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Research Article

Maize Market Chain Analysis and the Determinants of Market Participation in the Gamo and Gofa Zones of Southern Ethiopia

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The majority of farmers are producing maize in the Gamo and Gofa zones and they are not benefiting from it due to the marketing problem. Thus, this study was intended to analyze the maize market chain and determinants of market participation in the selected maize-producing districts of the Gamo and Gofa zones. To achieve this objective, multistage sampling techniques were followed to randomly select 151 sample respondents. The data were analyzed by using descriptive statistics, marketing margins, and the double hurdle model. The survey results revealed that approximately 35.88% of the maize from the total maize produced by the sampled farmers was marketed in the study area. The result indicates that among the five identified maize marketing channels, the largest volume of maize passed through channel V (producers, urban collectors, and consumers). In the marketing of maize, traders set the price due to poor market linkage and the low bargaining power of producers. The model regression result indicates that among the hypothesized factors, family size, allocated land size for maize, and market information have a significant effect on the quantity of maize market supply. Based on this finding, strengthening extension services through training and accessing inputs are recommended. Furthermore, market linkage through the cooperative establishment and the availability of market information by respective bodies is suggested.

1. Introduction

Agriculture is the backbone of the Ethiopian economy, contributing 41.4% of gross domestic product (GDP), 83.9% of total exports, and 80% of all employment [1]. Crop production is an integral part of agriculture with a high potential to transform the Ethiopian economy [2]. In Ethiopia, cereals are the major crops in terms of area coverage and production volume. According to CSA [3], of the total grain crop area, approximately 11,610,331 hectares (79.83%) were under cereals. It contributed approximately 87.08% (283,922,484 quintals) of the country's grain production [3]. Maize (*Zea mays* L.) is among the major cultivated cereal crops in Ethiopia and is internationally superior to most other cereals [4, 5]. Out of the cereal area covered in Ethiopia, approximately 2.526 million hectares were covered by maize, with a total production volume of 1055709.36 tons and average productivity of 4.179 tons per hectare [3]. Maize is an important crop both as a source of food and income generation for farmers in Ethiopia [5, 6].

For the optimal allocation of resources in agriculture and in stimulating farmers to increase their output, an integrated and responsive market mechanism has critical importance [1]. However, farmers in the rural areas of Ethiopia have limited opportunities to sell their products at good prices [7, 8]. The Gamo and Gofa zones are the main maize-producing zones within southern Ethiopia. Although the zones have huge potential for maize production, there is a high problem in terms of the production and marketing of maize [9]. As the result, the maize-producing farmers share the lowest profit from the final selling price. Due to the significant role of traders and transporters in linking with end market markets, the marketing activities of producers are limited to waiting for the buyer at the production site [10]. Hence, smallholder maize producers in the zones lose out on benefits due to poor organization linkage and unequitable access to markets.

Several types of research have been performed on maize in the study area [9–14]. However, most previous studies have focused on maize production improvement only by

ignoring maize marketing issues in the study area. Although maize is produced as a major crop in the Gamo and Gofa zones, farmers face severe market problems in the study area [9]. Although the problem still exists, thus far, maize marketing chain analysis and its characteristics have not been studied. The only increase in production was not sufficient to increase the household income that needs market improvement [15]. Therefore, this study was proposed to describe maize production and marketing by identifying and mapping major actors along the chain, identifying the profitability of maize production, identifying factors that determine maize supplied to the market, and identifying the opportunities and constraints along the market chain.

2. Research Methodology

2.1. Description of the Study Area. This study was conducted in two districts of the Gamo and Gofa zones. Arba Minch Zuria district is one of the districts in the Gamo zone located in the Great Rift Valley in the Southern Nations, Nationalities, and Peoples' Region [16]. The district is bordered on the west by Gerese, on the south by the Derashe special district, on the north by Chencha and GachoBaba, on the northeast by Mirab Abaya, on the southeast by the Amaro special district and on the east by the Oromia region [17]. The district is geographically located between $5°42'$ and $6°13'$ north latitude and $37°19'$ and $37°41'$ east longitude, with an elevation of 1170 m. a. s. l [18, 19]. The district has received 892 mm of average rainfall with minimum and maximum temperatures of 15.6 and 30.4°C, respectively, in recent decades [11].

Demba Gofa district is one of the Gofa zone districts in the Southern Nations, Nationalities, and Peoples' Region and is bordered on the west by Geze Gofa, on the south by Uba Debretsehay and Oyda, on the north by the Dawro Zone, on the northwest by Melo Koza, on the east by Kucha district, and on the southeast by Zala district [20]. The district is located at $8°11'21''$ to $8°71'84''$ N latitude and $42°19'35''$ to $43°89'86''$ E longitude and has an elevation range of 1350 to 2600 m. a. s. l [20]. The agroecology of the district is classified as lowland (76.4%), midland (15.8%), and highland (7.8%) [21]. The mean daily minimum and maximum temperatures of the district are 17.4 and 28.4°C, respectively, with a mean rainfall of 1300 mm [22].

Mixed farming is the main source of livelihood in the two selected districts in that maize (*Zea mays*) is the main crop [20]. Regarding the potentiality of maize production, the Gamo and Gofa zones had high potential areas with an area coverage of 57797.17 hectares. The maize production in the Gamo and Gofa zones was 2299412.75 quintals, with the productivity of 39.78 quintals per hectare [3].

2.2. Sampling Technique and Determination of Sample Size. Multistage sampling procedures were used for this study. In the first stage, based on the availability of maize production within zones, the two districts were purposively nominated. Based on maize production volume, four kebeles (Kebele is

the smallest administrative level in Ethiopian condition), namely, Kolla-Shelle, Zeyse-Wozeka, Borda, and Zangadormale, were selected purposively in the second stage. Finally, 151 maize-producing sampled farmers were randomly selected. The intended sample size was determined following Yamane's [23] formula:

$$n = \frac{N}{1 + N(e2)}, \tag{1}$$

where N is the population (maize producer), n is the sample size, and e is the level precision. Based on the above formula the sample size for this study was calculated as follows:-

$$n = \frac{4494}{1} + 4494(0.08)2 \sim 151. \tag{2}$$

In addition to producer's data, the trader data was collected from zonal, district, and kebele markets from the study area using an open and close-ended questionnaire. In addition, based on convenience sampling, 30 maize traders were selected for this study. Both primary and secondary sources were employed to undertake the study. After obtaining consent from all participants of the study, the primary data were collected through focus group discussions and key informant interviews, and household surveys using structured and semi-structured questionnaires. Published and unpublished documents were used as secondary data sources for this study.

2.3. Methods of Data Analysis and Variables Hypothesis. To analyze the collected data, both descriptive and econometric methods were used. For descriptive analysis, means, percentages, and margin analyses for the maize market were used. For econometrics, the double hurdle regression model has been employed to analyze the factors that influence the maize producers' decision to participate in the market and the volume supplied.

2.3.1. Marketing Margin Analysis. Marketing margins are an essential mechanism for the performance analysis of marketing systems [24]. To evaluate the marketing margin, the price and cost information obtained from the survey result was used. It can be analyzed using the actors' price difference in the marketing channels [25]. Accordingly, the total gross marketing margin (TGMM) is calculated by the given formula below:

$$TGMM = \frac{\text{End buyer price} - \text{first seller price}}{\text{End buyer price}} * 100. \tag{3}$$

To measure the level of fairness in the sharing of benefits increased along the market chain, the producer's gross margin (GMM_P), which is the ratio of the price paid by the end buyer, was calculated by the following formula.

$$GMMp = \frac{\text{End buyer price} - \text{marketing gross margin}}{\text{End buyer pricer}} * 100. \tag{4}$$

2.3.2. Econometric Model Specification. Several econometric models have been applied to analyse the determinants of market participation. Nevertheless, specification of the econometric largely depends on the type of data collected. Double hurdle is the model introduced as a more flexible and alternative to tobit model [26]. The modeling approach assumes a two-step decision process based on the assumption that the household makes two separate decisions; the first step involves the decision of whether to participate in market or not and second, is the quantity of maize supplied. In the first step, the probit model was used to analyze the probability of participation in the maize market, while in the second stage, a truncated model was used to analyze the factors impelling the quantity of maize sold.

The double hurdle model specification is as follows:

The first stage:

$$y_{i1}^* = \beta_1 X_{i1} + \varepsilon_{i1}, \quad \text{Participation decision equation,} \quad (5)$$

$$y_{i2}^* = \beta_2 X_{i2} + \varepsilon_{i2}, \quad \text{Maize amount marketed equation,} \quad (6)$$

$$y_i = \beta_i x_1 + \beta_i x_2 + \beta_i x_3 + \beta_i x_4 + \beta_i x_5 + \beta_i x_6 + \beta_i x_7 + \beta_i x_8 + \beta_i x_9 + \varepsilon_{i2} \cdots, \quad \text{If } y_{i1}^* > 0 \text{ and } y_{i2}^* > 0. \quad (7)$$

The first equation defines the decision between participation and nonparticipation in the maize market, where y^*_{i1} takes the value of 1 if a household decided to participate and 0 if not participated. The second equation defines the amount of maize marketed, β_1 and β_2 define the socioeconomic and institutional factors that affect the probability of participation and the amount of maize marketed, respectively. ε_{i1} and ε_{i2} are the error terms in the estimation of the participation and amount of maize marketed, respectively.

Based on previous empirical studies, the size of maize land, total family size, educational level of households, distance from the nearest market from their residence, frequency of extension service, access to market information, utilization of inorganic fertilizer, and improved seeds were the identified independent variables. Accordingly, the type, description, and expected sign of the hypothesized variables are described in Table 1 below.

3. Results and Discussion

3.1. Descriptive Analysis Results. As Table 2 illustrates, the age of the sample maize-producing respondents ranged from 20 to 75 years, with a mean age of 40 years. This shows that most maize producers are in the productive or active age group in the study area. Based on the education level categorization, the data showed that the majority (43.71%) of the sampled respondents attended formal education that ranged from grades 1 to 4. The remaining 13.25% and 36.42% of the sample respondents had no formal education and formal education from grades 5 to 8, respectively. This shows that the producers in the study area had a lower

education background to receive new technologies and innovations. The household size of the respondents was 6.47 on average, with maximum and minimum household sizes of 15 and 2 persons, respectively.

3.2. Production-Related Factors. Table 3 indicates that the mean total land owned per household was 1.63 hectares. The survey result indicates that the mean land assigned for maize production per household was 0.89 hectares, which ranged from 0.125 to 2.5 hectares. This shows that in the Gamo and Gofa zones, maize was a major and staple cereal crop, and compared with other zones, the area allocation was high. The land allocated per household for maize in the study area is much higher than that of land allocated at the SNNPR (0.228 hectares) and country level (0.247 hectares) [27]. The average production of maize was 23.25 quintal/ha. From the total produced, only an average of 7.5 quintals were marketed in local and district markets.

As shown in Table 4, approximately 79.47% of the sampled households produce maize for both consumption and the market. The remaining 20.53% of the sampled maize was produced for consumption purposes. This indicates that maize production in the study area is both for consumption and income-generating activity for the majority of producers. The farmers who produce only for consumption purposes are based on their land resources and insufficient products for the market.

3.2.1. Inputs Used for Maize Production and Production Seasons. Inorganic fertilizer is one of the main key production inputs used by maize farmers. Most of the maize farmers used inorganic fertilizer, as shown below 56.95%, 58.94%, and 21% of the sampled respondents used NPS, urea, and improved seeds, respectively, with average rates of 47.96 kg, 42.98 kg, and 9.15 kg (Table 5). As shown below, most farmers use inorganic fertilizer applications for maize production, but they could not use inorganic fertilizer at the recommended rate per hectare because of a capital shortage to use the full package.

Based on the survey data, maize grain is marketed in farm gates, local markets, district markets, and other markets (zone markets). A total of 63.5% of the product was marketed in the local market, 20.3% of the product was marketed in the district and zone market, and during harvesting time, 16.7% of the products were marketed at the farm gate (Table 6). During maize marketing, 53.5% of the sampled respondents confirmed that the price of maize was run by buyers/traders, and the remaining 46.5% of respondents said that the price of maize at the market was based on demand and supply.

Even though accessing market information is vital for reducing uncertainties and information gaps that exist in the agricultural sector, there is a market information problem, as respondents confirmed. Approximately 35.23% of the respondents have market information from their observations, 31.82% from other farmers, and 30.68% from local traders (Table 7). The majority of respondents in the study area

TABLE 1: Hypothesized variables and expected signs.

Variables	Type	Description and measure	Expected sign
Dependent variables			
Market participation decision	Dummy	It is a binary variable that takes the value of 1 for the household that participated in the market and whereas 0 for the household that does not participate	
The volume of maize sold	Continues	It is a continuous variable that indicates the quantity of maize sold and measured in quintal	
Independent variables			
Sex of household	Dummy	1 = Male 0 = female	−/+
Farming experience	Continuous	Continuous measured by the number of years	−/+
Total household size	Continues	The number of family member in household	−/+
Land allocated for maize	Continues	Allocated land size for maize production that was measured in a hectare.	+
Inorganic fertilizer	Dummy	Takes a value of 1 if the farmer uses inorganic fertilizer and otherwise, it takes 0.	+
Improved seed	Dummy	Takes a value of 1 if the improved maize seed variety was by farmer and otherwise it takes 0.	+
Market information	Dummy	Takes a value of 1 if the farmer gets market information and otherwise it takes 0.	+
Extension contact	Continues	Frequency of extension contact in a day	+
Distance from the nearest market	Continues	Distance to nearest market in walking minutes	−
Credit use	Dummy	1 = user 0 = nonuser	−/+

TABLE 2: Demographic characteristics.

	Variables response	Market participants	Non-market participants	Producers ($n = 151$)	Percent
Sex	Male	108	41	149	98.68
	Female	2	0	2	1.32
Education level	No formal education	14	6	20	13.25
	Grade 1–4	41	25	66	43.71
	Grade 5–8	46	9	55	36.42
	Grade 9–10	6	1	7	4.64
	Grade 10 and above	3	0	3	1.99
Mean household size		Mean = 6.02	Mean = 7.02	6.29	
Mean age of HH				39.74	
Marital status	Married	109	41	150	99.34
	Single	1	0	1	0.66

Source. own survey 2021.

TABLE 3: Land allocated for maize production and marketed.

Variable	Mean	Std. dev	Min	Max
Total land size in hectares	1.63	1.05	0.15	5
Maize land in hectares	0.89	0.61	0.12	2.50
Average maize produced qt per ha	23.25	10.99	6	60
Amount marketed (qt) per HHH	7.50	7.15	0.00	40.00

Source. Own survey 2021.

TABLE 4: Purpose of maize production.

Variable	Valid percent
Selling only	0
Consumption	20.53
Both sale and consumption	79.47

Source. own survey 2021.

TABLE 5: Input uses.

Variables		2019/2020	
		Percent	Mean
Fertilizer	NPS kg/ha	56.95	47.96 kg
	Urea kg/ha	58.94	42.98 kg
Herbicides L/ha		7.10	1.00 L
Pesticides/insecticides L/ha		6.70	0.77 L
Improved seed kg/ha		21.00	9.15 kg

Source. own survey results, 2021.

TABLE 6: Market place and price setting.

Place of market	Percent	Price setting	Percent
Farm gate	16.2	Buyer	53.5
Local market	63.5	Market supply and demand	46.5
District market and other	20.3		

Source. Own survey 2021.

informally obtained market information before selling their products. They had traveled an average distance of 41.60 minutes to sell their maize products.

3.3. Maize Marketing.
This section of the paper presents maize marketing actors, marketing chain, and marketing margin.

3.3.1. Maize Marketing Actors and Their Roles.
According to the data obtained from the survey results, the market actors that were involved in the maize transaction process are identified in the study area. The main maize marketing actors include farmers/producers, farmer traders, urban assemblers, district wholesalers, retailers, and processors (Cheka processors).

Producers/farmers: These are agents who participate in maize production as well as the marketing of maize. At the same time, they also transport maize to the nearest village markets by themselves, either using pack animals.

Farmer trader/local collectors: they are part-time traders in the assembly markets who buy a lower quantity of maize from farmers in village markets during the bulk harvesting period to resell it to traders in either rural or district markets.

Urban Collector: They consolidate the production of individual farmers' produce and prepare it for marketing. They are assemblers who not only know the areas of surplus well but also relieve their customers of the burden of quality by controlling the small quantities of maize typically offered by farmers.

Wholesalers: They are actors who buy maize in larger volumes than any other actors in maize marketing, and they resell to urban retailers and consumers. Wholesalers reside in district towns and purchase directly from a farmer, farmer traders and local assemblers (collectors).

Retailers: These are market actors who buy a small quantity of maize and resell it to the consumer in the study area. They differ from the collectors by their grain license. They had trade licenses for either maize or other cereal crops.

Consumers: These are the final actors of the chain who buy maize for their consumption purposes. They buy maize directly from producers, retailers, and assemblers to consume the maize produced in the study area and consume maize in the form of kurukufa, kita, fosose, injera, dabo, kolo, genfo, and others. It also includes local communities that consume local drinks called cheka, modo, or borde.

3.3.2. Maize Marketing Channel.
According to the maize market channel analysis results in Figure 1, out of the total volume of maize supplied (1411 quintals), the largest volume (33.38%) of maize passed through channel V, which is approximately 471 quintals. The channel is not only the largest volume of maize transacted but also the highest producer share (94.89%) recorded in the same channel. The second large and third volumes of maize passed through channels II and III, respectively. In the remaining channel, the flow of maize transactions is lower than 20% compared to other market channel flows. The two-channel (channel II & V) combination accounts for 54.21% of the total volume of

TABLE 7: Access to market and other service access.

		Percent	Mean
Market information	Other farmers	31.82	
	Local collectors	30.68	
	Personal observation	35.23	
	Other	2.27	
Distance to nearest market in a minute			41.60
Distance to extension service in a minute			27.04
Credit access (yes)		21	

Source. Own survey 2021.

maize supplied to the market. The maize producers were beneficiaries in these channels because the highest amount of maize market flows in these channels and the product was concentrated in these channels.

3.3.3. Maize Marketing Margin.
Here, the marketing margin is used to determine the performance of each actor involved in the marketing of maize in the study area. The gross profit of producers was highest in channel V when they sold the maize to urban collectors (Table 8).

According to Table 8 below, the gross market margin of maize producers was highest in channel V when they sold to urban collectors, which was 94.89% of the consumer's price, and lowest in channel II, which was 63.54% of the consumer's price. This implies that the producers were profitable when they sold their products to urban collectors. From the trader, local collectors shared the highest gross market margin of 17.04 birr/quintal in channel II when they purchased the product from the producers and sold it to retailers, and the urban collectors shared the lowest in channel V when they purchased from the producer and sold it to consumers. The total gross marketing margin was highest in channel II and lowest in channel V.

3.4. Econometric Result

3.4.1. Determinants of the Maize Market Participation Decision and Volume of Supply.
The result of the first hurdle (probit regression model) shows that the use of inorganic fertilizer and improved maize seed statistically influenced the probability of maize market participation in the study area (Table 9). For interpretation of the probit model result, the marginal effects (mfx) (the partial derivatives of the nonlinear probability function evaluated at each variable sample mean) were applied [28]. The mfx result shows that the predicted value of market participation is 0.74, which indicates that approximately 74% of the sampled respondents participated in the marketing of maize in the study area. The use of inorganic fertilizers may positively influence maize market participation at the 5% significance level. The marginal effect of the first hurdle shows that the market participation increased by 28% for those households who used fertilizers as compared to those farmers who do not apply them. This can be because if the producer properly uses inorganic fertilizer, then they produce in a large volume and participate in the market. While the likelihood of market
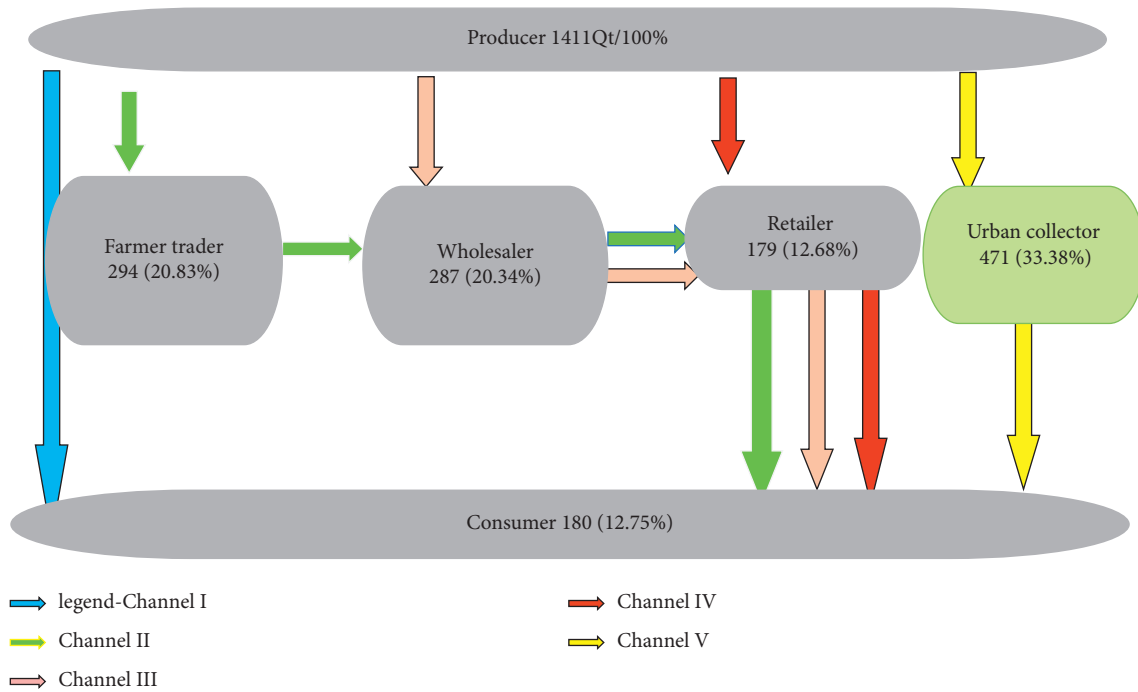
Figure 1: Market chain of maize in the study area.

Table 8: The market margin of maize.

Actors		I	II	III	IV	V
Producer	Marketing cost	30		54	27	30
	Selling price	1150	1080	1115.45	1100	1237
	Gross profit	1120	1080	1061.45	1073	1207
	GMMpr	100	63.54	83.6	87.69	94.89
Local collector/farmer trader	Purchasing cost		1080			
	Marketing cost		40			
	Selling price		1350			
	Gross profit		230			
	GMMcoll		17.04			
Urban collector	Purchasing cost					1237
	Marketing cost					50
	Selling price					1356.25
	Gross profit					69.25
	GMMurcol					5.11
Retailer	Purchasing cost		1100	1100	1100	
	Marketing cost		50	35	55	
	Selling price		1250	1275.50	1317.25	
	Gross profit		100	140.5	162.25	
	GMMrt		8	11.02	12.31	
Wholesaler	Purchasing cost		1200	1200		
	Marketing cost		40	35		
	Selling price		1400	1305.25		
	Gross profit		160	70.25		
	GMMwhs		11.42	5.38		
	TGMM	0	36.46	16.4	12.31	5.11

Source. Own survey results, 2021.

TABLE 9: Double hurdle model results.

Variables	Probit model regression result				Truncated regression result		
	Coef.	Std. err	Z	Mfx	Coef.	Std. err	Z
Sex	0.09	0.072	1.25	0.04	0.02	0.12	0.1667
Farm experience	0.08	0.07	1.14	0.03	0.59	0.76	0.776
Total household size	−0.05	0.47	−0.106	−0.02	−0.61***	0.17	−3.57
Maize land	−0.37	0.29	−1.27	−0.12	3.42***	0.79	4.329
Inorganic fertilizer	0.79**	0.32	2.46	0.28	1.59	1.76	0.903
Improved seed	0.61**	0.31	1.967	0.21	2.29*	1.39	1.647
Market information	0.08	0.28	0.286	0.03	2.12**	0.96	2.208
Extension contact	0.09	0.09	1	0.03	2.40***	0.26	9.231
Distance to market	−0.02	0.03	−0.667	−0.01	−0.02	0.12	−0.167
Credit use	0.055	0.037	1.486	0.02	1.16	0.96	1.208
_Cons					1.77	2.36	0.75

Sources' own survey 2021. *Note.****, ** and * indicate statistical significance at 10%, 5% and 1%.

participation increased by 21% for those farmers who used improved maize seed as an input. This may that those farmers producing maize for the market by early planning to participate in maize market to cover the cost of the improved seed.

The double hurdle model truncated regression results show that the hypothesized use of the improved seed, total family size, land allocated for maize production, extension contact, and market information significantly determined the volume of maize supplied to the market in the study area. As a result, only the significant variables are discussed as follows:

(1) Improved Seed. This variable significantly and positively affects the market participation of maize at a 5% probability level. Maize producers who used improved seeds had more participation compared to those maize producers who did not use improved seeds. In addition, the use of improved seeds can significantly and positively affect the intensity of maize marketed on the market at a 10% significance level. This implies that the improved seed in one quintal and the maize volume marketed increased in 2.29 quintals, keeping the other explanatory variable constant.

(2) Total Family Size. It significantly and negatively influences the level of maize market participation at a 1% probability level. The family number increased by 1 member, and the volume of maize supplied to the market decreased by 3.54 quintals, holding other explanatory variables constant. This can be because if the family number increases, the maize produced is more consumed in the home, and the volume of maize supplied to the market decreases. The studies of Chernet et al. [29]; Ayantu [30]; and Nugusa [31] agree with this result.

(3) Land Allocated for Maize (ha). The land allocated for maize positively influences the market participation level of maize at a 1% level of significance. The land allocated for maize production increased by 1 hectare, and the volume of maize market supplied increased by 4.28 quintal, holding other explanatory variables constant. A study by Ayalew et al. [7] found that land allocated from maize increases the volume of maize market participation positively in northern Ethiopia.

(4) Market Information. Access to market information positively influences the level of maize market participation at a 5% significance level. Compared to those households that have no access to market information, households that have access to market information and maize market supply increased by 2.8%, keeping all other variables held constant. The study by Nugusa [31] found a positive and significant relationship between market information and participation decisions in the maize market.

(5) Extension Contact. The number of extension contacts positively influences the level of market participation of maize at a significance level of 1%, holding all other explanatory variables constant. The regression result confirms that as the extension contact increases by one contact, the level of participation in the maize market increases by 2.4%. Studies by Engida et al. [32] and Ali [33] also found a positive and significant relationship between extension contact and participation decisions in the maize market.

4. Conclusions and Recommendations

Maize is highly produced in the Gamo and Gofa zones of southern Ethiopia. However, only 35.8% of maize was marketed, and the highest percentage was consumed in the study area. In the study area, the maize product transacted from producer to end-users through five market channels. From the market channel, the high volume of maize was transacted through channel five when they sold to urban collectors, which was 94.89% of the consumer's price implying that the producers were profitable when they sold their products to urban collectors. There were also maize market participation and volume determinants in the study area. Of these factors, the use of inorganic fertilizer and improved seed use determine significantly and positively the likelihood of maize market participation. While frequency of extension contact, family size, land allocated to maize production, and market information significantly influenced the volume of maize supplied to the. Based on the above results, introducing agroecology-based maize varieties and awareness of the on use of the recommended fertilizer rate is suggested. Including marketing information through extension system is recommended to increase the likelihood of

market participation and market supply. Furthermore, the establishment of maize collection centers and cooperatives to reduce the long maize market chain actors and supporting institutions starting from the kebele level are suggested recommendations.

Data Availability

Data used for this study will be available from the corresponding authors upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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