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Determinants of Market Participation and Intensity of Marketed Surplus of Teff Producers in Bacho and Dawo Districts of Oromia State, Ethiopia

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Abstract
The vast majority of households in Ethiopia live in rural areas and agriculture is still the main economic activity. They rarely produce for the market and are highly dependent on climate for their subsistence. In this paper, the market options available to these farmers, as well as market related factors that are problematic were investigated. Multi-stage sampling procedure was employed to draw sample of 150 teff producers. Double hurdle model was used to identify factors affecting market participation and intensity of marketed surplus of teff. Market participation of smallholder farmers was significantly affected by access to credit, perception of farmers on lagged market price of teff, family size, agroecology, farm size and ownership of transport equipment. The intensity of marketed supply was significantly influenced by family size, agroecology, distance to the nearest market, farm size, perception of current price, income from other farming and off-farm activity, and livestock holding. The findings generally suggest the need to create trust among value chain actors, reliable market information, strong extension intervention on upgrading the value chain, and giving training for farmers on marketing.
Keywords: Marketed Surplus, double-hurdle, probit

1. INTRODUCTION

1.1. Background of the Study

Agriculture has a substantial contribution to Africa's economy in terms of employment, aggregate output, foreign exchange earnings, and tax revenue. Integrated value chains and markets offer better opportunities for transforming African agriculture, because they have the potential of expanding market opportunities and enhancing incentives for private investors to undertake long-term investments in agribusiness and agro-processing. Without a strong regional integration, Africa cannot compete in the global economy, because African agriculture is dominated by small-scale producers and markets are small and fragmented (Mulat *et al.*, 2009). Major changes are happening in agricultural and food markets worldwide and especially so in developing countries; supermarkets revolution, share of high-value crops have increased, quality demands rise, food safety requirements for export countries, vertical integration, up-scaling, disintermediation, and branding (Reardon *et al.,* 2012).

The scientific name of *teff* is ***Eragrostistef*** *(Zucc.)* and is believed to have originated in Ethiopia (Vavilov, 1951). Teff is a tiny, round, khaki-colored grain closely resembling millet. It is the smallest grain in the world and often is lost in the harvesting and threshing process because of its size. From *teff* the preferred staple diet made in the Ethiopian and Eritrean is *injera* (pronounced *en-ger-a*, and sometimes spelled *injera*), a flat sour-like fermented pancake that is used with "*wot*", a stew made with spices, meats and pulses, such as lentils, beans and split peas (Piccinin, 2002).

Teff is one of the most important crops for farm income and food security in Ethiopia. *Teff* accounts for the largest share of the cultivated area (28.5%) in 2013, followed by maize (20.3%) and the second in terms of quantity of production. However, because its market price is often two or three times higher than maize, *teff* accounts for the largest share of the total value of cereal production. Since *teff* farm operations such as land preparation, weeding and harvesting are highly labor-intensive, with limited availability of suitable mechanical technology, there are no large-scale *teff* farmers in the country. It is Ethiopia's most important crop by area planted and value of production, and the second most important cash crop (after coffee), generating almost 464 million USD income per year for local farmers. In the major agricultural season of 2012/13, *teff* was grown by 6.3 million farm households in Ethiopia. Commercial surplus of *teff* is equal to the commercial surplus of the three other main cereals combined in the country (sorghum, maize, and wheat (CSA, 2013).

Gebreselassie and Sharp (2008) studied the commercialization of smallholder agriculture of *teff* growing farmers and identified factor affecting the degree of market participation. The smallholder's farmer in *teff* value chain depends on intermediaries, due to small quantities involved. Haile *et al.* (2004) studied market access versus productivity of *teff* in West Shewa showed the characteristics and roles of each *teff* market participants. Becho and Dawo districts have major potential in production of *teff.* Land cultivated for *teff* production in Becho and Dawo was 85% and 80% of the land cultivated in the district respectively (Districts agriculture bureau, 2014). However, the problems that exist in the *teff* production and marketing in Becho and Dawo districts includes limited variety development, high cost of inputs, fluctuating prices, poor infrastructure, high transaction costs, poor marketing, cash-constraints, lack of market information by farmers, lack of coordination between farmers and traders, and fragmented value chain. Therefore, a purpose of this study is to analyze factor affecting market participation and intensity of marketed surplus of *teff* producers in Becho and Dawo Districts.

Theoretical and Conceptual Framework

Marketed surplus defined as the portion of production that actually enters the market irrespective of farmer's requirements for family consumption, farm requirements, social and religious payments. It also includes the distress sales. Thus, the marketed surplus may be more, less or equal to the marketable surplus. Marketed surplus is more than the marketable surplus when farmer retains a smaller quantity of crop than his actual family and farm requirements. This is true especially of small and marginal farmers whose need for cash is immediate. This is termed as distress or forced sale. Such farmers generally buy the produce from the market in a later period to meet their requirements. Marketed surplus is less than the marketable surplus when the farmer's especially larger ones with better retention capacity retain some of the marketable surplus in anticipation of fetching higher prices in future period (Acharya *et al.,* 2012).

Table 1: *Teff* area cultivated and production for 2012/13 production season by region

Region	Area cultivated ('000' ha)	% share of area planted	Production ('000' Qt)	% share of production	Yield in Qt/ha
Amhara	1,090	39.96	15,281	40.59	14.02
Benishangul	19	0.70	197	0.52	10.37
Oromia	1,256	46.04	17,535	46.57	13.96
SNNPR	202	7.40	2,515	6.68	12.45
Tigray	161	5.90	2,122	5.64	13.18
Total	2,728	100.00	37,650	100.00	12.80

Source: CSA, 2013

In Ethiopia, *Teff* is mainly grown in Amhara and Oromia, with smaller quantities in the Tigray and SNNP regions (Table 2). According to the CSA data on annual agricultural sample survey, there are 46 zones and 9 special districts in the country in which production of *teff* is widely practiced. These include five zones in Tigray regions, ten zones and one special District in Amhara regions, seventeen zones in Oromia regions, three zones in Benshangule-Gumuz regions and eleven zones and eight special districts in SNNPR regions. However, more than 83 percent of the country's *teff* production comes from 19 zones found in Tigray, Amhara and Oromia regions. East Gojjam is the leading zone in *teff* production constituting more than 10 percent of the national annual *teff* production. There are also potential *teff* producing zones in Amhara (North Gonder, North Shewa and West Gojjam zones) and Oromia (West Shewa, East Shewa and South West Shewa zones) regions, which contribute five to ten percent of the national annual *teff* production. Most of *teff* surplus production in the market comes from these major producing areas and is distributed to the deficit markets through the grain market channel (CSA, 2013).

METHODOLOGY

The study was conducted in two districts of south-west Shewa zone (Oromia region) namely, Becho and Dawo district. Becho and Dawo district are located at latitude/longitude of 8°35'N 38°15'E and 8° 45' N 38° 10'E, and at about 80 km and 96 km from the capital Addis Ababa, respectively.

Dawo is one of the districts in the Oromia Region of Ethiopia. Dawo is bordered on the southwest by Waliso, on the west and north by Dendi, on the east by Elu, and on the southeast by Becho. The administrative town in Dawo district is Busa. Dawo is well known for its quality *teff*, which is marketed in Addis Ababa. The 2007 national census reported total populations for this district were 84,336, of whom 42,815 were men and 41,521 were women; 3,779 or 4.48% of its population were urban dwellers. The two largest ethnic groups in Dawo district were the Oromo (93.35%), and Amhara (6.17%); all other ethnic groups made up 0.48% of the population. Oromiffa was spoken as a first language by 98.04%, while 1.88% spoke Amharic; the remaining 0.48% spoke all other primary languages (CSA, 2007).

Becho is one of the districts in the Oromia Region of Ethiopia. Becho is bordered on the south by Kokir,

on the west by Walisona Goro, on the northwest by Dawo, on the north by Elu, and on the east by Tole. The administrative town in Becho district is Tulu Bolo. The 2007 national census total populations of the district were 74,016, of whom 37,481 were men and 36,535 were women; 14,476 or 19.56% of its population were urban dwellers. The three largest ethnic groups exists in Becho were Oromo (90.32%), Amhara (6.87%), and Silte (1.66%); all other ethnic groups made up 1.15% of the population. Oromiffa was spoken as a first language by 90.35%, 8.13% spoke Amharic, and 1.05% Silte; the remaining 0.47% spoke all other primary languages (CSA, 2007).

The livelihood of Becho and Dawo District is categorized as mixed farming and the main economic activities are crop production and livestock production. It has dominantly midland agroecology characteristics with a few highland areas. All wealth groups cultivate *teff*, wheat and chickpeas. The significant annual incomes for all wealth come from own crop sale, including the sale of *teff*, wheat, chickpeas and trees followed by livestock sale and self-employment.

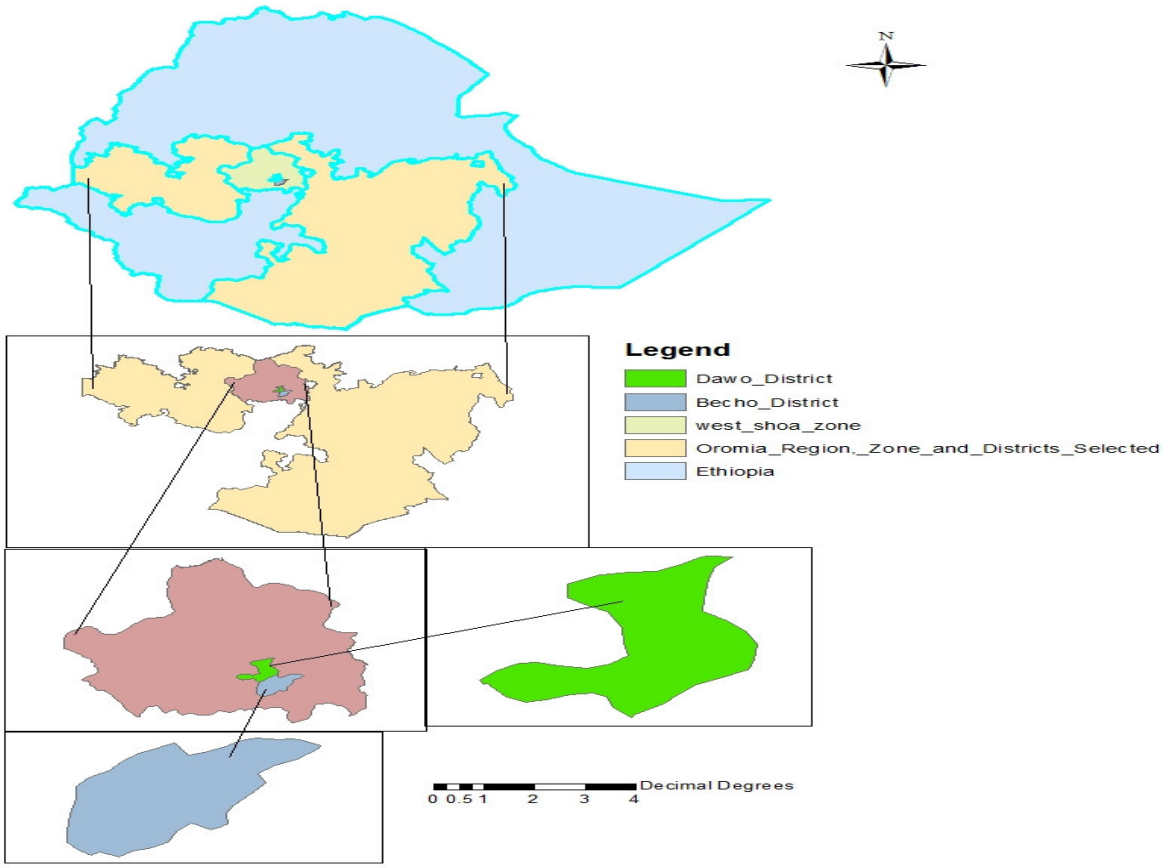

Figure 1: Geographical location of the study area
Source: Adapted from Ethiopia map

Types and Sources Data: Both qualitative and quantitative types of data were collected from both primary and secondary data sources. The primary data type was collected from sample teff producers by using structured questionnaires. Secondary data on population size of the study areas, lists of Kebeles administration, list of licensed teff traders', and amounts of production in the district was taken from Central Statistical Agency. The survey was carried out using a multi-stage sampling method, based on the selection of the combination of different sampling methods. First, within each district, the kebeles administration was ranked from smallest to the largest producer (in terms of farm size allocated to teff production in the district in 2013/14). Then kebeles administrations were stratified into two, less land cultivated for teff production (cultivating all together 50 percent of the areas in the district) and more land cultivated for teff production (cultivating all together 50 percent of the area). According to this stratification in Becho district seven kebeles administration was classified under more land cultivated and 12 kebeles was classified under less land cultivated. Following the same procedure for Dawo districts, six kebeles administration was classified under more land cultivated and 14 kebeles were under less land cultivated. Eight kebele administrations were randomly and proportionally selected from the two strata. One kebele administration was randomly and proportionally chosen from the more land cultivated by kebeles administration and three from the less land cultivated kebeles administration of each

district randomly and proportionally. In the second stage, several teff producers sampled from each selected kebele were obtained proportionally. Finally, 150 sample households were interviewed from each sample kebele randomly and proportionately.

Sample size was determined using probability proportional to sample size-sampling technique Cochran's (1977).

$$no = \frac{Z^2 * (P)(q)}{d^2}$$

$$n_1 = \frac{no}{(1 + no/N)}$$

Where; n_o = desired sample size when population greater than 10,000

n_1 = finite population correction factors when population less than10, 000

Z = standard normal deviation (1.96 for 95% confidence level)

P = 0.1 (proportion of population to be included in sample i.e. 11%) q =is 1-P i.e. (0.89),

N = is total number of population, d =is degree of accuracy desired (0.05).

The total number of *teff* producers in the two districts was 20,025 farmers. The number of *teff* producers in Becho and Dawo districts was 11967 and 8058 respectively (Agriculture office of districts). Depending on the proportion of *teff* producing farmers in the two districts of selected *kebeles* the number of respondents from each district was 80 and 70 from Becho and Dawo districts respectively.

$$no = \frac{Z^2 * (P)(q)}{d^2}$$

$$no = \frac{(1.96)^2 * (0.11)(0.89)}{(0.05)^2} = \approx 150$$

Table 2: Distribution of sample households across districts and sample *kebeles*

District	*Kebeles*	Number of households	Proportion	Sample households
Becho	Awash Bune	1615	0.21	31
	Jato	965	0.12	18
	Simbiro Ciracha	958	0.12	19
	Boji	600	0.08	12
Dawo	Neno Gabriel	1298	0.17	25
	Kersa Bombi	929	0.12	18
	Makit Suntare	1047	0.13	20
	Dawo Saden	347	0.04	7
Total		7759	1.00	150

Source: Agriculture Bureau of Becho and Dawo (Own computation)

Method of Data Analysis

Descriptive analysis: This method of data analysis refers to the use of percentages, means, chi-square, and t-test. It was employed in the process of examining farm household characteristics.

Econometric analysis

An econometric concern for modeling market participation is the fact that only a minority of households sell *teff*, thus the *teff* sales of non-sellers the majority of cases is zero. If the distribution of such dependent variable exhibits a reasonably large number of cases lumped at zero, this can create problems for standard OLS regression. Within the context of a study of the determinants of marketed surplus by *teff*-growing households, the rationale for a corner solution model is that a sales value of zero is a valid economic choice to be explained, not a reflection of missing data. The standard approach to modeling a corner solution dependent variable is to use Heckman, Tobit or a double-hurdle (DH) model.

Cragg (1971) modifies the Tobit model to overcome the restrictive assumption inherent in it, namely, he suggests the "double-hurdle" model to tackle the problem of too many zeros in the survey data by giving special treatment to the participation decision. The model assumes two hurdles to overcome to observe positive values. A non-zero marketed surplus can be observed if, first a decision whether to participate or non-participant decision is made, and second random circumstances permit intensity of participation, once it is participating.

The heckit and the double-hurdle models are similar in identifying the rules governing the discrete (zero or positive) outcomes. Both models recognize that outcomes are determined by the selection and level of participation. They also permit the possibility of estimating the first- and second-stage equations using different sets of explanatory variables. However, the heckit, as opposed to the double-hurdle, assumes that there are no

zero observations in the second stage once the first-stage selection is passed. In contrast, the double-hurdle considers the possibility of zero realizations (outcomes) in the second-hurdle arising from the individuals' deliberate choices or random circumstances. The difference between the two models can be illustrated using the following example on market participation. According to the heckit model, only non-participants respondents can report zero intensity of market participation. The model further assumes that individuals who participate in the market do not report zero values at all. On the other hand, the double-hurdle model assumes that zero values can be reported in both decision stages. The zeros reported in the first-stage arise from non-participants and those in the second stage come from non-sales due to the respondents' deliberate decisions or random circumstances.

The research objectives are to understand both the factors affecting the probability that a household sells *teff* and intensity of marketed surplus. When the household's *teff* market participation decisions and intensity of marketed surplus are made simultaneously, the Tobit model is appropriate for analyzing the factors affecting the joint sales decision. A key limitation of the Tobit model is that the probability of a positive value and the actual value, given that it is positive, are determined by the same underlying process (i.e., the same parameters). However, DH models offer a more flexible version of the Tobit in that they allow the household decision regarding whether to sell *teff* (participation) and what quantity to sell to be determined by different underlying processes. In this regard, the double-hurdle model can be considered as an improvement both on the standard Tobit and generalized Tobit (heckit) models.

The double-hurdle model is designed to analyze instances of an event that may or may not occur, and if it occurs, takes on continuous positive values. In the case of household *teff* sales, the decision to sell or not is made first, followed by the decision on how much to sell (quantity of *teff* sold). The structure of double-hurdle model is as follows:

$$d_i^* = \mathbf{x}_1\boldsymbol{\beta}_1 + \varepsilon_{1i},$$
$$\varepsilon_{1i} \sim N\left(0, \sigma_1^2\right)$$
$$d_i = \begin{cases} 1 \; if \;\; d_i^* > 0 \\ 0 \; if \; d_i^* \le 0 \end{cases}$$
$$y_i^* = \mathbf{x}_2\boldsymbol{\beta}_2 + \varepsilon_{2i},$$
$$\varepsilon_{2i} \sim N\left(0, \sigma_2^2\right)$$

$$y_i = \begin{cases} 1 \; if \;\; y_i^* > 0 \; and \;\; d_i = 1 \\ 0 \; if \; y_i^* \le 0 \end{cases}$$

The subscript i refers to the i^{th} household, d_i is the observable discrete decision of whether or not to sell *teff*, while d_i^* is the latent (unobservable) variable of d_i. y_i^* is an unobserved, latent variable (desired quantity of *teff* sold), and y_i is the corresponding observed variable, actual quantity of *teff* sold. $\mathbf{x_1}$ and $\mathbf{x}_2$ represent vectors of explanatory variables. $\boldsymbol{\beta_1}$ and $\boldsymbol{\beta}_2$ are vectors of parameters to be estimated and ε_1 and ε_2 are random errors.

Before running econometrics model, all the hypothesized explanatory variables was checked for the existence of multi-collinearity problem. There are two measures that are often used to test the existence of multicollineality. Variance Inflation Factor (VIF) for association among the continuous explanatory variables and contingency coefficients for dummy variables. In this study, a variance inflation factor (VIF) and contingency coefficient was used to test multicollinearity problem for continuous and dummy variables respectively. According to Maddala (1992), VIF can be defined as:

$$VIF(x_i) = \frac{1}{1 - R^2} \tag{15}$$

Where, R is the squared multiple correlation coefficient between x_i and the other explanatory variables. The larger the value of VIF, the more troublesome it is. As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if R_i^2 exceeds 0.95), that variable is said to be highly collinear (Gujarati, 1995). Similarly, contingency coefficients will be computed for dummy variables using the following formula.

$$CC = \sqrt{\frac{x^2}{n + x^2}} \quad (16)$$

Where, CC is contingency coefficient, x^2 =chi-square value and n = total sample size

Hypothesis and Definition of Variables

Dependent variables

Market participation decision of *teff* farmers (MPD_F): The binary dependent variable for the Probit stage of the double-hurdle model is =1 if the household sold *teff* in 2013/14, or =0 otherwise.

Quantity of marketed surplus of *teff* (QM_S): It is a continuous variable which represents the outcome (dependent) variable; the actual marketed surplus of *teff* by the farm household. The dependent variable in the second stages is the amount of marketed surplus of *teff* 2013/14.

Table 3: Definition and hypothesis of variables

Variables	Notation	Measurement	Market participation and Intensity
Sex	SHD_D	Dummy:1=if male; 0=otherwise	+
Teff farming experience	TFE_C	Number of years	-
Family size	FS_C	Number of people in the household	±
Proximity to the market	PTM_C	Kilometers	-
Literacy status of the household head	LSHH_D	Dummy: 1= if attended any formal education; 0= otherwise	+
Access to credit	ATC_D	Dummy: 1=if access credit; 0= otherwise	+
Land cultivated for *teff*	LCF_C	Hectares	+
Ownership of transport	OTE_D	Dummy: 1= if yes; 0=otherwise	+
Perception of lagged market price	PLMP_D	Category: 1=high; 2=medium; 3=low	+
Perception on current prices	PFP_C	Category: 1=high; 2=medium; 3=low	-
Livestock owned	NLO	TLU	±
On/off farm income	NFIA_C	ETB	+
Agroecology	AE_D	Dummy: 1=midland; 0= otherwise	±
Perception on post-harvest loss	PPL_D	Dummy: 1=Yes; 0=otherwise	

RESULTS AND DISCUSSION

This part of the thesis presents the major findings of the research work. In the first part, the socio-economic characteristics of the sample respondents are presented in tabular and narrative format. Then comes a part where the findings regarding factors affecting market participation and intensity of marketed surplus.

Description of *Teff* Production and Supply Factors:In this part of the thesis, socio-economic characteristics of *teff* producers, traders, value chain participants, constraints of producers and traders, market structure and channels, value share of each participants of *teff* value chain, *teff* value chain map, governance and upgrading activity of value chain discussed in detail.

Teff market participation: The demographic characteristics of teff market participants and non-participants are shown in Table 4. The average marketed surplus for households participated in the teff market is 8.51 quintals per household. Out of the total market participants 88.98 percent were male headed household and the male headed non-participants were 78.13 percent. This discrepancy can be explained by the nature of the crop; being a cash-crop, it is mostly associated with men. There was a significant difference between teff market participants and non-participants households in terms of gender at 10% probability level.

Farm size of sample farmers varies from one hectare to 8 hectares. Land is major constraints that limit farmers' production potential in the study areas. During survey, it was stressed that there was no option for newly formed households to have their own farmland. The only chance for such households was to share what the parent had in the past. The mean size of the total land owned by *teff* market participants and non-participants was 2.4 hectares and 1.6 hectare per household respectively. In terms of total cultivation land owned by households, there was a significant difference between market participant and non-participant at 10% level of significance. The explanation for this result is that land is a scarce resource in the study area and it is more likely that those with bigger pieces of land resort to cultivation of more crops such as teff, chickpea, grass pea and wheat which lead to high teff production and hence participate in the teff market.

Table 4: Description of variables by market participation status of teff producers

Variable		**Mean/proportion**			**t-/ χ^2 -value**
		Total (N=150)	Participant (N=118)	Non-participants (N=32)	
Farming experience		25.47	25	27	-0.86
Family size		7.24	7.21	7.34	-0.31
Sex of the household head	Male	86.67	88.98	78.13	2.57*
Distance to nearest market		9.60	9.60	9.61	-0.01
Farmers perception on last year price of teff	High	49.33	47.46	56.25	
	Medium	28	27.96	28.13	1.28
	Low	22.67	24.58	15.62	
Farmers perception on farm gate price of teff	High	4	4.24	3.13	
	Medium	45.33	46.61	40.62	0.53
	Low	50.67	56.25	56.25	
Land allocated for *teff*		2.08	2.05	2.16	-0.53
Total land owned		2.23	2.4	1.6	1.95*
Income from off-farm activity		2215.4	2190	2314.64	-0.23
Agroecology	Midland	87.33	86.44	90.63	0.39
	Highland	12.67	13.56	9.38	
Literacy status	Illiterate	30	30.51	28.13	1.58
	Literate	70	69.49	71.87	
Access to credit (yes)		73.33	91.53	6.25	93.61***
Ownership of transport equipment (yes)		74.67	70.34	90.63	5.48**
Livestock holding		8.66	8.86	7.93	0.98
Teff marketed supply		6.69	8.51	0	7.59***
Cost of production per quintal (ETB)		664.44	653.30	705.18	-1.09

***, ** and * are statistically significant at 1%, 5% and 10% probability level, respectively.
Source: Generated from field survey data (2014)

From the total sample, credit was obtained by 73.33% of the farmers. The results of the survey show that among market participating households, 91.53% have access to credit while 6.25% of the non-participating households had access to credit. Credit is important for cushioning cash constrained farmers to be able to meet their farm activities requiring cash on time. Based on the chi-square test there is statistically significant difference between market participant and non-participant of *teff* farmers at 1% probability level. This implies that market participant farmers have more access to credit than non-participants farmers.

From the total sample farmers 74.67 percent have their own transportation equipment such as animal cart and donkeys which is used to transport the *teff* product from the field to homestead or home to the market in the study area. During the FGDs farmers pointed that their transportation means was animal drawn cart (a cart drown by donkey, and horse), and pack animals (animals used for loading directly on their back without using cart). No farmer reported use of a vehicle to transport *teff* to the market or to their homestead. This could be due to accessibility of cheaper local animal transportation or absence of vehicle to transport the teff product to market or homestead. There was a significant difference between market participant and non-participant farmers in terms of ownership of transport equipment.

Econometrics Result: The results of DH model for factor affecting market participation and intensity of marketed surplus are displayed in Table below. Diagnostic test for multicollinearity which is a common problem in any regression analysis was conducted based on VIF and CC to identify any potential misspecification problems that may exist in the estimated models. This implies that multicollinearity is not a problem with the estimated models. Breusch-Pagan / Cook-Weisberg test for heteroscedasticity test also shows there is no problem of hereroscedasticity in the 1st and 2nd stages of Double Hurdle model.

The Wald chi-square value is 116.54 for market participation decisions that are significant at 1% significance level and indicating that explanatory variables jointly explained the probability of participating in the *teff* market. Smallholder farmer's decision to participate in *teff* market is determined significantly and positively by agroecology, access to credit, farm size, perception of lagged market price and ownership of transport equipment while it is significantly and negatively determined by family size.

Land allocated for *teff* production positively and significantly affects the probability of market participation at 10% probability level. The result is similar to expectation and a unit increases in the farm size increases the likelihood of market participation by 16%. A farmer who has a large farm size would have high probability to allocate more land for production of *teff*. Similar to the study done by Masoku *et al*. (2001) which showed that positive and significant relationship between land size and market participation in the maize market.

As expected, access to credit positively and significantly influences the likelihood of farmers in market

participation at 1% significance level. A shift from lack of credit to access credit has increased the probability of market participation by 40 percent. It implies that access to credit gives the farm households the economic power to cultivate on large scale by buying more land for *teff* production and enables farmers to buy others farm inputs. Randela *et al.* (2008) also found that access to credit had a positive and significant impact on producers' likelihood to participate in cotton market in South Africa, because availability of credit reduces transaction costs of both in input and output markets. Similarly, a study done by Alene *et al.* (2007) found positive and significant relationship between access to credit and maize market participation decision.

Farmer perception on lagged (last year) market price of *teff* is significant at 10% and 1% probability level for farmers whose perception on last year price are medium and low respectively. The change in probability of market participation when perception on lagged market price goes from 'high' to 'medium' decrease by 7%. Farmer whose perception on lagged market price of *teff* is low, about 14% less likely to sell *teff* relative to farmer who perceived lagged market price as high. This implies that when perception of lagged market price by farmers is high it motivates the farmers to produce more, they have surpluses to supply to the market and the lagged price can act as a motivation for them to participate or not to participate in the market. This is in line with Myint (2003) if prices in one year are bad, farmers will often respond by planting less in the next year. Gebreselassie and Sharp (2008) also discussed that last year prices of *teff* had a strong positive and high significant effect on the probability of market participation as a seller.

Agroecology is positively and significantly affects the probability of market participation by smallholder farmers at 5% probability level. This implies that if the farmers are from midlands the probability of market participation increases by 14% than farmers from highlands. This implies that highlands have the least agricultural potential of *teff* production and midlands have high potential *teff* production.

As hypothesized ownership of transport equipment is positively and significantly influences the market participation at 5% probability level. Thus, a shift from lack of transport equipment would increase the likelihood of market participation by 11%. This is because after production, farmers are constrained by transport cost and households own transport equipment would sell more because ownership of transport equipment would reduce transportation cost. Ownership of transport equipment such as donkeys and animal carts have positive impact on market participation by reducing the cost of transporting inputs from the market to the farm and output from the farm to the market. The finding corroborates that of Jagwe (2010) who found that in Great Lake Regions of Burundi, Rwanda and Democratic Republic of Congo ownership of means of transport had have a positive and significant effect on the probability of farmers participating in banana markets. Also, it is consistent with the finding by Kabeto (2014) that showed ownership of transport equipment lowers the proportional transaction costs, thereby enhancing the probability market participation of red bean.

Table 5: Regression result for double hurdle model of market participation

Variables		1st Hurdle	Std. Error	Marginal effect	2nd hurdle	Std. Error	Marginal effect
Sex of the household head		-1.45	-1.15	-0.08	-0.19	-0.13	-0.19
Farming experience		-0.05	-0.04	-0.01	-0.01	-0.01	-0.01
Family size		-0.30*	-0.16	-0.02	-0.06**	-0.02	-0.06
Proxy to the nearest market		-0.01	-0.09	-0.01	-0.02*	-0.01	-0.02
Literacy status		-1.13	-1.04	-0.06	0.02	-0.12	0.02
Access to credit		7.16***	-2.09	0.40	-0.10	-0.12	-0.10
Farm size		2.80*	-1.57	0.16	1.26***	-0.182	1.24
Perception of lagged market price	Medium	-1.39*	-1.10	-0.07	0.14	-0.11	0.14
	Low	-2.79**	-1.35	-0.14	-0.15	-0.12	-0.15
Perception on farm-gate prices	Medium	-0.11	-5.40	-0.01	0.50**	-0.24	0.48
	Low	0.37	-5.46	0.02	0.76***	-0.24	0.74
Agroecology		2.45**	-1.13	0.14	0.26*	-0.15	0.25
Transport equipment		1.98*	-1.03	0.11	-0.06	-0.10	-0.06
On/off farm income		-0.06	-0.22	-0.01	0.13***	-0.04	0.12
Livestock owned		0.09	-0.08	0.01	-0.03**	-0.01	-0.02
Constant		-12.13*	-6.74		-0.78*	-0.42	
Wald/LR Chi square		116.54			133.80		
Log-likelihood		-13.99			-82.56		
Observations		138			121		

***, ** and * are statistically significant at 1%, 5% and 10% probability level, respectively

Source: Generated from field survey data (2014)

Family size is negatively associated with the probability of market participation at 5% level of significance. An increase in the household size by one person decreases likelihood of market participation by 2%. The larger family size lower marketed surplus than smaller family size, since the larger family size, the higher

quantity consumed, and the less available for sell. This finding is inconsistent with Gani and Adeoti (2011) that family sizes have positive relationship with the probability of market participation decision.

To analyze the factor affecting intensity of market participation second stage of double hurdle (log-truncated) model was used. Out of the variables included in the model six were found to affect the intensity of market participation significantly namely; farm size, family size, perception on current price, distance to nearest market, number of livestock owned (TLU) and on/off-farm income. The coefficient for farm size allocated for *teff* production, perception of current price, agroecology and income from on/off-farm activity have positive relationship with quantity of marketed surplus, whereas coefficient of family size, distance to the nearest market, and number of livestock owned have been negatively affect the intensity of marketed surplus.

Household size is negatively associated with the intensity of *teff* sold at 5% probability level. An increase in the household size by one person decreases sale of *teff* by 6%. This implies that households with larger family sizes were less likely to participate in the *teff* market as sellers; they sell small *teff* when they participate. This could be because a large family size increases the quantity of *teff* needed for home consumption thereby reducing the marketed surplus. On the other hand, a larger household is labor-inefficient and produces less output but consumes a higher proportion, leaving smaller and decreasing proportions for sale. This finding is in line with Omiti and Mccullough, (2009) that showed negative relationship between family size and amount of marketed surplus in case of rural and peri-urban areas of Kenya.

Geographical locations of the households have positively and significantly affect intensity of market participation at 10% probability level. The amount of marketed surplus of *teff* increases by 25% if the farmers are from midland as compared to its counterpart. This implies that highlands are characterized by poor infrastructure and relatively low economic activity. These characteristics hugely reduce the likelihood of households participating in *teff* markets. The cheaper transport option lowers the proportional transaction costs and the exposure to wider markets lowers the fixed transaction costs associated with *teff* marketing for farmers from midlands.

Distance to the nearest market negatively and significantly influences the intensity of marketed surplus at 10% significant level. When the household is located one Kilometer away from the market, the quantity of *teff* sold decreases by 2%. It implies that as the distance from the nearest market increases, variable transport costs increase and this discourages smallholder farmers from selling high volumes of *teff*. These results are consistent to finding of soybean market participation by smallholder farmers in Zimbabwe in which distance to the market negatively influences smallholder farmers' extent of market participation (Zamasiya *et al.,* 2014).

Farm size allocated for *teff* production is positively and significantly affects the extent of marketed surplus at 1% significance level. One hectare increase in the farm size allocated for *teff* production increases volume of *teff* sold by 1.24%. The larger the farm size, the larger the area allocated to *teff* production thereby increasing the quantity of produce available for sale. This is in line with the study done by Abayneh *et al*. (2013) which showed a positive significant relationship between land size and extent of market participation in haricot bean market in Ethiopia. Olwande and Mathenge (2012**)** also found that the size of land cultivated has had a significant and positive relationship with the extent of market participation among poor rural households in Kenya.

Farmer medium and low perception on current price of *teff* is positively and significantly affected quantity of marketed surplus as compared to its counterpart (reference category is high perception on current price) at 5% and 1% probability level. Marginal effect of farmer perception on current price of *teff* showed that farmers who perceived current price of *teff* medium and low are just as likely to sell *teff* as farmer who have high perception on current price of *teff*, and sold about 48% and 74% more marketed surplus respectively. This is due to decrease in the price of product followed by increase in the quantity marketed surplus, since a higher quantity marketed can meet their cash requirements and vice versa. On other hand, lowest potential region react to higher expected *teff* prices by reducing their quantity of selling *teff*. On the other hand, negative price response is due to poor agro ecological environment (i.e. low supply elasticity) and the fact that *teff* constitutes a larger portion of household income (i.e. high-income elasticity). Strong household preferences to store food rather than rely on the market and low substitution effect between food and other goods. This finding is consistent with Renkow *et al.* (2004) that showed an increase in price for a subsistence crop may increase the producer's real income sufficiently so that the income effect on his demand for consumption of the crop outweighs the price effects on production and the consumption, and hence the marketed surplus may vary inversely with market price.

On/off farm income earned by *teff* farmer is found to be positively and significantly affect volumes of *teff* sold in the market at 1% probability level. One percent increase of income from on/off-farm activity is associated with 0.12% increase in amount of marketed surplus of *teff*. This result implies that farmers engaged in off-farm activity and other farming activity earning income other than *teff* farm income tend to dedicate more time to production and marketing of *teff*, which possibly results in higher quantities of *teff* sold. On the other hand, farmers who were liquid from on/off farm income were able to finance production and produced more marketed surplus of *teff*. The result is consistent with the finding of Siziba and Diagne (2011) that studied

determinants of cereal market participation by sub-Saharan Africa smallholder farmer and found that there are positive relationship between off farm income and extent of market participation.

The number of livestock owned by households is negatively and significantly affects the intensity of marketed surplus by smallholder's farmers at 5% probability level. This implies that when the household has less production; it must either borrow money or sell his livestock to meet household needs. Farmers who have low production of *teff* need to specialize in livestock production and hence it has negative impacts on marketed surplus. The result shows that one percent increase in the livestock causes 2 percent decrease in the intensity of marketed surplus. This is in line with study by Mussema (2006) that total tropical livestock unit has a negatively and significantly affected quantity of pepper sales.

Conclusions and Recommendations: Teff is the most important crop in Ethiopia in terms of area and value of production, and is the second most important cash crop after coffee.

The market participation decision of *teff* farmers is influenced significantly and positively by the perception of farmers on lagged market price of *teff*, family size, the land allocated for *teff* production, ownership of transport equipment and agroecology of farmers. The intensity of market participation is influenced by family size, agroecology, distance to the nearest market, farm size, TLU, the income obtained from other farming and off farm activity and farmers perception on farm gate price. Among the factors significantly affect the intensity of marketed surplus; family size, number of livestock owned, agroecology, distance to the nearest market and perception of farm gate price are negatively affect marketed surplus while farm size allocated for *teff* production and income from off farm and other farming activity positively influence the amount of marketed surplus of *teff*. Age of household head was negatively affect decision to add value by teff producers, while farming experience, distance to the nearest market, education status, access to credit and access to extension service are positively and significantly affects value addition decision of teff producers.

Based on the findings of this study the following recommendations are necessary to develop sustainable production and marketing of *teff* that are locally adapted and acceptable to cut down the high price of *teff* and increase competitiveness of smallholder *teff* producers. Despite extension services are being largely provided by government efforts still remain important to empower farmers to best practices through training and information. Improved market information should be made available to all participants in the chain.

Access to credit is seen as a great enabler for smallholder farmers to improve their production methods and ultimately increase outputs on farms. To enhance borrowing and use of credit, district agriculture office and Oromia credit and saving institutions together with other credit schemes and credit institutions should formulate educational programs to educate farmers on credit acquisition and use.

In addition, development of infrastructure should be improved; especially roads facilities should be established around the production centers. This will lower the rate of transaction cost thus enabling farmers to present more produce of better quality for sale.

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