



Market Participation and Income Distribution among Women Cassava Marketers in Anambra and Imo States, Nigeria

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HIGHLIGHTS

- Women marketers exhibited high participation in cassava marketing activities, experience significantly increased market participation.
- Market associations enhanced women's marketing involvement.
- Digital marketing participation remained very low and extension support can reduce marketing inequality among women.

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ABSTRACT

Marketing of Cassava is a major livelihood activity of the rural women in South-East Nigeria, yet the differences in market participation and income distribution exist. This study examined income distribution and market participation among women processed cassava marketers in Imo and Anambra States, Nigeria during the 2025 marketing season. A multistage sampling technique was used to select 368 respondents from eight major market through the use of a structured questionnaire. Data were analyzed using descriptive statistics, the Gini coefficient, participation index, multiple regression, and probit regression models. The pooled Gini coefficient of 0.39 showed moderate income inequality and the overall market participation was high (82.64%) in product regulation, standardization, value addition, cooperative sales management, stakeholder decision-making, and price advocacy. The marketing experience ($P < 0.01$) and market association membership ($P < 0.01$) significantly increased market participation. Education ($P < 0.01$) significantly influenced income distribution in Anambra, while marketing experience and marital status significantly influenced income distribution in Imo State and the pooled sample. Strengthening extension education, entrepreneurial capacity, and market institutions can enhance participation and income equality.

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) remains a strategic food security and income-generating root crop in sub-Saharan Africa, assisting millions of rural households through production, processing, and marketing activities. Globally, cassava production has increased steadily, with annual growth surpassing 3%, making it one of the fastest growing food crops in tropical regions (Obot et al., 2023). Africa contributes a substantial proportion of global cassava production, with Nigeria being recognised as one of the leading producers. Beyond its role as a staple crop, cassava has developed into an important commercial commodity that aids agro-processing enterprises, employment generation, and rural economic development through activities such as processing, aggregation, distribution, and marketing (Udemezue et al., 2019).

The increasing commercialization of cassava has created opportunities for rural entrepreneurs to participate in increasing agricultural value chains. Subsequently, the ability of small-scale marketers to benefit from these opportunities is influenced by access to productive resources, financial services, marketing information, infrastructure, and institutional support. Limited access to these resources may limit enterprise growth, decline competitiveness, and add to variations in economic results among market participants (Eerdewijk & Danielsen, 2015; Gebre et al., 2021). These challenges show the importance of effective value chain governance mechanisms that promote inclusive participation and equitable distributions of benefits among marketers. Agricultural commercialization and entrepreneurship are increasingly recognized as pathways for improving rural livelihoods by enhancing market integration, value addition, income generation, and economic empowerment (Nain et al., 2019; Kademani et al., 2020). Entrepreneurial capabilities, innovation adoption, and access to market linkages influenced the performance of agricultural enterprises (Gupta et al., 2023; Licciardo et al., 2023). Similarly, socioeconomic characteristics such as education, experience, institutional membership, access to information shape participation and performance in agricultural markets (Ajah et al., 2022). Extension education plays important role in assisting commercialization through the provision of technical knowledge, market intelligence, entrepreneurial skills, and networks to institutional resources. Raghavendra et al. (2023) reported that awareness and participation in electronic agricultural marketing systems are significantly influenced by access to information and institutional support, while Sangappa et al. (2023) showed that strengthening value chain linkages through farmer organizations facilitates market access and income opportunities among agricultural actors.

Evidence from CGIAR-related research further shows that women's empowerment within agricultural value chain is influenced by access to markets, training, extension services, and supportive institutions (Quisumbing et al., 2021). Furthermore, Banerjee et al. (2014), in a World Bank study, reported that unequal access to productive resources and agricultural services contributes to persistent gender differences in agricultural performance among women farmers in Africa.

Although, past studies have examined cassava production, profitability, and market participation in Nigeria, limited empirical

evidence exists on the relationship between market participation and income distribution among women processed cassava marketers. Existing studies have largely focused on the determinants of participation, profitability, or marketing efficiency, with limited attention to how differences in market participation translate into income differences among women entrepreneurs. Understanding this relationship is essential for formulating policies and extension interventions that promote inclusive commercialization and equitable livelihood results.

METHODOLOGY

The study was carried out in Imo and Anambra States, South-East, Nigeria. These states were selected purposively due to their active participation in cassava value chain activities. Anambra lies between latitudes 5°38'N and 6°47'N and longitudes 6°36'E and 7°21'E of the greenwich meridian, with 21 Local Government Areas (LGAs) across four agricultural zones (Awka, Anambra, Aguata, and Onitsha). It has a projected population of 5,720,035 and about 4,416 km² land area, with approximately 70% arable land (NBS, 2021). Imo State lies between latitudes 5°12'N and 5°56'N and longitudes 6°38'E and 7°25'E of Greenwich meridian, consisting of 27 LGAs and a projected population of 5,265,082 (Imo State Government, 2021). Agriculture dominates livelihoods in both states, with cassava marketing being highly visible.

A multistage sampling procedure was adopted. In stage one, four major markets were purposively selected from each state based on marketing intensity. In Anambra, Eke Awka, Nkwo Nnewi, Nkwo Ogbe-Ihiala, and Eke Ekwulobia were selected, while Ekeukwu Owerri, Eke Okigwe, Afor Ogbe, and Ahiazu Mbaise International Market were selected in Imo State.

The sample was determined using Cochran's (1977) sample size formula for finite population. A 95% confidence level ($Z = 1.96$), 5% margin error ($e = 0.05$), and an assumed population proportion of 0.50 were adopted because no prior estimate of target characteristic was available. The initial sample size was estimated as:

$$n_o = \frac{Z^2 P(1-P)}{e^2} \quad \dots (1)$$

Where, n_o = initial sample size, $Z = 1.96$ at the 95% confidence level, $P = 0.50$, $e = 0.05$.

Since the sample frame consisted of 922 registered women cassava marketers, the finite population correction was applied:

$$n = \frac{n_o}{1 + \frac{n_o - 1}{N}} \quad \dots (2)$$

Where, $N = 922$. The calculated sample size was proportionately allocated among the chosen markets, leading to 368 respondents. Proportionate random sampling was used to select 186 respondents from Anambra State and 182 respondents from Imo State.

Primary cross-sectional data were collected in the 2025 marketing season with the use of structured questionnaire covering socioeconomic characteristics, income levels, marketing experience, participation intensity, and income distribution factors. The questionnaire was validated by Agricultural Economics experts and achieved a Cronbach's alpha of 0.90, indicating high reliability.

Descriptive statistics (frequencies, percentages, and means) were used for preliminary analysis. Income inequality was measured using the Gini coefficient adopted from Anyaegbu et al. (2020). the model is specified as follows:

$$G.C = 1 - \sum_{i=1}^n F_i P_i \quad \dots (3)$$

Where, $G.C$ = Gini Coefficient, F_i = Proportion of women cassava marketers' income in the i th Class (Naira), and P_i = Cumulative Proportion of women cassava marketer's income in the i th Class (Naira). $i = i^{\text{th}}$ women processed cassava marketers in the study area.

The Gini coefficient was used to assess the degree of income inequality among women processed cassava marketers. The coefficient ranges from 0 to 1, with values closer to 0 indicating greater income equality and values closer to 1 indicating higher inequality. The categorization of inequality levels was based on the criteria proposed by Ahlin and Jeong (2021).

The level of market participation among women processed cassava marketers was evaluated using the participation Index (PI), which expresses the ratio of an individual's actual participation score to maximum obtainable participation score. The approach adopted in related participation studies, the index is expressed as:

$$P_i = \frac{ACP_i}{TOP_i} \quad \dots (4)$$

Where, PI_i = Participation Index, ACP_i = Actual Participation (Score), TOP = Total Participatory Level Obtainable (Score).

Higher Participation Index values indicate greater involvement in cassava marketing activities, while lower values reflect limited participation.

A binary Probit regression model was employed to identify socioeconomic factors influencing income inequality among women cassava marketers. The Probit model was preferred because it assumes a cumulative normal distribution of the latent response variable and is widely applied when the dependent variable is dichotomous. Although Logit and Probit models often produce similar results, the Probit specification provides efficient estimates under the assumption of normally distributed error terms and has been widely adopted in agricultural economics studies. The model as used by Nathan and Rosli (2016) was adopted for this study and the model is specified as;

$Y = (1, \text{if the respondent belongs to the high - income inequality}$
 $0, \text{if the respondents belongs to a low - income inequality})$

$$Y_i = \beta X_i + \varepsilon_i \quad \dots (5)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \varepsilon_i \quad \dots (6)$$

Y = Income Inequality (1, high income inequality; 0, otherwise),

Respondents were classified into the high-income inequality category using the predetermined income threshold adopted in this study (mean monthly income). This binary transformation enabled estimation of the probability that respondents belonged to the higher income inequality category as a function of their socioeconomic characteristics.

β is the estimated vector of parameters, and X_i is the vector of observed nonrandom explanatory variables.

Where, i = Number of Independent Variables, β_0 = Constant Term, $\beta_1 - \beta_9$ = Regression Coefficients, X_1 = Marital Status of the Processed Cassava women marketers (1, Married; 0, Otherwise), X_2 = Size of Households (Total Number of Persons), X_3 = Level of Education (Years),

X_4 = Marketing Experience (Years), X_5 = Amount of Credit accessed (Naira), X_6 = Membership of Market Association (1, Member; 0, Otherwise), X_7 = Age (Years), X_8 = Distance to Market (Proxied by Time spent in getting to the market in hours), X_9 = Level of Market Participation (1, Participated, 0, Otherwise) and U_i = Error Term.

Multiple Regression Analysis, following Onoja et al. (2013), was used to determine the factors influencing the level of market participation among women processed cassava marketers in the study area. Four alternative functional forms (Linear, Semi-log, Double-log, and Exponential) were estimated to identify the most appropriate empirical specification. The lead equation was selected based on a combination of statistical and econometric criteria, including the magnitude of the adjusted coefficient of determination (Adjusted R^2), overall significance of the F-statistic, statistical significance of individual regression coefficients, conformity of coefficient signs with a priori expectations, and economic interpretability. The model satisfying these criteria most adequately was selected for discussion. The model is specified as follows:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \varepsilon_i \quad \dots (7)$$

Where, Y_i = Participation Index (Number), X_1 = Educational Level (Years), X_2 = Years of Experience (Years), X_3 = Age of Farmer (Years), X_4 = Household Size (Units), X_5 = Membership of Market Association (1, Member; 0, Otherwise), X_6 = Amount of Credit Accessed (₦), and X_7 = Income (₦), ε_i = Errors Term.

To ensure the validity and reliability of the estimated regression model, several post-estimation diagnostic tests were conducted. Multicollinearity among the explanatory variables was assessed using the Variance Inflation Factor (VIF), with VIF values below 10 showing the absence of serious multicollinearity. Homoscedasticity of the residuals was examined using the Breusch-Pagan/Cook-Weisberg test, while the normality of the residuals was evaluated using the Shapiro-Wilk test. Independence of the errors in the multiple regression models was assessed using the Durbin-Watson statistic, with values close to 2 showing no evidence of serial correlation. For the probit regression model, goodness-of-fit was evaluated using the Log Likelihood, Log likelihood Ratio (LR) Chi-square statistics, McFadden's Pseudo R^2 , and classification accuracy. The LR Chi-square test was used to assess the overall significance of the model, while the Pseudo R^2 measured the explanatory power of the model. Classification accuracy was computed as the percentage of correctly classified observations based on the estimated probabilities.

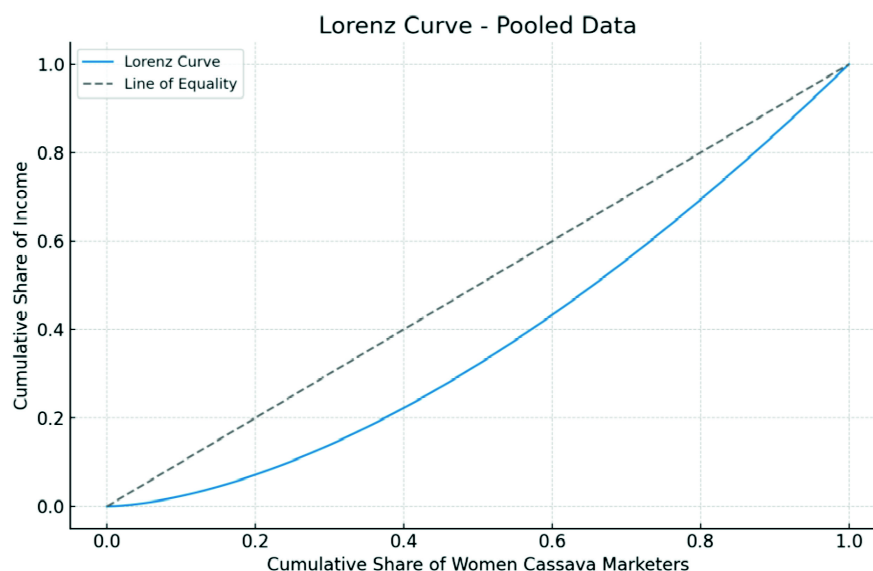
RESULTS AND DISCUSSION

Marketers in Imo State recorded a higher mean income of ₦ 167,265.10, Anambra State recorded ₦ 136,000.52 and the pooled

Table 1. Income Distribution and Gini Coefficient of Women Cassava Marketers

State	NR	MMI (₦)	CMI (₦)	Gini coefficient	Level of inequality
Imo	182	167,265.1	398,250.24	0.42	High inequality
Anambra	186	136,000.52	377,779.22	0.36	Moderate inequality
Pooled	368	151,459.63	388,447.50	0.39	Moderate inequality

Source: Field Survey Data, 2025 <0.31 (Low Inequality), 0.31 – 0.40 (Moderate Inequality), 0.41 – 0.50 (High Inequality), NR (Number of respondents), MMI (Mean Monthly Income), CMI (Cumulative Mean Income)

Figure 1. Income Distribution using Lorenz curve for processed cassava women marketers in the study area (pooled)**Table 2.** Categorization of Level of Participation

Imo	Participation Index Range	Participation Level	Frequency	Percentage
	0.00 – 0.39	Low Participation	0	0.00
	0.40 – 0.69	Moderate Participation	16	8.79
	0.70 – 1.00	High Participation	166	91.21
Total			182	
Anambra	0.00 – 0.39	Low Participation	4	2.15
	0.40 – 0.69	Moderate Participation	47	25.27
	0.70 – 1.00	High Participation	135	72.58
Total			186	
Pooled	0.00 – 0.39	Low Participation	4	1.04
	0.40 – 0.69	Moderate Participation	63	16.32
	0.70 – 1.00	High Participation	301	82.64
Total			368	

Source: Field Survey, 0.00 – 0.39 (Low Participation), 0.40 – 0.69 (Moderate Participation), 0.70 – 1.00 (High Participation)

Table 3. Marketing Activities Participation by Processed Cassava Women Marketers in Imo and Anambra States

Marketing Activity Name	Imo Mean Participation	Imo State Participation Level	Anambra Mean Participation	Anambra State Participation Level	Mean Participation	Remark
Cassava Product Regulation	3.6	Heavily Participated	2.8	Fairly Participated	3.2	Heavily Participated
Cassava Quantity Regulation	2.9	Fairly Participated	1.9	Infrequently Participated	2.4	Fairly Participated
Cassava Product Standardization	3.4	Heavily Participated	3.0	Heavily Participated	3.2	Heavily Participated
Price Violator Taskforce Committee	2.9	Fairly Participated	2.4	Fairly Participated	2.7	Fairly Participated
Stakeholder Decision Making	3.4	Heavily Participated	3.4	Heavily Participated	3.4	Heavily Participated
Cassava Marketing Committee	3.6	Heavily Participated	2.9	Fairly Participated	3.3	Heavily Participated
Committee on Use of Standard Measurement	2.6	Fairly Participated	2.2	Fairly Participated	2.4	Fairly Participated

Table 3 contd...

Marketing Activity Name	Imo Mean Partici- pation	Imo State Participation Level	Anambra Mean Partici- pation	Anambra State Participation Level	Mean Partici- pation	Remark
Value Addition Practices	3.4	Heavily Participated	3.2	Heavily Participated	3.3	Heavily Participated
Market Access Coordination	2.4	Fairly Participated	2.4	Fairly Participated	3.0	Fairly Participated
Financial and Digital Platforms	1.8	Infrequently Participated	1.8	Infrequently Participated	1.8	Infrequently Participated
Market Survey and Exploration	2.6	Fairly Participated	2.5	Fairly Participated	2.6	Fairly Participated
Cooperative Sales Management	3.6	Heavily Participated	3.4	Heavily Participated	3.5	Heavily Participated
Transport and Packaging Management	2.6	Fairly Participated	2.4	Fairly Participated	2.5	Fairly Participated
Market Price Advocacy	3.6	Heavily Participated	3.0	Heavily Participated	3.3	Heavily Participated
Quality Assurance Monitoring	2.6	Fairly Participated	2.0	Fairly Participated	2.3	Fairly Participated

Source: Computed from Field Survey (2025) Heavily Participated = 3.0 <above, Fairly Participated = 2.0 – 2.9, Infrequently Participated = 1.0 – 1.9, μ = Mean Value

Table 4. Determinants of Level of Market Participation by Women Cassava Marketers

Explanatory Variable	Anambra State				IMO State			
	+Linear	Exponential	Double-Log	Semi-Log	Linear	Exponential	+Double-Log	Semi-Log
Constant	0.965 (6.905)	-0.096 (-0.495)	0.768 (0.919)	1.533 (2.287)	0.970 (7.701)	-0.068 (-0.507)	0.143 (0.248)	1.233 (2.287)
Education	0.005** (1.753)	0.008* (1.737)	0.097 (1.294)	0.068 (1.253)	0.004 (1.155)	0.005 (1.325)	0.083 (1.436)	0.068 (1.253)
Marketing Experience	0.005** (2.367)	0.003** (2.166)	0.083** (2.836)	-0.049 (-1.243)	-0.003 (-0.727)	-0.003 (-0.847)	-0.058 (-1.373)	-0.049 (-1.243)
Age	-0.006** (-2.390)	-0.007** (-2.052)	-0.263* (-1.606)	0.015 (0.133)	0.001 (0.246)	0.001 (0.221)	0.019 (0.157)	0.015 (0.133)
Household Size	-0.002 (-0.431)	-0.002 (-0.264)	-0.005 (-0.118)	-0.096** (-2.475)	-0.013** (-2.180)	-0.011** (-1.805)	-0.087** (-2.102)	-0.096** (-2.475)
Market Association	0.086** (2.514)	0.090* (1.881)	0.040 (0.787)	0.032 (1.270)	0.026 (1.082)	0.040* (1.534)	0.043* (1.606)	0.032 (1.270)
Amount of Credit	-0.00000041** (-2.080)	-0.0000006.1** (-2.225)	-0.081* (-1.943)	0.012 (0.914)	0.000000065 (0.639)	0.000000073 (0.674)	0.013 (0.894)	0.012 (0.914)
Farm Income	0.000000027** (2.340)	0.00000034** (2.091)	0.044* (1.551)	-0.033* (-1.687)	-0.000000014 (-1.453)	-0.000000016* (-1.578)	-0.032* (-1.527)	-0.033* (-1.687)
R ²	0.503	0.485	0.453	0.469	0.597	0.637	0.760	0.800
Adj R ²	0.471	0.453	0.414	0.431	0.223	0.264	0.393	0.434
F Statistics	6.404**	5.714**	3.897**	4.390**	1.597*	1.710*	2.069**	2.186**
Observation	186				182			

Source: Field Survey Data Analysis, 2025 P< 0.05 = * and P < 0.01 = ** +Lead Equation Values in parentheses are the t ratio

Table 5. Pooled Data on Level of Market Participation by Women Cassava Marketers

Explanatory Variable	Linear	Exponential	Double-Log	+Semi-Log
Constant	0.990 (9.942)	1.365 (3.288)	0.441 (0.839)	-0.056 (-0.430)
Education	0.012 (5.161)	0.143 (4.097)	0.197 (4.442)	0.017 (5.815)
Marketing Experience	0.005 (2.476) **	0.057 (3.282)	0.078 (3.548)	0.006** (2.413)
Age	-0.006 (-3.553)	-0.246 (-2.986)	-0.316 (-3.029)	-0.008 (-3.510)
Household Size	-0.006 (-1.327)	-0.017 (-0.686)	-0.012 (-0.384)	-0.005 (-0.944)
Market Association	0.060 (2.719) **	0.055** (2.464)	0.054** (1.891)	0.069** (2.411)

Table 5 contd...

Explanatory Variable	Linear	Exponential	Double-Log	+Semi-Log
Credit Amount	0.0000000041 (0.041)	0.006 (0.438)	0.004 (0.217)	-0.0000000012 (-0.091)
Income	-0.0000000018 (-0.025)	-0.008 (-0.596)	-0.009 (-0.530)	-0.00000000052 (-0.005)
R ²	0.556	0.525	0.534	0.568
Adj R ²	0.539	0.507	0.516	0.552
F-Statistic	9.487	6.866	7.387	10.374
Mean VIF	2.02	2.02	2.02	2.012
Breusch-Pagan Test	1.84(0.175)	1.81(0.165)	2.03(0.152)	2.12(0.148)
Observation	368			

Source: Field Survey Data, 2025. P < 0.05 = * and P < 0.01 = ** +Lead Equation Values in parentheses are t ratio

Table 6. Probit Regression on Socio-economic Factors Influencing Income Distribution of Women Cassava Marketers

Variable	Anambra State			Imo State			Pooled Data		
	β	SE	z-value	β	SE	z-value	β	SE	z-value
Household Size	-0.005	0.034	-0.147	0.060	0.082	0.732	0.036	0.048	0.75
Education	0.093**	0.025	3.72	-0.050	0.059	0.847	-0.036	0.034	-1.059
Marketing Experience	0.001	0.014	0.071	0.182	0.049**	3.712	0.099	0.028**	3.536
Amount of Credit	0.0000010	0.0000012	0.898	0.0000011	0.0000014	0.813	-0.00000081	0.000000082	-0.982
Age	-0.020	0.015	-1.333	-0.045	0.038	1.184	-0.030	0.022	-1.364
Distance to market	0.001	0.001	1.000	0.001	0.001	1.000	0.001	0.001	1.000
Marital Status	-0.277	0.311	-0.890	-2.089	0.802*	-2.605	-1.100	0.395*	-2.785
Level of Participation	-1.493**	0.223	-6.695	0.016	0.404	0.040	-0.019	0.238	-0.080
Marketing Association	-0.243	0.243	-1.000	-0.291	0.343	-0.848	-0.230	0.202	-1.139
Cox & Snell Pseudo R ²	0.470			0.192			0.194		
Chi Square	366.976**			338.182**			270.594		
-Log likelihood	250.104**			271.987**			271.594		
Mean VIF	1.011			1.100			1.021		
Tolerance	0.791			0.810			0.989		
Durbin-Watson	1.911			1.802			1.902		
Classification Accuracy	85%			85%			80%		
Normality	Satisfied			Satisfied			Satisfied		
Homoscedacity	Satisfied			Satisfied			Satisfied		

Source: Field Survey Data, 2025. Using SPSS * p < 0.05; ** p < 0.01 β = Coefficient SE = Standard Error

mean monthly income was ₦ 151,459.63. This observed differences may be attributed to differences in market participation intensity, business experience, volume of cassava handled, and access to productive resources. This findings agrees with Obianefo et al. (2021), who reported that differences in access to productive resources, credit infrastructure, and institutional support influences the economic performance of women engaged in agricultural activities. The observed variations in income distribution among women cassava marketers have important implication for extension education, agricultural policy, and rural development. The findings suggest that improving women's economic outcomes requires more than increasing market participation; it requires targeted interventions that address differences in access to productive resources, market information, financial services, and capacity-building opportunities. Agricultural extension programmes should therefore increase beyond production-focused advisory services to include training on enterprise management, value addition, financial literacy, record keeping, and market linkage strategies that can enhance the competitiveness of women marketers.

Moreover, the Gini coefficient analysis shows the existence of income inequality among women marketers in Anambra and Imo States. The estimated Gini coefficients were 0.36 for Anambra State, 0.42 for Imo State, and 0.39 for the pooled sample. Based on the adopted classification criteria, the value of 0.36 shows a moderate level of income inequality in Anambra State, while the value of 0.42 represents a high level of income inequality among marketers in Imo State. Similarly, the pooled Gini coefficient of 0.39 shows a moderate level of income inequality across the study area. The relatively higher inequality recorded in Imo State implies greater differences in income distribution among marketers, which may be associated with differences in marketing scale, access to financial resources, market opportunities, business experience, and operational capacity. Conversely, the moderate inequality recorded in Anambra State and the pooled sample indicates that although differences exist in marketers' income levels, income concentration is comparatively less pronounced.

These findings agrees with Obianefo et al. (2021), who reported that women involved in agricultural cooperatives in South-East

Nigeria experience differences in access to productive resources, including credit, infrastructure, improved technologies, and extension services, which may contribute to differences in economic performance. The result also agrees with Okafor et al. (2023), who noted that cooperative participation, access to information, training, and institutional support enhance women's involvement and livelihood outcomes in agricultural activities. These studies reinforce the current findings by showing that structural factors, including differences in scale of operation, access to transportation, financial services, and market information, continue to influence income distribution among women cassava marketers.

The observed deviation of the curve from the line of perfect inequality indicates the presence of income disparities, consistent with the pooled Gini coefficient of 0.39. Overall, the findings highlight the persistence of income disparities among women cassava marketers and emphasize the need for policies that promote equitable access to productive resources, strengthen market participation, and improve income-generating opportunities.

In Imo State, 91.21% of respondents recorded high participation, while 8.79% were at a moderate level. In Anambra State, 72.58% exhibited high participation and 25.27% moderate participation. The pooled result indicates that 82.64% of respondents had high participation, while 16.32% recorded moderate engagement. This suggests active involvement of women in cassava marketing, with stronger participation intensity in Imo State, possibly due to better cooperative structures, improved access to market opportunities, and stronger institutional support. In contrast, lower participation in Anambra may reflect infrastructural constraints and weaker information networks. This agrees with Obot et al. (2023), Udemezue (2023), Bamigboye et al. (2024) and Kademani et al. (2024) who linked participation levels to institutional support, infrastructure, and access to market information.

Further analysis of specific activities shows variation across roles. Participation was generally high in cassava product regulation and stakeholder decision-making in both states. However, cassava quality regulation and standardization were more active in Imo than Anambra. Membership in committees such as price monitoring and standard measurement was moderate in both states, while participation in marketing committees was high in Imo and moderate in Anambra. These findings align with Azeez et al. (2021), highlighting the importance of cooperative institutions in strengthening engagement and regulatory compliance within agricultural markets.

The linear, double-log, and semi-log functional forms were selected as lead models for Anambra, Imo, and the pooled sample, respectively. The R^2 values were 0.503 (Anambra), 0.760 (Imo), and 0.568 (pooled), indicating that the explanatory variables explained a substantial proportion of variation in participation. The F-statistics were significant at 1%, confirming model adequacy. Results show that education, marketing experience, age, household size, association membership, credit access, and income significantly influenced participation. Education had a positive effect in Anambra, implying that higher schooling improves market access and managerial ability, consistent with Obisesan (2018). Marketing

experience was positive and significant across all models, indicating that accumulated knowledge and networks enhance participation, in line with Andaregie et al. (2021) and Zakari et al. (2023). Age was negatively significant in Anambra, suggesting lower participation among older women. Membership in market associations positively influenced participation, highlighting the role of collective action (Mango et al., 2017). Household size negatively affected participation in Imo, reflecting increased domestic pressure. Credit access also showed a negative effect, possibly due to diversion or repayment constraints. Income had mixed effects, positive in Anambra but negative in Imo, suggesting context-specific use of earnings in marketing activities.

The diagnostic tests confirmed that the estimated models satisfied the principal econometric assumptions for the Anambra, Imo, and pooled datasets. The mean Variance Inflation Factor (VIF) values of 1.011, 1.100, and 1.021, respectively, indicated the absence of serious multicollinearity among the explanatory variables. Similarly, the tolerance values of 0.791, 0.810, and 0.989 were above the acceptable threshold, further validating the independence of the explanatory variables. The homoscedasticity and normality tests confirmed that the models satisfied the assumptions of constant error variance and normally distributed residuals. In addition, the Durbin-Watson statistics of 1.911, 1.802, and 1.902 were close to the benchmark value of 2, suggesting that serial correlation was not a concern.

The Probit models demonstrated satisfactory goodness-of-fit across the three datasets, as indicated by the statistically significant Likelihood Ratio (LR) Chi-square values of 366.976, 338.182, and 270.594 ($p < 0.01$) for Anambra, Imo, and pooled samples, respectively. This implies that the explanatory variables jointly provided significant information in explaining variations in income distribution among women cassava marketers. The Cox and Snell Pseudo R^2 values of 0.470, 0.192, and 0.194 showed that the models explained approximately 47.0%, 19.2%, and 19.4% of the variations in income distribution, respectively. Although the explanatory power of the Imo and pooled models appears relatively modest, such values are considered acceptable in social science research where behavioural outcomes are influenced by several socioeconomic factors (Ozili, 2022). Furthermore, the classification accuracies of 85%, 85%, and 80% indicate good predictive performance, confirming the suitability and robustness of the estimated Probit models.

The results revealed that education and level of participation significantly influenced income distribution in Anambra State. Education exerted a positive and significant effect at the 1% level, indicating that women with higher educational attainment were more likely to achieve better income outcomes due to improved managerial skills, bargaining capacity, and access to market information. Conversely, the level of participation had a negative and significant influence, suggesting that inadequate involvement in marketing activities limits income-generating opportunities. In Imo State, marketing experience positively and significantly affected income distribution, implying that experienced marketers possess better knowledge of market dynamics, risk management strategies, and opportunities for improved returns. However, marital status had a negative and significant effect, suggesting that family responsibilities

may constrain resources available for business expansion and reinvestment. Overall, the findings highlight education, participation intensity, marketing experience, and marital status as important socioeconomic drivers of income distribution among women cassava marketers in the study area.

CONCLUSION

The findings revealed moderate income inequality 0.39 despite a high level of market participation, particularly in product regulation, value addition, cooperative marketing, and stakeholder decision-making. Education, marketing experience, association membership, household size, age, and credit access significantly influenced market participation, while education, marketing experience, marital status, and participation level significantly affected income distribution. Strengthening women's entrepreneurial capacity through extension education, improved access to market information, affordable credit, functional market associations, digital marketing platforms, and rural infrastructure will enhance market participation, reduce income inequality, and improve the livelihoods of women cassava marketers.

DECLARATION

Ethics approval and informed consent: This research was conducted in accordance with established ethical standards for social science research. The study was cleared from all ethical issues and approved by Department of Agricultural Economics, Federal University of Technology Owerri, Imo State, Nigeria. Verbal informed consent was obtained from all participating marketers before data collection. Respondents were assured of confidentiality, anonymity, and the voluntary nature of their participation throughout the study.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest. The authors further declare that they have thoroughly reviewed, revised, and edited the manuscript and take full responsibility for the final content of this publication. The authors declare that there is no conflict of interest regarding the publication of this paper.

Data availability statement: Data is available upon reasonable request from the corresponding author.

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