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DETERMINANTS OF SMALLHOLDER FARMER DECISION TO PARTICIPATE IN MILK AND BUTTER MARKET IN ADA'A BERGA DISTRICT, WEST SHEWA ZONE, ETHIOPIA*

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The main objective of this study was to examine smallholder farmers' milk and butter market participation decision and level of participation in the Ada'a Berga district. A multi-stage sampling technique employed to select 123 respondents. Heckman two stage model was used. The result of the Heckamn first stage show that breed type, income from dairy, membership of dairy cooperative and milking cows have a positive and statistically significant effect on milk market participation. While, the distance from market, number milking cows, market information and non-dairy income has a positive and statistically significant effect on the farmers' decision to participate in the butter market. The second stage Heckman model result shows education, number milking cows, credit and membership of dairy cooperative have a positive and statistically significant effect on the level of milk market participation. Also, factors such as number milking cows, access to credit, dairy income and volume of milk produced have a positive and statistically significant effect on level of butter market participation. Therefore, improving breeding, education, market information, strengthening cooperative and extension and credit service can increase farmers' participation in output market.

Keywords: Market Participation, Butter, Milk, Heckman, Ethiopia.
JEL Classification: D4, O16, M13

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1. INTRODUCTION

Africa directly or indirectly relies on agriculture sector (OECD, 2016). Likewise; economic development of Ethiopia is directly correlated to performance of agriculture sector. Agriculture contributes 36.2% of Gross Domestic product (GDP) and 72.7% of employment (CIA, 2017). Ethiopia is the first country from Africa in livestock resource and home for 60.39 million cattle. Out of total cattle stock about 12.39 million are milking cows (CSA, 2018). In Ethiopia about 95% dairy cattle are kept by smallholder farmers and only 5% of raw milk reaches formal market Shapiro et al. (2017).

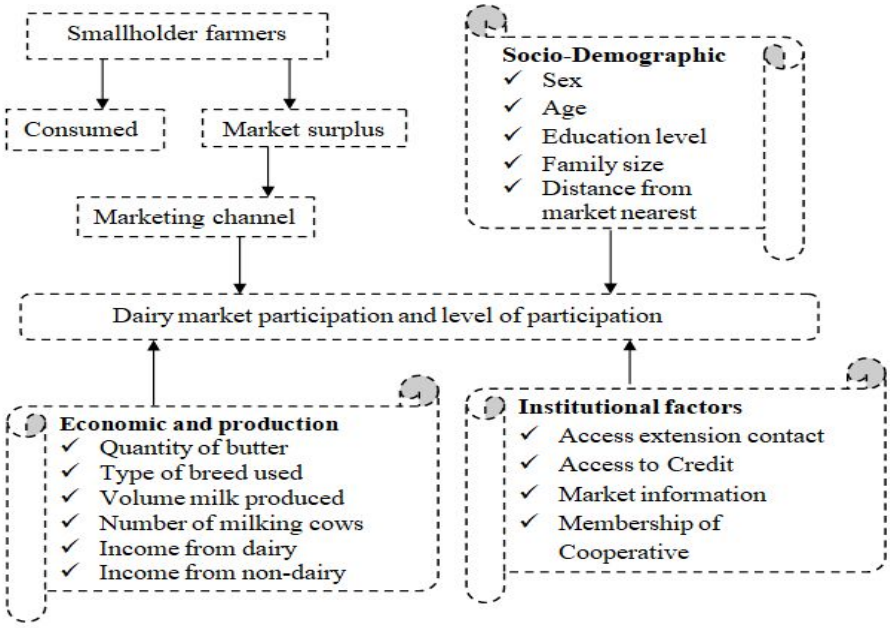
Dairy production has potential for millions of rural farmers in terms of employment, food and income Tegegne et al. (2013). Dairy producer used income earned from dairy for buying agricultural inputs; hire labour, rent land, food production and resiliency. However, farmers are poorly participating in market (Minten et al., 2018). About 31% of dairy value addition of in Ethiopia limited by lack of market access and about 3.4% milk loss is due poor infrastructure (Agricultural Growth Program Livestock Market Development (AGP-LMD), 2013). Farmers do not have access to all factors that are needed for delivering a product that response to market demand and they often face strong economic, social and physical disadvantages (Getachew, 2015). Recently Ethiopia, dairy sector is getting new investment, processors, inputs and farmers' organizations. But, producers and market actors are challenged by the problem of weak market linkages on both input and output market (Muhammed, 2011 and Yilma et al., 2011).

In terms of potential Oromia region has four big main milk-shed and contributes 50% nation's milk production. Ada'a Berga district has high dairy production potential (Van Geel et al., 2018 and TAP, 2016). Despite its potential, dairy production is characterized by low productivity and benefits realized from dairy do not match with existing potential. This due to lack of market access, inadequate logistical facilities, price fluctuation; poor market information, poor extension service and for several unknown factors.

Several studies have been performed on dairy production and marketing in Ethiopia. These studies were focused only milk market participation (Ali, 2017; Getachew, 2015; Haragweyni, 2015; Mamo et al., 2014; Meryem, 2013 and Bedilu, 2011). The majority of dairy farmers do not sell fluid milk and about 94% of dairy producer in rural Ethiopia sell butter (Gebremedhin et al., 2018).Understanding of household behaviours' in milk and butter marketing simultaneously can better inform policy. Therefore, this study attempted to empirically analysis of the determinants of smallholder farmer's decision to participate and level of participation both in milk and butter market in the Ada'a Berga district, Ethiopia.

2. THEORETICAL AND CONCEPTUAL FRAMEWORK MARKET PARTICIPATION

Market Participation idea in agriculture has been described differently by various authors. Market participation is integrating farmers into the inputs and output markets to increase production, earnings and decrease poverty (Otekunrin et al., 2019). Any market participation goal is addressing the question whether or no longer a household is better off participation in market. Household market participation decision is tested primarily based on the perceived utility from any option by minimizing transactions cost (Muricho et al., 2015). Smallholder farmers produce dairy to fulfil his/her physiological wishes of feeding, and/or to collect extra wealth through commercializing his activities and make certain decisions about what kind of dairy(s) to produce, how much to be produced, when and where to actually sell or market the produce which would result into most satisfaction from their labour in terms of returns.



Source: Own developed, 2018

Figure 1. Conceptual Frame Work of the Study

The decision to participate in the dairy market or not participant discrete in nature. The household's utility from participating in a given market is not observable but the decision to participate is observable. The decision to participate in the market is specified in Equation (1), where the selection variable M^* (probably based on marginal profitability of participating) is not observed but rather a sign of whether they participate or not. The variable M^* takes the value of 1 if the marginal utility the household ith gets from participating in the market is greater than 0 and 0 otherwise.

$$M_{ji}^{*} = \begin{cases} 1 & if\ \mathrm{M_{ji}} > 0 \\ 0 & otherwise \end{cases}. \quad (1)$$

Market participation decision and level of participation can be affected by different socio-economic and institutional factors. For example, transactions cost is one of impediment factors responsible for large market failure in developing countries.

Transaction costs, occasionally referred to as hidden costs and observable costs related with exchange of goods and services (Otekunrin et al., 2019). Farmer's characteristics such as household size, education, resource allocation, and price perception have an effect on participation decision and extent of participation (Musah, 2013). Factors associated to private assets such as breed type, number of dairy cow milk yield, size of land holding, livestock ownership, etc. and public assets such as market information and extension service were affects producers' market participation decision Getachew (2015).

3. METHODS AND PROCEDURES

3.1. Study Area and Sampling Procedure

The study was conducted in Ada'a Berga District, West Shewa Zone of Oromia National Regional State and Ethiopia. The located at 64 km north-west of Addis Ababa. The main economic activities in the study area crop-livestock mixed farming system. Dairy production in general significantly contributes to smallholder farmers as means of income, nutrition and employment.

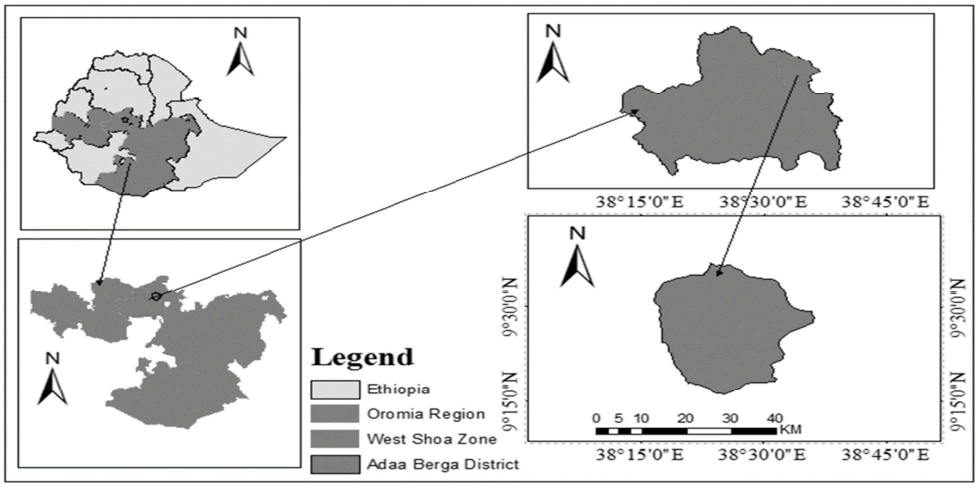


Figure 2. Map of study Area

The study was used both primary and secondary data. Three-stage sampling procedure was employed to draw sampled household. First, Ada'a Berge district selected purposively from west shewa zone. Secondly, consultation of district animal and fish resource office 20 potential dairy producing *kebeles* was selected out of 34 *kebeles.* By using simple random sampling technique four *kebeles* were selected out of 20 *kebeles*. Third stage, Yamane (1967) formula used to determine sample size as follows:

$$n = \frac{N}{1+N(e)^2} = \frac{7780}{1+7780(0.09^2)} \approx 123, \quad (2)$$

where n is the sample size, N is the population size and e is the level of precision assumed 9%.

Table 1. Sampled Distribution of Dairy Farm Households

No	Kebeles	Total numbers household's	sampled household's
1	Ittaya	298	20
2	Ejre	719	47
3	Biyho wogiide	413	28
4	Sireberga	401	27
	Total	1831	123

Source: Ada'a Berga Office of Agriculture (Animal and Fish Resource Department), 2019.

4. EMPIRICAL MODEL SPECIFICATION

Market participation involves farmer being able to buy input in the input market or being able to sell their output in the output market. Level of market participation is defined as the quantity of output sold by a farmer from total production or quantity of input a farmer can purchase in the input market (Sebatta et al., 2014). One of the main objectives of this study was to examine the determinants of smallholder farmer market participation decisions and level of participation in dairy market. Different researchers have used different econometric models to identify the determinants of smallholder market participation decision and level of participation. For instance, Heckman two-stage (Berhanu et al., 2013; Meryem, 2013; Benyam et al., 2017; Beyene et al., 2017; Dirriba, 2017; Ali, 2017 and Abera, 2018), double hurdle hurdle (Kassahun et al., 2020; Efa et al., 2016 and Temesgen et al., 2018), Tobit (Bultossa, 2016; Takele, 2015 and Holloway et al., 2004). Although, these researchers have used different models the nature of data set and underlying assumptions of the mode that the researchers have used has a significant role in selecting the appropriate econometric model.

In Tobit model the participation decision and level of participation were made simultaneously and factors that affect the participation choice and sales volume decision

is the same Tobin (1958). Tobit model assumes that zero values of participation associated with non-participation result from rational choice. As a result, Tobit model in cross-sectional analysis has poor relevance. Double-hurdle model allow to analysis market participation and level of participation separately as compared to Tobit model. It assumes that farmers face two hurdles; the first the decision to participate and level of participation (Cragg, 1971). Unlike Tobit model, participation and level of participation may not be the same. The limitation Double-hurdle model is error terms and the assumption of dominance (potential source of zeros and no considering the zero values).

Heckman selection model is appropriate if there is a censoring process in measuring the intensity of market participation (Humphreys, 2013). The Heckman two step procedures presume there are some potential levels in the sample population. However, there is sample selection problem. In general, Heckman's sample selection model is designed to account for the fact that the observed sample may be non-random. Heckman two step procedures assume that the error terms of the participation and level of participation equations are correlated, which is participation decision dominate level of participation.

The model implies that observed zero level of participation are the result of participation decisions only (i.e. zero observation in the outcome equation is due to first hurdle dominance); it assumes that there are no zero observations in the second stage once the first-stage selection is passed (John, 2016). The model further assumes that individuals who participate in the market do not report zero values and the assumption of bivariate normal distribution of error terms of selection represented by Inverse Mill's Ratio. The coefficient on the Inverse Mill's ratio will indicate if there is selection bias (Soderblom, 2011). Following this, we assumed that there is a non-zero and significant correlation between the error terms of the participation and the level of participation. As result, Heckman two step models have been applied. Heckman two stages (1979), provides consistent and asymptotically efficient estimates for all the parameters. Heckman's model first uses a probit regression with all variable data to estimate the probability of market participation. Then inverse Mills ratios (IMR), computed from the probit regression is used with different explanatory variables to help explain variances to the continuous non-zero dependent. Suppose that households participate in the market.

$$p_r\left(z_i = \frac{1}{x_i}, \tilde{\alpha}\right) = \Phi\big(h(x_i, \tilde{\alpha})\big) + \epsilon_i, \tag{2}$$

where $p_r\left(z_i = \frac{1}{x_i},\ \tilde{\alpha}\right)$ is the probability of a farmer making a decision to sell dairy into a market; z_i is indictor that unity of household sell/ participate milk and butter market; $\Phi(\cdot)$ is standard normal cumulative distribution function; $X_i = X_1 \ldots X_{13}$ are the variables specified expected to affect dairy market participation; $\tilde{\alpha}$ is a vector of coefficient estimated and ϵ_i is residuals that independently and normally distributed with zero mean and constant variance. The variable z_i takes the value of 1 if the marginal utility the household i gets from participating in the market is greater than 0

and 0 otherwise. So we have

$$z_i^* = \tilde{\alpha} X_i + v_i, \tag{3}$$

where z_i^* is the latent level of utility the household gets from dairy sell (i.e., market Participation. $v_i \sim N(0, 1)$.

$$z_i^* = \tilde{\alpha} X_i + v_1, \tag{4}$$

$$z_i = 1 \text{ if } z_i^* > 0. \tag{5}$$

In the second step, the inverse of mills ratio (IMR) was added as a regressed in the supply of milk and milk product function regarding the level of participation in order to correct for potential selection bias. Only households who participate in the market are included in the second stage, the IMR is computed as follows:

$$Mill\ ratios\ (\lambda_i) = \frac{\Phi\big(h(x_i, \tilde{\alpha})\big)}{\phi(\tilde{\alpha}, \text{xi})}. \tag{6}$$

The second-stage (sales) equation is given by:

$$Y_i^* = \beta' x_i + \gamma \lambda_i + u_i, \quad u_i \sim N(0, \sigma^2), \tag{7}$$

where Y is the (continuous) level of participation or Sales, x_i is a vector of independent variables affecting sales, and β is the vector of the corresponding coefficients to be estimated.

5. RESULT AND DISCUSSIONS

5.1. Socio-Economic Characteristics of Respondents

A total of 123 smallholder dairy producers interviewed about 23% household sold raw milk plus butter, 45% sold raw milk only and 32% sold only butter. The total volume of milk produced by sampled household was 328,098 litres and about 161,204 litres sold in market. The total volume of butter produced by sampled household was 4,672 kilogram and about 3,956 kilogram sold in market. The survey also found that about 166,894 (50.86%) litres of milk consumed directly or processed into other dairy product. This is supported by (Gebremedhin et al., 2018), who found households in rural do not sell fluid milk and about 68% of milk processed in to other dairy products.

Out of 123 dairy farmers interviewed about 56% were male head and the remaining 44% were female head. The overall mean of family size was 6. The mean family size of

milk market participant and non-participant was 7 and 5 respectively. The t-test statistic showed that mean difference in family size between milk market participants and non-participants was significant at less than 1%. The mean years of education level of household was 4 years. The mean educational level of the household head in terms of a number of years in school for milk market participant was 5.7 years and 2.2 year for non-participant. The mean educational level of the household head in terms of a number of years in school for butter market participant was 5.4 years and 2.5 years for non-participant. The mean difference between milk and butter market participant and non-participant was statically significant at less than 1% and 10% probability level, respectively. The average distance in kilometre between dairy farmers' residential place and nearest market centre was 11km on average. The mean distance from the nearest market centre was 6 kilometres for milk market participant and 11 km for non-participants. The mean distance from the nearest market centre was 20 Km for butter market participant and 11 kilometres for non- participant. The mean difference between milk and butter market participant and non-participants were significant at less than 1% probability level.

The mean income from non-diary source for butter market participant was 47421.27 birr per year compared to 26517 birr for non-market participant. The t-test statistic showed that there was a statistically significant mean difference in non-diary income between butter market participants and non-participants at less than 5% probability level. The average income from dairy source for milk market participant was 31,847 birr and 5084 birr for non-participant. The mean difference in dairy income between market participant and non-participant was statistically significant at 5% probability level. The mean income from dairy source for butter market participant was 14577 birr as compared to 5622 birr for non-market participant.

The result of study shows average milk produced by the milk market participant was 7 litres, as compared 3.5 litres for non-market participant and overall mean was 6 litres. The mean milk production of butter market participant household was 6 litres and 4 litres for non-participant. The overall mean butter production of household was 1.4 kilograms. The mean of butter production for milk market participant was 1.3 kilogram and 1.49 kilogram for non-participant. The mean butter production for butter market participant was 1.8 kilogram and 1.3 kilogram for non-participant. Numbers of milking cows are owned by dairy farmer was 3 cows. The average numbers of milking cows owned by milk market participant were 4 cows as compared to 2 cows for non-market participant and the mean numbers milking cows owned by the butter market participant was 3 cows as compared to 2 cows for non-participant.

5.2. Access to Institutional Service of Milk and Butter Participant and Non-Participant

The result of chi-square test statistics indicated that variation in access to extension contact, access to credit, access to market information, breed type and membership of

dairy cooperatives between milk and butter market participants and non-participants were statistically significant at 1% probability level (Table 2).

Table 2. Socio-economic Characteristics of Dairy Producers (Dummy Variables)

Variables			Milk producer			Butter producer		
		Overall %	Participant %	Non Participant %	χ^2	Participant %	Non participant %	χ^2
Access to Extension contact	Yes	70.00	60.00	10.00	34.40***	46.00	24.00	
	No	30.00	13.74	16.26		24.00	16.00	43.00***
Access to credit	Yes	63.40	49.00	14.40		47.00	16.40	
	No	36.60	14.40	12.43	58.70***	12.20	24.40	17.00***
Access to market information	Yes	66.67	43.00	23.67		52.00	14.67	72.00***
	No	33.33	23.67	9.66	50.14**	8.00	25.33	
Membership of Dairy cooperative	Yes	54.00	43.00	11.00	40.70***	37.00	16.00	
	No	46.00	11.00	35.00		15.50	28.45	18.80***

Source: own survey result, 2018.

5.3. Determinates of Smallholder Farmer Participation Decision and Level of Participation in the Milk and Butter Market

Milk and butter produced for sale and consumption in the study area. The econometric analysis done for milk and butter market participation decision and level of participation independently. The model overall goodness of fit parameters predicted and chi-square tests show that the overall goodness of fit for profit model was 119 and statistically significant at less than 1%. This shows that jointly independent variables included in the probit model. The pseudo-R^2 values show that the independent variables included in the regression explain a significant proportion of the variability in the farmer likelihood to take part in the milk market. Thus, pseudo-$R^2 = 0.90$ shows that about 90% of the variation in the dependent variable was for the explanatory variables included in the model. The first stage Heckman two-step model (binary probit model) for milk market participation shows that out of 15 explanatory variables eight were affected milk market participation (Table 3).

5.3.1. Determinates of Smallholder Farmers Milk Market Participation Decision

The outcome of milk market participation indicates that the breed type positively and statistically significant ($P < 5\%$). Being the owner of exotic breed cow increases milk production and the leading producer to take part milk market. Hence, the marginal effect shows that the chance of household owning exotic breed in milk market participation increase by 19.8% than household have a local breed cow. The finding similar to (Woldemichael, 2008 and Getachew, 2015). Incomes from a dairy source have a positive

outcome of the household milk market participation decision. The result displays a household who gains more income from dairy source are more engaged in management, production and supply to the market. The result of marginal effect shows that when the income of dairy source increases one thousand birr, chance of milk market participation of household would increase by 1%.

The distance from the nearest market centre was negatively related to dairy market participation. The most probable reason for the negative association in remote areas there is a lack of updated market information and high transaction cost that lower the farmers' profit. The marginal effect indicated that as the distance between the household residential places from the nearest market increase by one kilometre the chance of households takes part in the milk market decreases by 2.2%. This finding supported by Holloway et al. (2002) and Selamawit (2013).

Table 3. Results of Heckman Two-Step Milk Market Participation and Level of Participation

Variables	Milk market participation			Level of milk market participation	
	Coefficient	Standard error	Marginal effect	Coefficient	Standard error
Constant	7.181	2.747	-	5.981***	2.316
Distance from nearest market	-0.996**	0.474	-0.022	-	-
SEX	-1.910	4.422	-0.167	0.048	0.617
Family size of households	1.600***	6.210	0.029	-0.160	0.107
Education level of households	2.530	1.608	0.631	2.220**	0.953
Membership of dairy cooperative	18.200***	6.610	0.093	1.750**	0.705
Number of milking cows	10.818**	4.760	0.047	1.900**	0.367
Quantity of butter produced	-0.046	0.114	-0.003	-0.036	0.051
Access to market information	0.038	0.029	0.034	-0.188	0.661
Access to extension contact	0.084**	0.039	0.626	0.211	0.357
Access to credit service	0.149	0.370	0.458	2.140**	0.910
Income from non-dairy source	-0.013	0.032	-0.012	-0.435	0.655
Breed type	2.908**	1.201	0.198	6.132	54.020
Volume of milk output	0.006**	0.003	0.212	1.000***	0.024
Income from dairy sources	0.021**	0.010	0.349	-0.003	0.003
Age of households	-0.362	0.830	-0.015	1.238	3.750
Lambda				-41.100**	23.30
Rho(ρ)				-0.860	
Sigma				0.1039	
Number of observation = 123			LR χ^2_{14} = 89		
Censored observation = 39			Prob > χ^2 = 0.000		
Uncensored observation = 84			Pseudo R^2 = 0.900		
R^2 = 0.8713			Log likelihood = -7.73		
Adj R^2 = 0.8586			Wald χ^2_{14}= 91		

Notes: The dependent variable MMP is a dummy variable that takes on the value 1 if the farmer had sold milk in the market 0 otherwise. The dependent variable is a continuous variable volume of milk supply to market in litre (VMS). *, ** and *** represents significance level at 10%, 5% and 1% probability level, respectively.

Source: own survey model output, 2019.

The result of the study shows a positive association between a household's membership of a dairy cooperative and market participation decisions. This due to households who are members of the dairy cooperative are easily accessed to inputs such as feed, access market information, technical support as compared to a non-member. The marginal effect shows that a dairy farmer in a membership dairy cooperative would increase the likelihood of household participation in the milk market by 9.3%. The finding is supported by Asfaw (2009), Ali (2017), and Abafita et al. (2016). Numbers of local and crossbreed milk cows positive and significant at less than 5% level. The most likely reason for the statistically significant relationship could be a household that owns a large number of milking cows produce a large volume of milk. The marginal effect shows that for one unit increase in numbers of milking cows would increase the household market participation decision by 4.7%. The result supported by Bultossa (2016) and Bedilu (2011). Access extension contact positively affects milk market participation statistically significant at less than 5% significant level. This because of receiving enough access to extension contact from the development agent increase farmer's knowledge in dairy production and marketing. The marginal effect shows that when the farmers have enough access to extension contact would increase the chance of participating in the milk market by 62.6%. This finding is similar to Holloway et al. (2000) and Meryem (2013).

5.3.2. Determinates of Smallholder Farmers Level of Participation in the Milk Market

Heckman's second stage estimation show the factors that affecting the level of milk market participation by incorporating the inverse Mill's ratio calculated from the milk market participation decision. The overall joint goodness of fit based on the Wald Chi-square test (Wald $\chi^2 = 91$; Prob > $\chi^2 = 0.000$) result shows the overall goodness fit of the selection model was statistically significant at less than 1%.This shows that jointly independent variables included in the model explained level of milk market participants. If rho with an absolute value of 1 or approach 1 shows the existence of selection bias (Cuddeback et al., 2004). In this case, a rho value is -0.86 shows that the existence of selection bias. The result of the model showed that the educational level of household, number local and crossbred milking cows, volume of milk produced, access to credit and membership of dairy cooperative and inverse mills ratio were important factors influencing the level of participation

Education level of households positively significant affects level milk market participation. This due to education enhances managerial fitness in production, processing, marketing and enables to understand and interpret information. The coefficient of this variable showed that a unit increase in formal school year would increase household milk supply by 2.2 litres. This result is consistent to Kebede et al. (2015) and Woldemichael (2008). Number of local and crossbred milking cows had positive effect on milk supply. The result of coefficient shows that one unit increase in

number of milking cow will increase the volume of milk supply to the market by 1.9 litres. The result supported by Ali (2017) and Gizachew et al. (2005).

Volume of milk produced had a positive and significant (P < 1%) association with milk supply to market. The result of coefficient shows that one litre increase in milk produce; will increase milk supply in the market by 0.93 litres. This result is lined to Getachew (2015). Access to credit had a positive effect on milk supply to market. This probably due to farmers who received credit purchase feed and other inputs that enables farmer to produce more volume of milk. The result of coefficient shows that farmer access to credit services will increase milk supplied to the market by 2.14 litres. This result is confirmed to Haregeweyni (2015). A membership of dairy cooperative was positively affected milk supply to market. This may be due to farmers' who are members of the dairy cooperative are access to training, credit, and information. The result of the coefficient shows as farmers' a member of the dairy cooperative will increase volume milk supply to the market by 1.75 litres. This result supported by Ali (2017), Asfaw (2009) and Beyene (2017). The result of inverse mills' ratio negative and significant at less than 5% probability level. The result of coefficient shows that unobserved factor negatively affects both milk market participation decision and level of participation.

5.4. Determinates of Butter Market Participation Decision and Level of Participation

5.4.1. Determinates of Smallholder Farmer Butter Market Participation Decision

The decision to participate in the butter market was estimated by probit maximum likelihood estimator. The model chi-square tests applying appropriate degrees of freedom showed that overall goodness of fit of the probit model was statistically significant at less than 1% probability level for butter market participation. The probit model butter market explained 75% of the variations in the likelihood of dairy farmers to butter market participation predicted correctly. The result of the model showed that number of milking cows, access to market information, and distance from market, non-dairy income and quantity of butter produced were important factors influencing the dependent variable (Table 4).

Access to market information was positively related to the butter market participation. The model output confirms that as dairy farmers have enough access to market information, would increase the likelihood household's butter market participation by 8%. This result is similar to Embaye (2010) and Dirriba (2017). Dairy income positively affects the likelihood of butter market participation at less than 5%.This may because farmers who had cash from different sources used as supplementary income to purchase inputs like feed, medicine/vaccine and other inputs. The marginal effect shows for a thousand per increase in non-dairy income will increase butter market participation by 1.76%.5.4.2. Determinates of smallholder farmer level of participation in the butter market.

Table 4. Result of Heckman First Stage (Butter Market Participation)

Variables	Coefficient	Standard error	Marginal effect
Constant	7.820***	2.450	
Distance from nearest market	0.330*	0.174	0.042
Sex	-0.140	0.418	0.066
Family size of households	0.095	0.080	0.036
Education of households	0.152	0.597	0.059
Age of households	0 .010	0.023	0.011
Membership of dairy cooperative	0.768	0.656	0.296
Number of milking cows	0.915*	0.485	0.061
Access to market information	3.028***	0.783	0.805
Access to extension contact	0.110	0.530	0.042
Access to credit service	0.720	0.572	0.278
Income from non-dairy source	0.166**	0.073	0.018
Quantity of butter produced	0.147**	0.060	0.042
Type of breed used	0.523	0.497	0.149
Quantity of butter produced	0.057	0.389	0.163
Income from dairy sources	0.016	0.043	0.005
Number of observation = 123		Log likelihood = 20.84	
LR χ^2_{14} = 125.89		Wald χ^2_{14} = 44.73	
Pseudo R^2 = 0.7513			

Notes: The dependent variable BMP is a dummy variable that takes 1 if the farmer had sold butter in the market 0 otherwise. ***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.
Source: Model output, 2018.

5.4.2. Determinates of Smallholder Farmer Level of Participation in Butter Market

The butter market participation null hypothesis test shows that all coefficients are jointly zero. The Wald Chi-square test (Wald χ^2 = 118.75; Prob > χ^2 = 0.000) indicates that the overall goodness of fit for the selection model is statistically significant at less than 1%. The variables statically significant for the butter level of market participants are presented (Table 5). A number of local and crossbred milking cows had a positive influence on butter supplied to the market at less than 5% significance level. This confirms that average butter production per household had a direct relation to the numbers of milking cows. As the numbers of milking cows increase the milk output and derivatives increased. The result of the coefficient shows that for one unit increase in the number of milking cows will raise the butter supplied to the market by 1.82 kilograms. The result is supported by Mamo et al. (2014).

Access to credit had a positive and significant effect on the butter market supply. The coefficient of a variable shows that as farmers' access to credit would increase, the quantity of butter supplied to the market by 2.1 kilograms. This finding linen to Beyene

(2017) and Gebremedhin (2018). The volume of milk produced positively and significantly (P<1%) influences butter supply to the market. The coefficient variable shows that a one-liter increase in milk production will increase the butter supply to the market by 0.46 kilograms. The inverse Mills ratio is positive and significant at less than 5% (p=0.02) probability level. The result coefficients show that the unobserved error term positively affects the butter market participation and level of participation.

Table 5. Result of Heckman Second Stage (Butter Level of Market Participation)

Variables	Coefficient	Standard error
Constant	13.174	16.627
Sex	-3.540	2.896
Family size of households	-0.293	0.527
Education of households	1.181	4.364
Age of households	0.204	0.149
Membership of dairy cooperative	1.778	4.874
Numbers of milking cows	1.820**	1.010
Access to market information	6.727	4.900
Access to extension contact	3.550	4.200
Access to credit	2.100**	1.060
Quantity of butter produced	0.061	0.079
Income from non-dairy sources	0.991	16.627
Income from dairy source	0.157**	0.093
volume of milk produced	0.462**	0.210
Type of breed used	0.523	0.497
Volume of milk produced	0.057	0.389
mills lambda	9.360**	4.030
Rho(ρ)	1.000	
Sigma	9.369	
Number of observation = 123	Wald χ^2_{14} = 44.73	
Censored observation = 55	Prob > χ^2 = 0.000***	
Uncensored observation = 68		

Notes: The dependent variable is continuous variable quantity of butter supply to market in kilograms (QBS).
***, **, and * indicate statistical significance at 1%, 5%, and 10%, respectively.
Source: Model output, 2018.

6. CONCLUSION AND RECOMMENDATIONS

The primary objective of this study was to investigate smallholder farmers' milk and butter market participation decision and level of participation in the Ada'a Berga district west shewa zone oromia national regional state, Ethiopia. The primary information

gathered from 123 smallholder farmers through three-stage three-stage sampling procedure and interviewed using a structured questionnaire. The descriptive and Heckman two stage econometric models were used. The result, finding shows that breed type, income from dairy sources, membership of dairy cooperative and number milking cows were positively affect the smallholder farmers' decision to take part in milk market. The result of the study also shows the distance from the nearest market, number milking cows; access to market information, non-dairy income was positively affected decision to participate in the butter market. Education of household, number milking cows, milk produced, access to credit and membership of dairy cooperative were positively affect level of milk supply. The level of butter supply affected by number milking cows, access to credit, quantity of butter, income from dairy sources and volume of milk produce. The recommendation forwarded is development market infrastructure, institutionalized marketing information, strengthening cooperative, extension contact, formal education, credit, and improving breeding system can increase farmers' participation in output market.

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