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Analysis of Fresh and Dried Fish Marketing in Southeast Nigeria

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Abstract
The study sets out to analyse the nature, magnitude and direction of the determinants of net marketing revenue of the fresh fish and the dried fish marketers respectively in Anambra, Southeast Nigeria as well as determine which of the enterprises is more profitable in the area. Samples were selected purposively from three different markets in the area. Ten fresh fish and dried fish marketers were respectively sampled; the sample size was sixty. Data were analysed using gross margin and net returns, percentage efficiency index, and multiple regression technique. Hypotheses were tested with t test and Chows F ratio. The result show that the fresh fish marketers made a higher net returns relative to dried fish marketers. Cost of fish, cost of packaging materials, depreciation cost of marketing equipment, age of the marketers, and their education level were the statistically significant variables that influence the revenue of both marketing categories. Significant differences exist in the revenue of the marketers between fresh and dried fish, while no significant difference exist in their regression parameters.
Keywords: analysis, fish, marketing, determinants, regression, hypotheses, parameters

1. Introduction

Fish is an important source of protein in developing countries. However, it is highly perishable especially in the hot climate of Nigeria where unsanitary environment and poor handling practices worsen the situation (Ikeme 2006).

The United Nations population fund (UNPF 1993) posited that the demand for agricultural products is expected to reach unprecedented levels in the near future as the world population is estimated to double in fifty years time to about eleven billion with ninety-eight percent of the future population growth likely to be in the developing countries. Potentials therefore exist for demand-supply imbalance. Stake-holders in many developing countries respond to this assertion by making efforts to conquer poverty, food insecurity and malnutrition.

In Nigeria, poverty is found to be more pronounced and severe in the agricultural sector (NBS 1998 1999). There is also a high rate of rural – urban migration, high prices of food items and precarious food security situation (Okumadewa 2001). This makes the citizens vulnerable by diet associated diseases. Recent estimate show that at least forty-one percent of the Nigerian population is food insecure with sixteen percent being severely undernourished (Olayemi 1996).

The inability of Nigerians to meet their protein requirements could be linked to their poverty level. Animal protein sources such as beef, mutton and chicken are beyond the reach of an average income earner, he settles, therefore, for fish being the cheapest source of animal protein (Samson 1997). Hence since 1981, 384,000 tonnes of fish were consumed in Nigeria, out of which 296,000 tonnes were produced locally and 115,000 tonnes imported (FAO 1989). Freshly harvested fish need to be adequately preserved. Where preservation facilities are not available, as is the case in most developing countries, spoilage of fish is on the increase. The lack of adequate fish handling, preservation and processing methods contribute significantly to the low supply of fish to people especially the poor rural dwellers that form three-quarter of the population of the developing countries (Ikeme 2006).

It is likely that greater amount of fish are preserved and consumed in processed (dried) forms and not in fresh forms. This has a lot of implications for marketers of fresh fish and dried fish in the area.

This study will estimate and compare the costs and returns and hence, the net returns of fresh fish and dried fish marketers in Ogbaru area of Anambra state to determine which of them is more profitable in the area, it will determine the nature, magnitude and direction of the determinants of net returns of each marketing enterprise in the area as well as determine the percentage marketing efficiency of the marketing categories.

Two null hypotheses were tested. They are: there is no significant difference between the net returns of fresh fish marketers and that of dried fish marketers in the area, and there is no significant difference between the coefficients obtained from the revenue determinants of the fresh and the dried fish marketers in the area.

2. Materials and Methods

The study was conducted in Ogbaru area in Anambra central senatorial district of Anambra state, southeast Nigeria. The area is a rive-rine area which inhabits the two sides of the river Niger beginning from Odekpe through Adiawa on the eastern flank of the Niger and on the western flank, Oko down to Asa. The population of the area is 221,879 people which comprise of 117,975 males and 103,904 females (NPC, 2006). There are 16 communities in the area out of which 3 were purposively selected for the study. They are; Odekpe, Atani and Ogbakuba. Out of the 3 communities selected, 1 major market was purposively selected from each of the communities making it 3 major markets. These major markets were selected because they each have high proportion of marketers of both fresh and dried fish. 10 fresh fish and 10 dried fish marketers were randomly selected from each of the three markets making a sample size of 30 marketers respectively for each category of fish marketers and a grand total of 60 respondents of aggregate fish marketers.

Primary data were collected with the aid of questionnaire and interview schedule as collection instruments and analyzed using net margin analysis, percentage marketing efficiency, Chows F ratio as well as ordinary least squares multiple regression technique specified as follows:

Y_{df} = Net returns of dried fish marketers (₦)

Y_{ff} = Net returns of fresh fish marketers (N)

X_1= cost of fish (₦)

X_2= storage rent and market levy (₦)

X_3= cost of packaging (₦)

X_4= depreciation cost of marketing equipment (₦)

X_5= transportation cost (₦)

X_6= age of fish marketers (years)

X_7= marketing experience (years)

X_8= educational level (number of years spent in school) (years)

e = stochastic error term

NOTE: The symbol ₦ represents the Nigerian currency called the Naira

This implicit form was fitted into four functional forms for the two categories of marketers respectively. The form that best fits the regression line was chosen as the lead equation and used for further analysis.

Where multicollinearity problem was suspected in the model, a stepwise regression analysis was done so as to detect and remove the collinear variables from each of the models following Webster (1998) and Olayemi (1998).

Percentage marketing efficiency of the marketing categories was computed using the formula specified by Olukosi and Isitor (1990) thus:

$$\% \text{ Marketing Efficiency (M.E)} = \frac{\text{Net marketing margin}}{\text{Total marketing cost}} \times \frac{100}{1}$$

- Marketing Efficiency is the index of the ratio of total (or gross) marketing revenue (or income) to the total marketing costs.
- Net Marketing Margin is the difference between total revenue from fish marketing enterprise and the total variable costs incurred in that enterprise.
- Total Marketing Costs is the summation of fixed (or common) costs and variable costs incurred in the fish marketing enterprise.

If M.E.= 1; Marketing is efficient

M.E.< 1; Marketing is inefficient

M.E.> 1; Marketing is highly efficient

The first null hypothesis was tested using the t-statistic of difference between means of the marketing returns of fresh fish and dried fish marketers respectively in the area following Odii (2001) t-test for significance of net returns

$$t = \frac{\bar{Y}_1 - \bar{Y}_2}{\sqrt{\frac{(n_1 - 1)\,SD^2Y_1 + (n_2 - 1)SD^2Y_2}{(n_1 + n_2) - 2}\left[\frac{1}{n_1} + \frac{1}{n_2}\right]}}$$

Where,

$$SD^2Y_1 = \Sigma\left[\frac{Y_{1i} - \bar{Y}_1}{n_1 - 1}\right]^2$$

$$SD^2Y_2 = \Sigma\left[\frac{Y_{2i} - \bar{Y}_2}{n_2 - 1}\right]^2$$

Where,

t = calculated t-value for difference between means of the net marketing returns of fresh fish and dried fish marketers

Y_1 = net marketing returns of fresh fish marketers

Y_2 = net marketing returns of dried fish marketers

$\bar{Y}_1$ = gross marketing returns of fresh fish marketers

$\bar{Y}_2$ = gross marketing returns of dried fish marketers

SD^2Y_1 = variance of net returns of fresh fish marketers

SD^2Y_2 = variance of net returns of dried fish marketers

n_1 and n = number of observed fresh fish and dried fish marketers respectively

$(n_1 + n_2) - 2$ = degree of freedom

The hypothesis for testing differences in revenue is stated thus;

Ho: The net revenue of fresh fish marketers is statistically the same as that of the dried fish marketers; i.e. $Y_1 = Y_2$ or $Y_1 - Y_2 = 0$

Ha: The net revenue of fresh fish marketers is statistically different from that of the dried fish marketers; i.e. Y_1 =/= Y_2 or Y_1 - Y2 =/= 0

The hypothesis for the differences in regression parameters of fresh and dried fish marketers was tested using Chows (Stability) test following Thomas (1993);

$$F^* = \frac{\{\Sigma e^2 p - (\Sigma e_1^2 + \Sigma e^2{}_2)\} / K}{(\Sigma e_1^2 + \Sigma e^2{}_2) / (n1 + n2 - 2K)}$$

Where,

F^* = Chows F-ratio

e^2p = Unexplained variation of the pooled function

e_1^2 = Unexplained variation of the fresh fish marketers (Y_{ff})

e^2_2 = Unexplained variation of the dried fish marketers (Y_{df})

n_1 and n_2 = number of observations for the first and second samples respectively

K = number of estimated parameters plus intercept

= degree of freedom for the pooled residual variation

($n_1 + n_2 - 2K$) = degree of freedom for the sum of residual variation.

The hypothesis is stated thus;

Ho: The regression coefficients of fresh fish marketers is not statistically different from that of the dried fish marketers in the area

Ha: The regression coefficients of fresh fish marketers are statistically different from that of the dried fish marketers in the area

If the computed Chows F-ratio (F* cal) is greater than the tabulated F-value (F-tab) at 0.05level of statistical significance, Ho is rejected and Ha is accepted and vice versa.

In carrying out the above test, the variations e^2p, $e^2{}_1$ and $e^2{}_2$ were computed by subtracting their respective R^2 values from 1.

3. Results and Discussion

It was observed from the costs and returns analysis presented in Table 1 that the total returns from the sale of 25 cartons (containing 43 fish per carton) of fresh fish was ₦141, 269.59. The table shows that each fish was sold at ₦ 130 per fish. Cost of fish, the major variable cost, amounted to ₦120, 773.92, followed by transportation and packaging cost which amount to ₦2, 391.32 and ₦1, 987.84 respectively. Other marketing cost is the cost of drying the fish remained in each transaction by the fresh fish marketers and was the least of all the variable costs amounted to ₦600. The gross margin was ₦15, 516.48. The fixed costs were rent/market levy and depreciation cost which were ₦919.59 and ₦6.27 per month respectively and increased the total marketing cost to ₦126, 678.92 per month. The net return was ₦14, 590.64 per month.

On the other hand, the total revenue from the sale of 10 baskets of 36 pieces per basket of dried fish per month at an average selling price of N150 per fish was N55, 744.76. Cost of fish was also the major variable cost amounted to N42, 961.92, followed by transportation and packaging cost which amounted to N1, 302.84 and N1, 144.76 respectively. The gross margin was N10, 335.24. The fixed costs were rent/market levy and depreciation costs which were N949.62 and N9.22 respectively and increased the total marketing cost to N46, 368.36 per month. The net return was N9, 376.40 per month. Table 1 show further that Fresh fish enterprise made a higher net return relative to dried fish marketing enterprise in the area.

From Table 1, percentage marketing efficiency of the two marketing categories was computed as follows;

For fresh fish marketers,

$$\% \text{ marketing efficiency} = \frac{15\,516.48}{126\,678.92} \times \frac{100}{1}$$

$$= 0.122486 \times 100 = 12.45\%$$

For dried fish marketers,

$$\% \text{ marketing efficiency} = \frac{10\,335.24}{46\,368.36} \times \frac{100}{1}$$

$$= 0.22289 \times 100 = 22.29\%$$

Marketing efficiency of 0.122 and 0.223 obtained for fresh fish and dried fish marketers respectively is an

indication of an inefficient marketing system in the area.
Stepwise regression analysis conducted on each of the models shows that X_6, X_7 and X_8 were the collinear variables. They were accordingly expunged from the models.

Tables 2 show the results of the determinants of net returns of the marketers of fresh fish. The exponential functional form best fits the regression line and was therefore used for further analysis. The factors which significantly affect the level of net returns of the fresh fish marketers in the area were cost of fish, cost of storage and market levy, and depreciation cost of marketing equipment. They all have a positive coefficient which implies that they are directly related with net returns of fresh fish marketers. An increase in cost of fish, storage rent and market levy as well as depreciation cost of marketing equipment by 1unit will significantly increase the net returns of the marketers by 1.42units, 0.001 unit and 6.65 units respectively and vice versa. The lead equation gave an R-squared (R^2) value of 0.7927 which implies that about 79.3 percent of the variation in net returns of fresh fish marketers was explained by the exogenous variables included in the model.

Table 3 shows the result of the determinants of net returns of dried fish marketers in the area. The double log functional form best fits the regression line and was used for further analysis. The Table shows that cost of fish, storage rent and market levy, and cost of packaging material were the statistically significant exogenous variables that influence the net returns of dried fish marketers. Cost of fish, as well as storage rent and market levy were found to be positively related with net marketing revenue of dried fish marketers in the area. This implies that as their values are respectively increased by 1 unit, dried fish marketing revenue will increase by 1.10 and 2.70 respectively. The coefficient of cost of packaging material has negative sign which implies that as investment in packaging material is increased by 1 unit; dried fish marketing revenue will reduce by 2.01. R^2 value of 0.8557 obtained imply that about 86 percent of the variation in net returns of the marketers were explained by the exogenous variables included in the model
The hypothesis on the significant difference between the net returns of the two marketing categories using the formula previously specified is tested thus

$$SD^2Y_1 = \Sigma \left[\frac{Y_{1i} - Y_1}{n_1 - 1} \right]^2 = \frac{(14{,}590.64 - 141{,}269.56)^2}{30 - 1}$$

$$= 553,\, 363,\, 750.8$$

$$SD^2Y_2 = \Sigma \left[\frac{Y_{2i} - Y_2}{n_2 - 1} \right]^2 = \frac{(9{,}376.4 - 55744.76)^2}{30 - 1}$$

$$= 74,\, 138,\, 786.52$$

Having computed the values for the variances, the calculated and tabulated t values respectively were computed and the result is presented in Table 4. The table shows that a calculated t value of 18.70 and a tabulated t value of 1.67 at 5% level of statistical significance were obtained. Since the t calculated (t-cal) is greater than the t tabulated (t tab), the alternative hypothesis (Ha) that a significant difference exists in the net revenue of the fresh fish and the dried fish marketers in the area is accepted. The higher net marketing revenue recorded by the fresh fish marketers was statistically significant and not a chance effect.

Before proceeding, the ordinary least squares multiple regression of aggregate (both fresh and dried) fish marketers is computed and the result is presented in Table 5. The result of Table 5 will be used in testing the hypothesis for differences in regression parameters of the two marketing categories.

Hypothesis test for differences in regression parameters of the two marketing categories was conducted and the result is presented in Table 6. In carrying out the test, the unexplained variations of the fresh fish ($e^1{}_2$) and the dried fish ($e^2{}_2$) marketers in the area were obtained by subtracting the R^2 values of their lead equations, in Tables 2 and 3 respectively, from 1; while the unexplained variation of the pooled function ($e^2{}_{p)}$ was computed by subtracting the R^2 value, of the exponential functional form in Table 5, from 1.

As Table 6 shows, the tabulated F value is greater than the Chows F ratio (F*). The null hypothesis that the regression coefficients of the fresh fish marketers are not statistically different from those of the dried fish marketers in the area is, therefore, accepted. The differences recorded in their regression coefficients in Tables 2 and 3 were, therefore, chance effects.

If there were a significant difference in the functional relations of the fresh fish and the dried fish marketers, the next logical step would have been to conduct a structural stability test in order to determine the coefficients that differ between the two functional relations or to determine whether the difference was due to changes in the intercept (b_0) or slope (b_1) or both (Chow 1960).

4. Conclusion

The study analyzed the nature, magnitude and direction of the determinants of net marketing returns of fresh fish and dried fish marketers respectively in Anambra state, southeast Nigeria as well as determine which of the enterprises is more profitable. The results show that cost of fish, cost of storage and market levy and depreciation cost of marketing equipment were the statistically significant exogenous variables that influence the net revenue of the fresh fish marketers in the area; while cost of fish, rent for storage and market levy, as well as cost of packaging are variable that influence the net revenue of dried fish marketers in the area. The fresh fish marketers made higher net revenue relative to the dried fish marketers and a t-test conducted confirm that a significant difference actually exist in their net revenue while Chow test conducted show that the regression parameters of the two marketing categories do not differ significantly from each other.

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Table 1: Marketing margin and average cost and returns analysis of fresh fish and dried fish marketers in Anambra state

	Fresh Fish marketers	Dried fish marketers
Items	Total value (₦)	Total value (₦)
Total revenue	141,269.56	55,744.76
Variable costs		
Cost of fish	120,773.92	42,961.92
Transportation cost	2,391.32	1,302.84
Packaging cost	1,987.87	1,144.76
Other marketing cost	600.00	-
Total variable cost	125,753.08	45,409.52
Net marketing margin	15,516.48	10,335.24
Fixed cost		
Rent/market levy	919.57	949.62
Depreciation cost	6.27	9.22
Total marketing cost	126,678.92	46,368.36
Net return	14,590.64	9,376.40
Benefit cost ratio	1.12	1.20
Marketing margin	14.51%	22.93%

Source: Field Survey Data, 2011

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Table 2: Results of regression analysis for fresh fish marketers in the area.

	Linear	Double-log	Semi-log	Exponential
Constant	40380.74 (1.51)	9.46 (1.48)	74301.76 (2.251)*	10.695 (3.786)*
Cost of fish (X_1)	-1.36 (-5.35)*	0.02 (0.08)	-8487.35 (-2.176)*	-0.001 (-1.735)*
Storage rent and market levy (X_2)	122.92 (12.45) *	2.06 (3.81) *	276.958 (-1.021)	-0.0004 (-1.395)
Cost of packaging (X_3)	-3.40 (-1.39)	-0.31 (-0.52)	209.861 (0.400)	0.007 (2.326)*
Depreciation cost of marketing equipment (X_4)	-2.74 (-3.66) *	-1.07 (-1.58)	34.14 (0.401)	0.005 (1.804)*
Transportation cost (X_5)	0.74 (0.69)	0.007 (0.03)	-277.079 (-0.882)	-0.004 (-1.245)
R^2	0.9621	0.8127	0.7541	0.7927
Rc	0.9809	0.9015	0.8684	0.8903
F-Value	121.84	20.83	14.72	18.36
N	30	30	30	30
Standard Error	32107.17	0.8987	81779.22	0.9455

Figures in parentheses are the t ratios

Source: Field Survey Data, 2011

* = significant at 0.05 (5 percent) level of statistical significance

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Table 3: Results of regression analysis for dried fish marketers in the area.

	Linear	Double-log	Semi-log	Exponential
Constant	-43206.80 (-3.36) *	16.36 (3.35) *	1755613 (3.24) *	7.19 (15.37)*
Cost of fish(X_1)	0.027 (0.498)	1.10 (2.74)*	55989.13 (1.26)	0.07 (2.39)*
Storage rent and market levy(X_2)	0.939 (!.536)	2.70 (5.15) *	279266.4 (4.81) *	0.008 (5.03)*
Cost of packaging (X_3)	1.142 (0.356)	-2.01 (-2.96) *	-300124 (-3.99) *	1.43 (2.01)*
Depreciation cost of marketing equipment(X_4)	-0.073 (-0.026)	0.05 (0.22)	66692.34 (2.68)*	-0.0002 (-3.53)*
Transportation cost (X_5)	1.935 (0.595)	-0.12 (0.69)	-52299.6 (-2.73) *	1.02 (1.54)
R^2	0.9797	0.8557	0.7190	0.8305
Rc	0.9898	0.9250	0.8479	0.9113
F-value	231.89	28.46	12.28	23.51
N	30	30	30	30
Standard Error	23485.57	0.7889	87420.66	0.86

Figures in parentheses are the t ratios

* implies that the t ratios are significant at 0.05 level

Source: Field survey data, 2011

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Table 4: Computation of t-values

Value of Parameters	t-values
$Y_1 = 14\,590.64$	$t_{cal} = \dfrac{141\,269 - 55\,363\,750.8}{\sqrt{\dfrac{29(553\,363\,750.8) + 29(74\,138\,786.52)\,(1/15)}{(30 + 30) - 2}}}$
$Y_2 = 9\,376.40$	
$\bar{Y}_1 = 141\,269.56$	
$\bar{Y}_2 = 55\,744.76$	$= \dfrac{85\,524.80}{4\,573.48}$
$n_1 = n_2 = 30$	
$SD^2Y_1 = 553\,363\,750.8$	$t_{cal} = 18.70$
$SD^2Y_2 = 74\,138\,786.52$	t_{tab} at $\{n1 + n2\}$-2 df = t_{tab} at 58 df
	$t_{0.05} = 1.67$

Source: Field Survey Data, 2011

Table 5: Regression Results of Revenue of Aggregate Fish Marketers

Variables	Linear	Exponential	Double-log	Semi-log
Constant	-31439.2	8.30	3.75	70301.3
(Intercept)	(-1.99) *	(33.02) *	(1.47)	(0.24)
Cost of fish (X_1)	-1.50	3.18 -	0.24	-33290
	(-3.11)	(0.41)	(-2.72) *	(-3.22) *
Storage rent and	132.48	0.001	1.37	98080.28
Marketing levy (X_2)	(8.03)	(3.18)*	(6.06) *	(3.74) *
Packaging cost	1.74	2.15	0.04	-41305
(X_3)	(7.66) *	(5.99)*	(0.19)	(-1.66)
Depreciation cost of	-1.60	1.52	-0.26	2913.71
equipment (X_4)	(-1.29)	(0.77)	(-1.08)	(0.105)
Transportation cost	-0.85	1.55	0.21	5146.83
(X_5)	(-1.82)*	(0.21)	(1.45)	(0.31)

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R^2	0.7946	0.6730	0.7675	0.5062
Rc	0.8914	0.8204	0.8761	0.7114
F-value	41.79	22.23	35.65	11.07
Sample size (N)	60	60	60	60
Standard error	70462.75	1.1196	0.944	109267

Figures in parentheses are the t ratios

The symbol * implies that the t ratios are significant at 0.05 level

Source: Field Survey Data, 2011

Table 6: Computation of Chows F-ratio (F*)

Values of parameters	F values
$e^1_2 = 0.21$	$F^* = \dfrac{\{0.23 - (0.21 + 0.14)\} / 6}{(0.21 + 0.14) / (60 - 12)}$
$e^2_2 = 0.14$	
$e^2_p = 0.23$	$= \dfrac{-0.12 / 6}{0.35 / 48} = \dfrac{-0.002}{0.0073}$
$n_1 = n_2 = 30$	
$K = 6$	$F^* = -2.74$
	$Fv_1 = K = 6$
	$Fv_2\ (n_1 + n_2) - 2K = (30 + 30) - 2(6)$
	$= 60 - 12 = 48$
	$Fv_1 = 2.34$
	v_2

Source: Field Survey Data, 2011