Determinants of Participation in Milk Value Addition by Dairy Producers in Asella Milk-Shed, Ethiopia

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Abstract

Dairy producers in Ethiopia practice mainly traditional milk processing methods, and also recognize the benefit of milk value addition to increase income, minimize postharvest losses and prolong shelf life. Contrary to the existing knowledge, producers' participation in the value addition is generally limited to few traditional products. The objective of this study was to examine determinants of participation in milk value addition practices by milk producers in Asella milk-shed. The respondent dairy farmers (n= 178) were selected randomly by employing multi stage sampling techniques; following purposeful selection of the study district and kebeles. Heckman's two stage model was used to assess determinants of participation in the decision and extent of participation in milk value addition practices at farm level. The present study indicated that 77% of the households had added value to their milk products. The results of the Heckman's two stage model showed that milk value addition decision is positively and significantly affected by perceived price of value added products, access to livestock extension services, family size and level of education by household heads. The decision to participate in milk value additions were negatively affected by the number of children under six years of age, household head's age, membership to primary dairy cooperatives and owning only cross breed cows. On the other hand, the volume of milk produced, amount of non-dairy income, and access to livestock extension services positively affected the extent of participation in milk value addition. The results suggest that the decision to participate in value addition and extent of value addition depends on household characteristics, perceived benefit of value addition, access to extension service and breed type. Hence, due attention should be given to enhance households' capacity to add value by creating awareness, strengthening extension service and productivity.

Key words: Heckman Two Stage; Milk-Shed, Value Addition

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INTRODUCTION

Ethiopia has a considerable potential for dairy production, and thus for dairy value chain development opportunities. The country has 59.48 million cattle of which 11.83 million are dairy cows (CSA, 2016). From the total cattle population, the Oromia regional state owns 40.6% and 40.8% of the cattle and milking cow population, respectively. In spite of this potential, the dairy sector is not well developed and thus economic benefit to dairy producers as well as value adding actors is yet to improve (Sarah, 2011).

According to CSA (2016), Ethiopia produces approximately 3.1 billion liters from 11.8 million milking cows. The average milk production per cow per day is only 1.37 liters, which elapses for about six months lactation period.

Despite the low production and productivity of milk in the country, value addition is still pertinent strategy as dairy product consumption is highly seasonal and as most farmers are far from market access for their milk. As reported by Berhanu et al. (2011), most farmers in Ethiopia add values to milk, using old age traditional methods to get products such as butter, cottage cheese, skimmed milk and whey (byproducts from cottage cheese).

There are several empirical evidences that show peculiar differences in the characteristics of Ethiopian dairy value addition exercises, recognizing spatial and temporal variations (Asfaw and Jabbar, 2008; Berhanu and Dirk, 2008; Kedija et al., 2008; Asfaw, 2009; Bereda et al., 2014). Although dairy producers in Ethiopia and the present study area (Asella milk-shed) have abundant indigenous knowledge on milk value addition practices, limited study appreciated the existence of differences within similar cultures and agro-ecologies. The purpose of the present study is to contribute to the knowledge base by assessing main drivers to milk value addition practices and quantify the levels of participation in Asella milk-shed.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Asella milk-shed located in Tiyoworeda (Fig. 1). Asella milk shed was selected purposively as it is one of potential dairy producing areas in the country. Asella milk-shed covers 18 kebeles (the smallest administrative structure) and 3 rural based towns, namely, Gonde, Kulumsa and Ketar (WARDO, 2013). Tiyoworeda has 18,850 male headed and 4,244 female headed farm households. Asella town is the capital of Tiyoworeda and is located about 175 kilometers south-east of Addis Ababa with a latitude of 7°57′N and longitude of 39°7′E. Asella milk shed is characterized by mid subtropical agro-ecology with annual temperature ranging from 5-28^{0}Cand elevation ranging from 1780-3100 ma.s.l.

Mixed farming is the dominant farming system prevailing in the study area. The major crops grown in the woreda include barley, wheat, teff, potato, faba beans, maize and field peas. The woreda is recognized as surplus producing woredas in the region, and also have high livestock production. The agro-climatic condition of the woreda is classified as 52% mid altitude (Woyinadega), 37% high altitude (dega) and 11% low altitude (Kola) (WARDO, 2013).

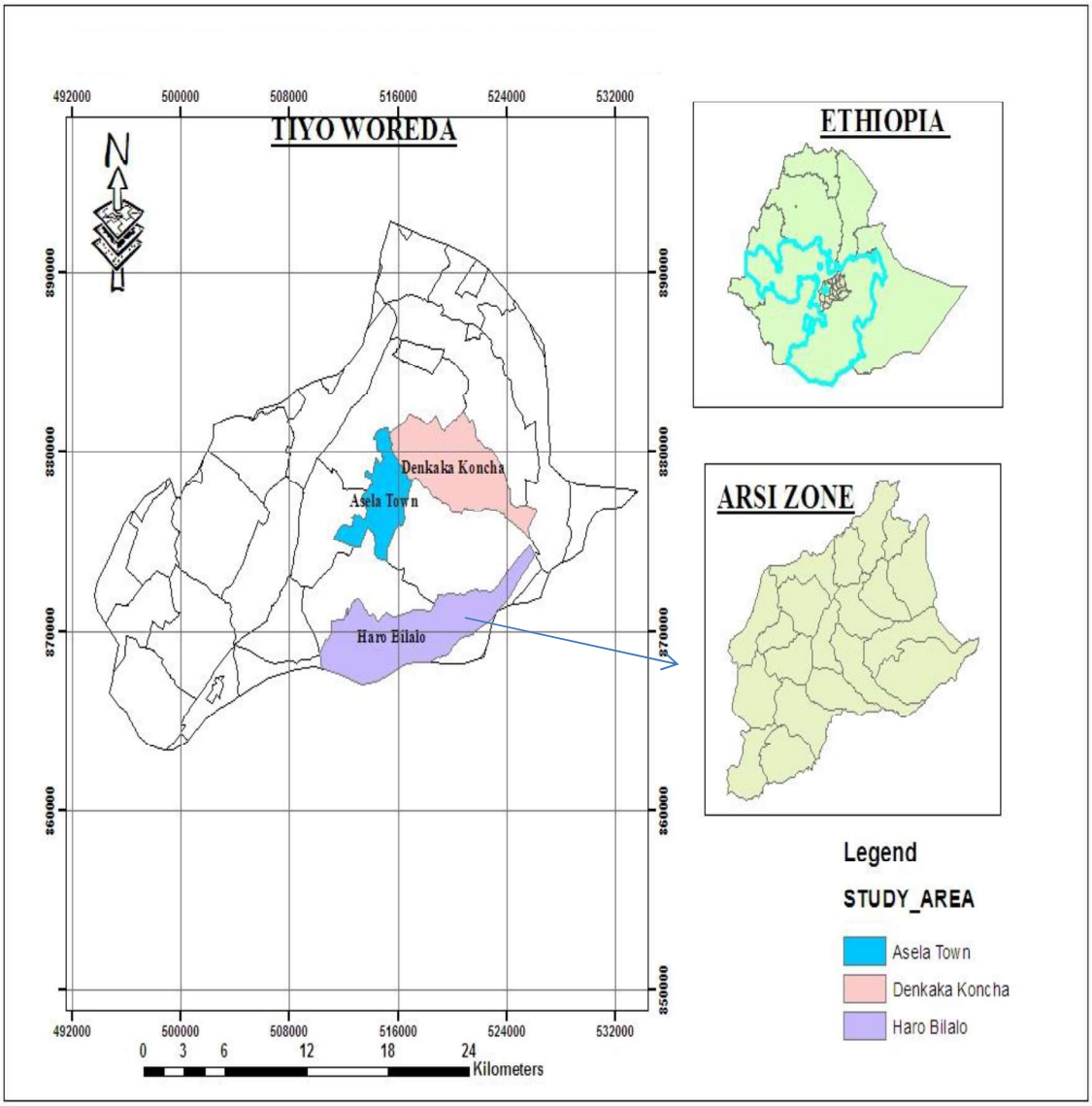

Figure 1. Map of the study area: Asella milk-shed

Data Collection

The study used both qualitative and quantitative data, which were obtained from primary and secondary sources. The primary data were collected from selected dairy producers with the use of structured questionnaire. The questionnaire was designed to collect data such as age, gender, religion, occupation, household size, educational attainment, frequency of contact with extension, availability of labor and equipment for value addition, price of value added milk, volume of milk produced, access to credit, training attendance, number and type of cows owned, distance to market place and milk processing factory. Secondary data were collected from records kept by agriculture office of the wereda and cooperative milk collection units and other literatures.

Sampling Technique and Sample Size

Three-stage sampling procedure was used to select the respondents. First, Asella milk-shed was selected purposively as it is one of potential dairy producing areas in the country. Second, the milk-shed was categorized into rural and urban and from which two rural kebelles and three urban kebelles with the largest number of milk producers were purposively selected. Third, the populations of smallholder dairy producers in the selected kebelles were stratified according to dairy cooperative membership status. Since the number of farmers who were members of nearby primary dairy cooperative in each Kebelle was small, all dairy farmers who were members of primary dairy cooperatives were selected while non-member dairy farmers were randomly selected. Finally, a total of 178 respondents were selected based on proportional probability sampling method.

Model Specification

Theoretical model

The general framework of utility or profit maximization is the theoretical base adopted for this study (Norris and Batie, 1987; Pryanishnikov and Katarina, 2003). The farmer'schoice of either adding value to milk or not depends on the actor's perception on the utility s/he is likely to derive from the practice. S/he decides to add value if the perceived utility from value addition is significantly greater than the one without value addition. Suppose that μ_v and μ_n represent farmer's utility for the two choices v and n. Then, the linear random utility model can be specified as:

$$\mu_v = \beta_v X_i + \varepsilon_v \text{ and } \mu_n = \beta_n X_i + \varepsilon_n$$

Where μ_v and μ_n are perceived utilities of value addition & non-value addition choices, respectively,

X_i= vector of explanatory variables that influence the perceived desirability of each choice,
β_v and β_n are utility shifters, and
ε_v & $\varepsilon_n$are error terms assumed to be independently & identically distributed (Greene, 2000).

In the case of milk value addition, if a dairy farmer decides to use option v, it follows that the perceived utility or benefit from option $v$is greater than the utility from other options (say n), i.e.,

$$\mu_{iv} = (\beta_v X_i + \varepsilon_v) \succ \mu_{in}(\beta_n X_i + \varepsilon_n), v \neq n$$

Empirical model

The farmer'sdesirethat leads to a particular choice was modeled in a logical sequence, starting with the decision to add value, and which is followed by a decision on the extent of the value addition. Thus, based on the nature of these decisions, the Heckman's two stage selection model whose estimation involves two stages was used to analyze the determinants of participation decision and level of participation at farmer level. Following Wooldridge (2002), these two successive equations, namely selection equation and outcome equation, respectively are presented as follows:

Selection equation: $y_{1i}^* = X_{1i}\beta_1 + \varepsilon_{1i}$

$y_{1i} = 1 \quad if \quad y_{1i}^* \succ 0 \; y_{1i} = 0 \quad if \quad y_{1i}^* \leq 0$

Outcome equation $y_{2i}^* = X_{2i}\beta_2 + \varepsilon_{2i}$

$y_{2i} = y_{2i}^* \quad if \quad y_{2i}^* \succ 0$,

y_{2i}^* not observed if $y_{1i}^* \leq 0$

Where,
y_1 = Probability of participation in milk value addition
y_2 = extent of value addition/volume of milk value added,
x's= independent variables/household characteristics,
β=parameters and ε = error term

The first stage of the model which assessed the decision to add or not to add value was a probit model whereas in the second stage OLS was used to analyze extent of value addition (Wooldridge, 2002). The reasoning behind the two stage approach is that the decision on the extent of milk value addition (the volume of value added milk) is usually preceded by a decision to engage in the process of value addition.

Maddala (1983) suggested the use of selection variable that can be assumed to affect largely the participation decision, but not the level of participation in the selection equation which enables the inverse Millis' ratio to predict correctly. Accordingly, this study used owning only cross breed cows as selection variables in probit model/selection equation. Owning only cross breed cow was expected to affect the milk value addition participation decision, but has no significant impact on level of participation in order to predict inverse Mill's ratio correctly. According to the model output, the Lambda (Inverse Mills Ratio) or selection bias correction factor has positive, but statistically insignificant impact on participation in milk value addition. There appears to be no unobserved factor that might affect both probability of dairy household milk value addition decision and volume of milk value added.

Prior to running the two stage Heckman model, both the continuous and discrete explanatory variables were checked for the existence of multi-collinearity problem. The technique of variance inflation factor (VIF) was employed to detect the problem of multi-collinearity for continuous explanatory variables (Chatterjee and Price, 1991). Likewise, the Phi (φ) statistic has been computed to check the existence of multi-collinearity problem for discrete explanatory variables, since variables under consideration have exactly two possible values (Arega, 2009).

The VIF and φ statistic results revealed that there is no problem of association among the discrete variable as VIF is below 10 and φ is below 0.5. Therefore, the proposed continuous and discrete explanatory variables were retained in the model. Finally, sixteen explanatory variables were used for the Heckman model.

Data analysis

The quantitative data were entered into IBM SPSS Statistics 20 computer software (IBM Corp., 2011) for ease of data management and were analyzed using STATA software version 15 (Stata Corp. 2017) whereas the qualitative data collected through FGD and interviews were analyzed using thematic and categorical interpretation.

Variables Definition

The dependent and explanatory variables included in the analysis and their postulated effects on participation and extent of milk value addition decision is discussed hereunder.

Dependent variables

Producers value addition decision (VAD_Dec): the decision either to process milk or not to process milk. It is dummy variable that takes either 1 (yes response) if the farmer processes or 0 (no response) if the farmer does not process milk.

Extent of value addition (Vol_VAD): volume of milk value added by the farmer. Continuous variable measured in liters of milk used for processing/value addition per day.

Independent variables

Age: defined as the age of the household head in years. It is a continuous variable. As the age of the household head increases their participation decision and extent of participation in milk processing is hypothesized to decline.

Gender: gender of the household head. Dummy (1=male, 0 = female). Women contribute more labor input in area of milking, milk value addition and marketing of dairy products. Thus, male headed households were expected to produce less amount of value added milk than female headed households.

Educational level (Educ): education level of the household head (continuous measured in number of years spent in formal school) and was expected to positively affect participation of farmer in milk value addition.

Number of children below 6 years age (Children): continuous variable measured in number of children whose age is below six years in the family. As the number of children under 6 years increases, the family's participation in value addition is hypothesized to decline due to increased consumption as the milk is preferable food for children in the household.

Household access to credit (Cred_acc): dummy (1= has access, 0= has no access). Farmer who has access to finance (credit) was hypothesized to

participate in milk value addition more than a farmer who has no access to credit.

Access to livestock extension service (Ext_acc): dummy variable (1= has access, 0= has no access). It was hypothesized that access to extension services positively affects both participation decision and level of participation in milk value addition.

Distance to market place (Dist_mkt): continuous variable (measured in Km). The higher the distance from milk and milk products market place, the higher the participation in milk value addition.

Access to market information (Mkt_info): a dummy variable that takes either 1 (has access) or 0otherwise. It was expected to positively affect milk value addition decision and extent of participation.

Volume of milk produced (Vol_Prod): it is continuous variable measured in liters of milk produced per day and was hypothesized to affect milk value addition positively.

Cooperative membership (Coop_mem): a dummy variable that takes two values either 1 or 0 (i.e. member=1, non-member=0). Dairy producers who are member of a dairy cooperative are supposed to supply raw milk to the cooperative on a daily basis. Thus, they will have no or less surplus milk thus, cooperative membership was expected to negatively affect the farmer's participation and level of participation in milk value addition.

Perceived price of value added milk/ liter (PrFair): although it was hypothesized as a continuous variable (measured in Ethiopian Birr), due to farmers' difficulty of quantifying the monetary value of value added products, their opinion on price of value added products was used as one of independent variables. Price of value added milk products was expected to positively affect the farmers' participation decision and level participation in milk value addition.

Non-dairy farm income (Nond_Inc): continuous (in Ethiopian Birr) and was hypothesized to affect participation decision and extent of participation in milk value addition positively. Having sound non-dairy income sources was expected to encourage farmer's participation.

Availability of family labor for value addition (Labor): dummy variable (1=yes, 0=No). Households who have access to family labor tend to add value to milk.

Religion (Rel_dum): dummy variable (1=Orthodox Christians, 0=otherwise) and was meant to capture the effect of fasting on farmers participation in milk value addition. The tradition of fasting with over 200 days of fasting within the Ethiopian Orthodox community creates excess supply of milk as most orthodox Christians abstain from consuming products of animal origin which was hypothesized to positively affect farmers' participation in value addition.

Cow breed: According to Kuma et al. (2011) and Mamo et al., (2014), the number and type of cow breeds have affected participation decision and volume of milk value addition. But, since the number of cows owned is correlated with the volume of milk produced, the researcher used owning only cross breed cow as an explanatory variable to capture the effect of breed type owned on the farmer's participation in milk value addition. The milk from local cow breeds is rich in its fat content so that farmers tend to process it.

Hypothesis

Summaries of factors that were hypothesized to influence farmer's participation and the expected signs for the two dependent variables, value addition decision (VAD_Dec) and extent of participation i.e. volume of milk value added (Vol_VAD) is presented in Table 1.

RESULTS

Milk production in Asella milk-shed is largely subjected to value addition. Out of the total 178 sample households interviewed, 137 of them (77%) added value to the milk they produced while the remaining 23% (41 households) did not.

Milk value addition decision category

Households' likelihood of participation in milk value addition was found to be different among respondents with different socio-economic, demographic, institutional and genetic characteristics of the herd (Tables 2 and 3).

The age of dairy producers who were practicing milk value addition was significantly lower from age of dairy producers not practicing value addition. Education level measured in years of schooling and number of milking local breed cowsowned by value

adding participants were higher than those not processing milk. The house hold size of value adding participants was significantly higher; besides, the distance to these households was more than the non-value adding counterparts.

Variables such as households access to livestock extension service and milk handling and processing technologies, availability of family labor for milk value addition and their opinion on the price of value added product were significantly different between the two groups (those processing and those selling fresh milk).

Table 1: Hypothesized determinants of farmer's participation decision and level of participation in farm level milk value addition and descriptive statistics of variables

Variable Name	Description	Mean (SD)	Expected signs
			VAD_Dec /Vol_VAD
Age	Age of the household head (years)	44.26 (8.44)	- /-
Educ	Education level of the household head (years)	6.03 (3.94)	+ /+
Gender	Sex of the HH head (1=Male, 0=Female)	0.76 (0.43)	- /-
Vol_Prod	Volume of milk produced per day (liter)	8.44 (8.52)	+ /+
PrFair	Is price of VAD products fair (1=Yes, 0=No)	0.63 (0.48)	+ /+
Ext_acc	Access to extension service (1=Yes,0=No)	0.49 (0.50)	+ /+
Labor	Availability of family labor (1=Yes,0=No)	0.56 (0.49)	+ /+
Mkt_info	Access to market information (1=Yes, 0=No)	0.76 (0.43)	+ /+
Nond_Inc	Non-dairy income per month (ETB)	622.2 (565.5)	+ /+
Famsize	Total family size of household (numbers)	5.54 (2.17)	+ /+
Chldren	Number of children under 6 years (numbers)	0.89 (0.81)	- /-
OLD	Number of people above 65 years (numbers)	0.19 (0.44)	- /-
Dist_mkt	Distance from market place (minutes of walk)	31.57 (23.38)	+ /+
Coop_mem	Cooperative membership (1=Yes,0=No)	0.34 (0.48)	- /-
Rel_dum	Religion of household head dummy (1=Orthodox Christian, 0=Non-Orthodox Christian)	0.75 (0.43)	+/+
Exoonly	Own only cross breed cow (1=Yes, 0=No)	0.49 (0.50)	-

Source: own survey data (2015), the numbers in the parenthesis are standard deviations of variables used in the model.

Table 2: Characteristics of sample householdsby milk value addition status (continuous variables)

Continous Variable	VAD Participants (137)		VAD Non-participants (41)		t-value
	Mean	St. Dev.	Mean	St. Dev.	
Age of HH Head (years)	43.61	8.08535	46.44	9.30873	1.8994**
Education level of HH Head (years)	6.4891	3.82353	4.512	3.97569	-2.8780***
Nondairy income (ETB)	651.09	614.424	525.9	344.826	-1.2461
Volume of milk produced/day (liters)	8.1734	9.04754	9.311	6.49393	0.7488
Family size of the household	5.832	2.19481	4.561	1.80345	-3.381***
Number of children <6 years of age	0.9124	0.83556	0.829	0.7383	-0.5734
Number of people above 65 years of age	0.2044	0.44173	0.171	0.43956	-0.4295
Number of local breed cows	1.1898	1.25166	0.024	0.1562	-5.9364***
Number of cross-breed cows	1.2993	1.38991	1.585	1.18270	1.1944
Distance to market place (minutes)	33.526	24.2654	25.03	18.9565	-2.0555**

*, ** and *** indicate significant difference at 10%, 5% and 1% probability levels, respectively.

Table 3: Characteristics of sample households (discrete variables)

Discerete Variable	VAD Participants (137)	VAD Non-participants (41)	Total (178)	Pearson chi^2
Religion				
Orthodox Christians	104 (75.9)	30 (73.17)	134 (75.28)	0.1275
Non-Orthodox Christians	33 (24.1)	11 (26.83)	44 (24.72)	
Gender				
Male	107 (78.1)	29 (70.73)	136 (76.4%)	0.9509
Female	30 (21.9)	12 (29.27)	42 (23.6%)	
Own only cross breed cow				
Yes	96 (70.07)	40 (97.56)	136 (76.4)	13.226***
No	41 (29.93)	1 (2.44)	42 (23.6)	
Access to market information				
Yes	103 (75.2)	33 (80.49)	136 (76.4%)	0.4927
No	34 (24.8)	8 (19.51)	42 (23.6%)	
Access to extension service				
Yes	77 (56.20)	11 (26.83)	88 (49.4%)	10.893 ***
No	60 (43.80)	30 (73.17)	90 (50.6%)	
Availability of labor (owned)				
Yes	88 (64.23)	12 (29.27)	100 (56.2%)	15.671***
No	49 (35.77)	29 (70.73)	78 (43.8%)	
Access to credit				
Yes	49 (35.77)	14 (34.15)	63 (35.4%)	0.0362
No	88 (64.23)	27 (65.85)	115 (64.6%)	
Cooperative membership				
Yes	49 (35.77)	12 (29.27)	61 (34.3%)	0.5915
No	88 (64.23)	29 (70.73)	117 (65.7%)	
Access processing equipment				
Yes	137 (100 %)	12 (29.3%)	149 (83.7%)	115.76***
No	0 (0 %)	29 (70.7%)	29 (16.3%)	
Type equipment owned				
Modern	21 (15.3%)	5 (41.7%)	26 (17.4%)	5.3135**
Traditional	116 (84.7%)	7 (58.3%)	123 (82.6%)	
Price of VAD product is fair				
Yes	105 (76.6%)	8 (19.5%)	113 (63.48)	44.429***
No	32 (23.4%)	33 (80.5%)	65 (36.5%)	

*** and ** indicate significant difference at 1% and 5% probability levels, respectively. Numbers in the bracket are percent of the sample households.

Milk value addition participants also differ from non-participants based on the number and type of breed of cows owned, perceived price of value added milk products, home distance from market and other socio-economic, demographic, institutional features. Moreover, more than 76% of respondents mentioned that they had access to market information mainly from neighbors (33%) and traders/consumers (20%).

Determinants of Dairy Farmers' Participation in Milk Value Addition

The results of the two stage Heckman model for the participation decision and level of participation revealed that the coefficient of Mills ratio (Lamda) is significant at the probability of less than 5% (i.e. p = 0.028, z = 2.19) (Tables 4 and 5). Moreover, the models goodness of fit and likelihood function were significant at Walda chi^2 (14) = 98.83 (p = 0.000).

The finding assures the appropriateness of the two stage Heckman model to avoid sample selection bias that could have been experienced as a result of existence of some unobservable farmer characteristics determining farmer's likelihood to add values to milk and thereby affecting the level of participation if probit model was used for the analysis (Berem et al., 2011).

Table 4: Results of first stage Heckman selection (probit) estimation of determinants of probability participation in farm level milk value addition.

Variables	Probability of participation in milk value addition (VAD_Dec)			
	Coef.	Std. Err.	P>z	dy/dx
Age of the household head (years)	-0.030	0.025	0.227	-0.003
Education level of the HH head (years)	**0.091***	0.051	0.073	0.010
Sex of the household head (1=M, 0=F)	0.436	0.420	0.300	0.058
Volume of milk produced per day (liter)	-0.002	0.021	0.940	-0.001
Is price of VAD products fair (1=yes, 0=no)	**1.803*****	0.367	0.000	0.313
Access to extension service (1=yes, 0=no)	**1.413*****	0.530	0.008	0.174
Availability of family labor (1=yes, 0=no)	0.525	0.381	0.168	0.062
Access to market information (1=yes, 0=no)	-0.352	0.446	0.430	-0.034
Non-dairy income per month (ETB)	0.001	0.001	0.164	0.001
Total family size of household (numbers)	**0.334*****	0.128	0.009	0.037
Number of children under 6 years of age	**-0.676****	0.269	0.012	-0.075
Number of people above 65 years of age	-0.597	0.371	0.108	-0.066
Distance from dairy market place (minutes)	0.003	0.008	0.707	0.001
Cooperative membership (1=yes, 0=no)	-0.489	0.543	0.368	-0.062
Religion (1=Orthodox Christian, 0=none)	0.416	0.414	0.315	0.055
Owned only crossbreed cow (1=Yes, 0=No)	**-1.60*****	0.565	0.005	-0.109
_cons	-0.412	1.425	0.772	
Number of observations **178**				
Censored observations **41**				
Uncensored observations **137**				
Walda chi^2 (14) = **98.83 (0.0000)*****, **z = 2.19,** rho = **0.92504,** sigma = **1.0060408**				

Dependent variable is probability of participation; *, ** and *** indicate significant difference at 10%, 5% and 1% probability levels, respectively.

Several variables were hypothesized to influence dairy producers' participation in farm level milk value addition in Asella milk-shed (Table 4).

As it was expected, education level of household head, households access to livestock extension service, perceived price of value added milk products, family size of the household, number of children below six years of age and type of cow breed owned were found to influence dairy holders' decision to participate in the milk value addition activities. Other variables included in the model were non-significant. Perceived price of value added milk products, family size and access to livestock extension service influenced the dairy holders' decision to go for value addition positively at 1% significance level. Similarly, Education level of the household head was found to positively influence dairy holders milk value addition participation decision at 10% significance level while number of children under six years and owning only cross breed cows affected likelihood of participation in milk value addition negatively at 5% and 1% level of significance, respectively.

The better educated milk producers, as expected, participated more eagerly in the milk processing activity for they have a better access to information and more clarity about emerging marketing opportunities in the milk processed products. As the number of years spent in formal education by dairy holder increases by one, the likelihood of participation in milk value addition increases by 10% ($p = 0.073$). This result is in line with the findings of Berhanuet al. (2011) and Tadeleet al. (2014). Moreover, price of value added products positively influenced the probability of participation ($p = 0.000$) indicating increased price of processed milk products might enhance the dairy holders value addition practice.

As hypothesized, households' access to livestock extension services is positively associated with farmer's likelihood to add values to milk. This

indicates that access to extension services increases the probability of adding values to milk by 17.37% (p = 0.008). This finding is in line with the results of both Kuma et al. (2011) and Tadele et al. (2014).

The marginal effect analysis also revealed that keeping all other exogenous variables at their mean level, as family size above 6 years age increases by one the probability of adding value to milk increases by 3.7 % (p = 0.09). The reason behind this is that dairy farmers with large family size have an opportunity to supply labor to process raw milk into butter or other value added milk products.

In addition, the decision to participate in milk value addition was also found to be influenced negatively by the number of children whose age is below six years in the household. The result shows that the probability of adding values to milk decreases by 7.5% (p = 0.012) as the number of children under six years of age increases by one unit. It was considered that the greater the number of children whose age is below six years, the lesser the probability of participation in milk processing due to the higher consumption of raw milk in the family. The results of Berhanuet al. (2011) is against this finding while the result of Tadele et al. (2014) supports. This might be because of similarity of study areas as both the current study and Tadele et al. (2014) were conducted in semi-urban areas while the study of Berhanu et al. (2011) in rural Ethiopia.

Moreover, households who owned only cross breed cows were found to participate less in milk value addition than those who owned local breed cows. The result showed that owning only cross breed cows decreases the probability of adding values to milk by more than 10%. More than 66% of the sample households preferred local breed cows for value addition for several reasons. Although exotic cows are known for their high milk yield so that there could be more surplus milk either to sell or process, local cows were found to be the most preferable for their fat rich milk. Consumers' preference for dairy products (such as butter) from local breed cows was reported to be high for its taste, fat content and other reasons.

Determinants of extent of participation in farm level milk value addition

The second stage of the analysis revealed that volume of milk produced per day, household access to livestock extension service and non-dairy income earned are positively associated and statistically significant with the level of value additional at 1% level of significance. On the other hand, age of the household head and cooperative membership influenced the volume of value added milk products negatively at 10% and 1% level of significances, respectively (Table 5).

Age of the household head was found to play a key role in determining the level of participation of a household in milk value addition. The older the household head, the lesser the volume of milk used for value addition. Keeping other explanatory variables at their mean level, as the household heads age increases by one year, the volume of milk value added declines by 0.026 liter. This could be because dairy holders through age become risk averse and arenot willing to venture into new fields or take part in activities that theyare not certain about. Furthermore, older members are less energetic and find it hard engaging in laborious activities. This finding is in line with the results of Berem et al. (2011) and Berhanu et al. (2011) while it contradicts with results of Tadele et al. (2014).

Volume of milk produced in liter per day is positively related and statistically significant with the level of value addition participation (Table 5). This indicates that, ceteris paribus, an increase in milk yield per day by a liter increases the volume of milk processed by 0.053 liter. This might be due to more surplus milk in the family following increased production that could be used for consumption or processed in to different value added products. This finding is in line with the results ofTadeleet al. (2014) while it contradicts with the finding of Berhanuet al. (2011).

Table **5**: Results of second-stage Heckman selection estimation of determinants of level of participation in farm level milk value addition

Variable	Volume of milk value added (Vol_VAD)		
	Coefficient	Std. Err.	P value
Age of the household head (years)	-0.026*	0.015	0.083
Education level of the HH head (years)	0.016	0.030	0.590
Gender of the household head (1=M, 0=F)	0.259	0.231	0.261
Volume of milk produced per day (liter)	**0.053****	0.011	0.000
Is price of VAD products fair (1=yes, 0=no)	0.394	0.270	0.145
Access to extension service (1=yes, 0=no)	**1.076****	0.260	0.000
Availability of family labor (1=yes, 0=no)	0.022	0.218	0.919
Access to market information (1=yes, 0=no)	-0.001	0.001	0.734
Non-dairy income per month (ETB)	**0.239****	0.063	0.000
Total family size of household (numbers)	-0.079	0.124	0.519
Number of children under 6 years of age	-0.112	0.217	0.606
Number of people above 65 years of age	0.194	0.243	0.424
Distance from dairy market place (minutes)	0.005	0.005	0.289
Cooperative membership (1=yes, 0=no)	**-0.677****	0.256	0.008
Religion (1= Orthodox Christian, 0=Otherwise)	-0.165	0.220	0.454
_cons	-0.377	0.866	0.663
mills lambda	**0.931****	0.425	**0.028**
Number of observations = **178**			
Censored observations = **41**			
Uncensored observations = **137**			
Walda chi^2 (14) **= 98.83 (0.0000)***, z = 2.19,** rho = **0.92504,** sigma = **1.0060408**			

Dependent variable is volume of value added milk (Vol_VAD in liters); *** indicate significant difference at 1% probability level.

Dairy holders' access to livestock extension service affected not only their participation decision in milk value addition, but also the volume of milk value added. Households who have access to extension service were better in terms of volume of milk they process i.e. farmers' extent of participation in milk value addition was positively and significantly influenced following their access to the service. The result of the second step analysis revealed that, ceteris paribus, as the status of households access to livestock extension service changes from 'No' to 'Yes' (from 0 to 1), the volume of milk value added increases by 1.07 liter per day. The finding of Tadele et al. (2014) is also in agreement with the present result.

Moreover, by keeping other independent variables constant, an increase in the households' monthly non-dairy income by 1 ETB increases the level of participation (volume of milk value added) by 0.24 liter per day. This might be due to the dairy farmers' ability to afford inputs for milk production and processing as a result of high non-dairy income. This result is consistent with findings of Tadeleet al. (2014).

Cooperative membership (Coop_mem) was another factor that was expected to affect dairy holders' participation decision as well as extent of participation in milk value addition. Dairy holders who were not member of primary dairy cooperative found to participate more eagerly in milk value addition than cooperative members. As the dairy farmer's status changes from non-cooperative member to member of cooperative, their level of participation in milk value addition decreased by 0.67 liter. This might be because cooperative members are supposed to sell raw milk everyday (as per their agreement) to the cooperative, being a member of dairy cooperative was found to negatively affect the dairy holders participation in milk value addition made at household level.

CONCLUSION

The results of the two stage Heckman model for the participation decision and level of participation revealed the decision to add value is positively and significantly influenced by the perceived price of value added products, dairy holders access to livestock extension service, family size and education level of the household head, while number of children below six years of age and owning only cross breed cows negatively affected the decision to go for value addition. Moreover, the extent of participation in milk value addition was significantly and positively influenced by the volume of milk produced per day, non-dairy income and access to livestock extension service while it was negatively influenced by age of the household head and membership to primary dairy cooperative. Although majority of dairy producers in the study area owned exotic cows, the milk from exotic cows was not exploited to the extent it ought to be, due to lack of capacity to produce commercial milk products. This is further associated with access to modern milk handling and processing equipment, ingredients, training, and technical support. Moreover, smallholder dairy producers complain the need for training on improved feed formulation and animal husbandry practices and scale up/out good practices so that maximum milk production is exploited to feed not only their family but also other consumers through marketing raw milk and value added dairy products.

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