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Research Article

Determinants of Garlic Producers Market Outlet Choices in Goncha Siso Enese District, Northwest Ethiopia: A Multivariate Probit Regression Analysis

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This study investigates the factors influencing garlic producers' market outlet selection decisions in Goncha Siso Enese District, Ethiopia. A total of 359 garlic producer households were polled, and the results were analyzed using a multivariate probit (MVP) model. According to the MVP model results, extension contact, access to market information, quantity of garlic sold, and farm experience in farming were negatively and significantly associated with the choice of consumer outlet. Besides this, the estimated MVP for retailer outlet choice is positively influenced by the amount of quantity sold, and farm experiences in garlic have a significant and positive effect on the choice of retailer outlets. In contrast, education level, access to credit, extension contact, and land area allocated for garlic have a negative influence on the choice of retail outlet. Moreover, wholesaler outlet choice is significantly and positively influenced by education level, access to credit, amount of quantity sold, extension contact, and distance to market, whereas it is negatively influenced by lagged price. Assembler outlet is also positively influenced by sex, distance to market, access to market information, and quantity sold, and negatively affected by extension contact and lag price. The implication is that, if smallholder garlic producers have access to alternative market outlets, they must select an appropriate combination of market outlets to maximize their income in the long run. It is suggested that equal access to marketing infrastructure in potential production areas, the garlic production system, and rural-urban development infrastructure should be improved and made more accessible.

1. Introduction

Vegetables (including garlic) play an important role in rural modernization [1] and in providing additional income, as well as nutrition [2, 3] when vegetables are cultivated as vegetable home garden. Garlic (*Allium sativum*) is one of Ethiopia's most important bulb crops and a popular spice [4]. It is the second most widely cultivated crop in the *Alliaceae* family. Garlic's aroma makes it popular in everyday cooking around the world [5]. Garlic crop cultivation is currently expanding due to the crops' high economic value. Throughout the world, the crop has been known to have a variety of food and medicinal uses [6]. It is used to preserve meat and meat products, as well as season salads and vegetables. Garlic has become an increasingly popular spice in recent years among producers, marketers, and consumers in a variety of ways in all curries, fried dishes, seasoning dishes, pickles, and sauces [7], and it is regarded as the queen of the kitchen. Garlic extracts are commonly used to treat whooping cough, lung disease, stomach pain, childbirth disorders, earaches, hypertension, and eye sores [8]. Garlic could also be used as an insecticide, to lower cholesterol levels in human blood, and to repel snakes [5].

Garlic is becoming more popular as a culinary delight, and producers have discovered it to be a potentially profitable crop. During the meher season of 2020-2021, Ethiopia

produces 1,149,447 quintals of garlic [9]. According to the same source, Ethiopian garlic thrives in the country's northwestern areas, producing 126,155,690 quintals.

The choice of marketing outlet is one of the most important farm household decisions for selling their produce and has a significant impact on household income [10]. Market outlet selection is a household decision, and several factors must be considered as a basis for such a decision. One of the challenges of producing perishable vegetables is identifying appropriate market outlets to deliver the produce fresh and earn a higher price [6, 11]. Several empirical studies on the factors influencing marketing channel choice decisions for various products have been conducted. For example, onion [12], vegetable [11, 13], pepper [14], potato [15], coffee [16], honey [10], and teff [17] marketing outlets were studied. According to these studies, household characteristics, resource endowment, prices, access to market information, institutional services, and access to different market outlets can all influence smallholder farmers' decisions to choose different market outlets. Furthermore, the difficulty in accessing more rewards alternative markets forces smallholder farmers to sell their produce through a low-cost outlet [15].

However, no literature has been found in Ethiopia, including the study area, which attempted to investigate the factors influencing garlic producers' market outlet choice. The study area, Goncha Siso Enese District, is one of northwest Ethiopia's most important garlic-producing areas. Despite the rapidly increasing demand for garlic products for both food condiments and medicinal values, research on the marketing outlet choice of garlic producers has been lacking in the literature. Given the high potential area for garlic production, this study attempts to investigate the factors influencing the selection of appropriate market outlets in the Goncha Siso Enese District of northwest Ethiopia. Thus, the purpose of this study is to investigate how the characteristics of garlic producers, their resource endowment, production and marketing characteristics, and institutional service delivery interact to influence garlic market outlet choice in the Goncha Siso Enesie District. Therefore, the researcher tried to answer the following research questions and evaluate the objectives.

1.1. Research Question.

(i) What are the socio-economic characteristics of garlic farmers be described?

(ii) What are the factors that influence garlic market outlet choices of small holder farmers in the study area?

1.2. Objectives of the Study

1.2.1. General Objective. To examine the socio-economic and demographic factors influence market outlet choices of garlic farmers in Goncha Siso Enese district, Northwest Ethiopia.

1.2.2. Specific Objectives.

(i) To describe the socio-economic characteristics of garlic farmers.

(ii) To identify factors that influence wheat market outlet choices of small holder farmers in the study areas.

2. Literature Review on of Determinants of Market Outlet Choice Decisions

The following literature empirically reviews the critical factors influencing small-holder farmer's outlet choice decisions. For example, Tarekegn et al. [10] investigate the determinants of honey producer market outlet choice in Chena District, southern Ethiopia. They discovered that the quantity of honey sold, frequency of extension contact, beekeeping experience, and distance to the nearest market, market information, cooperative membership, and trust in buyers affect their outlet choice decisions in the honey market among retailer, collector, and consumer outlets.

Other research findings showed that access to credit and pricing information, volume of quantity sold, and extension service all influence consumer outlet choice for coffee [18]. Similarly, gender, education level, education, distance to market, and access to market information all determine wholesaler outlet choice in the coffee market [16]. Furthermore, quantity sold, farming experience, extension contact, year of schooling, market distance, and livestock ownership all had a statistically significant effect on pepper market outlet choices [14].

Endris et al. [13] also discovered that education level, gender, farming experience, land cultivated, quantity produced, selling price, and extension contact all had a substantial impact on onion growers' market outlet selection decisions. More precisely, male-headed households had quite a positive effect on collector outlet options but a negative effect on consumer outlet choices, whereas education, farming experience, amount produced, and extension contact are all positively linked with wholesale outlet choice. Other findings indicate that farm size, education level, credit access, and livestock size in TLU influence the choice of retail and wholesale outlets [19]. Family size, farming experience, and quantity sold have all influenced retailer choice in the tomato market [20].

Similarly, credit access, distance to nearest market, output yield, livestock holding, and extension service have all influenced onion farmers' choice of wholesaler, retailer, and assembler outlet [12]. Proximity to markets and lag price are adversely connected with the choice of assembler/collector and retailer outlet in the onion market, though quantity and access to credit are positively associated. Furthermore, the choice of wholesale outlet is favorably linked with lagged price and distance to market, but access to credit and tropical livestock units are negatively associated.

Education and farming experience [21] are negatively correlated with retail outlets, whereas distance to market is positively associated with assembler outlets. According to Ababulgn [22] and Terekegn et al. (2017), market information is favourable to consumer outlets but negative to assemblers. Similarly, lagged prices and quantity of output sales [23] have a significant impact on wholesalers' and assemblers' outlets. Furthermore, land size has a positive

impact on wholesale and a negative impact on retail outlets among teff farmers. Moreover, Mariyono's [24] findings shows that education, experience, and distance to market in vegetable is negative and affects the participation of intensive commercial vegetable farming and marketing, while credit availability has a positive effect. Access to available information and its devices [25–28] reduces transaction cost and increase customers as well as production and productivity. Mohammed Kassaw et al. [29] also identified as education, distance to market, credit were identified as the main determinants of the choice of market outlet choices for vegetables.

Therefore, different studies indicate that there are several factors influencing market outlet choice decisions in different products. However, there was no previous comprehensive research regarding the factors influencing market outlet choice decisions of garlic products in the literature though garlic is a high value commodity as it considered as the queen of kitchen. There has been no research on the market outlet choice decisions of garlic farmers in Ethiopia including the study area where there is great potential for garlic producers. As a result, this study is essential for understanding the fundamental factors influencing garlic producers' market outlet choices.

2.1. Conceptual Framework. The link between the independent and dependent variables in this study is depicted in Figure 1. The researcher desired to determine the factors that influence market outlet choice decision of garlic producer based on a review of the literature. According to the figure, there are thirteen variables that affect outlet choice decision of garlic farmers.

3. Research Methodology

3.1. Description of the Study Area. Goncha Siso Enese District is one of the 18 districts of the Amhara Regional State's East Gojam Administrative Zone in northwest Ethiopia. The district is located 343 kilometers from Addis Ababa, Ethiopia's capital city. The district is bounded on the east by Enebise Sar Midir; on the south by Enarg Enawga; on the west by Hulet Eju Enese; and on the north by the Abay River, which divides it from the South Gondar Zone. Furthermore, the district has two towns and 41 rural kebeles, totaling 39,209 households [30]. A total of 32,783 households were involved in agriculture. The major town in Goncha Siso Enese is Ginde Weyin.

The agro-ecological situation of the study district is characterized by 12 percent Dega (highland ranging from 2200–3200 m.a.s.l), 48 percent Woinadega (midland ranging from 1600–2200 m.a.s.l), and 40 percent Kolla (lowland ranging from 1000–1600 m.a.s.l). The terrain is divided into three categories: plain (46%), undulating (16%), and mountainous (38%). Because the soil is shallow in depth and bare, it is prone to soil erosion. Brown soil (60 percent), gray soil (20 percent), and red soil (15 percent) are the most common soil types. The district has a total land area of 98,385 ha, with 46,664.30 ha cultivated, 11,698.05 ha of grazing, 6,358 ha of bush land, 320 ha of forest, 1846 ha of water bodies, 5,276 ha of barren land, and 18,520 ha of settlement. The average annual rainfall of the district is 1100–1500 mm, with an uneven distribution of rainfall with respect to time and space [30]. In the Goncha Siso Enese District, there is a high potential for garlic production, and many households are engaged in the production and marketing of garlic products. Therefore, the study was conducted in Goncha Siso Enesie District, as depicted in Figure 2.

3.2. Sampling Techniques and Sampling Procedure. A two-stage sampling procedure was used to identify potential garlic producer households. First, four high-garlic producer kebeles from the district were chosen using a purposive sampling method. The kebeles' potential for garlic production and the accessibility of the areas to travel were factors in the selection. Second, the intended sample size was determined proportionally to the population size of garlic producer farmers using a population list from sample kebeles. Then, 362 representative households were chosen at random using a simple random sampling technique based on Yamane's [31] formula.

Yamane's [31] general formula will be used to calculate the sample size of rural households. The study will use a 95% confidence interval and $a + 5\%$ margin of error. The sample size was calculated using the following formula:

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

where n represents sample size required, N signifies the total household population under study who are engaged in agriculture, and e represents the desired level of precision, i.e., margin of error (0.05).

Thus,

$$n = \frac{3,814}{1 + 3,814\left(0.05^2\right)}, n = \frac{3,814}{(1 + 9.535)}, n = \frac{3,814}{10.535}, \tag{2}$$

$$n = 362.03 \sim 362.$$

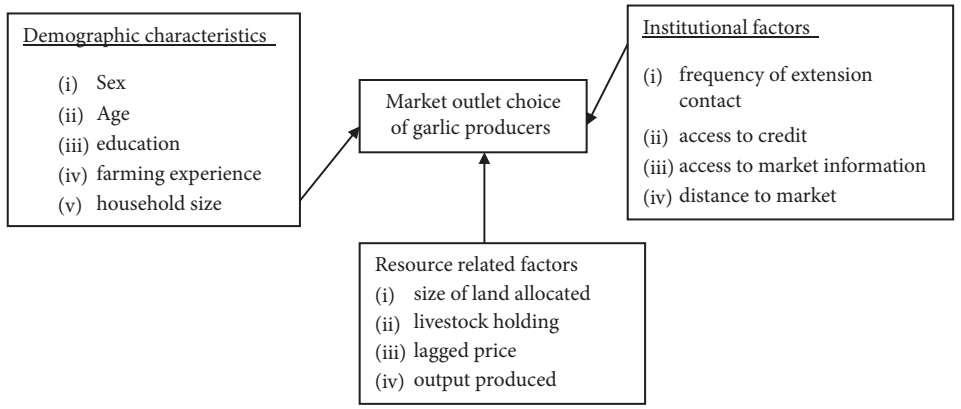

Figure 1: The study's conceptual framework. Source: own composition based on a review of relevant literature.

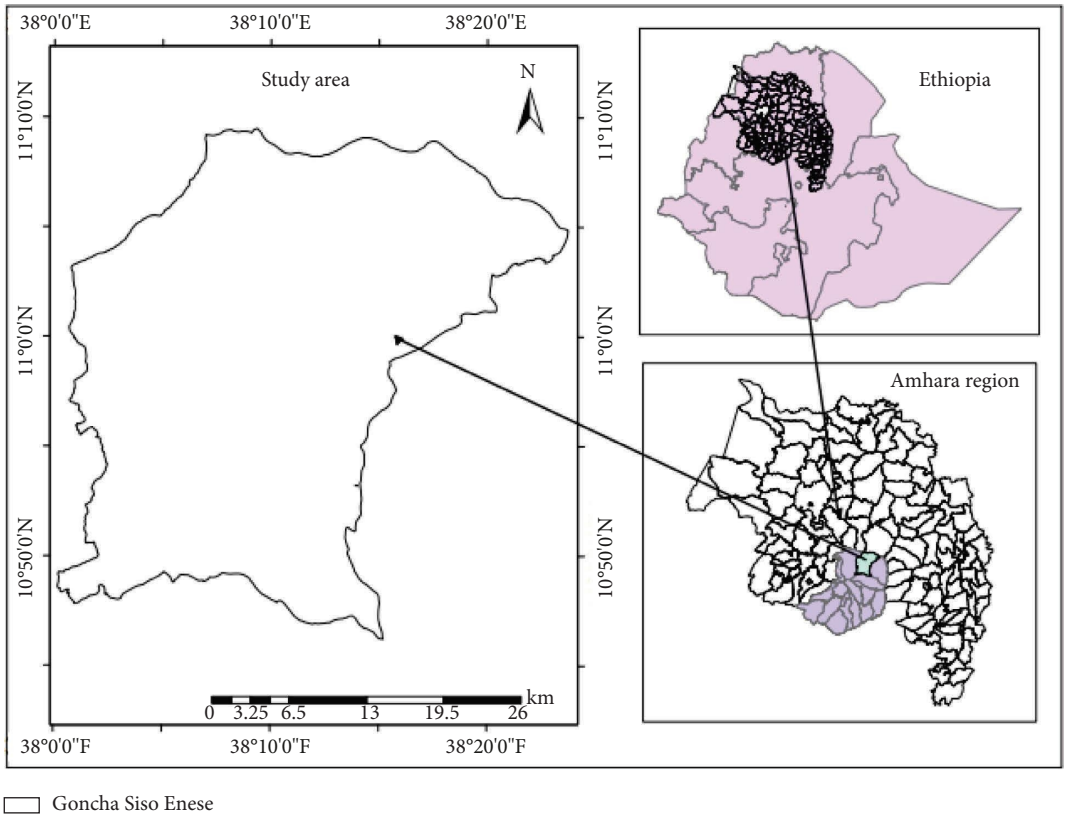

Figure 2: Location map of the study area. Source: ArcMap 10.3.

The distribution of the sample size across the kebeles was based on their relative share of garlic producers to the total sampling frame as shown in Table 1.

3.3. Data Source and Data Collection Method. To meet the study's objectives, both qualitative and quantitative data were collected from primary sources on a wide range of garlic producer information. A team of five trained enumerators administered semi-structured questions and personal interviews to small-scale garlic farmers in the study area for the cross-sectional survey. The intended sample size from each sample kebele was determined proportionally to the size of the garlic growers' households. Finally, using the household list of small garlic producers, 362 total samples from all kebeles were randomly selected using the random sampling technique.

3.4. Method of Data Analysis. The data was analyzed using descriptive statistics and an econometric model. The descriptive

Table 1: Sample kebeles and garlic producers.

No.	Sample kebeles	Number of garlic producer households	Number of sample households
1	Goshera	1057	100
2	Gomite	968	92
3	Embawoch	790	75
4	Debreyakob	999	95
Total		3814	362

Source. GSED [30].

analysis was performed using mean, frequency, percentage, and table data, while the econometric model was examined using the multivariate probit model (MVP). A multivariate probit model was used to identify the factors influencing sample households' market outlet choices. A multivariate probit model simultaneously shows the influence of a set of explanatory variables on market outlet choice while accounting for potential correlations between unobserved disturbances as well as the relationship between market outlet choices [32].

Smallholder garlic producers in the study area have a variety of market outlets to choose from, including wholesalers, consumers, retailers, and cooperatives. Thus, in this study, garlic is one of the cash crops that allows producers to select multiple outlets that are not mutually exclusive in order to obtain a better price. Given the possibility of concurrent outlet selection and the potential correlations among these market outlet selection decisions, a multivariate probit model was appropriate and used to capture household variation in market outlet selection and estimate several binary outcomes jointly.

The selection of appropriate market outlet i by farmer j is ${Y_{ij}}^A$, defined as the choice of farmer j to transact market channel i (${Y_{ij}}^A = 1$) or not (${Y_{ij}}^A = 0$), it is expressed as follows:

$$Y_{ij}^A = \begin{cases} 1 & \text{if } {Y_{ij}}^A = {X_{ij}}^A a_{ij} + \mathscr{E}^A \geq 0 \Leftrightarrow {X_{ij}}^A \geq -\mathscr{E}^A, \\ 0 & \text{if } {Y_{ij}}^A = {X_{ij}}^A a_{ij} + \mathscr{E}^A < 0 \Leftrightarrow {X_{ij}}^A < -\mathscr{E}^A, \end{cases} \tag{3}$$

where a_{ij} a vector of simulated maximum likelihood (SML) parameters to be estimated, $\mathscr{E}^A$ is a vector of correlated error terms under the assumption of normal distribution, and Y_{ij}^A is dependent variable for market outlet choices simultaneously and X_{ij}^A combined effect of the explanatory variables.

The multivariate probit simultaneous model was used because the choice of one type of market outlet is dependent on the choice of another, and smallholder farmers' choice decisions are interdependent and must be estimated simultaneously. Because smallholder farmers' market outlet decision-making was expected to be influenced by the same set of explanatory variables.

$$\begin{cases} \text{Consumer}_j = X_1^{'}\beta_1 + \mathscr{E}^A, \\ \text{Retailer}_j = X_2^{'}\beta_2 + \mathscr{E}^B, \\ \text{Wholesaler}_j = X_3^{'}\beta_3 + \mathscr{E}^C, \\ \text{Assembler}_j = X_4^{'}\beta_4 + \mathscr{E}^D, \end{cases} \tag{4}$$

where wholesaler$_j$, Retailer$_j$, Consumer$_j$, and Assembler$_j$ are binary variables taking values 1 when farmer j selects wholesaler, retailers, consumers, and cooperatives, respectively, and 0 otherwise; $X1$ to $X4$ are vector of variables; and $\beta 1$ to $\beta 4$ a vector of simulated maximum likelihood (SML) parameters to be estimated and ε disturbance term. The use of multiple market outlets at the same time is possible in a multivariate model, and the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity, and ρij represents the correlation between endogenous variables, given by the following equation:

$$\begin{pmatrix} \mathscr{E}^A \\ \mathscr{E}^B \\ \mathscr{E}^C \\ \mathscr{E}^D \end{pmatrix} \ldots N\left[\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}\begin{pmatrix} 1 & \rho 12 & \rho 13 & \rho 14 \\ \rho 21 & 1 & \rho 23 & \rho 24 \\ \rho 31 & \rho 32 & 1 & \rho 34 \\ \rho 41 & \rho 42 & \rho 43 & 1 \end{pmatrix}\right], \tag{5}$$

$$E\left(\frac{\mathscr{E}}{X}\right) = 0,$$

$$Var\left(\frac{\mathscr{E}}{X}\right) = 1,$$

$$\text{Cov}\left(\frac{\mathscr{E}}{X}\right) = \rho.$$

$\varepsilon 1$ to $\varepsilon 3$ are correlated error terms in a seemingly unrelated multivariate probit model; and ρ's are tetra choric correlations between endogenous variables. Possible explanatory variables and associated hypothesis are presented in Table 2 below.

4. Results and Discussions

4.1. Socio-Economic Characteristics of Sample Households. The socioeconomic characteristics of sample households play an important role in promoting or discouraging profitable market outlet choices. The total sample size of farm respondents handled during the survey was 359, as shown in Table 3. Male-headed households accounted for 82% of total sample survey respondents. This implies that male household heads have better access to marketing information and market networks due to their ability to interact with one or more garlic product buyers than females, who are typically limited to home tasks. The sample household heads' average age was 52.74 years, with a standard deviation of 11.08 years, implying that the majority of the sample households' farmers were experienced in crop production. Similarly, the average family size was 5.17 members per household. The size of a family is a proxy for labor force, which increases garlic production and productivity. This means that a large family size household has the option of selling their products through any appropriate market channel, because they cope well with a shortage of market outlets for the sale of garlic products.

Table 2: Summary of explanatory variables and working hypothesis.

Variables	Measures	Expected outcome on major market outlet choice			
		Cons	Reta	Whols	Assem
Age	Continuous (years)	+	+	+	+
Sex	Dummy (1 for male, 0 otherwise)	+	+	+	+
Household size	Continuous (no of person)	+	+	+	+
Education (in year of schooling)	Continuous (grade)	+	+	+	+
Livestock holding	Continuous (in TLU)	+	+	+	+
Land size	Continuous (in hectare)	+	+	+	+
Frequency of extension contact	Continuous (in number)	+	+	+	+
Access to credit	Dummy (1 has got credit, 0 otherwise)	−	+	+	+
Distance to market	Continuous (in walking hours)	−	−	−	−
Access to market information	Dummy (1 has access, 0 otherwise)	−	+	+	+
Lagged price of garlic	Continuous (in birr/quintal)	−	−	+	−
Quantity of output sold	Continuous (in quintal)	−	+	+	+
Garlic farming experience	Continuous(in years)	+	+	+	+
Land size allocated to garlic	Continuous (in hectare)	−	−	+	+

Note. "Cons," "Reta," "Whols," and "Assem" refers to consumers, retailers, wholesalers, and assembles, respectively. Source: own composition (2022).

Table 3: Characteristics of garlic producer households (continuous and dummy variables).

Continuous variable	Mean	Standard deviation
Age of household head	52.74	11.08
Household size	5.17	1.62
Education level of household head	2.24	3.09
Livestock holding	3.98	2.30
Land size	1.11	1.11
Frequency of extension contact	1.69	2.56
Distance to market	2.02	1.73
Lagged price of garlic	4507.78	1846.89
Quantity of output sold	3.97	3.37
Garlic farming experience	24.71	12.49
Land size allocated to garlic production	0.46	0.518
Dummy variables	*Frequency*	*Percentage*
Sex (male)	295	82
Access to credit (yes)	133	37
Access to market information (yes)	147	41
Total observation		359

Source. Authors computation from sample survey data (2022).

In terms of education, the sample households' average education level was 2.24 years of schooling. The education level of the household head determines their willingness to accept new innovations as well as their market participation and selection of better market outlets. Similarly, garlic producers' average livestock holding was 3.98 Tropical Livestock Units (TLU). This implies that households with large livestock can generate a lot of money to cover their high transaction costs. Livestock holding is also regarded as a major source of cash for purchasing agricultural inputs, including garlic production, in order to increase the market surplus of garlic. Similarly, the average size of land owned by the sample household was 1.11 hectares. This implies that household heads with large land holdings have the option of allocating relatively large land holdings for garlic production and livestock grazing, increasing the amount of garlic produced and allowing them to choose a more appropriate market channel.

The extension service was another important factor in garlic marketing. Increasing access to extension services boosts garlic productivity and production. Their contact during land preparation, seedling, and harvesting times, as well as distributing market information to producers, will increase garlic productivity and returns. Table 3 shows that the average frequency of extension contact for sample households was 1.69 times per year. According to the survey results, the average distance required for producers to walk to the nearest market place was 2.02 hours. This means that farmers who live closer to the market have a better chance of selling their product to the appropriate market outlet than farmers who live further away from the market. Besides, the average lag price of garlic was 4507.78 birr/quintal. Similarly, the sample households' average garlic yield was 3.97 quintals/year. Farmers will choose the best market outlet for their yield if the quantity produced is large.

In the district, the average experience of farmers in garlic production was about 24.71 years, implying that sample households have good experience in the production and marketing of garlic. The average size of garlic production land was 0.46 hectares. As the amount of land allocated to garlic production grows, so does the quality of production and the selection of appropriate market outlets. Furthermore, credit is available to 37% of the sample households. Farmers who have access to credit can reduce their financial constraints and choose the best market outlets. Finally, 41% of the sample households had access to market data. Market information is critical for market-oriented crops such as garlic.

Garlic producers in the study area sell their product in four market outlets in order to maximize their profit. These market outlets included consumers, retailers, wholesalers, and assemblers or collectors, who were mostly chosen in tandem.

Table 4: Proportion of market outlets chosen by sampled garlic producers.

Decision	Market outlets for garlic producers			
	Consumers	Retailers	Wholesalers	Assemblers
Number of respondents (yes)	97	111	121	79
Proportion (%)	27	31	33	22
Quantity of garlic supplied to each outlet (in quintal)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
	1.57 (0.11)	2.69 (0.11)	7.00 (0.35)	3.94 (0.22)

Source. Authors computation from the sample survey data (2022).

Accordingly, one of the most commonly used market outlets by producers is the wholesaler outlet, which was chosen by approximately 33% of respondents with a mean supply of 7 quintal, while approximately 31% of respondents sold to retailers with a mean supply of 2.69 quintal. Consumers are a popular marketing channel in the district, so 27 percent of sample households sold to them, with a mean supply of 1.57 quintal. Furthermore, 22 percent of all respondents chose assemblers as a garlic marketing outlet, with a mean supply of 3.94 quintals. This implies that farmers have a limited number of market outlets through which to sell their produce. As a result, it must have enough information to enable farmers to maximize their return on agricultural product sales (Table 4).

4.2. Determinants of Garlic Market Outlet Choice. Farmers in the East Gojjam Zone of northwest Ethiopia have four market outlet options for selling garlic: consumers, retailers, wholesalers, and assemblers. The econometric model took these four outlets into account. Table 5 shows the outcome of the multivariate probit regression model (MVP).

The Wald test (chi2 (56) = 266.52, Prob > chi2 = 0.0000) is strongly significant at the 1% level, indicating that the model's subset of coefficients is jointly significant and the explanatory power of the factors included in the model is satisfactory. Thus, the MPV model fits the data reasonably well. The simulated maximum likelihood test (LR chi2 (6) = 77.1817, Prob > chi2 = 0.0000) of the null hypothesis of independence between market outlet decisions ($\rho 21 = \rho 31 = \rho 41 = \rho 32 = \rho 42 = \rho 43 = 0$) is significant at the 1% level. As a result, the null hypothesis that all (rho) values are jointly equal to 0 is rejected, indicating the model's goodness of fit and supporting the use of the MVP model over the individual probit model. This demonstrates that separate estimation of market outlet choices is biased, and that household decisions to choose the four market outlets are interdependent.

Individual rho (ρij) values represent the degree of correlation between each dependent variable pair. The model resulted in a negative and statistically significant correlation between the choice of retailers and consumers ($\rho 21$), wholesaler and retailer ($\rho 32$), assemblers and consumers ($\rho 41$), assembler and retailer ($\rho 42$), and correlation between the choice of assemblers and wholesalers ($\rho 43$), with the exception of the wholesaler and consumer ($\rho 31$), which has a positive correlation. According to this finding, farmers who sell to retailers are less likely to sell to consumers ($\rho 21$). Farmers who sell to wholesalers are also more likely to sell to consumers and less likely to sell to retailers ($\rho 31$, $\rho 32$). Besides, those working in assembler market outlets are less likely to send their garlic to consumers, retailers, and wholesalers ($\rho 41$, $\rho 42$, $\rho 41$). This indicates that all pairs of two market outlets have a competitive relationship.

The marginal success probability of each market outlet is also shown by the simulated maximum likelihood estimation. The likelihood of selecting a wholesaler outlet (34%) is relatively high when compared to the likelihood of selecting a retailer (32%), consumer (28%), and assembler (22%). In terms of the joint probabilities of success and failure of market outlets, choice decisions indicate that those households are less likely to choose all four market outlets at the same time. The likelihood of garlic producers jointly selecting the four market outlets was 0.002%, which is nearly zero when compared to their failure to do so (11.7%). This indicates that the likelihood of selecting the joint market outlet is extremely low. This finding implies that the optimal mix of market channels will be determined by different factors for each market outlet.

Four of the 14 explanatory variables included in the MVP model significantly affected consumer choice, while six variables significantly affected retail, wholesale, and assembly outlet choice at 1%, 5%, and 10% significance levels.

Sex of the household head (Sex): Male-headed households are more likely than female-headed households to sell garlic to assemblers (5%). This could be because males are more likely to be involved in farm tasks than female-headed households, and they may deliver to assemblers in bulk, reducing transaction time and returning to farm activity. Endris et al. [13] confirmed that male farmers have more marketable resources and are thus more likely than female-headed households to deliver products to collector outlets. Female households are also less likely to sell vegetables to assembler outlets [33].

Education (Eductn): The education level of household heads had a positive effect on the likelihood of choosing wholesalers (10%) and a negative effect on the likelihood of choosing retailers (5%). Farmers' ability to analyze relevant market information and choose the best market outlet that is expected to give them a better price for their produce improves as they get more education. Educated farmers improve their ability to make decisions about market outlet selection based on marketing margin and marketing cost. This finding is consistent with Endris et al. [13], Chala and Fana [19], and Woldesenbet [21], who discovered that education

Table 5: Multivariate probit estimation for determinants of garlic producer outlet choice.

Variables	Market outlet choice			
	Consumers Coeff (Se)	Retailers Coeff (Se)	Wholesalers Coeff (Se)	Assemblers Coeff (Se)
Age	−0.017 (0.01)	0.005 (0.01)	0.004 (0.02)	−0.008 (0.01)
Sex	−0.069 (0.26)	−0.166 (0.21)	−0.412 (0.32)	0.642 (0.25)**
Household size	−0.001 (0.07)	0.068 (0.05)	−0.029 (0.08)	0.082 (0.05)
Education	−0.047 (0.05)	−0.107 (0.04)**	0.085 (0.05)***	0.019 (0.03)
Livestock holdings (TLU)	0.000 (0.05)	0.022 (0.04)	−0.030 (0.06)	−0.008 (0.04)
Land size	0.03 (0.11)	−0.080 (0.09)	0.177 (0.14)	0.079 (0.10)
Extension contacts	−0.393 (0.15)*	−0.180 (0.08)**	0.227 (0.11)**	−0.195 (0.08)**
Access to credit	0.195 (0.27)	−0.513 (0.20)**	1.621 (0.27)*	−0.246 (0.20)
Distance to market	−0.014 (0.05)	−0.029 (0.04)	0.321 (0.08)*	0.119 (0.04)**
Access to market information	−0.515 (0.25)**	−0.297 (0.19)	0.274 (0.26)	1.007 (0.19)*
Lagged price of garlic	0.000 (0.00)	0.000 (0.00)	−0.000 (0.00)***	−0.000 (0.00)
Quantity of garlic sold	−0.437 (0.09)*	0.147 (0.07)**	0.466 (0.12)**	0.227 (0.07)*
Garlic farm experience	−0.021 (0.01)***	0.016 (0.01)***	−0.002 (0.01)	0.005 (0.01)
Land area for garlic	0.468 (0.48)	−0.768 (0.33)**	−0.178 (0.45)	−1.193 (0.32)*
Constant	2.256 (0.73)	−1.251 (0.63)	−2.103 (1.42)	−1.521 (0.87)
Multivariate probit (MSL, # draws = 5)				
Number of obs = 359				
Wald chi2 (56) = 266.52				
Log likelihood = −488.03361				
Prob > chi2 = 0.0000				
Predicted probability	0.2816632	0.3228928	0.3399945	0.2230343
Joint probability (success)		0.0000189		
Joint probability (failure)		0.1172155		
Estimated correlation matrix	$\rho 1$ ($Y1$)	$\rho 2$ ($Y2$)	$\rho 3$ ($Y3$)	$\rho 4$ ($Y4$)
$\rho 1$ ($Y1$)	1.00			
$\rho 2$ ($Y2$)	−0.441* (0.08)	1.00		
$\rho 3$ ($Y3$)	0.292*** (0.15)	−0.384* (0.12)	1.00	
$\rho 4$ ($Y4$)	−0.358* (0.11)	−0.292*(0.10)	−0.288** (0.12)	1.00
Likelihood ratio test of rho21 = rho31 = rho41 = rho32 = rho42 = rho43 = 0: chi2 (6) = 77.1817				
Prob > chi2 = 0.0000				

*, **, and *** are significant at 1%, 5%, and 10% level of significance, respectively. $Y1$, $Y2$, $Y3$, and $Y4$ are consumers, retailers, wholesalers, and assemblers, respectively. Source: own survey results (2022).

reduces the likelihood of choosing consumers, retailers, and assemblers' outlets while increasing the likelihood of choosing wholesaler outlets for vegetable marketing. One possible reason for this is that formal education encourages farmers either to produce more and supplying to wholesalers or encouraging farmers to get job other than farming vegetables [24]. Another reason might be that as the education level increases, farmer's productivity increases and the linkage with wholesalers strengthens [29]. Education increases the knowledge of farmers that can be used to collect information, interpret the information received, and make knowledgeable and marketing decisions.

Frequency of extension contact (extn): The frequency of extension contact has a positive and significant influence on wholesaler outlets but a negative and significant influence on consumer, retailer, and assembler outlets (Table 5). Extension services improve farmers' ability to obtain relevant market information and enable garlic producers to improve production methods and thus produce more output, increasing producers' ability to select the best market outlet for their product. Thus, households that received more visits from extension agents were more likely to deliver garlic to wholesalers' outlets and less likely to sell to consumer, retailer, and assembler outlets. The findings are similar to those of Endris et al. [13] and Wosene et al. [14]; who discovered that regular contact with extension functionaries was significantly and positively associated with the use of wholesaler outlets as opposed to retail and assembler outlets.

Access to Credit (Accrdt): Access to credit also had a negative and positive impact on the likelihood of choosing a retailer and wholesaler outlet, with a 5% and 1% level of significance, respectively. As farmers gain access to credit, their likelihood of participating in the wholesale market channel increases, while it decreases for retailer outlets. Farmers who accessed credit have a higher level of commercialisation than those who did not. Farmers can obtain the operating capital needed for intensive vegetable farming from credit. The importance of credit in enforcing farmers to commercialise their farming was high. This is because in the wholesale market, large amounts are sold. Credit

functions as lubricant or catalyst in commercial farming [34, 35], because farmers apply advanced technology when the credit is easily accessible to farmers [36, 37]. The outcome is inversely related to the findings of Mohammed Kassaw et al. [29].

Distance to market (Dsmkt): At 1% and 5% significance levels, distance to the market is positively associated with the likelihood of selling to wholesaler and assembler outlets, respectively. The distance of farming location to vegetable market affects costs and efficiency of transportation for selling the product, such that the more distant farmers from the market, the more likely they are to choose assembler and wholesale outlet. The closer the farmers are to vegetable markets, the more likely they will choose wholesale and assembler outlet. The result is support this [24]. This means that there may be an excellent road infrastructure for wholesalers and assemblers to sell their products, and choosing these outlets reduces the time spent bargaining and other transaction costs. Distance to the market has been found to be positively related to the choice of assemblers [10, 38] and wholesalers [12] outlets.

Access to market information (Acmif): At 1% and 5% significance levels, access to market information is positively associated with the likelihood of selling to assemblers' outlets and negatively associated with the choice of consumers' outlets. Farmers' access to information increases their bargaining power to get a reasonable price [25, 39]. Using the available information, smallholder farmers get equal competition with the larger producers, and they develop their knowledge to increase production and productivity as well as choose appropriate outlets for their product. The availability and utilization of required information sources led to high sales because farmers could do many things to increase production and, eventually, sales [24, 26]. For instance, Arinloye et al. [28], Musungwini [27], and Mariyono et al. [25] suggest that farmers who have mobile phones contact more customers and are perceived to reduce the asymmetry of market information, particularly for the prices of inputs and products. The asymmetry undeniably leads to low bargaining power and lower prices for farmers [28, 40]. The number of sources of market and technology information has a significant influence on the adoption of intensive commercial farming. When market information is available and accessible to farmers, vegetable farming becomes less risky, and farmers have stronger bargaining power, particularly when negotiating produce prices. The number of vegetable-related technologies available in the local market, such as hybrid seeds, modern fertilizers, and crop protection inputs, also significantly led to the creation of commercial vegetable farming enterprises.

Lagged Price of Garlic (Lgdprc): The lagged garlic price measures the price of garlic (Birr) per quintal and is expected to influence market outlet selection. According to the findings of this study, the lag price of garlic has a negative and significant relationship with the likelihood of household heads choosing wholesalers' market outlets at the 10% significance level. This meant that as the lag market price of garlic increased by a birr/quintal, the likelihood of garlic farmers using wholesalers as market outlets decreased. This could be because last year's high output price encourages farmers to produce more, even though the current price is expected to be low, and farmers are shifting from the option of selling to wholesalers to other market outlets that pay better prices for farmers. Furthermore, a lag price can stimulate production, resulting in a marketable supply of garlic for the following year, and producers are motivated to sell their products to market outlets. This means that if prices in one year lag are low, farmers will often respond by planting fewer crops the following year. This resulted in lower production and higher prices, encouraging more plantings the following year and a subsequent price drop. The garlic market is characterized by cyclical production and pricing. As a result, producers are forced to supply garlic products that are directly related to the price offer. The result is supported by the previous findings of Taye et al. [12] and Berhanu et al. [41] who found that access to milk market outlet price negatively affect accessing cooperative milk market outlet as compared to individual consumer milk market outlet.

Quantity of garlic produce (Qntprod): It influenced the likelihood of selecting wholesalers, retailers, and assembler market outlets positively. However, the quantity of garlic produced has a negative impact on consumer outlet selection. The results showed that households with a greater quantity of garlic produced preferred wholesalers and assemblers over consumer outlets. This could be because wholesalers pay fair prices and buy in bulk to ensure a healthy profit margin and large sales. Households with a high volume of sales prefer wholesalers and assemblers' outlets because wholesalers buy in bulk and at a lower price than consumers [23].

Farming experience (Experience): It has a positive relationship with the likelihood of choosing retailers and a negative relationship with consumer market outlet choice. Households with a long history of garlic farming are more likely to use retailers and less likely to use consumer outlets. This could be because experienced farmers have a better understanding of the costs and benefits associated with fluctuating market demand for garlic products and market prices, allowing producers to choose outlets that increase sales volume and profit. Experienced farmers may have had prior negative experiences in the choice of consumer outlet, which led them to reduce the intensity of their farming activities. This outcome is consistent with the finding of Mariyono [24]; showing a negative impact of experience on farmers' decision to access better innovation and farm productivity, respectively. But other studies show that experience positively affects the adoption of

agricultural technologies [42]. The finding of this study was in contradiction with Wosene et al. [14] and Tura and Hamo [20], who found that farm experience had a negative effect on the choice of retail outlet.

Land cultivated for garlic (Landgarlic): At 5% and 1% significance levels, respectively, land areas allocated for garlic have a negative and significant effect on retailers and assemblers market outlets. This implies that households with a large area of cultivated garlic are more likely to produce a large volume of garlic and are less likely to sell it to retailers and assemblers, who buy it in smaller quantities than wholesalers. Abate et al. [17] and Tolan and Ketema [43] found that farm size is negatively affected by the choice of retailer outlet because farmers with a larger total landholding produce more and prefer to sell in bulk to wholesalers.

5. Conclusions

Many rural households in developing countries continue to receive lower prices for their products, which have a negative impact on their livelihoods. To solve the agricultural development problems, the agricultural transformation plan of Ethiopia must exist to provide an appropriate package of agricultural inputs and marketing infrastructure for the produce. Following this, garlic producers prefer to sell their products in a specific or joint market outlet because of its proximity or because it offers the best price for their products. Thus, this study investigates the role of demographic, institutional, and resource-related variables on households' decisions about garlic market outlet choices in Goncha Siso Enese District, Ethiopia. A total of 359 garlic producer households were polled, and the results were analyzed using a multivariate probit (MVP) model. The descriptive results show that in the study district, there are four market outlets for garlic: consumer, retailer, wholesaler, and assembler outlets. The study's key findings indicate that wholesaler outlets were the primary choice of garlic producers in the study area, followed by retailer, consumer, and assembler outlets, respectively. The interdependent outlet choices were important for garlic producers in the study area. Garlic producers choose multiple marketing channels as a strategy to protect their investment decisions and maximize their income and return. Garlic producers choose multiple market outlets based on their garlic output supply level and the cost of marketing. It was discovered that farmers who choose retail outlets are less likely to sell their products to consumer outlets. Farmers who sell to wholesaler outlets are also less likely to sell to consumers and retailers. Furthermore, those preferring assembly-line outlets are less likely to send their garlic to consumers, retailers, and wholesalers. This indicates a competitive relationship between a number of market outlets.

According to the MVP model results, extension contact, access to market information, quantity of garlic sold, and farm experience in farming were negatively and significantly associated with the choice of consumer outlet. Besides this, the estimated MVP for retailer outlet choice is positively influenced by the amount of quantity sold, and farm experiences in garlic have a significant and positive effect on the choice of retailer outlets. In contrast, education level, access to credit, extension contact, and land area allocated for garlic have a negative influence on the choice of retail outlet. Moreover, wholesaler outlet choice is significantly and positively influenced by education level, access to credit, amount of quantity sold, extension contact, and distance to market, whereas it is negatively influenced by lag price. Assembler outlet is also positively influenced by sex, distance to market, access to market information, and quantity sold, and negatively affected by extension contact and lag price.

The implication is that, if smallholder garlic producers have access to alternative market outlets, they must select an appropriate combination of market outlets to maximize their income in the long run. Thus, the government should intervene to provide market information, expand and follow-up extension services, and builds roads and other marketing infrastructure in potential garlic production areas to improve the effective marketing of garlic producers in all outlets. Furthermore, it is critical to increase garlic production and open additional outlets in potential production areas to encourage garlic producers and allow them to sell their product at an optimal price. It is also required to disseminate innovative garlic production systems and rural-urban development infrastructures to realize agricultural transformation.

Data Availability

The data used for the study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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