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FACTORS INFLUENCING EXPORT PERFORMANCE OF NIGERIA WOOD CHARCOAL IN INTERNATIONAL MARKET: AN AUTO-REGRESSIVE DISTRIBUTIVE LAG APPROACH

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ABSTRACT

Wood charcoal is a sustainable biofuel for agrarian and metropolitan users. Demand for charcoal has been increasing especially in urban area of Kaduna metropolis as well as in rural areas for many years. Government policy have been to reduce such demand and promote the use of liquid natural gas and CNG, which though are safe to use as substitute to high cost of petrol and kerosene among households yet wood charcoal and firewood constitute the bulk of energy consumption among households. This study investigated factors influencing export performance of Nigeria Wood charcoal in international trade: An Auto-Regressive Distributive Lag(ARDL) approach. Secondary data were sourced from FAO, CBN and Bureau of Statistics covering 21 years from 2002 to 2022. The data were analyzed using descriptive statistics, Jarque – Bera(JB) normality test, Augmented Dickey-Fuller (ADF) model, and ARDL model. The outcome shows that the average wood charcoal production (WCP), wood charcoal export (WCE), and World Export of wood charcoal (WOE) approximates 3, 890, 140 tons, 127, 243 tons and 2, 002, 046 tons, respectively. The likelihood of the JB data of more than 0.05 signifies the confirmation of the null hypothesis that the data are distributed normally. The Agriculture and Forestry Machinery (AFM) was stable at I (0) level, while Trade Openness (TROP), Consumer Price Index(CPI), Exchange Rate (EXR), Population Growth (PG), World Trade in Wood Charcoal (WTWC), Agriculture and Forestry Labour(AFB) were stationary at level I (1). The CPI, PG, WTWC, AFB, and AFM were significantly different from zero in influencing export performance of wood charcoal. Improvement in production efficiency including adoption of modern technologies such as Kilns and promote sustainable harvest practices to ensure long term resource availability. Also is the development of infrastructure that which enhance transportation networks, invest in quality and reduce export cost, explore new export markets, meet international standards for quality and build trade relationships.

Keywords: Export Performance, Wood Export, Market, Auto-Regressive Lag Model.

Introduction

Nigeria is the largest oil producer in Africa, despite these abundant resources many people both in rural and urban areas still depend on biomass energy in the form of charcoal, firewood, crop residues, and animal waste (Zira, 2019). The wood charcoal (WC) production method relates to getting the wood heated without air or partially combusted with the restriction of finite oxygen supply ((Ankona *et al.*, 2021). Wood charcoal (WC) can be defined as a solid residue obtained after controlled combustion of a broad range of materials generally processed from wood materials and wood from part of trees such as trunks and branches by passing and burning

through fire under conditions of limited amount of oxygen (Haruna *et al*., 2015). Wood charcoal (WC) can also be defined as the solid residue produced from the process of distillation, carbonization, distillation, torrefication or pyrolysis of the branches and trunk of wood byproducts and trees by batch systems or continuous earth kilns (mound, pit, and brick) (Demirbas, 2001). Wood charcoal is the most significant commercial fuel obtained from wood capable of generating more heat than fuelwood (Agbugba and Obi, 2013). Millions of people in Africa especially those in peri-urban and urban areas rely on charcoal as a locally accessible fuel as over 2 billion people depend on it for heating and cooking, it is generally clean compared to burning agricultural waste or wood (Vihi *et al*., 2023). Wood charcoal is important for households, chemists, and gardeners, in addition, it is important for industrial and domestic power generation (Paramasivan and Premadas, 2019). Wood charcoal is a sustainable biofuel, value-added energy for urban and rural users because of the emission of marginal smoke and higher energy density when compared with firewood (Nyarko *et al*., 2021). The peculiarity of wood charcoal such as supply-reliability, affordability, and accessibility made it desirable to renewable and non-renewable energy resources.

The wood charcoal industry has provided either indirect or direct employments to various categories of people including transporters, manufacturers, traders and their families and millions of other people (Mwampamba *et al*., 2013). The industry has raised the economic value of the people at the national and local level and is documented to rival some other more valued sectors in most nations. In Nigeria, the industry generates more income for the agrarian people, in addition; wood charcoal production shares a high percentage in the GDP of many nations including Nigeria, India, Brazil, Ghana, Ethiopia, Rwanda, and Zambia. Wood charcoal is generated in sub-Saharan Africa, and the region recorded for about 65% of world charcoal production, and 21% of its charcoal output is exported (Mensah *et al*., 2020). The top producers in Africa include Nigeria, Ghana, Senegal, Tanzania, Ethiopia, and Madagascar (Jekayinfa *et al*., 2020). It has been documented that 40 percent of charcoal utilized in Europe was imported from Africa (Nabukalu *et al*., 2019). Charcoal is now an export forest product in Nigeria, with a large market in the USA, EU, and Asia. Tropical Africa accounts for 70% of the export and the market occurs all year round (Essiet, 2019). In Nigeria, approximately 4, 828, 689 tons and 4, 907, 916 tons of wood charcoal was produced in 2021 and 2022, respectively (FAO, 2024). Also, in 2021 and 2022, the wood charcoal export in Nigeria approximates 118, 626 tons and 99, 330 tons, respectively (FAO, 2024). The world export of wood charcoal in 2022 approximates 3, 161, 080.66 tons (FAO, 2024). In 2022, Nigeria accounted for 3.1% of the world total wood charcoal export. Most of the research on wood charcoal focused on tree species and wood quality, biofuel implications, political issues and policies, impact on food safety, environmental and health implications, and socio-economic factors, none focus on export performance of wood charcoal. The commonly preferred hardwood species used for wood charcoal production in Africa include *Milicia excels, Lophiraalata, Afzelia Africana spp*, and *Tessmania Africana* among others. The commonly preferred softwood species used for wood charcoal production include *Gmelina arborea, Pinus pinaster*, and *Hevea brasiliensis* among others. The Nigeria

hardwood is preferred in international trade compared to all other African nations because of characteristics lie in high temperatures it produces during heat combustion and low moisture content (Agbugba *et al*., 2021). Most African forest has been lost due to charcoal export to Europe, more so about 6 to 15 tons of wood are needed to make 1 ton of charcoal (Paramasivan and Premadas, 2019). Charcoal production is labour demanding that employ millions of people at different stages, and it burns more cleanly than dried biomass or wood, in addition, it gives higher temperature, and cheaper to store and transport.

The broad objective of the study was to explore the factors influencing export performance of Nigeria's wood charcoal in international market: an auto-regressive distributive lag (ARDL) approach and the specific objectives are to; estimate the percentages in quantity of wood charcoal export to production in Nigeria relative to world export of wood charcoal in international market; determine the trends of quantities of wood charcoal produced and exported in tons in Nigeria; examine the summary figures, for instance, kurtosis, skewness, and Jarque-Bera (JB) of the test regressors; determine the stationarity and co-integration test of the test regressors; estimate the predictors affecting export performance of wood charcoal in Nigeria and assess the presence of long run association among the predictors affecting exportability of wood charcoal production.

Methodology

Study area

This study was carried out in Nigeria. The population of Nigeria was evaluated at 229, 152,217 and it is growing at approximate of 2.39 percent per year (NPC, 2024). Agriculture and forestry stands as the mainstay of the economy, providing food and forestry products, and also exporting primary crops / seeds, fruits and forestry products to other nations.

Sources of data

Secondary data were utilized for this study. These were pertaining to the period of 2002 to 2022 (21 years). The data were obtained from CBN, NBS, and FAO. Data were analyzed using the following descriptive statistics and econometric tools:

Analytical techniques

Descriptive Statistics: This involves the use of frequency distributions, line graph, mean, percentages, kurtosis skewness, standard deviation, to have an outline information of the series.

ADF (Augmented Dickey-Fuller) (ADF) Version: This study follow the model developed by Dickey and Fuller (1979, 1981) for evaluating formally non-stability. The version is presented thus:

$$\Delta Y_t = \pi Y_{t-1} + \sum_{j=1}^{P} \gamma_j \Delta Y_{t-1} + \mu_t \ldots\ldots\ldots (1)$$

Where,

Δ = Operator for 1st Difference,
π and γ_j = Estimates
μ_t = Noiseterm
Y_t = Time data series to be evaluated
P = Maximum lag period for the predictors.

ARDL version: This study follows the model used by Pesaran *et al*. (2001) as it combines the long and short outcomes in a one equation set up. The model is stated as:

$$WCP = f(TROP, EXR, CPI, PG, WTWC, AFB, AFM) \ldots\ldots\ldots$$

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Where,

WCP = Wood Charcoal Production (tons)
TROP = Trade Openness (Index)
EXR = Exchange Rate measured in (%)
CPI = Consumer Price Index (Index)
PG = Population Growth Rate of Nigeria (%)
WTWC = World Trade in Wood Charcoal (Tons)
AFB = Agriculture and ForestryLabour (Number of People)
AFM = Agriculture and Forestry Machinery (Billion Naira)
The ARDL model is displayed as follows:

$$\Delta WCP_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i}\Delta WCP_{t-1} + \sum_{i=1}^{k} \alpha_{2i}\Delta TROP_{t-1} + \sum_{i=1}^{k} \alpha_{3i}\Delta EXR_{t-1} + \sum_{i=1}^{k} \alpha_{4i}\Delta CPI_{t-1} + \sum_{i=1}^{k} \alpha_{5i}\Delta PG_{t-1} + \sum_{i=1}^{k} \alpha_{6i}\Delta WTWC_{t-1} + \sum_{i=1}^{k} \alpha_{7i}\Delta AFB_{t-1} + \sum_{i=1}^{k} \alpha_{8i}\Delta AFM_{t-1} + \gamma_1 WCP_{t-1} + \gamma_2 TROP_{t-1} + \gamma_3 EXR_{t-1} + \gamma_4 CPI_{t-1} + \gamma_5 PG_{t-1} + \gamma_6 WTWC_{t-1} + \gamma_7 AFB_{t-1} + \gamma_8 AFM_{t-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Where,

α_0 = Constant Parameter
α_{1i} -α_{8i} = Parameters for short run,
γ_1 - γ_8 = Multipliers for long run
Δ = Operator for 1st difference
k = Order for maximum lag
ε_t = Noise term

The JB (Jarque – Bera) formula is given as: $JB = \frac{N}{6}\left(S^2 + \frac{(K-3)^2}{4}\right) \ldots\ldots\ldots\ldots\ldots\ldots (5)$

Where,

JB=Jarque – Bera (Number)
S^2 = Skewness (Number)
K = Kurtosis (Number)
N = Number of Observation (Number)

Results and Discussion

The Wood Charcoal Production (WCP) and Export in Nigeria

The results presented in Table 1shows the magnitudes of wood charcoal produced and exported (tons) in Nigeria, in addition to world wood charcoal export in tons from 2002 to 2022. Also, figures 1 and 2 shows the trends of wood charcoal production and exported in Nigeria from 2002 to 2022. The ratio of wood charcoal export to production and the ratio of wood charcoal export in Nigeria to world wood charcoal export were also displayed in Table 1. The maximum and lowest quantities of wood charcoal production approximate 4,907,916 tons and 3,248,602 tons, respectively and this occurs in years 2022 and 2002, respectively. Also, the maximum and lowest quantities of wood charcoal export in Nigeria approximate 280,080 tons and 17,019 tons, respectively, and this occurs in the years 2017 and 2002 respectively.

Similarly, the highest and lowest world export of wood charcoal approximate 3,161,080.66 tons and 1,041,534 tons, respectively and this occurs in the years 2022 and 2002, respectively. In the year 2018, approximate 4,519,220 tons of wood charcoal was produced, in the same year, 226,739 tons of wood charcoal were exported, this approximate to 6.1% of wood charcoal produced in 2018 were exported and was the highest percentage wood charcoal exported between 2002 and 2022. Similarly, in 2018, the world export of wood charcoal approximate 2,937,995 tons and the export market was boosted with 9.5% of this amount was contributed from trade with Nigeria wood charcoal produced, this represent the highest percentage within the period of 2002 and 2022. Interestingly, wood charcoal production witnessed continued growth in output from

2002 to 2022, the percentage exported declined to 2.0 % of production in 2022 (Table 1, Figure 1).

Table 1: The Ratios of Wood Charcoal Export to Production and to World Export of Wood Charcoal in International Market

Year	Wood Charcoal Production (tons)	Wood Charcoal Export (tons)	World Export of Wood Charcoal (tons)	Decimal of Wood Charcoal Export to Production in Nigeria	Decimal of Wood Charcoal Export in Nigeria to World Export of Wood Charcoal
2022	4,907,916	99, 330	3 3,161, 08(	0.020	0.031
2021	4, 828, 689	118, 626	22,824, 261	0.025	0.042
2020	4, 750, 741	267, 855	22,796, 078	0.056	0.095
2019	4, 672, 279	257,971	2, 831,933	0.055	0.091
2018	4,595, 112	280,080	22, 937,995	0.061	0.095
2017	4, 519, 220	226, 739	22,482, 305	0.050	0.091
2016	4, 444,581	194, 145	22,279,980	0.044	0.085
2015	4, 371, 175	171, 148	22, 344, 54(	0.039	0.072
2014	4, 281, 341	140, 486	22, 252, 42[	0.033	0.001
2013	4, 193, 352	156, 999	11, 987, 12(	0.037	0.079
2012	4, 107, 172	132, 278	22,024, 338	0.032	0.065
2011	4, 022, 763	126, 201	22,085, 079	0.031	0.060
2010	3, 940, 089	88, 345	11, 954, 00[	0.022	0.045
2009	3, 850, 113	87, 858	11, 910, 42[	0.023	0.004
2008	3, 762,200	24, 312	11, 736, 75[	0.006	0.013
2007	3, 676, 300	90, 971	11, 557, 71[	0.025	0.058
2006	3, 592, 327	71, 332	11, 761, 64[	0.019	0.040
2005	3, 510, 292	52, 306	11, 510, 99[	0.015	0.034
2004	3, 420, 800	42,096	11, 415, 63[	0.012	0.029
2003	3, 333,589	26, 010	11, 257, 21[	0.008	0.020
2002	3, 248, 602	17, 019	11, 041, 53[	0.005	0.016



Figure 1: Trends of Wood Charcoal Production (tons) in Nigeria.

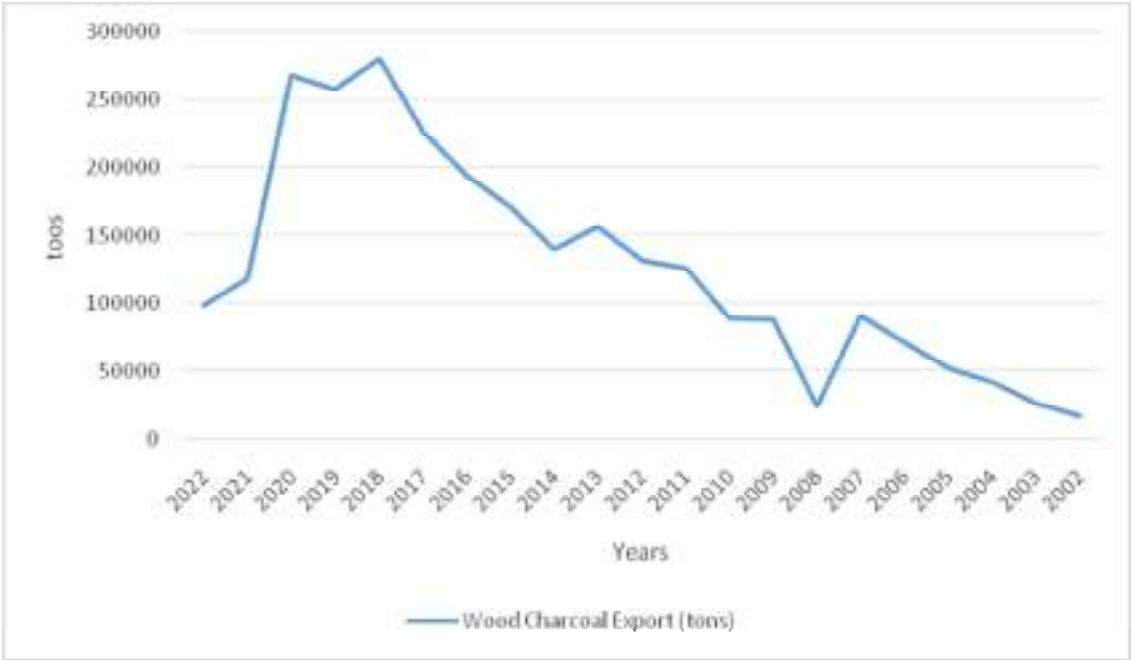


Figure 2: Trends of Wood Charcoal Export (tons) in Nigeria.

Descriptive Figures of Predictors in Export Potentials of Wood Charcoal in Nigeria

The data were put through to descriptive analysis to assess their minimum, mean and maximum values over the period from 2002 to 2022 as well as to estimate the spread; and is presented in Table 2. The average figures of WCP and WCE approximates 3,890,140.92 tons and 127,243.19 tons, respectively. Similarly, the average figures of PG, WOE and TOP approximate 2.52, 2,002,046.24 tons, and 31.5972, respectively. The WCP has maximum value of 4,907,916 tons in 2022, while the maximum values of WCE, and WOE approximates 280,080 tons and 3,161,080.66 tons in the years 2018 and 2022, respectively.

The WCP has minimum figure approximate 3,248,602 tons in 2002, while the minimum values of WCE and WOE approximates 17,019 tons, and 1,041,534 tons in the years 2002 each, respectively. The skewness, Jarque – Bera (JB) and kurtosis figures were tested for the normality of series, the skewness of zero (0) and kurtosis of three (3) signifies that the data are distributed normally; whereas, the likelihood of the JB data of more than 0.05 signifies the confirmation of the null proposition that the data are distributed normally. Mostly, the predictors are skewed negatively since their estimates are less than zero (0). The predictors have kurtosis lower than three (3) signifying that at the tail they are not thick, as kurtosis evaluates the symmetry with respect to the spread. The likelihood value of more than the designate 0.05 mean that most of the predictors are distributed normally. The stated outcome agrees with the work of Umar (2020).

Table 2: Descriptive Figures of Predictors in Export Performance of Wood Charcoal in Nigeria.

	WCP (tons)	WCE (tons)	PG	WOE(tons)	EXR	TOP
Mean	3,890,140.92	127,243.19	2.52	2,002,046.24	264.83	31.5972
Maximum	4,907,916	280,080	2.75	3,161,080.66	426	53.27796
Minimum	3,248,602	17,019	2.38	1,041,534	153.9	20.72252
Std Dev	924,204.87	81,187.45	0.1288	711,191.06	100.2731	9.30945
Skewness	-0.04180	-0.353614	-0.0142	-0.61543	-0.63225	-0.3317
Kurtosis	1.23869	1.476463	1.4589	2.55824	2.27740	2.3658
JB	0.38606	0.37391	1.19685	1.69202	1.074491	0.40788
Sum	81692953	2,672,107	34.50	42,042,971.14	3378	489.1665
Probability	0.0627145	0.056371	0.10789	0.27245	0.22782	0.43720
Observation	21	21	21	21	21	21

WCE- Wood Charcoal Export, WOE-World Export of Wood Charcoal

The ADF Unit Root Test

The ADF approach was employed to evaluate the stability of the data, the outcome was displayed in Table 3. Every critical figure at 5% and 1% are stated in lines 4 and 3. As regard ADF estimation information was stated in line 2. Concerning unit root estimation, it was evaluated to give statistics on the features of the data used in expressing the export

potentials of wood charcoal. As shown in Table 3, AFM was stable at I (0)level, the predictors TROP, CPI, EXR, PG, WTWC, AFB, and WCP attained stability after 1st difference [I (1)]. In view of decision attained following the unit root estimations were stated in line six (6) and the deduction is that the data are of combination order of integration, specifically of order one I (1) and zero I (0). This present the confirmation for using ARDL bound estimation to evaluate for the co-integration and assess the connection between the predictors affecting the export potentials of wood charcoal. This outcome agrees with results of Okuduwor *et al*., (2023) who achieve equivalent outcome while estimating agricultural export illustration on economic growth in Nigeria.

Table 3: The Unit Root Test using ADF

Variables	ADF Statistics	1% CV	5% CV	Probability	Order of Integration
TROP	-5.97	-3.66	-2.96	0.0004	I(1)
EXR	-8.74	″	″	0.0001	″
CPI	-5.91	″	″	0.0002	″
PG	-3.15	″	″	0.0283	″
WTWC	-8.93	″	″	0.0001	″
AFB	-3.13	″	″	0.0349	″
AFM	-6.47	″	″	0.0008	I(0)
WCP	-6.97	″	″	0.0001	I(1)

CV-Critical Values

The Test involving Co-Integration

The ARDL bound approach was employed to examine if there is long span stability association among the data assessed. The use of this approach came from the unit root estimation as the data were of order I (1) and I (0). Table 4 displays the outcome of the upper and lower bounds for an asymptotic and actual sample number. The bound test shows the critical figures of 3.927and 2.697 for the upper and lower bound, correspondingly at the 5 percent level of probability. The calculated F-value of 5.799 at 5 df (degree of freedom)is more than the upper bound estimate of 3.927 at the 5 percent level of probability. This signifies that the predictors in the version were co-integrated, this signifies that there is long span association between the predictors in the version. Based on the association, the ARDL version is used on the series to estimate the features of the association. This decision conforms with outcomes of Olojede and Micheal (2020).

Table 4: The Bounds Estimation for Co-Integration Result

Significant Level	Lower Bound	Upper Bound	Value
10 Percent	2.187	3.591	F-Value = 5.799, K = 7
5 Percent	2.697	3.927	
1 Percent	3.698	5.45	

The Predictors Affecting Export Potentials of Wood Charcoal in Nigeria

The long run estimates using ARDL version was displayed in Table 5. The estimate of TROP is positive but not significantly different from zero against the a priori anticipation. The TROP is expected to increase market access for Nigeria's wood charcoal, but did not do so. The EXR has positive estimate but not significantly different from zero, this is against the a priori anticipation, the positive association means that Nigeria's currency (the Naira) may have been over estimated and lost its position with regard to its wood charcoal partners. This also verified the rationale why it could not take the privilege of the world trade openness. The outcome means that for one unit change in EXR, the wood charcoal output in Nigeria will get costlier by 26%. The outcome signifies that the rate of the Naira with respect to the US dollar can help to supporting export potentials of agricultural commodity in Nigeria if fundamental domestic environments such as infrastructures and energy supply are in place to boost local output and export. This finding agrees with outcomes of Umar (2020) and Obansa *et al*. (2013).

The estimates of CPI are negative and was significantly different from zero at 5 percent significant level, this agrees with a priori anticipation. This signifies that for any decrease/increase (appreciation/depreciation in prices) in CPI, Nigeria wood charcoal output increase or decrease by 9.4%. The PG was positive and significantly different from zero at 1 percent significant level influence on wood charcoal output. It means that a unit rise in the population of the country raises Nigeria wood charcoal output by 74 percent. So it can be derived that the Nigeria's rising population growth rate approximate 2.52% yearly has assist the output of the wood charcoal, as there are rising demand for the commodity. The WTWC (World Trade in Wood Charcoal) has negative estimate and was significantly different from zero at ($P < 0.05$) to Nigeria's wood charcoal market. The estimate was (-0.672) and this signifies that as the world market in these wood charcoal rises by one (1) %, Nigeria share of the trade for wood charcoal will reduce by 67.2 percent. The outcome shows that AFB (Agricultural and Forestry Labour) has positive estimate and is significantly different from zero at 5 percent significant level on WCP, this agrees with apriori anticipation.

It means that one unit rise in agricultural and forestry labour will raise WCP by 22.9 percent. The AFM has positive estimate and was significantly different from zero at 5 percent significant level, this agrees with apriori anticipation. This shows that an increase/reduction of a one percentage change in the use of AFM will decrease/rise of WCP by as much as 76.8%. The error correction estimate (- 0.782) agrees to apriori anticipation, it is negative, and significantly different from zero derivatives. The estimates value of -0.782 signifies that the evaluated ARDL version (1,0,0,0,0,0,0,0,) regulate back to long duration from short duration at the speed of 78.2% when there is short duration noise. The coefficient of determinations(R^2) is 0.62, this signifies that 62% of the fluctuations in export attainment of wood charcoal was accounted by predictors entered in the ARDL version. The F-statistics of 2.70 was different from zero at 5percent level of significant, this means that the version was well-fitted. The Durbin-Watson (DW) value was estimated at 1.71 which means there was low level of autocorrelation.

Table 5: The Long Run Estimates of the ARDL Version

Variables	Coefficient	Standard Error	t-Values	Probability
Dependent Variable : WCP				
TROP	0.257	0.3911	0.657	0.610
EXR	.258	.2935	0.879	0.564
CPI	-0.094***	0.0246	-3.82	0.001
PG	0.745***	0.2211	3.369	0.001
WTWC	-0.672**	0.2350	2.859	0.031
AFB	0.229**	.0823	2.780	0.042
AFM	.768**	0.2901	2.647	0.024
C	2.362	0.5416	4.361	0.001
CointEq (-1)	-0.782	0.1433	-5.456	0.001

$R^2 = 0.62$
Adj.R^2 =0.61
DW = 1.71
F-Statistics = 2.697490**

*-Significant at 10%, **-Significant at 5%, ***-Significant at 1%,

The Diagnostic Tests

The diagnostic estimation was performed out on the residuals of the data and the estimate values to verify the dependability of the values and the ARDL version is fit to be used for forecast purposes. The stochastic noise term must be white noise (hence non-auto correlated) with constant variance and zero (0) mean (normally distributed and homoscedasticity). The outcome of the diagnostic estimation displayed in Table 6 shows that the version passed the evaluation of homoscedasticity, serial correlation, JB and linearity test assuming that their likelihood estimates are more than 0.05. This finding agrees with outcome of Okuduwor *et al*., (2023).

Table 6: Summary of Diagnostic Tests

Test	F-Statistics	Prob (F-Statistics)
Breusch-Godfrey LM Test	4.851489	0.2910
Breusch-Godfrey	0.795984	0.8280
JBfor Normality	2.982579	0.2452
Ramsey RESET	0.362733	0.8791

Conclusion

Wood charcoal is sustainable biofuel, value-added energy for urban and rural users because of the emission of marginal smoke and higher energy density when compared with firewood. This research work has shown that Nigeria has export wood charcoal in tons to international trade for 21 years with the anticipated span of 2002 to 2022.There has been rise in abilities of wood charcoal output in tons within this stipulated time without equivalent rise in export of this forestry product.

The significant predictors affecting export performance of wood charcoal include CPI, PG rate, WTWC, AFB, and AFM. The

significance predictors affecting export performance of wood charcoal include CPI; which is a factor reflective in cost of living and inflation. This may affect domestic production cost and pricing strategies. Consequently, reducing production efficiency and competitiveness in the international market. Also, population growth rate influence on export performance of charcoal is regarding the growing population, that which increases the domestic demand for wood charcoal and thereby may impact on the quantity available for export. However, larger could implies greater work force that could support export activities.

Furthermore, world trade in wood charcoal often depend on international market conditions, trade regulations and competition with other producer and these will influence Nigeria's ability to export wood charcoal to the international market. Also, agriculture and forestry labour force influence wood charcoal production output for international market such that the strength and labour force in agriculture and forestry directly affect charcoal production. A well trained labour force can enhance quality and supply consistency, benefiting export potentials. Lastly, agriculture and forestry machinery factor regarding the availability and use of modern machinery in agriculture and forestry can improve production efficiency, reduce labour cost and increase overall output thereby helping Nigeria to better compete in the global market. However, the exchange rate and trade openness were not significantly different from zero, the trade openness has positive estimate against the apriori expectations and could not expand trade access for Nigeria wood charcoal. The exchange rate has positive estimate against the a priori anticipation and may have been overestimated and lost its position with regard to its wood charcoal partners. The utmost challenges were conflicting government on forestry policies, low capacity building on export of quality wood charcoal, and lack of credit to producers and exporters. Established on these outcomes the following recommendations were made:

The forestry policies that would boost export of these forestry produce should be enacted. Such policies should focus towards long term export finance at concessionary and affordable interest rates to exporters of this forestry product.

Improvement in production efficiency including adoption of modern technologies such as Kilns and promote sustainable harvest practices to ensure long term resource availability. Also is the development of infrastructure that which enhance transportation networks, invest in quality and reduce export cost, explore new export markets, meet international standards for quality and build trade relationships.

Value-added product should be promoted among wood charcoal exporters. They should be encouraged to produce charcoal briquettes which may attract higher export process and provide a more sustainable, efficient use of raw materials.

Public private partnership should be encouraged to facilitate partnership between the government and private investors to build large scale efficient charcoal production facilities, which could lead to higher quality output and increased export.

Nevertheless, there should be massive tree planting campaigns across the local government community areas of the country, especially in places where great amount of wood logging and wood charcoal production is taking. The campaigns should include

youth and women and in schools to ensure sustainable wood resources for wood charcoal production.

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