# DETERMINANT OF MAIZE COMMERCIALIZATION AMONG SMALLHOLDER FARMERS IN GOG DISTRICTS, ANYWAA ZONE, SOUTHWESTERN, ETHIOPIA

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## ABSTRACT

*Agricultural commercialization is a process of transformation from subsistence farming system to market oriented production system. Motivating smallholder farmers to produce further than their consumption and empowering them to be profit oriented should be given priority in order to foster the economic growth in developing countries where agriculture is the pillar of the economy and smallholder farmers are the largest section of the country like Ethiopia. Nevertheless, due to a number of reasons smallholder farmers' level of commercialization is very low and insignificant. There are only few studies conducted about agricultural commercialization in Ethiopia but the studies are not focused to the study area. Consequently, this aimed to analyze the factors that determine market participation and degree of commercialization by smallholder maize producers in Gog district, Anywaa Zone, Ethiopia. Data were collected from 385 smallholder maize producers in four kebeles where maize is produced potentially through multistage sampling method. Furthermore, interview schedule, focus group discussion and key informant interview were used to gather the required primary data. In order to attain the study objectives, Tobit model was employed to analyses both market participation and intensity of commercialization. From the analysis education level, livestock holding, frequency of extension contact, training, off/non-farm income activity, quantity of maize and lagged price were found to have significant effect on market participation while intensity of commercialization was significantly influenced by education level, livestock holding, training, frequency of extension contact, off/non-farm activity, quantity of maize produced and lagged price. To conclude based on the results, smallholder maize producers should be supported frequently by extension agents in order to upsurge their practical skills which results enhancement of their market participation and* intensity of *commercialization.*


**Keywords:** *Gog,* Commercialization, Maize, Smallholder Producers, Tobit Model.

## Introductions of the Study

Agriculture is the mainstay of Ethiopian economy as it is a means of livelihood for about 84% of the population and it constitutes about 33.3% of the country's GDP (NBE, 2018). The majority of farmers in Ethiopia are smallholders and they are a source of 95% of the country's agricultural production (CSA, 2018). Enhancing the productivity of smallholder farmers has been the primary goal of the government in order to foster the economic growth in Ethiopia.

Contempt the background that agriculture is giving a notable progress in Ethiopia, it is not yet advanced to the expected level. Consequently, Low productivity, low employment of agricultural technologies and subsistence-based smallholder farming are still the characteristics of the sector (Doss et al., 2003; Shita et al., (2018). On the others hand, strategies and policies


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designed to bring economic growth in the country such as Agriculture Development Led Industrialization and Growth and Transformation Plan has been mainly focusing on agricultural development through shifting the current smallholder subsistence-based farming to commercialized agriculture (Gebreselassie, 2006; MoFED,2006 as cited in Agerie, 2017). Furthermore, Agricultural commercialization is a process of transformation from subsistence farming system to market oriented production system (Alemu et al., 2006). Commercialization in smallholder farming is very important for low-income countries since it has a potential to improve incomes and play a key role in reducing rural poverty level (Awotide et al., 2016; Hailu et al., 2015; Osmani et al., 2014). Agricultural commercialization particularly grain crops are more subsistence than cash crops in Ethiopia. Ethiopian low level of commercialization can be explained by, market imperfections, lack of capital, lack of market accessibility and high transaction costs (Getahun, 2020; Hagos & Geta, 2016; Senbeta, 2018).

There are several studies conduct in Ethiopia on the different commodities by different researchers. For instant (Abafita et al., 2016; Abadi, 2014; Getahun, 2020; Hailu et al., 2015; Agerie, et al., 2017), they identified the factors affecting the commercialization of the crops and their participations. Despite to this, there was no any study being conduct in the study particularly in Gog district, Anywaa zone, Gambella, Ethiopia in Figure 1.

## Description of the Study Area

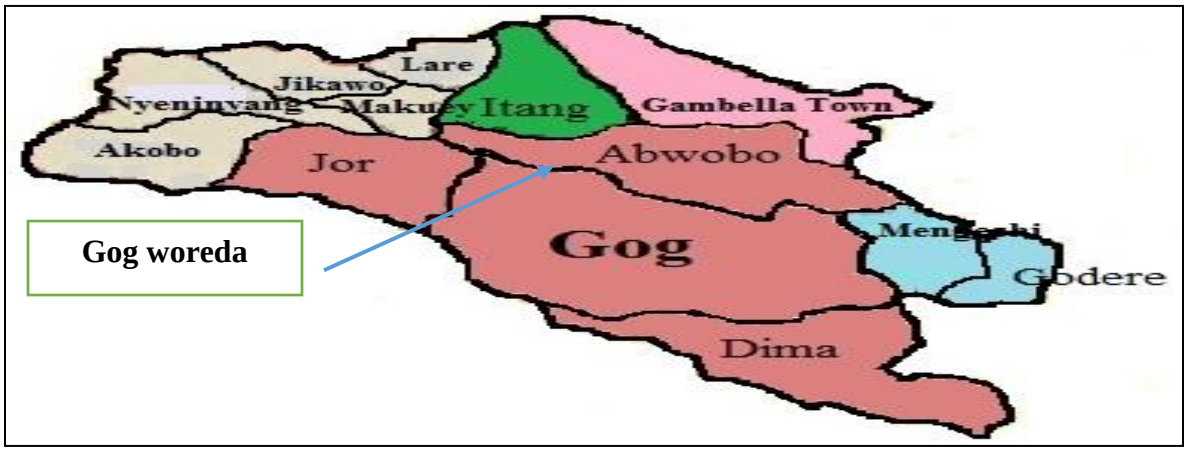


**Figure 1**
**GAMBELA REGION OF ETHIOPIA**

Gog woreda is one of the woredas in the Gambela Region of Ethiopia and part of the Anuak Zone. Gog woreda is bordered on the south by Dimma, on the southwest by the Akobo River which separates it from South Sudan, on the west by Jor, and on the north by Abobo. The major town in Gog is pinyudo town. Then, the terrain of Gog is predominantly flat, with the elevation ranging between 400 and 600 meters above sea level; high points include Mount Masango (552 meters). Major bodies of water in this woreda include the Gilo River and Lake Tata. According to the *Atlas of the Ethiopian Rural Economy* published by the Central Statistical Agency (CSA), around 30% of the woreda is forest. A notable landmark is the Gambela National Park, which occupies the land west of the pinyudo Gambela road (Wayback Machine, 2007).


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The economy of Gog woreda is predominantly agricultural. There are no agricultural cooperatives, and little other infrastructure. (Wayback, 2007 pp 30). While there are roads in this woreda, details about them are not available. At the start of the Federal Democratic Republic of Ethiopia, Gog was part of the Administrative Zone 2; however between 2001 and 2007 the Zone was reorganized and Gog became part of the Anuak Zone (Dereje, 2003). At some point between the 1994 national census and the 2001 *Sample Agricultural Enumeration*, Dimma was split from Gog. Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this woreda has a total population of 16,836, of whom 7,751 are men and 9,085 women; with an area of 3,250.25 square kilometers, Gog woreda has a population density of 5.18, which is greater than the Zone average of 4.83 persons per square kilometer.

Reportedly 5,617 or 33.36% are urban inhabitants. A total of 3,633 households were counted in this woreda, which results in an average of 4.6 persons to a household, and 3,450 housing units. The majority of the inhabitants said they were Protestant, with 87.52% of the population reporting they observed this belief, while 4.44% of the population practiced Ethiopian Orthodox Christianity, 5.45% were Catholic, and 2.59% are follower of Muslim belief religions (CSA, 2017). The four largest ethnic groups were the Anuak (95.59%), the Amhara (1.17%), the Oromo (1.11%), and the Mezhenger (1.01%); all other ethnic groups made up 1.13% of the population. Anuak is spoken as a first language by 95.67%, 1.16% Oromiffa, 1.09% Amharic, and 1.01% speak Majang; the remaining 1.11% spoke all other primary languages reported.

## METHODOLOGY OF THE STUDY

### Sampling Procedure and Sampling Technique

A combination of different sampling procedures was used to select the samples to successfully meet the aims of the study. The sampling frame of the study was the list of households in the selected kebeles**,** in the respective districts of Gog districts, who are engaged in maize production. Households are the unit of analysis. A multistage sampling procedure was employed to select potential maize producer farmers. In the first stage, Gog districts were selected purposively based on their maize production potential. In the second stage from the selected districts, six maize producing kebele were selected using simple random sampling technique. In the third stage, households in the selected kebelles were stratified in to maize producers and non-producers. Finally, 385 smallholder maize farmers were selected using systematic random sampling technique by taking in to account the proportion of number of maize producers in each kebelle in the corresponding districts. To obtain a representative sample size, for cross-sectional household survey the study employed the sample size determination formula given by Kothari (2004):

### Sources of Data and Methods of Collections

Both primary and secondary sources of data were used. Before the data collection, the questionnaire was pre-tested on selected farmers to evaluate the appropriateness of the design, clarity, and relevance of the questions. Then, Having the appropriate modification on the questionnaire based on the pre-tested result three enumerators from each district were recruited and trained about the content of the questionnaire and interviewing process.


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Primary data were collected using interview schedule, focus group discussion and key informant interview whereas secondary data were also collected to supplement the primary data from published and unpublished sources.

## Method of Data Analysis

Two types of analysis, namely: descriptive and econometric analyses were used for analyzing the data. Descriptive method of data analysis refers to the use of ratios, percentages and means in the process of examining and describing household characteristics. To analyses the factors that determine market participation and intensity of commercialization Tobit model was employed. Intensity of commercialization was measured as the ratio of the percentage of marketed output to total production. It is necessary to show the decision of smallholder maize farmers' market participation in order to estimate the degree of commercialization. The dependent variable, decision to commercialize and intensity of commercialization, in this case has an upper limit of one in all cases and a lower limit of zero. The rationale for this is to match farmers' decision to fit the Tobit model that cannot take dependent variables greater than one or a negative.

# RESULTS AND DISCUSSION

## Socio-Economic Characteristics of Respondents

Sample respondents were composed of both female and male household heads. Accordingly, about 5% were female headed households and about 95% were male headed households. In terms of participation in maize market, 24% of household heads were participant while 76% of the households were not participant. The average age of the respondent households were 46 years with a range minimum of 25 years and maximum of 76 years. Similarly, the average quantity of maize annually produced was 15.27 quintal while the minimum was one Quintal and 54 quintals was the maximum. The average amount of maize supplied to market was 3.52 quintal and the minimum was supplied nothing and the maximum was 35 quintals. The extent of maize commercialization was 23%.

**Table 1**
**MAIZE PRODUCTION AND MARKETING RELATED PROBLEMS IDENTIFIED BY THE SAMPLE RESPONDENTS**

| s/no | Problems identified by respondent | percent |
|---|---|---|
| 1 | Lack of improved maize seeds | 45.5 |
| 2 | Poor road infrastructures | 41 |
| 3 | Low prices | 33 |
| 4 | Weathers changes | 49 |
| 5 | Inadequate transportation service | 70.23 |
| 6 | Lack of the input supply | 45 |

**Source;** Field study 2020**.**

Table 1. Discloses on production and marketing problems of maize in the study area. As observed from the table, 95.53% of the households reported that lack of improved maize seeds as serious problem for maize production in the study area. maize disease is another major problem in the study area according to the percentage response of the households (58%). They criticize that, American worms in particular destroying their maize on farm thereby contributing low


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harvest of output. Additionally, binding constraint in production and marketing of maize in the study area reported by sample households is lacks of input supply. As result, 50.67% of the households responded as they were suffering from lacks of input supply. According to their response, as volatility in market prices of fertilizer, improved seeds and labor highly discouraging them are discouraging at the district. A relatively low market price of maize was also among production and marketing problems reported by about 49.33% of the households.

Poor road infrastructure, inadequate means of transportation, and weather change were also identified as constraints in maize production and marketing in the study area by 46.67%, 20.67%, and 31.33% sampled respondents respectively. According to respondents, poorly developed road infrastructure in the area made them face difficulty in transporting their output and incur significant transportation cost. In this regard this study is in line with study conducted by Firdisa (2016) who also demonstrated that poor infrastructure being one of major problems of crop production of rural areas. Also, there is poor facility in public means of transportation. Inadequate public means of transportation could be associated with poor road infrastructure both of which force farmers sell their produce at farm gate price.

Weather change was also reported as a critical problem in production of wheat in the study area. Rendering to respondents, variability in rainfall occurring at time of sowing and harvesting was highly reducing their production potential due to deterioration of yields.

## Determinants of Market Participation and Degree of Commercialization

As already mentioned in the methodology section, this study employed Tobit model to estimate both determinants of smallholder maize producers' market participation and intensity of commercialization. Commercialization index which is a ratio of quantity of maize supplied to market by a particular household in the specified year to the quantity of maize produced by the same household in the same year was used to measure the intensity of maize commercialization (Abafita, J., 1Atkinson, J. and Kim, C.-S., (2016).); Makombe et al., 2017). Therefore, the output of the Tobit model revealed that seven variables were found to be significantly creating variation on the probability of smallholder maize producers' market participation and degree of commercialization out of the total thirteen explanatory variables. Whereas, Education level, livestock holding, Frequency of extension contact, Training, Off/non-farm income activity, Quantity of maize, lagged price were explanatory variables significantly influence probability of smallholder maize producers market participation and degree of commercialization. Overall, the probability of smallholder maize producers to sell their maize in the output markets was 76.3%. Tobit estimation for maize commercialization is presented in Table 1 and statistically significant explanatory variables are interpreted as follows:

**Education level**: the variable education level is a continuous variable measured a grade of formal schooling which had positively influence the probability of market participation and degree of commercialization of maize at 1% level of significance. This indicates that household who were more educated had better market participation and high degree of commercialization. The positive relationship could be due to the fact that educated people can more easily contribute to the generation of new technologies and more readily utilize those technologies (Derso et al., 2016). Furthermore, educated people manage their fields properly and then this activity results have pushes to get good production and productivity of the land. This result is in line with the findings of Awotide et al., (2016) which is analyzed by Heckman two stage model and confirmed that level of education has positive and statistically significant effect on market participation of farmers in rice marketing.


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**Frequency of extension contact:** It is obvious that agricultural extension services play a vital role in motivating farmers towards accepting and implementing improved agricultural technologies and agronomic practices. However, the result of this study shows that frequency of extension contact negatively and significantly influence the probability of maize market participation and degree of commercialization at 5% level of significance. This might be smallholder maize producers who have frequent contact with development agent could not get practical information on new technologies and agronomic practices which might boost their production and productivity of maize. Instead development agents out of their profession, might spent their time with farmers talking about politics and other issues which is not directly relevant to enhance farmers' production and productivity. Thus, negative but statistically significant effect of extension service on market participation and commercialization level had been reported in some other African countries such as in rural Nigeria (Awotide et al., 2016) and in Ghana (Martey et al., 2012).

**Training:** training was found to have positive and statistically significant influence on both the probability of maize market participation and degree of commercialization at 5% significance level. Thus, Trainings on application of new agricultural technologies, agronomic practices, harvest and post-harvest loss minimization and other related trainings could build smallholder farmers' production capacity. Ultimately, it increases the likelihood of maize market participation and degree of commercialization for producers. In line with our finding a study conducted in the northern part of Ethiopia, Tigray Region, confirmed that training on crop marketing has a positive and significant effect on intensity of crop commercialization (Hailu et al., 2015).

**Off/non-farm income activity:** This variable was measured in terms of whether or not respondents get additional income from off/non- farm income beyond their own agricultural activity. Off/non-farm income activity had positively and statistically significant influence at 1% level of significance on the probability of market participation and degree of commercialization. The positive relationship could be because of farmers who have got additional income from off/non-farm activities might not face financial shortage to purchase farm inputs to increase their maize production and productivity which ultimately increases their market participation and degree of commercialization. This result was in line with the findings of Hailu et al., (2015) which states that off-farm income is the driving force of increased crop commercialization. In addition, Matthews et al., (2015) confirmed that the direct effect of off/non-farm income in enabling smallholder farmers to be technical efficient in maize farming in Ethiopia. This might increase the production level and market participation of the farmers. Contradicting to this result, off/non-farm income had shown significant negative influence on farmers' market participation was reported by Awotide et al., (2016) and commercialization level by (Martey et al., 2012).

**Livestock holding:** this variable was a continuous variable measured in Tropical Livestock Unit (TLU) was found to have negatively and statistically significant at 10% level of significance on the probability of smallholder maize producer market participation as well as degree of commercialization. Whereas, the negative relationship could imply that as the households' have more livestock endowment, their market participation and degree of commercialization decreases. The possible reason might be to purchase farm inputs which can enhance production and productivity like fertilizer, improved seed, pesticides and insecticides, farmers directly sell their livestock and store their maize output. This finding contradicts with the findings of Abafita et al., (2016). In their study on smallholder cereal farmers' commercialization in Ethiopia by


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using Heckman two stage models, Ox that is a proxy for total livestock holding had positive effect on probability of participation on cereal marketing.

**Quantity of maize produced (in quintal)** this variable was found to have positive and statistically significant influence on the probability of participation in maize marketing as well as degree of commercialization at 5% level of significance. As the evidence obtained from sample respondents, maize producers who produced more had better chance to participate in maize marketing and supply high amount of maize in to the market. A previous study conducted in Ethiopia has shown a significant positive effect of value of crop produced on the probability of market participation and the level of commercialization by smallholder cereal farmers (Abafita et al., 2016). In addition, the study conducted in rural Nigeria confirmed our result and it indicates that the positive and statistically significant effect of yield of rice on farmers' rice market participation and welfare maximization (Awotide et al., 2016).

**Lagged price:** which was measured in Ethiopian birr had positive and statistically significant relationship with probability of maize market participation and degree of commercialization at 1% level of significance. This research finding is in line with the study by Martey et al., (2012) conducted in Ghana founded the significant effect of unit of price output on intensity of commercialization was documented in the study by. Therefore, it was due to the fact that lagged price of maize was high. Accordingly, as High price level of the output in the previous year was higher it could motivate maize smallholder farmers to produce more in the form of allocating more land and use of appropriate agricultural technologies and to increase their market participation and degree of commercialization in Table 2.

**Table 2**
**DETERMINANTS OF MARKET PARTICIPATION AND DEGREE OF COMMERCIALIZATION**

| INDEPENDENT VARIABLE | COEFFICIENTS | STD.ERR | T | P>T |
|---|---|---|---|---|
| sex | .0494098 | .0606818 | 0.81 | 0.416 |
| Family size (Adult equivalent) | .0017478 | .0054668 | 3.15*** | 0.002 |
| Livestock holding | -.0076951 | .0041222 | -.87* | 0.063 |
| Level of Education | .072341 | .0054668 | 3.15 | 0.002 |
| Experience in maize farming | -.0006447 | .00229674 | -0.22 | 0.828 |
| Quantity of maize produced | .0046001 | .0036009 | -0.30 | 0.761 |
| Distant to the nearest | .0004674 | .0005713 | 0.82 | 0.414 |
| Distant to the main road | -.000335 | .0011529 | -0.29 | 0.772 |
| Frequency of extension contact | -.0018345 | .0008548 | -2.15** | 0.045 |
| Off farm Income activities | .0748959 | .0277707 | 2.70*** | 0.007 |
| Training | .0990867 | 0.493309 | 2.01** | 0.045 |
| Current price | -.0010982 | .0036009 | -0.30 | 0.761 |
| Lagged price | .0665395 | 0.147429 | 4.51*** | 0.000 |
| Number of Obs=385<br>Uncensored=292<br>Left censored=93 | | | | |


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Limited: lower=0
Upper=+inf
Right censored=0
LR chi2(13) = 69.45
Prob>chi2=0.0000
Log likelihood= -82.50748
Pseudo R2=0.2962

Source; own computations 2020
Note: ***, ** and * represents significance level at 1%, 5% and 10%, respectively
Effects of changes in significant explanatory variables

**Table 3**
**MARGINAL EFFECTS OF EXPLANATORY VARIABLES**

| INDEPENDENT VARIABLE | Change in Probability of market participation | Change in degree of commercialization | Change in Unconditional expected value of commercialization |
|---|---|---|---|
| sex | .06216245 | .02679699 | .03747441 |
| Family size (Adult equivalent) | .00219887 | .00094789 | .00132558 |
| Livestock holding | -.00968116 | -.04417335 | -.05583625 |
| Level of Education | .02168224 | .00094789 | .00132558 |
| Experience in maize farming | -.00081109 | -.00034964 | -.00048896 |
| Quantity of maize produced | -.0578700 | .02249485 | .03348894 |
| Distant to the nearest | .00058799 | .00025347 | .00035447 |
| Distant to the main road | -.00042147 | -.00018169 | -.00025408 |
| Frequency of extension contact | -.00230794 | -.00999491 | -.00539134 |
| Off farm Income activities | .09422652 | .04061917 | .05680413 |
| Training | .12466106 | .0537389 | .07515148 |
| Current price | -.00138166 | -.0005956 | -.00083293 |
| Lagged price | 0.8371335 | 0.3608716 | .0504663 |

Source; own computations 2020.

All variables that were found to influence the participation decision and degree of commercialization might not have similar contribution for influencing the participation decision and degree of maize commercialization. Hence, using a decomposition procedure suggested by (Moffitt & Mcdonald, 1980), the marginal effect results of Tobit model was used to assess the effects of changes in the explanatory variables into participation decision and intensity as follows by using the decomposition command which is **dtobit2.**

The dtobit2 command estimates a Tobit model and provides a table of marginal effects evaluated at the observed censoring rate of the dependent variable. The marginal effects were computed for the dependent variable conditional on the censoring and on the unconditional expected value of the dependent variable. Therefore, the effects of each significant explanatory variable which affects smallholder maize producers' probability of maize market participation


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and degree of commercialization is interpreted as follows based on the marginal effect results presented in Table 3.

**Education level:** Educated members are expected to have more exposure to the external environment and familiar with their duties and rights they have in different social activities and need to actively participate in economic and democratic right to take right decision. Education increases human capital which enhances the farmer's ability to adopt new agricultural technology which in turn leads to high degree of commercialization. The results of the econometric model indicated that, an increase in the education level of households by one grade increase the probability of farmer's market participation and the expected level of commercialization of maize producing farmers by 2.17% and 0.01 units, respectively. Moreover, the education level of households increases by one grade the unconditional expected value of maize commercialization increases by 0.01 units.

**Livestock holding:** The marginal effect of this variable revealed that, as the number of livestock increases by one TLU from the mean, the probability of farmer's market participation and the expected level of commercialization of maize producing farmers decreased by 0.97 % and 0.04 units, respectively keeping other variables constant at their mean value. Moreover, as the number of livestock increases by one TLU from the mean, the unconditional expected value of maize commercialization decreases by 0.06 units.

**Frequency of extension contact:** The marginal effect shows as the smallholder maize producers increase extension contact by one time in a year from the mean, the probability of farmer's market participation and the expected level of commercialization of maize producing farmers decreased by 0.23 % and 0.01 units, respectively keeping other variables constant at their mean value. Moreover, as the smallholder maize producers increase extension contact by one-time **in** a year from the mean, the unconditional expected value of maize commercialization decreases by 0.01 units.

**Training:** The marginal effect revealed that smallholder maize producer who got agricultural training had 12.47% more probability for market participation and 0.05 unit more expected level of maize commercialization compared to those who didn't took training keeping other variables constant at their mean value.

Moreover, smallholder maize producers who got agricultural training had 0.08 unit more unconditional expected value of maize commercialization compared to producers who didn't too k training.

**Off/non-farm income activity:** The marginal effect of the model was interpreted as farmers who have got extra income beyond their farm activities. This variable could be interpreted as the farmers engaged in off/non-farm job, the probability of market participation was 9.42% and 0.04 unit more expected level of maize commercialization compared to farmers who didn't get any income from off/non-farm income activities keeping all other variables constant at their mean value. Furthermore, farmers who have extra income from off/non-farm income activities beyond their farm activities had 0.06 unit more unconditional expected value of maize commercialization compared their counter parts.

**Quantity of maize:** The results of the econometric model indicated that, as the quantity of maize production increased by one quintal from the mean, the probability of farmer's market participation and the expected level of commercialization of maize producing farmers could increase by 5.79% and 0.02 units, respectively keeping other variables constant at their mean value. Furthermore, as the quantity of maize production is increased by one quintal from the mean, the unconditional expected value of maize commercialization increases by 0.03units.


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**Lagged price:** The results of the econometric model showed that, as lagged price increases by one Ethiopian birr per kilogram of maize from the mean, the probability of farmer's market participation and the expected level of commercialization of maize producing farmers increased by 8.37% and 0.04units, respectively keeping other variables constant at their mean value. Furthermore, as lagged price increases by one Ethiopian birr per kilogram of maize from the mean, the unconditional expected value of maize commercialization increases by 0.05units.

## CONCLUSION

The overall aims of this study were analysis of maize commercialization among smallholder farmers with a specific objective of identifying factors determining market participation of smallholder maize producer and investigating the factors affecting the intensity of maize commercialization among smallholder producers. Tobit model was employed to investigate both maize market participation and intensity of participation for smallholder maize producers.

The marginal effect of the Tobit model indicated that education level of household head, attending training, getting income from off/non-farm income activities, quantity of maize produced and lagged price had positive and statistically significant influence on both the probability of smallholder maize producers market participation and intensity of market participation. However, total livestock holding and frequency of extension contact were found to have negatively and statistically significant effect on both probabilities of maize producer's market participation and intensity of commercialization. Based on the findings of this study, it is recommended that extension agents should provide practical and professional advices to farmers to enhance their production which in turn increase their probability of maize market participation and intensity of commercialization. In addition, smallholder maize producers who have more number of livestock had less likely to participate in maize marketing and their intensity of commercialization was also low. Therefore, training should be provided for them regarding how to minimize post-harvest loss of their maize storage.

### Competing Interests

The authors declare that they have no competing interests

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