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Original Research

Market Performance and Supply Chain Analysis of Maize: The Case of Guduru Woreda, Horro-Guduru Wollega Zone, Ethiopia

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Abstract

The maize market in Guduru Woreda encounters several obstacles that affect the overall market performance and supply chain efficiency. Smallholder farmers, who are the primary producers, often face challenges related to limited access to market information, inadequate infrastructure, and weak bargaining power. These issues are exacerbated by the lack of well-organized market institutions and supply chain inefficiencies, resulting in price volatility and reduced income for farmers. Therefore, the objective of the study was to examine the factors influencing maize market performance and to analyze the maize supply chain. For the analysis, both primary and secondary data were utilized. Primary data were collected from 15 traders, 25 consumers, and 201 sampled households. Both inferential and descriptive analyses were employed in the study. It was determined that farmers marketed their maize through seven distinct channels. Market performance was assessed using cost and marketing margin analysis. When producers sold their goods through channels IV, VI, and VII, their profit margins were 389.7 387.15, and 384.45 birr per quintal, respectively. The results indicate that wholesalers and collectors hold the majority of the profit margin in channel V, with 45.9% and 42.5%, respectively. The determinants of maize market supply were analyzed using the Ordinary Least Squares (OLS) model. The OLS model's findings suggest that the quantity of maize produced and its market price in 2023 were significantly influenced by factors such as cooperative membership, farmer experience, and the acreage allocated for maize cultivation

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INTRODUCTION

Ethiopia's economy is still expanding quickly, with agriculture leading the way, in part because to significant advancements made during GTP I (2023). Ethiopia's agriculture sector is still vital to the country's development since it produces the food needed to support a growing population, but it also contributes significantly to the industrialization and general change of the national economy. To advance the transformation of Ethiopia's agriculture sector, it is imperative to guarantee that smallholder farmers and pastoralists have the tools, knowledge, and support required to transition from a traditional subsistence orientation to one that is more market-oriented and commercialized (ATA, 2021). In Ethiopian agriculture, the production and marketing of cereals is the single largest subsector. It is the largest in terms of national GDP, percentage of rural employment, use of agricultural land, and calorie intake. The contribution of cereals to GDP is 47 percent, industry 10.8 percent and services 42.2 percent (Neelakantam and Naidu, 2016).

Several stakeholders are involved in Ethiopia's maize value chain, including farmers, retailers, wholesalers, traders (local assemblers and distributors), consumers, and input suppliers. South Africa and Nigeria are the two largest producers of maize in Africa, with Ethiopia coming in third. Ethiopia accounted for 12.3 percent of total maize production in Eastern and Southern Africa, compared to 36.3 percent for South Africa. The average maize yield in Ethiopia surpasses that of other sub-Saharan African countries and increased by 9.8%. Thus, the observed increase in production in Ethiopia is largely the outcome of improved productivity of these crops (Adenegan *et al*., 2012; Chekole and Ahmed, 2023).

Maize has played a crucial role in Ethiopia's economic and social development. With 8 million smallholders cultivating maize compared to 5.8 million for teff and 4.2 million for wheat. Maize is the most widely grown crop among smallholder farmers in Ethiopia, making it essential for their livelihoods. Additionally, maize surpasses teff and sorghum in production, with an output of 4.2 million tons, compared to 3.0 million tons for teff and 2.7 million tons for sorghum. Maize is also a key component of food security, being the most cost-effective cereal calorie source, providing 1.5 times and 2 times the calories per dollar compared to wheat and teff, respectively. A thriving maize sector could enable Ethiopia to produce sufficient food to meet the needs of its rapidly growing population and address the country's food deficit (FAO, 2023).

Markets are necessary for providing the goods and services required for a person's survival, growth, and security of livelihood, claim Harini *et al.* (2017). Market forces determine the cost of food as well as the money producer households make from the sale of their own products and labor. Along with physical market components like transportation and telecommunication networks, storage facilities, and other infrastructures, they also have an impact on the quantity and quality of food that is available. Markets maintain the stability of the food supply and prices by ensuring the movement of food from excess to shortage areas and generating an effective demand that drives production (Rashid and Negassa, 2011).

Several issues contribute to the lower-than-average maize productivity in the area, including a lack of extension services, high fertilizer costs, the absence of improved varieties, high production expenses, and delays in the procurement of inputs. Abrupt seasonal fluctuations in maize prices, particularly in rural areas, indicate inadequate grain reserves held by both dealers and farmers. Capacity limitations, liquidity problems, and significant storage losses (which disproportionately affect maize compared to other crops) exacerbate price instability and impact smallholders. Farmers face challenges such as limited access to affordable individual transportation and insufficient knowledge of prices in neighboring markets. Due to minimal involvement in the value chain and a flawed marketing system, smallholders act as price takers with limited negotiating power, which hinders their ability to secure fair prices for their produce. Additionally, low levels of trust among farmers restrict collective sales or transportation efforts. Consequently, producers earn less compared to traders due to weak value-adding activities (GWARDO, 2022).

Although similar studies on cereal crops, including maize, have been conducted in other regions of the country, there has been no empirical research focused on improving maize production and marketing specifically in the research area. Previous studies have predominantly concentrated on output, with less emphasis on quality, value addition, marketing, well-established marketing systems, and the interactions among input suppliers, producers, traders, and consumers.

Therefore, it is essential to assess the functioning of the maize market and identify the factors affecting the supply of maize. This study aims to analyze the determinants of maize market supply and estimate market performance in the Guduru woreda of Horro Guduru Wollega Zone to inform policy formulation. Additionally, the study seeks to address the information gap in this area by identifying the key beneficiaries in the maize supply chain and examining their roles and activities within the system.

MATERIALS AND METHODOS

Description of the Study Area

The maize value chain analysis survey was conducted in the Guduru woreda of the Horro-Guduru Wollega Zone (Figure 1), which is located around 372 kilometers west of Addis Ababa. The area is located between longitudes 37° 26' East and latitudes 09°29' North. The research area is bounded by the following areas: Ginde beret woreda, which is a part of the West Showa zone, to the East; Jima Rare woreda to the South; Abbay Coman and Hababo Guduru to the North; and Jima Genet woreda to the West. Additionally, according to GWLEPO (2013), this woreda is located 372 kilometers to the West of Adds Ababa, the regional administrative town, and 67 kilometers from Shambu, the zonal administrative town.

The 2296 meters above sea level is its average elevation. From March until mid-October, the area has a lengthy rainy season. There are only five to six dry months and no rain in the region because of its nearly perfect environment with enhanced rainy seasons. The study region receives between 1450 and 2500 mm of precipitation annually. In addition, the area has year-round high temperatures, with winter highs of 22 degrees Celsius and summer lows of 190 degrees Celsius. ~~A~~ Horro-Guduru Wollega has a range of agro climatic zones, including tropical (kola), subtropical (Wina Dega), and temperate (Dega), are experienced in the research region. According to GWLEPO (2016), the study region exclusively contained tropical and sub-tropical agro-climatic zones. The sub-tropical agro-climatic zone comprises approximately 79% of them, while the tropical zone accounts for the remaining 21%.

There are twenty kebeles in the woreda. Since five of these kebeles are tropical, they do not grow maize (kola). 31218 (22.2%) wood land, 15750 (11.2%) pasture land, and 10258 (7.3%) residential land~~. land~~, and 50618 (35.9%) cultivated land make up the woreda's total land area of 140869.069 hectares. The remainder 33058 (33.4%) are made up of lakes, gorgy land, stony terrain, marshy area, and other types of land. In the woreda, a mixed crop-livestock agricultural method is employed. Agro-ecology shapes the kind of crops grown in the woreda and the overall adaptability to subsistence. The main products of Weina dega include legumes, pulses, wheat, sorghum, maize, and teff. Sesame, sorghum, fruit trees, and soybeans are produced in the kola. Actually, fear prevents households in the kola area from adapting to plant maize because it is not possible to produce maize there.

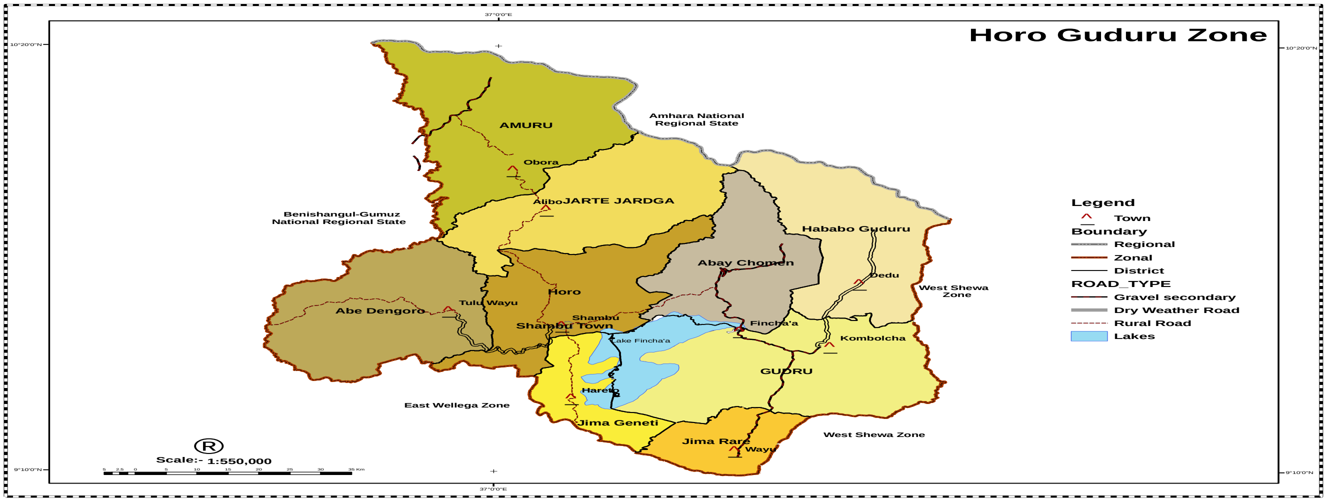

Figure 1. Map of the study area

Sampling Technique and Sample Size

Using a three-stage sampling procedure, the sample size of smallholder maize producers for the interview was determined for this study. Firstly, three kebeles were randomly selected from each of the three districts that produce maize; Secondly, sample households were randomly selected from each of the three kebeles based on probability proportional to size; and thirdly, sample size was determined at 95% confidence level, with a 0.5 degree of variability and 9% level of precision, using a simplified formula proposed by Yamane (1967).

$$n = \frac{N}{1 + N\,(e)^2} = 201$$

Where, n = sample size for the research use, N = household size in the district and e = level of precision (0.09)

Technique for Gathering Data

For this investigation, both primary and secondary data sources were used. Interviews with a sample of farmers, retailers, and customers were conducted using semi-structured questionnaires in order to gather primary data. Before data collection started, the questionnaires were pre-tested to make sure they were appropriate for gathering the required data. The enumerators speak Afan Oromo, the local language; they were selected for the position based on their prior expertise gathering data and familiarity with the research area. Enumerators received training on the questionnaire's contents and the process of gathering data. Secondary data were acquired from a number of sources, including the Internet, other published and unpublished materials, Non-Government Organizations, Central Statistical Authority, Woreda Agriculture and Rural Development Office, reports of Ministry of Agriculture at different levels, and prior study findings.

Data Analysis

The data collected from producers, traders, and consumers were analyzed using two methodologies: econometric analysis and descriptive statistics.

Descriptive statics: Cramer and Jensen (1982) defined marketing margin as the difference between the price a producer receives and the retail price a customer pays. This amount might be considered the cost of providing a range of marketing services. Another approach to define marketing margins is as the cost of a set of marketing services, which is determined by the relationship between the supply and demand for those services. Descriptive analysis was used in this instance to look at marketing participant costs, margins, and net marketing margins. Pricing comparisons across various marketing actor tiers are the focus of marketing margin analysis. It measures the share of the final selling price that is captured by particular agent in the marketing chain and related to price paid by the end consumer, expressed in percentage as following (Mendoza, 1995). The formula to calculate total gross marketing margin (TGMM) is given as:

$$\text{TGMM} = \frac{\text{End buyer price} - \text{farmers' price}}{\text{End buyer price}} \times 100\%$$

The percentage that remains after the intermediary's marketing expenses are subtracted to determine his net income is known as his net marketing margin (NMM). Additionally, it shows how welfare is distributed among marketing and manufacturing representatives.

$$NMM = \frac{Gross\ marketing\ margin - marketing\ cost}{End\ buyer\ price} \times 100\%$$

Net marketing margin (NMM), is the portion of the intermediary's net income that is left over after deducting his marketing costs. It also illustrates the welfare divide between representatives from industry and marketing.

$$GMMi = \frac{(SPi - PPi)}{TGMM} \times 100\%$$

Where, SPi is selling price at i^{th} link and PPi is purchase price at i^{th} link.

Econometric analysis

Using the Ordinary Least Squares (OLS) model, all the households produced and supplied to the market. To examine the variables influencing smallholder farmers' supply of maize, the OLS model was chosen. There are no situations in which the range of the variables to be represented can be restricted. Therefore, issues impacting both the volume and size of sales are addressed by an OLS model. Statistically, we can express the OLS model as:

$$Yi = B0 + BiXi + Ui$$ Where,

Yi = volume of wheat marketed (dependent variable)
B0 = an intercept
Bi = coefficients of i^{th} independent variable
Xi = independent variable
Ui = unobserved disturbance term or error term

RESULT AND DISCUSSION

Channels of distribution and performance evaluation

The cost of producing maize in the research area

Finding the household's costs and profits is one aspect of market chain analysis. The cost of households per hectare was shown in Table 1. With a yield of 46 quintal per hectare, the households' total production cost came to 4,544.5birr. The entire cost of production per quintal was 98.8 ETB, as the table illustrates.

Table 1. Production cost of maize per hectare in Ethiopian Birr (ETB)

Input cost	Production cost per hectare (ETB)	Percentage
Seed cost	312	6.89
Land preparation	302.25	6.65
Plowing	162.25	3.57
Labor	200.5	4.41
Dap cost	1192	26.22
Urea cost	1100	24.20
Weeding cost	225.5	4.96
Harvesting cost	650	14.30
Material cost	250	5.5
Storage cost	150	3.30
Total production cost per hectare	**4,544.5**	**100**
Yield in quintal hectare	**46**	
Cost in ETB per quintal	**98.8**	

Source: own survey result of 2023; ETB: Ethiopian Birr

Farmers' marketing expenses in the maize value chain

Various marketing expenditures are offered when a maize product is moved from one actor to another. Since it must travel a great distance to reach the exchange location, the cost of transportation was significant. Because they occasionally sell to the Addis Ababa wholesaler, wholesalers have far higher transportation costs than other participants in the research area's maize value chain. As indicated in Table 2, the producers' profit margin was 341.2 and their total cost per quintal was 148.8. Value is added at every stage as the product moves through the stages. The actor's expenses rise in tandem with the value added. Based on data gathered from each actor, the cost and profit margin of collectors, cooperatives, wholesalers, and retailers were computed. Apart from farmers, wholesalers who purchase from farmers, collectors, and cooperatives also made substantial profits despite bearing more expenses than other participants. To make an 80 Ethiopian birr profit margin, wholesalers' added value of 93 ETB.

Table 2. Participants in the maize value chain's marketing expenses (ETB/quintal) actors

Marketing cost	Producers	Collectors	Cooperatives	Wholesalers	Retailers
Cleaning Cost	-	2	1	4	2
License Cost	-	-	1	2	2
Loading/Unloading Cost	-	-	1	4	1
Material Cost	-	-	2	4	2
Miscellaneous Cost	50	5	6	10	10
Packaging Cost	-	-	1	2	3
Storage Cost	-	-	2	5	2
Telephone Cost	-	1	1	2	2
Total production cost	98.8	-	-	-	-
Total market cost	60	18	35	93	44
Transportation Cost	**10**	**10**	**20**	**60**	**20**

Source: own survey result, 2023

Maize margin analysis

Table 3 makes it evident how much each participant farmers, collectors, cooperative wholesalers, and retailers paid and made. The results show that farmers' gross profit margins are larger when they sell to cooperatives in channel VI and collectors in channel IV. On the other hand, farmers' profit margins are reduced when they sell straight to wholesalers in channel II. At 97.21% and 84.31%, respectively, the producer's market share in channels III and VI is noteworthy when they sell directly to collectors and cooperatives. In channel III, producers hold a substantial portion of the market since collectors buy close to the farm gate to save on transportation costs. When wholesalers sold directly to consumers and retailers, respectively, they made the biggest gross profit from traders in channels II and V. It could be because there aren't many middlemen in channel II. When selling directly to wholesalers in channel V, collectors made the largest gross profit margin, trailing only wholesalers. This suggests that in the research area, wholesalers made the largest gross profit. Cooperatives made a sizable profit in channel V but a high gross profit in channel VI. Retailers make the least amount of money overall among traders, and cooperatives make up the second-smallest profit share.

Table 3. Marketing margins of actors in the maize value chain across several market channels

Actors		I	II	III	IV	V	VI	VII
	Production cost	98.80	98.80	98.80	98.80	98.80	98.80	98.80
	Marketing cost	60.00	45.60	34.75	56.50	46.25	32.80	41.75
Producer	Selling price	535.50	520.75	515.50	545.00	521.50	518.75	525.00
	Gross profit	376.70	376.35	381.95	389.70	376.45	387.15	384.45
	GMMp (%)	100.00	76.70	97.21	80.30	74.90	84.31	78.30
	Purchase price			500.00	500.00	500.00		
	Marketing cost			10.00	23.50	30.00		
Collector	Selling price			530.25	555.50	572.50		
	Gross profit			12.25	32.00	42.50		
	GMMc (%)			5.70	9.90	12.70		
	Purchase price					515.00	515.00	
	Marketing cost					50.00	62.50	
Cooperative	Selling price					590.50	615.25	
	Gross profit					25.50	37.75	
	GMMcp(%)					12.80	16.30	
	Purchase price		510.00		528.00	528.00		528.00
	Marketing cost		121.60		121.60	121.60		121.60
Wholesaler	Selling price		678.60		678.60	695.50		670.00
	Gross profit		47.00		29.00	45.90		20.40
	GMMw(%)		24.80		22.20	24.08		21.20
	Purchase price					750.00		
	Marketing cost					95.00		
Retailers	Selling price					865.50		
	Gross profit					20.50		
	GMMr					13.34		
TGMM		**0.00**	**24.70**		**21.20**	**39.70**		**21.60**

Source: Own survey result of 2023. GMMp, GMMc, GMMcop, GMMw, GMMr, Gross marketing margin of producers, collectors, cooperatives, wholesalers and retailers, respectively. TGMM shows total gross marketing margin of each actors.

Econometric Result

Reddy *et al*. (2013) state that the majority of economic data frequently exhibits the multicollinearity problem, commonly known as the correlated input variables. This issue results from the selection of multiple strongly correlated input variables, which causes imprecise forecasts and significant forecasting errors. The presence or absence of multicollinearity in the studied data was evaluated using the Variance Inflating Factor (VIF) and Contingency Coefficient tests. The Variance Inflation Factor (VIF) illustrates how multicollinearity inflates the variance of an estimate. The VIF equals 1 in the absence of multicollinearity and approaches infinity when 46 multicollinearity increases. The formula for the Variance Inflating Factor for each explanatory variable (Xi) can be found in Gujarati (2010) and Reddy *et al*. (2013).

$$vif(xi) = \frac{1}{1 - R^2}$$

The coefficient of correlation, or R^2, is produced when one explanatory variable regresses over all other explanatory variables. Alternatively, tolerance (TOL), the inverse of VIF (1/VIF), can be used to measure multicollinearity (Table 4). How near to zero its TOL is indicates the degree of collinearity between one explanatory variable (Xi) and the other explanatory variable. On the other hand, the TOL of Xi approaches 1 in the stronger the suggestion that Xi is not collinear with the other explanatory variables (Gujarati, 2010).

Table 4. The continuous explanatory variable's variance inflation coefficients

Variable	VIF	1/VIF
Distance to the nearest market	2.15	0.46
Age	1.73	0.58
Family size	1.38	0.73
Total livestock owned	1.21	0.82
Farming experience	1.17	0.86
Education of the household	1.13	0.88
Frequency of Extension Contact	1.11	0.90
Amount of land allocated to teff	1.10	0.91
Mean VIF	**1.33**	

Source: Computed from the field survey data

Using the Contingency Coefficient (CC), a measure of the degree of connection between dummy variables was discovered (Table 5). Based on the chi-square measure of association, contingency coefficient values, which vary from 0 to 1, indicate the strength of the relationship between discrete variables. According to Healy (1997) and Befekadu and Yeboah (2017), a contingency coefficient value of 0.75 or above suggests a significant degree of link between discrete variables, but a value near to zero indicates no series correlation between discrete variables. It is calculable as:

$$CC = \frac{x^2}{n+x^2} \text{ Where,}$$

n = the sample size, χ^2 is the chi-square value, and CC = is the contingency coefficient.

The study's mean VIF for the continuous explanatory variable was 1.86, and the contingency coefficient for each of the dummy variables in the model was less than 0.75, suggesting that multicollinearity was not a significant issue.

Table 5. Contingency coefficient for dummy variables

Variables	Sex	Membership to coop	Access to market information
Sex of the household	1.0000	-	-
Membership to cooperatives	-0.0323	1.0000	-
Access credit service	0.0215	0.1368	1.0000
Of farm income	0.00413	0.2134	2.0000

Source: Computed from the field survey data, 2023

Determinants of Maize Market supply

The OLS model indicated in the Table 6 result showed that, of the thirteen explanatory factors, five production, experience, family size, and experiences as well as the market price from the previous year, total farmland, and cooperative membership have a substantial impact on market supply. All six of the variables that have an impact on market supply have a positive and considerable impact.

Quantity produced (PROD): As anticipated, it has a 1% impact on the market supply. The amount of maize on the market grows as production rises by quintals. The model's output showed that the market supply of maize grew by 0.18 quintals for every quintal increase in production. This outcome is in line with Rahim (2006) findings, which showed that production amount had a positive and considerable impact on the supply of peppers on the market.

Farming Experience (Exp): Experience has a 5% anticipated impact on the market supply of maize. The benefits of experience are evident in the fact that well-versed households in maize production have learned from their errors and have gained a wealth of knowledge. They increase the amount of maize available on the market by knowing when to plant seeds and how to use inputs sensibly to create high yields. As a result, more goods from well-off households than from those with less experience make it to market. According to the model's output, for every year of expertise, the market supply increased by 0.46 quintals. Benjamin (2013) discovered a positive relationship between market sales of groundnuts and farming expertise. Additionally, Bizualem *et al*. (2016) found that an increase in farming experience of one year corresponds to a rise in the marketable excess of coffee.

Family size. Family size was previously thought to have a positive or negative impact on the volume of maize marketed. The results of the model show that home family size positively affects market supply at a 5% significance level. The positive effects of family size on supply suggest that larger families may divide the workload, increasing market supply. The coefficient verifies that the market supply grew by 0.32 quintals for every household size increase of one. This is consistent with Hami (2017) findings, which showed a positive correlation between the size of the family and the availability of durum wheat on the market.

Membership to cooperatives: Farmers who were the membership of the cooperatives are better performed than not members. The result shows that, as the farmer's members to the cooperatives, the market supply increased by 2 quintals.

Table 6. Ordinary least square (OLS) estimates of market supply

Variables	Coefficient	Robust Std. Err	P-value
Quantity produced	0.1899	0.0487	0.000***
Total livestock owned	-0.0380	0.1566	0.808
Distance to the nearest market	-0.317	1.722	0.854
Family size	0.3287	0.1975	0.098**
Farming experience	0.4613	0.0723	0.000***
Total land size	1.999	0.4588	0.000***
Age	-0.062	0.0455	0.172
Extension contact	0.1148	0.4896	0.815
Access to credit service	-0.4501	0.8583	0.601
Membership to cooperatives	2.098	0.9752	0.033**
Education	-0.9384	0.8661	0.280
Offarm income	-0.971	0.8804	0.271
Constant	-3.96	3.402	0.245
Number of observation		**201**	
F(13187)		**39.30**	
Prob > F		**0.000*** **	
R-squared		**0.73**	

***, ** and * represent significant at 1%, 5% and 10% probability levels, respectively.

CONCLUSION

In this study, the market performance and supply chain of maize in Guduru Woreda of the Horro-Guduru Wollega Zone, Oromia, Ethiopia, were investigated. The analysis revealed that factors such as the quantity produced, market price, experience, and cooperative membership significantly influenced the supply of maize in the market. The findings also indicated that increasing the quantity of maize produced helps farmers select appropriate markets. To enhance maize participation, it is essential to address factors related to maize production levels. This can be achieved by providing extension services, offering organizational and technical support, granting credit, and using improved inputs. The model results suggest that experienced farmers are able to supply larger quantities of maize to the market. Therefore, training and consultation should be provided to farmers to enhance their skills in production and market supply. Additionally, training should be offered to farmers about the benefits of cooperative membership, especially for those who are already knowledgeable about cooperatives.

Conflict of interest

The authors declare that they have no conflict of interest.

Data Availability

All data generated are included within the article. Furthermore, datasets are available from the corresponding author upon request.

REFERENCES

Adenegan, K. O., Adepoju, A., & Nwauwa, L. O. E. (2012). Determinants of market participation of maize farmers in rural Osun State of Nigeria. International Journal of *Agricultural Economics & Rural Development*, 5(1), 28-39.

ATA (Agricultural Transformation Agency). 2021. Annual Report in Ethiopia. Innovations to help our country grow.

Befekadu L. & Yeboah, O. (2017). Profitability and Competitiveness of Indigenous Horo Cattle Production in Ethiopia. *Research in Agricultural and Applied Economics*, 1-17

Benjamin, A. (2013). *Working with Walter Benjamin: Recovering a Political Philosophy: Recovering a Political Philosophy*. Edinburgh University Press.

Bizualem, A. (2016). Macroeconomic stabilty implications of GTP-II: evidence from macro-econometic model for Ethiopian economy.

Chekole, F. C., & Ahmed, A. M. (2023). Future climate implication on maize (*Zea mays*) productivity with adaptive options at Harbu district, Ethiopia. *Journal of Agriculture and Food Research*, *11*, 100480.

Cramer, G.L., & Jensen, W. (1982). Agricultural Economics and Agribusiness, 2nd Edition. McGraw Hill Book Company, USA. 222p.

Gujarati, D., & Porter, D. C. (2010). Functional forms of regression models. *Essentials of Econometrics*, *6*, 132-177.

GWARDO (Guduru Woreda Agricultural and Rural Development Office), (2022). Unpublished document

Hami, M. (2017). The effect of inflation on financial development indicators in Iran (2000–2015). *Studies in Business and Economics*, *12*(2), 53-62.

Harini, H., Purwaningsih, Y., Widiyanti, E., & Cahyadin, M. (2017). Trading system of food commodity. *Economic Journal of Emerging Markets*, *9*, 172-180.

Healy, P. M., Palepu, K. G., & Ruback, R. S. (1997). Which takeovers are profitable? Strategic or financial. *MIT Sloan Management Review*, *38*(4), 45-57.

Mendoza, M. S., & Rosegrant, M. W. (1995). Pricing conduct of spatially differentiated markets. *Prices Products and people: Analyzing agricultural markets in developing countries*, 343-360.

Neelakantam, T., & Naidu, P. D. (2016). Agricultural Contribution in Development of Ethiopia Issues and Challenges. *ITIHAS the Journal of Indian Management*, *6*(1), 38-54.

Rahim, T., Khan, M., & Shafi, M. M. (2006). Marketing of selected surplus fruits and vegetables of Dir district [Pakistan]. *Sarhad Journal of Agriculture (Pakistan)*, *23*(2). 501-507.

Rashid, S., & Negassa, A. (2011). Policies and performance of Ethiopian cereal markets. Ethiopia strategy support program, 2.

Reddy, M. M., Vivekanandhan, S., Misra, M., Bhatia, S. K., & Mohanty, A. K. (2013). Biobased plastics and bionanocomposites: Current status and future opportunities. *Progress in polymer science*, *38*(10-11), 1653-1689.

Food and Agriculture Organization of the United Nations. (2023). *Pesticide residues in food: Joint FAO* (No. CC4115/EN/1/03.23).

Yamane, T. and Lamola, A. A., (1967). Sensitized photo dimerization of thymine in DNA. *Proceedings of the National Academy of Sciences*, *58*(2), 443-446.8