

Determinants of Smallholders' Beef Cattle Market Participation: In Selected Districts of West Shewa Zone, Ethiopia

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Abstract— The study was aimed at analyzing determinants of smallholders' beef cattle market participation and quantity supplied to the market in Toke Kutaye and Bako Tibe Districts, West Shewa Zone, Oromia National Regional State, Ethiopia. The primary data for this study were collected from 376 sampled household producers by using interview schedule, site visit and personal observation. Data analysis was made using descriptive and inferential statistics and heckman two-step selection model. The results of the heckman two-step selection model indicated that beef cattle market participation and quantity supplied to the market is significantly determined by education level, household size, using veterinary services, grazing land owned, selling price of cattle, frequency of farmer gets market information, body condition of cattle and total number of cattle owned. It was concluded that there is poor market information and infrastructure, lack of access to services and weak linkage of producers with next actors. Access to market information and infrastructure and veterinary services improves market participation and supplying of cattle. Therefore, the required recommendations were improving farmers' access to market information and infrastructure by improving linkages between the producers and service provider institutions, creating strong horizontal and vertical linkage between the farmers and other chain actors and enabling them to produce market oriented products and supplying to the market.

Keywords— *Beef cattle, market participation and heckman two-step model*

1. Introduction

The diverse biophysical and agro-climatic conditions in Ethiopia make it suitable for the production of different kinds of livestock. Livestock production is an integral part of Ethiopia's agricultural sector and plays a vital role in the national economy. At present, livestock contributes about 20% of the GDP, supporting the livelihoods of 70 % of the population and generating about 11% of annual export earnings [1]. As the country has a large livestock population, it has much to gain from the growing global markets for livestock products. Ethiopia has the largest livestock inventory in Africa which are not managed to maximize their value for meat production. Large numbers of livestock are held for several years to supply draught animal power and milk for the family in the highland areas and these old animals do not produce the best meat. Ethiopia has potential to increase the volumes and values of domestic and export sales of animal and its products [1]. This could be achieved by increasing meat exports, expanding commercialization of production and marketing of livestock, diversifying into other products and boosting domestic consumption [2].

The value chain analysis in particular focuses on understanding factors that determine market success, and how the information is transmitted between actors in the value chain to provide market or price incentive to supply the market and invest in meeting standards, improving quality and expanding productivity [3]. In a profitable market with growing volumes, there should be an opportunity for deepening the value chain through new specialized service providers. Thus, it

becomes important to examine the major determinants of market participation and supply of beef cattle in the study areas.

Therefore, also the study areas have a potential of beef cattle production and marketing due to its suitable climatic condition for the cattle and presence of main road connecting the markets in the area with the capital city of the country; supply of beef cattle to the market by smallholder producers and its determinants and their market channel has not yet been systematically studied and documented in the areas. Due to all these reasons, the analysis of beef cattle value chain has been initiated to understand determinants of beef cattle keepers' market participation and supply to the market and the existing market channels and recommend viable options to improve the supply of value added products. At the end, the study makes an attempt to solve the information gap in the study areas.

1.1. Objectives of the study

General objective

To analyze factors affecting smallholder beef cattle owners market participation in the study areas.

Specific objective

- To analyze determinants of smallholders' market participation and quantity of beef cattle supplied to the market in the study areas.

2. METHODOLOGY

2.1. Sources of Data and Methods of Data Collection

Both primary and secondary sources of data were used for the study. Various publications and reviews (from internet), material studies, data from the National Statistics Agency, Ministry of Agriculture, district offices and other relevant sources were used as secondary sources. Interview schedules, site visits, focus group discussion and structured observation

methods of data collection and information obtained from different government and non-governmental organizations were used as primary sources. Both qualitative and quantitative data were collected for the study. The qualitative data was collected using Participatory research approach / key informant interview, site visits and structured observations and quantitative data was collected using interview schedules.

2.2. Sampling Techniques and Sample Size Determination

Toke Kutaye and Bako Tibe districts were selected purposively based on the existing potential of cattle production, fattening practices and marketing of beef cattle in the districts. Toke Kutaye and Bako Tibe districts have 27 and 32 kebeles, respectively. With the consultation of districts' livestock experts, out of the potential kebeles from the districts, three kebeles from each district namely Naga File, Birbirsaf dogoma and Lenca from Toke Kutaye and Dembi Dima, Seden Kite and Bacara Oda Gibe from Bako Tibe district were selected randomly. A simple random sampling technique was used to select the required sample household producers from the kebeles.

The sample size for collecting data for the study was determined by using [4]. formula and the following formula was used to calculate total sample size (n) for households. The sample size for each kebeles was calculated proportionally.

$$n = \frac{N}{1+N(e)^2} = 376$$

Where,

n = designates the sample size the research uses (376);

N = designates total number of households (12634);

e = designates maximum variability or margin of error 5%;

l = designates the probability of the event occurring.

Table 1: Sample size of the study areas

Name of selected districts	Name of selected kebeles	Number of household producers in the kebeles	Sample of household producers in the kebeles
Toke Kutaye	Naga File	1420	42
	Birbirsaf dogoma	3430	104
	Lencha	2160	64
Bako Tibe	Dembi Dima	1054	30
	Seden Kite	1820	54
	Bacara Oda Gibe	2750	82
Total	6	12634	376

Source: The districts' livestock and fishery development office, 2019

Therefore, Total sample size = 376

2.3. Methods of Data Analysis

2.3.1. Descriptive and inferential analysis

Data analysis was employed descriptive and inferential statistics such as mean, percentage, t-test and chi²-test by using STATA software was used in continuous variables while percentage and chi²-test in categorical variables.

2.3.2. Econometric analysis

This method of data analysis was used Heckman two-stage model to analyze the smallholder market participation and quantity of beef cattle supplied to the market.

Heckman two-stage model

For this, Heckman two-stage procedure was used in the analysis of factors determining smallholders' market participation and market supply of beef cattle in the study areas.

The Heckman's sample selection model where a probit model for the participation or selection equation was estimated and an OLS regression model which is corrected for selectivity bias was specified to account for the amount marketed was estimated. In this sample selection model the first procedure is to estimate the probability of participation using the Maximum Likelihood Probit estimation and estimating Inverse

Mill's Ratio as a right hand variable in the corresponding beef cattle market supply function. The probit model is specified as:

The participation Equation/the binary probit equation

$$Y_{1i} = X_{1i}\beta_1 +$$

$$U_{1i} \quad U_{1i} \sim N(1, 0)$$

$$BCMP = 1 \text{ if } Y_{1i} > 0$$

$$BCMP = 0 \text{ if } Y_{1i} \leq 0$$

Where, Y_{1i} is the latent dependent variable which is not observed

X_{1i} is vectors that are assumed to affect the probability of sample household beef cattle market participation

β_1 is vectors of unknown parameter in participation equation

U_{1i} is residual that is independently and normally distributed with zero mean and constant variance.

The observation equation/the supply equation

$$NCS = Y_{2i} + X_{2i}\beta_2 + U_{2i} \quad U_{2i} \sim N(0, \delta^2) \quad (2)$$

Y_{2i} is observed if and only if $BCMP = 1$.

The variance of U_{1i} is normalized to one because only $BCMP$, not Y_{1i} is observed.

The error terms, U_{1i} and U_{2i} , are assumed to be bivariate, normally distributed with correlation coefficient, ρ . β_1 and β_2 are the parameter vectors.

Y_{2i} is regressed on the explanatory variables, X_{1i} , and the vector of inverse Mills ratios (λ_i) from the selection equation by ordinary least squares.

Where, Y_{2i} is the observed dependent variable, X_{2i} is factors assumed to affect number of beef cattle sale

β_2 is vector of unknown parameter in the supply equation

U_{2i} is residuals in the supply equation that are independently and normally distributed with zero mean and constant variance. $\lambda_i =$

$$\frac{f(x\beta)}{1-F(x\beta)}$$

$f(x\beta)$ is density function and $1 - F(x\beta)$ is distribution function.

Table 2. Summary of variables used in the determinants of beef cattle producers' market participation and quantity supplied to the market

Variables	Nature of variables	Description and measurement of variables	Hypothesis
Beef cattle market participation (D1)	Dummy	Defined as 1 value if a household participate in beef cattle market in the survey year and 0 otherwise.	Depended
Quantity of beef cattle supplied to the market (D2)	Continuous	Measured as the actual supply of beef cattle to the market in the survey year and it has a positive value	Dependent
Land size for grazing	Continuous	Measured as total land size for grazing owned by the household in hectares	+ve
Sex of the household head	Dummy	Taking 0 if female and 1 if male	If 1, +ve
Veterinary service	Dummy	Defined as 1 if getting the service and 0 otherwise	+ve
Experience	Continuous	Measured by the number of years of experience sample households have in beef cattle production and marketing	+ve
Household's income	Continuous	Measured as an estimation of on-farm income plus off-farm income in birr per year	+ve
Number of beef cattle owned	Continuous	Measured in terms of total number of beef cattle owned by sample households	+ve
Body condition of Beef Cattle	Categorical	Defined as 1 if the beef cattle owned by the households are thin (poor), 2 if it is medium and 3 if it is fat (good) body condition.	+ve
Household size	Continuous	Measured in terms of number of person living in the household	+ve
Distance to market	Continuous	Defined as distance of the household from the near market in km	+ve
Access to credit	Dummy	Defined as 1 if the household has access to credit and 0 otherwise	+ve
Education level of the respondents	Categorical	defined as 1 for illiterate, 2 for primary school, 3 for secondary and preparatory school, 4 for certificate/diploma and 5 for degree and above	+ve
Access to market information	Dummy	Defined as 1 if cattle keepers have access to market information and 0 otherwise.	+ve
Price of cattle	Continuous	Defined as selling price of cattle at the market	+ve

3. RESULTS AND DISCUSSIONS

3.1. Beef cattle market participation of the sampled household producers

The mean value of socio-economic and demographic characteristics (continuous variables) of beef cattle market participant and non-participant respondents are given in (Table 3). From 376 sampled household producers, 295 (78.46%) were market participants as they were found to sell beef cattle during the year of survey, while the rest 81 (21.54%) did not sell beef cattle during the year of survey.

The total mean of age of household head was 42.59 years and there was no significance difference between market participant and non-participant household respondents. With regard to total number of cattle owned in the year, the total mean of number of cattle owned of household respondents was 10.80. Separately, the mean number of cattle owned by market participants and non-participants of sampled household producers were 11.69 and 7.57, respectively and is found to be significant at less than 1% significance level. This result indicates that household producers with larger number of cattle more participate to the market and as a result they were more supply cattle to the market when compared with those who have few numbers of cattle. The total mean of grazing land owned of sampled household producers was 0.49 hectares. The mean grazing land owned of beef cattle market participant and non-participant

household respondents were 0.5 and 0.46 hectares. For grazing land owned of household respondents there was no significance difference between market participants and non-participants.

The mean experience in supplying beef cattle to the market of market participant and non-participant household respondents was 14.04 and 10.43 years, respectively. The t- statistic value depicted that mean difference in experience of supplying beef cattle to the market among market participants and non-participants was statistically significant at less than 1% significance level. This indicates that experience can directly influence sampled household producers market participation which shows that households who have been in supplying beef cattle for many years are better to participate in market. The total mean of distance of the market from homestead of the sampled household respondents was 6.04km. The mean distance of the sampled household respondents from the nearest market of beef cattle market participants and non- participants was 5.97 and 6.33km, respectively. This result showed that compared to market participants, non - participants are placed at insignificantly further distance from market. The t-value confirmed that mean difference in distance to the nearest market among beef cattle market participants and non- participants was statistically insignificant.

Table 3. Socio-Economic and Demographic Characteristics of beef cattle market participant and non-participant respondents (Continuous variables)

Variables	Mean of household respondents in the beef cattle market participation			
	Participants (N = 295)	Non-participants (N = 81)	Total (N = 376)	T-value
Age of household head in years	42.87	41.62	42.59	-1.22
Household size in number	7.38	6.70	7.24	-2.42**
Total number of cattle owned in the year	11.69	7.57	10.80	-7.27***
Total annual income in birr	60658.31	46283.95	57561.70	-2.93***
Grazing land owned in hectares	0.50	0.46	0.49	-0.66
Total number of beef cattle sold in the year	2.20	0.00	1.723404	-20.44 ***
Average selling price of beef cattle in the year in birr	11247.12	7956.79	10538.30	-11.25 ***
Experience in supplying beef cattle to the market in years	14.04	10.43	13.26	-6.63***
Distance of the market from homestead in km	5.97	6.33	6.04	0.93

*** = significant at $p \leq 1\%$ level, ** = significant at $p \leq 5\%$ level

Source: field survey, 2019

Socio-economic and demographic characteristics of beef cattle market participant and non-participant household respondents of categorical variables like sex of household head, educational level, body

condition of beef cattle, frequency of farmers to get market information, access to credit, frequency of farmers visited by extension agents were found to be

significantly varied among beef cattle market participants and non- participants.

Table 4 showed that about 93.62% of the sampled household respondents in the market participants and non-participants was male headed while the remaining (6.38%) was female headed household. From this about 98.64% was male headed households and only 1.36% was female headed in beef cattle market participants and 75.31% was male headed and 24.69% was female headed household in non-participants. Sex of household head by the market participant and non-participant household respondents was statistically different at less than 1% significance level. Majority (61.02%) of sampled household heads' education level of market participants was primary school which is followed by secondary school (26.44%), illiterate (11.53%) and certificate (1.02%) and for non-market participants majority (56.79%) of sampled household heads' education level was illiterate which is followed by primary school (35.80%) and secondary school (7.41%). The household heads' education level of market participant and non-participant household respondents was found to be significantly different at less than 1% significance level. The market participant households head had higher educational level than non-participant sampled household producers. This indicated that education is a significant factor for skill development and enhancing marketing decisions. This concept is fully supported by the study conducted by [5], who stated that formal education enhances the information acquisition and adjustment abilities of the farmer, thereby improving the quality of decision making to participate in agricultural market.

In case of body condition estimation of beef cattle, majority (71.01%) of sampled household producers had medium body condition score which is followed by fat (19.41%), thin (7.71%), very fat (1.06%) and very thin (0.80%) and the result showed that for the body condition estimation of beef cattle there is a significance difference between market participant and non-participant of sampled household respondents. From the (table 6) it could be seen that respondents those who had better body condition score of beef cattle more participate to the market and vice versa. According to the survey results, 18.98% and 4.94% of market participant and non- participant household respondents had access to/used credit while, 81.02% market participants and 95.06% of non-participants were not used credit. The difference in access to credit across the beef cattle market participants and non-participants was found to be significant at less than 1% significance level.

This result indicated that access to credit has direct impact on households' market participation as it facilitates the introduction of innovative technologies, input and output marketing arrangements and promote beef cattle production thereby increasing marketable surplus. Majority (62.50%) of sampled household producers get market information weekly. Market participant and non-participant sampled household respondents get market information mostly weekly (71.53%) and yearly (48.15%), respectively. The results confirmed that the difference in frequency of farmers get market information by the market participant and non-participant household respondents was statistically different at less than 1% significance level.

Table 4. Socio-Economic and Demographic Characteristics of beef cattle market participant and non-participant household respondents (Categorical variables)

Variables	Categories	Percentage of sampled household producers in the beef cattle market participation						X ² -value
		Participants (N = 295 (78.46%))		Non-participants (N=81(21.54%))		Total (N = 376 (100%))		
		%	N	%	N	%	N	
Sex of household head	Men	98.64	291	75.31	61	93.62	352	57.91***
	Women	1.36	4	24.69	20	6.38	24	
	Illiterate	11.53	34	56.79	46	21.28	80	
	Primary school	61.02	180	35.80	29	55.59	209	

Education level of household head	Secondary and preparatory school	26.44	78	7.41	6	22.34	84	79.59***
	Certificate/diploma and above	1.02	3	0.00	0	0.80	3	
Body condition of beef cattle owned	Very thin	0.00	0	3.70	3	0.80	3	61.08***
	Thin	2.71	8	25.93	21	7.71	29	
	Medium	75.59	223	54.32	44	71.01	267	
	Fat	20.34	60	16.05	13	19.41	73	
	Very fat	1.36	4	0.00	0	1.06	4	
Used /access to credit	No	81.02	239	95.06	77	84.04	316	9.35***
	Yes	18.98	56	4.94	4	15.96	60	
Frequency of farmers visited by extension agents in years	No visit	1.02	3	25.93	21	6.38	24	98.38***
	Once a year	8.14	24	2.47	2	6.91	26	
	Twice a year	20.68	61	44.44	36	25.80	97	
	Quarterly	24.07	71	11.11	9	21.28	80	
	Monthly	29.49	87	8.64	7	25.00	94	
	Weekly	16.61	49	7.41	6	14.63	55	
Frequency of farmers get market information	Yearly	1.69	5	48.15	39	11.70	44	140.36***
	Monthly	20.34	60	22.22	18	20.74	78	
	Weekly	71.53	211	29.63	24	62.50	235	
	Daily	6.44	19	0.00	0	5.05	19	

*** = significant at $p \leq 1\%$ significance level

Source: field survey, 2019

3.2. Determinants of beef cattle producers' market participation decision

Out of the thirteen independent variables expected to affect the probability of market participation decision, seven variables were found to significantly determine the probability of beef cattle market participation. These are sex of household head (Sex), Education level of household head (Educn), Average body condition of cattle owned (Abodycoc), Grazing land owned (Grazland), Frequency of farmers visited by the extension agents (Freqexc), Frequency of farmer gets market information (Fregminf) and Average selling price of beef cattle (Asellpri) (table 7). Significantly affecting beef cattle market participation decision variables were separately discussed as follows:

Sex of household head (Sex): Sex of the household head has positive and significant effect on market participation decision of the sampled household producers at less than 1% significance level. The positive and significant relationship between the two variables indicates that there is positive relationship between beef cattle market participation decision and male headed households. This is because; male contributes more in the area of buying and selling cattle than female. The finding of this study agrees

with the findings of [6]. The marginal effect also confirmed that keeping other variables constant, the probability of participation in beef cattle market of being male headed household is increased by 30% compared with female headed households.

Education level of household head (Educn): The results showed that education level of household head has positive and significant impact on market participation decision of the sampled household producers at less than 10% significance level. This indicates that there is positive relationship between beef cattle market participation decision and educated household headed. This may be due to educated cattle keepers are more likely to use the market information more efficiently thus negotiate for a higher price for their cattle resulting into more market participation. The marginal effect also confirmed that, as education level of household head increases, the probability of beef cattle market participation increased by 2.6%, keeping other factors constant.

Average body condition of cattle owned (Abodycoc): The marginal effect for body condition score of cattle was positive and statistically significant at less than 1% significance level. As a result, good body condition of beef cattle leads to a better

probability of producers' participation in beef cattle markets by 6.7%, keeping other factors constant. Beef cattle with good body condition are more demanded by buyers and at good market price than others which have poor body condition/appearance that influence market participation positively.

Grazing land owned (Grazland): In contrary to prior expectation, grazing land owned negatively and significantly affected beef cattle market participation at less than 10% significance level. The finding coincides with [7], large areas owned by the cattle keepers had negative effect on the household decision to participate in the market as a seller but had a positive effect to participate as the buyer. The negative relationship between beef cattle market participation and grazing land owned indicates that market oriented beef cattle production does not necessarily require large grazing land. The model output further confirmed that beef cattle market participation decreases by 3.89% as grazing land owned of household increases by 1 hectare, keeping other factors constant.

Frequency of farmers visited by the extension agents (Freqexc): The model result depicts that access to extension service has a positive and significant impact on beef cattle market participation decision of the sampled household producers. The variable was statistically significant at less than 10% significance level. The positive and significant relation between the variables indicates that as the frequency of farmers visited by the extension agents increases, the likelihood of beef cattle market participation by the sampled household producers also increases. This is because; extension services expected to widen the household's knowledge with regard to the use of improved cattle production technologies and have positive impact on cattle market participation decision. The marginal effect of the variable indicated that increase in one visit of extension services leads the probability of household beef cattle market participation increases by 1.25%, keeping other factors constant. [7], reported the same result with this finding.

Table 5. First-stage probit estimation results of determinants of beef cattle producers' market participation

Variable	Coefficient	Std. Err.	Marginal effect (dy/dx)	P> z
Sex	0.3029938	0.0520646	0.3029938***	0.000
Educn	0.026015	0.0138398	0.026015*	0.060
Abodycoc	0.0672351	0.0149243	0.0672351***	0.000
Tannuico	2.58e-07	1.93e-07	2.58e-07	0.180
Expbcf	0.0022083	0.0015101	0.0022083	0.144
Usvetse	0.0393989	0.0324028	0.0393989	0.224
Uscrd	0.0021867	0.0192058	0.0021867	0.909
Grazland	-0.0389563	0.0201333	-0.0389563*	0.053
Freqexc	0.0125216	0.006758	0.0125216*	0.064
Dstmark	0.0031048	0.0027322	0.0031048	0.256
Fregminf	0.043692	0.0164003	0.043692***	0.008
Asellpri	0.0000117	3.66e-06	0.0000117***	0.001
Tnumcat	0.000019	0.0024496	0.000019	0.994

Source: field survey, 2019

Dependent variable =Beef cattle market participation, number of obs (N) = 376, Uncensored obs = 295, Censored obs =81, Wald chi2(13) = 10849.09, Prob> chi2 = 0.0000, ***, **, and * represents significance level at less than 1%, 5% and 10% probability level, respectively.

Frequency of farmer gets market information (Fregminf): As it was expected, access to market information has positive relationship with household

beef cattle market participation decision and was statistically significant at less than 1% probability level. This is because; farmers marketing decisions are

based on market price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient produce movement. The marginal effect of the variable confirmed that keeping other factors constant, increasing frequency of farmers get market information leads likelihood of household beef cattle market participation to increase by 4.3%. [8], found that the provision of market information will strengthen the cattle keepers' negotiation during transactions with buyers and consequently prevent possible exploitation by better informed buyers.

Selling price of beef cattle (Asellpri): As hypothesized selling price is one of the important variables affecting beef cattle market participation decision. The marginal effect of this variable was positive and statistically significant at less than 1% significance level. This showed that for every one unit increase in selling price (1 birr/cattle) of the beef cattle, there would be increase in the probability of beef cattle market participation by 0.00117%, holding other factors constant. The result indicates that household producers were more sensitive to selling price and positive relationship between selling price of cattle and beef cattle market participation decision. Correspondingly low prices reduce cattle keepers' chances of realizing profits from the enterprise and reduce their market participation. Stable and attractive prices are a major incentive for smallholder agricultural producers [8].

3.2.1. Determinants of quantity of beef cattle supplied to the markets

In the second stage Heckman selection model; out of 11 independent variables expected to determine the quantity of beef cattle supplied to the market, 8 variables: Education level of household head (Educn), Household size of the respondent (Houshdsz), Using veterinary services (Usvetse), Grazing land owned (Grazland), Average selling price of beef cattle (Asellpri), Frequency of farmer gets market information (Fregminf), Average body condition of owned cattle (Abodycoc) and Total number of cattle owned (Tnumcat) are found to be significant (table 8).

Explanatory variables significantly affecting quantity of beef cattle supplied to the markets were discussed as follows:

Education level of household head (Educn): The model output showed that education level of household head has positive and significant impact on quantity of beef cattle supplied to the market of the sampled household producers at less than 5% significance level. This indicates that there is positive relationship between quantity of beef cattle supplied to the market and educated household headed. This may be due to educated cattle keepers are more likely to use the market information more efficiently thus negotiate for a higher price for their cattle resulting into more supply of cattle to the market. The coefficient also confirmed that, as education level of household head increases, the probability of quantity of beef cattle supplied to the market increased by 0.43 units, keeping other factors constant.

Household size of the respondent (Houshdsz): As expected, household size as an independent variable affects quantity supply of beef cattle producers in the markets positively and significantly at less than 1% significance level. As [9] argued in his study, families with more household members tend to have more labour and production in general and marketable surplus in particular is a function of labour. Coefficient showed that as household size increases by a head, the probability of quantity of beef cattle supplied to the market increases by 0.29 units, keeping other factors constant. An increase in the household size is expected to increase the demand for market goods thus an increased demand for cash that will subsequently increase the cattle keepers' sales [9].

Using veterinary services (Usvetse): Access to veterinary service has an expected outcome. It is found to affect quantity of beef cattle supplied to markets positively and significantly at less than 1% significance level. As the sampled household producers start receiving veterinary service for beef cattle their probability of quantity of beef cattle supplied to markets increases. As a result, the coefficient confirmed that having access to veterinary service increases the quantity supply of beef cattle to markets by 1.48 units, keeping other factors constant.

Table 8. Results of second-stage Heckman selection estimation of determinants of beef cattle quantity supply to the market.

Variables	Coefficient	Std. Err.	P> t
Sex	0.1785372	0.3594066	0.619
Educn	0.4359377**	0.1795513	0.015
Houshdsz	0.2961724***	0.0530041	0.000
Usvetse	1.482277***	0.4130605	0.000
Grazland	-0.4814205**	0.2343522	0.040
Asellpri	0.0002171***	0.0000578	0.000
Exsell	0.0231324	0.028937	0.424
Fregminf	0.6564244***	0.1442383	0.000
Abodycoc	0.5044225***	0.1445224	0.000
Tannuico	3.85e-06	3.12e-06	0.217
Tnumcat	0.170353***	0.0378139	0.000
lambda	0.1364353***	0.0338228	0.000

Source: field survey, 2019

Dependent variable =Quantity of beef cattle supplied to the market, ***, **, and * represents significance level at less than 1%, 5% and 10% probability level, respectively.

Grazing land owned (Grazland): In disagreeing to the previous expectation, grazing land owned negatively and significantly affected quantity of beef cattle supplied to the market at less than 5% significance level. The negative relationship between quantity of beef cattle supplied to the markets and grazing land owned indicates that market oriented beef cattle production does not necessarily require large grazing land. The model output further confirmed that quantity of beef cattle supplied to the market decreases by 0.48 units as grazing land owned of household producer increases by 1 hectare, keeping other factors constant.

Selling price of beef cattle (Asellpri): As hypothesized selling price is one of the important variables affecting quantity of beef cattle supplied to the markets. The coefficient of this variable was positive and statistically significant at less than 1% significance level. This showed that for every one unit increase in selling price (1 birr/cattle) of the beef cattle, there would be increase in the probability of quantity of beef cattle supplied to the market by 0.0002171 units, holding other factors constant. The result indicates that household producers were more sensitive to selling price and positive relationship between selling price of cattle and quantity of beef cattle supplied to the market. Correspondingly low prices reduce cattle keepers' chances of realizing profits from the enterprise and reduce their quantity

supply. Stable and attractive prices are a major incentive for smallholder agricultural producers [10].

Frequency of farmer gets market information (Fregminf): As it was hypothesized, access to market information has positive relationship with household producers supplied beef cattle to the market and was statistically significant at less than 1% probability level. This is because; farmers supplying beef cattle to the market are based on market price information, and poorly integrated markets may convey inaccurate price information, leading to inefficient produce movement. The coefficient of the variable confirmed that keeping other factors constant, increasing frequency of farmers get market information leads likelihood of household producers supplied beef cattle to the market increases by 0.65 units. [10] found that the provision of market information will strengthen the cattle keepers' negotiation during transactions with buyers and consequently prevent possible exploitation by better informed buyers.

Body condition of owned cattle (Abodycoc): The coefficient for body condition score of cattle was positive and statistically significant at less than 1% significance level. As a result, good body condition of beef cattle leads to a increase probability of producers' quantity supply in beef cattle to the markets by 0.50 units, keeping other factors constant. Beef cattle with good body condition are more demanded by buyers and at good market price than others which have poor

body condition/appearance that influence quantity supply of beef cattle to the market positively.

Total number of cattle owned (Tnumcat): As it was expected, the number of beef cattle owned by a household could have a significant and positive impact on the quantity supply of beef cattle to the market. This variable is significant at less than 1% significance level and has a positive effect on marketable beef cattle quantity. The model output predicts that the addition of one beef cattle to the household producers leads to an increase in the quantity of beef cattle supply to the market by 0.17 units, keeping other factors constant. This result is believable and suggests that marketable beef cattle surplus of the household producers in the study areas are more responsive to number of cattle owned. It is assumed that household with larger number of beef cattle have better income and financial position to purchase sufficient amount of inputs [10].

Lambda: Inverse Mills ratio (lambda) is found to affect quantity of beef cattle supply to markets significantly at less than 1% significance level. This implies covariates that condition the quantity of beef cattle sold operate conditional on the probability to participate in beef cattle markets as a seller. This indicated sample selection bias existence of some unobservable household characteristics affecting likelihood to participate in beef cattle market and thereby affecting quantity of beef cattle supply.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

The overall conclusion from the results was that beef cattle production is traditional and not market-oriented. Producers sell their cattle when they are in need of cash. They also sell any cattle that happen to be available, rather than what the consumer demand. Beef cattle market participation decision was significantly determined by sex of household head, education level of household head, body condition of cattle owned, grazing land owned, frequency of farmers visited by the extension agents, frequency of farmer gets market information and selling price of beef cattle. Again variables such as education level of household head, household size of the respondents, using veterinary services, grazing land owned, selling price of beef cattle, frequency of farmer gets market information, body condition of owned cattle and total

number of cattle owned are found to be significantly determines quantity of beef cattle supplied to the markets in the study areas. Improving farmers' access to services, market information and training by improving the linkage between farmers and service provider institutions. This study also recommends linking the districts with national livestock market information system and provision of market information to farmers and enabling them to produce market oriented products and supplying to the market.

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