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Full Length Research Paper

Sheep market participation of rural households in Western Ethiopia

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Sheep production is an integral part of the subsistence crop-livestock based livelihoods of the Ethiopian highlands and plays a crucial role in economic development and poverty reduction. This study analyzed determinants of intensity of market participation of smallholder sheep keepers in Western Ethiopia. Data were generated from the rural households in their villages in Horro Guduru locality, Western Ethiopia. Poisson model was employed to examine factors determining the level of sheep keepers' market participation. The results of the empirical analysis show that flock size, family size, educational background, experience, access to market information and access to veterinary service are decisive factors determining the household's level of market participation. This study highlights the need to expand market information and veterinary services to sheep producers and capacity for their delivery. It also magnifies essential changes that need to happen in the management and marketing of sheep at farm level in order to generate higher and sustainable income for sheep producers in the region.

Key words: Poisson model, Horro Guduru, market participation.

INTRODUCTION

Ethiopia possesses the largest livestock population in Africa with more than 50 million cattle, 25 million sheep, 22 million goats and enormous amount of other animals (Kassie et al., 2008; CSA, 2009). This wealth of large livestock population, genetic diversity, and production system is attributed to the country's geographical location being close to the historical entry point of many livestock populations from Asia along the Nile Basin, topography of the country and its climatic conditions (EEA, 2005, 2006). The sector sustains and supports the livelihoods of an estimated 80% of the rural people (FAO, 2004), while constituting 30 to 40% of the agricultural gross domestic product (AGDP) as well as 17 to 20% of the overall GDP (Knips, 2004). Despite the magnitude of the livestock wealth and its importance in the economy of the country, performance of Ethiopian livestock sector in the production of major food commodities of livestock origin has always been quite low (Berhanu et al., 2007; Kassie, 2007; Gizaw et al., 2010). The reasons responsible to the very low performance of the livestock production sector include inadequate feed and nutrition, widespread diseases and poor health, poor breeding practice, inadequate livestock development policies with respect to extension, marketing, credit and poor infrastructure (EEA, 2005). It is also argued that the current land tenure policy and the common property nature of grazing land motivate households to keep livestock beyond the carrying capacity of the land, damaging pasture land and contributing to declining livestock productivity (FAO, 2004). The sector is therefore predominantly subsistence oriented whereby the livestock products and services are primarily produced for household/on-farm consumption.

The system is also a low input production process with

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most of the required inputs supplied by the family. The feeding system is virtually entirely dependent on natural pasture and free grazing. Very few areas in the country practice cut and carry fodder feeding regime or rotating paddock system. Such a system can hardly meet the growing demand for livestock products and services due to the ever increasing human population (Kassie, 2007). Re-orientation of livestock production systems towards consumer preferences and demands through timely and comprehensive transformation is currently the main agenda among the stakeholders of livestock improvement. Efforts have been exerted to introduce and promote market oriented livestock production. These efforts are however miniscule compared with the size of the livestock population and the number of households who rear them. Improvement in sheep production system through appropriate breeding strategy is crucial to make smallholder sheep keepers beneficiary of the prevailing market opportunities. However, improvement in production system is not an end by itself. Smallholder sheep keepers' market participation is vital as well for sustainability of interventions in improving production. Market orientation of livestock production system apparently requires proper understanding of the drivers of the propensity to participate in marketing. Considerable research based evidence is available on the factors that determine market agricultural participation of rural and peri-urban communities in Africa with an apparent focus on high value horticultural crops (Barrett, 2008). Very few published reports are available on analysis of livestock market participation.

To the best of our knowledge, only six studies; that is, Holloway et al. (2000, 2005), McPeak (2004), Barrett et al. (2006), Bellemare and Barrett (2006) and Omiti et al. (2009) have addressed the issue of market participation for livestock or livestock products in the whole of Eastern Africa region so far. Bellemare and Barrett (2006) and Barrett et al. (2006) – based on econometric results of Bellemar and Barrett (2006) - are the only two studies that analyzed livestock market participation that included sheep. They estimated an ordered Tobit model to analyze the participation (and intensity of participation) and reported, among others, that education of the household head, herd size, land size, fixed costs of marketing positively influence the quantity of livestock sold, whereas variable cost and price of the livestock do have negative effect. There are some other relevant research reports done in other African countries. Bahta and Bauer (2007) applied a binary logistic regression to investigate the major factors which determine livestock farmers' decision to participate in the market using data generated from five districts of South Africa. Their finding shows that distance to market, market information, births, extension visit and training were both logically and statistically significant determinants of farmers' decision to sell their livestock. Similarly, Balagtas et al. (2007) evaluated determinants of dairy market participation by agricultural households in Cote d'Ivoire by using the Heckman selection model to correct for indigenous cattle ownership. They reported that net sales of milk is influenced by age of the household head, ownership of local and cross-bred cows, number of agricultural extension visits and cross-boundary trade routes.

As discussed earlier, Bellemar and Barrett (2006) considered pastoral areas of Southern Ethiopia and aggregated their analysis for all livestock converting the livestock population into tropical livestock units. Our study focuses on the sedentary crop-livestock production system of Western Ethiopia and treats sheep market participation only. The study has generated important information on as to why the intensity of market participation varies across farmers. Generally, market participation studies - that measure participation in numbers of animals sold - assume that the distribution of animals sold follows a normal distribution. This might be justifiable in cases where the number of animals sold shows a lot of variation and has higher central tendency and when the selling decision unit is proportion of animals that can be sold. The sheep sold in our study area are very few and the selling decision is made in number units. In such cases, where a dependent variable takes on very few values, the distribution can be very different from normal (Wooldridge, 2000). Accordingly, this study assumes that the data generation process follows a Poisson distribution and estimates models based on this assumption. Therefore, this study analyzes of determinants of smallholder sheep keepers' market participation in mixed crop-livestock farming system using count data model. The paper is structured as follows. The following presents the methodology followed in the study with brief description of the study area, data collection and analytical procedures followed. Then the results and discussion will detail both descriptive and inferential results of the study.

Finally, we conclude and suggest general ideas for intervention based on the most important results of the study.

METHODOLOGY

The study area

The study was conducted in Horro Gudru Wollega zone of Western Ethiopia which is located at about 310 km west of Addis Ababa. The total area of the zone is about 710,000 ha. The 2007 population and housing census of the Central Statistical Agency (CSA) of Ethiopia showed that the zone has a total population of about 600,000 out of which 50.1% are male and 49.9% are female. About 89% of the population in the zone lives in the rural areas depending entirely on agriculture (CSA, 2007). Crop farming is the mainstay of livelihoods in the zone and the major crops grown in the area include wheat, teff, maize and pulses. Livestock production is an equally important economic activity for the rural communities in the study area. According to the national agricultural sample survey, the livestock population of the zone is composed of about 127,000 cattle, 25,000 sheep and 12,000 goats (CSA, 2009).

Sheep production has always been an important component of the traditional subsistence mixed crop-livestock production system in the area.

The data and descriptive statistics

The data used in this study are mainly primary data collected through a survey with structured questionnaire from four districts of Horro-Guduru Wollega Zone. A multi stage sampling technique was used to draw sample households from the population. In the first stage, we identified four potential sheep producing districts. In the second stage, four kebeles[1] were randomly selected from each of the districts making a total sample of 16 Kebeles. Finally, a total of 200 households were selected randomly from all 16 districts proportional to the population (household) size. The survey was conducted on a sample of 200 farm households randomly selected from sheep producing districts of the zone. The instrument used in the survey was designed to generate data on different variables that include characteristics of the household and particularly the household head, the livestock wealth of the household, quantity of sheep sold seasons and seasons of sheep marketing, challenges in sheep marketing, other livestock bought, decision making process in the household and management of sheep production.

Analytical tool

Smallholder farmers face various challenges to supply their products to the market and hence their level of market participation varies. Smallholder farmers in the area supply a limited number of sheep to the market in a given year. The selling decision is made on head of sheep basis essentially regardless of the share of number of sheep to be sold from the total sheep population. This implies that the number of sheep sold is more relevant in implying the level of market participation of the sheep keepers than other indicators such as proportion of off-take. Therefore, to investigate the factors that determine the intensity of market participation, in terms of the number of sheep sold in a year, the Poisson model has been employed. Our modeling builds upon the formulations and estimations of market participation studies in rural and peri-urban areas of Kenya (Omiti et al., 2009) and in pastoral areas of Ethiopia and Kenya (Bellemare and Barrett, 2006). According to Cameron and Trivedi (2005), the natural stochastic model for counts is a Poisson point process for the occurrence of the event of interest, in this case sheep sold. This implies a Poisson distribution for the number of sheep sold in our case, with density or more formally probability mass function of:

$$\Pr(Y = y) = \frac{e^{-\mu}\mu^{y}}{y!}, \quad y = 0, 1, 2, \ldots, \tag{1}$$

Where Y is number of sheep sold, μ is the intensity or rate parameter. We refer to the distribution as p(μ). The first two moments for this distribution are: E(Y) = μ and V(Y) = μ, which is an important assumption of the Poisson distribution; that is, equidispersion.

Following this distributional assumption, the Poisson regression model can be derived (Cameron and Trivedi, 2005; Wooldridge, 2000). The standard approach is to use the exponential mean parameterization:

$$\mu_i = \exp(x_i'\beta), \; i = 1,2,3,\ldots N, \tag{2}$$

Where, by assumption, there are K linearly independent covariates, including a constant, μ_i is the predicted number of sheep sold or the probability that a given number of sheep (y = 0, 1, 2,…) is sold, conditional on explanatory variables, x_i is a vector of explanatory variables and β is a vector of unknown coefficients to be estimated.

Given Equations 1 and 2 and the assumption that the observations ($y_i|x_i$) are independent; the most natural estimator is maximum likelihood. The log-likelihood function for Poisson regression model is, therefore given as:

$$\ln L(\beta) = \sum_{i=1}^{N} \{ y_i x_i'\beta - \exp(x_i'\beta) - \ln y_i ! \}. \tag{3}$$

An obvious deficiency of the Poisson model is that for count data, the variance usually exceeds the mean, a feature called overdispersion. The Poisson model instead implies equidispersion. Large overdispersion leads to grossly deflated standard errors and grossly inflated t-statistics in the usual MLE output (Cameron and Trivedi, 2005). However, quasi-maximum likelihood estimator (QMLE) maximizes Equation 3 and it is generally consistent under the condition given in Equation 3, even if $y_i|x_i$ does not have a Poisson distribution (Verbeek, 2004). Therefore, Poisson QMLE was also used as it is improvement over Poisson maximum likelihood and reduces the inflated t-values due to understated standard errors. Market participation has been shown to be influenced by different factors that include household and household characteristics, asset ownership and access to agricultural support services. The variables we considered in the analysis encompass all these factors. The variables are of both continuous and discrete nature. Simple effects coding method was used for multinomial categorical variables and the series of variables generated from them were then entered into the model. Table 1 summarizes the variables used in the econometric estimation along with others discussed.

RESULTS AND DISCUSSION

Characteristics of the sample households

The entire sample population ekes out a living from the semi-subsistence agriculture they are engaged in. Only 10% of the sample households are female headed and only 8% of the household heads are unmarried or separated. The most important decisions in agriculture are made mostly (60.8%) by the husband and wife, husband only (28.6%), wife only (6%) and the whole family (4.5%). The average age of the heads of the sample households is 38 years and it ranges from 20 to 77 years. About 25% of the sample households are illiterate and about 21.5% are only exposed to primary level (grades 1 to 4) education. Very few (7%) household heads have gone above secondary school education. Average family size of the sample households is about 7 with a minimum of 2 and a maximum of 18 family members. In terms of man equivalent (MEQ), the average family size equates to 3.5 MEQ and the range of 0 to 12 MEQ. The average per capita land holding of the sample households is 0.3 ha ranging from 0 to 1.88 ha. This is a very small holding even by Ethiopian standards (Table 2). Sample households walk on average for more than an hour to arrive at the nearest town and livestock market. About 68% of the sample households have access to veterinary services and yet 61% of them said that the services were not satisfactory. Sample households keep

[1]Kebele (pl. Kebeles) is the smallest administrative unit in Ethiopia.

Table 1. Summary of variables used in the econometric models.

Variable	Type	Values/code
Number of sheep sold in a year	Continuous	Total number of sheep sold (per year)
Flock size	Continuous	Total number of sheep owned excluding sheep sold during the year
Sex of household head	Dummy	1=male, 0= female
Family size	Continuous	Number of family members
Total tropical livestock unit	Continuous	Total TLU excluding sheep
Land size	Continuous	Land owned in hectare
Distance from nearest livestock market	Continuous	Walking minutes
Access to credit	Dummy	1=yes, 0=otherwise
Market information	Dummy	1=yes, 0=otherwise
Access to veterinary	Dummy	1=yes, 0=otherwise
Primary education	Dummy	1= primary, -1= illiterate, 0=otherwise
Elementary education	Dummy	1= elementary, -1= illiterate, 0=otherwise
High school education	Dummy	1= high school, -1= illiterate, 0=otherwise

Table 2. Characteristics of the sample population.

Characteristic	N	Mean	Minimum	Maximum
Age of the household head	200	38.11	20	77.00
Family size	200	6.84	2	18.00
Experience in sheep production (Years)	200	15.11	0	51.00
Number of years involved in sheep selling	181	13.46	0	50.00
Walking distance to the nearest livestock market (minutes)	200	72.75	5	180.00
Walking distance to the nearest town (minutes)	200	76.03	5	180.00
Number/frequency/ of extension visit per year	171	23.96	0	48.00
Man equivalent of the family size	200	3.52	0	11.76
Farm land owned (hectare/capita)	200	0.30	0	1.88
Livestock currently owned (no. of animal/capita)				
Cattle	200	1.38	0	8.00
Sheep	200	1.13	0	8.00
Goat	200	0.17	0	2.29
Chicken	200	0.70	0	5.00
Donkey	200	0.10	0	1.30
Horse	200	0.14	0	1.44
Mule	200	0.01	0	1.00
Livestock sold over 12 months (no. of animal/capita)				
Cattle	200	0.10	0	2.00
Sheep	200	0.55	0	4.67
Goat	200	0.05	0	1.00
Chicken	200	0.20	0	3.33
Donkey	200	0.01	0	0.83
Horse	200	0.01	0	0.20

different types of livestock for different purposes. The average per capita ownership figures show that a typical household owns on average 1.38 cattle, 1.13 sheep, 0.17 goats, 0.7 chicken, 0.1 donkey, 0.14 horse and 0.01 mule. It is therefore clear that sheep ownership is as high as cattle which are the most important species of animal in the crop-livestock mixed systems (Kassie et al., 2011). On average, the sample households have been rearing sheep for over 15 years. This experience ranges from 0 to 51 years (Table 2). Sample households have reported

that sheep is their priority animals along with cattle and about 50% of the sample respondents said that sheep would be given the priority whenever there is shortage of important resources such as labor and feed. Farmers mentioned short maturity period, convertibility to cash and less demand for external input are the most important reasons why they keep sheep. Sheep are kept with other livestock both in the field and in the barn. But, some farmers (36%) have separate barns for their sheep. The number of livestock sold per capita over 1 year period show that sheep are by far the most marketable animals of the sample households. A typical household sold on average 0.1 cattle, 0.55 sheep, 0.05 goats, 0.2 chickens, 0.01 donkeys and 0.01 horses. Similarly, there is an average of 13.5 years of sheep marketing experience among the sample households and the minimum experience is 0 while the maximum is 51 years (Table 2). The most important reason for sheep selling is cash generation for loan repayment and child schooling. Medication costs and old ewe replacement were also mentioned as reasons why farmers sell their sheep. Most (66%) of the sample households sell their sheep in the nearest livestock market, whereas 7% of them sell within the village and 7% in distant markets where prices are higher. The remaining households reported that they sell anywhere they find it appropriate. Sample households sell their sheep during social and religious festivities and when cash needs arise. The cash needs are higher in September when the academic year starts. Given the lack of market information, farmers need to make decision; they depend on personal observation in the market (19%), bargain on the spot (51%) or rely on brokers (2%) to set the prices for their animals. This shows how high the non-monetary transaction costs could be to the poor farmers who are in the market to generate enough cash to meet their dire financial needs. This challenge is further compounded by the fact that not all farmers are able to sell their sheep whenever they need to. Nearly 50% of the households have reported inability to sell at least once in the last 12 months. The main reason was the low price offered to their sheep. This price offer is low compared to what they expected and these expectations were formed under no or little information on demand, supply and price of sheep. About 50% of the sample households have reported not to have received any information from any source on demand, supply and price before they left to the market.

Econometrics results

Model characteristics

Table 3 summarizes results of both maximum likelihood (ML) and quasi maximum likelihood (QML) estimations of the Poisson model. QMLE adjusts the standard errors of the MLE which is known to understate the standard errors and hence inflate t-values (Cameron and Trivedi, 2005). The two approaches have shown slight differences in terms of the magnitudes of the standard errors of the estimated coefficients. The standard errors of coefficients estimated using QMLE are higher than that of ordinary MLE - particularly for coefficients of sex of household head, family size and distance from nearest market - implying that overdispersion is not off-limits (Table 3). This slight variation has not in fact influenced the statistical significance of the coefficients estimated and hence the incidence rate ratios for the two estimation procedures were exactly the same for all covariates. These features imply that the conditional distribution of number of sheep sold, $y_i|x_i$, follows Poisson and hence the specification is justifiable.

Determinants of degree of market participation

The intensity of participation model results show that sheep flock size, family size, educational background, experience in sheep marketing, access to market information and access to veterinary service significantly influence sheep market participation at household level. Family size is significantly different from zero and affects the number of sheep sold negatively. The incidence rate of this variable is 0.951 implying the rate of number of sheep sold would be expected to decrease by factor of 0.951 if family size of the households increases by one, ceteris paribus (Table 3). Livestock rearing in general and sheep production is a semi-subsistence economic activity in the region with a primary objective of sustaining the food supply of the household. Accordingly, households with bigger family size would be expected to retain their livestock for immediate consumption of the products than opting to sell. This is expected to be the case particularly in cases where most of the household members are young and unable to supplement the household economy through, for instance, engaging in off-farm income generating activities. The result is in line with both theoretical and empirical experiences documented in a number of published reports. For example, analyzing intensity of participation in dairy, vegetable and maize markets, Omiti et al. (2009) reported that family size significantly reduces the intensity of market participation in rural and peri-urban communities of Kenya. Otieno et al. (2009) has similarly reported a negative influence of family size on intensity of vegetable market participation in Kenya. Educational dummies, with illiteracy as a reference were also significant and associated with rate of sheep sold positively. The coefficient of elementary education level was 0.2121 while that of high school educational level was 0.1578. The implication is that, ceteris paribus, the average number of sheep sold by households headed by those who have attained elementary education level was 23.63% more than that of the base variable - illiterate household head. Similarly, the

Table 3. Estimation results of Poisson model; MLE and QMLE results[i].

Variable	Coefficient	Standard error		IRR	
		MLE	QMLE	MLE	QMLE
Constant	0.5290†	0.2120	0.2526		
Sex of household head	0.0804	0.1505	0.1481	1.0837	1.0837
Family size	-0.0502‡	0.0192	0.0174	0.9510	0.9510
Primary education	-0.0397	0.0824	0.0920	0.9611	0.9611
Elementary education	0.2121‡	0.0667	0.0671	1.2363	1.2363
High school education	0.1578†	0.0745	0.0752	1.1709	1.1709
Tropical livestock unit	-0.0103	0.0078	0.0087	0.9897	0.9897
Total sheep owned	0.0581‡	0.0062	0.0078	1.0598	1.0598
Experience	0.0105†	0.0043	0.0050	1.0106	1.0106
Land size	-0.0008	0.0350	0.0364	0.9992	0.9992
Distance from nearest livestock market	-0.0005	0.0009	0.0008	0.9995	0.9995
Access to credit	-0.1063	0.0931	0.0917	0.8991	0.8991
Market information	0.2821‡	0.0899	0.0958	1.3259	1.3259
Access to veterinary services	0.3667‡	0.0967	0.0942	1.4430	1.4430
Log-likelihood		-348.6041			
Pseudo R^2		0.2125			
LR test $\left(\chi^2_{13}\right)$		188.16 (P-value = 0.0000)			

‡ and † significant at 1 and 5%, respectively for both MLE and QMLE; N = 177. IRR = incidence rate ratio.

average number of sheep sold by households headed by those with high school education was 17.09% more than that of households with illiterate household heads. It is also interesting to note that primary education (that includes adult education) does not have any significant influence on intensity of participation as compared to illiteracy. It is therefore apparent that as literacy level of the household head increases, the number of sheep sold increases, ceteris paribus. Education increases capacity of people to access and synthesis information thereby reducing the uncertainty in which they make decision and concomitantly the market risk they expect. Similarly, Bellemere and Barrett (2006) and Bahta and Baur (2007) - in livestock marketing - and Omiti et al. (2009) - in vegetable marketing – have reported a positive relationship between education of the household head and intensity of market participation. As expected, the flock size owned by the household was positively related to the number of sheep sold by the households and was significantly different from zero. The incidence rate ratio (IRR) of total number of sheep was 1.0598 implying the rate of number of sheep sold by the households would increase by factor of 1.06 if number of sheep owned increases by one, ceteris paribus. This is also expected as the increase in flock size results in marketable surplus that can be sold to generate cash income for basic expenses such as loan repayment, children schooling and medication.

Mailu and Wachira (2009) have reported a similar result on chicken flock size vis-à-vis market participation. Bellemere and Barrett (2006) have found a positive influence of herd size on intensity of livestock market participation albeit a smaller magnitude. Experience in sheep marketing – measured in years – was also found to be significantly influencing the intensity of sheep market participation. The incidence rate ratio of this variable indicates that if the experience in sheep production of the household head increases by one year, the rate of the number of sheep sold by the household would increase by a factor of 1.011, keeping. This is expected as farmers who are familiar with the norms of the market and the marketing procedures will be more informed and hence more encouraged to participate more than those who are less experienced. This is very much related to the fact that market information available to rural sheep keepers is very limited and most of the market information is generated through frequent visits to the markets before engaging in any transaction (Kassie et al., 2011). Access to market information was found to be significant and positively related to the number of sheep sold by the households. Farmers who have access to market information are expected to have a rate of 1.3259 times higher for the number of sheep sold compared to farmers who have no access to market information, ceteris paribus. Given its scarcity and importance, access to market information is crucially important to smallholder farmers who have to always try to minimize the risk they might face. Nonetheless, market information availability and access is always asymmetric (Abdulai, 2000; Barrett and Mutambatsere, 2007) that not

all smallholders do get as much information as they need and therefore their marketing decision are always made under imperfect knowledge discouraging them from participating in the market. It is not therefore unexpected that access to information increases the confidence and hence degree of market participation by sheep keepers in Western Ethiopia. Such positive influences of access to market information have been reported by Bahta and Baur (2007) and Omiti et al. (2009). The other significant institutional variable is access to veterinary services. It significantly and positively influences the number of sheep sold.

Households who have access to veterinary services are expected to have a rate of 1.443 times higher for number of sheep sold compared with those who have no access to veterinary service, ceteris paribus. Access to veterinary service was expected to have positive influence mainly through maintaining the flock size and hence increasing the marketable surplus sheep produce. Ethiopian smallholder livestock keepers struggle with a number of pandemics that often wipe out their flock mainly due to lack of veterinary services. The availability of the services is therefore an important impetus to market participation as a result of bigger and more stable flock size.

Conclusions

Livestock in general and sheep in particular play a crucial role in the livelihoods of the rural communities in HoroGudru zone of western Ethiopia. The contribution of livestock can be easily enhanced if the whole production system is transformed in such a way that it becomes a more dependable source of income for the poor communities depending on it. This reorientation of the production system requires active and higher participation of the livestock keepers in marketing. The current level of market participation of livestock keepers in pastoral areas of Ethiopia has already been indicated to be very low (Barrett, 2001; Barrett et al., 2004; Negassa and Jabbar, 2008; Negassa et al., 2011). Our study has shown that low participation is the case in sedentary farming systems of western Ethiopia as well. The factors that significantly influence the number of sheep being sold by the sample households in the study area are flock size, family size, educational background, experience in sheep marketing, access to market information and access to veterinary service. The importance of access to veterinary services, education, market information and experience in sheep marketing needs to be re-emphasized due to the characteristics of the sheep production and marketing activities discussed in this paper. Educational background and number of years of experience in sheep production are important determinants of degree of market participation implying the importance of improvement of farmers' sheep management skills. This can be possible through tailored and timely training interventions for farmers. Therefore, targeted and adequate training for farmers is important to improve farmers' market participation.

Similarly, access to market information is also found to be decisive factor implying the need for improvement of farmers' access to market information. This can be possible by integrating provision of market information with other support services provided by different entities. Access to veterinary services is another factor that needs emphasis in order to enhance farmers' participation in sheep market. In sum, the empirical results suggest that in order to make smallholder farmers beneficiaries of the prevailing market opportunities which arise from domestic as well as worldwide increase in population, development interventions should aim at the improvement of access and adequacy of support services for sheep keepers.

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[i]Tobit estimation resulted in less meaningful output. The output is available upon request.