PROFIT EFFICIENCY AMONG CATFISH MARKETERS IN LAGOS STATE, NIGERIA: A STOCHASTIC PROFIT FRONTIER ANALYSIS (SPFA) APPROACH

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Abstract: *The study analyzed the determinants of profit efficiency among catfish marketers in Lagos state, Nigeria. Multistage sampling procedure was used to select 120 catfish marketers, data were collected with the aid of a structured questionnaire. The data collected were analyzed with the use of descriptive statistics, enterprise budgetary technique, Shephered-Futrell method and stochastic profit frontier analysis (SPFA) model. The result of the gross ratio and net return on investment reveals that catfish marketing was a profitable and bankable enterprise. About 76.72% of sales revenue was taken up by the costs. The SPFA reveals that cost of catfish purchased and depreciation cost had positive (p<0.01) effects on profit while transportation cost (p<0.01) and labour cost (p<0.05) had negative effects. Furthermore, marital status and credit use (p<0.01) had negative effects on profit inefficiency, the mean profit efficiency of the catfish marketers was 74%. The study concluded that catfish marketers were inefficient, however, to improve the efficiency of the marketers and create more job opportunities; the study recommends that credit facilities that will enable the marketers increase their scale of operation, acquire better marketing resources and employ capable hands in catfish marketing should be made available and accessible. Policies that will help to provide good road networks and reduce the pump price of premium motor spirit (PMS) should be given adequate consideration*

INTRODUCTION

In recent times, there has been a rising awareness for fisheries and aquaculture in Nigeria which has translated greatly to increase in fish marketing with catfish taking the bulk of the farmed species. This boom in the fishery industry coupled with the increase in human population has led to an increase in annual per capita consumption and high demand for catfish, especially as an important economic source of animal protein to meet the daily dietary requirements; thus, it represents a significant proportion of animal protein in the diet of most Nigerian, and globally, accounting for about 6.7 per cent of all protein consumed by humans (FAO, 2016; Robadue et al., 2018). Catfish production and marketing are equally important in order to create more jobs, increase income and livelihood diversification towards poverty reduction.

According to Shaw (2012), marketing activities are needed in the process of distributing the catfish from producers to its final consumers. These activities have an important role in facilitating the interactions between the forces of demand and supply through the adjustment of catfish prices across time and space, also in dealing with the risks arising as a result of shocks to the demand and supply factors existing in a market. Markets that are well-integrated help in reducing variability in prices encountered by both consumers of catfish and marketers. Hence, it is important to examine the supply chain and its performance especially the marketing activity (Barrett, 2005; Shin et al., 2018). Ladu et al. (2013) reported marketers to be important participants in the distribution process; they take specific roles (such as fishing, processing, marketing and reprocessing to maintain its value pending the time of sale) in the marketing of different forms of fish. Thus, in response to changing economic conditions, there is

a need to examine the ability of these catfish marketer in achieving the highest possible profit given the cost incurred to know how profit efficient they are.

In Nigeria, the annual demand for catfish far exceeds local production which has resulted in high importation. Thus, effort must be concerted if this gap is to be close. There is a need for price efficiency through efficient marketing to encourage marketers. However, challenges such as inadequate market information, poor market structure, inadequate storage facilities and product deterioration had led to price instability and low income of the marketers which has greatly affect price efficiency of the marketers (Eze et al., 2010). Also, catfish marketers travelled longer distances to buy or sell their product, a situation, which has created gaps between supply and demand, exerts pressures on handling and packaging; and has also led to unstable market prices and reduced marker margins. This is coupled with the fact that catfish is a perishable product and is susceptible to spoilage (Ali et al.,2008; Falodun, 2011).

Previous researches carried out on catfish in Nigeria focused on the risk-coping strategies, production, catfish culture and resource use efficiency (Ugwumba et al., 2010; Adewumi and Olaleye, 2011; Olasunkanmi and Yusuf 2014). In spite of the increase in catfish production in Nigeria, little attention has been given to profit efficiency of catfish marketers; given the potentials of the catfish industry in contributing considerably well to the socio-economic development of Nigeria through job creation, income generation, food security and livelihood diversification. It is against this backdrop that this study described the socioeconomic characteristics of catfish marketers, estimated the marketing efficiency levels of catfish marketers, and analyzed the factors influencing profit efficiency among catfish marketers and estimated the profit efficiency levels among marketers.

Theoretical Framework

The theoretical framework underpinning this study was profit efficiency model. The profit function approach combines the concepts of technical and allocative efficiency in the profit relationship and any errors in the production decision are assumed to be translated into lower profits or revenue for the producer (Ali et al., 1994). Profit efficiency, therefore, is defined as the ability of a catfish marketer to achieve the highest possible profit given the prices variable inputs and levels of fixed factors of that farm. Profit inefficiency in this context is defined as the loss of profit for not operating on the frontier. Ali and John (1989) extended the stochastic production frontier model by suggesting that the inefficiency effects can be expressed as a linear function of explanatory variables, reflecting farm-specific characteristics.

The advantage of this model is that it allows the estimation of a marketer specific efficiency scores and the factors explaining the efficiency differentials among marketers in a single-stage estimation procedure. Following

Rahman et al. (2012) this study utilizes the Battese and Coelli (1995) model by postulating a profit function, which is assumed to behave in a manner consistent with the stochastic frontier concept. The stochastic profit function is defined as:

$$\pi^* = \frac{\pi}{\rho} = h(q_i, z) \exp(v_i - u_i)$$

Z = vector of fixed input(s); P = output price used to normalize variables in the model; π = marketer's profit defined as total revenue minus the total cost of incurred; while total cost is made up of the cost of inputs; $\exp(v_i-u_i)$ = composite error term.

The profit/economic efficiency (EE) of an individual marketer in the context of stochastic frontier profit function is derived as a ratio of the predicted, observed or actual profit (πi) to the corresponding predicted maximum profit ($\pi^* i$) for the best marketer or frontier profit given the price of variable inputs and the level of fixed factor(s). Mathematically, it is expressed following Sunday, et al. (2013) as:

$$\text{Profit Efficiency (EE)} = \frac{\text{Actual farm profit}}{\text{Frontier profit}} = \frac{\pi_i}{\pi_i^*} = \frac{(q_i,z)\exp(v_i \; u_i)}{(q_i \; z)\exp(v_i)}$$

$$\text{Profit Efficiency} = \frac{\exp(v_i - u_i)}{\exp(v)} = \exp(-u_i)$$

RESEARCH METHODOLOGY

Study Area

The study was conducted in Lagos state, Nigeria. The state is inland in southwestern Nigeria, with its capital at Ikeja. It is bounded by Ogun state in the west, by the Benin Republic behind its southern borders lies the Atlantic Ocean. The state is located in the rainforest vegetation belt of Nigeria within longitude 3o 45 E and 6035E and latitudes 6.538oN and 6o 35N in the tropics. The land area is 3,577square kilometer. Lagos State is arguably the most economically important state of the country, the nation's largest urban area. Fresh fish production and marketing is common in the state due to large water bodies.

Sampling Technique and Sample Size

Multistage sampling technique was used for this study, the first stage was a purposive selection of Kosofe Local Government Area (LGA) due to high concentration of cat fish marketers, the second stage involved random selection of five markets out of eight markets in the LGA through the use of table of random numbers, the selected markets were; Mile 12 market, Ketu market, Ikosi market and Ajelogo market. The third stage involved selection of 24 catfish retail marketers from each of the selected markets to arrive at a total sample size of 120 respondents.

Data Source and Collection

Data for this study were obtained from primary source. Primary data were obtained with the aid of a structured questionnaire, data collected were on their socio-economic characteristics such as; age, sex, marital status, years of marketing experience, level of education, etc. data were also collected on marketing cost and returns.

Analytical Technique and Model Specification

The data collected from the field was analyzed using descriptive statistics, enterprise budgetary technique, Shephered –Futrell, and stochastic profit frontier model.

Enterprise Budgetary Technique

Enterprise budgetary technique was used to estimate the marketing cost and returns, Following Nwankwo et al. (2017) the enterprise budgetary technique used to estimate the enterprise profitability was specified as;

$$GM = TR\text{-}TVC \qquad (4)$$
$$GR = TC/TR \qquad (5)$$
$$NMI = TR\text{-}TC \qquad (6)$$
$$NROI = NMI \qquad (7)$$
$$TC = FC\text{+}VC \qquad (8)$$

Where;
GM= Gross margin, GR=Gross ratio, TR=Gross ratio, TR=Total revenue, TVC=Total variable cost, NMI=Net marketing income/profit, TC= Total cost, NROI= Net return on investment.

Marketing Efficiency

The Sherpherd-Futrell method was used to determine the efficiency of catfish marketing by the, following Ugwumba and Okoh (2010), it is as specified as;

$$ME = \frac{TC}{TR} \; X \; \frac{100}{1} \qquad (9)$$

Where;
ME = Coefficient of marketing efficiency
TC = Total cost incurred by the marketers
TR = Total value of the product sold.

Stochastic Profit Frontier and Profit Inefficiency Models

A multiple regression model based on the stochastic frontier profit function which assumes Cobb-Douglas functional form was employed to determine the profit efficiency of catfish marketers in the study area. Following Sunday et al. (2013), the model was therefore specified as follows;

$$\ln\pi_i^* = \beta_0 + \sum_{j=1}^{5} \beta_j \ln X_{ji} + vi - ui \qquad (10)$$

Where;
π= normalized profit computed for i-th farmer,
ln = natural log,
X_1= cost of catfish purchased (Naira/naira) normalized by the price of catfish,
X_2= cost of labour (Naira/ mandays) normalized by the price of catfish,
X^3= cost of tax levied (Naira/naira) normalized by the price of catfish,
X_5= cost of transportation (Naira/naira) normalized by the price of catfish,
X_5= depreciation on assets (Naira/naira) normalized by the price of catfish,
β_0, β_1...β_5 are parameters to be estimated, vi represents statistical disturbance term and ui represents profit inefficiency effects of ith farmer.

The determinants of profit inefficiency of catfish marketers in line with Ogunniyi (2011) were modeled following specific characteristic of marketers in the study area. From equation (2) the component is specified as follows:

$$u_i = \lambda_0 + \sum_{r=1}^{7} \lambda r \, w_r + k \qquad (11)$$

Where:
u_i = Profit inefficiency of i-th farmer, λ_0 and λ_r are parameters to be estimated, are variables explaining inefficiency effects, r =1,2,3....,n, k is truncated random variable,
w_1= Marketer`s age (year),
w_2= Level of education (years),
w_3= Marital status (married = 1, single =0),
w_4= Household size (number),
w_5= Farming experience (years),
w_6=Membership of cooperatives (yes =1, no =0),
w_7= Credit access (had access =1, had no access = 0),

RESULTS AND DISCUSSION

Socioeconomic Characteristics

Table 1 shows the frequency distribution of respondents. Almost all of the respondents were female while fewer were male; this implies that women constitute a greater percentage of those involved in catfish marketing in the study area. This result agrees to that Nwankwo et al. (2017) that marketers are predominantly female. More than half of the catfish marketers are within 41-60years of age with a mean age of 42years, this implies that the majorities of the catfish marketers was still very agile, energetic and are within their productive age and this may positively influence their marketing efficiency level, this result supports the findings of Ugwumba and Okoh (2010). Larger proportion of the respondents were married, this implies that most of the catfish marketers are matured and responsible to cater for their households as well as have a clear knowledge of their wellbeing, there is also an implanted sense of responsibility as marital status prompts commitment to business because of the family needs that must be met and this would subsequently enhance marketing efficiency, this result corroborates the findings of Njoku and Offor (2016). More than half of the respondents had primary education. The results signify that catfish marketers are literate which is of significant importance in their marketing decision-making process which may contribute positively to their marketing efficiency. This finding agrees with Ugwumba and Okoh (2010) that revealed that literate marketers find it relatively easy in their dealings with people more especially in the exchange process. Larger percent of the respondents had between 1-5persons in their households with a mean household size of 5 persons, this implies that most of the catfish marketers had a fairly large household labour they could employ in their business, and this result is in line with the findings of Njoku and Offor (2016) and Nwankwo et al. (2017). Larger percent of the respondents had less than 10years marketing experience with mean marketing experience of 9years, this implies that most of the catfish marketers had enough experience about marketing and this may influence their efficiency positively and this may increase their profit, this corroborates the finding of Njoku and Offor (2016).

Table 1: Distribution of Respondents According to their Socioeconomic Characteristics.

Variable	Frequency	Percentage	Mean	Standard deviation
Sex				
Female	111	92.50		
Male	9	7.50		
Total	120	100.00		
Age (years)				
1-20	3	2.50	42	9.46
21-40	42	35.00		
41-60	75	62.50		
Total	120	100.00		
Marital status				
Single	20	16.67		
Married	100	83.33		
Total	120	100.00		
Level of education				
No formal	1	0.83		
Primary	75	62.50		
Secondary	38	31.67		
Tertiary	6	5.00		
Total	120	100.00		
Household size (persons)				
1-5	81	67.50	5	1.78
6-10	39	32.50		
Total	120	100.00		
Marketing experience (years)				
≤10	91	75.83	9	4.85
11-20	28	23.33		
21-30	1	0.83		
Total	120	100.00		

Source: Field Survey, 2019.

Profitability of Catfish Marketing

Table 2 shows the estimated costs and returns of catfish marketers in the study area. The cost analysis revealed that the cost of purchases accounted for 89.41% of the total cost of marketing, transportation costs accounted for 6.06%, the tax levied (1.34%) and labour cost accounted for 2.36% of the total cost of marketing. This result is in tandem with the findings of Bassey et al. (2015) which reported that purchases constituted 95.2% and 96.2% of the total cost of marketing of fresh fish for the wholesalers and retailers, followed by transportation costs (3.7%) and security charges (0.23%) for the wholesalers and 2.6% and 0.24% for the retailers. The Gross margin analysis revealed that the raw marketing profit was ₦4,263,688 for catfish marketers; this implies that catfish marketing in the study area was profitable, as this is similar to the result of Abah (2013). The justification of this may be due to higher volumes of investment and turnover as well as better economies of scale enjoyed in the marketing process. The Net return on investment of 0.23 for the catfish marketers

implies that for every ₦1 expended in the enterprise, 23 kobo is realized, hence re-confirming that the enterprise is profitable. This result supports the findings of Bassey et al. (2015) that reported 0.24 and 0.23 net return on investment by fresh fish wholesalers and retailers. Furthermore, the gross ratio measures producers' ability to maximize cost or efficiency in input utilization and other costs of production to improve profit. The lower the gross ratio the better is the business, conversely, the higher the gross ratio the worst is the business. The gross ratio of 0.77 for catfish marketers in the study area implied that 77% of the total income generated was used in offsetting marketing costs. By implication, the profit made by catfish marketers was 23% over the capital invested. This result recorded a similar finding with Bassey et al. (2015).

Table 2: Estimated Costs and Returns of Catfish Marketers per month

Marketing cost	Amount (₦)	% of TC
Variable Cost (VC)		
Cost of fish purchased	12236500	89.41%
Transportation	829800	6.06%
Tax levied	183612.32	1.34%
Labour	323400	2.36%
Total Variable Cost (TVC)	**113573312**	**99.18%**
Fixed Cost (FC)		
Depreciation on assets	111805.9	0.82%
Total Cost (TC)	**13685118**	**100%**
Total Revenue	**17837000**	
Gross Margin (GM)	**4263688**	
Gross Ratio (GR)	**0.77**	
Net Marketing Income (NMI)	**4151882**	
Net Return on Investment (NROI)	**0.23**	

Source: Field Survey, 2019.

Marketing Efficiency Level of Catfish Marketers

Table 3 shows the estimation of the marketing efficiency level of catfish marketers using Sherpherd-Futrell technique. The Shepherd-Futrell technique which has been proved to be a better method of calculating marketing efficiency (Arene, 2008), yielded coefficients of marketing efficiency of 76.72%. This result indicated that 76.72% of their sales revenue was taken up by costs. That is, the lower the coefficients of marketing efficiency the higher the level of efficiency. This result agrees with the postulation of by Ugwumba and Okoh (2010) that 92.05% and 82.33% marketing efficiency level was recorded for wholesalers and retailers of catfish marketing in Anambra State, Nigeria.

Table 3: Estimation of marketing efficiency levels-Shepherd-Futrell technique

Items	Amount
Total Revenue (TR)	17837000
Total Cost (TC)	13685118
Marketing Efficiency (ME)	76.72%

Source: Field Survey, 2019.

Determinants of Profit Efficiency among Catfish Marketers

Table 4 shows the maximum likelihood estimates (MLE) of the stochastic profit frontier model parameters for catfish marketers in the study area. The estimate of the variance parameter (σ^2) 0.63 is significantly different from zero indicating a good fit and the correctness of the distributional assumption specified. The variance ratio, γ, is significantly different from zero at 5 per cent level of significance, which implies that the inefficiency effects are significant in determining the level and variability of profit. The presence of a one-sided error component in the specified model is thus confirmed, implying that the ordinary least square estimation would not be an adequate representation of the data. The variance ratio, defined by $\gamma = \sigma_\mu^2 / (\sigma_v^2 + \sigma_\mu^2)$ is estimated to be 0.84, meaning that 84 percent of the discrepancies between the observed profit from the frontier profit is primarily due to factors which are within the control of the catfish marketers in the study area. The table indicates that the coefficients of the estimated parameters of the normalized profit function were negative except the cost of catfish purchased and depreciation cost which was found to be positive. Furthermore, the coefficient of the normalized cost of catfish purchased with a positive value of 0.4984 was statistically significant at 1% level of significance. This means that for every ₦1 incurred on purchase of catfish, the profit obtained from catfish marketing will increase by 49.84 kobo. This result agrees with the findings of Oladeebo and Oluwaranti (2012). The coefficient of the normalized cost of transportation with a negative sign of -0.2359 was statistically significant at 1% level of significance. This implies that for every ₦1 incurred on transportation, the profit obtained from catfish

marketing will reduce by 23.59 kobo. This result corroborates the findings of Oladeebo and Oluwaranti (2012). The coefficient of the normalized cost of labour with a negative sign of -0.0712 was statistically significant at 5% level of significance. This indicates that for every ₦1 incurred on labour, the profit obtained from catfish marketing will reduce by 7.12 kobo. This result is consistent with the findings of Mulie (2014) and Ogunniyi (2011). The coefficient of the normalized depreciation cost with a positive sign of 0.0825 was statistically significant at 1% level of significance. This indicates that for every ₦1 incurred on assets, the profit obtained from catfish marketing will increase by 8.25 kobo. This result is in support of the findings of Mulie (2014).

Determinants of Profit Inefficiency Model

The result of the inefficiency model revealed that marital status and credit usage were the significant determinants of inefficiency. A negative sign implied that the variable had the effect of reducing inefficiency, hence increasing profit efficiency. The coefficient of marital status revealed that married catfish marketers are more efficient than their unmarried counterparts; this is because married catfish marketers are more likely to use their family labour in catfish marketing thereby reducing cost expended on labour, this will thereby increase the profit of the catfish marketers. The coefficient of credit access implies that catfish marketers that have access to credit are more efficient than those that did not have access to credit, this is so because credit use enables the catfish marketers to increase their scale of operations as they are more likely to enjoy higher economic of scale thereby increasing their profit efficiency.

Table 4: Maximum Likelihood Estimates of Stochastic Frontier Profit Function

Variable	Parameter	Coefficient	Std. Error	t- value
Constant		0.0828566***	0.0147326	5.62
Cost of catfish purchased		0.4984341***	0.0495172	-10.07
Cost of transportation		-0.2359631***	0.025356	-9.31
Tax levied		0.0046828	0.0157272	0.30
Cost of labour		-0.0712374**	0.0309851	-2.30
Depreciation cost		0.0828566***	0.0147326	5.62
Inefficiency Effect				
Marketer's age		0.0001103	0.0003586	0.31
Level of education		0.0011172	0.0005677	1.97
Marital status		-0.0129626***	0.0028687	-4.52
Household size		0.0001827	0.0019721	0.09
Farming experience		-0.0004279	0.0008964	-0.48
Membership of cooperatives		-0.0023151	0.00251	-0.92
Credit access		-0.0094544***	0.0007172	-13.18
Diagnostic Statistic				
Sigma square	δ^2	0.63		
Lambda	γ	0.84		
Wald chi2		513.71		
Log-likelihood		53.499411		

***, ** Significant at 1% and 5% probability level

Source: Field Survey, 2019.

Profit Efficiency Level of Catfish Marketers

Table 5 shows the distribution of profit efficiency of catfish marketers. The mean profit efficiency level is 0.74 implying that on the average catfish marketers were able to obtain 74% profit at reduced cost. This implies that marketers are losing 26% profit as a result of inefficiency. This suggested that there is room for 26% improvement in profit of the catfish marketers by lowering their cost.

Table 5: Distribution of Profit Efficiency Level of Catfish Farmers

Efficiency	Frequency	Percentage
0.30 – 0.39	19	15.83
0.40 – 0.49	17	14.18
0.50 – 0.59	16	13.33
0.60 – 0.69	21	17.50
0.70 – 0.79	39	32.50
0.80 – 0.89	7	5.83
0.90 – 0.99	1	0.83
Total	120	
Mean	0.74	
Max.	0.92	
Min.	0.35	

Source: computed from profit frontier model

CONCLUSIONS AND RECOMMENDATIONS

The study examined the determinants of profit efficiency among catfish marketers in Lagos state, Nigeria. It was established that catfish marketing was dominated by female at the retail level. It was also established that catfish marketing was a profitable and bankable enterprise in the study area. The result showed that cost of catfish purchased and depreciation cost positively influence the profit of the catfish marketers while transportation cost and labour cost had negative effects. The implication of these results is that increase in cost of labour and transportation cost will result to decline in profit of the catfish marketers and any attempt to reduce these costs would result to increase in profit of the marketers. Credit use and marital status had negative effects on profit inefficiency of the catfish marketers; this implies any attempt to make credit accessible to the catfish marketers will improve their profit efficiency. The catfish marketers were inefficient, however, to improve the profit efficiency of the catfish marketers, policy aimed at reducing the transportation cost should be given adequate consideration, this can be achieved by providing good road networks and reducing the pump price of Premium Motor Spirit (PMS) as it is a major driver of the transportation cost. Credit facilities that will enable the marketers increase their scale of operation, acquire better marketing resources and employ capable hands in catfish marketing should be made available and accessible to the catfish marketers. This can be achieved when catfish marketers form cooperative society so that they can access credit from formal or informal sources at zero or reduced interest rates.

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