Cereal Crops Commercialization Decisions of Smallholder Farmers: A Case Study of Horro District, Western Ethiopia

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Abstract

This study aimed at identifying and analysing factors affecting commercialization decisions of smallholder farmers on major cereal crops in Horro District, Oromia, Ethiopia. A multi-stage sampling approach was employed to choose the district, *kebele* and sample households. A total of 144 farm households were considered in this study. Focus group discussions, key informant interviews and field observations were held to generate qualitative data. This was supplemented by secondary data collected from different published and unpublished sources. Descriptive statistics and logit model were used to identify determinants of commercialization decisions of smallholder farmers and effects of explanatory variables on their decision. The results of the study indicated that 16 per cent of the sampled farm households were in commercialized category, whereas the majority (84%) fell in non-commercialized category. Access to credit service, storage methods, extension access, oxen resource endowment, farming equipment endowments and total harvest were important in affecting commercialization decisions of smallholder farmers, focusing on wheat, barley, maize and *teff*. To accelerate agricultural commercialization in the area, there is need to encourage market infrastructure, credit services, extension service, and improved crops storage facilities.

Keywords: smallholder farmers, cereal crop, commercialization decision, Horro district, western Ethiopia

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1. Introduction

Agriculture in Africa is dominated by smallholder farmers. About 83 percent of rural households cultivate crops on less than two hectares of land (FAO 2011). The sector is characterized by subsistence farming system (Eastwood et al. 2010). The Sub-Saharan African agriculture is also dominated by subsistence farming which is characterized by weathered soils of poor fertility, rain-based cultivation, poor irrigation, limited mechanization and poor market linkages for inputs and outputs (Binswanger et al. 2010).

The Situation of Ethiopian agriculture is not different from other Sub-Saharan African (SSA) countries. The sector is dominated by subsistence orientation, low inputs and outputs and is highly rain-fed in its nature (MoFED 2003). The use of chemical fertilizers, pesticides and improved seeds is limited. Agricultural productivity is low, due to limited access by smallholder farmers to agricultural inputs, financial services, improved production technologies, extension services and irrigation; and, more importantly, due to poor land management practices that lead to land degradation (MoA 2012).

Many attempts were made in Ethiopia to integrate farmers into the agricultural markets. In the 1950s, the emphasis had been on improving productivity and reducing economic dependence on agriculture; whereas in the 1960s, the focus shifted to agro-industrial economy and increment of foreign earnings. In the 1970s, the focus was reoriented to smallholders' potential after inefficiencies were observed in mechanized farms (Jaleta et al. 2009).

Transforming Ethiopian agriculture from its current subsistence orientation to market-oriented production system, therefore, forms the basis for agricultural development strategy which requires paying attention to smallholder farming, poverty reduction, and agricultural technological intensification (Gebremedhin and Jaleta 2010).

Ethiopia paid attention to agricultural commercialization, but the majority of smallholder farmers are still engaged in subsistent production and low level

of agricultural commercialization (MoA 2015). In the 2010/11 production season, for instance, about 20,348,528.8 metric ton of grain yields were produced; but, only 20 per cent of that produce was sold and about 62 percent was used for consumption. For cereals, the figure has been 16 percent and for pulses it stood at 21 per cent (CSA 2011). The proportion of cereal output sold on the market is very small, reflecting its subsistence production system. Cereal crops are dominantly cultivated in Horro District, but they are the least in terms of the amount sold on the market. In other words, it constitutes about 88 percent of grain production, which is consumed at household level.

Horro is one of the districts of the Horro Guduru Wollega Zone of Oromia region. Smallholder farmers of the district are characterized by mixed crop-livestock system in which cereal crops production is dominant. Even though Horro District has diverse cereal crop production due to its favourable production environments, smallholder farmers are driven mostly by their immediate subsistence needs rather than market demands (Mekonen 2007). Thus, it is not possible for the smallholder farmers to integrate with the market and enjoy the benefits of commercialization.

A number of empirical studies have been carried out to assess commercialization of agriculture (Gebremedhin and Jaleta 2010; FAO 2011), but research works that tried to identify and analyse factors affecting commercialization decision of smallholder farmers are limited as existing research works focused on horticultural crops or cash crops rather than cereal crops. For instance, Samuel et al. (2013) studied determinants of commercialization of smallholder tomato and pineapple farms in Ghana. Aman et al. (2013) studied determinants of smallholder commercialization of horticultural crops in Gemechis District, West Hararghe Zone, Ethiopia. In general, most previous studies are silent about commercialization of cereal crops.

The objective of the study was to determine commercialization status of major cereal crops, identify factors affecting commercialization decision of

smallholder farmers and assess their practices of marketing major cereal crops in Horro district.

1.1. Studying Commercialization Decision of Smallholder Farmers

There are different approaches used to assess household commercialization level; some are old but some are new approaches. Under old approaches, the degree of commercialization can be seen as simple binary distinction of whether or not the farm sells any of its crop outputs. While simple, such a measure would treat most farms as commercialized although there are few that do not sell anything, not even a small part of their output. Under the old approaches, commercialization level is graded by the absolute amount of produce sold, either by volume or value, thereby producing a continuum of degrees of commercialization (Von Braun et al. 1994).

One possible criticism is that it makes no meaningful distinction between a farmer who produces just one bag of maize and sells that one bag, and another who grows fifty bags of maize and sells thirty bags of it. Commercialization index is measure of the proportion of agricultural output sold to the market and input acquired from the market to the total value of agricultural production. On the basis of the Commercialization Index, a farmer with a Commercialization index of 100, would appear to be more commercialized than one who has a Commercialization Index of 60. There is some validity to this criticism. However, for reasons that will become clearer below, in practice, there are few tiny farms, at least at lower levels of economic development, that sell all of their output as and similarly few large farms that do not sell most of theirs (Von Braun et al. 1994).

However, under the new approach, the measurement of commercialization has to consider, according to Pingali (2006), both the input and output sides of production, and the decision-making behaviour of farm households in production and marketing, simultaneously. Moreover, commercialization is not restricted only to cash crops, as traditional food crops are also frequently marketed to a considerable extent. Commodities, traditionally considered as food crops, may increasingly be marketed during the transformation process as households specialize.

On the other hand, Von Braun et al. (1994) specified three dimensions of commercialization indices at household level. The first index measures proportion of agricultural output sold on the market, and input acquired from the market, to the total value of agricultural production. In the second index of commercialization, commercialization of the rural economy is defined as the ratio of the value of goods and services acquired through market transactions to total household income. Here, there is an assumption that some transactions may take place in-kind, such as payments with food commodities for land use. Thirdly, the degree of household integration to the cash economy is measured as the ratio of the value of goods and services acquired by cash transaction to the total household income.

Gabre-madhin et al. (2007) used four approaches to measure the level of household commercialization: i) sales-to-output; ii) sales-to-income ratios; iii) net and absolute market positions (either as a net buyer, net seller or autarkic/self-sufficient household); and iv) income diversification or level of specialization in agricultural production. The sales-to-output ratio measures the gross value of all agricultural sales by a household as a percentage of the total gross value of its agricultural production. The total sales-to-income ratio is the ratio of the gross value of total sales to total income from crop production. In this index, income from crop production is assumed as a proxy to total household income, ignoring income from livestock, and off- and non-farm sources. The market position of a household is evaluated using the ratio of volume of sales and volume of purchases to the total volume of stock: the sum of storage from the previous production years and production in the current year.

Measurement of agricultural commercialization shifts from production for solely domestic consumption to dominantly market-oriented production. Similarly, commercialization of smallholder production is a process involving the transformation from production for household subsistence to production for the market. Again, the degree of participation in the output markets goes with the focus on cash incomes. Recently, most approaches classified commercialization as subsistence (non-commercialized), and

commercial-based on market orientation. Specifically, when farmers sell equal to or more than half of their total production, they are considered as commercialized farmers while farmers who sell less than fifty percent of their total produce are called non-commercialized farmers (Hazell and Wood 2008). Not only the sale of agricultural output, but also usage of agricultural inputs, is considered as important parameter of commercialization.

To summarize, in the old approach, agricultural output sales were considered as the only parameter, whereas household-to-market linkage could relate to output or input markets either in selling, buying or both. Alternatively, smallholder commercialization could also be seen as a dynamic process that indicates at what proportion outputs sold and inputs purchased are changing over time at household level.

2. Study Area Description and Methods

2.1. Description of Study Area

The study was undertaken at Horro District which is located in the Horro Guduru Wollega Zone of Oromia National Regional State, Ethiopia. Horro is located at about 315 kms from Addis Ababa and the district is between 9º 34´ N latitude and 37º 06´ E longitude in West Ethiopia. The District shares boundaries with Jarte Jardega District in the North, Jima Geneti District in the South, Abaye Coman District in the East and Abe Dongoro District in the West. The District has 22 rural Kebeles and 1 urban *kebele*[1] (HDADO 2014).

Agriculture in Horro District is mainly rain-fed. The rainy season, with mean annual precipitation of about 1800 mm, occurs from April to mid-October where maximum rain is received in months of June, July and August (CSA 2009). The mean, average, maximum and average minimum temperatures of the area are about 22^0C, 27^0C and 12^0C, respectively (HDADO 2014). The main crops of the district, among others, are maize,

[1] *Kebele* Is a word in Amharic language that refers to the smallest administrative unit in either urban or rural administrative ladder of the country.

wheat, barley, sorghum, nug, teff, millet, field peas, onion, tomato, and faba beans. Crop production is mainly rain-fed and little irrigation is also practiced for crop production. For long times, production of cereal crops was favoured by the majority of farmers over production of pulses and oilseeds. The major crops produced in terms of volume and coverage in the area are wheat, barley, maize and teff (HDADO 2016).

2.2. Methods

Both qualitative and quantitative data were collected from primary and secondary sources. Primary data was collected from sample households by well-trained enumerators using a survey interview under the supervision of the researcher. For primary data collection, combinations of qualitative and quantitative methods were used. For quantitative data, structured survey interview, including both open-ended and closed-ended questions, was designed and pre-tested to ensure validity and reliability.

The survey was designed to explore household demographic and socio-economic characteristics; institutional, market, and road factors; and farm input usage. To complement the structured survey, qualitative information was gathered through focus group discussions (FGDs) and key informant interviews (KIIs) that were undertaken with smallholder farmers and key informants from different organizations and institutions. Moreover, direct observation was made to triangulate with the survey, interviews, FDGs and KII results.

Secondary information was collected from Horro Guduru Wollega Zonal Agriculture Development Office (HGWZADO), Horro District Agriculture Development Office (HDADO), the FDRE Central Statistics Agency (CSA), and Ministry of Agriculture and Natural Resources (MoANR). The sources reviewed consisted of published and unpublished documents, namely: survey reports, annual reports, bulletins and websites.

The study district, kebele and farm households were selected by employing a multi-stage sampling approach. Of the 10 districts (one urban) of the zone,

Horro district was purposively selected based on volume of production and productivity of cereal crops, particularly wheat and barley, which had better production volume compared to other districts of the zone. In addition, familiarity of the researcher to the socio-economic and cultural setups gave a better chance of identifying the factors affecting crop commercialization decision of smallholder farmers of the district.

After consultation with Horro District Agricultural Office and Development Agents, out of the 23 kebeles of the district, one was excluded purposively, because it was not primarily engaged in agriculture, particularly in cereal crop production. Finally, out of the remaining 22 rural kebeles that have a similar farming system, four kebeles were randomly selected considering the available time and cost. The selected kebeles were Akaji Sebet, Doyo Bareso, Ejersa Mecca and Getilo Dale.

Finally, the sample households were selected by systematic random sampling at every 13th interval using sampling frame obtained from the respective kebele administration. Sample size was determined as below, following Yamane (1967).

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

Where:

n=sample size for the research use,

N=total number of smallholder households in kebele, and

e=confidence level.

In the case of this study, N=1888, e = 0.08

Thus, n= 1888/1+1888(0.08)^2 = 1888/13.08= 144 respondents

The sample size (n) was, thus, computed to be 144 sample households. For each kebele, the sample size was determined proportionally (Table 1).

Table 1. Sample distribution of smallholder farmers

Name of sample kebeles	Total households	Sample households
Akaji Sebet	431	33
Doyo Bareso	508	39
Ejersa Mecca	352	27
Getilo Dale	597	45
Total	1888	144

Source: Computed from HDADO (2015)

In addition, one FGD was conducted per kebele. On average, each group had eight persons, including farmers from women-headed households. FGD was held in groups based on pre-determined discussion guides. Key informants consisted of four Development Agents from each sampled kebele, one Senior Extension Expert, Coordinator/Vice Coordinator of Horro District Agricultural Development Office, Vice Coordinator of Horro District Trade Office and Coordinator of Horro District Road and Transport Authority. Data generated at various levels were supported by personal observations at each kebele and triangulated with other data.

Quantitative data were analysed using descriptive statistics such as mean, percentage, standard deviation, tabulation, ratio and frequency distribution. T-test and Chi-square statistics were employed to measure the mean and percentage differences between commercialized and non-commercialized farmers. In addition, simple descriptive statistics were used to analyse marketing practices and problems faced.

Econometric model was used to assess factors that affect smallholder farmers' decision to participate (or not to participate) in output markets for a given reference period, which was referred to as commercialization decision in this study. A binary logit model which best fitted the analysis for factors affecting commercialization decision by smallholder farmers was employed. For the purpose of this study, commercialization was calculated as proportion of production that was sold. Strasberg et al. (1999) suggested the following crop commercialization index (CCI):

$$CCI = \frac{\text{value of major cereal crop sales by household i}}{\text{value of major cereal crops production by household i}} \times 100.$$

Once commercialization decisions were measured, farmers were categorized into two, based on cut-off point by Ruthenberg (1987) which considers the degree of commercialization, as: 1) subsistence (non-commercialized) farmers, (if > 50 percent of the value of produce is for home consumption), and 2) commercialized farmers (if ≥ 50 percent of produce is for sale). Using the survey data, the study tracked and explained factors that affected the probability to fall in either of the categories using binary logit. The factors considered included household demographic and socio-economic characteristics, institutional access, market access, road factors and farm input usage.

The dependent variables took a value of zero or one depending on whether or not farmers fell in commercialized or non-commercialized category for major cereal crops. Independent variables were both continuous and dummy. Using the survey information, the study tracked and explained factors that affected the probability to fall in each of the categories using binary Logit model. These factors included household characteristics, resource endowment, market access situations and agricultural extension and trainings access. This method analysed the impact of various explanatory variables on the probability of being in one or another category (outcome).

In the model, y denotes commercial category and x denotes household attributes and it attempts to show how, all other things remaining the same, changes in the elements of $\boldsymbol{x}$ affect the response probabilities $P(y = j / X)$, j =1 and 2. Since the probabilities must sum to unity, $P(y = j / x)$ is determined once the probabilities for j = 1 and 2 is known.

Let $\boldsymbol{x}$ be a 1× K vector with first element unity. The logit model has response probabilities:

$P(y = j/X) = \exp(X\beta_j) / [1 + \Sigma^{j}_{h=1} \exp(X\beta_h), j = 1 \& 2]$ …….. (1)
Where β_j is Kx1, j=1 and 2.

For this study, the outcome or response probabilities are two:

1. Subsistence farmers/non-commercialized (proportion of value sold is less than 50%)
2. Commercial farmers (proportion of value sold is equal or above 50%)

The parameter estimates of the binary logit model provide only the direction of the effect of the independent variables on the dependent (response) variable; but estimates represent neither the actual magnitude of change nor probabilities. Differentiating equation (1) with respect to the explanatory variables provides marginal effects of the explanatory variables given as:

$$\frac{\partial P_i}{\partial x_j} - P_i(\beta_{ij} - \sum_{i=1}^{i-1} P_i \beta_{ij}) \ldots\ldots. (2)$$

The marginal effects or marginal probabilities are functions of the probability itself and measure the expected change in probability of a particular category with respect to a unit change in an independent variable from the mean (Greene 2000). Using this procedure, the factors that differentiate the commercialization level of the households are discussed and explained. Hence, the foregoing econometric model was used in this study and was treated against the potential variables affecting commercialization decision of smallholder farmers. The coefficient of the logit model presents the change in the log of the odds associated with a change in the explanatory variables (Hanushek and Jackson 1977).

2.3. Multicollinearity diagnosis

To study factors affecting cereal crops commercialization status of smallholder farmers, data gathered from 144 farmers were subjected to logistic regression analysis. Stata version 13.00 statistical software was used for analysing the data. Prior to running the logistic regression model, both the continuous and discrete explanatory variables were checked for the existence of multi-collinearity problem. The problem arises when at least one of the independent variables is a linear combination of the others.

The existence of multicolinearity might cause the estimated regression coefficients to have the wrong signs and smaller t-ratios that might lead to

wrong conclusions (Gujarati 2003). There are two measures that are often suggested to test the presence of multi-collinearity. These are: Variance Inflation Factor (VIF) for association among the continuous explanatory variables and contingency coefficients for dummy variables (Gujarati 2003).

The VIF technique was employed to detect the problem of multi-collinearity among the continuous variables. According to Gujarati (2003), VIF can be defined as:

$$VIF = \frac{1}{1 - R_i^2}$$

Where R^2_i is the square of multiple correlation coefficient that results when one explanatory variable (xi) is regressed against all explanatory variables. The larger the value of VIF (x_i), the more "troublesome" or collinear the variable X_i is. As a rule of thumb, if the VIF of a variable exceeds 10, there is a multi-collinearity problem. The VIF values displayed at Table 2 have shown that all the continuous explanatory variables have no serious multi-collinearity problem.

Table 2. Variance inflation factor (VIF) for continuous explanatory variables

Variables	VIF	1/VIF
NOFMLY	1.21	0.829144
AGREGASET	1.40	0.712490
NOOXEN	3.16	0.316124
TOTALTLU	2.96	0.337900
TOTALHARV	2.84	0.351614
CULTIVELAND	2.79	0.357834
TOTALSEDFRT	1.92	0.519637
ANIMALPLOU	1.67	0.597379
Mean VIF	2.25	

Source: Computed from field survey data (2016)

Similarly, contingency coefficients were computed to check the existence of multi-collinearity problem among the discrete explanatory variables. The contingency coefficient is computed as:

$$c = \sqrt{x^2}/_{N + x^2}$$

Where, C= Coefficient of contingency,

χ^2= Chi-square random variable and

N = total sample size.

Following the decision rule for contingency, there were no serious correlation problems (Table 3).

Table 3. Contingency Coefficients for discrete explanatory variables

	1	**2**	**3**	**4**
1	1.0000	-	-	-
2	0.0077	1.0000	-	-
3	0.2084	-0.0974	1.0000	-
4	-0.1549	0.0941	-0.0000	1.0000

Source: Computed from field survey data (2016)

Noes: 1 = CREDITACCES (Credit access), 2 = IMPRMETHSTOR (Improved Methods of storage), 3= EXTENCONT (Extension Contact), 4= EDUSTATUS (Education Status).

Based on the VIF and contingency coefficient results, the data were found to have no serious problem of multi-collinearity and therefore the continuous and discrete explanatory variables were retained in the model.

3. Results and Discussion

3.1. Characteristics of Sample Farm Households

The survey drew 144 respondents from four kebeles of the district. The majority (94%) of the households were male-headed while 6% were female-headed. The average age of household heads was 43.14 years, with minimum and maximum ages of 25 and 79 years, respectively. About 12% of the smallholder farmers were within the age group of 20 to 30 years, and 45% were between 31 and 40 years of age.

3.2. Level of Market Participation of Smallholder Farmers

The top crops cultivated at large coverage in 2014/15 in the study area were wheat, teff, barley, maize, niger seed (*'nug*), faba bean and oats (HDADO 2015). The households in this study produced 3985.4 quintals of major cereal crops in 2014/15. Out of the total cereal crops harvested, 39.2% was consumed and 34.3% was sold in markets. The remaining amount, 15.1% and 11.4%, constituted quantity stored for consumption and quantity retained for seed, respectively. In the 2014/2015 production season, the proportion of maize, wheat and teff sold was 42.5%, 33.5%, and 33%, respectively. Barley was the least sold item (Table 4). This indicates that, although the major cereal crops covered large areas with higher production, larger proportion of the produce was used for consumption not for sale.

In this study, market participation of rural households was measured in terms of smallholders' participation in crop output markets and agricultural input markets. Commercialization status was measured by the proportion of outputs sold to the total production. In the case of input market participation, the ratio of input cost to the total value of production was used as proxy for commercialization. Under normal circumstances, the higher the ratio, the higher the level of commercialization decision of the farmers.

Based on this definition, the majority (84%) of the farmers fell in non-commercialized category and the rest in the commercialized farmers' category. Out of non-commercialized category, 46.3% of the farmers were subsistence as they sold less than 25% of their total production and 53.7% were in transition category (sold between 25% and 50% of their outputs). This finding is almost compatible with most empirical studies (Berhanu and Moti 2010; FAO 2011) which showed that the majority of smallholders were non-commercialized.

Also using purchased inputs as indicator for commercialization decision, farmers were ranked according to their degree of commercialization. The data indicated that 73.6% of the farmers fell under non-commercialized and 26.4% under commercialized category in terms of market participation in crops input. The category was given based on the cut-off point set by the Ministry of Agriculture and Natural Resource Development (MoANR

2015), where use of over 50% of inputs against standard is considered as commercialized, while use of less than 50% of inputs against standard is considered as non-commercialized.

Regarding accessibility of inputs, FGD members stated that agricultural inputs were not timely supplied and price of inputs did not match with income from crops sold. Almost all FGD members revealed that availability of improved seed was very scarce.

Table 4. Quantity Produced, Consumed, Sold, Stored and Retained for Seed

Cereal crops	Parameter	Quantity (q)	Percentage
Wheat	Harvested	1613	
	Consumed	585	36.3
	Sold	540	33.5
	Stored	274	17
	Retained for seed	213	13.2
Barley	Harvested	471.45	
	Consumed	224	47.5
	Sold	101.75	21.6
	Stored	68	14.4
	Retained for seed	77.7	16.5
Maize	Harvested	970	
	Consumed	428	44
	Sold	413	42.5
	Stored	93	9.5
	Retained for seed	39	4
Teff	Harvested	930.95	
	Consumed	330.5	35.5
	Sold	306.75	33
	Stored	165.1	17.7
	Retained for seed	128.5	13.8
Total	Harvested	3985.4	
	Consumed	1560.5	39.2
	Sold	1365	34.3
	Stored	600.1	15.1
	Retained for seed	454.7	11.4

Source: Computed from the field survey data (2016)

3.3. Descriptive Results on Selected Variables

In order to have a clear picture of the quantitative demographic, socio-economic, market and institutional variables, which differentiate between commercialized decisions of smallholder farmers from the non-commercialized, t-test was applied. Among eight continuous variables, about five were found significant with 1% and 5% probability level. Only these significant variables are described in Table 5.

Table 5. Mean differences of continuous variables for commercialized and non-commercialized category

Variables	Non-commercialized category	Commercialized category	P-value
	Mean	Mean	
AGREGASET	10.96	11.83	0.027**
CULTIVELAND	2.57	3.37	0.002***
NOOXEN	1.79	3.22	0.000***
TOTALHARV	2491.9	4218.26	0.012**
DISTANCROAD	10.30	5.13	0.000***

Source: Computed from field survey (2016)

Note: ***, **, * represent significance of results at 0.5%, 1% and 5% levels, respectively

Farm implement (AGREGASET) were key factors for smallholder farmers positioned in commercialized category than those in non-commercialized category. The mean value of number of total agricultural asset was 11.83 for commercialized farmers' category and 10.96 for non-commercialized farmers' category. The mean difference between farmers in commercialized and non-commercialized categories was significant ($p<0.05$). The result of the survey was as expected because farmers who owned more agricultural assets could participation in more crop production. In addition, more total agricultural asset reflects ownership of an important asset, which affects smallholder farmers' commercialization category. In this case, agricultural assets consisted of animal-drawn plough set, hand pump and treadle pump to lift water, knapsack sprayer, winnowing tool, spade, sickle, slasher, rake, axe, water pump (powered) and large grain winnower.

Commercialized smallholder farmers had larger total cultivated land size (CULTVELAND) than farmers in non-commercialized category. The mean value of total cultivated land size was 3.37 and 2.57 hectares for farmers in commercialized and non-commercialized categories, respectively. The mean difference between farmers in both categories was significant ($p<0.01$). The result of the survey was as expected because farmers who own more cultivated land size can utilize more capital. This shows that ownership of an important asset affects smallholder farmers' commercialization category.

Number of oxen in total livestock units (TLU) (NOOXEN) was higher for commercialized smallholder farmers' category than for non-commercialized farmers' category. The mean value of number of oxen/household was 3.22 and 1.79 for commercialized and non-commercialized farmers' category, respectively and the difference was significant ($p<0.01$). Farmers who own more oxen can have higher harvest and utilize more capital. Ownership of an important asset, such as large number of oxen, affects smallholder farmers' commercialization status.

Total major cereal crops harvested (TOTALHARV) was an important variable that affected smallholder farmers' commercialization status. Harvest of major cereal crops of farmers in commercialized category was, on the average, significantly higher (4218.26 Kg) than that of farmers in non-commercialized category (2491.9 Kg) ($p<0.05$) The quantity of major cereal crops harvested plays a significant role in determining smallholder farmers' commercialization category.

Mean distance to market (DISTANCMKT) was significantly less ($p<0.01$) for farmers in commercialized category (5.13 Km) than those in non-commercialized category (10.30 Km). This indicated that farmers with short distance to market had better access to market information and transportation, thereby determining their commercialization category.

3.4. Factors Affecting Commercialization of Major Cereal Crops

The Logit regression estimate indicated that all the variables mentioned in Table 6 were used to explain the cereal crops commercialization status of households. The likelihood ratio statistics, as indicated by χ^2 statistics, are highly significant (P<0.0000), suggesting the model has a strong explanatory power. The explanatory variables included in the model explain 93.79% of the variation in the status of crops commercialization of farmers.

Table 6. Logit Regression Estimates of Farmers Market Participation Status

Variables	**Commercialization status of smallholder farmers**			
	Odds Ratio	***Std. Err***	***Z***	***P>Z***
Education status	0.9121465	1.315554	0.07	0.944
Number of Family Size	1.053723	0.308338	0.17	0.865
Total Farm implement	0.6379771*	0.2667216	1.69	0.092
Number of Oxen	14.67266***	1.034931	2.60	0.009
Total livestock	0.9902815	0.2319934	0.04	0.966
Cultivated land	0.5187844	1.147839	0.57	0.567
Quantity Harvested	1.001867**	.000811	2.30	0.021
Quantity Imp. seed and Fertilizers used	1.004796	.0042392	1.13	0.259
Improved Storage	107.2647***	1.494068	3.13	0.002
Extension Contact	0.0663195*	1.561842	1.74	0.082
Credit Access	138.566***	1.759789	2.80	0.005
Constant	1.0206	5.07907	2.72	0.007

N=144, Prob> F= 0.0000 R^2= 93.79 pseudo R^2= 0.7415

Source: Computed from field survey data (2016)

Notes: * Significant at 10 %, ** significant at 5%, *** significant at 1%.

According to logit regression output, household characteristics, specifically education status of household heads, family size, total livestock owned,

cultivated land and quantity of improved seed and fertilizers used were insignificant variables, whereas number of oxen owned, quantity of harvest, storage methods, total farm equipment owned, access to extension services, and access to credit services positively affected commercialization status of farmers (Table 7).

Table 7. Marginal Effects of the Explanatory Variables on the Probability of Commercialization

Variables	ımercialization status of smallholder farmers			
	Marginal effect	Std. Err	Z	P>Z
Education status	0.0031915	0.0456114	0.07	0.944
Family Size (n)	0.0018162	0.0107092	0.17	0.865
Total Farm Equip.	0.0155993*	0.0083996	1.86	0.063
Number of Oxen	0.0932235***	0.0272149	3.43	0.001
Total livestock	0.000339	0.0080503	0.04	0.966
Cultivated land	0.0227773	0.0395771	0.58	0.565
Quantity Harvested	0.0000647***	0.0000235	2.76	0.006
Quantity of Imp. seed and fertilizers	0.000166	0.0001412	1.18	0.240
Storage Methods	0.1622673***	0.0328139	4.95	0.000
Extension Contact	0.0941705*	0.0485313	1.94	0.052
Credit Access	0.171154***	0.0441063	3.88	0.000

Notes: * Significant at 10 %, ** significant at 5%, *** significant at 1%

The marginal effect, which measures the expected change in probability of a particular category with respect to a unit change in an independent variable, is reported and discussed below.

Total Farm Equipment: This variable significantly ($p<0.015$) affects crop commercialization status of smallholder farmers positively. This indicates that farming equipment endowments is a necessary asset that increases the commercialization status of households.

Number of Oxen in TLU: In the rural areas, this is considered as accumulation of wealth, security against emergencies, and dowry. It is primarily used for ploughing and as a cultural privilege. Oxen can also be easily converted into cash when the demand arises. It was hypothesized that the variable would have a positive relationship with the dependent variable because, as the total number of oxen in the household increases, the household would be more likely to produce more for commercialization. The variable had significantly a more positive relationship ($p<0.01$) which implied that smallholder farmers with larger number of oxen were more commercialized than those with less number of oxen. Commercialization status of farmers with larger number of oxen increased by 9.3 %.

Total Harvest: As indicated in Table 7, increase in the production of crop by 100 kilogram increases the probability to belong to the commercialized category by 0.06%. This is because increase in crop production will leave the households with slight surplus production that is brought to market, and hence increases the commercialization status of the households. This is consistent with the finding of Wolday (1994) who reported that smallholder farmers with higher level of cereal crop production tended to have higher commercialization status.

Storage Methods: The logit model also revealed that using improved storage methods significantly increased ($p<0.01$) the probability of being commercialized farmers by 16.22%. Increased application of improved crop storage methods will leave the households with surplus stored production for market, thus increasing the commercialization status of the households.

Extension Service: The marginal effect estimate indicated that extension access significantly increased ($p<0.1$) commercialization status of smallholder farmers by 9.4%.

Credit Access: Access to rural financial services can provide important incentives to invest in improved input use practices and it is mostly meant for boosting agricultural production and protection, training and awareness creation in order to achieve the desired purpose of credit. The present study revealed that the probability of commercialization status of farmers was

positively and significantly influenced by credit access ($p<0.1$) and the marginal effect favoured increase of commercialization status by 17.1 %.

3.5. Market Practices and Problems

Market access is a distance measured in kilometres to reach the nearest market. The survey result revealed that market infrastructure development in Horro District was very low and it was far and unsuitable for all means of transportation. The main market centres for households in the area were local markets located in the nearby villages and larger markets were mostly available in district towns. Households in this study reported that 66% of their marketed outputs were sold in local markets and the remaining were sold in town/district markets.

The majority of smallholder farmers primarily preferred to sell their cereals crop products at local markets. Due to absence of suitable market infrastructure facilities (road) and lack of capacity to sell their products to national and international markets, no farmer sold cereal crops at farm gate or at bigger markets far from their residence (HDADO, 2016). In addition, majority of smallholder farmers (75%) sold large proportion of cereal crop outputs for purchase of inputs, particularly fertilizers, improved seeds and pesticides. About 16% of households sold their cereal crops to cover expenses for, among others, children's clothing, and education material; and 5.6% of farmers sold their crops for repayment of credit. Only 2.1% of smallholder farmers sold their crops during peak price season. This indicated that large number of smallholder farmers sold crops for their immediate needs.

Regarding means of transport, almost all (97.9%) smallholder farmers used pack animal to transport their crops to the markets for sale or for input market integration, while 2.1% used hand driven carts to transport to output and input markets. The time taken is not proportional to the distance, mainly due to the mode of transportation and absence proper road.

The KII results indicated many crop marketing problems, the major ones being price fluctuation, transportation problems, and poor delivery to the

market. A total of 69.4% of the households strongly agreed and 28.5% agreed to price fluctuation of cereal crops as the main marketing problem. About 41% and 39.6% of households strongly agree while 39.3% and 49.3% agreed to the fact that transportation problems and road problems, respectively, were also the other main marketing problems (Table 8). About 40.3% of the household strongly agreed on lack of market information and poor market access as other main problems in marketing of crops. Similarly, FGD opinions and personal observations indicated that transportation problems, poor marketing infrastructure, lack of market information and price fluctuation were serious challenges in limiting smallholder farmers' market integration in each kebele of the district.

Table 8. Percentage of Responses on Market-Related Problems

Level	Price fluctuation	Transport problem	Road problem	Lack of market info.	Poor market access
Strongly agree	69.4	41.0	39.6	40.3	40.3
Agree	28.5	49.3	49.3	50.0	49.3
Neutral	2.1	6.9	6.9	6.9	6.9
Strongly disagree	0.0	2.8	4.2	2.8	3.5
Disagree	0.0	0.0	0.0	0.0	0.0

Source: Computed from field survey (2016)

4. Conclusions and Implications

The Ethiopian Government designed different strategies and long term plans to improve commercial status of smallholder farmers. For instance, Agricultural Development Led Industrialization strategy primarily aims at transforming smallholder farmers from the subsistence-based production to market oriented production system. Similarly, the Growth and Transformation Plans I and II give high attention to agricultural commercialization. However, the level of agricultural commercialization is at its infant stage in Ethiopia.

Cereals have been the major crops produced in large volume and area coverage by smallholder farmers for long period of time in Ethiopia. Five major cereals (*teff*, wheat, maize, sorghum, and barley) are the core of Ethiopia's agriculture and food economy, accounting to large proportion of the total area cultivated and volume of production. But, it is mainly produced for consumption rather than for market.

Improving market infrastructure: lack of market information at regular basis, road problems, transportation problems and poor market access are the major problems in relation to crop output marketing in the study area. Therefore, intervention is needed in providing price information and stabilizing price fluctuation. Mainly, to avoid asymmetry of price information and minimize transaction costs, it is very important to have weekly or monthly price broadcast through any available media and to arrange market information centre at rural level in order to reach farmers. On the other hand, to improve market linkage, improving road facilities and transport facilities is necessary.

Improving agricultural extension services: The focuses toward agricultural extension services are better on cereal crops in comparison to other sub-sectors like livestock sector. In addition, extension service is not updated timely and not practical. The services are, rather, mainly theoretical, and practical skills of Extension Agents are not improved effectively. Therefore, it is important to upgrade Extension Agents' educational status and practical skills in different areas, specifically in areas of production market linkage, and strengthen the capacity of farmer training centres with necessary equipment. In addition, at district level under Agricultural Development Office, separate agricultural commercialization department should be established to improve perception of smallholder farmers toward commercialization and to provide market information for rural people timely.

Improving credit services: provision of credit services is the most important services in rural areas. Due to unaffordable price of fertilizers at the right time, smallholder farmers fail to use the inputs at their optimum

level. Consequently, utilization of fertilizers is very low. Therefore, intervention is needed in accessing credit services in all rural areas and providing better extension services to the livestock sector, equal to the other sectors, and improving, and expanding veterinary services into rural areas.

Improving crop storage methods: traditional granaries are the common method of crop storage by smallholder farmers in the country, which is not safe and easily affected by pests, moulds, termites, rodents and other storage diseases. In some areas, improved crop handling methods like indoor bags and indoor storage play key role in storing crops for longer time in a safe way, but storage bags are not distributed to many rural areas. Therefore, providing practical training on post-harvesting crop handling to farmers and improved storage equipment would decreases storage losses by the farmers.

Finally, further study is also needed on the issue of ratio of input cost to farm income as a measure of commercialization status as the data here indicates inconclusive results. This lack of consistency between measuring commercialization as input utilization and output sales ratio need further investigation.

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