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Market participation and commercialization intensity of small-scale broiler farmers in Ondo State, Nigeria

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ABSTRACT

This study explored the determinants of market participation and the level of commercialization among small-scale broiler farmers in Owo Local Government Area of Ondo State, Nigeria. Specifically, the study analysed among other things, factors influencing participation decisions and the proportion of broiler sales by broiler farmers. A multistage sampling procedure was used to select 64 broiler farmers from six purposively chosen communities. Data were collected through structured questionnaires and analysed using a Household Commercialization Index (HCI).While the Heckman two-stage selection model was employed to determine factors influencing participation decisions and the extent of participation. Findings showed that 45% of farmers were market-oriented, while 55% operated below the commercialization threshold. Market participation was positively influenced by education, cooperative membership, vehicle ownership, access to market information, and full-time farming status, whereas age and marketing experience had negative effects. On proportion of broiler sales, significant variables included education, household income and flock size. The positive inverse Mills ratio indicated sample selection bias, thus validating the use of the Heckman model. These findings suggest that improving farmer education, transport access, and cooperative engagement could enhance commercialization and profitability in small-scale broiler farming.

KEY WORDS: *Broiler production*; *Market access*; *Commercialization index*; *Agribusiness*

1. Introduction

The contribution of livestock to Nigerian agricultural sector cannot be overemphasized. It plays a critical role in the provision of food, income and employment. Livestock generates about $34 billion to Nigerian economy in 2024, thus making it fifth position.

In the livestock subsector, poultry production, particularly broiler farming, has gained prominence due to its short production cycle, low start-up capital, and high consumer demand for poultry meat. Broiler production is known for its meat production, and it is commonly practiced across Nigeria without religious or cultural limitations, making it an attractive agribusiness

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opportunity for small-scale farmers (Adeyonu *et al*., 2021).

Despite all these economic advantages, the poultry subsector is being faced with several challenges in developing countries, including Nigeria. Some of these challenges are documented in the literature as limited access to credit, high cost of input, inadequate technical knowledge, weak extension services, poor transport infrastructure, and inefficient market linkages (Adeyonu *et al*., 2021; Machuki *et al*., 2025).

Consequently, many broiler farmers operate at subsistence or semi-commercial levels, with limited engagement in output markets. While poultry production has increased over the years, the level of market participation among small-scale broiler farmers remains relatively low.

Market participation is critical for transforming subsistence agriculture into a market-oriented system capable of improving farmers' incomes and livelihoods. Participation in output markets enables farmers to benefit from economies of scale, access price incentives, and integrate into value chains. However, farmers' decisions to participate in markets are influenced by a combination of socioeconomic, institutional, and infrastructural factors (Rantlo & Bohloa, 2022; Lekhisa & Muroyiwa, 2024; Rondhi *et al*., 2020). In the context of broiler farming, these factors may include education, experience, access to market information, transport facilities, cooperative membership, and scale of production.

Previous empirical studies on poultry enterprises in Nigeria focused on profitability, technical efficiency, and production constraints, with limited attention given to market participation behaviour and its intensity. Moreover, studies that jointly analyze participation decisions and the extent of participation while accounting for sample selection bias are scarce. This gap limits the understanding of factors that drive commercialization among broiler farmers.

Against this background, this study investigates market participation and the intensity of commercialization among small-scale broiler farmers in Ondo State, Nigeria. Specifically, it examines the determinants of market participation decisions and the factors influencing the extent of participation using the Heckman two-stage selection model. The study contributes to the literature by providing empirical evidence on broiler market participation and offers policy-relevant insights for promoting commercialization in the poultry subsector.

One of the major pathways of achieving a Sustainable Development Goals (SDGs). is by supporting market participation among small-scale livestock producers. Specifically, improved commercialization of broiler production contributes to SDG 2 (Zero Hunger) by enhancing the availability of affordable animal-source protein and increasing the productivity and incomes of smallholder farmers. By improving market integration and production efficiency, broiler agribusiness also supports more sustainable food systems in developing countries.

2. Materials and Methods

A multistage sampling procedure was employed to select respondents for the study. In the first stage, six communities: Owo, Emure, Uso, Iyere, Upemen, and Epele were purposively selected based on their high involvement in broiler production. In the second stage, a snowball sampling technique was adopted to identify broiler

farmers within the selected communities, given the absence of a comprehensive sampling frame. This approach was considered in order to locate active broiler producers in the study area.

A total of two hundred and seventy-four (274) broiler farmers were initially contacted. However, only two and sixty-four (264) questionnaires were found to be adequately completed and were therefore used for the analysis. Primary data were collected using a structured questionnaire covering socioeconomic characteristics, production and marketing information, access to services, and institutional factors.

2.1 Analytical techniques

Descriptive statistics

Descriptive statistics such as means, percentages, and standard deviations were used to summarize the socioeconomic characteristics of broiler farmers.

Household commercialization index

The level of broiler market participation was measured using the Household Commercialization Index (HCI), following Govereh *et al.* (1999). The index is defined as the ratio of the quantity of broilers sold to the total quantity produced, expressed as a percentage:

$$HCI_i = \frac{\text{Quantity of broilers sold}}{\text{Quantity of broilers produced}} \times 100 \quad \text{------(1)}$$

Farmers with an HCI of 60% and above were classified as market participants, while those below 60% were classified as non-participants.

Heckman two-stage selection model

The Heckman two-stage selection model (Heckman, 1979) was employed to identify factors influencing participation and the extent of participation in broiler marketing. The model corrects for potential sample selection bias arising because the proportion of broilers sold is only observed for households that participate in the market.

The model involves two steps:

Step 1: Selection equation

A probit model was used to estimate the probability that a household participates in broiler marketing:

$$Z_i^* = \alpha X_i + u_i \mu_i \sim N(0, \sigma^2) \quad \text{----------(2)}$$

where Zi is the latent level of utility of the small-scale broiler farmers received from participating in the market, $u_i \sim N(0, 1)$ and

$$Z_i = 1 \; if Z^*_i > 0$$

$$\text{Zi} = \begin{cases} 1, \text{ if } Z_i^* > 0 \\ 0, \text{ if } Z_i^* \leq 0 \end{cases} \quad \text{----------(3)}$$

Where,

Z_i = 1 if household $i$participates, 0 otherwise
Z_i^*= latent utility from participation
X_i= vector of explanatory variables influencing participation
α= vector of coefficients
u_i= error term

Step 2: Outcome equation

For households that participate, the proportion of broilers sold (Y_i) was modeled using OLS with an inverse Mills ratio (λ_i) to correct for selection bias:

$$Y_i = \beta X_i + \gamma \lambda_i + \mu_i \quad \text{----------(4)}$$

Where:
Y_i= proportion of broilers sold
X_i= vector of explanatory variables affecting the quantity sold
β= vector of coefficients
λ_i= inverse Mills ratio
$\mu_i \sim N(0, \sigma^2)$

The Heckman two-step procedure ensures unbiased and consistent estimates of factors affecting both participation and the extent of broiler marketing.

3. Results and Discussion

3.1 Socioeconomic characteristics of broiler farmers

The average age of broiler farmers was 50 years, indicating that most respondents were middle-aged and economically active. Approximately 65.6% of the respondents were male, reflecting male dominance in broiler production, possibly due to higher access to resources and capital. The mean household size was four persons, while the average marketing experience was eight years (**Table 1**).

In terms of education, a substantial proportion of respondents had formal education, with many respondents attaining tertiary education. This suggests a relatively educated farming population, which is expected to positively influence decision-making and market orientation. The average farm size was 0.31 hectares, confirming that broiler production in the area is predominantly small-scale. About 60.9% of respondents were full-time farmers, while the remaining 39.1% combined farming with other occupations.

3.2 Household commercialization index

The results of the household commercialization index showed that 45.3% of respondents were market-oriented, while 54.7% exhibited low levels of commercialization (**Table 2**). This indicates that although broiler production is widespread in the study area, a majority of farmers still operate at subsistence or semi-commercial levels, with limited engagement in output markets. Increased commercialization of broiler production also has implications for SDG 3 (Good Health and Well-being) through improved availability of poultry meat, which is a key source of high-quality and affordable animal protein.

3.3 Determinants of market participation (first stage)

Market Participation Decision (Heckman Selection Equation)

Table 1: Socioeconomic Characteristics of Broiler Farmers (n = 64)

Variable	Description	Mean	Std. Dev.
Age (years)	Age of household head	50.2	9.8
Household size	Number of household members	4.1	1.6
Marketing experience (years)	Years of broiler marketing	8.3	4.5
Farm size (ha)	Size of production unit	0.31	0.18
Education (years)	Years of formal education	12.6	4.2
Flock size	Number of birds per cycle	215	96

Table 2: Household commercialization index distribution

Commercialization level	HCI (%)	Frequency	Percentage
Low commercialization	< 60	35	54.7
High commercialization	≥ 60	29	45.3
Total		64	100

Source: Field survey, 2025

Table 3 presents the results of the first-stage Heckman selection equation, which examines the factors influencing broiler farmer's decision to participate in the market. The model is statistically significant, as indicated by the Wald Chi-square value of 1055.11 ($p < 0.01$), suggesting that the explanatory variables jointly explain market participation. The estimated rho ($\rho = 1$) and a positive sigma (0.21) confirm the presence of sample selection bias, thus justifying the use of the Heckman two-stage model.

Age had a negative and statistically significant effect on market participation ($p < 0.10$), indicating that older farmers are less likely to participate in the broiler market, compare to younger ones who have a long-term horizon. This outcome is line with the findings of (Rondhi *et al.*, 2020; Olasore *et al*., 2023) who also found negative relationship between age and market participation.

However, the positive and significant coefficient of age squared ($p < 0.05$) suggests a non-linear (U-shaped) relationship which implies that participation initially declines with age but increases at higher age levels. The probable reason for this may be due to accumulation of market networks and capital among older farmers after an initial decline in physical capacity.

Similarly, the result shows that experience had a negative and significant influence on market

Table 3: First stage: Probit Model (Participation Decision)

Variable	(dy/dx)	Coef.	Std. err	Z
Constant	-	54.15**	31.83	1.7
Age	-8.3	-32.18**	18.12	-1.78
Age squared	1.31	5.09**	2.58	1.97
Experience	-4.31	-4.01**	1.55	-2.58
Age * Experience	-1.03	16.71***	6.24	2.68
Household size	-0.05	-0.21	0.89	-0.23
Gender	-0.13	-0.51	0.49	-1.03
Tertiary Education	0.57	7.88***	0.55	14.23
Vehicle Ownership	0.52	2.00***	0.71	2.8
Coop. membership	0.49	1.88***	0.715	2.63
Full-time farmer	0.09	0.35	0.521	0.67
Market information	0.32	1.23**	0.638	1.92
Rho		0.81		
Sigma		0.21		
Wald Chi^2 (14)		1055.11		
Prob> Chi^2		0.00		
No of Obs		64		

participation ($p < 0.01$). This result implies that more experienced broiler farmers may rely more on subsistence or informal sales channels. Similar outcomes were also found in Lesotho, Tanzania and Ethiopia on the effect of farmer's experience on market participation that involves a contract farming and volume of product sales (Kibona & Yuejie, 2021; Haile *et al*., 2022, Lekhisa & Muroyiwa, 2024).

However, the interaction between age and experience is positive and highly significant ($p < 0.01$), indicating that experience moderates the negative effect of age, such that older farmers with substantial experience are more likely to engage in market activities.

Household size and gender had no significant influence on market participation, suggesting that market entry decisions among broiler farmers in Ondo State are not strongly driven by household labour availability or gender differences.

Education plays a critical role in market participation. Tertiary education had a positive and highly significant effect ($p < 0.01$), indicating that broiler farmers with higher education are more likely to participate in markets. This may be due to better access to information, improved managerial skills, and enhanced ability to meet market requirements. This result supports the findings of Ababiya *et al*. (2025) and Machuki *et al*. (2025) who found that education increases the likelihood of farmer's participation in poultry's market.

Ownership of a vehicle significantly increases the likelihood of market participation ($p < 0.01$), stressing the importance of transport infrastructure in reducing transaction costs and facilitating access to output markets. Lekhisa & Muroyiwa (2024) found similar result for broiler market participation in Lesotho. Similarly, cooperative membership positively and significantly influences market anticipation ($p < 0.01$), reflecting the role of collective action in improving market access, bargaining power, and information sharing. The likelihood of broiler market participation would increase by 0.49 when a membership increases by a 1%. This same outcome was earlier reported by Habiyaremye *et al*., (2023) and Lekhisa & Muroyiwa, (2024).

Market information is important to the sustainable broiler farmers. It keeps them abreast of all changes that take place in the markets. Thereby promoting market participation. The positive and significant effect ($p \leq 0.05$) on volume of broiler sold underscores the importance of timely price and demand information in encouraging broiler farmers to engage in market-oriented production. Being a full-time farmer, however, does not significantly affect the decision to participate in the market.

3.4 Commercialization intensity

Table 4 presents the second-stage outcome equation analyses of the factors influencing the commercialization intensity of market participation among broiler farmers. The coefficient of the inverse Mills ratio ($\lambda = 0.22$) is positive and statistically significant ($p \leq 0.05$), confirming that correcting for selection bias was necessary and that unobserved factors jointly influence participation and commercialization intensity.

The coefficient for age variable was negative and statistically significant in relation to commercialization intensity ($\beta = -6.56$, $p < 0.05$). The result suggests that older broiler farmers sell a

smaller proportion of their output compared to younger farmers. This is similar to the finding of Simon *et al*. (2015). However, the positive and significant coefficient of age squared ($p < 0.01$) again indicates a non-linear relationship, where commercialization intensity increases beyond a certain age threshold. This demonstrates that older farmers may become more commercially oriented after accumulating experience and resources.

Experience of the farmers was negative with significant affects on commercialization intensity ($p < 0.01$), while the interaction between age and experience remains positive and significant ($p < 0.01$). This means that a combination of experience and age can promote commercialization, due to improved production efficiency and stronger market linkages over time.

Our study shows that education significantly enhances commercialization intensity. The positive and significant effect of secondary education showed it is sufficient to provide the basic skills and knowledge to the farmers to transition from subsistence to commercial-oriented poultry farming. Similarly, positive influence of tertiary education is stronger ($\beta = 0.64$, $p < 0.01$), suggesting a better decision making, adoption of innovation and sustainability toward market participation. This supports the finding of Belay *et al*. (2021) on determinants of smallholder commercialization of livestock in Ethiopia.

The negative and significant relationship between farm size and commercialization intensity effect ($p < 0.05$) implies that larger farms may allocate a greater share of output to non-market uses or face management inefficiencies that limit commercialization intensity. Paradoxically, farmer's income was positive with a strong influence on commercialization ($\beta = 0.67$, $p < 0.01$), indicating that wealthier farmers are better positioned to bear transaction costs and expand market engagement. Studies by many authors find that larger farm scale raises profitability and often

Table 4: Second Stage: OLS Model (Extent of Participation)

Variable	Coef.	Std. Err.	z
Constant	4.5	7.92	0.57
Age	-6.56**	3.15	-2.09
Age squared	1.24**	0.45	2.77
Experience	-1.32**	0.44	-2.98
Age * Experience	4.87**	1.71	2.85
Household size	0.04	0.14	0.29
Gender	-0.09	0.1	-1.02
Secondary Education	0.50**	0.17	2.89
Tertiary Education	0.64***	0.16	3.91
Price per bird	-0.35	0.44	-0.79
Farm size	-0.08**	0.04	-2.13
Farmer's income	0.67***	0.06	12
Flock size	0.22***	0.06	3.76
Source information	0.04	0.05	0.66
Extension services	0.14	0.15	0.94
Mill lambda	0.22**	0.11	1.96

Source: Field survey, 2025

commercialization, through economies of scale and better ability to spread fixed costs.

Flock size had a positive significant influence on the extent of market participation of broiler farmers and highly significant effect ($\beta = 0.22$, $p < 0.01$), suggesting that scale of production is a key driver of commercialization intensity in broiler production. This suggests that farmers with larger flocks are more market-oriented and better integrated into output markets.

Source of information and access to extension services do not significantly affect commercialization intensity, which may reflect weaknesses in the relevance, coverage, or effectiveness of extension delivery for broiler marketing in the study area.

4. Conclusion

This study examined the determinants and extent of market participation among small-scale broiler farmers in Ondo State, Nigeria, using the Heckman two-stage selection model. The findings revealed that education, cooperative membership, vehicle ownership, access to market information, and full-time engagement in farming significantly increased the likelihood of market participation, while age and marketing experience reduced participation. Furthermore, education, income, and flock size positively influenced the extent of market participation.

The study concludes that enhancing commercialization among broiler farmers requires targeted interventions aimed at improving human capital, reducing transaction costs, and strengthening institutional support. Policies should prioritize farmer education and training, promote cooperative development, improve access to market information, and support investment in transport infrastructure. Encouraging youth participation in broiler farming and facilitating access to finance for scaling up production will further enhance market integration and sustainability in the poultry subsector.

Overall, this study provides empirical evidence that boosting market participation and commercialization among small-scale broiler farmers supports progress toward SDGs 2, 3, and 12 by bolstering food security, improving access to animal food source, and promoting more efficient and responsible poultry production systems in developing countries.

5. Conflicts of interests

The authors declare that there are no conflicts of interests.

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