Hindawi
International Journal of Forestry Research
Volume 2023, Article ID 5578146, 7 pages
https://doi.org/10.1155/2023/5578146

Research Article

Determinants of the Market Outlet Choice of Bamboo Culms (*Yushania alpine*) Producers in Banja District, Western Ethiopia

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Received 10 February 2023; Revised 1 May 2023; Accepted 5 May 2023; Published 29 May 2023

Academic Editor: Ranjeet Kumar Mishra

Bamboo meets a growing and various bamboo product demand and generates revenue. The study is aimed at analyzing the critical variables that affect the choice of alternative bamboo market outlets. By using two stages sampling procedures, 114 bamboo producers were randomly and proportionally selected. The determinants that affect the choice of bamboo market outlet were analyzed by multivariate probit model. Based on the model result, the probability of bamboo producers to select wholesaler, retailer, processor, and local traders' outlet were 16.8%, 46.2%, 60.8%, and 54.3%, respectively. The probability of success and failure to select four market outlets were 2.5% and 2.2%, respectively. The result of MVP revealed that family size, total land holding size, amount of culm production, farming experience, distance to the market, and silviculture management practice affected the probability of farmers' market outlet choice. Therefore, improving the producers' knowledge and skills through capacity building and creating framers' organization for collective action can help producers select the right market to sell bamboo products.

1. Introduction

Bamboo is one of the most important vegetation resources in the highlands of Ethiopia, with diverse local and national importance in terms of filling subsistence needs and cash income [1]. The trading of bamboo products is limited to the domestic market. The demand and supply of bamboo culms are minimal, and the trading activity is small regarding product to the locations, distributions, and final usage [2]. The production, marketing, and processing systems remain under-developed and informal [3]. The highland bamboo can grow between 2200 and 3200 m.a.s.l. and average yearly temperatures ranging from 10 to 200°C with an annual rainfall of 1700–2200 mm [4]. Bamboo is the most economically useful nontimber forest products, with its renewable nature and accessibility to rural poor people. It also has great potential for commercialization and can drive rural development. It can be used at all levels of industrial activity from small crafts-based industries to modern integrated plants [4]. *Yushania alpina* and *Oxytenanthera abyssinica* A.Rich Munro are distributed in South, Southwest, and in the central parts of Ethiopia, which includes Benishangule Gumuz, Oromia region, southern nations nationalities, and Amhara region [5].

The bamboo value chain in the Awi zone is characterized by raw material distribution followed by marketing and product reaching to final users. Bamboo producers sell their bamboo culms to local traders who in turn sell the product to processors [6]. The choice of marketing channel is an important farm-level decisions which have a great impact on the income of households' [7]. The choices of marketing outlets are mostly household-specific decisions, and they

require the consideration of demographic, socioeconomic and market-related factors [7, 8]. Understanding the factors that affect the choice of market outlet selection strategies is imperative since the exploitation of such strategies has the potential to increase crop production, investment, and farm income [9]. Muricho et al. [10] argue that understanding the relationship between the market outlets and the factors that affect the selection of each market outlet is fundamental to profiling the markets as well as establishing policy interventions that are carefully designed to benefit farmers. Each market outlet is characterized different market return, risk, cost structure, and other requirements; understanding these characteristics is beneficial to producers who aim to access market outlets [9]. In order to get the maximum return, producers can select different market outlets. But, different factors affect the selection decisions of households. Identifying the factors help pinpoint the possible areas of intervention that may help bamboo producers in maximizing benefits. This study aimed to identify the factors that affect the market outlet choices for bamboo culm producers. Therefore, understanding different factors affecting the market outlet choice of bamboo culms helps to design sound policies related to the marketing of bamboo products and the overall contribution of the bamboo sector to the development of the nation.

2. Methodology

2.1. Area Description. Banja district was selected for this study (Figure 1). It has 25 rural and 1 urban kebeles. From the total kebeles highland bamboo is produced in 20 kebeles. From Northwest of Addis Ababa and Bahirdar city, it is around 442 km and 116 km, respectively. The total population of the Woreda is estimated at about 315,271, with 5% in towns and 95% in rural areas. From the above population, 187,213 are females and 128,058 are males, respectively, and average family size is 7 people per HH [11].

2.2. Sampling Procedures. Two stage sampling procedure was used to select sample producers. Initially, 20 potential kebeles were identified, and four kebeles were selected purposively. The sampled kebeles include Kessa, Gashena, Ledeta, and Surta. Then, populations were listed out and 114 sample producers were selected randomly. Yamane [12] is used to determine the sample size. In the selected kebeles, highland bamboo is produced by 1,449 farmers. Based on this formula, 114 sample respondents were selected from each kebele based on the proportional probability of the size of the population (Table 1).

$$n = \frac{N}{1 + N(e)^2}, \tag{1}$$

where N = the number of producers in selected kebeles, n = the sample size, and e = the level of precision which is 9%.

$$n = \frac{N}{1 + N(e)^2} = \frac{1,449}{1 + 1,449(0.09)^2} = 114 \text{ HHS}. \tag{2}$$

2.3. Method of Data Collection. Primary data were collected through conducting semistructured interviews, and secondary data were collected from different published articles. Primary data were collected from bamboo producers, local traders, wholesalers, and processors. During the household survey, the following issues were included annual bamboo culm production, bamboo market supply, price of bamboo culms, and amount of income gained from different bamboo products. To support the primary data, secondary data were collected from different office reports and published materials.

2.4. Data Analysis. Descriptive statistics was used to analyze the socioeconomic characteristics of bamboo producers and multivariate probit model (MVP) was employed to analyze the determinant factors. Econometric models such as multinomial probit/logit and multivariate probit models are used for the analysis of categorical choice dependent variables. The multinomial probit/logit model assumes independence across the choices and does not allow correlation between alternative choices. MVP considers the interdependence and correlations among the outlets. It is an extension of the probit model and is used to estimate several correlated binary dependent variables jointly [13].

The decision whether to select the market outlet or not is considered in profit maximization [14]. It considered interdependence among the choices of alternative market outlets. Assume i^{th} bamboo producer ($i = 1, 2, 3, 4, \ldots, N$) facing a problem related to the selection of alternative market outlets. Assume U_K^* denote profit of producer to select wholesalers ($Y1$), retailers ($Y2$), processors ($Y3$), and local traders ($Y4$). The bamboo producer decides to select K^{th} market outlet if $Y_{\text{ik}}^* = U_k^* - U_0 > 0$. U_k^* represent the utility derived from the selected K^{th} market outlet if selected by i^{th} farmer and U_0 is utility if the market k is not selected. The net benefit (Y_{ik}^*) that producers obtained by selecting a market outlet which is a latent variable depends on the observed independent variables (Xi) and error terms (ϵ_i) as given in the following equation:

$$Y * ik = X'i\beta k + \varepsilon i\, K = (Y1, Y2, Y3, Y4). \tag{3}$$

Therefore, based on the indicator function, the abovementioned equation can be translated into observed binary outcome equation as follows:

$$y_{\text{ik}=} \begin{cases} 1 \text{ if } y_{\text{ik}}^* \\ 0 \text{ Otherwise} \end{cases} > 0\left(K = Y_1, Y_{2,} Y_3, Y_4\right). \tag{4}$$

The probabilities that all alternative market outlets selected by a producer can be entered into the likelihood function are specified as follows:

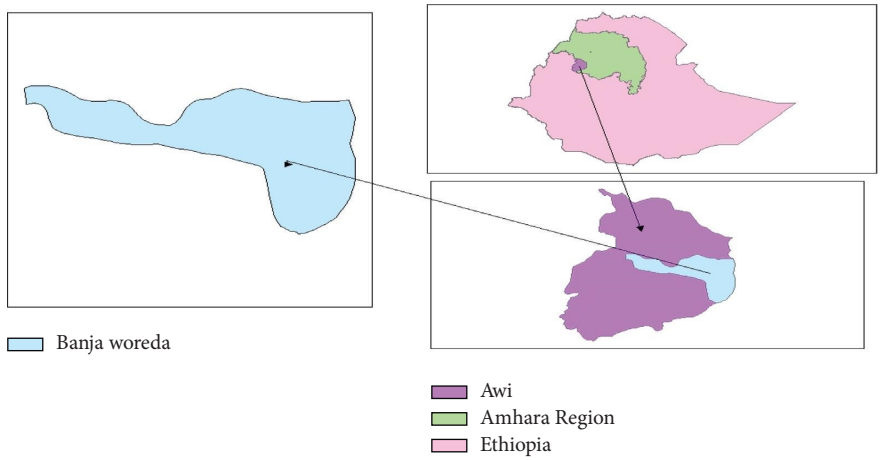

Figure 1: Study area.

Table 1: Proportional sample size determination of sampled households.

Kebeles	Producers	Proportion	Sample size
Kessa	492	0.34	38
Gashena	350	0.24	27
Ledeta	325	0.22	25
Surta	282	0.2	24
Total	1449	1	114

$$\Pr[y1i = 1, y2i, y3i, y4i] = \Phi(\beta\_1 x\_1i, \beta\_2 x\_2i, \beta\_3 x\_3i, \beta\_4 x\_4i, \rho) = \Pr(\varepsilon 1i \le \beta 1x1i, \varepsilon 2i \le \beta 2x2i, \varepsilon 3i \le \beta 3x3i, \varepsilon 4i \le \beta 4x4i). \tag{5}$$

In MVP, the selection of combinations of the market outlet is possible, and the error terms jointly follow a normal distribution with a zero mean, normalized to unity, and symmetric to the covariance Ω given as follows:

$$\Omega = \begin{bmatrix} 1 & \rho y1y2 & \rho y1y3 & \rho y1y4 \\ \rho y2y1 & 1 & \rho y2y3 & \rho y2y4 \\ \rho y3y1 & \rho y3y2 & 1 & \rho y3y4 \\ \rho y4y1 & \rho y4y2 & \rho y4y3 & 1 \end{bmatrix}. \tag{6}$$

The function of log-likelihood associated with the sample outcome is described as follows:

$$L = \sum_{i=0}^{n} \omega \ln \varphi i(\mu_i, \Omega), \tag{7}$$

where ω is an optional weight for observations $i \ldots N$ and Φi with arguments μi and Ω are standard normal distributions.

$$\text{Where } \mu i = (\text{ki1}\beta 1\text{xi1}, \text{ki2}\beta 2\text{xi2}, \text{ki3}\beta 3\text{xi3}, \text{ki4}\beta 4\text{xi4})$$
$$\Omega\text{jk} = \Omega\text{kj} = \text{KijKik}\,\rho\text{jk} \tag{8}$$
$$\text{With Kik} = 2\text{yik} - 1 \text{ for each } i \text{ and } k = 1 \ldots 4. \text{ Matrix } \Omega \text{ constitutes } \Omega\text{jkwhere } \Omega\,\text{jk} = \text{for } j \ne k = 1 \ldots$$

2.5. Hypotheses and Definition Variables

2.5.1. Dependent variables: Market Outlet Choices. These are categorical variables represent the probability of a producer's choice among alternative market channels. The market outlet choices were among the four alternative channels which are denoted in the model as *Y*1 for producers who select wholesalers, *Y*2 who select retailers' outlet, *Y*3 who select processors, and *Y*4 represents households who choose local traders to sell bamboo culms (Table 2). Bamboo wholesalers are the traders who purchase bamboo culms in large amounts from bamboo producers and other traders. Bamboo retailers are the traders who purchase bamboo culm from village traders and producers and sell it to processors

Table 2: Hypothesis of variables used in multivariate probit.

Variables	Measurement/codes	Expected outcomes on the market outlets			
		Wholesalers	Retailers	Processor	Local trader
Sex	Dummy (1 male, 0 otherwise)	+ve	−ve	+ve	−ve
Education	Categorical	+ve	−ve	−ve	−ve
Family size	Continuous (man equivalent)	+ve	−ve	−ve	−ve
Price	Continuous (in birr)	+ve	−ve	+ve	−ve
Total land size	Continuous (hectar)	+ve	+ve	+ve	−ve
Experience	Continuous (in year)	+ve	−ve	+ve	−ve
Distance	Continuous (walking hour)	−ve	−ve	−ve	+ve
Extension contact	Continuous (number of contact)	−ve	−ve	−ve	−ve
Silviculture management	Dummy (1 = Yes, 0 otherwise)	+ve	+ve	+ve	−ve
Number of culm harvested	Continuous (number of culm)	+ve	+ve	+ve	−ve

and end users of bamboo culm. Local traders are the traders who purchase and collect bamboo culm from the producers and sold it to wholesalers and retailers. They sold bamboo culm to wholesalers and processors in the district. Each market outlet is a binary indicator which takes one if the producer chooses the given alternative outlet and zero otherwise. The hypothesis of independent variables were presented in Table 2.

3. Results and Discussion

3.1. Characteristics of Bamboo Producers. The age of producers ranged from 26 to 75 years. 53.11 years is the mean age of households in the study area. It indicated most of the producers are categorized under the productive age of the population. The family size of respondents ranged from 2 to 9 members. Land is the main production factor which affects the production and supply of bamboo culm. In Banja district, producers used their land for bamboo production. The minimum and maximum land sizes of the producer was 0.125 and 2.75 ha, respectively, and the mean land size is 1.21 ha of land. The average land size allocated for bamboo plantation was 0.15 ha (Table 3). It indicates that the land size allocated to bamboo production is limited.

Table 3: Characteristics of bamboo producers.

Variables	Minimum	Maximum	Mean	SD
Age	26	75	53.11	10.76
Family size	2	9	5.33	1.55
Total land size	0.125	2.75	1.21	0.49
Land size for bamboo	0.013	0.75	0.15	0.10
Bamboo farming experience	3	47	19.34	9.03

Source: field survey result, 2020.

3.2. Bamboo Marketing Outlets. In Banja district, bamboo producers used wholesalers, retailers, processors, and local traders to sell bamboo culms. However, the selection of right market outlet is not easy because it is affected by different factors. In this section, based on the output of the multivariate probit model significant independent variables were discussed.

The Wald X^2 (102.52, $p = 0.001$) indicated that the test is significant at 1%. It indicated the subsets of coefficients are jointly significant, and explanatory variables explained the dependent variables. Therefore, multivariate probit model is highly significant. The likelihood ratio test (LRX^2 (6) = 29.68 (prob > X^2 = 0.001)) which is statistically significant at 1%. It revealed the rejection of the null hypothesis, i.e., all rho values equal to zero are rejected based on the test result. It also indicated the fitness of the model and the decision to select alternative market outlets were interdependent with each other, and it supports the use of the multivariate probit model.

The ρ values (ρij) in Table 4 indicate the correlation between each pair of market outlets. The value of $\rho 31$ (the degree of correlation between processor and wholesaler) is negatively correlated and statistically significant at 1%. The value of $\rho 42$ (degree of correlation between local traders and retailer) is negatively correlated and significant at 1% and the value of $\rho 43$ (correlation between local traders and processor) indicated the existence of negative correlation and which is statistically significant at 1%. These correlations indicate that each pair of market outlets competes with each other.

The maximum likelihood estimation indicated the marginal probability of for each market outlets. As indicated in Table 4, the likelihood of choosing wholesale market (16.8%) was small as compared to the likelihood of selecting (46.2%), processor (60.8%), and local trader (54.3%). The joint probability of success and failure was 2.5% and 2.2%, respectively. It indicated that bamboo producers are more likely to select four market outlets jointly (Table 4).

Three variables affect the wholesale market; two variables affect the retailer market; four variables the processor market; and two variables affect significantly the local market outlet at 1%, 5%, and 10% levels of significance (Table 5).

3.2.1. Family Size of the Household. It was positively and negatively correlated and affected the probability of selecting wholesale market and processor market outlets at a 1% and 5% significance level, respectively. Household heads who have more active labour forces have high probability of selling bamboo culms to wholesale market because it helps the producer to harvest a large number of bamboo culm which they can deliver to the wholesale market. This finding

Table 4: Overall fitness of the model, probabilities, and correlation matrix of alternative market outlets.

Variable	Wholesalers	Retailers	Processors	Local traders
Marginal probability	16.8	46.2	60.8	54.3
Joint prob (success)	2.5			
Joint prob (failure)	2.2			
Number of draws	5			
Log-likelihood	−219.18			
Wald χ^2 (48)	102.52***			
Prob χ^2	0.000			
	$\rho 1$	$\rho 2$	$\rho 3$	$\rho 4$
$\rho 1$	1.00			
$\rho 2$	0.0793271	1.00		
$\rho 3$	−0.549***	−0.174	1.00	
$\rho 4$	0.269	−0.388***	−0.533***	1.00
Log-likelihood ratio:	$\rho 21 = \rho 11 =$	$\rho 41 = \rho 32 =$	$\rho 42 = \rho 43 = 0$:	Chi2 (6) = 29.68*** probχ^2 = 0.001

***, **, and * indicate the statistical significance at 1%, 5%, and 10%.

Table 5: The results of multivariate probit model.

Variables	Wholesalers Coef (se)	Retailers Coef (se)	Processors Coef (se)	Local traders Coef (se)
Sex	0.726 (0.744)	−0.131 (0.506)	0.748 (0.533)	0.193 (0.426)
Read and write	−0.259 (0.369)	0.342 (0.301)	−0.278 (0.329)	−0.087 (0.288)
Attend primary school	−0.226 (0.457)	0.607 (0.380)	0.247 (0.407)	0.134 (0.354)
Attend secondary school	−4.314 (103.9)	−0.777 (0.845)	0.686 (0.755)	−0.716 (0.692)
Family size	0.328*** (0.123)	0.119 (0.089)	−0.231** (0.09)	0.115 (0.083)
Price	0.030 (0.034)	0.032 (0.025)	0.027 (0.025)	−0.007 (0.023)
Total land size	0.737* (0.397)	0.470 (0.320)	0.048 (0.341)	−0.101 (0.292)
Bamboo farming experience	−0.008 (0.019)	−0.05*** (0.024)	0.063*** (0.023)	−0.037*** (0.012)
Distance to the market	−0.001 (0.004)	0.003 (0.003)	−0.02*** (0.004)	0.009*** (0.003)
Extension contact	−0.1003 (0.112)	0.015 (0.088)	−0.029 (0.095)	−0.048 (0.081)
Silviculture management	−0.061 (0.370)	0.287 (0.303)	0.664** (0.326)	−0.417 (0.289)
Number of culm harvested	0.001* (0.001)	0.001* (0.001)	0.0003 (0.0004)	0.0004 (0.0004)
Constant	−4.769 (1.604)	−1.392 (1.167)	0.326 (1.169)	−0.204 (1.064)

Source: field survey result, 2020. *Note.*** indicates the statistical significance of variables at 1%. ** indicates the statistical significance of variables at 5% and * indicates the statistical significance of variables at 10%.

is supported by the findings of Honja et al. [15], who found that the active labour force in the household affected the probability of selecting wholesale market outlet positively. It is also consistent with Melekamu [16] who reported that households with a large family size were positively related to the probability of choosing a wholesaler outlet because having a large family size helps to supply output to wholesale market rather than selling to local traders. In the other way, households who have more number of family members have less probability to choose processor outlet rather they want to produce different value-added product, in this case, the probability of supplying to the processor become decreased. This finding is consistent with Kuma et al. [8], who reported that family size has a relationship with the probability of selecting processor market outlets.

3.2.2. Total Land Size of the Household Head. It was positively correlated with wholesaler, and it was significant at a 10% level of significance. This finding revealed that households who have a better land size are more likely to choose wholesaler outlet than households having smaller area of land because it enables to produce more number of bamboo culm and wholesalers need to buy a larger number of bamboo culms in bulk form. Total land size was positively correlated with assembler market outlets because when bamboo producers have large total land size, the probability of allocating land for bamboo plantation increases. It enables the producer to produce large volumes of agricultural products for wholesalers who can purchase the product in large volume [17]. Similar results were reported by Dessie et al. [18] and Kumar [19], who indicated that farm size positively affected the choice of assembler market outlet.

3.2.3. Farming Experience of the Household Head. It was negatively correlated with retailers and local traders, and it was statistically significant at 1%. It indicated that more experienced bamboo producers have less probability of selling bamboo culms to the retailers' market outlets and local traders than less experienced bamboo producers. Because, through time, experienced producers make market linkage with processors. This finding is in line with Wosene [20], who found that experience affected negatively the

probability of selecting retailer market outlet and it is also supported by the report of Emana et al. [21], who indicated farming experience is negatively correlated and affected negatively the probability of selecting collectors. On the other way, it affected the probability of choosing the processor positively at a 1% significance level. It means through time, experienced bamboo producers form relationship with bamboo processors. A study conducted by Kiplangat and Kiprop [22], who indicated that pineapple farming experience has a positive relation with the probability of selecting urban market outlet.

3.2.4. Distance to the Market. As hypothesized, it was negatively and positively correlated with processors and local traders, respectively, and it was significant at a 1% significance level. Households who walked long distances are less likely to sell bamboo culms to processors because bamboo processors found on towns. This result also supported by Tilahun [23], who found that long market distance has a negative relation with the probability of choosing processor market outlets. On the other way, producers who are distant from the district market are more likely to choose local traders to sell bamboo culms because the local traders collect the bamboo culm at the farm gate; in this case, producers did not expend transportation cost. Households located far away from the nearest market face difficulty in delivering their output to retail markets. As a result, they prefer to sell products to local collectors because collectors can purchase products at farm gate [24]. The result is consistent with Mmbando [25], who revealed that producers far from the market incurred a high transaction cost, and they opt for the brokers to sell the product at a production place rather than selling to the wholesale market. This finding is also consistent with the finding of Emana et al. [21] who indicated that distance from the nearest rural market is negatively related to the retail market because they prefer to sell their products to local traders.

3.2.5. Silviculture Management. It was found to be positively correlated with processors and statistically significant at 5%. It indicated that households who practice good silviculture management are more likely to select processor outlet as compared to other bamboo producers who cannot practice silviculture management in bamboo farming. It implies that when producers apply good silviculture management activities, they can produce a number of bamboo culms with the required quality. In this case, processors require a bamboo culm which has a required size, type, and thickness with the required quality. Therefore, the probability of selling to the processor increases.

3.2.6. Number/Quantity of Culm Harvested. It was positively correlated with wholesalers and retailers and significantly affected wholesalers and retailers at a 10% level of significance. The result indicated that households who can produce large number of bamboo culm mostly preferred to select combinations of two or more market outlets found in the district. It implies that when bamboo producers can produce enough bamboo culms, they can sell culms to wholesalers and retailers. It is supported by Mirie et al. [17], who reported the probability of selecting wholesale and retail markets were positively affected by the quantity of teff production. A study conducted by Tilahun [23] also indicated that the probability of selecting wholesalers and retailers outlets were affected by the quantity of potato produced. Again, it is in line with Medekesa [26], who indicated that the quantity of coffee sold to the market agents increases the probability of farm households choosing trader market outlets.

4. Conclusions and Policy Implications

The study was aimed at analyzing determinants of the market outlet choices of bamboo producers. The joint probability of success and failure was 2.5% and 2.2%, respectively. The result of a multivariate probit model also revealed that the three ρ values are statistically significant and negatively correlated. It indicated the existence of competitive relationship between the processor with wholesalers, local traders with retailers, and local traders with processors. The result of the MVP model indicated that bamboo producers in the area made their market outlet choice based on the bamboo farming experience, area of total land holding size, number of bamboo culm harvested, family size, distance, and silviculture management practice. To increase the benefit of bamboo producers, micro, and small enterprise office and development agents of the district should link the processors with bamboo producers. If producers can link with bamboo processors, the market margin for processors and producers become increased because unnecessary costs can be eliminated through market linkage. Therefore, it is the appropriate market outlet for bamboo producers to increase their marketing margin. Awareness creation about ways of obtaining market information, ways of selecting appropriate market outlets, and ways to get fair price for bamboo products should be provided by development agents and market experts for bamboo producers. The development agents and other concerned bodies should improve the producers' knowledge and skills through capacity building and creating framers' organization for collective action help to increase the market supply of bamboo, the share of producers, and the ability of producers to choose appropriate market outlets to sell bamboo culms.

Data Availability

The data used to support the finding of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors read and approved the final manuscript.

Acknowledgments

The authors thank the sample respondents and experts of agricultural development office for their cooperation and support during data collection process.

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