the low-income level to middle-income households, i.e., earning between less than or equal to N69,000 monthly. This could be because both dirty and clean sources characterize most of the household energy consumption. However, when the income increases to greater than or equal to N70,000 per month, extending from middle income to high-income households, the pollution began to decline following the hypothesis. This shows that low-income households emit more CO_2 than high-income homes. Thus, the higher the income level, the lower the pollution in the long run.

Table 4. Determinants of Direct Negative Externalities (CO_2 emission) In Nigerian Households.

Variable	Income	Sex	Age	Household size	Education
Urban					
T value	26.123	1.2169	-1.9718	2.7411	6.3359
p>[t]	7.8845e-131**	0.224	0.048759*	0.0061738**	2.8678e-10**
Rural					
T value	25.369	1.5622	0.44045	6.4134	5.7771
p> [t]	8.772e-117**	0.11848	0.65968	1.9523e-10**	9.3869e-09**

Source: Generated by Stata 13 from the NBS 2016 data.

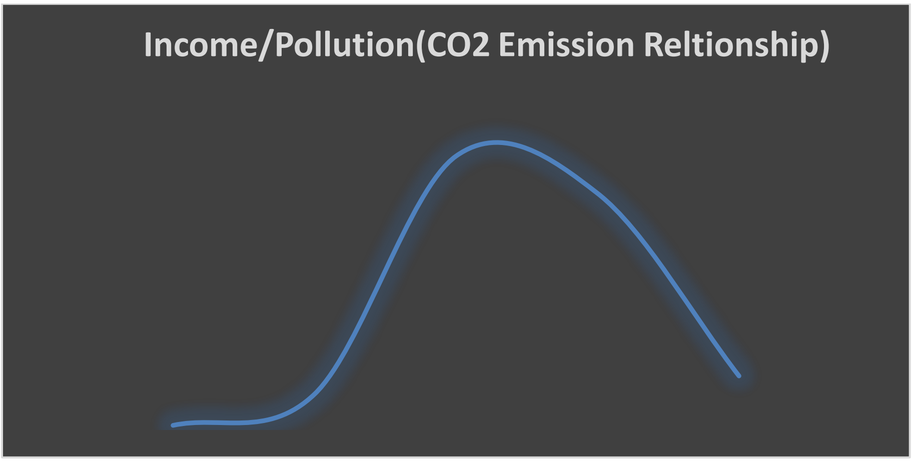

Fig. 3. Income/Pollution Relationship.
Source: Generated by Stata 13 from the NBS 2016 data.

On the other hand, the sex of household (X_2) was insignificant for both the two areas. This is contrary to the a priori expectation that assumed that the coefficient of the sex of household head female would be negative with CO_2 emission—implying that the female household heads would prefer to use clean energy sources, hence less emission. However, the coefficients were positive implying that the male gender has more influence. The reason could be the dominance of males as household heads in the country. Thus, they are in charge of the family's purchasing material needs, including energy sources (Akinleye, 2009).

Similarly, the coefficients of age (X_3) were only significant for urban households at a 5% level and were negatively related to CO_2 emission. This agrees with a prior expectation, implying that *Ceteris paribus* younger household heads would use more clean energy sources such as electricity for lighting homes and LPG for cooking. This could be justified because they are more comfortable with these energy sources due to convenience, low risks, and fewer health implications than Fuel wood, known for causing indoor air pollution.

On the contrary, family size (X_4) has a positive relationship with CO_2 emissions and is significant at the 1% level for rural and urban areas. This means that the higher the family size, the higher the CO_2 emission. This could be justified because the more the family size without a corresponding increase in income, the more they resort to the use of alternative but dirty fuels.

Equally, the educational level variable (X_5) was also positive and significant, at 1%. However, the result is contrary to prior expectations. It was expected that the higher the educational level, the lower the CO_2 emission due to the use of more clean energy sources. Surprisingly, the results imply that the higher the academic level, the more CO_2 emission. The justification for this is that there is low awareness of the causes, effects, and mitigation of CO_2 emission by households because the issue started not long ago. Thus, it should be mentioned that household heads are less informed about the link between their energy choices and CO_2 emission. This, therefore, coincides with the findings of (Ojo and Chuffor, 2013).

4. Conclusions

This study analyzes the various households' fuel choices based on Nigeria's expenditure and their direct impact on the negative externality of CO_2 emission on the environment based on CLA method. The results show that households dedicate a more significant share of their income on dirty fuels that directly impact the environment, resulting in an unsustainable environment. In general, monthly a total of 135,631 kg of CO_2 is emitted while, on average, a total of 38 kg of CO_2 is emitted by a single household. The higher share comes from urban homes and the southwest, south-south, and north-central zones. Although, ordinarily, it is believed that Less Developed Countries (LDC) such as Nigeria emit less CO_2 but could be mitigated through the carbon cycle by trees. However, there is a high rate of deforestation and desertification and indiscriminate cutting down of trees without replacement then a better policy option needs to be considered.

On the determinants of CO_2 emission, OLS method was used, and the results reveal that increase in family size, educational level, and household income are associated with an increase in CO_2 emission. Moreover, the environmental Kuznets hypothesis holds for Nigerian households. However, younger household heads emit less negative externality with the sex of household heads as an insignificant determinant for both rural and urban households. Hence, from the foregoing, it is concluded that the household sector in Nigeria also emit some amount of CO_2 through their unsustainable energy use because they did not consider all the available energy sources used by households. Given this result, there is a need for CO_2 emissions mitigation policies to avert CC's possible impact, especially on countries like Nigeria, where vulnerability is high.

5. Recommendations

Based on the findings of the study, it was recommended that:

- The existing policy of "Cut one tree and Plant five" should be reinforced to serve as a carbon sink for the CO_2 emitted. This can also be achieved based on the stipulation of the United Nations policy of Reducing Emissions from Deforestation and Forest Degradation (REDD) by rewarding people for conserving their trees instead of cutting them down, paying them to plant more trees.
- The ongoing hydroelectric dams in Nigeria should be completed.
- There should be an investment in solar as a clean energy source, especially in the northern states, where there is abundant solar radiation to burst the electricity supply.
- There is the need to improve the consumer's income because a higher income level, in the long run, results in low CO_2 emission and is achieved by skills acquisition programs, issuing of soft loans, etc.
- Finally, LPG use should be encouraged to improve the air quality of the environment by making the setting up (importation of cylinders and other equipment) duty-free so that the start-up cost of using it will be reasonable to other products.

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