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Gender, Labor, and Output Allocation in Nigeria's Aquacultural Sector

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Notices

Abstract

Aquaculture is an important source of food and income in Nigeria, but evidence on gender differences in labor participation and output allocation remains limited. Using nationally representative microdata from the National Agricultural Sample Survey and weighted ordinary least squares (OLS) and fractional logit models, this study examines whether the gender of the aquacultural manager is associated with labor participation, production, and allocation of output to home consumption and sales. The results show that after controlling for observable characteristics, households managed by women are not less engaged in aquaculture and do not produce less than households managed by men. Instead, gender differences appear in how farms operate and distribute their output. Households managed by women employ a substantially higher share of women's labor and allocate approximately 4 percentage points more of their output to home consumption, even after conditioning on production scale, a result that is robust across OLS and fractional logit specifications. Sales shares, however, do not differ significantly by the manager's gender. The consumption share results may suggest that women's management is associated with greater home retention of output, which could carry food security implications not captured by standard income-focused metrics, although the survey does not permit direct assessment of food security or nutritional outcomes. The findings suggest that policies aimed at strengthening women's participation in aquaculture should consider differences in how labor is organized and output allocation, alongside efforts to improve productivity and market participation.

Keywords: Aquaculture, gender, labor, production, output allocation, consumption, Nigeria.

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1. Introduction

Nigeria's aquacultural sector contributes significantly to nutrition and livelihoods by addressing protein deficiencies, enhancing food security, and stimulating economic development in a country where more than 200 million people rely heavily on fish as a dietary staple (Béné et al. 2015; Tran et al. 2021; FAO 2022a). With production volumes surpassing 300,000 metric tons annually, Nigeria is the largest aquaculture producer in sub-Saharan Africa, primarily through small- and medium-scale operations focusing on species such as catfish and tilapia (Kaleem and Sabi 2021; Adam and Njogu 2023; Ogunji and Wuertz 2023). The sector has grown rapidly, driven by rising domestic demand, urbanization, and policy attention (FAO 2022b; Ajayi et al. 2022). Yet the sector's rapid expansion has not eliminated longstanding inequalities in access to productive resources, labor, and market opportunities. Gender remains a persistent inequality, shaping participation in aquaculture through unequal access to productive resources, economic opportunities, and decision-making within production systems (Kruijssen et al. 2018; Gonzalez Parrao et al. 2021; Adam et al. 2021).

The gendered dimensions of aquaculture in Nigeria reflect broader patterns observed across agriculture and agrifood systems in low- and middle-income countries (Oseni et al. 2015; Elias et al. 2024). Women are often concentrated in downstream activities such as processing, smoking, retailing, and small-scale trading, while men are more active in upstream activities such as farm management, pond construction, input acquisition, and transport. These differences are frequently interpreted as evidence of unequal access to land, capital, labor, extension services, and producer organizations (Adam and Njogu 2023; Olaniyi et al. 2025). They also reflect social norms that shape who can control productive assets, hire labor, and make decisions about consumption, sales, and earnings (Gomna and Rana 2007; Bosma et al. 2019; Bradley et al. 2020). As a result, women's participation in aquaculture may not necessarily translate into equal control over production or equal access to the gains generated by it.

Within Nigeria specifically, a small but important body of research has begun to document the gendered structure of aquacultural production and value chains, though important gaps remain. A systematic review by Adam and Njogu (2023) of 78 studies on gender and aquaculture in Nigeria, using the Reach-Benefit-Empower-Transform framework, found that women in aquaculture consistently earn lower profits than their male counterparts. A subsequent mixed-methods study by Adam and colleagues (2025) in Ogun and Delta States documented that men dominate all three main stages of the aquacultural value chain, including input supply, production, and marketing, and found significant gender gaps in the value of productive assets owned by women relative to men. The WorldFish scoping study by Subasinghe and colleagues (2021) mapped how household decision-making over income is systematically skewed toward male household heads, limiting women's ability to direct aquacultural earnings toward household needs. These studies establish that gender inequalities in aquaculture are real, pervasive, and structurally rooted in asset ownership, capital access, and social norms that confine women to downstream, lower-margin activities. However, they share a common limitation: they rely on qualitative methods, purposively sampled localities, or value chain mapping that, while rich in contextual detail, cannot establish whether gender gaps reflect differences in production, labor participation, or household allocation choices and whether these findings can be generalized to Nigeria's aquacultural sector as a whole. This paper addresses this gap by focusing on the gender of the aquacultural manager to identify where gender differences are most apparent within aquacultural enterprises.

The objective of this paper is to investigate gendered patterns in labor participation, production, and output allocation in Nigeria's aquacultural sector. To meet this objective, the paper seeks to answer the following questions: (1) Do female-managed aquacultural households differ from male-managed households primarily in labor organization and production performance? (2) Do gender differences appear in how aquacultural output is allocated between home consumption and market sales? (3) What do these patterns imply for how gender gaps in Nigerian aquaculture should be understood and addressed? Labor participation captures whether and how intensively households engage in aquacultural production and how labor is allocated across men and women. Production captures the scale of aquacultural output. Output allocation captures how much of the harvest share is retained for home consumption rather than being sold in markets. This distinction is important because households can produce similar quantities while still making different decisions about who works in production and how the output is used after harvest. Furthermore, if female management is associated with greater home retention, policy relevance extends beyond commercial performance to include household nutrition and food security.

The results indicate that the most pronounced gender differences in aquacultural production relate to how labor is organized and output allocation. Female-managed households rely more heavily on women’s labor and retain a slightly larger share of aquacultural production for home consumption, while the share sold in markets does not differ systematically by the manager’s gender. Because allocation shares are bounded between zero and one, the analysis uses both ordinary least squares (OLS) and fractional logit models. Sampling weights are applied throughout to preserve national representativeness.

The study contributes to the literature in three ways. First, it provides nationally representative quantitative evidence on gender and aquaculture in Nigeria, filling a gap in a field that has often relied on qualitative or geographically narrow studies. Second, it separates labor organization, productivity, and allocation into analytically distinct outcomes, making it possible to identify whether gender differences operate through participation, production efficiency, or postharvest decisions. Third, it speaks to a broader policy debate on whether gender-responsive interventions should focus primarily on access to resources, labor organization, market integration, or household food and nutrition security. If gender gaps are concentrated in labor composition and output allocation rather than productivity, then the appropriate policy response differs from what would be warranted if women were systematically less productive than men.

The paper proceeds as follows: Section 2 presents the methods and describes the data and empirical strategy. Section 3 presents the results, Section 4 discusses the findings, and Section 5 concludes with implications for policymaking, limitations, and directions for future research.

2. Methods

2.1 Data sources

This study uses nationally representative microdata from Nigeria's National Agricultural Sample Survey (NASS), implemented by the National Bureau of Statistics. The NASS is nationally representative of agricultural households in Nigeria, which are defined as households engaged in crop or livestock farming and fishery activities. The survey covered 767 of Nigeria's 774 local government areas (LGAs) across all 36 states and the Federal Capital Territory, with seven LGAs excluded due to insecurity in Borno and Imo States. The NASS employs a stratified, multistage sampling design to capture agricultural and aquacultural production across states, agro-ecological zones, and farm types.

The analysis draws on three components of the survey. First, the household roster module provides detailed demographic and human capital information for all household members, including gender, age, education, marital status, participation in agricultural training, credit access, market linkages, and decision-making. Second, the aquacultural (fish farming) module contains information on production activities during the previous 12 months, including output quantities, labor engagement, consumption, and sales. Third, the labor module provides information on the gender composition of households and hired labor in aquaculture.

The analysis is restricted to households that reported engaging in aquacultural activities during the 2022/2023 reference period (Section 5A of the questionnaire). After merging modules, applying the participation filter, and trimming the top 5 percent of key outcome variables to address extreme outliers, the descriptive sample comprises 2,487 households (1,451 with only male managers and 1,036 with at least one female manager, as shown in Table 1). The regression analysis excludes 57 jointly managed households, yielding an analytical sample of 2,430 households (1,409 solely male-managed and 1,021 solely female-managed). Effective regression samples range from approximately 1,977 to 2,225 observations depending on the outcome, reflecting missing values across modules after merging. Because the sample is restricted to aquaculture-participating households, the sampling weights, originally calibrated to the full agricultural household population, produce estimates that are representative of households engaged in aquaculture in Nigeria. Results should be interpreted accordingly.

2.2 Definition of variables

2.2.1 Outcome variables

We analyze three sets of outcome variables capturing dimensions of aquacultural labor, production, and output allocation.

- **Labor participation:** Labor participation is measured in two ways. First, labor is captured by the number of weeks during the past 12 months in which the household actively engaged in aquacultural production (*labor weeks*). Second, labor scale is measured by the total number of individuals engaged in aquacultural activities (*aquacultural workers*), constructed at the household level from the labor module. In additional specifications, we examine women's labor involvement using the number and share of female aquacultural workers.
- **Production (output):** Aquacultural production is measured as the total quantity of output (in kilograms) reported by the household over the reference period. Given the absence of a standardized measure of production scale such as pond size or area cultivated in the dataset, output levels are used directly. Due to the skewed distribution, the natural logarithm of output

is used in regression analysis. Observations with zero output are excluded from log specifications.

- **Consumption and sales shares:** Household allocation behavior is captured using two fractional outcomes. The *consumption share* is defined as the fraction of total aquacultural output consumed by the household, calculated as the ratio of quantity consumed to total quantity produced. The *sales share* is defined analogously as the fraction of output sold by quantity. Both variables lie in the unit interval [0,1].

2.2.2 Explanatory variables

The main explanatory variable is the manager's gender, a binary indicator equal to one if the household aquacultural operation is solely female-managed and zero if solely male-managed. The aquacultural manager is identified from the household roster (Section 0C), which asks each member: "*Is [NAME] responsible for the household's farm?*" The questionnaire defines this responsibility as the person who "*decides what shall be cultivated, which animals shall be raised, and what inputs shall be used*." The sex of the manager is recorded directly from this roster. Households with multiple managers of both sexes (jointly managed) (N=57, 2.3 percent total) are excluded from the regression analysis but shown separately in Table 1. Results including these joint operations remain substantively unchanged.

To capture gendered labor organization more directly, we also include the share of female workers engaged in aquaculture. Additional controls capture managerial, household, and institutional characteristics. These include manager age, education, agricultural training, marital status, household size, urban residence, recordkeeping, legal status of the operation, and ownership of crops and livestock. All household-level controls are constructed prior to merging with aquacultural outcomes to reduce concerns about simultaneity.

2.2.3 Empirical strategy

The empirical analysis proceeds in three stages.

First, we examine whether aquacultural labor use differs by the manager's gender. We estimate weighted OLS models of the form:

$$Y_i = \beta_0 + \beta_1 FemaleManager_i + \gamma X_i + \varepsilon_i \tag{1}$$

where Y_i denotes either labor weeks or the log number of aquacultural workers in household i, $FemaleManager_i$ is the gender indicator, and $X_i$is a vector of controls.

Second, we estimate gender differences in aquacultural production using weighted OLS models. We first estimate a specification without labor inputs:

$$\log(Output_i) = \beta_0 + \beta_1 FemaleManager_i + \gamma X_i + \varepsilon_i \tag{2}$$

We then include labor inputs:

$$\log(Output_i) = \beta_0 + \beta_1 FemaleManager_i + \beta_2 \log(AquaWorkers_i) + \gamma X_i + \varepsilon_i \tag{3}$$

Comparing these two specifications allows us to assess whether gender differences in output persist after accounting for labor scale.

Third, we examine gender differences in output allocation. Because allocation decisions occur after production, we model consumption and sales shares as functions of manager gender and output scale rather than labor inputs:

$$Share_i = \beta_0 + \beta_1 FemaleManager_i + \gamma X_i + \varepsilon_i \tag{4}$$

and

$$Share_i = \beta_0 + \beta_1 FemaleManager_i + \beta_2 \log(Output_i) + \gamma X_i + \varepsilon_i \tag{5}$$

Because the dependent variables are fractional and bounded between zero and one, OLS estimates with robust standard errors are complemented by fractional logit models as robustness checks. All regressions apply sampling weights from the NASS, and standard errors are clustered at the state level to account for within-state correlation and unobserved heterogeneity.

This empirical strategy identifies conditional gender differences by comparing female- and male-managed aquacultural households while also capturing differences in labor composition. Female-managed households may face greater constraints in access to assets, labor, or markets, which could lead the estimates to understate women's productive potential. At the same time, women who become aquacultural managers may be positively selected on motivation or entrepreneurial ability, which could bias estimates in the opposite direction. To reduce observable differences, the regressions control for managerial characteristics, household structure, institutional factors, and state fixed effects. The results should therefore be interpreted as conditional relationships rather than causal effects.

3. Results

3.1 Descriptive statistics

Table 1 presents descriptive statistics by the gender of the aquacultural manager. Female-managed aquacultural farms report slightly fewer weeks of aquacultural activity than male-managed farms, but they record somewhat higher average output than male-managed farms (207 kg for female-managed and 185 kg for male-managed) and marginally higher consumption and sales shares. Compared to male-managed farms, they are also larger on average, managed by slightly younger individuals, and more likely to have managers with higher educational levels.

Clear differences also appear in household structure. Female-managed households are larger on average than male-managed households (4.8 members versus 4.3 members), and female managers are less likely to be identified as the household head than their male counterparts. This indicates that many female aquacultural managers operate within households headed by another member, rather than heading the household themselves. Female managers are also more likely to be formerly married or never married. These descriptive patterns highlight differences in household composition between female- and male-managed aquacultural enterprises. In the sample, 3.1 percent of male-managed and 1.5 percent of female-managed households report a joint operation structure; this represents 57 households in total, which are excluded from the regression results, as stated earlier.

Table 1: Characteristics of aquacultural manager by gender

Variable outcomes	Male-managed			Female-managed			
	Mean	SD	N	Mean	SD	N	Total sample size
Consumption share	0.17	0.19	1,443	0.20	0.20	1,025	2,468
Sales share	0.69	0.27	1,322	0.70	0.26	936	2,258
Labor (weeks)	10.01	9.39	1,451	9.16	9.23	1,036	2,487
Labor participation (weeks worked/52)	0.19	0.18	1,451	0.18	0.18	1,036	2,487
Output quantity (kg)	185.37	338.98	1,443	206.61	374.81	1,025	2,468
Aquacultural workers (number)	2.28	1.51	1,235	2.67	1.68	959	2,194
Share of female workers	0.28	0.51	1,235	0.80	0.67	959	2,194
Female labor ratio*	0.11	0.22	1,235	0.33	0.32	959	2,194
Manager characteristics							
Age (years)	44.86	11.76	1,451	41.65	10.58	1,036	2,487
Attended school (%)	0.90	0.289	1,451	0.98	0.16	1,036	2,487
Agricultural training (%)	0.26	0.44	1,451	0.24	0.43	1,036	2,487
Education level (scale 1–5)	3.43	0.74	1,272	3.43	0.67	999	2,271
Married (%)	0.86	0.35	1,451	0.88	0.33	1,036	2,487
Formerly married (%)	0.03	0.17	1,451	0.13	0.33	1,036	2,487
Never married (%)	0.17	0.38	1,451	0.31	0.46	1,036	2,487
Head of household	0.98	0.13	1,451	0.91	0.29	1,036	2,487
Organization	0.96	0.19	1,451	0.98	0.15	1,036	2,487
Household characteristics							
Household size (N)	4.27	2.60	1,451	4.78	2.19	1,036	2,487
Urban household (%)	0.67	0.47	1,451	0.80	0.40	1,036	2,487
Commercial orientation (%)**	0.72	0.44	1,451	0.63	0.48	1,036	2,487
Keeps records (%)	0.69	0.46	1,451	0.66	0.47	1,036	2,487
Institutional characteristics							
Joint operation (%)	0.03	0.17	1,451	0.02	0.12	1,036	2,487
Formal legal status (%)	0.89	0.31	1,451	0.90	0.30	1,036	2,487
Credit access (%)	0.74	0.44	1,451	0.80	0.40	1,036	2,487
Market link (%)	0.65	0.48	1,451	0.64	0.48	1,036	2,487
Decides earnings in household (%)	0.92	0.26	851	0.85	0.35	569	1,420

Source: Authors.

Note: Shares are defined as fractions of total aquacultural output. Differences across groups are descriptive and do not imply causal relationships. *Female labor ratio is defined as the proportion of aquacultural workers who are women; it is equivalent to the share of female workers and thus reported consistently as a single measure. **Commercial orientation refers to whether production is primarily intended for market sale rather than household consumption, and it is distinct from the sales share, which measures realized allocation outcomes.

Table 2 shows the distribution of aquacultural species by manager's gender. Catfish dominates production for both groups, accounting for the majority of households in each category (76 percent male-managed, 80 percent female-managed). Female-managed farms appear somewhat more diversified, with relatively higher shares in species such as shrimp, common carp, and hybrid fish. The overall pattern observed in the sample suggests that aquaculture is heavily concentrated in a few commercially important species, particularly catfish.

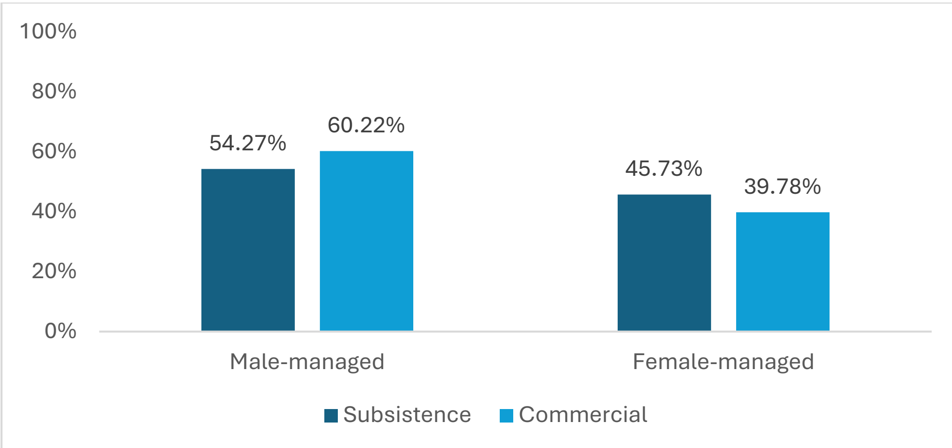
Table 2: Distribution of aquacultural species by gender

Species	Male-managed		Female-managed		Total (N)
	N	%	N	%	N
Tilapia	287	19.8	125	12.1	412
Catfish	1,102	76.0	827	79.8	1,929
Carp	11	0.8	11	1.1	22
Shrimp	13	0.9	19	1.83	32
Prawn	3	0.2	4	0.4	7
Oysters	1	0.1	1	0.1	2
Water snail	11	0.8	11	1.1	22
Common carp	5	0.3	6	0.6	11
Hybrid fish	10	0.7	20	1.9	30
Lates	1	0.1	1	0.1	2
Other	7	0.3	11	0.3	18
Total	1,451		1,036		2,487

Source: Authors.

Descriptive evidence further indicates that aquacultural participation is predominantly commercial for both male- and female-managed farms (Figure 1). As shown in Figure 1, commercial aquaculture substantially outweighs subsistence activities in both categories. Among households primarily engaged in subsistence aquaculture, 54.3 percent are male-managed while 45.7 percent are female-managed. In contrast, among households whose main purpose is commercial aquaculture, 60.2 percent are male-managed, and 39.8 percent are female-managed. Overall, male-managed households constitute 58.3 percent of the sample, whereas female-managed households account for 41.7 percent. This finding suggests that aquaculture in Nigeria is largely pursued as an income-generating activity rather than solely as a home-consumption strategy, although male-managed farms still account for a larger absolute number of commercial producers.

Figure 1: Purpose of aquacultural participation by manager's gender



Source: Authors.

3.2 Gender differences in labor use

Table 3 examines whether the manager's gender is associated with labor participation and labor composition. Women's management is not significantly associated with the number of weeks that households engage in aquacultural activities, suggesting that solely female- and male-managed households devote similar amounts of time to production after accounting for observable characteristics. In contrast, female-managed households employ significantly more aquacultural workers overall ($\beta = 0.088$, $p < 0.05$) and substantially more female workers ($\beta = 0.314$, $p < 0.01$). They also exhibit a markedly higher share of women working in production ($\beta = 0.215$, $p < 0.01$).

These findings suggest that gender differences are concentrated in labor organization rather than overall labor participation. Female-managed aquacultural households do not appear to participate less intensively in production, but they rely more heavily on women's labor. The analysis does not identify the reasons for this pattern, although it may reflect differences in household labor availability, hiring practices, or broader social and institutional factors that are not directly observed in the data.

Among the control variables, household size is positively associated with the number of aquacultural workers, while household headship is associated with a lower share of women's labor. Formal legal status is negatively associated with the total number of workers but positively associated with women's labor share. These results point to labor segmentation as an important feature of aquacultural production. Full results are included in appendix.

Table 3: Labor linear regression

Variables	(1) log(Labor participation)	(2) log(Aquacultural workers)	(3) log(Female aquacultural workers)	(4) Female labor share
Solely female manager	-0.014	0.088**	0.314***	0.215***
	(0.013)	(0.041)	(0.036)	(0.020)
Manager's age	0.000	0.002	-0.000	0.001
Agricultural training	-0.008	0.039	0.037	0.014
Education level	0.002	0.007	0.006	0.006
Married	0.003	0.114**	0.107**	0.024
Household head	-0.032	0.048	-0.121***	-0.156***
Household organization	-0.001	-0.072	0.109	0.062
Household size	-0.001	0.024***	0.004	-0.007**
Urban	-0.007	0.050	0.088*	0.054
Keeps records	-0.002	-0.095	-0.036	0.006
Formal legal status	-0.024*	-0.145**	0.077	0.088**
Has crops	-0.005	0.043	-0.109***	-0.073***

Source: Authors.
Note: Robust standard errors are clustered at the state level. Columns 2–4 weighted by sampling weights. * p<0.10, ** p<0.05, *** p<0.01. Observations indicate the number of farm-level observations used in each regression.

3.3. Gender differences in output

Table 4 reports the association between the manager's gender and aquacultural output. Across both specifications, female management is not significantly associated with production. The coefficient is small and statistically insignificant in the baseline model ($\beta = 0.071$) and remains insignificant after controlling for labor inputs ($\beta = -0.063$).

Labor inputs, however, are positively associated with production. After controlling for household and manager characteristics, a 1 percent increase in the number of aquacultural workers is associated with approximately a 0.47 percent increase in output ($p < 0.01$). Agricultural training is also positively associated with production across specifications.

These results provide little evidence that female-managed aquacultural households produce systematically more or less than comparable male-managed households. Instead, observed variation in production appears to be more closely associated with labor inputs and selected household characteristics than with the manager's gender itself. Full results are included in appendix.

Table 4: Manager gender, labor inputs, and output

Variable	(5) log(Output) Baseline	(6) log(Output) With Labor Inputs
Female manager	0.071	-0.063
	(0.095)	(0.080)
log(aquacultural workers)		0.470***
		(0.142)
Manager age	0.012*	0.009
	(0.006)	(0.006)
Agricultural training	0.343**	0.304**
	(0.145)	(0.131)
Education level	0.130	0.163
	(0.095)	(0.103)
Married	0.148	0.168
	(0.227)	(0.210)
Household head	-0.114	-0.213
	(0.328)	(0.340)
Manager organizes	0.332**	0.286
	(0.163)	(0.192)
Household size	0.045*	0.029
	(0.022)	(0.024)
Urban	0.394	0.449
	(0.321)	(0.320)
Keeps records	-0.008	0.069
	(0.110)	(0.104)
Formal legal status	0.152	0.249
	(0.253)	(0.260)
Has crops	-0.044	-0.005
	(0.233)	(0.219)
Constant	2.021***	1.534**
	(0.603)	(0.598)

Source: Authors.

Note: Robust standard errors are clustered at the state level in parentheses. Sampling weights applied. * p<0.10, ** p<0.05, *** p<0.01.

3.4. Gender differences in output allocation (consumption and sales shares)

Table 5 examines whether the manager's gender is associated with the allocation of aquacultural output between household consumption and market sales. Female-managed households allocate a significantly larger share of production to home consumption in both specifications. After controlling for output, the association becomes marginally significant as female management is associated with approximately a 3.6-percentage-point higher consumption share ($\beta = 0.036$, $p < 0.01$).

By contrast, the manager's gender is not significantly associated with the share of production sold in markets. The sales-share estimates remain close to zero across specifications. Larger households and household headship are associated with lower sales shares in some specifications, while higher output is associated with lower home consumption shares. These findings suggest that gender differences are more apparent in output allocation than in market sales. Female-managed households retain a slightly larger share of production for home consumption, even after accounting for differences in production levels, whereas the proportion sold does not differ systematically by the manager's gender. Full results are included in appendix.

Table 5: Gender and allocation of aquacultural output: Consumption and sales shares

Variable	Consumption share Baseline	Consumption share with output	Sales share with output
Female manager	0.033**	0.036***	-0.004
	(0.013)	(0.012)	(0.019)
log(Output)		-0.040***	0.001
		(0.005)	(0.005)
Manager age	-0.000	0.000	-0.001
	(0.001)	(0.001)	(0.001)
Agricultural training	-0.015	-0.001	-0.017
	(0.019)	(0.019)	(0.029)
Education level	-0.017**	-0.012*	0.011
	(0.008)	(0.006)	(0.016)
Married	0.038*	0.044*	-0.050*
	(0.023)	(0.023)	(0.029)
Household head	0.047*	0.043**	-0.079**

Variable	Consumption share Baseline	Consumption share with output	Sales share with output
	(0.025)	(0.021)	(0.033)
Household size	-0.000	0.001	-0.006*
	(0.002)	(0.002)	(0.003)
Urban	-0.034*	-0.018	0.010
	(0.017)	(0.022)	(0.021)
Keeps records	-0.001	-0.002	-0.013
	(0.015)	(0.013)	(0.025)
Formal legal status	-0.002	0.004	0.000
	(0.021)	(0.021)	(0.026)
Has crops	0.012	0.010	0.017
	(0.032)	(0.025)	(0.017)
Constant	0.155*	0.236***	0.867***
	(0.081)	(0.081)	(0.136)

Source: Authors.
Note: Robust standard errors clustered at the state level. Sampling weights applied.* p<0.10, ** p<0.05, *** p<0.01.

3.5. Fractional logit estimates for consumption and sales shares

Table 6 reports fractional logit estimates for the allocation outcomes. The results broadly confirm the OLS findings. Female management remains positively associated with the consumption share ($\beta = 0.257$, $p = 0.001$ on the logit scale), while the relationship with the sales share remains statistically insignificant ($\beta = -0.020$). Output continues to be a strong negative predictor of the consumption share ($\beta = -0.298$, $p < 0.001$), indicating that larger producers devote a smaller share of output to home use. Household headship increases the consumption share but strongly reduces the sales share.

These fractional logit results are consistent with the OLS findings and confirm that the positive association between female management and home consumption is not an artifact of the linear specification. The coefficient on female management is positive and of similar magnitude across both OLS and fractional logit models, and across specifications with and without output controls, though it sits at the margin of the 10-percent-significance threshold in the preferred specifications. At the same time, the findings reinforce the conclusion that the consumption-share result is the clearest evidence of a gender difference in postharvest allocation. This pattern suggests that the main gender gap lies not in commercialization itself but in the extent to which aquacultural production is redirected toward household consumption. Full results are included in appendix.

Table 6: Fractional logit estimates for shares

Variable	(R1) Consumption share	(R2) Sales share
Female manager	0.257***	-0.020
	(0.082)	(0.090)
log(Output)	-0.298***	0.004
	(0.030)	(0.026)
Manager age	0.003	-0.005
	(0.004)	(0.005)
Agricultural training	-0.027	-0.081
	(0.133)	(0.134)
Education level	-0.091**	0.051
	(0.046)	(0.073)
Married	0.332*	-0.257*
	(0.179)	(0.153)
Household head	0.353*	-0.407**
	(0.185)	(0.188)
Household size	0.011	-0.026*
	(0.013)	(0.015)
Urban	-0.131	0.049
	(0.132)	(0.101)
Keeps records	-0.013	-0.062
	(0.098)	(0.120)
Formal legal status	0.023	0.001
	(0.147)	(0.121)
Has crops	0.098	0.080
	(0.184)	(0.082)
Constant	-1.239**	1.703**
	(0.580)	(0.690)

Source: Authors.
Note: Coefficients reported from fractional logit models. Robust standard errors clustered at the state level. Sampling weights are applied. $p < 0.10$, $p < 0.05$, $p < 0.01$.

4. Discussion

This study examined gender differences in labor participation and organization, production, and output allocation among aquaculture-producing households in Nigeria using nationally representative survey data. Three findings emerge consistently. First, upon considering observable household and managerial characteristics, female- and male-managed aquacultural households do not differ systematically in their production. Second, female-managed households organize labor differently, relying more heavily on female workers. Third, the clearest gender difference appears after production: female-managed households retain a modestly larger share of aquacultural output for home consumption, while the share sold does not differ significantly by the manager's gender. The findings are discussed sequentially, focusing on what they suggest about the nature of gender differences in Nigeria's aquacultural sector and how they relate to existing evidence.

4.1 Labor organization

The finding that female-managed households rely more on women's labor, despite exhibiting similar overall labor participation, suggests that gender differences in aquaculture are reflected more in labor composition than in production intensity. Previous studies from Nigeria have largely documented gendered specialization across aquacultural value chains, with women concentrated in processing, retailing, and selected production activities (Adam and Njogu 2023; Adam et al. 2025). Our results complement this literature by showing that gendered specialization is also apparent within aquaculture-producing households themselves.

The available data do not identify why female-managed enterprises employ relatively more women. Several explanations are plausible, including differences in household labor availability, preferences for family labor, hiring networks, local labor markets, or social norms surrounding task allocation. However, these mechanisms cannot be distinguished in the current cross-sectional data; future work combining household surveys with qualitative research or time-use data could help clarify these mechanisms.

4.2 Production outcomes

Notably, there is no statistically significant difference in output between female- and male-managed aquacultural households, upon controlling for observable characteristics. Much of the literature on gender in agriculture emphasizes productivity differences arising from unequal access to land, capital, extension, or labor. The present findings do not contradict that broader literature but instead suggest that such differences are not evident in aggregate output among Nigerian aquacultural producers. Several interpretations are possible. Female managers who participate in aquaculture may have access to resources or experience comparable to male managers. Alternatively, women may organize production differently while achieving similar output levels.

The results indicate that differences in observable production outcomes are smaller than differences in labor organization and postharvest allocation. This distinction is important because much of the policy discussion surrounding gender in agriculture assumes that inequality is primarily reflected in productivity gaps. The present analysis suggests that, at least within this sample of aquaculture-producing households, gender differences may instead be expressed through the organization of production and use of outputs.

4.3 Output allocation

The most consistent gender difference identified in this study concerns the allocation of production after harvest. Female-managed households retain a slightly larger share of aquacultural output for household consumption, and this association remains robust across both OLS and fractional logit specifications.

Although modest in magnitude, this finding complements previous evidence from parts of sub-Saharan Africa suggesting that women may allocate a larger share of food production toward household use (Soh Wenda et al. 2024). At the same time, the results should be interpreted cautiously. A larger consumption share does not necessarily imply better household nutrition or food security. Households selling a greater share of production may use the resulting income to purchase diverse foods, invest in productive assets, or smooth consumption during periods of economic stress. The current data do not include information on diets, food security, expenditure patterns, or intrahousehold allocation, making it impossible to determine the welfare implications of alternative allocation strategies.

The absence of a corresponding gender difference in the share sold also provides useful context. Female- and male-managed households appear to similarly participate in markets, even while female-managed households retain a slightly larger proportion of production for household use. This suggests that commercialization and home consumption are not necessarily mutually exclusive strategies. Instead, households may combine market participation with household provisioning in ways that differ modestly by the manager's gender.

These findings suggest that evaluating gender differences in aquaculture solely through production outcomes may overlook important differences in how production is organized and allocated within households. They also indicate that policies intended to strengthen women's participation in aquaculture should consider labor organization and postharvest allocation alongside productivity. At the same time, the present analysis does not identify the mechanisms generating these differences or establish whether one allocation strategy produces better welfare outcomes than another. Addressing those questions will require richer longitudinal data incorporating household consumption, nutrition, time use, and market participation.

5. Conclusion and policy implications

This study examines how gender shapes labor participation, production, and output allocation in Nigeria's aquacultural sector using nationally representative data from the NASS. Nigeria's aquacultural sector does not appear to exhibit gender gaps in production performance among participating households, but the analysis does reveal systematic differences in how production labor is organized and used. This distinction matters, as the evidence suggests that gender inequality in aquaculture is less about whether women can produce and more about the conditions under which they produce and the roles they occupy within production systems. Female-managed enterprises rely more heavily on women's labor and allocate a slightly larger share of output to home consumption, which may point to differentiated production strategies that are consistent with both labor segmentation and household provisioning roles. These patterns reinforce the need to recognize that gendered constraints and choices are embedded in labor use and intrahousehold allocation processes that shape how benefits from aquaculture are distributed.

From a policy perspective, these findings suggest that interventions focused narrowly on increasing women's productivity or market participation may miss the more relevant margins along which gender differences operate. Policies that expand access to hired labor markets, reduce constraints on labor mobility, and support women's ability to engage beyond gender-segmented roles within aquacultural production may be more effective in addressing structural inequalities. At the same time, the observed differences in output allocation suggest that aquaculture may contribute to both income generation and household consumption in gender-differentiated ways, underscoring the importance of integrating nutrition-sensitive approaches into aquacultural development strategies. Strengthening women's decision-making power over production and income, alongside improving access to inputs, finance, and training, may support broader development objectives and production outcomes. Future research should build on these findings by linking production, allocation, and welfare outcomes using longitudinal and intrahousehold data to better understand how gendered production strategies translate into broader development impacts.

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Appendix

Full regression results for gender differences in aquaculture labor, output, and output allocation

Table A1. Labor participation

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	-0.014	(0.013)	-1.08	0.288	-0.042	0.013
Manager's age	0.000	(0.000)	0.90	0.372	-0.000	0.001
Agricultural training	-0.008	(0.015)	-0.53	0.601	-0.038	0.022
Education level	0.002	(0.005)	0.39	0.695	-0.009	0.013
Married	0.003	(0.014)	0.24	0.815	-0.025	0.032
Household head	-0.032	(0.025)	-1.29	0.204	-0.082	0.018
Manager organizes daily work	-0.001	(0.016)	-0.06	0.949	-0.033	0.031
Household size	-0.001	(0.002)	-0.76	0.450	-0.005	0.002
Urban	-0.007	(0.014)	-0.52	0.607	-0.036	0.021
Keeps records	-0.002	(0.010)	-0.24	0.811	-0.023	0.018
Formal legal status	-0.024*	(0.013)	-1.87	0.070	-0.051	0.002
Has crops	-0.005	(0.010)	-0.51	0.612	-0.026	0.016
Constant	0.212***	(0.047)	4.55	0.000	0.117	0.306

*Source: Authors. Note: Dependent variable: log(Labor participation). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Unweighted. Observations = 2,225; R-squared = 0.010; F(12, 36) = 2.62, p = 0.0128. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A2. Aquaculture workers

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.088**	(0.041)	2.15	0.039	0.005	0.172
Manager's age	0.002	(0.002)	1.19	0.242	-0.002	0.006
Agricultural training	0.039	(0.041)	0.94	0.353	-0.044	0.121
Education level	0.007	(0.017)	0.39	0.695	-0.027	0.040
Married	0.114**	(0.055)	2.09	0.044	0.003	0.226
Household head	0.048	(0.046)	1.04	0.305	-0.045	0.141
Manager organizes daily work	-0.072	(0.054)	-1.33	0.192	-0.181	0.038
Household size	0.024***	(0.007)	3.24	0.003	0.009	0.039
Urban	0.050	(0.049)	1.01	0.318	-0.050	0.149
Keeps records	-0.095	(0.059)	-1.61	0.115	-0.214	0.024
Formal legal status	-0.145**	(0.068)	-2.14	0.039	-0.283	-0.008
Has crops	0.043	(0.050)	0.87	0.392	-0.058	0.145
Constant	0.933***	(0.123)	7.60	0.000	0.684	1.182

*Source: Authors. Note: Dependent variable: log(Aquacultural workers). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 1,993; R-squared = 0.104; F(12, 36) = 41.40, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A3. Female aquaculture workers

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.314***	(0.036)	8.76	0.000	0.241	0.387
Manager's age	-0.000	(0.001)	-0.07	0.941	-0.002	0.002
Agricultural training	0.037	(0.034)	1.08	0.285	-0.032	0.106
Education level	0.006	(0.012)	0.46	0.649	-0.020	0.031
Married	0.107**	(0.046)	2.29	0.028	0.012	0.201
Household head	-0.121***	(0.044)	-2.78	0.009	-0.210	-0.033
Manager organizes daily work	0.109	(0.067)	1.64	0.109	-0.026	0.245
Household size	0.004	(0.006)	0.80	0.429	-0.007	0.016
Urban	0.088*	(0.050)	1.77	0.085	-0.013	0.188
Keeps records	-0.036	(0.034)	-1.07	0.292	-0.104	0.032
Formal legal status	0.077	(0.047)	1.65	0.107	-0.018	0.172
Has crops	-0.109***	(0.029)	-3.78	0.001	-0.168	-0.051
Constant	0.034	(0.103)	0.34	0.739	-0.174	0.243

*Source: Authors. Note: Dependent variable: log(Female aquacultural workers). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 1,993; R-squared = 0.220; F(12, 36) = 57.10, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A4. Female labor share

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.215***	(0.020)	10.49	0.000	0.173	0.256
Manager's age	0.001	(0.001)	1.05	0.303	-0.001	0.002
Agricultural training	0.014	(0.019)	0.75	0.458	-0.025	0.054
Education level	0.006	(0.010)	0.55	0.583	-0.015	0.026
Married	0.024	(0.043)	0.56	0.576	-0.062	0.110
Household head	-0.156***	(0.048)	-3.26	0.002	-0.253	-0.059
Manager organizes daily work	0.062	(0.038)	1.61	0.116	-0.016	0.139
Household size	-0.007**	(0.003)	-2.35	0.024	-0.013	-0.001
Urban	0.054	(0.041)	1.33	0.193	-0.029	0.137
Keeps records	0.006	(0.015)	0.38	0.710	-0.025	0.036
Formal legal status	0.088**	(0.036)	2.45	0.019	0.015	0.160
Has crops	-0.073***	(0.014)	-5.17	0.000	-0.101	-0.044
Constant	0.085	(0.059)	1.45	0.155	-0.034	0.205

*Source: Authors. Note: Dependent variable: Female share of aquacultural labor. Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 1,993; R-squared = 0.189; F(12, 36) = 54.24, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A5. Output (baseline)

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.071	(0.074)	0.96	0.342	-0.079	0.221
Manager's age	0.012*	(0.006)	1.96	0.058	-0.000	0.025
Agricultural training	0.343**	(0.145)	2.37	0.023	0.050	0.637
Education level	0.130	(0.095)	1.37	0.180	-0.063	0.323
Married	0.148	(0.227)	0.65	0.519	-0.312	0.608
Household head	-0.114	(0.328)	-0.35	0.731	-0.779	0.551
Manager organizes daily work	0.332**	(0.163)	2.03	0.049	0.001	0.663
Household size	0.045*	(0.022)	2.02	0.051	-0.000	0.090
Urban	0.394	(0.321)	1.23	0.228	-0.257	1.045
Keeps records	-0.008	(0.110)	-0.07	0.941	-0.231	0.215
Formal legal status	0.152	(0.253)	0.60	0.553	-0.362	0.665
Has crops	-0.044	(0.233)	-0.19	0.852	-0.515	0.428
Constant	2.021***	(0.603)	3.35	0.002	0.798	3.243

*Source: Authors. Note: Dependent variable: log(Output). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 2,209; R-squared = 0.052; F(12, 36) = 4.79, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A6. Output (with labor)

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	-0.063	(0.080)	-0.78	0.440	-0.226	0.100
log(Aquacultural workers)	0.470***	(0.142)	3.30	0.002	0.181	0.758
Manager's age	0.009	(0.006)	1.52	0.137	-0.003	0.022
Agricultural training	0.304**	(0.131)	2.33	0.025	0.040	0.569
Education level	0.163	(0.103)	1.59	0.121	-0.046	0.372
Married	0.168	(0.210)	0.80	0.429	-0.258	0.595
Household head	-0.213	(0.340)	-0.63	0.535	-0.902	0.476
Manager organizes daily work	0.286	(0.192)	1.49	0.144	-0.103	0.675
Household size	0.029	(0.024)	1.20	0.237	-0.020	0.077
Urban	0.449	(0.320)	1.40	0.169	-0.200	1.099
Keeps records	0.069	(0.104)	0.66	0.512	-0.143	0.281
Formal legal status	0.249	(0.260)	0.96	0.343	-0.277	0.776
Has crops	-0.005	(0.219)	-0.02	0.981	-0.450	0.440
Constant	1.534**	(0.598)	2.56	0.015	0.321	2.747

*Source: Authors. Note: Dependent variable: log(Output). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 1,977; R-squared = 0.072; F(13, 36) = 24.45, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A7. Consumption share (OLS)

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.033**	(0.013)	2.53	0.016	0.007	0.060
Manager's age	-0.000	(0.001)	-0.14	0.893	-0.001	0.001
Agricultural training	-0.015	(0.019)	-0.81	0.425	-0.053	0.023
Education level	-0.017**	(0.008)	-2.14	0.040	-0.033	-0.001
Married	0.038	(0.023)	1.67	0.104	-0.008	0.084
Household head	0.047*	(0.025)	1.91	0.065	-0.003	0.098
Manager organizes daily work	0.019	(0.020)	0.96	0.344	-0.021	0.058
Household size	-0.000	(0.002)	-0.14	0.889	-0.005	0.004
Urban	-0.034*	(0.017)	-1.97	0.056	-0.069	0.001
Keeps records	-0.001	(0.015)	-0.09	0.933	-0.031	0.028
Formal legal status	-0.002	(0.021)	-0.10	0.925	-0.045	0.041
Has crops	0.012	(0.032)	0.37	0.713	-0.053	0.077
Constant	0.155*	(0.081)	1.90	0.065	-0.010	0.320

*Source: Authors. Note: Dependent variable: Consumption share. Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 2,209; R-squared = 0.027; F(12, 36) = 3.48, p = 0.0018. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A8. Consumption share (+ output)

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.036***	(0.012)	2.93	0.006	0.011	0.061
log(Output)	-0.040***	(0.005)	-8.48	0.000	-0.050	-0.030
Manager's age	0.000	(0.001)	0.73	0.467	-0.001	0.002
Agricultural training	-0.001	(0.019)	-0.08	0.939	-0.039	0.036
Education level	-0.012*	(0.006)	-1.84	0.075	-0.025	0.001
Married	0.044*	(0.023)	1.93	0.062	-0.002	0.090
Household head	0.043*	(0.021)	2.01	0.052	-0.000	0.086
Manager organizes daily work	0.032*	(0.019)	1.71	0.096	-0.006	0.070
Household size	0.001	(0.002)	0.79	0.434	-0.002	0.005
Urban	-0.018	(0.022)	-0.83	0.412	-0.063	0.027
Keeps records	-0.002	(0.013)	-0.12	0.908	-0.029	0.026
Formal legal status	0.004	(0.021)	0.19	0.849	-0.039	0.047
Has crops	0.010	(0.025)	0.41	0.687	-0.040	0.061
Constant	0.236***	(0.081)	2.89	0.006	0.070	0.401

*Source: Authors. Note: Dependent variable: Consumption share. Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 2,209; R-squared = 0.135; F(13, 36) = 32.25, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A9. Sales share (+ output)

Variable	Coefficient	Std. Error	t	p (>|t|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	-0.004	(0.019)	-0.19	0.849	-0.042	0.035
log(Output)	0.001	(0.005)	0.13	0.896	-0.010	0.012
Manager's age	-0.001	(0.001)	-1.06	0.295	-0.003	0.001
Agricultural training	-0.017	(0.029)	-0.60	0.555	-0.075	0.041
Education level	0.011	(0.016)	0.69	0.495	-0.021	0.042
Married	-0.050*	(0.029)	-1.75	0.089	-0.108	0.008
Household head	-0.079**	(0.033)	-2.36	0.024	-0.146	-0.011
Manager organizes daily work	-0.021	(0.042)	-0.50	0.619	-0.107	0.065
Household size	-0.006*	(0.003)	-1.70	0.098	-0.012	0.001
Urban	0.010	(0.021)	0.48	0.633	-0.033	0.054
Keeps records	-0.013	(0.025)	-0.52	0.604	-0.064	0.038
Formal legal status	0.000	(0.026)	0.01	0.993	-0.052	0.053
Has crops	0.017	(0.017)	0.98	0.332	-0.018	0.051
Constant	0.867***	(0.136)	6.40	0.000	0.592	1.142

*Source: Authors. Note: Dependent variable: Sales share. Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Analytic weights (final_weight). Observations = 2,025; R-squared = 0.017; F(13, 36) = 4.73, p < 0.001. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A10. Consumption share (fractional logit)

Variable	Coefficient	Std. Error	z	p (>|z|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	0.257***	(0.082)	3.12	0.002	0.095	0.418
log(Output)	-0.298***	(0.030)	-9.93	0.000	-0.357	-0.239
Manager's age	0.003	(0.004)	0.76	0.447	-0.005	0.011
Agricultural training	-0.027	(0.133)	-0.21	0.836	-0.288	0.233
Education level	-0.091**	(0.046)	-1.99	0.047	-0.180	-0.001
Married	0.332*	(0.179)	1.85	0.064	-0.019	0.683
Household head	0.353*	(0.185)	1.91	0.056	-0.010	0.716
Manager organizes daily work	0.257	(0.156)	1.64	0.100	-0.049	0.563
Household size	0.011	(0.013)	0.82	0.410	-0.015	0.036
Urban	-0.131	(0.132)	-0.99	0.320	-0.391	0.128
Keeps records	-0.013	(0.098)	-0.14	0.891	-0.205	0.178
Formal legal status	0.023	(0.147)	0.16	0.874	-0.266	0.312
Has crops	0.098	(0.184)	0.54	0.592	-0.262	0.459
Constant	-1.239**	(0.580)	-2.14	0.033	-2.376	-0.102

*Source: Authors. Note: Dependent variable: Consumption share (logit scale). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Sampling weights (pweight, final_weight). Observations = 2,209; Pseudo R-squared = 0.039; Wald $\chi^2(13) = 383.84$, $p < 0.001$. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01.*

Table A11. Sales share (fractional logit)

Variable	Coefficient	Std. Error	z	p (>|z|)	95% Confidence Interval	
					Lower	Upper
Solely female manager	-0.020	(0.090)	-0.22	0.827	-0.196	0.156
log(Output)	0.004	(0.026)	0.14	0.888	-0.047	0.054
Manager's age	-0.005	(0.005)	-1.06	0.287	-0.015	0.005
Agricultural training	-0.081	(0.134)	-0.60	0.549	-0.344	0.183
Education level	0.051	(0.073)	0.70	0.482	-0.091	0.194
Married	-0.257*	(0.153)	-1.67	0.094	-0.557	0.044
Household head	-0.407**	(0.188)	-2.16	0.031	-0.776	-0.037
Manager organizes daily work	-0.111	(0.213)	-0.52	0.601	-0.529	0.306
Household size	-0.026*	(0.015)	-1.72	0.086	-0.056	0.004
Urban	0.049	(0.101)	0.49	0.624	-0.148	0.247
Keeps records	-0.062	(0.120)	-0.52	0.603	-0.298	0.173
Formal legal status	0.001	(0.121)	0.01	0.994	-0.237	0.238
Has crops	0.080	(0.082)	0.98	0.329	-0.081	0.241
Constant	1.703**	(0.690)	2.47	0.014	0.350	3.056

*Source: Authors. Note: Dependent variable: Sales share (logit scale). Robust standard errors, shown in parentheses, are clustered at the state level (37 clusters). Sampling weights (pweight, final_weight). Observations = 2,025; Pseudo R-squared = 0.005; Wald $\chi^2(13)$ = 56.78, $p < 0.001$. t / z, p-values, and 95% confidence intervals are reported for the coefficient of each variable. * p<0.10, ** p<0.05, *** p<0.01*

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