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Determinants of market participation and intensity of marketed surplus among maize producers in Fogera District of South Gondar Zone, Ethiopia: Heckman Two Stage Approach

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Abstract

Theagricultural productivity is low due to use of low level of improved agricultural technologies, risks associated with or no access to market facilities and low participation of the smallholder farmers. Hence the study focused on the specific objectives wereto identify factors that affect market participation decision of households and to determine factors affecting the volume of market supply of maize. Quantitative and qualitative data were collected from primary and secondary sources. The cross-sectional survey was conducted using structured questionnaire,key informant interviews, and focus-group discussions. A stratified stage sampling technique was used to draw 150 sample units using systematic random sampling technique. Descriptive statistics and Heckman Two-Stage model was employed. The result indicated that 56 % of market participant were male headed, while 30.67 % were female headed. Whereas 15.58% of non-market participants were male headed households, while 5.84% of non-market participants were female headed households. Out of 17 potential variables, seven variables age, area of maize, oxen number, distance to market, access to market information, member of cooperatives and inverse mill's ratio were significantly influence the decision & extent participation in maize marketing. Therefore, the following points are recommended to develop sustainable production and marketing of maize that is locally adaptable and acceptable to increase the competitiveness of smallholder farmers: improving access to credit to apply fertilizer, farmers should rely on intensive cultivation rather than extensive cultivation and strengthen extension service.

Key words: 1. Hackman two-stage 2. market Participation 3. Volume of participation 4. Fogera

Introduction

1.1. Background

Agriculture is the main business of Ethiopian economy about GDP (43%), employment (80%) and the export (90%). But agricultural production is low due to use of low level of improved agricultural technologies, risks of no access to market facilities resulting in low participation of the smallholder farmers in value chain or value addition of their produces etc. Moreover, due to the ever-increasing population pressure, the land holding per household is declining leading to low level of production to meet the consumption requirement of the households. As a result, intensive production is becoming a means of promoting agro-enterprise development in order to increase the land productivity. horticultural production gives an opportunity for intensive production and increases smallholder farmers' participation in the market (Negassa, 2009).

The economy of Ethiopia depends on agriculture and in turn other economic activities depend on agriculture, including marketing, processing, and export of agricultural products. A huge part of exports commodity is supported by the small agricultural cash crop sector. Exports are almost entirely agricultural produce, and coffee is the largest foreign exchange earner(Tena et al., 2015). Understanding the role of agriculture as the source of all development endeavors, the government of Ethiopia has found agricultural development strategy known as Agricultural Development Led Industrialization(Dube et al., 2019).

According to available estimate, in Ethiopia, cereal production represents about 30% of gross domestic product (GDP). This calculation follows from the fact that cereals contribute to agricultural GDP is 65% (Diao & Pratt, 2007). In the country, Cereal products are also the major stable food crops. Out of the total grain crop area, 78.17% (9,601,035.26 hectares) was under cereals. Teff, maize, sorghum and wheat took up 22.23% (about 2,730,272.95 hectares), 16.39% (about 2,013,044.93 hectares), 13.93 % (1,711,485.04 hectares) and 13.25% (1,627,647.16 hectares) of the grain crop area, respectively. Cereals contributed 84.96% (about 196,511,515.46 quintals) of the grain production. Maize, teff, wheat and sorghum made up 26.63% (61,583,175.95 quintals), 16.28% (37,652,411.66 quintals), 14.85% (34,347,061.22 quintals) and 15.58% (36,042,619.65 quintals) of the grain production, in the same order(CSA, 2016).

In the Amhara Region; Agriculture is the backbone of the regional economy; contributing for about 73% of the regional GDP and more than 90% of the total employment (Desta, 2014). Out of the total land size of the region of land had been used for the production of cereals, 3,254,156.12 hectares; the estimated production was about 59,051,697.91quintals

at yield of 16.75 of these 494,625 hectares was covered by maize contributing 13,387,027.21quintals (CSA, 2016). Cereals account for more that 80 percent of cultivated land and 85 percent of total crop production. The principal cereal crops in the Amhara Region are teff, barley, wheat, maize, sorghum and finger millet (ibid). Pulses and oil crops are the other major categories of field crops. Based on thereport of (Yimer et al., 2017), East Gojam, west Gojam, South Gondar zones and Fogera district are the major cereal producingareas in the region.

In South Gondar Zone; Agriculture is the backbone of the economy. Out of 370,138.47 hectares of cereal crops, 6,450,970.22 quintal is produced of which 36,417.32 hectares was covered by maize with total production of 860,616.98 quintals (Yimer et al., 2017). In fogera districts, where the study focused, maize crop is one widely cereal crop grown in the area. The entire maize production in the districts is mainly for market sometimes which is utilized much for home consumption.

1.2. Statement of the Problem

The efforts of increasing agricultural production and productivity have to be accompanied by a well-performing marketing system which satisfies consumer demands with the minimum margin between producers and consumer prices (Challa et al., 2016). Supply of agricultural crop in the study area is subjected to seasonal variation where surplus supply at harvest and surplus supply peak season are the main feature. The nature of the product on the one hand and lack of properly functioning marketing system on the other, often resulted in lower producers' price.

Teff, wheat, maize, red paper and rice are the major cash cropsgrown in the study aremainly for market. However, marketing aspects of only rice were undertaken while leaving marketing of maize, is not yet done as far as researchers knowledge concerned. Moreover, there is a need to employ a commodity market to fully understand and resolve the problem of maize at all levels. Yet there is no such study which tries to look into the all of these areas of market participation of maize and determinants of their supply in Fogera District. This makes undertaking determinants of maize market supply in the district imperative.

1.3. Objectives of the study

1.3.1 General objective

The overall objective of this study is to assess determinants of maize market supply in Fogera district.

1.3.2 Specific objective

1. To identify factors that affect market participation decision of households.
2. To determine factors affecting the volume of market supply of maize.

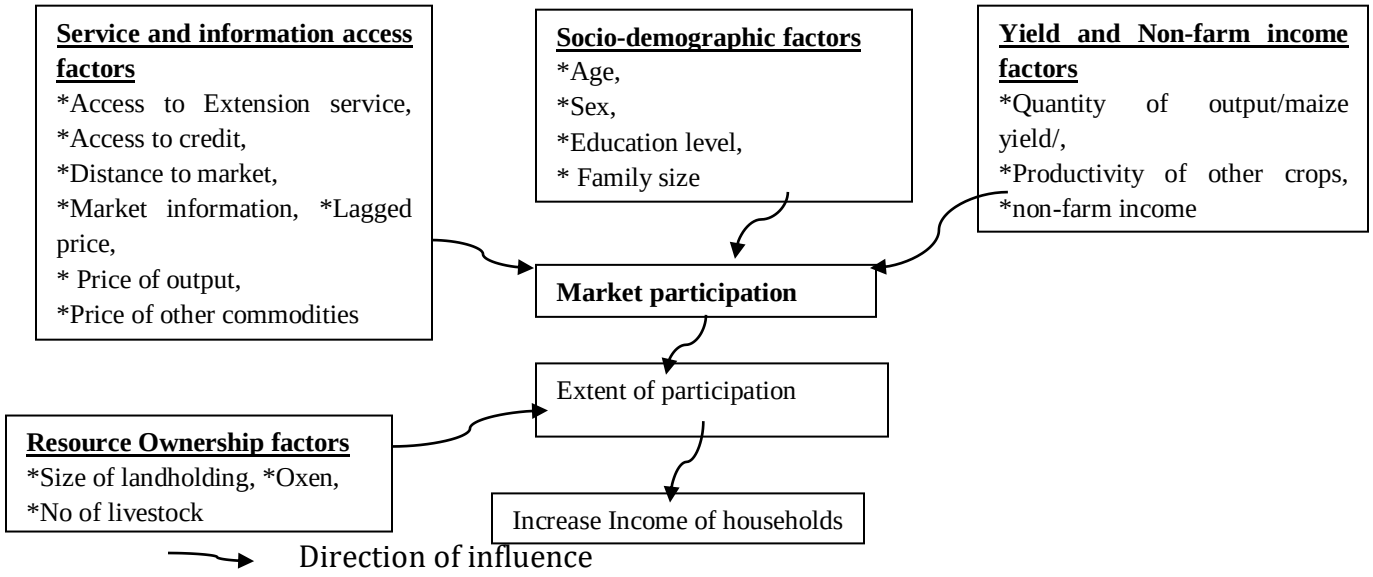
1.4. Research questions

1. What are factors that affect market participation decision of households?
2. What are the determinants of market supply of maize in the study area?

2. Conceptual framework

The conceptual framework in Figure 1 illustrates the interrelationships of variables in the study, the key variables involved and how they werebe interrelated.

Figure 1: Conceptual frame work of the study

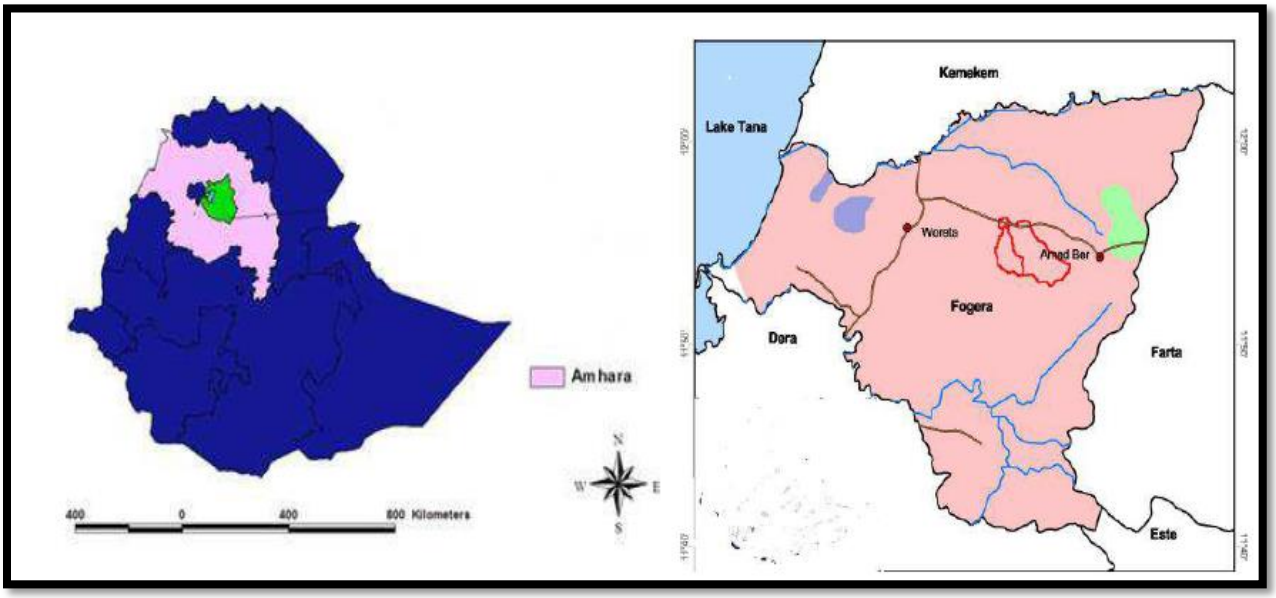


Source: own conceptualization based on literatures

3.1. Description of the study area

This study was conducted in south Gondar, specifically in Fogera district. It is one of the 126 districts in the region. It has an area of 117,405 hectares divided administratively in to 32 kebeles (30 rural and 2 urban). The population size was 233,529. The total number of households who engaged in agriculture was 42,746 of which more than 39,277 are maize producers. The capital is Woreta located at the North East on the main road to Gondar from Bahir Dar.

Figure 2: Map of the study area.



Source: IPMS(2005)

3.2. **Source of data, Methods of Data Collection and Sampling procedure**

In this study both quantitative and qualitative data were collected from primary and secondary sources. The cross-sectional survey was conducted using structured questionnaire, key informant interviews, and focus-group discussions. Focus group discussions were held with two groups based on predetermined checklists and a total of 10key informants were interviewed from different organizations and institutions. The sample frame of the study was the list of small farmers in Fogera district and Kebeles Administrations(KAs). A stratified stage sampling technique was used todraw sample units. In the selection process Fogera districts agricultural office experts were consulted. There are two urban and 30 rural Kebeles in the district, out of which 25 administrative Kebeles are producing maize. These Kebeles were selected purposively and stratifies based on agro ecology (lowland and upland agro ecology). From each of agro ecology, two Kebeles Administrations (KAs) from each zone were randomly selected based on lottery method, (Four KAs were selected). Then, the intended sample size from each sample Kebeles were determined proportionally to household size of maize grower farmer. Finally using the household list of small maize producers, the predetermined size which is 150 of the sample farmers from each Kebeles were randomly selected using systematic random sampling technique.

3.3. Sample size selection

Table 1:sample size distributions by kebeles

	Sample kebeles		Sample household populations	Sample size
Fogera plain	1.	Shina	2011	52
	2.	Abana Kokit,	921	24
Fogera high lands	1.	Bebeks,	1465	38
	2.	QuahrMichiel,	1411	36
Total			5808	150

3.4. Methods of data analysis

Data from the field was edited, coded, and cleaned to ensure consistency, uniformity, and accuracy. Data was entered into computer software for analysis. STATA version.

3.4.1 Descriptive statistics

The main descriptive indicators that have been employed are t-test and Chi square to investigate the relative difference between market participants and non-market participants of maize marketing.

3.4.2 Econometrics analysis

Econometric analysis was used for processing the data obtained from the survey. The appropriate econometric models that can help identify the factors affecting the amount of maize sold to the market and the market participation decision are Tobit or Heckman Two-stage (Gujarati, 2004). Heckman Two-Stage model was employed because of its advantages over the Tobit model in its ability to eliminate selectivity bias and it separates the effect of variables on the probability of market participation from the effect on the volume of maize that can be sold (Bellemareet al.,2006). Using the Heckman sample selection model, the first stage is market participation equation, which helps to identify factors affecting maize market participation decision using Probit. Then in the second stage, OLS regression was fitted along with the Probit estimate of the Inverse Mill's ratio to identify factors that determine the volume of marketed supply of maize.

1. The probability of a household's head to participate in supplying will be given by the selection equation as:

$$Y_i = \beta_i X_i + \varepsilon_i$$

Where $\varepsilon_i \sim N(0, 1)$

i= 1, 2, . . ., n.

Y_i = A dummy variable that takes a value of 1 if a household's head has participated and0 otherwise

β_i = Vector parameter

X_i= Parameters to be estimated in the model

ε_i = error term and it is normalized to 1 since a farmer who participated is observed and it is assumed to bivariate, and normally distributed (with correlation coefficient, ρ).

2. The amount (intensity) of maize supply will be given by the following equation by including an estimate of the inverse Mill's Ratio (λj) as:

$$Y_j = \beta_i X_i + \lambda_j \mu + \varepsilon_j$$

$$Y_j = \beta_0 + \beta_1 QUAPROD + \beta_2 PRCLAG + \beta_3 FARMSIZE + \beta_4 FAMSIZE + \beta_5 EXTSER + \beta_6 MARKINFO + \beta_7 EDUC + \beta_8 AGE + \beta_9 SEX + \beta_{10} CRACC + \beta_{11} OTHERPRC + \beta_{12} OXEN + \beta_{13} NONFARINC + \beta_{14} NO.LIV$$

where $\varepsilon_i \sim N(0, \delta^2)$

Y_j= the amount of maize supply and observed if only participation is yes, that is Y_j =1

β_j = Unknown parameter to be estimated in the outcome equation

X_j = Explanatory variable that can affect the amount of maize supply

λ= A correction factor for selection bias (Inverse Mill's Ratio) $\lambda = \frac{f(Y_i)}{1 - f(Y_i)}$

ε_j = Error term, this is assumed to be bivariant, and normally distributed with correlation coefficient, δ^2

Gujarati (2004) indicated that Variance Inflation Factor (VIF) is used to check multicollinearity among continuous variables. If the value of VIF is greater than 10, the variables are said to be highly collinear.

$$VIF(X_j) = \frac{1}{1 - R_j^2}$$

The multicollinearity between discrete variables can be calculated using contingency coefficient. The value ranges between 0 and 1, with 0 indicating no association between the variables and value close to 1 indicating a high degree of association between variables.

$CC = \sqrt{\frac{\chi^2}{N + \chi^2}}$; If the value of CC is greater than 0.75, the variables are said to be collinear.

Result and Discussion

4.1. Description of Maize production and marketing

Figure 3: Productivity of maize produce

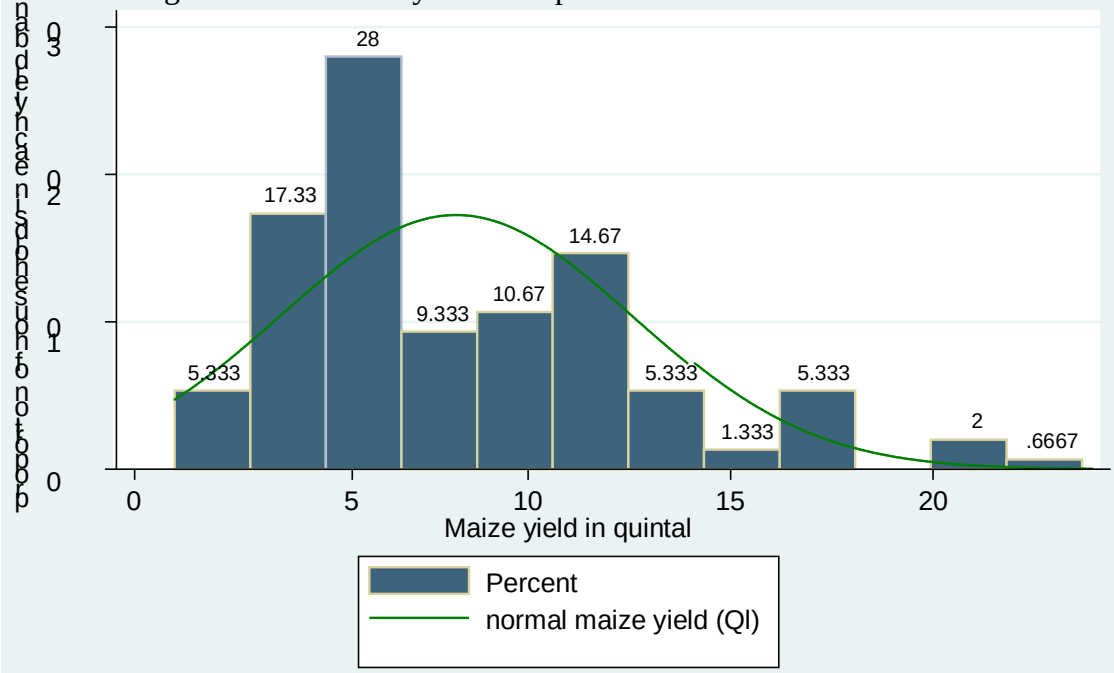


Figure3above indicates that most of the maize producers were producing between 5quintal and 10 quintals per hectare. The extreme maximum & minimum proportions of households in yield ban of maize were 0.67 % and 5.33 % respectively.

4.2. Socio-economic Characteristics of Households

Table 2 presents the demographic and socio-economic characteristics of the sample respondents in relation to market participation. The total sample size of the farm respondents handled during the survey was 150. Majorities of sample respondents were male headed households in the study area (district). This implies that the participation of women/females/ in maize cultivation was very low; this might be related with unequal distribution of resources as well as cultural barriers and belief of the society.

Table 2: Mean and Proportion comparison of demographic and socio-economic characteristics of sample respondents' relation to market participation

Continuous variables	**Market participant (N=97)**	**Non-market participant (N=53)**	**Over all mean**	**t/x² value**
Age(years)	49.45361	44.24528	47.61333	-2.2996***
Size of family (Hectare)	2.237113	2.226415	2.233333	-0.0818
Areas of maze (Hectare)	.3663015	.2558962	.3272917	-3.4357***
Oxen number (Number)	1.505155	1.169811	1.386667	-2.3229***
Distance to market center (Kilometer)	36.47423	33.16981	35.30667	-1.0499
Lagged price (Birr)	541.3711	544.3962	542.44	0.2128
Other crops price (Birr)	560.567	563.0755	561.4533	0.1869
Non-farm income (Birr)	1114.948	962.2642	1061	-0.3175
Number of livestock (TLU)	1.866629	1.717925	1.814087	-0.8907
Dummy variables	**Market participant (N=97)**	**Non-market participant (N=53)**	**Over all mean**	**t/x² value**
Sex (male,%)	56	30.67	86.67	0.0011
Formal education (literate, %)	26	16	42	0.3626
Improved inputs use (yes, %)	58.67	28	86.67	3.9064**
Time of sale (immediately after, %)	41.33	0.00	41.33	57.7437***
Access to market information (yes, %)	50	13.33	63.33	23.1252***
Credit access (yes, %)	22	6	28	4.9360**
Access to extension service (yes, %)	62.67	32.67	95.33	1.5286
Members of cooperative (yes, %)	52.67	21.33	74	7.9052***

Note: ***, **and* are statistically significant at 1,5 and 10% significance level respectively
Source: survey data ,2020

The result of t-test indicates that area of maize size is statistically significance at 1% significance level. This means that the mean maize land sizes owned by market participants are greater than that of non-market participants. Therefore, land is the single most important factor of production and a measure of wealth in the study area.

The result of t-test shows that number of oxen owned was statistically significant at 1% significance level. This indicates that market participant farmers owned more numbers of

oxen than non-market participant farmers. Oxen increases agricultural production and productivity. This implies that increasing the volume of production increases the market participation of farmers.

The result indicates that the mean of distance to the nearest market for market participant was 36.47 km, while that of non-market participant was 33.17 km. The overall mean of distance to the nearest market for sample respondents was 35.31km. The result of t-test shows that distance to the nearest market was statistically insignificant. This indicates the mean distance to the nearest market for market participants and non-market participants were not a factor whether or not participant.

The independent sample t-test revealed in Table 2 that there was a mean age significant difference among the participate and non-participate household heads and mean age of sample farmers was 49.45 years for participant and 44.25 years for non-participants respectively. the overall mean age of the respondents is 47.61 years. This may be due to the fact that older farmers have more experience than young farmers in participating in markets and in contrast youngers do not have wise use of resources in producing outputs which could have an impact on participation.

The result of chi-square shows that the use of improved input was statistically significant at 5% significance level. The use of agricultural inputs increases the volume of production. This implies that increasing the volume of production increases the market participation of farmers.

When Time of sale was considered, As the chi-square result indicates that 41.33% of market participants were selling their maize product immediately after harvest, while 23.33% was not. On the other hand, no one of non-market participants were selling their maize, while the remaining 35.33% was not selling maize product after harvest. The overall maize time of sale status of sample households was 41.33%. The variable time of sale had statistically significant at 1% significance level. It means producers of maize will likely earn a better price if maize market participation is immediately after harvest as compared to those farmers who supply their produce later. This is due to the fact that supply would increase at a time when all households are planned to sell their maize products after threshing all their crops harvested and therefore price would decrease at that time. The same study was conducted by (Tegegn, 2013). time of sale affect sesame market chain analysis: the case of metema woreda, north Gondar zone, Amhara national regional state positively and significantly.

In terms of access to market information, Access to market information is extremely limited in the Ethiopian maize market. At the producer level, farmers have very limited information on price prevailing even in nearby markets(Wolday et al., 2014). There was

statistical difference among participant and non-participant according to their level of information access at 1% significant level. Producers that have access to market information are likely to supply more maize to the market. The Chi-square test also revealed that participant and non-participant sample household heads were significantly different at 5% significant level. this means farmers had access of participation in credit service produces more maize hence can supply maize to the market than non-participants.

Maize market participant and non-participant were significantly different at 1% significant level in member of primary cooperatives. This mean being a member of cooperatives had an advantages of information access, input access and better utilities than non-members. Therefore, member of cooperative farmers was producing more maize than non-members due to the reasons listed above.

4.3. Econometric result analysis

The Heckman sample selection model was employed to identify the determinants of maize market participation and marketed surplus. Before running Heckman two-step selection model, Multicollinearity test was carried out. In this study, the result showed that Multicollinearity was not a problem.

Table 3: Heckman two-step selection equation result.

Variables	Dy/dx	Coef.	Std. Err.	Z	P>|z|
Sex	.0296934	.0296934	.54077	0.05	0.956
Age	.0264784**	.0264784	.01297	2.04	0.041
Formal education	.2175492	.2175492	.32596	0.67	0.505
Size of family	-.3756284	-.3756284	.24103	-1.56	0.119
Area of maize	2.117855***	2.117855	.76124	2.78	0.005
Oxen no_	.4596815**	.4596815	.19603	2.34	0.019
Improved input	.1800856	.1800856	.53698	0.34	0.737
Distance to market	-.0187469**	-.0187469	.00865	-2.17	0.030
Time of sale	-.1187264	-.1187264	.37446	-0.32	0.751
Lagged price	-.0003085	-.0003085	.00276	-0.11	0.911
Access to market information	.8837682**	.8837682	.37932	2.33	0.020
Other crops price	.0040909	.0040909	.00277	1.48	0.140
Credit access	.5286882	.5286882	.33462	1.58	0.114
Access to extension service	.4856562	.4856562	.90719	0.54	0.592
Non-farm income	-.0000224	-.0000224	.00006	-0.41	0.684
Members of cooperatives	1.32172***	1.32172	.47013	2.81	0.005

No_ of livestock	-.0331393	-.0331393	.16359	-0.20	0.839

Note: Dependent variable: - Maize market participation.
***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.
Source: Survey result, 2020.

Table 4: Hackman two-step outcome equation result

Variables	**Coef.**	**Std. Err**	**Z**	**P>|z|**
Sex	-.4005143	.3742865	-1.07	0.287
Age	.0382401***	.0093663	4.08	0.000
Formal education	.3622019	.2313956	1.57	0.120
Size of family	-.4487667***	.1692206	-2.65	0.009
Area of maize	2.214285***	.6162356	3.59	0.000
Oxen no_	.5825642***	.1542189	3.78	0.000
Improved input	.2879113	.3260337	0.88	0.379
Distance to market	-.0212768***	.0068002	-3.13	0.002
Time of sale	.6754701***	.1570619	4.30	0.000
Lagged price	-.000551	.0019488	-0.28	0.778
Access to market information	1.393301***	.2819753	4.94	0.000
Other crops price	.0048129**	.0020352	2.36	0.020
Credit access	.6434742***	.2471124	2.60	0.010
Access to extension service	.3412101	.5348321	0.64	0.525
Member of cooperatives	1.403254***	.3404601	4.12	0.000
Non-farm income	.0000203	.0000382	0.53	0.596
No_ of livestock	-.09338	.1099541	-0.85	0.397
Lambda	2.098698***	.5192368	4.04	0.000
-cons	-5.960341***	1.317559	-4.52	0.000
Number of observations = 150		Waldchi2(17) = 54.10		
Censored observation = 53		Prob>chi2 = 0.0000		
Uncensored observation = 97				

Note: Dependent variable: - Maize marketed surplus. ***, ** and * are statistically significant at 1%, 5% and 10% significance level respectively.
Source: Survey result, 2020.

4.4. Discussion on Factors influencing maize market participation

The results of first stage Heckman two-step selection model estimation of the determinants of maize market participation of the sample households are given in Table 3. Out of 17

potential variables, six variables significantly influence the decision to participate in maize marketing.

Age of household heads: previously the likely sign of the coefficient of age on sales participation was not hypothesized since older farmers have more experience than young farmers in participating in markets in one way and/or as farmer gets older, she/he may not be able to sell more of her/his produce as compared to younger farmers due to social networks fomented over a period of time. However, age of the household head influenced the decision of maize market participation positively and statistically significant at less than 5% significant level. This explanatory variable tells that as age of households increased by a year, the decision to participate increases by 2.6 %, other things held constant. From this result it can be stated from the fact that those older farmer households are believed to be wise in resource use, management and due to their experience in preparation and tillage of their farm land which will increase their production level and finally their marketed surplus. Therefore, as the age of sample household heads gets old, the likelihood of maize market participation tends to increase.

Area of maize: as the result indicates the variable size of the cultivated land for maize production had positively and significantly influenced the likelihood of participation of farmers in maize market at less than 1% significance level. The result of the study indicates that as the cultivated land for maize increases by a hectare, the probability of maize farmers' market participation will increase by more of 11.8 %, other things being constant. This implies that a farmer who has relatively large plot of land can cultivate all of his land to increase surplus of his production and finally to increase his maize market participation. The finding of the study is in agreement with many researches (Ghimire & Huang, 2015; Rahmeto, 2007) which showed that size of cultivated land was significant and positive to the participation study.

Oxen number: oxen ownership had a positive and significant relationship with participation decision at less than 5% probability level. This is in line with earlier hypothesis that farmers who own oxen are more likely to till in time and thus, produce more which can be reflected on marketed supply. This variable reflects that as farmers own one a greater number of oxen, the probability of maize market participation will increase by 46 %, other things being equal. Evidence from the study area reflects that farmer who had a greater number of oxen are wealthier and had sufficient number of oxen to plough their field timely as a result of which they quickly decided to participate in the agricultural production activity. Oxen ownership is very important for farm operations. The same results were reported by (Abrar et al., 2021; Kebebe, 2017). This implies that oxen ownership has an influence on the participation decision in marketing in different areas.

Distance to the market: The closer the residence of the household to the rural market center, the more is the probability quantity of market participation and marketed surplus. As it was hypothesized to be negatively related to market participation, it had influenced the decision to participation at less than 5% significant level. It therefore implied that when the distance increases by l kilometer to the market center, then the probability of maize market participation decreases by 1.9 %, holding other things constant.

4.5. Discussion on factors influencing maize marketed surplus

Heckman second stage estimation identifies factors that determine the extent of maize market participation by using the selection model which included the inverse Mill's ratio calculated from probit estimation of maize market participation. The coefficient of Inverse Mill's ratio (Lambda) in the Heckman two-stage estimation is significant at less than 1% probability level (Table 3). This indicates that sample selection bias, existence of some unobservable farmer characteristics determines farmers' participation in maize market and thereby affecting marketed surplus.

Age: It was hypothesized that the age of household head could influence quantity of supplied to the market for each commodity indeterminate. But age has had a positive influence on volume of sales. Hence, the amount of maize produced by households is one of the major factors that determine the volume of maize supplied to the market.

Family size: The influence of family size (measured in adult equivalent)of households on the extent of maize marketed was predicted as indeterminate in the original hypothesis. The number of family size that the household head holds negatively and significantly influences the quantity of maize supplied to the market at 1% level of significance. This indicates that as the number of family size household head holds increases by one, the quantity of maize supplied to the market decreases by 0.449quintal, all other factors held constant. The reason behind is obvious: a larger family size requires larger amounts for consumption, reducing marketed surplus which in turn decreases the quantity of maize supplied to the market.

Area of maize: The influence of this variable on the extent of maize marketed was as predicted in the original hypothesis. The landholding size of farmers'/household head positively and significantly affects the quantity of maize supplied to the market at 1% level of significance. It indicates that as the landholding size of household head allocated to maize production increases by a hectare, the quantity of maize supplied to the market increases by 2.214 quintal, all other factors held constant.

Oxen number: The influence of oxen number owned by households on the extent of maize marketed was as predicted in the original hypothesis. The number of oxen owned by

household head positively and significantly influences the extent of maize supplied to the market at 1% level of significance. This is due to the fact that producers who own oxen are more likely to till in time than producers who own no oxen. Thus, they produce more which can be reflected on market supply.

Distance to the market: The distance of nearest market to the household heads home had negatively and significantly influences the extent of maize supplied to the market at 1% level of significance. As the distance of nearest market to households' home increase by a hectare, the volume of maize supplied to the market decreases by 0.0213 quintal. This is due to the fact that, Access to market is a continuous variable that has been measured in kms from the household residence to the market centers. The closer the residence of the household to the rural market center, the more is the quantity of marketed surplus.

Time of sale: The influence of time of sale on the extent of maize marketed was as predicted in the original hypothesis. The time of sale had positively and significantly influenced the extent of maize supplied to the market at 1% level of significance. Hence as the farmers tendency to sell their maize product increases by 1%, then the amount of maize to be supplied to the market increases by 67.5%. Because a farmer that supplies his maize to the market soon after harvest is assumed to get better price than a farmer supplies lately.

Access to market information: As expected, market information positively and significantly influences the farmer's level of participation in maizemarketing at 1% significance level. This is because; producers that have access to market information are likely to supply more maize to the market. As households' probability of having market related information increase by 1%, then the level of maize market supply also increased by more than 39%.

Other crops price: it was expected that other crops price will influence marketed supply of maize negatively but it had positive and significant influence on the farmer's level of participation in maize marketing at 5% significance level. This was because an increase in price of other crops produced in the farm is expected to be stored for te next better price expectations by households as farmers can shift their supply to expensive crops. Hence the result shows as the price of a substitute crops (wheat) price increases by a birr, the supply of maize increased by 0.005 quintal.

Credit access: As expected, access to credit positively and significantly influence the farmer's decision to participate in maize marketing at 1% significance level. This indicates that a farmer who has credit access increases the probability of participating in maize market by 64.35%, all other factors held constant. This suggests that access to credit improves the financial capacity of farmers to buy improved inputs, thereby increasing production which is reflected in the marketed surplus of maize.

Member of cooperatives: This variable was as expected to affect the supply of maize positively. Therefore, it influences level of maize market participation positively and significantly at less than 1% significant level. Because, producers who are members of cooperatives are likely to get inputs and market information, thus could supply more maize to the market than non-members. Hence as farmers are cooperative society, the level of market participation of maize increased by more than 40% (other variables held constant).

5. Conclusion and Recommendation

Maize is an important cash crop in Fogera District. It takes the lion's share of the available cultivable land and produced mainly for market. Maize market participation and extent of market participation were influenced by different sets of factors in the Heckman two-step selection model. To this effect, age, area of maize, oxen number, distance to market, access to market information and member of cooperatives influence farmers' decision to participate in maize marketing. On the other hand, age of household head, size of family members (adult equivalent), area of maize, oxen number, distance to market, time of sale, access to market information, other crops price, credit access, member of cooperativesand inverse mill's ratio were found significantly influencing the extent of maize market participation.

Therefore, based on the finding of this study, the following points are recommended to develop sustainable production and marketing of maize that is locally adaptable and acceptable to increase the competitiveness of smallholder farmers: Improving access to credit to apply fertilizer, farmers should rely on intensive cultivation rather than extensive cultivation and strengthen extension service.

Compliance with Ethical Standards

Availability of data and materials

The authors want to declare that they can submit the data at any time based on publisher's request. The datasets used and/or analyzed during the current study will be available from the author on reasonable request.

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Ethical approval

This study was approved by the university research ethics committee and all procedures performed in studies involving human participants were in accordance with the ethical

standards of the institutional and/or national research committee and with declaration or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Conflicts of Interest

There has no conflict of interest in conducting &writing the research.

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