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Determinants of Market Participation of Enset (Ensete Ventricosum) Farmers: The Case of Doyogena District, SNNPR, Ethiopia

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Abstract
Enset (Ensete ventricosum) is a traditional staple food crop in many parts of the densely populated south and south-western highlands of Ethiopia. It is a multipurpose crop whose every part is useful, however, kocho and bulla are the two main products processed from the crop. Enset can be dependable source of income in areas where it is grown. Doyogena district, southern Ethiopia, is one of the major producers of enset products. Despite its share in the market, there is limited empirical evidence on its products (kocho and bulla) market participation to design appropriate policies for improving smallholder market participation in the products. Therefore, this study analyzes determinants of kocho and bulla market participation of enset farm households in Doyogena district. Out of 13 kebeles producing enset, three of them were selected randomly for this study. A total of 154 households were selected randomly. Data were obtained through face to face interview and focus group discussion by using pre-tested questionnaire and checklists respectively. Heckman selection model (two-step) was used to estimate determinants of kocho and bulla market participation decision and intensity of participation. Eleven variables were hypothesized to determine market participation decision and intensity of participation of kocho and bulla producers. The model result indicated that, out of 154 producers interviewed, 68.2% and 71.4% of the respondents were kocho and bulla market participants respectively. The model output revealed that age of the household head, nearest market distance and area under enset cultivation as statistically significant determinants of market participation decision and intensity of participation of kocho producers. The model also shows age of household head, family size, nearest market distance and area under enset cultivation as statistically significant determinants of market participation decision and intensity of participation of bulla producers. Therefore, policies that aim in enhancing market participation of enset farmers should take into consideration the difference in response to the various factors that affect kocho and bulla market participation by enset farm households.
Keywords: Bulla, Doyogena, *enset*, kocho, participation, Heckman (two-step) model, SNNPR, Ethiopia

1. INTRODUCTION

In Ethiopia, there are four major agricultural systems such as pastoralist, shifting cultivation, grain-based cultivation and *enset* based cultivation. *Enset* based mixed agricultural system is the main agricultural production in southern and south-western highlands of Ethiopia (Birmeta *et al*, 2004). According to the author, *enset* has been grown in Ethiopia for more than 10,000 years. Indigenous hunters of Southern Ethiopia are thought to have been the first to cultivate *enset.* They later introduced the crop to the northern highlands of the country. However, farmers in the central and northern stretches grow the crop mainly as an ornamental crop to use its leaves for various purposes.

Enset is unknown as foodstuff outside Ethiopia and in western parts of the country. But it has a multipurpose uses in areas where it is grown as foodstuff. It is the main crop of a sustainable indigenous African system that ensures food security in the country that is food deficient. Its products are available throughout the year and can be stored in pits for long periods of time without spoiling so that it can be used at any time of the year (Valentina, 2015).

Enset is one of the indigenous root crops cultivated as traditional staple food crop in many parts of the densely populated south and south-western highlands of Ethiopia. Its cultivation represents about 65 percent of the total crop production in southern nation nationalities and people's regional state of Ethiopia. The productivity of *enset* cultivation is very high when compared with other crops but varies with cultural practices, ecological

factors and altitude differences (Birmeta *et al*., 2004). It is traditionally grown in small plantations adjacent to homesteads; and grows to a height of six meters. As a result, it can provide valuable windbreaks and shade from direct sunlight; and soil erosion as a result of *enset* cultivation is minimal. In *enset* plantations, the fertility of native soil improved due to the long term application of the manure, natural mulching of leaf and stem residues, rainfall captured, and the resulting soil moisture conservation and reduced run-off when compared to bare ground farming. *Enset* has large leafy fronds; therefore, it is a good plant to intercrop with coffee, potato and other food crops which benefit from shady growing conditions (Chakoro and Mekuria, 2015).

The importance of *enset* extends far beyond food. It is a multi-purpose crop whose every part is useful for something. According to Birmeta et al. (2004), farmers in *enset* growing area describe the importance of *enset* by saying "*enset* is our food, our cloths, our beds, our houses, our cattle feeds and our plates". In other words, *enset* is a crop of life; like coconut it provides a basis for subsistence culture. The major foods obtained from *enset* are *kocho* (a bulk of fermented starch obtained from the mixture of decorticated leaf-sheaths and grated corm) and bulla (a white powder obtained by squeezing liquid containing starch from the mixture of decorticated leaf-sheaths and grated corm). Both *kocho* and bulla are consumed locally as well as exported to urban markets. From the total of 98002435 *enset* plants harvested during 2014/15 agricultural year in Ethiopia, total productions of 50171871.37 quintals were obtained in the form of *kocho* and *bulla*. Of this amount, 34509385.36 quintal was from Southern Ethiopia (CSA, 2015).

Doyogena, in Kembata Tembaro Zone, is one of the known districts in Southern Ethiopia by its maximum cultivation of *enset*. *Enset* cultivation plays a considerable role in augmenting farm income for the growers in the district. It is the first important food crop and plays considerable role in augmenting farm income after potato, wheat and cabbage in the district. During 2014/2015 production year, about 26372 tons of *kocho* and *bulla* were supplied to the market from the district (DTIDO, 2016). Research effort to increase production and productivity of *enset* has been underway. A review of the past research work by different scholars indicates that the research mainly focused on *enset* production aspect such as indigenous knowledge of *enset* farming and its disease management. Hence, this study was aimed at identifying determinants of farmers' participation in *enset* products *(kocho* and *bulla)* markets in Doyogena district in order to indicate areas of intervention for further improvement in marketing system of the products.

2. RESEARCH METHODOLOGY

2.1. Site description

This study was conducted in Doyogena district (Figure 1) which is one of the seven districts in Kembata Tembaro zone, southern nation's nationalities and people's regional state, Ethiopia. The administrative center of the district is Doyogena town located at a distance of 258 km away from Addis Ababa in South West direction. The total area coverage of the district is about 17263.89 hectare. The district is bordered on the south by Kachabira district of the zone, on the west and north by Hadiya Zone and on the east by Angecha district of the zone. The total population of the district is about 101, 618 of which 49,889 (49.09%) are male and 51,729 (50.91%) are female (DFEDO, 2016).

The district is approximately 2585 meter above sea level and its altitude ranges from 1900 to 2748 meter. It has two major agro-ecologies, Dega (70%) and Woyina dega (30%). The average temperature of the district 22°C, and receives average annual rainfall of 1400 mm. Regarding the current land use pattern of the study area, about 86 percent of the total cultivated area is used for crop cultivation, 11.8 percent is forest and bush land, 2 percent is grazing land, and 0.2 percent is degraded land. The maximum, average and minimum land holding per household is 2.75 ha, 0.75 and 0.25 ha respectively. The primary occupation of the district is both crop cultivation and livestock production. The major crops grown in the district are *enset*, cereals (wheat, barley and maize), pulses (beans and peas), vegetables and root crops. Livestock production in the district includes oxen, milking cows, sheep, equines and poultry keeping (DFEDO, 2016).

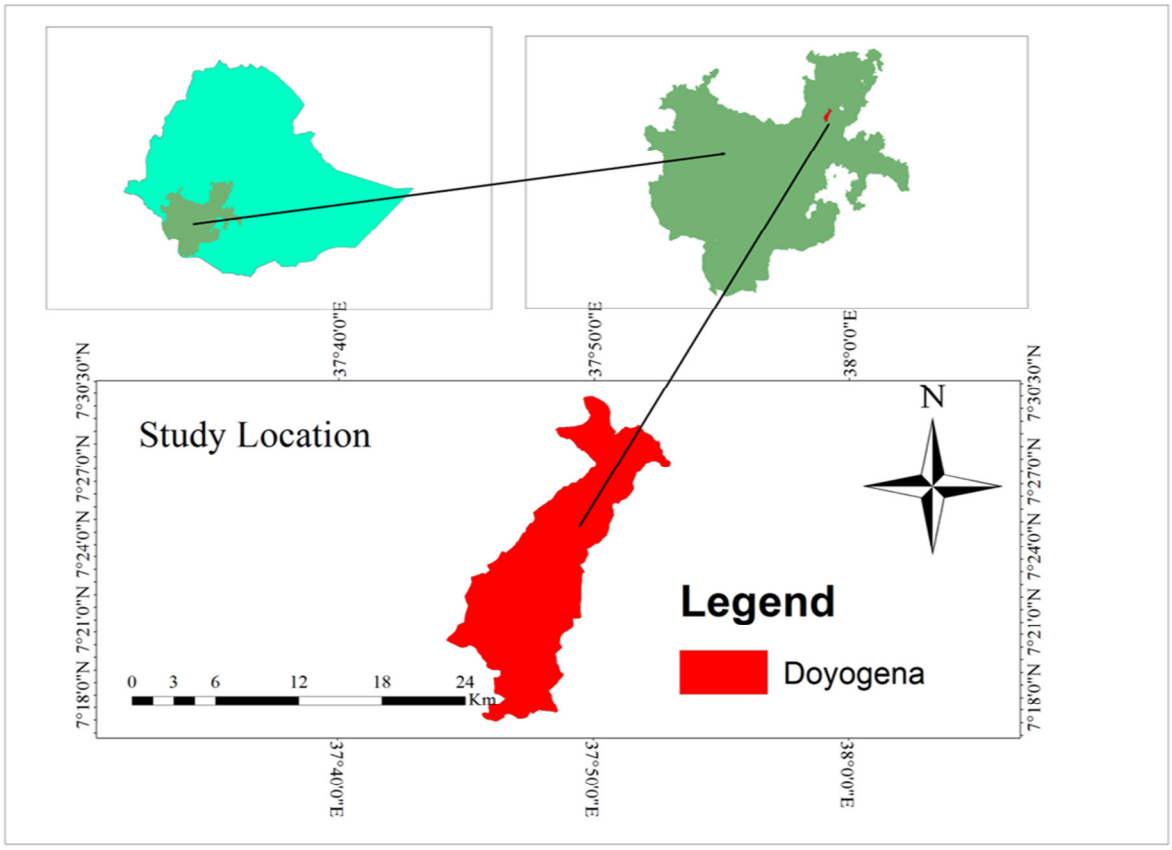

Figure 1. Geographical location of the study area

2.2. Type, Source and Method of Data Collection

Both primary and secondary data were used in this study. The primary data were collected from producers and traders using two types of interview schedule (one for farmers and the other for traders) by trained enumerators using pre-tested structured questionnaire. Focus Group Discussion (FGD) by using checklists was used to collect data which may not be collected during individual interviews. For Focus Group Discussion (FGD), individual having experiences in *kocho* and *bulla* production were selected and classified into groups to discuss specific issues related to the purpose of the study. Three focus groups, each consisting of 12 group members, were held at each kebele. The discussion was facilitated by the researcher together with the enumerators by using discussion guide so as to encourage the group members to speak freely. Beside this, market places were observed to obtain both qualitative and quantitative data regarding the products marketing system. Secondary data were collected from different sources such as government and non-government institutions, reports, articles and websites. In addition, published and unpublished documents were reviewed to get relevant information regarding *kocho* and *bulla* production and marketing.

2.3. Sampling Procedure and Sampling Size

Formal survey was conducted with *kocho* and *bulla* market chain actors such as farmers and traders. To conduct household survey with farmers, a two-stage sampling technique was employed to draw representative sample households for the population under consideration. First, out of thirteen kebeles producing *enset*, three kebeles were selected randomly. In the second stage, the household list of the sampled kebeles was updated and sample size was determined based on population proportional to size of household in the kebeles. Thus, out of the total 2031 *enset* farmers in the selected kebeles, 154 *enset* farm households were selected randomly (Table 1).The determination of sample size was resolved by using a simplified formula provided by Yamane (1967) with 95 percent confidence level. Accordingly, sample of 154 households were determined by the formula from the total of 12,000 farm households in the district.

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

Where: n = sample size, N = total *enset* producers in the study district, margin of error at 8%

Table1: Sample distribution of *enset* producers

Name of kebele	Total households in the kebeles	Sample households from the kebeles
Hawora Arara	472	36
Gomora	924	70
Mare	635	48
Total	2031	154

Source: Computed based on District office of agriculture (DOA)

2.4. Econometric model specification

Econometric model was used to identify determinants of *kocho* and *bulla* market participation decision and intensity of participation. The survey dataset was thoroughly checked to choose from econometric models which best fits the dataset. From the dataset it was observed that some *enset* farm households were not participating in the products market. In the study area, e*nset* cultivation serves as source of food and cash. However, it is not realistic to assume that all households participate in *enset* products market as some households may not prefer to participate in *kocho* and *bulla* markets; while the other may be excluded by market conditions and/or community perception towards the products marketing as these *kocho* and *bulla* are socially considered as cash commodity for relatively poor farm households in the study area.

Accordingly, Heckman selection model (two-step) model was used to overcome sample selectivity bias. This analysis involves two decisions (identifying factors that determine the market participation decision and the intensity of participation) in *kocho* and *bulla* marketing. As indicated by Heckman (1979), in the first stage of the model, participation equation determines factors affecting households' market participation decision; and it is used to construct a selectivity term called 'Inverse Mill's Ratio'. The second stage, outcome equation, determines factors affecting volume of the products supplied to the market. The Heckman selection model (two-step) specification for identifying factors that determine *kocho* and *bulla* market participation decision and level of participation is formulated as follows:

Participation equation

If y_{1i}=1, the dependent variable (*kocho* or *bulla*) market participation is observed. If y_{1i}=0, market participation is not observed.

$$y_{1i} = Z_i\beta_{1i} + u_{1i} \qquad u_{1i} \sim N(0,1) \qquad (2)$$

Where: y_{1i} is latent variable which is not observed, Z_i is vector of variables determining market participation decision, β_{1i} is vector of parameters to be estimated in the participation equation; and u_1 is the error.

The outcome equation

$$y_{2i} = x_i\beta_{2i} + u_{2i} \qquad u_{2i} \sim N(0,\delta) \text{ and } Corr(u_1,u_2) = \rho \qquad (3)$$

Where: y_{2i} is the outcome variable (quantity of *kocho* or *bulla* sales); x_i is vector of explanatory variables determining marketed surplus of the products; β_{2i} is vector of parameters to be estimated in the outcome equation; u_{2i} is the error in the outcome equation; and ρ is correlation between residuals from selection equation and outcome equation.

Hence, the independent variables expected to affect both market participation decision and decision on intensity of participation in *kocho* or *bulla markets* were:

1) Sex of the household head (1=female, 0=otherwise)
2) Age of the household head (years)
3) Formal years of schooling(years spent in education)
4) Area under *enset* cultivation(hectares)
5) Nearest market distance (kilometer)
6) Annual extension visits (Number of days of contacts by development agents)
7) Amount of credit used (ETB)
8) Access to market information (1=no access, 0=otherwise)
9) Non-farm income (ETB)
10) Total family size (Number of family members)
11) Number of livestock owned (TLU)

In addition to these explanatory variables, access to transportation facility, which takes one for those who have no access to transportation facility and zero otherwise, was included in the selection equation as exclusionary variable to satisfy the Heckman selection assumption.

3. RESULT AND DISCUSSIONS

3.1. Socio-demographic characteristics of sampled *enset* producers

The survey result (Table 3) revealed that there was statistically significant mean difference between *kocho* and *bulla* market participants and non-participants in terms of age, years of schooling, family size, nearest market

distance, number of extension visits, tropical livestock units owned and area under *enset* cultivation at different probability level. However, the mean differences of credit level and non-farm income level between the groups were statistically insignificant.

The overall mean age of the *enset* producers was found to be 45.5 years. The mean age of *kocho* and *bulla* market participants was 51.37 years with standard deviation of 10.67 years; and that of non-participants was 32.91 years with standard deviation of 2.41years. The test statistics revealed that age difference between the groups was statistically significant at 1% probability level (Table 3).

The level of education measured in formal years of schooling of the *enset* producers was found to be 3.76 years on average. The mean years of schooling of *kocho* and *bulla* market participants and non-participants were found to be 3.55 and 4.20 years respectively. However, the mean difference in formal years of schooling between the groups was statistically insignificant.

The overall mean family size of sampled *enset* producers was found to be 5.78 family members per household. The mean family size of *kocho* and bulla market participants and non-participants were found to be 5.52 and 6.32 family members with standard deviation of 1.40 and 1.20 family members respectively. The test statistic showed that there was statistically significant mean difference in family size between kocho and bulla market participants and non-participants.

The average distance in kilometer between *enset* farmers' residential location and nearest market was 4.55km. On average, the residence of *kocho* and *bulla* market participant farmers is 3.31km far from their nearest market place with standard deviation of 1.68km distant market place; whereas the residence of non-participants is 7.19km far from their nearest market place, with standard deviation of 1.45km. The test statistics showed that the mean kilometer difference in nearest market distance between the two groups was statistically significant at 1% probability level.

The average number of annual extension visits towards *enset* farmers was found to be 19.64 times per year. The mean annual extension visits was higher for *kocho* and *bulla* market participants with mean visits of 25.87 times per year while that of the non-participants was 6.31 times per year. The t-test statistics revealed that the average number of annual extension visits by development agents towards *kocho* and *bulla* market participants and non-participants differs significantly at 1% probability level.

The average number of livestock ownership measured in tropical livestock unit was found to be 3.29 TLU. The mean TLU owned by *kocho* and *bulla* market participants was 4.25 with standard deviation of 1.04 TLU; whereas that of the non-participants was 1.26 with standard deviation of 1.20 tropical livestock unit. The test statistics indicated that the mean difference in livestock holding between the products' market participants and non-participants was statistically significant at 1% probability level.

The overall average area under *enset* cultivation by sampled *enset* producers was found to be 0.24 ha. The average areas under *enset* cultivation by *kocho* and *bulla* market participants and non-participants were found to be 0.30 ha and 0.13 ha respectively. The test statistics shows that the mean difference in area under *enset* cultivation between the groups was statistically significant 1% probability level.

The average amount of money borrowed by *enset* farmers for facilitating *enset* production was found to be 171.04 birr. Average amount of money borrowed by *kocho* and *bulla* market participants and non-participants were 180.75 and 150.61 birr respectively. The average amount of money borrowed was higher for the products' market participants. However, the mean difference between the groups was statistically insignificant.

The average income earned from non-farm activities by *enset* farmers was found to be 436.10 birr. The average non-farm income was higher (457.76 birr) for non-participants in *kocho* and *bulla* markets; and lower (426 birr) for *kocho* and *bulla* market participants. But the mean difference in the level of non-farm income earned between *kocho* and *bulla* market participants and non-participants was statistically insignificant.

The mean yield of *kocho* and *bulla* for the sampled *enset* producers were 9.51 and 1.75 quintals with standard deviation of 2.92 and 0.61 quintals respectively. The average yields of *kocho* and *bulla* for market participants were found to be 10.64 and 1.96 quintals respectively, whereas the yields for non-participants were 7.08 and 1.31 quintals respectively. The test statistics revealed that the mean difference in yields between market participants and non-participants was statistically significant at 1% probability level.

Table 2: Variables mean comparison between *kocho* and *bulla* market participants and non-participants

Variables	Overall mean	Standard deviation	Market participants (68.5%) Mean	Market participants (68.5%) Standard deviation	Non-participants (31.5%) Mean	Non-participants (31.5%) Standard deviation	t-value
Age	45.5	12.39	51.37	10.67	32.91	2.41	11.94***
Years of schooling	3.76	3.95	3.55	4.01	4.20	3.83	0.95
Family size	5.78	1.39	5.52	1.40	6.33	1.20	-3.46***
Market distance	4.55	2.42	3.31	1.68	7.19	1.45	-13.93***
Extension visits	19.64	14.88	25.87	13.65	6.31	5.95	9.59***
TLU	3.29	1.77	4.25	1.04	1.26	1.20	15.8***
Credit level (ETB)	171.03	251.62	180.8	290.99	150.61	133.14	0.69
Area under *enset*	0.25	0.11	0.3	0.09	0.13	0.05	12.97***
Non-farm income	436.1	908.75	426	999.61	457.76	683.11	-0.2
Kocho yield (qtl)	9.51	2.92	10.64	2.79	7.08	1.20	8.55***
Bulla yield (qtl)	1.75	0.61	1.96	0.56	1.31	0.45	7.05***

***, ** and * shows significance level at 1%, 5% and 10% probability level respectively
Source: Survey result (2016)

The survey result revealed that from the total of 154 *enset* farmers interviewed 68.8 percent were male and the remaining 31.2 percent were female (Table 3). Out of 68.8 percent male *enset* farmers, 66.03 percent were market participants and 33.97 percent were non-participants. Out of 31.2 percent female *enset* farmers 72.90 percent were *enset* products market participants and the other 27.10 percent were non-participants. However, the proportion test statistics indicated that the variation in *enset* products market participation due to difference in sex of the household head was statistically insignificant.

Table 3 shows that from the total of 154 *enset* farmers 38.96%, of which 58.33% were market participants and 41.67% were non-participants, have access to market information regarding *kocho* and *bulla* marketing. The remaining 61.04 percent of *enset* farmers have no access to market information regarding the products. From those *enset* farmers (61.04%) who have no access to market information 74.47 percent were participants in *kocho* and *bulla* market; whereas 25.53 percent were non-participants in the products market. However, chi-square test statistics indicated that variation in access to market information between *enset* products market participants and non-participants was not statistically significant.

Table 3: Proportion test between *kocho* and *bulla* market participants and non-participants

Variables	Response	Market participants Frequency	Market participants %	Non-participants Frequency	Non-participants %	Total Frequency	Total %	X^2
Sex of the household head	Male	70	66.03	36	33.97	106	68.8	0.4
	Female	35	72.9	13	27.1	48	31.2	6
Access to market information	Yes	35	58.33	25	41.67	60	38.96	0.0
	No	70	74.47	24	25.53	94	61.04	5

Source: Survey result (2016)

3.2. Analysis of *kocho* and *bulla* market participants

The survey result revealed that, out of a total of 154 respondents, 68.18% were participants both in *kocho* and *bulla* market. Of all *enset* farm households interviewed, 3.25% were non-participants in *kocho* market but participate in bulla market (Table 4). In other way, all *enset* farm households participating in *kocho* market were also participants in bulla market; but some of the bulla market participants were non-participants in *kocho* market. The more probable reason could be that per unit price of bulla is much higher than that of the *kocho* price which encourages relatively poor farm households to sell bulla in order to purchase other household consumables.

Table 4: Proportion of the respondents by *kocho* and *bulla* market participation

Kocho market participation	*Bulla* market participation		Total
	No	Yes	
No	44	5	49
	(28.57)	(3.25)	(31.82)
Yes	0	105	105
	(0.00)	(68.18)	(68.18)
Total	44	110	154
	(28.57)	(71.43)	(100)

Values in ( ) represents the percentage of the frequency in the cell
Source: Survey result (2016)

3.2.1. Determinants of *kocho* and *bulla* market participation decision

The results of probit estimation of the first step Heckman selection model (two-step) of determinants of *kocho* and *bulla* market participation decision of farm households is presented in table 4. The model correctly predicted the observations with a significant chi-square of 161.34 and 149.26 for *kocho* and *bulla* respectively. This shows that the dataset significantly fits the model at 1% probability level. Accordingly, four out of the eleven independent variables were found to determine farm level *kocho* market participation decision significantly; and five of the eleven variables significantly determined bulla market participation (Table 5). From the table it is possible to draw conclusions about the directions and magnitude of each variable on the probability of participating in *kocho* and *bulla* markets by farm households.

There exist a positive and significant relationship between age of the household head and *kocho* and *bulla* market participation decision against the prior expectation. This means as the farmer gets older his *enset* farm became more fertile than before leading to increased yield of *kocho* which in turn increases the probability to participate in *kocho* market. This finding is in-line with Adenegan *et al* (2012) who found a positive and significant relationship between the proportion of maize sold and age of the farmer. Contrary to this finding, Nuri *et al* (2016) found a negative and significant relationship between age of the household head and market participation decision. The marginal effect implies that, holding other factors constant, a one year increase in ages of the household head would increase the household's *kocho* and bulla market participation by 17.7 and 24.5 percent respectively.

As expected, a negative and significant relationship exists between *kocho* and *bulla* market participation decision and nearest market distance from the farmer residence. More likely reason may be the heavyweight per unit volume of the products. Therefore, the households may be discouraged to participate in the products market due to high transportation cost resulted from heavyweight per unit volume of the products. The finding is consistent with Dawit (2009) who found negative relationship between market distance and market participation. The marginal effect also indicted that as the distance between the household residential location and nearest market for *enset* products increases by one kilometer the probability of deciding to participate in *kocho* and *bulla* market decreases by 25.7 and 14.5 percent respectively.

Number of livestock owned by the household measured in tropical livestock unit (TLU) was expected to have a positive relationship with *kocho* and *bulla* market participation decision. As expected, it influenced the products market participation decision positively and significantly at different probability level. The most probable reason for the statistically significant relationship could be that livestock holding and *enset* farming are complementing farm enterprises. In the study area, the most important fertilizer for *enset* farm is manure and most important livestock feed is from *enset*. Therefore, owning more number of livestock means providing large volume of manure for *enset* farm which increases the fertility of *enset* farm and leading to increased *kocho* and bulla yield. The marginal effect indicated that a one unit increase in tropical livestock unit would increase the probability of the household's *kocho* market participation decision by 36.8 percent; and that of bulla market participation decision increases by 11.1 percent for a unit increase in tropical livestock unit owned by the household. The finding is supported by Nuri *et al.* (2016) who indicated a positive effect of livestock holding on *enset* products market participation decision.

As prior expectation, a positive and statistically significant relationship exists between decision to participate in *kocho* and *bulla* market and area under *enset* cultivation. The relationship indicates as the area covered by *enset* increases, *enset* to be harvested for its products processing will increase resulting in more *kocho* and *bulla* yield which in turn leads to increased probability of deciding to participate in the products market by the households. The marginal effect also indicated that a one hectare increase under *enset* cultivation would increase the probability of *kocho* and *bulla* market participation decision by 49.8 and 52.7 percent respectively.

Family size of the household had a negative and significant relationship with *bulla* market participation decision. This implies that more family members in the household the more likely that most of the produce will be consumed at home resulting in less likely to participate in the products market. In other way, households

decide to sell when they cannot consume all they have produced. The marginal effect indicated that a one family member increase in household size will reduce marketable surplus of *bulla* thereby decreases the probability of *bulla* market participation by 15.4 percent. However, the effect of family size of the household on *kocho* market participation decision was statistically insignificant.

Table 5: Determinants of *kocho* and *bulla* market participation decision at farm level

Variables	Kocho			Bulla		
	Coefficient	Standard error	Marginal effect	Coefficient	Standard error	Marginal effect
Constant	-4.656*	2.641		-7.422*	4.056	
Sex of household head	0.055	0.76	0.069	-0.428	0.66	-0.026
Age of household head	1.692*	0.991	0.177	0.324**	0.128	0.245
Years of schooling	0.035	0.08	0.019	0.117	0.086	0.099
Family size	-0.231	0.239	-0.016	-0.467*	0.241	-0.154
Market distance	-0.524**	0.211	-0.257	-0.597***	0.212	-0.145
Extension visit	0.032	0.043	0.162	0.037	0.046	0.025
TLU	0.726***	0.236	0.368	0.382*	0.199	0.111
Credit level	0.013	0.012	0.001	0.003	0.002	0.001
Area under *enset*	9.310***	3.184	0.498	11.114*	5.930	0.527
Ln non-farm income	-0.058	0.09	-0.02	-0.094	0.092	0.001
Market information	-0.875	0.669	-0.072	-0.674	0.546	-0.026
Transport facility	0.089	0.998	0.063	-0.474	0.840	0.341
Kocho: Number of observation = 154, LR chi^2 (12) = 161.34, prob > chi2 = 0.0000, Pseudo R^2 = 0.838, Log Likelihood = -15.657				*Bulla:* Number of observation = 154, LR chi2 (12) = 149.26, Prob > chi2 = 0.0000, Pseudo R2 = 0.810, Log Likelihood = -17.504		

*, ** and *** represents significance level at 10%, 5% and 1% probability level respectively

Source: Own survey result (2016)

3.2.2. Determinants of intensity of *kocho* and *bulla* market participation

The results of outcome equation of Heckman selection model (two-step) of determinants of intensity of *kocho* and *bulla* market participation of farm households is presented in table 6. The volume of *kocho* and bulla sold in quintal by individual respondents were used as dependent variables. The model correctly predicted the observations with a significant Wald chi^2 of 73.53 and 88.68 for *kocho* and *bulla* respectively. These indicate that the coefficients of the independent variables are jointly different from zero at 1% probability level. Accordingly, four out of the eleven independent variables were found to determine intensity *kocho* and *bulla* market participation significantly (Table 6).

A positive and statistically significant relationship exists between age of the household head and the volume of *kocho* and *bulla* supplied to the market. Based on the model output, a one year increase in the ages of the household head will contribute to a 0.044 quintal increase in the volume of *kocho* sold; and the sales volume of bulla increases by 0.014 quintal for a one year increase in the ages of the household head.

A negative and significant relationship was expected between the number of family member and the volume of *kocho* and bulla marketed. As expected, there exist a negative and statistically significant relationship between total family size and the volume of the products marketed. The most probable reason could be that *enset* is the most important staple food crop in the study area. Therefore, as the size of the household increases, there will be more mouths to consume the produce in the household leading decreased volume of the products supplied to the market. The model output shows a one family member increase in the household will decreases sales volume of *kocho* and *bulla* by 0.157 and 0.053 quintals respectively, other variables held constant.

As prior expectation, there exists a negative and statistically significant relationship between the sales volume of *kocho* and *bulla* and the products market distance. The reason could be a small volume of the products have heavyweight which in turn limits the amount to be transported to the products market. This means households whose residential location is far from nearest products market are likely to offer less quantity than those nearer to the market place. The model output showed that one kilometer increase in *kocho* and *bulla* market distance from the household residential location will decrease the volume of *kocho* and bulla offered for sale by 0.218 and 0.064 quintals respectively, holding other variables constant.

A positive and significant relationship exists between *kocho* and *bulla* sales volume and the size of *enset* farm owned by the household. This implies a household with greater area under *enset* cultivation will have more number of matured *ensets* to be harvested which in turn increases the surplus of *kocho* and *bulla* to be provided for market. The model output indicated that one hectare increase in the household's *enset* farm size will increase

the sales volume of *kocho* and *bulla* by 3.56 and 1.07 quintals respectively, holding other variables constant.

Table 6: Determinants of decision on intensity of *kocho* and *bulla* market participation

Variables	Kocho		Bulla	
	Coefficient	Standard error	Coefficient	Standard error
Constant	0.577	1.184	0.275	0.253
Sex	-0.078	0.269	-0.026	0.058
Age	0.441**	0.171	0.014***	0.004
Years of schooling	0.028	0.032	0.009	0.007
Family size	-0.157*	0.093	-0.053**	0.021
Market distance	-0.218**	0.098	-0.064***	0.021
Extension visit	-0.003	0.014	-0.001	0.003
TLU	0.068	0.146	0.011	0.028
Credit level	-0.006	0.004	-0.001	0.002
Area under *enset*	3.556***	1.346	1.071**	0.421
Ln non-farm income	0.0013	0.042	0.001	0.009
Market information	-0.0622	0.276	-0.026	0.061
Mills lambda (l)	1.249*	0.667	0.281**	0.112
Kocho: Number of observation = 154, Censored observation = 49, Uncensored observation = 105,Wald chi2 (11) = 73.53, Prob > chi2 = 0.000, Sigma = 1.249, rho = 1.0000, Volume of *kocho* sold in quintal by individual household were used as dependent variable		Bulla: Number of observation = 154, Censored observation = 44, Uncensored observation = 110, Wald chi2 (11) = 88.68, Prob > chi2 = 0.000, Sigma = 0.281, rho = 1.000, Volume of *bulla* sold in quintal by individual household were used as dependent variable		

*, ** and *** represents significance level at 10%, 5% and 1% probability level respectively

Source: Own survey result (2016)

4. CONCLUSION AND RECOMMENDATIONS

Enset based agricultural production is one of the agricultural systems in Ethiopia which is commonly practiced in many parts of the densely populated south and south-western highlands of Ethiopia. Although *enset* is mainly cultivated as staple food crop, it serves as considerable income source for the growers. Factors that determine *enset* products (*kocho* and *bulla*) market participation by farm households were analyzed by using econometric model (Heckman selection model (two-step)). The results of the model analysis indicated different socioeconomic variables such as age of the household head, distance between the farmers' residence and the products market, tropical livestock unit owned by the household, number of family members in the household and area covered by *enset* were found to be important variables affecting *kocho* and *bulla* market participation by *enset* farmer households. Therefore, policies that aim in enhancing market participation of *enset* farmers should take into consideration the difference in response to the various factors that affect *kocho* and *bulla* market participation by *enset* farm households.

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