

Determinants of Cow Milk Commercialization in Yabello District, Borana Zone of Oromia National Regional State, Ethiopia

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Abstract

Milk is an important dairy product socially and economically in pastoral area of Ethiopia generally and Yabello district particularly. It is a source of food and cash income for the majority of milk producers. This study was aimed at analyzing cow milk market participation and determinants of cow milk commercialization. Data were collected from 154 randomly selected producers in the district through a structured questionnaire. Both descriptive statistics and econometric models were used to analyze the data. The double hurdle model was used for analyzing cow milk market participation (first hurdle) and determinants of cow milk commercialization (the second hurdle). In first hurdle, the result of Probit Regression Model revealed that cow owned (TLU), cooperatives membership, production experience, market place, availability of labor force (adult equivalent) and age of the household head played a significant role in cow milk market participation. In the second hurdle, the result of Truncated Regression Model revealed that cows owned (TLU), milk production experience (year), market distance and age of the household head were found to significantly influence the cow milk commercialization in the study areas. Therefore, focuses are needed to support households for dairy commercialization in the study area. Especially, focus should be given to the establishment of a market place for milk and dairy product, supporting cooperative, selection of local breed, which determine the cow milk commercialization in the study area.

Keywords: dairy commercialization, Yabello, Smallholder, Market Participation, Tobit, probit

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1. INTRODUCTION

Agriculture sector remains a key for the national economy of Ethiopia. It accounts for 36.7% of overall GDP, 70% of foreign exchange earnings and also the sector provides employment opportunity for 72.7% of the population and is a means of generating livelihood for about 83% of the rural population (ATA, 2017). The Ethiopian government, in its two-consecutive five years Growth and Transformation Plan (GTP-I and GTP-II), has given much emphasis on agricultural commercialization, among which the second pillar aims to achieve growth and thereby improve people's livelihoods and reduce poverty (MoFED, 2015).

Commercialization of the smallholder farmers has been seen by the government as the major source of agricultural growth in Ethiopia. The government of Ethiopia implemented agricultural commercialization clusters with the primary goal of commercialization of smallholders' agriculture and agro-industrial development, contributing to a strategic access point for private sector engagement (Pauw, 2017).

Livestock production as one component of the agriculture industry plays an important role in the economic and social development of Ethiopia at national and household level. The country holds large potential for dairy development due to its large livestock population, the favorable climate for improved, high-yielding animal breeds, emerging market opportunity, improved policy environment for involvement of private sectors, and the relatively disease-free environment for livestock (Matawork, 2016).

In the economy of the country, livestock is the main household asset and a key productive resource for pastoralist communities especially living in the border areas of Ethiopia. Thus, the pastoral area owns about 40 percent of the country's total livestock population. The livelihood of pastoral communities of the Oromia lowlands mainly Borana is based on livestock and livestock products. Borana zone is one of the pastoralist zones depending on livestock rearing, which have livestock population of 1,056,040 cattle, 868,571 goats, 573,369 sheep, 1096 horses, 3149 mules, 81,023 donkeys, 51,607 camels, 490,717 poultry and 64,699 bee-keeping (CSA, 2017).

Milk is one of the most important livestock products and the main diet for pastoralists in the Borana pastoral communities. It is also used as the main income sources for the women pastoralists (CARE, 2009). In Borana pastoral communities, the total overall average milk produced is estimated to be 129,029 tons. Daily it is 353,504 liters, of these milk constitutes 69,864, 58, 016, and 1,149 tons from cows, and camel and shoat milk, respectively. In terms of the market share cow, camel and shoat milk constitute 59.4%, 39.4% and 31.2% respectively. However, Borana pastoralists were not economically benefited to the extent it should be. Similarly, both the productivity and

price variability is higher in pastoral areas whereas the product may vary due to unpredictable rains and other natural hazards (Yacob and Catley, 2010). Therefore, identifying the factors that determine cow milk market participation and commercialization is very important for both research and development interventions to improve and diversify the income of households.

1.1. Objectives of the Study

The major objective of this study is to identify the determinants of cow milk commercialization in Yabello District of Borana Zone, Ethiopia.

The specific objectives of the study are:

1. To identify the factors that determine cow milk market participation in the study
2. To identify the determinants of cow milk commercialization in the study area

2. RESEARCH METHODOLOGY

2.1. Description of the Study Area

The study was conducted in Yabello district of the Borana zone of the Oromia Regional State. The Yabello districts is one of the 13th districts of Borena zone located at Central of the Zone and also Zonal capital which is located at 570 km from Addis Ababa to Southern at main road of Addis Abeba to Moyale. According to the information obtained from Woreda Administration and Communication Office the total population of the district were 63,648 out of which 36,382 were men and 27,266 were female. The total households of rural kebeles of the district were 10,048 out of which 7880 were male and 2168 were female. The estimated area of the district is 555,000 square kilometers with an estimated population density of 14.9 people per square kilometer, which is less than the zone average that is 21.1 people per square kilometer.

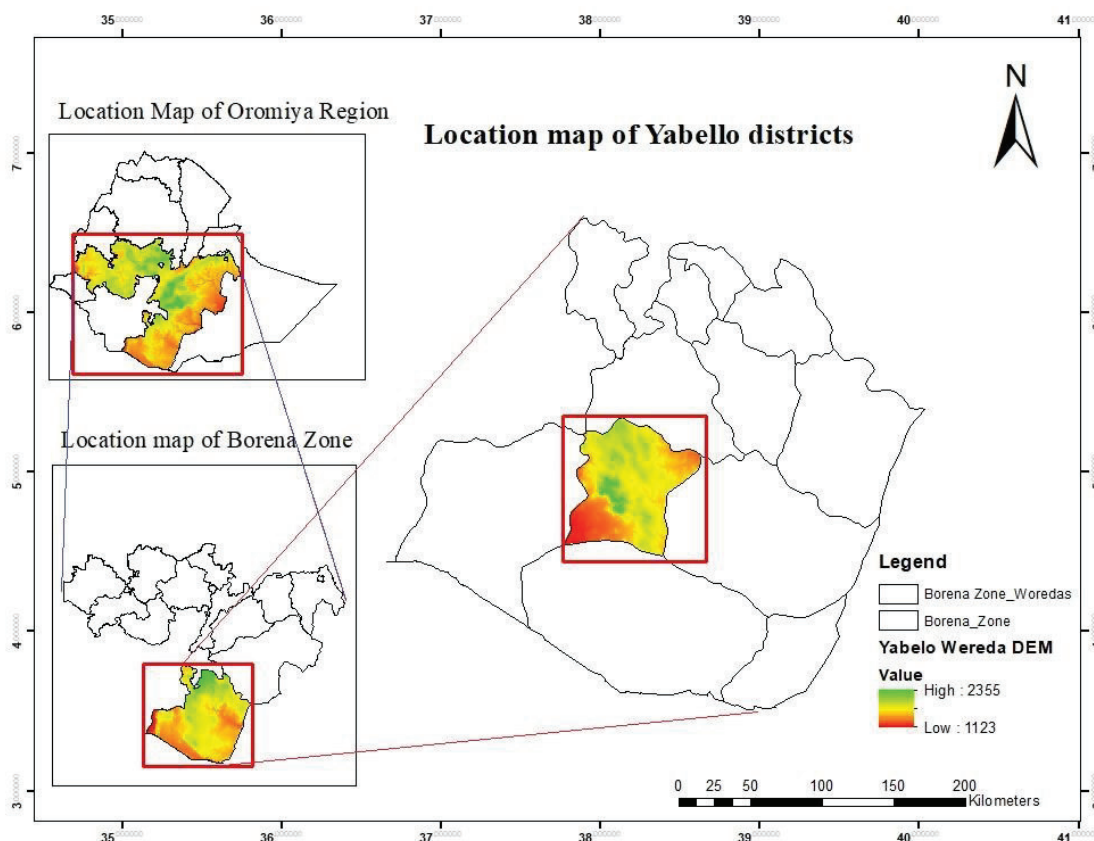


Figure1. Location of the study area

2.2. Data Type, Sources and Methods of Data Collection

Both quantitative and qualitative data were collected from of primary and secondary sources. Primary data were collected from randomly selected milk producers and checklist was used to generate data through group discussion and key informants. Personal observation and informal discussions were made to elicit information to support the data obtained from the producers. Besides primary data, secondary data were reviewed from various sources such as documents from the district office of livestock and pastoral development and empirical findings related to the topic of interest. Structured and semi-structured interview schedules and checklists were developed and pre-tested

to collect data from producers. Trained enumerators, who are familiar with the local culture and language, were used to conduct the survey.

2.3. Sampling Procedures and Sample Size Determination

Purposive and two stages random sampling procedure was used for the selection of sample household heads. Yabello district was selected purposively since it is the potential. In the first stage, four cow milk-producing kebeles; namely; Haro bake, Yubdo, Dadim, and Dikale were selected randomly. In the second stage, from the total of 2801 households in the selected four kebeles, 154 sample household heads were selected randomly, using probability proportionate to the size of cow milk producer's households in the kebeles. to determine the required sample size, this study used a simplified formula developed by Yamane (1967) was used to minimize the availability of error and bias during sample determination. Therefore, the required sample size at 95% confidence level with a degree of variability of 5% was used to obtain a sample size required to represent the true population. The total sample size (n=154) was determined following a simplified formula provided by Yamane (1967).

$$n = N / 1 + N(e)^2 \quad (2)$$

Where: n = sample size, N = population size (sampling frame) and e = level of precision.

Table 1: Sample distribution of households of cow milk producer in selected kebeles

Name of kebele	Total number of Households (cow milk producers)	Number of sampled households
Yubdo	657	36
Haro bakes	413	23
Dikaale	1195	66
Daddim	536	29
Total	2801	154

Source: Yabello District Pastoral Office, (2019) and own computation result

2.4. Methods of Data Analysis

Both descriptive statistics and econometric model were employed for analyzing the data collected from smallholder cow milk producers.

2.4.1 Descriptive statistical analysis

Descriptive statistical analysis method such as mean, proportions, percentages, and standard deviations were used.

2.5. Econometric Analysis

In this study, the cow milk market participation and commercialization index are the dependent variables. the double hurdle model was selected and used for the sake of analyzing cow milk market participation (first hurdle) and determinants of cow milk commercialization (the second hurdle) of cow milk producer. The first hurdle model, which is probit is used in estimating the factors determining the probability of participation in cow milk market. Truncated regression as one part of Double hurdle model has been used in estimating the determinants of cow milk commercialization.

Participation decision equation is specified as follows:

$$Y_{i1}^* = X_1 \beta_1 + \varepsilon_{i1}, \varepsilon_{i1} \sim N(0, \delta_{12}) \quad (3)$$

$$Y_{i1} = \begin{cases} 1, & \text{if } Y_{i1}^* > 0 \\ 0, & \text{if } Y_{i1}^* \leq 0 \end{cases}$$

Cow milk commercialization equation is specified as:

$$Y_{i2}^* = X_2 \beta_2 + \varepsilon_{i2}, \varepsilon_{i2} \sim N(0, \delta_{22}) \quad (4)$$

$$Y_{i2} = \begin{cases} X_2 \beta_2 + \varepsilon_{i2}, & \text{if } Y_{i1}=1 \text{ and } Y_{i2}^* > 0 \\ 0, & \text{if } Y_{i2}^* \leq 0 \end{cases}$$

Where Y_{i1}^* is unobserved (latent) variable for the cow milk market participation decision

Y_{i1} is the observed discrete decision of the producer whether he/she has participated or not in cow milk market, the subscript i refers to the i^{th} household, the subscripts 1 and 2 refer to the variable and parameters related to the participation equation and the level of participation, respectively.

X_1 's are the index of explanatory variables determining the participation decision of the producer in cow milk market,

X_2 's are the index of explanatory variables determining the determinants of cow milk commercialization.

β_1 refers to the index of parameters related to explanatory variables determining participation decision of the

producer,

β_2 refers to the index of parameters related to explanatory variables that determining the determinants of cow milk commercialization by producers,

ϵ_{i1} is the error term of the participation equation which is normally distributed ($\epsilon_{i1} \sim N(0, \delta_1^2)$), with zero mean and constant variance,

ϵ_{i2} is the error term equation which is normally distributed ($\epsilon_{i2} \sim N(0, \delta_2^2)$) with zero mean and constant variance,

Y_{i2}^* Unobserved (latent) variable for the participation of producer in cow milk market,

Y_{i2} is the observed actual number of the cow milk market

Analysis of the Marginal Effects of Participation Decision

The marginal effects that are determined from the estimation of probit part of double hurdle model in this particular study interest could be determined by using the formula of partial derivations/ partial effects.

The marginal effect, the effect of a unit change or discrete change in explanatory variables on the probability of participating milk market can be given as follows.

$$\frac{\partial P(Y_{i1}=1/X_i)}{\partial x_j} = \beta_j \phi(X\beta) \quad (5)$$

Where β_j is the coefficient on x_j and $\phi(x\beta)$ is the standard normal probability density function which would be

evaluated at $(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots)$.

For the continuous explanatory variables, these marginal effects are used to calculate elasticity at the sample means because the slope of the dependent variable is not constant at different per unit change of the variables. For the discrete or categorical variables, the marginal effects are used to calculate percentage changes in the dependent variable when the variable shifts from zero to one, ceteris paribus.

2.6. Definition of Variables and Working Hypotheses

To identify the factors affecting cow milk market participation decision and the determinants of cow milk commercialization of producers, the definition and hypothesis as to how these factors are related to the dependent variables are required. Accordingly, the dependent and independent variables are defined and hypothesized as follow.

Dependent variables

Milk market participation (SALE): It is a dummy dependent variable that represents the probability of milk market participation of households. The variable takes the value one for a household who participates in milk market whereas it takes the value of zero for the household who does not participate in the milk market. This is regressed in the probit model framework (The first hurdle).

Commercialization index (HCI): It is a limited dependent variable, which is measured as the ratio of the gross value of milk sales to a gross value of milk produced by the household in 2018/19 production year and it is expressed in percentage. This is regressed in the truncated model framework (The second hurdle).

Table 2: Summary and hypothesis of independent variables for market participation and commercialization of cow milk

Variable	Type	Measurement	Expected sign
Age	Continuous	Age of household	+
Sex	Dummy	1 if the household head is male and 0 otherwise	-
Milk production experience	Continuous	Number of years of involving in milk production	+
Family size	Continuous	Number of family members in the household	-
Distance	Continuous	Distance from town/market in kilometers	-
Market place		1 if there is shade for milk in the market area or 0 other	+
Nonfarm/off farm income	Continuous	monetary value(ETB) and shows the amount of income obtained from other activities	-
Extension contact	Dummy	1 if the person is have extension contact or 0 otherwise	+
Cooperatives	Dummy	1 if the person is a member of cooperatives or 0 otherwise	+
Education	Continuous	the household head Access to education	+
Number of cows	Continuous	number of milking cows owned by a household in Tropical Livestock Unit (TLU)	+
Land	Continuous	The size of the household land holding for grazing	+

3. RESULTS AND DISCUSSION

3.3.1 Descriptive statistical analysis

Among 154 sample respondents, 129 of them were cow milk market participants and the rest 25 respondents were non-participants. Group comparison of the market participants and non-participants was figured out using χ^2 -test for dummy variables and t-test for continuous variables, as it is presented in Tables 3 and Table 4 respectively..

As indicated in Table 3, regarding cooperative memberships out of total sample respondents, 27(16.23%) were cooperative members and the remaining 127(83.77%) were not organized under cooperatives. Concerning to milk market places, from total sample respondents 21 (13.6%) households have appropriate milk market place whereas 133 (86.4%) have no milk market place among market participants. In terms of extension services, out of the total sample respondents, 14 (7.8%) have to access to extension service while 142(92.2%) have not.

Table 3: Test statistics of market participant and non-participant (chi²/Fisher's exact test)

Variables	Participants		Non-participants		Total		χ^2 -value
	N	%	N	%	N	%	
Cooperative membership							
Involving	26	20.2	1	4.00	27	16.23	3.7801*
Excepted	103	79.8	24	96.0	127	83.77	
Availability of Milk Market Place							
Exist	8	38.10	13	61.9	21	13.64	37.2976***
Missed	121	90.98	12	9.02	133	86.36	
Access to Milk Extension services							
Access	16	100.00	0	0.00	12	7.79	3.4603*
Not access	113	81.88	25	18.12	142	92.21	

Source: Own survey result, 2019

***, ** and * implies statistically significance at 1, 5, and 10% levels, respectively.

The mean of dairy milk selling experience of milk market participants and nonparticipants were 4.9 and 0 respectively. With regard to distance to the nearest market, the producers sold their milk products walking 6.5 hour on average. In the study area, mixed crop and livestock farming system were practiced which is dominated by livestock productions. Livestock resources are useful in the livelihoods of smallholder's producers.

Table 4: Summary statistics of variable by market participation status (continuous variable) mean and standard error

Variables	Participant (n=129)	Non-participant (n=25)	Total (n=154)	t-value
Milk selling Experience (Years)	4.96±0.36	0	4.15±0.34	5.98***
Total No of Livestock (TLU)	11.43±7.29	6.47± 2.66	10.63±6.99	3.35***
No cow owned (TLU)	3.07±3.426	1.8±1.756	2.863±3.244	1.80*
Distance to the nearest market (Hr.)	6.95±0.70	4.20±1.57	6.50±0.64	1.64*

Source: Own survey result, 2019

***, ** and * implies statistically significance at 1, 5, and 10% levels, respectively.

3.2 Econometric Analysis

Prior to the econometric analysis, essential tests that verify the model to employ for the analysis were undertaken on hypothesized variables. The double hurdle model was applied to analyze determinants of cow milk commercialization and market participation. This double hurdle model involves two-step estimation procedure. In first stage, probit model was used to explore factors governing market participation decision for a given reference period which is referred to as commercialization decision in this study.

3.2.1 Factors determining cow milk market participation

The result of probit model estimation that whether the household's decision to participate in cow milk market or not (Table 5). The probit model has been estimated by the maximum likelihood method. Marginal effect was used as a useful measure to explain the result as coefficients of the probit model are difficult to interpret since they measure the change in the unobservable y^* associated with a change in one of the explanatory variables (that is, not partial effects). The overall model is significant at 0.000 levels as indicated by log likelihood value of -43.108. Moreover, based on pseudo R² of 0.369 the model appears to have good fit to the data (Table 5).

Cow ownership: As expected the variable has positive and significant effect at 1% on households' cow milk market participation. The positive and significant relationship between the two variables indicated that as the number of milking cows owned increased by a TLU, the milk production per household increases, turn increasing the percentage share of cow milk sold per day per households. The marginal effect of the variable confirm that a unit increase in milking cow by TLU leads the probability of participating in milk market to rise by 3.2 % (Table 5). The result is in line with Berhanu *et al.* (2014).

Cooperatives membership: As expected the variable has positive and significant effect at 5 % on households' cow milk market participation. The positive and significant relationship between the two variables show that the households who are cooperative member had access to sell their milk at a cooperative place that minimizes the time they devote to sell milk at the market place and transportation costs and this motivates the households to participate in milk markets. The marginal effect of the variable confirms that as the household member of cooperatives the probability of participating in milk market to rise by 7.1 %.The result is in line with Geremew, 2016.

Milk production experience: As hypothesized milk production experience of the household was found to have positive and significant effect on cow milk market participation at 1%. This indicates that household heads who have more milk production experience are expected to be more knowledgeable, this improves the productivity and quantity of milk sold turn leading to an increase in the probability of cow milk market participation The marginal effect of the variable confirm that as the year of milk production of the household increased, market participation of cow milk increases by 1.3 % (Table 7). The result is contrary with Berhanu *et al.* (2014).

Table 5: Estimated cow milk market participation model part of double hurdle (probit part)

Independent Variables	Coefficients	Robust Std. Err.	P> z	Marginal Effects (dy/dx)
Education level of the household	-0.484	0.388	0.212	-0.065
Cow ownership(TLU)	0.308	0.113	0.007 ***	0.032
Cooperatives membership	1.150	0.559	0.040 **	0.071
Milk production experience	0.126	0.051	0.013 ***	0.013
Extensions service	0.694	0.489	0.156	0.047
Land holding size	0.016	0.071	0.820	0.002
Market distance	-0.002	0.002	0.237	0.000
Access to market information	-0.711	0.450	0.114	-0.049
Market place	1.979	0.401	0.000***	0.489
Household size (Adult Equivalent)	-0.117	0.067	0.081*	-0.012
Age of the head	-0.151	0.055	0.006 ***	-0.016
Sex of household	-0.640	0.415	0.123	-0.048
Access to credit service	-0.640	0.402	0.442	-0.037
Income from off farm (ETB)	0.000	0.000	0.374	0.000
Constant	6.202	1.414	0.000***	
Number of Obs. = 154 Wald chi2(14) =55.82 Prob> chi2 = 0.00 Pseudo R2 = 0.369 Log likelihood = -43.108				y=Pr(SALE) (predict) =0.95

Source: Own computation result, 2019

Note: Symbols ***, ** and * indicates significant at 1%, 5% and 10% levels, respectively.

Market place (MKTPC): Market place was found to positively and significantly contribute at 1% on the cow milk market participation. This indicated that appropriate and permanent market place to sell their milk product helps households to participate in the market that could increase the probability of cow milk market participation. The marginal effect showed that getting access to suitable market place by milk sellers will increase the probability of cow milk market participation by 48.9% (Table 7). The result coincides with (CARE, 2009).

Household family size: As contrary to hypothesize the variable is found to negatively and significantly affect participation in cow milk market at 10%. This indicates that the household with small family size had higher marketable milk surplus than households with larger family size and it indirectly affect the cow milk market participation. The negative impact of household size indicated that the higher the number of household members, the more they will consume their production. In other way, an increase in family size may also increase the number of dependent family members which would in turn increase the number of mouths to be fed and disproportionate volume of production and hence contribute to a decrease in the level of market participation. The marginal effect of the variable confirms that as member of household added to the family, the market participation of cow milk decreases by 1.2 % (Table 7).The results inconsistent with the findings of Aman Tufa *et al.* (2014) and agree with (Koskeiet *al.*, 2013)

Age of the house head: The result is contrary to prior expectation. The variable had negatively and significantly influenced households' participation in cow milk market at 10%. This indicate that old aged household heads are more probable to minimize their livestock number due to their inability to feed them by cut and carry system as well as taking them to far remote grazing areas. Also they traditionally perceive milk to be used only for house consumption. The marginal effect indicated that as the age of the household head increases by

one year, the probability of cow milk participation decreases by 1.6 % (Table 7). This result agreed with the results of Woldemichael (2008) and Berhanu *et al* (2014), Cunningham *et al.* (2008) and Mahelet (2007) shows that age of the head negatively and significantly affects the degree of market participation.

3.2.2. Determinants of commercialization of cow milk producer

The factors that determine commercialization of cow milk producers was analyzed using truncated regression model.

The Truncated regression model estimated results showed that the likelihood function of commercialization index was significant at 1% level indicating a strong explanatory power of independent variables to explain level commercialization of cow milk producers. The model result indicated that, out of explanatory variables used in the model; cow owned (TLU), cow milk production experience (year), market distance and age of household were found to significantly influencing the commercialization of milk producers in the study areas (Table 8).

Cow owned: Number of cows owned measured in TLU was found positively and significantly contribute to the level of cow milk commercialization at 1% significance level. This indicated that, as the number of milking cows owned increased by a TLU, the milk production per household increases. As a result the percentage share of milk sold per day per household's increase in turn increasing the probability of cow milk commercialization. The positive coefficient of livestock possession implies that an increase in cow possession by one TLU would increase the value of cow milk outputs of the household sold by about ETB 393.2. The result is in line with the finding of Getaneh (2005).

Milk production experience: As hypothesized milk production experience of the household head was found to have positive and significant effect on the level of cow milk commercialization at 1% significance level. The positive and significant relationship between two variable indicate that, the household heads who have longer milk production experience are expected to be more knowledgeable, this improves the productivity and quantity of milk sold this in turn could be increases the probability of cow milk commercialization. On average, more experience household earns about ETB 421.36 more as compared to less experience household head from sales of cow milk. This result in line with: (Edward *et al.*, 2012) and (Staal *et al.*, 2006)

Market distance: as expected distance to the nearest market was found negatively and statistically significant influence on level of cow milk commercialization at 5% level. The shorter the time taken to reach the nearest market would result to a greater degree of commercialization of cow milk. Distance to market was negatively affecting the value of milk sold possibly because of the increased transaction costs associated with marketing of the products. This implies that the location of producer in respect of potential markets is an important factor in encouraging producers to increase their sales. The shorter the time taken to reach the nearest market would result to a greater degree of commercialization of cow milk. This result is in conformity with the findings of Berhanu and Moti (2010), which found that being closer to market, enhance commercialization of cow milk

Age of the head: As opposite to expectation, age of the household head had negative and significant impacts on the level of cow milk commercialization at 1% significance level. This indicates that the young aged household heads use more input for dairy cows and have more milk participation that could increase the probability of cow milk commercialization. This finding was in agreement with the work of scholars such Tshionza *et al.*, (2001) and Berhanu *et al.*, (2014) and disagrees with.

Table 6: Estimation of truncated part of double hurdle

Independent Variables	Coefficients	RobustStd. Err.	P> z
Education level of the household	-134.942	2244.97	0.821
Cow ownership(TLU)	393.216***	182.066	0.006
Cooperatives membership	-2132.069	2254.118	0.295
Milk Production Experience	421.36***	154.29	0.000
Extensions service	1421.82	2263.06	0.371
Land holding size	-872.0337	505.9314	0.125
Market distance	-9.210989**	7.700695	0.036
Access to market information	-3552.424	1964.394	0.322
Market place	2268.289	2770.278	0.207
Household size (Adult Equivalent)	187.2218	122.4358	0.928
Age of the head	-346.7945***	147.2641	0.000
Sex of household	4406.946	2355.002	0.402
Access to credit service	254.833	1789.523	0.295
Income from off farm (ETB)	0.1509219	0.10249	0.759
Constant	6055.507***	4702.395	0.000
Sigma	5465.386	701.0462	0.000

Source: Own computation result, 2019

Note: Symbols ***, ** and * indicates significant at 1%, 5% and 10% levels, respectively.

4. CONCLUSION AND RECOMMENDATIONS

The study aimed at analyzing cow milk commercialization in Yabello district of Oromia National Regional, State Ethiopia. The specific objectives of this study were to analyze the cow milk market participation and the determinants of cow milk commercialization. The Primary data were collected from randomly selected 154 milk producer households in four kebeles. Descriptive statistics and econometric models were used to analyze the collected data. Double hurdle model was employed to identify the factors determining commercialization. Double hurdle model involves two-step estimation procedure. In first stage, probit model was used to explore factors governing market participation decision and the truncated regression to analyze determinant of cow milk commercialization.

The result of probit estimation shows that the likelihood of household participation in cow milk market were influenced by owned (TLU), Cooperatives membership, production experience, market place, availability of labor force (Adult equivalent) and age of the household head. The Truncated regression model results shows that cow owned (TLU), cow milk production experience (year), market distance and age of household were found to significantly influencing the commercialization of milk producers in the study areas.

From the findings of this study the following relevant recommendations are forwarded in order to formulate appropriate intervention in this area. The recommendations are the following: Number of cows owned has positive and significant impact on cow milk market participation and commercialization. So, increasing the herd size with good milk producing cows should be emphasized to benefit producers. Thus to increase cow milk commercialization; there needs to be a crucial intervention by concerned development actors and partners for feed and water problem; in order to enable a stable feed and water supply throughout the year.

Cooperative member has positive and significant impact on cow milk market participation. The variables show that the households who are cooperative member had access to sell their milk at a cooperative place that minimizes the time they devote to sell milk at the market place and transportation costs and this motivates the households to participate in milk market. Therefore, the concerned body supports cooperative members through financing and training in order to increase the commercialization of cow milk producer.

More experienced households are better in cow milk market participation and commercialization. Provision of training to the pastoral communities is imperative so as to improve their knowledge and skills on the management of dairy animals. Thus, should be able to increase the awareness of households through experience sharing events in order to increase cow milk commercialization.

An increase in household size was found to have negative and significant influence on cow milk market participation. This is because households with large household member consume more proportion of cow milk produce and reduce the amount that is going to be sold. Since production resources are limited intervention on family planning based on interest of pastoral, by showing its negative impact is important in the study areas.

Market distance the shorter the time taken to reach the nearest market would result to a greater degree of commercialization of cow milk. as a result, improving rural infrastructure in developing market infrastructure in the form of establishing produce collection points across rural areas would assist poor producer for faster delivery

The results of the study showed that age of household head is negatively affecting cow milk participation and the level cow milk commercialization. This means old aged household heads are more probable to minimize their livestock number due to different reasons. Hence, supporting older aged households through training to participate in cow milk marketing is important for cow milk commercialization. Therefore there is a need for investment in areas such as transport systems, improvement of market place and setting up modern market infrastructure.

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6. Appendix Tables

Appendix Table 1 Conversion factor of Tropical Livestock Unit (TLU)

Livestock Category	TLU	Livestock Category	TLU
Camel	1.25	Donkey (young)	0.35
Ox	1.00	Horse	1.10
Cow	1.00	Sheep (adult)	0.13
	0.34	Sheep (young)	0.06
Heifer	0.75	Goat (adult)	0.13
Calf	0.25	Goat (young)	0.06
Donkey (adult)	0.7	Poultry	0.013

Source: Storck, *et al.*, 1991

Appendix of the Table.2. Conversion factor used to compute man equivalent (Labour Force)

Age group	Male	Female
< 10	0.60	0.60
10-13	0.90	0.70
14-16	1.00	0.75
17-50	1.00	0.75
>50	1.00	0.75

Source: Samuel and Sharp, 2008