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DETERMINANTS OF MARKET PARTICIPATION AND PARTICIPATION DECISION AMONG TEFF PRODUCERS IN HORO BULUK DISTRICT OF HORO GUDURUWOLLEGA ZONE, ETHIOPIA

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Abstract

Teff is very essential cereal crop in Ethiopia, especially in Horo Buluk district. It is produced for food and income generating by majority of the respondents. This study was aimed to analyzing factors affecting market participation and participation decision of teff producers in Horo Buluk district. This research was employed the first hand data that gathered from 190 randomly chosen teff producers and double hurdle model was employed to classify the determinants of market participation decision and intensity of participation. In the first hurdle, age, educational status of the household head, perception of farmer on lagged teff market price, number of oxen, chemical fertilizer used, cooperative membership, farm size allocated to teff and family size were found to influence the participation in teff sales considerably. In the 2nd hurdle; schooling level of the household head, number of oxen owned, chemical fertilizer employed, size of land covered by teff and distance from nearest market were found to have significant role in intensity of participation. Working towards improving rural education system, scaling up the family planning program; enhancing access to market and institutional services; and assist the producers to enhance land productivity, where possible, by intensifying farm practices through provision of sustainable and timely availability of inputs are strategies to increase farmers' participation in teff marketing.

Key words**:** *Double hurdle, Horo Buluk, market participation, Smallholders, teff*

INTRODUCTION

Agriculture persists to dominate the national economy of Ethiopia, accounting for 36.3% of GDPand over 70% of exports earning (UNDP, 2018) [21]. It also generates employment of 73% to thetotal population and supplies 70% of the raw-material requirements of local industries (UNDP, 2016) [20]. The sector also serves as a spring board to bring about structural transformation in the long run through contribution to industrial growth MoFED (2010) [17]. In the country agriculture is dominated by smallholder producers which cover 95% of the total land employed under agriculture which contributes 90% to the whole agricultural outputs. This indicates that smallholder producers are dominantly contributing to the overall agricultural production in the country. (MoARD, 2010; Gebreslasie and Bekele, 2012) [12,16].

Teff is among less utlized stple crops that can contribute to food security and crop diversification. About 6.8 million smallholder farmers produce it and its production has experienced significant growth from year to year. Total teff produced in quintal by smallholder reached 52,834,011.56 in 2018 showing 5.24% increment from 50,204,400.47 of 2017 (CSA, 2018) [11]. Horo Guduruwollega zone is one of potential teff producer zone in Oromia region. The production of the zone in 2018 was 910,650 quintal from 51,348.5 hectare with 17.7 quintal productivity and also in Horo Buluk about 104,419.37 quintal was produced from 5,321 hectare with the productivity of 19.62 quintal per hectare (Nigus G. *et al*., 2019) [6].

In recent years, teff has been internationalized and has become an export commodity, given

its nutrition value, thereby boosting its level of commercialization beyond the domestic market (Alemu and Birhanu, 2018) [7]. Among the cereals, teff is the most widely marketed in Ethiopia with 27 percent of teff output sold (CSA 2014) [9]. The CSA (2016) [10] estimated that on average, 28.11 percent of all teff produced at household level was sold.

The product have unique characteristics; due to shortage of marketing system frequently result in lesser producers' price, inadequate way in to market facilities, limited information of product market, inadequate infrastructural, absence of institutions who help the sector and intricacy in transportation services are among the main challenges for the reason to little involvement of smallholder producers in trading their products. Moreover, the amount of teff which the farmers actually sell in the market in the study area is changing sometimes going up and the other time getting down depending on situations. It is obvious that it is getting higher during harvesting period and getting down other time. This is therefore; recognizing determinant factors hindering the actual size of teff soled in the market do have absolute worth for preparation of guiding rules in the area of agricultural commodities marketing as well as pricing and also can be used as widely expansion target for the country at national level. Thus, it is very use full to study determinant factors obstructing teff market participation and quantity of marketed surplus in the study area.

MATERIALS AND METHODS

This part deals with, sampling technique, techniques of data assembly, and the way of data analysis and description of variables hypothesized were projected.

Types, Sources and Techniques of data Gathering

The study engaged both quantitative and qualitative types of data collected from both primary and secondary sources. The primary data from farmers was gathered focusing on factors affecting the market participation decision, proportion of teff produce and sold. Secondary data on socio-economic data of the district, crops types produced and livestock resource, trends in agricultural production.

Sampling Method and Sample size determination

In order to select sample respondents two stage sampling procedures were used. Framers that were producing teff were the population of this research. First of all four teff producing kebeles (Peasant Associations) from eleven rural kebeles of the district were chosen at random. Secondly from the selected kebeles, teff Producer farm households were identified in coordination with development agents. In this level a total of 190 teff producer farm households were chosen at random from the selected sample kebeles by using simple random sampling system (Table 1). The maximum numbers of respondents were determined by using a formula developed by Yamane (1967). To find out the required sample size, 7% level of precision is used.

$$n= \frac{N}{1+N(e)^2} \quad = \frac{2714}{1+2714(0.07)^2} \quad =189.8088 \sim 190$$

Table 1. Sample of selected district's kebeles teff producing farmers' households

S.no	Name of Kebeles'	HH NO	Proportion	Sample respondents
1	Bone Abuna	790	29	55
2	Rifenti Chabir	509	19	36
3	Gudina Abuna	627	23	44
4	Abile Egu	788	29	55
Total	4	2,714	100	190

Source: HBOARD (2018) [14].

Data analysis technique

Both descriptive statistics and econometric models were engaged to analyze the data gathered from respondents.

Descriptive statistics

T-test and Chi square were used to see the relative disparity in the case of market participants and non-participants of teff selling. Percentages, means, and standard deviations were engaged throughout investigating and illustrating marketing facilities, services and household behaviour.

Econometric analysis

Different market participation researches have used the Tobit model to estimate market participation interaction with few dependent variables. Tobit model is also statistically restrictive as it takes inconsideration that the same set of variables decides on both the chance of participation decision and level of involvement. For this work, double hurdle model was chosen as it allows the peculiarity between market participation decision and level of participation on teff through two stages. That means it is possible to analysis the factors affecting participation and volume of sale separately by using probit for market participation decision and truncated for size of sale.

The universal form of double hurdle model for producers' market participation and degree of participation are explained as follows separately.

$$d^* = wi`\beta + vi, vi \sim N(0,\sigma 2) \; di = \begin{bmatrix} 1 if d^* i > 0 \\ 0 if d^* i \le 0 \end{bmatrix} (1)$$

$$y^* = xi`\delta ui, ui \sim N(0,\sigma 2) \; yi = \begin{bmatrix} y^* if y^* > o and d^* > o \\ 0 if y^* \le 0 \end{bmatrix} \quad (2)$$

Where:

d^*i is a unrecognizable variable describing the i^{th} household decision to engage in the teff market as seller (d_i),

y^*i is a latent variable describing the i^{th} household extent of participation in the teff market

y_i is the actual size of teff sold to the market by the household i which is observable variable.

W'i and X'i are vectors of variables illustrating the participation decision and level of participation decision respectively,

β and δ are vectors of parameters to be estimated,

v_i and u_i are error terms assumed to be independent and normally distributed.

RESULTS AND DISCUSSIONS

Demographic and socio-economic characteristics of the households

As it is illustrated in Table 2 and 3 below that 81% the respondents were male headed and 18% were female headed households. Regarding market participation, 82% of market participant were male headed, whereas 18% were female headed. In the other way around, 79% of non-market participants were male headed households, whereas 21% of non-market participants were female headed households. The chi-square result in Table 2 showed that Lagged market price is statically significant at 1%. This point out those who perceive lagged price as high participate in teff marketing more by increasing their cultivation.

Table 2. Chi^2/Fisher's exact-test for dummy variables

Variables		Participant		Non-participant		Total sample		X^2-value
		N	%	N	%	N	%	
Sex of HH Head	Male	105	82.03	49	79.03	154	81	0.2446
	Female	23	17.97	13	20.97	36	19	
Member to cooperative	Yes	58	45.31	24	38.71	82	43.15	0.7423
	No	70	54.69	38	61.29	108	56.84	
Lagged market price	Low	22	17.19	43	69.35	65	34.21	50.5044***
	High	106	82.81	19	31.65	125	65.78	
Credit use	Yes	60	46.88	38	61.29	98	51.57	3.4753 ***
	No	68	53.13	24	38.71	92	48.42	

Source: Own computation (2019).

Note: *** shows 1%, 5 significance level.

Mean-comparison test for Demographic and socio-economic Characteristics of respondents

Two-group mean comparison test of continuous variables were used in order to confirm that there was a significant mean difference among market participants and non-participants. On average the respondents' formal schooling completed was 4.88 years with a standard deviation of 3.62. Average education level of participants and non-participants were 6.76 and 1.07 respectively which indicates existences of the mean difference in educational level of household head among market participant and non-participant and statistically significant at 1 %.

The family sizes of the respondents were between two and eleven with average family number of 4.96 and 1.85 a standard deviation. This number is almost parallel with national number of average family size which is 5.32 persons per the household (CSA, 2011) [8]. The average family number of participants and non-participants were also different. It is 4.46 for participants and 5.98 for non-participants. This shows that, there is mean difference among them at 1% significance level.

The ages of all respondents were between 27 and 65 years with average age of 46.54 years and standard deviation of 6.74. Mean age of participant and non-participants were 48.43 and 42.64 respectively which is statistically significant at 1%.

Table 3. T-test for continuous variables

	Participant		Non-participant		Total sample		t-value
	Mean	S.D	Mean	S.D	Mean	S.D	
Age of HH Head	48.43	6.49	42.64	5.48	46.54	6.74	-6.0403***
Family size(AE)	4.46	1.75	5.98	1.62	4.96	1.85	5.7120***
Education level of HH Head	6.76	2.78	1.07	1.37	4.88	3.62	-15.348***
Non /off farm income	1,178.37	3,329	3,892.22	4,485.58	2,092.51	3,961	4.7066***
Chemical fertilizer used	150.703	8.6935	36.2903	1.55515	113.368	97.16	-9.1131***
Farm size allocated to teff	1.43	0.72	0.30	0.18	1.06	0.80	-12.0252***
Distance from nearest market	72.10	23.74	105	7.49	82.86	25.24	10.6647***
Number of oxen	4.1	2.38	0.88	0.92	3.05	2.53	-10.2458***
Live stocks excluding oxen	10.04	7.95	2.44	3.71	7.56	7.73	-7.1449***
Number of extension contact	8.35	4.50	3.11	2.72	6.64	4.70	-8.4436***

Source: Own computation (2019).
Note: ***, shows 1%, significance

Determinants of Teff Market Participation Decision

The outcomes of first-stage probit model for factors affecting teff market participation decision of the respondents were given in Table 4. From the fourteen explanatory variables, eight variables were found to determine the probability of participating in teff market significantly. These are: Age, family size, perception on lagged market price, education, number of oxen and farm size allocated to teff, cooperative membership and chemical fertilizer applied.

Age of the household head (AGE)

It was linked with the probability of market participation positively at 10% significance level. The age of respondents were taken as a proxy for experience in farming. This implies that aged households are believed to be wise in resource allocation, risk management and have more contact which allows trading partners be find out at lower cost than younger households due to the experience they achieved. Therefore, the marginal effect the result shows a year increased in the age of respondents increases the probability of participation in teff market by 0.48 %. This output confirms the findings of Abera (2015) [3].

Education level of household's head

The outcome of the analysis shows that schooling status of the household head was positively significant at 1%. This shows that the household head attained higher schooling stage gain knowledge and gets information about the market. For this reason, the

possibility of participation increases. The marginal effect shows that as the household head get educated more the possibility of market involvement increases by 2%. Which is similar with the findings of Abayneh and Tefera (2013) [2].

Farm size Allocated to Teff:

The analysis shows, it was positively and significantly correlated with the prospects of market participation at 5% significance level. The marginal effect indicates that adding one more hectare of land for teff would increase the chance to be partcipated by 11.2%; this is similar with the outputs of Getahun (2018) [13].

Family Size (adult equivalent): The output of the analysis shows it have negative and significant impact on teff market participation decision at 5% significance level. The marginal effect shows, as the family member increased by one, the chance of market participation decreases by 1%. The result is true becouse household with more family member consume more output produced and less amout is available for market. This is inline with result of Getahun (2018) [13].

Table 4. First hurdle analysis output of teff market participation decision

Independent variables	Coef.	Robust Std. Err.	z	P>z	Marginal effect
Sex of household head	.1969483	.6668633	0.30	0.768	.0069722
Age of household head	.1358761**	.0550088	2.47	0.014	.0048102
Family Size	-.2968211*	.1531388	-1.94	0.053	-.0105078
Cooperative membership	1.026705**	.4749638	2.16	0.031	.0363466
Education level of household	.587452***	.2047993	2.87	0.004	.0207965
Non –farm income(log)	.0226681	.0396634	0.57	0.568	.0008025
Farm size allocated to teff	3.161087**	1.259203	2.51	0.012	.1119065
Distance from market	.0232876	.0276916	0.84	0.400	.0008244
Perception on lagged price	1.378877**	.5852284	2.36	0.018	.048814
Number of oxen	1.281665***	.2673497	4.79	0.000	.0453726
Livestock excluding oxen	-.0201611	.0371851	-0.54	0.588	-.0007137
Number of extension visit	.1599102	.1040907	1.54	0.124	.005661
Credit use	-.1258487	.5342351	-0.24	0.814	-.0044552
Chemical fertilizer used	.0458213**	.0190901	2.40	0.016	.0016221
_cons	-16.00599	5.395281	-2.97	0.003	
Wald $\chi 2$ (14) = 80.78 Log likelihood=-12.31535 Prob.> $\chi 2$=0.000.					

Source: model output (2019).

Note: "*", "**" and "***" represent significance levels at 10, 5 and 1% respectively.

Perception on Lagged Market Price: It influences the households' decision to take part in teff marketing positively at 5% significance level. This means, as the farmers distinguished the price of teff during the past years was higher; the decision to take part in teff marketing will increase by 4.88%. This result verifies the economic theory of product price is a motivation for farmers in order to produce more products which will be presented for non farming communities. This finding is in line with the anticipation and

result of Musah et al. (2014) and Abera (2015) [3, 18].

Membership in Cooperative (MCOOP):
It has positive and significant influence on households' decision to join teff marketing at 1% significance level. Which means those who are members of the cooperative could have better access to market information, inputs, extension services and technical advice. This could be results in raising the probability of cooperative members' involvement in teff marketing. Thus, being a member of cooperative increases the chance of participation in teff market by 3.63% which is in line with the results of Adeoti et *al* (2014) and Abera (2015) [3, 5].

Number of Oxen Owned (NOXEN): The analysis shows that it was positively and statistically significant at 1%. This means, the household with higher number of oxen were expected to participate more than those who have less number. This is as hypothesized that the number of oxen owned supplements the chance to be a seller. As ox is a very important asset for smallholder farm households, it has direct contribution to produce more products that will be taken to the market. Therefore, as a single ox is added to the numbers of oxen owned the likelihood of participation in teff market increase by 4.53 %. This is verifying the finding of Abera (2015) [3] that say asset endowments have higher probability of market participation.

Chemical fertilizer used (CFU)
Chemical fertilizer influenced market participation decision significantly and positively. The result showed that as use of chemical fertilizer increase by one kilogram, probability of market participation increase by 0.16%.Chemical fertilizer was an important input for crop production as most of the soils were deficient in their fertility status. Increases in use of this most important input for better yield may force farm households to be more market participants. This result is in line with the findings of Ademe *et al*., (2017) [4] who found increase in fertilizer use increase productivity which leads increment of possibility to output market participation.

Determinants of Volume of *Teff* Market Participation

Education level of the Household Head: It was estimated to have positive and significant influence on the amount of teff market participation at 1%. The estimated coefficient reveal that as the household head education level increased by one grade; the volume of teff sold increases by 0.64 quintal which is parallel with the result of Getahun (2018) [13].

Farm size allocated to teff (FRSATT): It was estimated to have positive relation. The possible explanation could be as more farm land is allocated to teff, the bigger volume of teff will be produced which in turn results in higher amount of the product will be available for market. As a land under teff production increased by one hectare the volume of teff to be sold will be increased by 5.97quintals.This finding is similar with findings of Adeoti *et al.,* (2014) and Abera (2015) [3, 5].

Oxen owned (NOXEN): Oxen are one of the most important inputs for crop production in the country in general and in the study area in particular. As it was hypothesized, the number of oxen owned by the household heads influenced the size of teff taken to the market positively and significantly at 5% significance level. The result shows that a unit increase in a number of oxen increases the size of teff marketed by 0.6 quintals. This is due to the fact that as oxen are the main sources of traction power for the producers, growth in the number of oxen increases the production of teff. This result verifies the finding of (Kefyalew, 2012) [15].

Distance to the Nearest Market (DSMK): This is the minutes taken to the nearest marke on foot. It was negatively influenced the amount of teff traded to the market at 1% significance level. This means as the distance to the nearest market place increases by one minute the producer will decrease the volume of teff marketed by 0.1 quintal; which is similar with the findings of Tadesa (2018) [19].

Chemical fertilizer used Chemical fertilizer influenced market participation level significantly and positively. The result showed that as use of chemical fertilizer

increase by one kilogram, intensity of participation increase by 0.025 quintal. Chemical fertilizers were an important input for crop production as most of the soils were deficient in their fertility status. Increases in use of this most important input for better yield may force farm households to be involved more in teff market. This finding is in line with the work of Abafita *et al*., (2016) [1] who found that fertilizer user households produce more and sell more of their output.

Table 5. Second hurdle (truncated regression) result of intensity of teff market participation

Variables	Coef.	Robust Std. Err.	z	P>z
Sex	-1.186517	.9559061	-1.24	0.215
Age	.0269557	.0495428	0.54	0.586
Family Size	-.3089506	.2134191	-1.45	0.148
Cooperative membership	.4047133	.8617989	0.47	0.639
Education level	.6447521***	.2504887	2.57	0.010
Non –farm income(log)	-.0718919	.0447298	-1.61	0.108
Farm size allocated to teff	5.97159***	1.210616	4.93	0.000
Distance from market	-.1046103***	.0282073	-3.71	0.000
Perception on laggeprice	-.4939238	.8841469	-0.56	0.576
Number of oxen	.6060612**	.2969649	2.04	0.041
Livestock excluding oxen	.0381414	.0839133	0.45	0.649
Number of extensions visit	-.0605567	.1140835	-0.53	0.596
Credit use	.0136984	.7868398	0.02	0.986
Chemical fertilizer used	.0249267***	.0069204	3.60	0.000
_cons	4.246396	4.180616	1.02	0.310
/sigma***	3.848801	.2813077	13.68	0.000
Number of observations				128
Truncated observations				62
Wald $\chi 2$ (14), Pr> $\chi 2$				737.77***
Log likelihood				-332.625

Source: model output (2019),
Note: ***, **, * shows 1%, 5%, and 10% significance level

CONCLUSIONS

In Horo district Teff is an essential crop for both consumption and sale. It covers the largest portion of available land and produced primarily for market as a source of income and next for family feed. Teff market participation and level participation were influenced by various factors in the double hurdle model. These are: previous teff price, adult equivalent family size, age of household head, cooperative membership, and education level, farm size allocated to teff, number of oxen owned and chemical fertilizer applied influence farmers' decision to participate in teff marketing. Whereas, land size allocated to teff, family size, distance from nearest market, number of oxen, size of livestock excluding oxen and Chemical fertilizer used were influencing the degree of teff market participation significantly. Finally, based on the outcome of the study, the following points were forwarded: rural education system and family planning program needs to be stronger. Access to market and institutional services as well as supports given to enhance land productivity also needs to be built well through intensifying farm practices through timely and sustainable provision of inputs for

producers and building the capacity of others stakeholders.

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