Economics of Palm oil Marketing and Processing in Abia State, Nigeria

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Abstract
The research explored the economics of palm oil marketing and processing in Abia State, Nigeria, with the following key objectives: analyzing the market structure, assessing the performance regarding costs and returns, and identifying factors influencing the marketers' net returns. Primary data was gathered through structured questionnaires administered to respondents. A multi-stage sampling method was employed to select 60 palm oil marketers. The data was analyzed using econometric models such as the Gini coefficient, net margin, marketing efficiency, and ordinary least squares regression. The market structure analysis revealed a Gini coefficient of 0.65 for palm oil, indicating high seller concentration and significant inequality. The Lorenz curve analysis further confirmed imperfect market competition with a 65% Gini coefficient. The market performance analysis showed a meagre fixed cost (0.66%) compared to variable costs. Factors affecting net returns included marketers' age, marital status, marketing experience, household size, selling price, cooperative membership, transportation cost, purchase price, and educational qualification. The study suggests providing adequate credit facilities and promoting cooperative membership to help marketers expand their sales.
Keywords: Economics, palm oil marketing, processing, Abia State, Nigeria

Introduction

Palm oil, extracted from the fruit of the oil palm tree (*Elaeis guineensis*), has been a fundamental part of Nigeria's agriculture and economy for a long time. As a top global producer and consumer of palm oil, Nigeria's industry is intricately connected to the country's socio-economic framework (FAO, 2023). Palm oil marketing in Nigeria involves a blend of traditional methods and modern challenges, influenced by local and global factors (Ndubuisi, 2021). The history of palm oil in Nigeria spans centuries, predating European colonization. Traditionally, palm oil was used for cooking, cosmetics, and as a trade commodity among indigenous communities. During the 19th century, under colonial rule, Nigeria's palm oil became a major export, meeting the British Industrial Revolution's need for industrial oils and fats. By the early 20th century, Nigeria had become the world's largest palm oil producer, contributing about 43% of global output (FAO, 2023).

The Nigerian palm oil market features a clear divide between small-scale producers and large commercial plantations. Smallholders, who rely on traditional cultivation and processing methods, dominate the market, contributing around 80% of the country's production (FAO, 2023). These family-run operations typically use labour-intensive manual techniques, which can hinder production efficiency and quality consistency (Adebayo, 2023). In contrast, large commercial plantations, though less numerous, employ advanced agronomic practices and modern processing technologies. These plantations are often vertically integrated, managing extensive parts of the value chain from cultivation to processing and distribution.

Despite Nigeria's historical significance in the palm oil industry, the sector faces numerous challenges. Firstly, the country's palm oil production has lagged behind domestic demand, necessitating imports to fill the shortfall. Contributing factors include outdated farming methods, inadequate infrastructure, and limited access to modern agricultural inputs and technologies (Ogunleye and Aremu, 2023). Secondly, the palm oil supply chain in Nigeria is plagued by inefficiencies at every stage, from harvesting and processing to distribution and marketing, leading to higher costs and lower quality products, which undermines competitiveness both locally and internationally. Thirdly, the expansion of palm oil cultivation has raised environmental concerns such as deforestation, biodiversity loss, and greenhouse gas emissions. Socially, the industry faces criticism for labour issues and land rights conflicts, particularly where large

plantations encroach on Indigenous lands.

Additionally, government policies and regulations significantly impact the palm oil market. However, inconsistent and sometimes protectionist policies can hinder efficient market operations and deter investment. The Nigerian government has introduced measures to support the local industry, including import restrictions and incentives for local producers, but the effectiveness of these policies is mixed (Eze and Okoro, 2023). Marketing strategies and opportunities for palm oil in Nigeria must navigate the intricate dynamics of local consumption patterns, export possibilities, and competitive pressures. Key strategies include product differentiation, value addition, strengthening supply chains, and leveraging digital platforms (Utibe, 2022; Akinola, 2023; Adeyemi, 2023).

In Abia State, located in south-eastern Nigeria, the area is renowned for its rich agricultural heritage and substantial contributions to the country's palm oil production. However, the palm oil industry in Abia State faces numerous challenges that hinder its growth and efficiency. According to Eze and Okoro (2023) and Agwu and Eze (2023), these challenges include inefficient and outdated processing techniques. Many smallholder farmers and processors still rely on traditional methods for palm oil extraction and processing. These labour-intensive and time-consuming methods result in low oil yield and quality. The use of basic tools and the absence of modern processing facilities lead to high post-harvest losses and reduced competitiveness in both local and international markets.

Another major issue is the fragmented and inefficient supply chain for palm oil in Abia State. With numerous small-scale producers scattered across rural areas, the supply chain suffers from inefficiencies in logistics and distribution, leading to higher costs and lower product quality (Okoye and Nnamdi, 2023). Poor infrastructure, including inadequate road networks and storage facilities, worsens these challenges, making it difficult for producers to access markets and achieve economies of scale.

Furthermore, limited access to finance and modern agricultural inputs is a significant problem. Many small-scale palm oil farmers and processors struggle to obtain finance and modern agricultural inputs. The high cost of acquiring modern processing equipment and agricultural inputs, such as fertilizers and improved seedlings, often forces them to rely on outdated and less efficient practices. This financial constraint prevents them from improving productivity and adopting innovations that could enhance processing efficiency and product quality (Smith and Johnson, 2021; Roberts and Lee, 2022).

While existing literature on palm oil marketing and processing, such as Nze *et al.* (2019), Onu *et al.,* (2021), and Aina *et al.* (2021), has covered various areas, there has been limited research focused on Abia State, Nigeria. This gap in research prompted the current study, which aims to determine the structure of the palm oil market in the study area, estimate the market performance of palm oil marketing, and identify the determinants of net returns for palm oil marketers.

Methodology
The research was carried out in Abia State, which covers an area of 700 square kilometers and includes 17 local government areas. Abia State was established from Imo State on August 27, 1991. It is located between longitudes 7° 23' and 8° 2' East of the Greenwich Meridian and latitudes 5° 49' and 6° 12' North of the equator. The state is bordered by Cross River and Akwa Ibom States to the east, Ebonyi and Enugu States to the north, Imo State to the west, and Rivers State to the south. Abia is divided into three agricultural zones: Aba, Umuahia, and Ohafia (NPC, 2017). The state's population is 2,833,999, comprising 1,434,193 males and 1,399,806 females, with about 65% of the population engaged in agriculture (ASPC, 2017). The annual rainfall in Abia ranges from 200-250mm, and temperatures vary from 22°C to 35°C. Farming is primarily subsistence-based, with fertile soil supporting crops like yam, cassava, cocoyam, melon, maize, oil palm, garden egg, and cocoa. Major livestock include poultry, goats, pigs, and sheep. Abia State is organized into 17 local government areas. The study employed a multistage sampling technique. In the first stage, two agricultural zones out of the three were randomly selected: Aba and Umuahia. In the second stage, two markets known for a significant supply of oil palm products were purposively chosen from each selected agricultural zone. This resulted in a total of four markets for the study: Ahia Ohuru, Itungwa Market, Ubani Market, and Ndoru Market. The sampling frame consisted of lists of oil palm produce wholesalers provided by market association officials. From each market, fifteen palm oil wholesalers were randomly selected, totalling sixty palm oil wholesale marketers. These wholesalers typically sell palm oil in 25-liter gallons and store it to sell when prices increase. Primary data were collected for the study using structured questionnaires and oral interviews. The questionnaire was designed to assess the marketing performance of palm oil in the study area, including the costs and returns of palm oil marketing. Various econometric and statistical tools were employed as appropriate for the study and its variables, consistent with empirical research. The first objective was achieved using the Gini Coefficient, the second through cost and return analysis, marketing margin and efficiency, and return on investment, while the third objective was realized using OLS.

Gini Coefficient
The Gini coefficient was employed to analyze the market structure to achieve objective (i). It serves as a statistical measure of dispersion commonly used to assess inequality in wealth or product distribution. Mathematically, the Gini coefficient computation, adapted from Smith and Johnson (2010), is expressed as follows:

$$GC = 1 - \sum XY \ldots\ldots\ldots (1)$$

Where:
GC = Gini Coefficient, X = Proportion of Sellers, Y = Cumulative Proportion of Sales,
$\sum$ = Summation Sign, and 1 = constant or unity
The Gini coefficient ranges from 0 to 1. A coefficient of zero indicates perfect equality in distribution, while a coefficient of one represents perfect inequality. The closer the Gini coefficient is to zero, the greater the equality, indicating lower concentration and more competitive markets. Conversely, as the Gini coefficient approaches one, it signifies higher inequality, greater concentration, less competitive markets, and lower market efficiency (Smith, 2015). The Gini coefficient is also used to illustrate the degree of income inequality among households in a population. It precisely measures the position of the Lorenz curve, with values between 0 and 1. The coefficient is calculated by measuring the ratio of the area between the Lorenz Curve and the 45-degree line. If the Lorenz curve lies on the 45-degree line, the Gini Coefficient value would be zero. Generally, the closer the Lorenz Curve is to the line of perfect equality, the less the inequality and the smaller the Gini coefficient.

Net Returns, Net Margin and marketing efficiency
The costs and return analysis is given as:
NR = TR – TC ……..2
Where
NR = Net return (N)
TR = Total revenue from sales (N)
TC = Total marketing costs (N)
Marketing margin is specified thus:

Marketing Margin =
$$\frac{\text{Selling price} - \text{Purchase price}}{\text{Selling price}} \times \frac{100}{1} \quad \text{……… (3)}$$

The decision rule was that:
A high margin between the wholesaler's price and the supplier's price is an indication of an inefficient marketing system while the lower margin indicates efficiency in the marketing system.
Marketing efficiency was measured as

$$ME = \frac{\text{Total revenue}}{\text{Marketing cost}} \times 100 \quad ….. (4)$$

The value of marketing efficiency ranges from 0% to infinity. A marketing efficiency of 100% indicates a perfectly efficient market, where the price increase is sufficient to cover the marketing costs of the commodity. If the marketing efficiency is greater than 100%, it indicates excess profit, whereas a value less than 100% signifies inefficiency. In essence, the higher the percentage, the more efficient the marketing of oil palm produce is (Oguzor, 2013). It is the return due to a naira invested. It is given as:
$$ROI = \frac{NR}{TC} \times 100 \quad …… (5)$$

Where,
NR = Net return
TC = Total cost

Multiple Regression Analysis
The implicit functional form of the regression model is specified as follows;

$Y = f(X_1, X_2, X_3, X_4, X_5, X_6 X_7, X_8, ………. X_{14})$ ……… (6)
Where,
Y = Net returns (N)
X_1 = Age of the wholesalers (years)
X_2 = Marital status (1 = married, 0 = others)
X_3 = Sex (1 = male, 0 = female)
X_4 = Household size (number of people)
X_5 = Educational level (years)
X_6 = Marketing experience (years)
X_7 = Membership of market union (1 = yes, 0 = no)
X_8 = Source of finance (1 = personal, 0 = others)
X_9 = Purchase price (N)
X_{10} = Transportation cost (N)
X_{11} = Handling cost (cost of loading and offloading of the produce) (N)
X_{12} = Selling price (N)
X_{13} = Storage cost (Cost of rent for the space where the commodity is stored) (N)
X_{14} = Depreciation for the fixed cost items (N)
Four different functional forms of the regression model were tested. The model that provided the best fit was selected as the lead equation. This selection was based on several criteria: the number of significant variables, the R^2 value (coefficient of multiple determination), the F-ratio, and the alignment of the variables with prior expectations.

Results and Conclusion
Structure of the Palm Oil Market in Abia State
Davies and Brown (2023) indicate that market structure fundamentally shapes competitive dynamics and pricing strategies within markets. The results illustrated in Figure 1 display the Lorenz curves, which visually represent the concentration of sellers, quantitatively assessed using the Gini coefficient. The graph plots the cumulative market share on the x-axis and the cumulative proportion of palm oil marketers on the y-axis. A perfectly equal concentration is represented by the straight diagonal line (y = x), known as the line of perfect equality or the 45-degree line. The curves, which arc away from this line, indicate the levels of inequality in market share among the marketers. The degree to which these curves deviate from the line indicates the concentration of sellers and the competitive landscape in the study area. The Gini coefficient value of 0.65 for oil palm traders in Abia State approaches unity, suggesting a significant level of inequality and high seller concentration. Additionally, the Lorenz curve's deviation from the line of equality indicates imperfect market competition (65% Gini), meaning that no single oil palm market participant possesses enough power to set prices, although a small number of traders control a significant portion of the market transactions.

Performance of Palm Oil Marketing in Abia State, Nigeria
The performance of palm oil marketing in Abia State was assessed by applying the following market performance index; net returns, marketing margin, marketing efficiency, and returns on investment.
The monthly average cost and returns analysis for palm

oil marketers in the study area is shown in Table 1.

The result in Table 1 reveals that the purchase price of palm oil comprises the majority of the total variable cost, accounting for 98.73% out of the overall 99.49% variable cost. This indicates that the purchase price forms the largest portion of the marketing costs for palm oil sellers. Meanwhile, transportation, loading, offloading, marketing charges, and other related costs only make up about 0.12% of the total variable cost. The combined results show an average variable cost of 99.49% and an average fixed cost of 0.66%, highlighting that variable costs are the predominant expenses in palm oil marketing. The fixed costs, including shop rent, equipment depreciation, and loan interest, are minimal at 0.66% compared to variable costs. This finding aligns with Johnson and Smith (2017), who observed lower fixed costs relative to variable costs in their study on cocoa marketing costs and returns in Ghana. The total marketing cost amounted to N649,435.78. On average, the selling price for 25-liter gallons was N9,101.67, with an average sale of 83 gallons. The total revenue from palm oil sales was N755,438.33, yielding a net return of N106,002.55 for marketers in Abia State. This positive net return indicates that palm oil marketing is profitable, aligning with the profitability findings observed by Smith (2015) and Johnson and Williams (2017) in their respective studies on palm oil marketing. Additionally, the marketing margin was 15%, meaning that for every Naira a consumer spends on palm oil, 0.15 Naira (15 kobo) goes to the marketers. This margin is acceptable for a homogeneous and storable commodity. According to Smith (2010), margins between five to fifteen percent are reasonable for both storable and perishable commodities. The results for marketing efficiency show a value of 116%, indicating that the market is efficient. A percentage value of 100 or above signifies an efficient market where the price increase is sufficient to cover the marketing costs of the commodity. This high marketing efficiency suggests that marketers can cover the costs of value addition (marketing service costs) and earn a profitable margin above 100%. This finding is consistent with Smith and Jones (2014), who also noted that higher efficiency ratios indicate improved marketing efficiency. The Return on Investment (ROI) was 16%, meaning that for every Naira invested in palm oil marketing, 16 kobo is gained as net returns for the marketers. This finding aligns with Smith (2010), who recorded an ROI of 18%. The ROI result also suggests that palm oil marketing is viable.

Factors Affecting the Net Returns of Palm Oil Marketers in Abia State
The factors influencing the net returns of palm oil marketers were assessed using ordinary least square regression. Data was analyzed through regression analysis, and four different functional forms of the regression model were tested. The double-log form was selected as the primary equation based on various criteria, including the size, magnitude, and direction of coefficients, the number of significant variables, the R^2 value, the F-ratio, and the alignment of variables with

prior expectations. The factors impacting net returns from palm oil marketing in Abia State is shown in Table 3. The double log functional form was selected as the primary equation. This selection was based on the number of significant variables, the magnitude of the coefficient of multiple determinations (R^2), the alignment of variables with *a prior* expectation, and the significance level of the F-ratio. The R^2 value was 0.847, indicating that 84.7% of the variation in the net returns of palm oil marketers in the study was explained by the model's explanatory variables, while the remaining 15.3% was due to error or omitted variables. Significant variables impacting the net returns of palm oil marketers in Abia State included age, marital status, household size, educational level, marketing experience, market union membership, purchase price, transportation cost, and selling price. The age of marketers in Abia State was significantly related to their net returns at the 1% level, but the relationship was negative. This suggests that younger marketers achieved higher net returns compared to older ones. This is likely because younger marketers are more enterprising and willing to take more risks, which is advantageous in the palm oil wholesale business. This finding is supported by Nze *et al.* (2017), who also observed that increasing age negatively impacts marketers' net returns. Marital status was significant at the 5% level and positively related to net returns. This indicates that married palm oil marketers had higher net returns than their single counterparts. Nwauwa (2011) also noted that married individuals receive support from their spouses and children, which aids their marketing efforts. Household size showed statistical significance at the 5% level and was found to have a positive correlation with net returns. This suggests that larger households tend to generate higher net returns for marketers. Moreover, a larger household size can facilitate marketing efforts by increasing scale, which in turn enhances net returns. Educational level was significant at the 1% level and positively related to the net returns of the marketers. Wholesale marketers with higher levels of education achieved greater net returns. Education enhances decision-making objectivity and improves the ability of marketers to adapt to modern marketing innovations and techniques (Nze *et al.,* 2017). Marketing experience was found to be statistically significant at the 5% level and positively associated with net returns in palm oil wholesale marketing. This aligns with the expectation that accumulated experience allows marketers to allocate limited resources effectively, thereby reducing costs and maximizing net returns. This finding is consistent with Smith (2015), who similarly noted that greater years of experience correlate with increased net returns in commodity marketing. Membership in market unions was found to be positively significant at the 5% probability level, indicating that marketers who belong to market unions tend to achieve higher net returns compared to those who do not. This disparity can be attributed to the advantages that union membership provides. Members have access to loans from the union, enabling them to expand their operations and thereby increase their net returns (Nwauwa, 2011). The purchase

price was found to be statistically significant at the 1% level and inversely associated with the net returns of palm oil marketers. This indicates that as the purchase price rises, the net returns of marketers decrease. Higher purchase prices result in increased costs per unit of the commodity (Nze et al., 2017). Transportation costs were found to have a significant negative impact, with a coefficient significant at the 1% level. This suggests that as transportation costs increase, the net returns of marketers decrease. This is because higher transportation costs result in increased expenses for wholesale marketers, thereby reducing net returns. These findings align with Bassey et al., (2013), who noted that transportation costs constitute a significant portion of the marketing margin in Africa. The coefficient for selling price was positively significant at the 1% level, indicating that higher selling prices corresponded to higher net returns. This implies that as the selling price increases, net returns also increase, and conversely, as the selling price decreases, net returns decrease. This finding aligns with Fareyola et al., (2013), who found that an increase in the selling price of a commodity results in higher net returns.

Conclusion
The study conducted an economic assessment of palm oil marketing and processing in Abia State, Nigeria, utilizing a sample of 60 respondents, all of whom were wholesalers. The findings revealed a substantial return on investment for palm oil marketing. Consequently, the study concludes that palm oil marketing is a profitable venture, evidenced by the significant net returns realized from the business. Given the efficient market dynamics, expanding the market presence could be beneficial. Exploring new geographic markets, both locally and internationally, could increase sales volumes and profitability. Market research to understand emerging consumer trends and preferences can help in tailoring products and marketing strategies to new segments. Strengthen partnerships with market unions to leverage collective bargaining power, share resources, and access market information. Collaborating on advocacy efforts to influence policies that benefit marketers is also needed. Inadequate finance was one of the major constraints therefore palm produce wholesale marketers should be encouraged to form cooperative societies where they can mobilize their savings to increase their access to credit that could boost their business. This will also lead to better dissemination of market intelligence and information.

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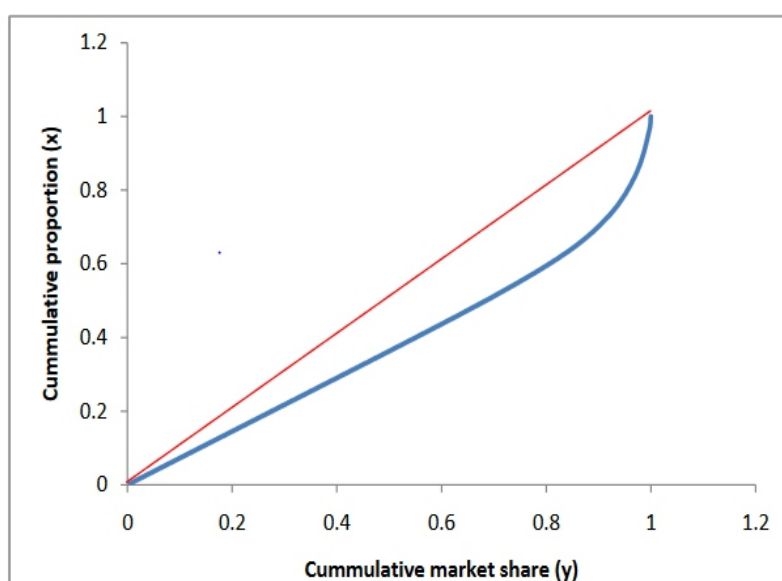
Figure 1: Lorenz curve for palm oil marketers in Abia State

Table 1: Monthly average cost and returns for palm oil marketers

Variable Cost (₦)	Amount (₦)	%
Average purchase price per gallon	7,455.83	
Average number of gallons sold	83	
Purchase price for the number sold	641,201.67	98.73
Transportation cost	756.00	0.12
Cost of loading and offloading	325.18	0.05
Marketing charges	101.67	0.02
Other marketing costs	2,735.91	0.42
Total Variable Cost (TVC) (₦)	**645,120.42**	**99.34**
FIXED COST		
Rent on shop	1,206.78	0.19
Depreciation on equipment	2,720.01	0.42
Interests on loans	388.57	0.06
Total Fixed Cost (TFC)	**4,315.36**	**0.66**
C. TOTAL COST (TC) (₦)	649,435.78	100.00
REVENUE		
Selling price per gallon	9,101.67	
Total Revenue (TR) (₦)	**755,438.33**	
Net Returns (NR)	106,002.55	
Marketing Margin (MM)%	15%	
Marketing Efficiency (ME)%	116%	
Return On Investment (ROI)%	16%	

Table 3: Factors affecting the net returns of palm oil marketers in Abia State

Variables	Linear	Exponential	Double-Log[+]	Semi-log
Constant	105432.9	4.779	9.369	-530223.900
	(7.096)***	(10.507)***	(3.270)***	(-5.763)***
Age	-225.591	-0.401	-1.036	-10560.340
	(-3.289)***	(-2.329)**	(-3.285)***	(-2.347)**
Marital Status	620.396	-0.101	0.981	1498.901
	(0.041)	(-0.022)	(2.427)**	(0.118)
Sex	10041.1	0.033	0.036	10378.160
	(0.949)	(1.977)*	(0.919)	(2.101)**
Household size	5631.732	0.023	1.103	28986.810
	(2.359)**	(1.364)	(2.542)**	(1.795)*
Educational level	155.312	0.311	1.617	2077.750
	(3.098)***	(2.158)**	(3.185)***	(2.150)**
Marketing experience	524.575	0.201	1.642	2938.264
	(2.535)**	(2.301)**	(2.296)**	(1.935)*
Membership of market union	14742.32	0.052	0.845	13751.540
	(1.342)	(2.475)**	(2.441)**	(1.432)
Source of finance	-12577.36	-0.056	-0.052	-10698.250
	(-1.181)	(-1.308)	(-1.325)	(-2.135)**
Purchase price	-180.245	0.012	-1.989	-1456.167
	(-2.469)**	(-0.540)	(-3.187)***	(-2.127)**
Transportation cost	-222.663	-0.068	-0.129	-34351.810
	(-2.101)**	(-2.274)**	(-3.815)***	(-4.184)***
Handling cost	180.85	0.111	0.064	11221.970
	(0.223)	(0.513)	(1.219)	(0.876)
Selling price	110.906	0.038	1.392	102419.600
	(2.573)**	(1.197)	(4.329)***	(1.434)
Storage cost	2311.032	0.106	-0.032	-8387.828
	(0.273)	(0.302)	(-1.442)	(-0.481)
Depreciation	3220.039	0.089	0.011	2906.498
	(0.195)	(2.313)**	(1.482)	(0.743)
R²	0.753	0.746	0.847	0.725
Adjusted R²	0.736	0.723	0.824	0.709
F-statistic	31.025***	29.161***	45.673***	26.970***

*Source: Field survey, 2021. ***, ** and * represents 1%, 5% and 10% levels of significance respectively. + = lead equation. Values in parentheses are t-ratios. N = 60*