

ANALYSIS OF PRICE SPREAD AND SPATIAL INTEGRATION AMONG CATFISH VALUE CHAIN ACTORS IN SOUTH-SOUTH, NIGERIA

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Abstract

The study examined the determinants of net income of catfish value chain actors in South-South, Nigeria. Specifically, the study determined the costs, returns, and marketing efficiency of catfish value chain actors and estimated the determinants of net income of catfish value chain actors. The study population comprised all producers (60), processors (60), and marketers (60) of catfish in the South-South States of Nigeria. Giving a sample size of 180 respondents which was selected using a multistage sampling technique. Data were analyzed using descriptive statistics, a price spread formula, and a correlation coefficient. Results showed that Catfish value chain actors were middle-aged, educated, experienced, and obtained credit mainly from families/friends. Catfish marketers recorded the highest price spread, implying that they sell their products at a significantly higher price than what they paid for them. The strongest correlation was observed between marketer prices in urban and rural markets (0.8770), implying that price changes in one market influenced prices in other markets. Therefore, there was efficient market operation with little to no price distortion in the study area. The study recommended that government and non-governmental organizations should train catfish producers and processors to improve their marketing strategies and increase their price spreads and profitability.

Keywords: Producers, processors, marketers, correlation, market integration

Introduction

Fish are aquatic vertebrates distinguished by their streamlined bodies, fins for propulsion, and gills for breathing. It is a highly nutritive animal food consumed by people of different socio-economic status (Nwuba, 2022). Throughout history, humans have used fish as a food source for dietary protein. Catching fish for food or sport is known as fishing, while the organized effort by humans to catch fish is called a fishery (which also describes the area where such enterprise operates) (OECD, 2020). Every day, fish is provided for hundreds of millions of people worldwide by the fisheries and aquaculture sector. The sector employs more than half a billion people worldwide. In Nigeria alone, over 1.477.651 people were reported to be working in the industry in 2018 (WorldFish, 2022). Although Nigeria is the largest consumer of fish products in Africa, the output from captured fishes is far below the country's demand (Agom & Okon, 2024).

Fish production, processing, and marketing are significant to the Nigerian economy given their importance in providing a cheap source of food/nutrition security, income, and employment and serve as a source of foreign exchange particularly those of the riverine communities (NBS, 2017). The fisheries sector contributed 1.09% GDP of the country's total GDP in the year 2020 and 0.9% in the Q3 of 2021 (NBS, 2022). The Nigeria fishery sectors produced 5.79 million tonnes of fish between 2010 and 2014 and 6,861,700 tonnes of fish between 2015 and 2020 (Directorate of Agriculture and Rural Development–ECOWAS Commission, 2020).

Catfish marketing is a range of activities aimed at creating, communicating, delivering, and exchanging value for catfish to fulfil the needs and wants of customers (FAO, 2022). Market integration refers to the extent to which different economic agents such as businesses, consumers, and investors are interconnected and operate in a unified or integrated manner within a particular market

or across multiple markets (Offor *et al.*, 2022). It involves the free flow of goods, services, capital, and information across geographical or institutional boundaries. The fundamental process of market integration known as price transmission, takes place when a shift in one market's price influences a shift in another market's price. There are primarily two types of market integration: vertical market integration and spatial market integration.

Spatial market integration is the transmission of price signals between markets in different locations, whereas vertical market integration refers to the transmission of price signals from one marketing channel to another (Offor *et al.*, 2020). The study of spatial price efficiency looks at the relationships between homogenous produce prices across markets and space, particularly transportation costs. Spatial integration /efficiency permits distant places to absorb excess local supply preventing excessive price falls that would otherwise hurt the profitability of catfish marketers (Offor *et al.*, 2020). Strengthening linkages between producers, processors, and markets over space and time can create a more integrated and efficient catfish value chain.

A value chain is a business model that describes the full range of activities needed to create a product or service. The catfish value chain links the movement of catfish from the farmers to the consumers, including input suppliers, production, processing, marketing, and finance (Obot *et al.*, 2021). Catfish value chains are segmented into pre-farm-gate value chains and post-farm-gate value chains. The former implies broodstock providers, catfish hatchery operators, feed producers, and farmers. The latter encompasses wholesalers, processors, and retailers (Tran *et al.*, 2021).

To the best of the researchers' knowledge, studies on the analysis of price spread and spatial integration among catfish value chain actors in South-South, Nigeria are limited. The available studies focused on economic analysis of the Nigerian fisheries sector (Odioko & Becker, 2020); Current trends in fisheries and aquaculture (Nwuba *et al.*, 2022), and the value chain of catfish products in Ibadan Metropolis, Oyo State, Nigeria (Oluwafemi *et al.*, 2023). The present study filled this research gap.

Specifically, this study examined the socioeconomic characteristics of catfish value chain actors in South-South, Nigeria; identified the catfish value chain actors; assessed the price spread among them; and examined the degree of market integration between different spatial markets in South-South, Nigeria

Methodology

The Study Area

The study was conducted in the South-South States of Nigeria which comprises Akwa-Ibom, Bayelsa, Cross Rivers, Delta, Edo, and Rivers States. It is located within Latitude 6.2059° N and Longitude 6.6959° E of the Greenwich Meridian. South-south covers an area of 84,587 km² and has a coastline spread of over 540km with an estimated population of 28,829,288 people (National Bureau of Statistics (NBS), 2018). The area is bordered to the South by the Atlantic Ocean and to the East by Cameroun (Edoumiekumo *et al.*, 2014). The climate is tropical and humid with heavy and abundant rainfall. The annual rainfall is usually above 2,000 mm. Over 4,000 mm of rainfall is received in the coastal part around the Niger Delta area. It is characterized by two high rainfall peaks, with a short dry season and a longer dry season falling between and after each peak. People in the region are predominantly farmers. Yam, cassava, cocoyam, plantains, oil palms, and bananas are the main crops grown by the farmers. The inhabitants participate in catfish milling, lumbering, palm wine tapping, local gin making, trading, carving, and weaving (Nwankwo *et al.* 2018). The people rear livestock like poultry, goats, and sheep among others, and they also engage in fishing as one of their major economic activities. The most important mineral in the area is petroleum (Edoumiekumo *et al.*, 2014).

Sampling Procedure and Sampling Size

The study population comprised all catfish producers, processors, and marketers in the South-South States (Akwa-Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers) of Nigeria. The sample size of this study was 180 respondents (60= producers, processors= 60, and marketers= 60). A multistage sampling technique was used to select the respondents. Stage 1 involved random selection of 3 states (Akwa Ibom, Cross River, and Rivers) out of

the 6 states in the South-South, Nigeria. Stage II entailed the random selection of 5 L.G.A., from each of the selected States, thus making a total of 15 LGAs. Stage III entailed the random selection of 2 communities from each of the selected LGAs, thus making a total of 30 communities. At stage IV, lists of all catfish producers, processors, and marketers were formed with the help of community leaders and key informants. From the list, 1 urban and 1 rural catfish producer, processor, and marketer respectively were randomly selected from the selected communities, giving a total of 180 respondents.

Analytical Technique

Objective i was analysed using descriptive statistics like frequencies, means and percentages.

Objective ii was analyzed with the price spread formula as follows:

$$\text{Price Spread (PS)} = P_{\text{sale}} - P_{\text{purchase}} \dots\dots\dots 1$$

P_{sale} = Sale price at a given stage

P_{purchase} = Purchase price from the previous stage

Objective iii was analyzed with Pearson correlation coefficient as follows:

$$Pr = \frac{n \sum P1tP2t - (\sum P1t)(\sum P2t)}{\sqrt{\{n \sum P1t^2 - (\sum P1t)^2\} \{n \sum P2t^2 - (\sum P2t)^2\}}} \dots\dots\dots 2$$

Where;

Pr = correlation coefficient of the degree of market integration between different spatial markets in South-South,

P1t = Price of catfish in urban market

P2t = Price of catfish in rural market

Decision rule: The size of this coefficient and its significance shows the level of inter-market dependence. A correlation coefficient (r) greater than 0.8 signifies a strong correlation when r falls between 0.6-0.8, it is regarded as a moderate correlation while a correlation coefficient (r) less than 0.6 is regarded as a weak correlation.

Results and Discussion

Socioeconomic characteristics of catfish value chain actors

Results of the age distribution of catfish value chain actors showed that the mean age of

catfish producers was 47 years while the marketers and processors were 46 and 43 respectively. This implies variation in the mean age of catfish value chain actors in the study area. This aligns with a report by Enwelu *et al.* (2023) that found out that in Anambra State Nigeria, catfish producers had a mean age of 47 years. More so, this finding also implies that the catfish value chain actors in the study area are middle-aged, with catfish producers having more experience than the processors and marketers. Higher experience could enhance their investment decision-making skills; hence, they would manage risks better, potentially increasing their productivity and profitability. In addition, catfish marketers had a lower mean age compared to catfish producers. This suggests that, in the study area, younger catfish marketers could adapt easily to market trends and are well-placed to embrace innovation to attain higher efficiency and profit margins. Oluwatoyin *et al.* (2019) reported a mean age of 41 years for catfish marketers in Ondo State. Nevertheless, among the various groups along the catfish value chain within the region, processors were observed as the youngest. It follows that they have the potential and physical ability to carry out strenuous tasks that are involved in the processing of catfish. Catfish processors being younger than marketers and producers may readily accept dynamic methods of catfish processing which may enhance their profitability prospects.

Most of the catfish value chain actors in the study area were males. This implies that catfish value chains in the study are male-dominated enterprises. It could also mean that catfish value chain activities in the study area are gender sensitive. This report is in tandem with Oluwatoyin *et al.*, (2019) who reported that catfish marketing in Ondo State, Nigeria is a male-dominated enterprise. The male dominance in catfish-producing enterprises could imply increase access to land, capital, and other resources necessary for catfish farming. Also, catfish processing and marketing were male-dominated. Men in processing roles may have more control over key resources such as processing facilities and networks, giving them a competitive edge in the market.

The majority (60.00%) of the catfish producers and 71.67% of the marketers were married while 55.00% of the catfish processors were single. This finding is in tandem with Igwe *et al.*, (2021) that catfish marketers in Anambra State Nigeria are married. The result showed distinct patterns of involvement in the catfish value chain based on marital status in the study area. The higher percentage of married individuals among catfish producers and marketers in the study area is a pointer to the fact that catfish production and marketing are more stable, family-oriented ventures. As expected, marriage comes with responsibility

and could imply greater financial stability and access to family labor. This might have pushed the producers and marketers to invest more in their enterprises. On the other hand, the majority (55.00%) of the processors were single, implying that younger individuals, less established, and those in the early stages of their careers are attracted to catfish processing in the study area. Of course, single individuals, especially younger or less financially established, may find it easier to enter processing because it involves fewer financial risks and lower overhead costs (Oluwatoyin *et al.*, 2019).

Table 1: Socioeconomic characteristics of catfish fish value chain actors

Variable	Producers (n=60)		Processors (n=60)		Marketers (n=60)	
	Freq.	%	Freq.	%	Freq.	%
Age (years)						
20 – 29	14	23.33	15	25.00	18	30.00
30 – 39	21	35.00	22	36.67	20	33.33
40 – 49	17	28.33	22	36.67	15	25.00
50 – 59	8	13.34	1	1.67	7	11.67
Mean	47		43		46	
Sex						
Male	38	63.33	42	70.00	50	83.33
Female	22	36.67	18	30.00	10	16.67
Marital status						
Single	24	40.00	33	55.00	17	28.33
Married	36	60.00	27	45.00	43	71.67
Education						
No schooling	0	0.00	0	0.00	3	5.00
FSLC	0	0.00	0	0.00	7	11.67
SSCE	18	30.00	5	8.33	10	16.67
NCE/OND	22	36.67	15	25.00	30	50.00
Degree/HND	20	33.33	32	53.33	5	8.33
M.Sc/Ph.D	0	0.00	8	13.00	5	8.33
Mean	14		16		15	

Source: Field survey, 2024.

Most catfish producers and processors in the study area are educated while 5.00% of the catfish marketers in the study area are illiterate. This showed the varying educational demands and skill sets required in the catfish value chains in the study area. This finding corroborates with Enwelu *et al.*, (2023) who reported that most catfish producers in Anambra State, Nigeria are educated. Education is pivotal to catfish production due to the technical knowledge required for

successful catfish production. Of course, those in the production line need to understand modern production practices, water quality management, fish health monitoring, feed formulation, and business management to produce efficiently, which are promoted by education. Concerning the catfish processors, education can guide them in adopting efficient and hygienic processing methods like cleaning, smoking, frying, cooking, and packaging. It could also inform them about food regulations,

quality controls, and food safety measures that could enable them to produce high-quality products that meet market demands. However, 5.00% of the catfish marketers are illiterate. This finding contradicts Hussayn *et al.*, (2021) who reported that most catfish marketers in Lagos State, Nigeria are educated. The fact that 5.00% of catfish marketers are illiterate in

The mean household size of the catfish marketers (6 persons) was higher than that of processors (5 persons) and producers (3 persons). The mean household of 6 persons among the catfish marketers in the study area is slightly higher than the mean household size of catfish marketers in Lagos State, Nigeria (Hussayn *et al.*, 2023). A mean household size of 6 persons recorded among the marketers indicates that they are financially better positioned to support larger families. Their household size could provide them with more hands, allowing family members to assist in various marketing activities such as transporting, selling, or managing stock. This availability of labor can enable them to reduce costs associated with hiring external labor and could make them more efficient and profitable. The results also showed that the household size of the catfish processors falls between that of marketers and the producers, which could indicate that processing catfish, though labor-intensive, provides a moderate income that supports medium-sized families. For catfish producers, the smaller household size (3 persons) has direct implications on their productivity and profitability, particularly in terms of labor costs, availability, and affordability. Enwelu *et al.*, (2023) reported a mean household size of 7 persons among catfish producers in Anambra State, Nigeria, which is larger than the mean household size observed among the respondents in this study. Since catfish production requires significant time and labor for tasks such as feeding, water quality management, and stock monitoring, having a smaller household may limit the availability of family labor to assist with these tasks. Without enough family members to share the workload, producers might face challenges in maintaining consistent productivity. The small household size especially among the catfish producers might force them to rely more heavily on external labor, which can increase their operational costs.

the study area suggests that they employ interpersonal skills, local knowledge, and informal market strategies in carrying out their marketing activities. Moreover, the marketers may have relied on traditional methods, personal connections, and practical experience, which can compensate for the lack of formal education in this role.

Catfish processors and marketers in the study had the same average years of experience (5 years) in the study area while that of catfish producers was 3 years. This finding is in tandem with Oluwatoyin *et al.*, (2019) who reported that the mean household size of catfish marketers in Ondo State, Nigeria was approximately 5 years but contradicts the report of Chiekezie *et al.*, (2022) who reported that the mean household size of catfish producers in South Eastern Nigeria was 21 years. However, 3 years of experience implies that the catfish producers are relatively new to the business. Their limited experience in catfish production could affect their pricing strategies and profit. Because they have a weak grasp of market dynamics and cost structures and may struggle to set competitive prices. For the catfish processors and marketers, 5 years of experience implies that they may have developed a good level of expertise in their enterprises. This experience may likely influence their techniques for processing and marketing catfish, leading to better product quality and efficiency. It could promote the drying, smoking, and packaging skills of the processors, resulting in higher processing standards and potentially greater profit. Experienced processors and marketers are generally better equipped to negotiate prices and set competitive rates.

The distribution of the respondents by the amount of credit received showed that the mean amount of credit (₦1,004,000) received by catfish processors was higher than that of the producers (₦838,666.70) and marketers (₦607,101.70) in the study area. This finding contradicts the report of Omodara *et al.*, (2021) that the average amount of credit received by small-scale, medium-scale, and large-scale catfish value chain actors in Nigeria were ₦2,105,000.00, ₦6,333,333.33 and ₦20,666,666.67 respectively. The disparity in the credit amount received by the actors could be attributed to how secure their business is, the nature of their activities, the financial

requirements of their businesses, and potential profitability. Catfish processing typically involves significant capital investment in equipment and facilities for tasks such as smoking, drying, and packaging. These investments require substantial funding, which might explain why processors receive more credit. The higher amount of credit allows

processors to purchase and maintain the necessary equipment, ensure high-quality processing, and manage operational costs. This financial support is crucial for processors to scale their operations, improve efficiency, and meet market demand effectively. Conversely, catfish producers and marketers received relatively lower profits in the study area.

Table 1b: Socioeconomic characteristics of catfish fish value chain actors

Variables	Producers (n=60)		Processors(n=60)		Marketers (n=60)	
	Freq.	%	Freq.	%	Freq.	%
Household size						
1-3	31	51.67	19	31.67	11	18.33
4-6	29	48.33	25	41.67	42	70.00
7-10	0	0.00	12	26.66	7	11.67
Mean	3		5		6	
Experience						
1 – 3	37	61.67	21	35.00	28	46.67
4 – 6	23	38.33	19	31.67	21	35.00
7 – 10	0	0.00	20	33.33	11	18.33
Mean	3		5		5	
Credit amount Obtained						
No credit obtained	49	81.67	30	50.00	26	43.33
<1,000,000	0	0.00	16	26.67	16	26.67
1,000,000-2999,999	2	3.33	4	6.67	10	16.67
300,000,000 and above	9	15.00	10	16.66	8	13.33
Mean	838,666.70		1,004,000		607,101.70	
Sources of credit						
Commercial banks	1	1.67	6	10.00	4	6.66
Microfinance	9	15.00	7	11.67	12	20.00
Cooperatives	10	16.67	20	33.33	22	36.67
Family/friends	40	66.66	27	45.00	22	36.67

Source: Field survey, 2024.

The distribution of the respondents by sources of credit showed that most of the respondents obtained credit from family/friends in the study area. This finding contradicts Okidim & Obe-Nwaka (2021) who reported that most catfish value chain actors obtained credit from cooperative societies in Rivers State, Nigeria. However, the fact that most of the respondents relied on family/friends, and informal sources of credit like families/friends further suggests that a significant portion of the respondents

had limited access to formal financial services in the study area. This could be attributed to the fact that family/friends are often more accessible and flexible compared to formal financial institutions. Obtaining credit from personal connections usually involves less paperwork, quicker approval processes, and more lenient terms. In contrast, formal credit sources typically have stringent requirements, lengthy application processes, and collateral demands, which can be challenging for

individuals with limited assets. Formal credit sources often charge higher interest rates and require strict repayment schedules, which can

Catfish value chain actors and price spread among them

Catfish producers accounted for 31.18% of the total price spread in the study area. On the other hand, catfish processors accounted for 32.31% of the total price spread. This relatively lower price spread might reflect their role in adding value through processing, which could include cleaning, washing, cooking, frying, filleting, or packaging. Their higher average sale price compared to the purchase price indicates a value addition, which aligns with their role in transforming raw catfish into finished products. Also, catfish marketers contributed 36.51% to the total price spread in the study area. This result

be burdensome for small-scale producers, processors, or marketers.

corroborates with Oluwafemi *et al.*, (2023) who reported that catfish marketers in Ibadan Metropolis, Oyo State recorded the highest total price spread. Comparing the price spreads, catfish marketers have the highest contribution to the total price spread (36.51%), followed by the processors (32.31%) and marketers (31.18%). This suggests that catfish marketers provided the most value in the catfish value chain in the study area, which may be due to their strategic role in the distribution process. It could also be attributed to the roles they play in linking catfish producers and consumers such as transportation, storage, and marketing of catfish in various rural and urban markets in the study area

Table 2: Catfish value chain actors and price spread among them (n=180)

Catfish value chain actors	Average purchase price (₦)	Average sale price (₦)	Price spread (₦)	% Spread contribution
Producers	-	2,510.67	2,510.67	31.18
Processors	2,518.08	5,120.22	2,602.14	32.31
Marketers	2,610.00	5,550.07	2,940.07	36.51
Total			8,052.88	100

Source: Field Survey, 2024

Degree of market integration between different spatial markets

The strongest correlation was observed between marketer prices in urban and rural markets (0.8770), indicating a close alignment of marketer pricing strategies across locations. This finding implies that price changes in one market are quickly and proportionally reflected in the other, implying efficient market operation with little to no price distortion in the study area. This finding corroborates with the Law of One Price (LOP), which states that in the absence of transportation costs and market frictions (like

taxes, tariffs, or monopolistic behavior), the price of a homogeneous good should be the same in different markets (Kamal & Khan, 2022). Also, producer prices in the urban market correlated strongly with the marketer prices in urban (0.8508) and rural markets (0.7495), suggesting that a change in the producer's price in urban markets significantly influences marketer pricing decisions. However, rural and urban market price linkages are less pronounced, which could indicate inefficiencies in market integration between rural and urban areas.

Table 3: degree of market integration between different spatial markets

	Produce price in urban market	Produce price in rural market	Processor price in urban market	Processor price in rural market	Marketer price in urban market	Marketer price in rural market
Produce price in urban market	1.0000					
Produce price in rural market	0.4215	1.0000				
Processor price in urban market	0.5684	0.3249	1.0000			
Processor price in rural market	0.7915	0.2034	0.4609	1.0000		
Marketer price in urban market	0.8508	0.2330	0.5056	0.7219	1.0000	
Marketer price in rural market	0.7495	0.1745	0.4141	0.6236	0.8770	1.0000

Source: Field Survey, 2024

Conclusion

Catfish value chain actors were middle-aged, educated, experienced, and obtained credit mainly from families/friends. Catfish marketers recorded the highest price spread, implying that they sell their products at a significantly higher price than what they paid for them. The strongest correlation was observed between marketer prices in urban and rural markets (0.8770), implying that price changes in one market are quickly and proportionally reflected in the other. Therefore, there was efficient market operation with little to no price distortion in the study area.

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Recommendations

Based on the findings and conclusion of this study, the following recommendations were proffered; Government and non-governmental organizations should provide training for catfish producers and processors to improve their marketing strategies, increase their price spreads and profitability. Government and non-governmental organizations should also improve access to credit for all catfish value chain actors, by creating partnerships with financial institutions to offer loans.

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