



RESEARCH ARTICLE

# Determinants of Market Participation among Dairy Producers in Southwestern Ethiopia

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**Abstract:** Though Bench Sheko and Sheka zones have great potential for dairy production in Ethiopia, the majority of dairy producers' could not get benefit from the sector in a sustainable way due to the low market participation problem. Hence, this study was designed to analyze determinants of market participation by dairy producers' in Southwestern Ethiopia. Data from 160 sampled dairy producers were employed and analyzed by using the probit model. The model result shows the ownership of crossbreeds, utilization of improved livestock feeds and size of dairy cows' ownership affect market participation decisions significantly and positively. While the number of children below six years and distance from the market is the significant factors determining the likelihood of dairy market participation negatively in southwestern Ethiopia. Therefore, demonstrations of improved livestock breed through supplying improved bulls and artificial insemination technologies, demonstration of improved livestock forages and concentrates through training, and organizing dairy marketing cooperative and dairy products collection centers are suggested to improve the market participation in the study area.

**Keywords:** Cattle; Dairy; Probit model; Crossbreed; Marketing

## 1. Introduction

Ethiopia is continually shown as one of the most potential countries in livestock resources in Africa with a projected 70.292 million cattle<sup>[1]</sup>. Of the total cattle population, about 56.22% of the national herd was female cattle. Dairy is an integral part of livestock production in the country which is a major contributor to economic development<sup>[2]</sup>. Due to its ample availability of resources for dairy production, the country has an immense capacity for

dairy production<sup>[3]</sup>. Dairy products are highly nutritious and valuable human food that are consumed in a variety of different products forms by millions in Ethiopia<sup>[3,4]</sup>.

The Southern Nations Nationalities and Peoples Region (SNNPR) of Ethiopia has about 11.13 million cattle population that making the region the third-highest livestock production area next to Oromia and Amhara regions<sup>[1]</sup>. The average cow productivity is 1.65 litres per day per cow with a total annual milk yield of 667,562 tons. According to SNNPR's BoA<sup>[5]</sup>, about 5,443,567 dairy cows

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are found in the region, from which 103,252 tons of milk are produced per annum. However, the livestock productivity and the benefits obtained from the sector do not match the high livestock population in Ethiopia [6,7]. In addition due to low market participation in the region, the dairy sector has a low capacity to benefit the producers and diversify their income sources [8]. Since dairy market participation is an important tool for minimizing losses and diversification for dairy farmers' income, identifying the factors limiting dairy farmers' market participation at the household level has paramount importance [6].

For many years, Bench Sheko and Sheka zones of Southwestern Ethiopia have had well-suited agro-ecology and vegetation cover for livestock production [8,9]. The area has great potential for dairy production because of the ample availability of forage and water but there is a market participation problem among small dairy farmers [8,9]. Because of this, most dairy producers are unable to sustainably benefit from the sector. Besides, the determining factors that affect dairy market participation are not well addressed. So, it is important to investigate factors affecting dairy producers' market participation in the zones. Though there are different studies regarding dairy marketing in Ethiopia like Somano [10], Benyam et al. [11], Kassa and Dekamo [12], Embaye [13], Abera [14], Gebrekiros et al. [15], Muzemil [6], Lee et al. [7], Eshetu [16] and Gemechu et al. [17]. None of these studies have empirically investigated the determinants of dairy market participation in Bench Sheko and Sheko zones while the area has huge dairy production potential.

To promote the dairy sector as an important pathway to food security for the growing urban markets demand, strengthening dairy production with stronger dairy producers' market participation is highly encouraged [18,19]. Therefore, to develop the dairy value chain, the identification of root causes for interventions targeting the improvement of the production and marketing system of the dairy sector are crucial. Thus, this study was intended to identify the determinants of dairy products market participation in southwestern Ethiopia. The result of this study will enable policymakers to design and implement effective policies and programs [18].

## 2. Methodology

### 2.1 Description of the Study Area

The study was conducted in the Bench Sheko and Sheka zones of Southwestern Ethiopia. The zones are located at 561 km and 694 km far distance from Addis Ababa in the southwest part, respectively. The altitude of the Bench Sheko zone ranges from 850 to 3000 meters and while the

Sheka zone range is 1200 to 3000 meters above sea level [8]. For the Bench Sheko zone, the annual rainfall and temperature range from 20 °C to 40 °C and 1200 to 2000 mm, respectively and while for the Sheka zone it ranges from 15.1 °C-27.5 °C and 1201 mm-1800 mm, respectively [20]. The zones have the highest amount of forage availability throughout the year with suitable agro-ecology for livestock production [9]. About 284,361 and 367,853 cattle populations are found in the Sheka and Benchi-Sheko zones of southwestern Ethiopia, respectively [1].

### 2.2 Sampling Methods and Sample Size

A multistage sampling technique was followed for this study to select sample dairy producers. In the first stage, two districts were selected purposively from each zone based on the existing potential of dairy production. In the second stage, two kebeles (the smallest administrative level in Ethiopia) were selected randomly from each selected district since dairy production was in the study area. In the third stage, within the selected kebeles households were categorized into dairy producers and non-producers groups based on the presence of lactating cows during the survey period and a total of 160 sample households were selected randomly. The formula given by Yamane [21] that is suitable for the finite population was used to determine the intended sample size. Accordingly, the sample size was determined as illustrated by the following formula:

$$n = \frac{N}{1+N(e^2)} = \frac{21785}{1+21785(0.08^2)} = 155\sim 160 \quad (1)$$

Where n is a sample size, N is the total number dairy producing households in the selected kebeles which is 21785 and e is the level of precision (8%=0.08).

### 2.3 Methods of Data Collections

This study used both quantitative and qualitative research methods to collect cross-sectional data from the sampled households. To increase the precision and reliability of data, a triangulation method was applied by semi-structured questionnaires, focus group discussions (FGD), and key informant interviews (KII) as endorsed by Ariho et al. [22]. The semi-structured questionnaire was used for the dairy producers' survey while the checklist was used to collect supporting data through FGD and KII. To collect the intended data, the Development Agents (DA) who are working at sample kebeles were used as enumerators. Before data collection, clarity on each question included in the interview schedule and on the techniques of data collection was given to the selected enumerators. Before the formal survey, to evaluate the appropriateness of the questionnaire design, clarity, relevance and time taken for

the interview, the pretest of the questionnaire was done on randomly selected 18 households. Based on the pretest feedback, appropriate amendments were made to the questionnaire before undertaking the formal survey.

In addition, 8 FGD were conducted with a group of 6-10 dairy producers at kebele level by using the checklist. The quantitative and qualitative data on current dairy production and marketing systems were collected through KII from each selected district within the two zones. Finally, the collected data were coded, entered into Statistical Package for Social Sciences (SPSS) version 21. For detailed analysis, the entered data were transferred to STATA 16 version.

## 2.4 Analytical Framework

Market participation is the involvement of farmers in inputs and output markets to rise production, earnings that in turn reduce poverty<sup>[23,24]</sup>. In smallholder dairy farming, market participation is determined by production and marketing access factors as indicated by various authors<sup>[6,7,15,25-27]</sup>. The decision of farmers to participate in the market was based on the perceived utility gotten from it with a minimum cost of transactions<sup>[28]</sup>. Thus, the decision to participate in the dairy products market or not participate was a dummy choice that was built on utility maximization theory<sup>[16,17]</sup> and it was considered under the general framework of utility maximization illustrated by Barrett<sup>[29]</sup>. Though utility was not observed directly, it was observed through the choices actions made by dairy producers. Suppose that and represent a household's utility for two choices, which are, correspondingly, denoted by and, respectively. Thus, the linear random utility model specified as 2:

$$U_j = \beta_j X_i + e_j \text{ and } U_k = \beta_k X_i + e_k \quad (2)$$

Where  $U_j$  and have perceived utilities of market participation for dairy and non-market participation choices  $j$  and  $k$ , respectively,  $X_i$  the vector of explanatory variables that affect the perceived utilities of each choice, and  $U_k$  utility shifters, and and  $e_k$  are error terms assumed to be independently and identically distributed<sup>[30]</sup>. From the economist's perspective, an individual  $i$  decides to participate if the utility associated with that participation choice ( $U_j$ ) is higher than the utility associated with the decision not to participate (choice), ( $U_k$ ). In the case of dairy market participation, if a household decides to use option  $j$ , it follows that the perceived utility or benefit from option  $j$  is greater than the utility from options  $k$  as illustrated in Equation 3:

$$U_{ij}(\beta_j X_i + e_j > U_{ik}(\beta_k X_i + e_k), k \neq \forall_i \quad (3)$$

For econometric estimation, linear probability model (LPM), Logit, Probit models suggested regression models by numerous for binary choice depended on variables<sup>[6,23,31-34]</sup>. Since our dependent variable is dummy, the alternative binary models such as logit and probit models were used for this study. Since the probabilities are bounded between 0 and 1 for these models, they fit well into the nonlinear relationship. Even though the binary models have quite similar cumulative normal function (probit) and the logistic function (logit), Gujarati<sup>[34]</sup> has noted the main difference by indicating that being the logistic function has a slightly fatter tail. In addition, Wooldridge<sup>[35]</sup> suggested that the use of the probit model is more advantageous due to its normal distribution nature latent error terms. Since our data resemble a normal distribution while checking error terms distribution, the probit model was used to estimate the likelihood of dairy producers' market participation. Thus, the model is built on a latent variable with the following formulation:

$$\Pr (Y_i = 1 | X_i, \beta_i) = \Phi (h (X_i, \beta_i)) + \mu_i \quad (4)$$

Where is a dependent variable that takes on the value of 1 if the farmers participated in dairy marketing and 0 otherwise.

$\Phi$  is the standard normal cumulative distribution function,

$X_i$  is a vector of factors that determine the dairy producers' decision to participate in the market,

$\beta_i$  is a vector of coefficients to be estimated which measures the effects of explanatory variables on the farmers' decision

$\mu_i$  is normally distributed disturbance with a mean (0) and constant variance and captures all unmeasured variables.

The variable takes the value of 1 if the marginal utility of the household  $i$  get from participating in the market is greater than zero, and zero otherwise. From Equation 3, then:

$$Y_i^* = \beta_i X_i + \mu_i \quad \mu_i \sim N(0,1) \quad (5)$$

Where is a latent (unobservable) variable representing a level of utility the household gets from selling dairy products and,

$$Y = 1 \text{ if } Y_i^* > 0, \quad (6)$$

$$Y = 0 \text{ if } Y_i^* \leq 0 \quad (7)$$

The probability of farmers' decision to participate in the dairy market depends on socio-economic, marketing, production and institutional related issues assuming. Thus, based on previous studies on dairy market participation<sup>[6,7,11,13,14,15,16,17]</sup> and researchers' insights, the determinants of dairy market participation are hypothesized as follows in Table 1.

**Table 1.** Description variables hypothesized as determinants of dairy market participation

Variables	Variable Type	Variable definition and measurement	Expected Effect
Market participation	Dummy	1 if household participate in dairy marketing, otherwise 0	
Sex of household	Dummy	1 if household head is male, otherwise 0	+/-
Experience	Continuous	Number of years in dairy production engaged	+
Household size	Continuous	Number	+
Education level	Continuous	Household head education level in grades attended	+
Dairy cows size	Continuous	Dairy cows owned during the survey period in a number	+
Type of breeds owned	Categorical	1= Improved (cross) breed, 0=Local breed	+
Extension contact	Continuous	Frequency of extension contact per month	+
Annual Income(1000)	Continuous	Total annual income in Ethiopian Birr( ETB)	+
Distance to market	Continuous	Nearest market distance in kilometres	-
Use of improved feeding	Dummy	1 if farmers used improved feeding and 0 otherwise	+

### 3. Results and Discussions

#### 3.1 Descriptive Results

The survey results in Table 2 revealed that from the total of 160 sampled households, 68% were males and 32% were females. The average age of the respondents was found to be 49.50 years. The average family size under six years was about 2 children. The dairy production experience of the respondents was about 21 years. The average annual income generated from agricultural activities and nonagricultural was 28984.06 Ethiopian Birr (ETB). The result also revealed that the farmers in the study area owned 3 lactating cows on average. This may be due to the availability of forage in the study area which leads to

keeping a lot of livestock per household.

The majority (88%) of sampled households are not users of improved feeding practices like improved feeds and forages. This may be due to the low level of improved feeding technology demonstrations in the study area. In addition, feed supplementation was not commonly practiced in rural areas of the study area as most of the dairy producers relied on grazing lands. In terms of the quantity of milk produced, on average 2.46 liters per day was produced at each farmer’s level in the study area with a lactating length of 8 months. The distance to the nearest market in the study area is 4.5 km on average which shows there is a problem with accessing the market at a shorter distance that hinders farmers’ market participation.

**Table 2.** Socio-demographic characteristics of sampled households

Dummy/Categorical variables	Response	Frequency	Percent
Sex	Male	109	68.13
	Female	51	31.88
Use of improved feeding	No	140	87.50
	Yes	19	12.50
Continuous Variables	Observations	Mean	Std. Dev.
Age	160	49.51	8.61
Educational level	160	2.64	1.18
Family size	160	2.24	1.05
Experiences	160	20.88	9.04
Annual Income (1000)	160	28.984	3.468
Distance from the nearest market	160	4.54	1.764
Extension contact per year	160	3.45	2.62
Number of dairy cows	160	2.72	1.33
Milk yield /day in the liters	160	2.46	1.27
Lactation length in months	160	8.13	1.42

The type of breed used is one of the important factors which determine the productivity of dairy cows. The result in Figure 1 shows that the majority of the sampled respondents (69%) were using local breeds while the remaining 26% used both local and crossbreeds in the study area. From this, only about 5% of respondents were using cross breeds alone. This indicates that the breed improvement work in the area is weak and needs a lot of collaborative work.

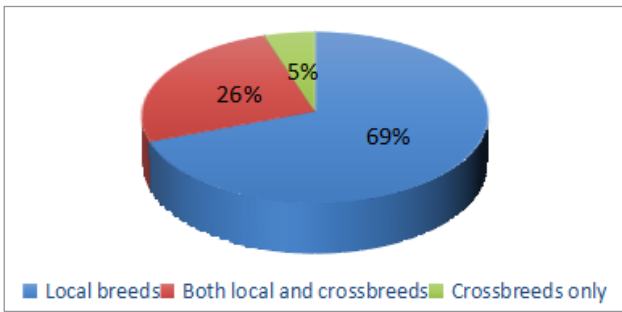


Figure 1. Types of cattle breeds owned

### 3.2 Determinants of Market Participation

The maximum likelihood estimates of Probit model is strongly significant (LR  $\chi^2(11) = 436.35$  Prob >  $\chi^2 = 0.000$ ) indicating the joint significance of the coefficients. It indicates that the overall model is fittest and adequate with at least one of the explanatory variables contributing to the forecast of the dependent variable. Finally, the test for model goodness-of-fit statistic shows that there is no statistically significant difference between predicted and observed values. Thus authors cannot reject the model since Pearson  $\chi^2(149) = 156.12$  with Prob >  $\chi^2 = 0.4065$  which is not significant. Of the hypothesized variables, family size under the age of six years, number of dairy cows owned, type of breed owned, use of improved feeds and distance from nearest market influenced dairy market participation significantly (Table 3).

The model result shows that the number of dairy cows owned had a positive and significant effect on dairy market participation as expected. The relationship between the two variables indicates that an additional dairy cow owned by farmers could have increased the production linearly and that increases the probability of household market participation. The marginal effect shows that the increase in the number of dairy cows owned by one will increase the probability of farmers' participation in the dairy market by 22%. This finding is similar to previous findings of Benyam et al. [11], Muzemil [6], Gemechu et al. [17].

Family size under six years had a significant and nega-

tive association with market participation decisions at less than a 1% probability level. The negative relationship is maybe a larger the family size under six-year, the parents give priority to those children since milk is considered as the main food for those children under six-year. The model result with its marginal effect coefficient confirms that as the family size under six years increases by one child, the probability of dairy products market participation decreases by 10.9 percent. The study conducted by Muzemil [6] confirmed the negative and significant effect on the participation decision while a study by Gemeda et al. [32] found the contrary result to the current study.

The annual income of households is an income from farm and non-farm activities that have a significant and negative association with dairy products market participation decision at a 10% probability level. Holding other factors constant, the model output indicates that the probability of dairy market participation decreases by 5.6% for each 1000 Ethiopian Birr increase in household income. The negative relation between the variables indicates that any additional income enables the farmers' household to consume dairy products at home by considering the income gotten from dairy products marketing as insignificant and then contributing to decreased market participation probability. A study by Gemechu et al. [17] contradicts the current finding in Ethiopia.

The type of dairy breed owned had a significant impact on dairy product market participation at a 1% probability level. The marginal effect after probit model shows that the likelihood to participate in dairy product marketing increased by 15% for those households who have improved dairy breeds as compared to those households who have the local dairy breeds. The use of improved dairy cattle breed encourages the farmers to increase the volume of milk production thus they decide to participate in dairy product marketing. This result suggests that the dairy market participation of households in the study area is more responsive to the type of cattle breed owned. Studies by Muzemil [6] and Gemeda et al. [32] found similar finding that is in agreement with the current study.

As expected improved feed utilization has a positive and significant relationship with dairy products market participation at a 1% probability level. The model output reveals that dairy product market participation likelihood has increased for those smallholders' farmers who utilized the improved livestock feeds increased by 18% as compared to those farmers who do not utilize improved feeds (like improved forage and concentrates). This may be due that the use of improved forage like improved forages and concentrates in some peri-urban areas increased milk production that interns increase the probability of market par-

**Table 3.** Determinants of dairy market participation Probit model Maximum likelihood estimates

Variable	Coefficients	Marginal effect	P>z
Sex (Male)	0.047(0.113)	0.008(0.014)	0.645
Education level	0.173(0.10)	0.049(0.027)	0.605
Family size below six year	-0.408(0.147)	-0.109(0.026)	0.005***
Experience in dairy	0.052(0.042)	0.053(0.04)	0.318
Average annual income (1000)	0.053(0.035)	0.056(0.034)	0.083*
Number of dairy cows owned	0.949(0.294)	0.217(0.093)	0.000***
Improved feed utilization (Yes)	0.83(0.076)	0.183(0.048)	0.000***
Type of dairy breed owned (Improved)	0.523(0.178)	0.151(0.043)	0.000**
Extension services	0.379(0.163)	0.082(0.043)	0.140
Distance from the nearest market	-0.208(0.082)	-0.064(0.027)	0.023**
Constant	1.275(0.254)		0.000

*Number of obs = 160 LR chi2(10) = 436.35 Prob > chi2 = 0.0000*  
*Log likelihood = -6473.8637 Pseudo R2 = 0.3345*  
*estatgof = Pearson chi2(149) = 156.12 with Prob> chi2 = 0.4065*

\*\*\*, \*\* and \* denotes significance level at 1%, 5% and 10% probability level, respectively.

Source: Model output own survey data, 2021.

ticipation. A study by Kassa et al. [8] found a similar result that confirms the utilization of improved feeds increase market participation in Ethiopia.

As anticipated, distance to the nearest urban center is statistically significant and negatively associated with farmers' likelihood to participate in dairy products marketing. The negative association may be probable dairy producers in remote areas lacks updated market information and low profit may be due to high transaction cost. The marginal effect result indicates that as farmers far from the nearest dairy products marketing center increased by 1 km, the probability of farmer's dairy market participation decreased by 6%. Studies by Lee et al. [7] and Gemechu et al. [17] found a similar result that confirms the higher distance from the marketing center lowers the likelihood of market participation.

#### 4. Conclusions and Recommendation

In conclusion, dairy producers' market participation in Bench-Sheko and Sheko zones was weak as compared to the potentiality of the area from dairy production. The model regression result suggested that family size under the age of 6 years, income level of household head and distance from the nearest market were negatively associated with the probability of market participation whereas the number of dairy cows owned, use of improved cattle breeds, and feeds had a positive and significant effect on dairy product market participation decisions in the study area. Since the use of improved dairy cattle has a significant impact on the amount of dairy produced, the

demonstration of improved dairy cattle in the study is crucial to increase the adoption and production rates and market participation of farmers in the study area. In addition, supplying the improved bull at kebele level increases the chance of getting improved dairy cattle in the study area. Furthermore, the utilization of improved livestock feeds like improved forages and concentrates enhance dairy production substantially in the area where they are utilized. Thus, the office of livestock development and research institutions should demonstrate the improved livestock feeds for dairy production. Finally, distance from marketing centers decreases the producers' motivation to participate in the market due to weak market information and high transaction cost in the study area. Hence, the establishment of dairy products marketing cooperatives at the kebele level and dairy products collection centers within the community level are suggested.

#### Conflict of Interest

The authors declare that they have no individual relationships that could have performed to affected the work reported in this study and have no known conflict of financial interests.

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