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DETERMINANTS OF FARMERS' DECISION TO CHOICE MARKET OUTLETS: EVIDENCE FROM MILK PRODUCER FARMERS IN ADA'A BERGA DISTRICT ETHIOPIA

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Abstract. In Ethiopia, many initiatives have been implemented to empower smallholder dairy farmers to develop viable livelihoods from the sector. The problem with these policies is the inability to reach farmers at large, and dairy farmers in rural areas are always challenged to deliver milk and milk products faster to the final market. The study was aimed at investigating factors that influence market channel choices among dairy producers in Ada'a Berga district Ethiopia. This paper uses data from a survey of 123 dairy producer households in four rural kebeles to analyse the factors that influence the choice of a milk marketing channel. Multivariate probit econometric model results show that income from dairy source, market information and educational level of household affected wholesaler outlet. The choice of consumer outlet is influenced by family size, membership in a dairy cooperative, market information, non-dairy income and income from dairy source. Number of milking cows, membership in a dairy cooperative and non-dairy income determined the choice of dairy cooperative outlet. The choice of district retailer's market outlet was affected by sex of households, membership in a dairy cooperative and income from dairy sources. Choice of rural collector outlet is negatively influenced by non-dairy income and access to an extension contact. Therefore, policies should be designed that encourage farmers' cooperatives, contract farming and collective action in order to lower transaction costs, expand market information for dairy producers, expand extension services and expand infrastructures such as road and transportation facilities, which are needed to promote the effective marketing of milk through all outlets.

Keywords: multivariate probit, milk marketing channels, dairy farmers Ada'a Berga District, Ethiopia

INTRODUCTION

Agriculture is the primary source of food and income for Africans and provides up to 60% of all jobs on the continent Diop (2016). More than 70% of Ethiopia's population is still employed in the agricultural sector CIA (2019). Dairy is a staple product in Ethiopia and mainly depends on indigenous livestock resources: cattle contributes the largest of the total national annual milk output at (81.2%), followed by goats (7.9%), camels (6.3%) and sheep (4.6%) and managed under extensive grazing and uncontrolled breeding CSA (2020). In developing nations, demand for milk and milk products is increasing and the drivers of change to the dairy sector are demography, growing economies, underserved markets, conducive policy and enabling environment, globalization and market opportunities (Shapiro et al., 2017). Dairy is a source of income and food, thereby reinforcing the overall reduction of poverty in Ethiopia (Tegegne et al., 2013).

Meeting the increasing demand for milk and milk products cannot be realized without reducing the transaction costs prevailing along the supply-chain by identifying cost-effective marketing channels and coordinated supply chains Kilima and Kurwijila (2020). The dairy

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sector transformation process requires periodically identifying critical challenges and opportunities and designing interventions and investment options for the public and private sector Gebreyohanes et al. (2021). It is important to understand how the marketing channel is organized and what factors limit farmers in their choice of market as part of the dairy improvement programs in Ethiopia. Farmers have alternative market outlets for selling their agricultural produce. These outlets offer different prices and sales services, which determine farmers' choices as to which market outlet they should send their produce Geoffrey (2015). Choice of market outlet plays an important role in improving incomes. Farmers choose a particular channel if the expected utility gained by selling through the selected channel is greater than all the other channels (Mamo et al., 2021).

The inability of dairy farmers to reach the national or international markets is a key challenge for dairy production and marketing in Ethiopia. To tackle challenges and support the dairy sector, different interventions have been made by the government, national and international research institutions. For instance, Ethiopia's Livestock Master Plan (LMP) set out predicted growth opportunities, and within the LMP an ambitious programme was drawn up for the dairy sector Shapiro et al. (2015). The LMP was planned to increase milk production from 167 million to 1,490 million litre and increase the contribution of dairy to Gross domestic product from 1.1 billion to 10.0 billion Ethiopian Birr (ETB) by 2020. With the Livestock Master Plan, the government planned to empower smallholder farmers with access to markets to create viable livelihoods from dairy and encourage growth of the formal market (National Planning Commission, 2016). Also, the Ethiopia agricultural transformation agency has established a plan and intervention on solving systemic bottlenecks within the agricultural sector to catalyse transformation from a subsistence oriented, low output agricultural sector to a high performing sector (Bachewe et al., 2018).

However, in Ethiopia, the problem of these policies is the inability to reach farmers at large. Informal channels are dominant in rural areas, especially where there are not strong dairy cooperatives operating actively (Brasesco et al., 2019). Most of the milk consumed by most urban consumers is mostly supplied through the informal sector, whereas rural and peri-urban producers supply directly to traders as well as local kiosks, hotels and shops. In Ethiopia, raw milk is a missing market link between the formal milk processing companies and dairy producers. As a result, formal milk processing companies in Ethiopia are operating at less than half of their full capacity (Mulugeta et al., 2019). On the other hand, dairy producers that operate in and around major cities in Ethiopia face milk marketing problems, especially during fasting periods resulting in low milk prices and high milk wastage (Adam et al., 2019). Also, producers are not benefitting from the opportunity of high demand for milk due to poor value chain governance and the absence of strong linkages between producers and buyers (Brasesco et al., 2019). Zegeyesh et al. (2017), rural poor farmers are always challenged to deliver milk to the final market. Jaleta and Gardebroek (2007) showed that inadequate market channels and poor information regarding prices were among factors affecting commercialisation of agriculture. Smallholder farmers are excluded from international markets (Arinloye et al., 2015) and small-scale dairy farmers are forced to sell their dairy products through informal marketing channels for myriad factors AGP-LMD (2013).

Previous studies showed that the decision of milk farmers on their choice of milk market outlet is influenced by the characteristics related to membership in a cooperative, form of payment, volume of milk produced, level of education and marketing costs (Jaiswal et al., 2016), being in rural areas, breed type, separate milking place, supply of hay (Ketema et al., 2016), transaction costs and socio-economic variables such as sex, dairy farming experience, dairy cooperative membership, number of milking cow owned, frequency of extension contact, non-farm income (Ayyano et al., 2020), milk buyers' related factors such as purchase frequency and quantity purchased (Berem et al., 2015), institutional factors such as access to credit and financial strength (Innocent et al., 2018), characteristics related to the seller (reputation, desire to control channel) and market information (Ishaq et al., 2017; Singh, 2018; Zegeyesh et al., 2017). Past studies on the dairy market show more attention given to participation of producers in the dairy market and marketing efficiency of the chain (Ordofa et al., 2021). However, limited work was done on the choice pattern of farmers when it comes to channel choice and the factors influencing those choices regarding outlet of milk market. Another limitation of the past studies was the methodological approach. The analytical model widely utilized for the econometric analysis was the multinomial logit (MNL) model, which

fails to address interdependent decisions to sell milk to more than one channel. The exceptions were the studies by Ayyano et al. (2020), Mamo et al. (2021) and Zegeyesh et al. (2017) who utilized the multivariate probit (MVP) model.

In recent years, various actors in Ada'a Berga district such as traders (wholesaler, retailers, collectors), cooperatives and processors companies have frequently joined the milk market due to increased demand for milk products in urban and pre-urban areas. The emerging new market and network is an opportunity for producers to maximize the benefit if they make an appropriate decision on the choice of market outlet where they should sell their product. However, there are various factors that affect households' decisions in selecting appropriate channels for delivering their products to the market. Identifying these factors is very important in terms of pinpointing possible areas of intervention that may help farmers to maximize benefits from their milk production and marketing activities. In addition, given the potential of Ada'a Bega for milk production, processing, marketing and consumption, the results of the study are essential in terms of providing vital and valid information in relation to the choice of appropriate market outlets. In doing so, the study attempts to analyse factors affecting milk channel choice decisions of milk producer households in Ada'a Berga district, Ethiopia.

METHODS

Study area

This study was conducted in Ada'a Berga District, West Shewa Zone of Oromia National Regional State, Ethiopia (see Fig. 1). Geographically, it is located 64 km Northwest of Addis Ababa on the road of Mugher cement enterprise at 9°12'to 9°37 N latitude and 38°17' to 38°36' E longitude. The district is bordered by Walmara district in the South, Ejerie district in the South West, Meta Robi, district in the West and Muger River in the East. The Ada'a Berga district is composed of 34 rural *kebeles* and three urban *kebeles*. This case *kebele* is a peasant association and the smallest administrative unit of Ethiopia that was used to manage household surveys. The Ada'a Berga district is characterized by a crop-livestock mixed farming system where in general livestock contribute to a farmer's livelihood as a source of food, cash income, source of traction power and means of transpiration. Dairy production significantly contributes to smallholder farmers as a means of income, nutrition and employment. The Ada'a Berga district milk production is predominantly a smallholder mixed part of the subsistence dairy production system. In this system, all feed requirements are derived from native pasture and a balance comes from crop residues and stubble grazing. Cattle are the main source of milk even though they are kept primarily as a draught power source with very little or no consideration given to improving their milk production capabilities. The milking months of local breeds exist for almost seven months of lactation and the potential average milk yield per cow per day is about 1.48 liters per a day (CSA, 2020). The majority of the dairy products are sold in the local market. Milk and milk by-product prices vary between different seasons and locations. The increase in the amount of milk sold during the wet season was high in the mixed crop- livestock system. The increase of milk yield and supply to the market is mainly due to more cows calving in the wet season and increased feed availability. The dairy farmers in Ada'a Berga have many market outlets for selling their milk, such as cooperative, wholesaler, rural collectors, hotels and direct to consumers. However, low amount of milk produced, distance to the market and high cost of transport were the major constraints faced by milk producers.

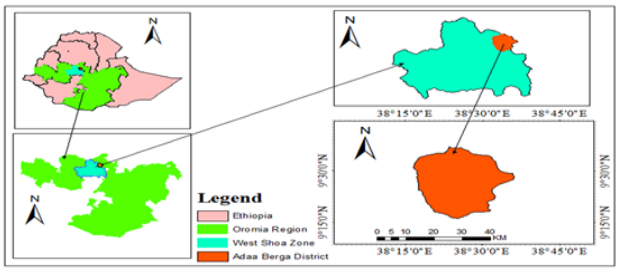

Fig. 1. Map of study Area

Sampling techniques and sample size determination

The multistage sampling techniques were applied to divide the large population into smaller clusters in several stages to make primary data collection more manageable. First, the West Shewa Zone was selected from four main milksheds in Ethiopia. Second, considering the

potential of milk production and marketing, Ada'a Berga district was selected. Third, from 34 *kebeles* of the Ada'a Berga, 20 milk producing *kebeles* were selected and clustered into three agro climatic zones, and four *kebeles* namely, *Ittaya, Ejre, Biyhowogiide and Sireberga* were selected using simple random. Finally, a total of 123 households allocated to four *kebeles* based on the proportional to sample size (Table 1). Yamane (1967) formula was employed to calculate the sample size. Although it is common to use 5% significance level to estimate the sample size, this study used 9% due to the financial and time constraints of using a large sample size.

The sample size was determined using the following formula:

$$n = \frac{N}{1 + N(e)^2} = \frac{1831}{1 + 1831(0.09^2)} = 123 \qquad (1)$$

Where, n = sample size, N = Population size and e = 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		1 831	123

Source: Ada'a Berga Office of Agriculture (Animal and Fish Resource Department), 2020.

Empirical model specification

The theoretical basis for choosing an appropriate econometric model to analyse factors affecting milk marketing channel choice decisions of the dairy farms is derived from the random utility theory (McFadden, 1986). The underpinning assumption of this theory is that a decision-maker is rational who has perfect information to make decisions of choosing an alternative that offers the highest utility from a choice set. However, considering dairy producers as rational decision makers with perfect information is unrealistic because they have cognitive limitations, limited time and do not have full information to make rational decisions. This leads to the bounded rationality theory, which means they cannot make utility maximizing decisions but a nearly optimal decision that is sufficient to compare alternatives (Simon, 1955). It has become common practice to apply logit models for data which are individual (household) specific (Green, 2000). The application of logit models depends on the number of marketing channels involved to study decisions related to market participation and channel choice (Lu, 2007). When the choice set consists of only two options, binary or probit models are the most frequently used econometric models for an empirical analysis. However, if the choice sets are more than two, then the multinomial logit discrete choice model is used (Green, 2000). When the choice set consists in estimating several correlated binary outcomes jointly and the influence of the set of variables on the choice of markets outlets, then the multivariate probit (MP) is used (Green, 2000). Multivariate probit is used over multinomial logit (ML) because ML is not viable since the market channel choice might not be mutually exclusive given the possibility of simultaneous choices of channel and the potential correlations among these market channel choice decisions.

The model assumes that the decision to participate in a particular marketing channel is based on the maximization of an underlying utility function and a farmer selects his/her market channels based on his/her expected utility (McFadden, 1986). A farmer's decision whether or not to participate in each market channel is made by evaluating gains in expected utility, taking into account the related investments, benefits and costs. If this expected utility is positive and higher than the alternative options, this market will be selected by a farmer and it is assumed that given farmer i in planning, considering exclusive alternatives that constituted the choice set i^{th} dairy marketing outlet, the choice set may differ according to the decision maker. Consider the i^{th} farm household ($I = 1, 2\ldots..$ N), facing a decision problem on whether to choose available market outlets, let is dairy market outlet and represent the benefits to the farmer who chooses wholesalers, and let U_k represent the benefit of farmer to choose the Kth market outlet: where K denotes choice of wholesalers (y_1), retailers (y_2), consumers (y_3), Dairy cooperative (y_4) and rural collectors (y_5).

$$y^*_{ik} = U^*_k - U_0 > 0 \qquad (2)$$

(y^*_{ik}) the net utility which is unobserved that farmer derives from choosing a market outlet is determined

by observed explanatory variable (X_i) and the error term (ε_i).

$$y^*_{ik} = x'_i \beta_{ki} + \epsilon_i$$
$$k = y, y_2, y_3 y_4 \wedge y_5 \quad (3)$$

Whilst it is not possible to directly observe the utilities, the choice made by the farmer revealed which marketing outlet provides the greater utility (Greene, 2012). Hence, the utility was decomposed into deterministic (V_{ij}) and random (ε_{ij}). The unobserved preferences in equation (1) translate into the observed binary outcome equation.

$$\text{Yik } \{1 \textit{ if } y_{ik} > 0 \; 0 \text{ otherwise}$$
$$k = y_1, y_2, y_3, y_4 \wedge y_5 \quad (4)$$

Where: y_1 – wholesaler, y_2 – retailer, y_3 – consumer, y_4 – dairy cooperative and y_5 – rural collector.

In the multivariate model, where the choice of several market outlets is possible, the error terms jointly follow a multivariate normal distribution (MVN) with zero conditional mean and variance normalized to unity (for identification of the parameters) where the symmetric covariance matrix is given by ($\mu_{y1,}$ $\mu_{y2,}$ $\mu_{y3,}$ μ_{y4}, $\mu_{y5)}$ MVN ~ (0, Ω) and the symmetric covariance matrix is given Ω by

$$\Omega = \begin{bmatrix} 1 & \rho y1y2 & \rho y1y3 & \rho y1y4 & \rho y1y5 \\ \rho y2y1 & 1 & \rho y2y3 & \rho y2y4 & \rho y2y5 \\ \rho y3y1 & \rho y3y2 & 1 & \rho y3y4 & \rho y3y5 \\ \rho y4y1 & \rho y4y2 & \rho y4y3 & 1 & \rho y4y5 \\ \rho y5y1 & \rho y5y2 & \rho y5y3 & \rho y5y4 & 1 \end{bmatrix} \quad (5)$$

Of particular interest are off-diagonal elements in the covariance matrix, which represent the unobserved correlation between the stochastic components of the different types of outlets. This assumption means that equation (4) generates an MVP model that jointly represents the decision to choose a particular market outlet. This specification with non-zero off-diagonal elements allows for correlation across error terms of several latent equations, which represents unobserved characteristics that affect the choice of alternative outlets.

RESULTS AND DISCUSSIONS

Data

Out of 123 dairy farmers interviewed about 56% were male headed and the remaining 44% were female headed. The overall mean family size of households was found to be 6 family members per household. The mean years of education level of the household was 4 years. The average distance in kilometres between dairy farmers' residential location and nearest market centre was 11 km on average. The mean incomes from non-dairy sources for butter market participants were 1482 USD. and average income from dairy sources for milk market participants were 995 USD. The estimated total milk and butter production by sample household was 258,098 litres and 4,672 kilograms respectively. The marketed surplus of milk and butter by household was 161,204

Table 2. Socio-economic and institutional characteristics of producers

Variables	Mean	SD		
Family size (number)	6	3.3		
Age(year)	45.33	11		
Distance from market (Kilometre)	11	10.6		
Non-dairy income (USD)	1 240	1 413		
Numbers of milking cows (number)	3	2		
Education level (year)	4	1.5		
Volume milk produced (Litre)	6	4.26		
Income from dairy (USD)	446	280		
Variables	Yes	No		Overall %
Access to extension contact	70	30		100
Access to credit	63.4	36.6		100
Access to market information	66.67	33.33		100
Membership of dairy cooperative	54	46		100
Breed type	Exotic	Local	Both	
	15	60	25	100
Sex	Male	Female		
	56	44		

Source: own survey result, 2020.

litres and 3,956 kilograms, respectively. The survey results show the average milk produced by a sample household was 6 litres on average. The mean of milking cows owned by the household was 4 cows. The survey result shows that 70% of the households had access to extension contact and 63.4% of sample households had access to credit. The survey shows that about 66.67% of the sample household had access to market information. The result of the findings show that about 54% of the sample households were members of a dairy cooperative. The survey result found that about 60% of households owned locally bred milking cows, 25% own both exotic and local breed milking cows and 15% own exotic breeds.

Milk market channel

Market channel choice is linked to the theory of utility maximization. The theory assumes that producers are rational and attempt to choose marketing channels that maximize their utility. The major marketing outlets were identified and characterized by many intermediaries along the chain (Table 3). A large number of milk farmers choose direct wholesaler, followed by dairy cooperative, district retailer, rural collector and direct consumer marketing channels respectively. Of the total volume of milk supplied by sample households, about 34%, 26.6%, 18%, 11.2% and 9.7% were sold to wholesalers, followed by dairy cooperative, district retailer, rural collector and direct consumer marketing channels, respectively. The large number of milk farmers choose direct wholesaler, followed by dairy cooperative, district retailer, rural collector and direct consumer marketing channels respectively. Of the total volume of milk supplied by sample households, about 34%, 26.6%, 18%, 11.2% and 9.7% were sold to wholesalers, followed by dairy cooperative, district retailer, rural collector and direct consumer marketing channels, respectively.

Econometric model result

Determinants of dairy producers' market outlets choice

The model fits the data reasonably well. The Wald test (70) = 139.73, p = 0.00) was statistically significant at the 1% level, which indicates that the subset of coefficients of the model are jointly significant and that the explanatory power of the factors included in the model is satisfactory. Furthermore, the results of the likelihood ratio test in the model (LR χ^2 (10) 56.039, P > χ^2 = 0.00*** is statistically significant at 1% level, indicating that the independence of the disturbance terms (independence of multiple market outlets) is rejected and there are significant joint correlations of the several estimated coefficients across the equations in the models. The likelihood ratio test of the null hypothesis of independency between the market channel decision (ρ_{21} = ρ_{31} = ρ_{41} = ρ_{51} = ρ_{32} = ρ_{42} = ρ_{52} = ρ_{43} = ρ_{53} = rho_{54} = 0) is significant at 1%. Therefore, the null hypothesis that all the ρ (Rho) values are jointly equal to 0 is rejected, indicating the goodness-of-fit of the model. Hence, there are differences in market outlet selection behaviour among farmers, which are reflected in the likelihood ratio statistics. The ρ_{21} is the correlation between the choice of district retailer and wholesaler outlet) and ρ_{41} (correlation between the choice of rural collector and district

Table 3. Proportion of milk supplied to each milk market channel

Market channel	Total (N)	Supply of milk in litres		
		Total	Mean	SD (Standard deviation)
District retailer	26	29 435	1 811	1 915
Wholesalers	42	55 099	1 839	1 841
Consumer	35	15 725	233	1 680
Dairy cooperative	48	42 977	2 249	1 911
Rural collectors	37	18 893	1 832	1 976
		161 204	1 554	1554

Source: survey result, 2020.

retailer outlet) and statistically significant at the 1% probability level, indicating a competitive relationship of collector outlet with retailer outlet and consumer outlet while ρ_{32} correlation between choice of consumer and consumer outlet) are positive and statistically significant at 1% level of significance indicating complementarity relationships between wholesaler and consumer outlet. ρ_{43} (correlation between the choice of rural collector and consumer outlet) is significant at less than 10% probability level (Table 4).

Table 4. Multivariate probit results (Coefficients and Std. Err.) of market channel choices

Variables	Wholesaler	Consumer	Dairy Cooperative	District Retailer	Rural collector
	Cofe (SE)	Cofe (SE)	Cofe (SE)	Cofe (SE)	Cofe (SE)
Constant	2.61 (1.120)	–3.10 (1.34)	0.756 (1.45)	3.0** (1.5)	–2.4 (1.02)
Distance from nearest market	0.01 (0.019)	0. 034 (0.18)	0.022 (0.02)	0.03 (0.02)	0.02 (0.018
Sex of household	0.43 (0.34)	–0.18 (0.29)	–0.07 (0.29)	0.64** (0.3)	0.49* (0.3)
Family size of household	0.03 (0.05)	0.08* (0.05)	0.01 (0.04)	0.04 (0.05)	–0.03 (0.05)
Age of households	–0.01 (0.014)	0.016 (0.01)	–0.01 (0.013)	–0.05 (0.01)	0.02 (0.02)
Education level household	1.32** (0.48)	0.64 (0.37)	–0.05 (0.351)	0.13 (0.37)	0.68* (0.4)
Membership of dairy cooperative	0.43 (0.445)	1.24*** (0.42)	1.2*** (0.44)	1.4** (0.48)	–0.64 (0.44)
Number of milking cow	0.01 (0.228)	0.34 (0.204)	0.39*** (0.1)	–0.02 (0.129)	0.09 (0.14)
Access to extension contact	–0.43 (0.4)	–0.35 (0.382)	–0.25 (0.2)	–0.35 (0.38)	–0.74* (0.4)
Access to credit	–0.33 (0.395)	–0.12 (0.357)	–0.01 (0.01)	0.28 (0.365)	0.41 (0.39)
Market information	0.72** (0.37)	0.77** (0.32)	0.092 (0.04)	0.53 (0.33)	0.16 (0.33)
Types of breeds used	0.346 (0.24)	0.34 (0.2)	–0.256 (0.2)	–0.4** (0.22)	0.18 (0.2)
Income from dairy	0.10** (0.03)	0.04*** (0.02)	–0.04 (0.01)	0.02* (0.013)	0.04 (0.02)
Milk output	0.09 (0.04)	–0.08 (0.19)	0.09 (0.036)	0.033 (0.04	0.098 (0.22)
Non-dairy income	–0.23 (0.19)	0.04** (0.2)	0.09** (0.04)	0.13 (0.21)	–0.1** (0.04)
Predicted probability	42.63%	43.77%	50.73%	31.78%	41.45%
r_{21}		0.31* (0.17)			
r_{31}		0.26 (0.16)			
ρ_{41}		0.73*** (0.12)			
ρ_{51}		0.23 (0.15)			
r_{32}		0.72*** (0.12)			
ρ_{42}		0.05 (0.18)			
ρ_{52}		–0.05 (0.175)			
ρ_{43}		0.267* (0.16)			
ρ_{53}		–0.2 (0.156)			
ρ_{54}		0.26 (0.1)			
Wald chi2 (70)		139.73			
Log Likelihood		273.33			
Joint probability (success) =7.23%, Joint probability (failure) =15.18%					

Likelihood ratio test of: $r_{21} = r_{31} = \rho_{41} = \rho_{51} = r_{32} = \rho_{42} = \rho_{52} = \rho_{43} = \rho_{53} = \rho_{54} = 0$: c^2 (10) = 56.04*** Prob > chi2 = 0.0000. ***, ** and * means statistically significant at 1%, 5%, and 10%, respectively.
Source: model output of survey, 2020.

Milk producers use different rural channels or substitute one channel over other outlets in Ada'a Berga district. The simulation results indicate that the probability that milk producers' chose a wholesaler, district retailer, consumer, rural collector and dairy cooperative market outlet were 42.63, 31.78%, 43.77%, 41.45%, and 50.73%, respectively. The joint probabilities of success and failure of the five variables also suggest that it would be unlikely for households to choose all five market outlets simultaneously, for their likelihood to do so was only 7.23%. As depicted in (Table 4), out of 14 explanatory variables included in multivariate probit model, three variables significantly affected wholesaler market outlet; five variables significantly affected district retailer outlet; six variables significantly affected consumer outlet; three variables significantly affected dairy cooperative and four variables affected collector outlet choices at 1%, 5% and 10% probability levels.

The MVP model results showed that most of the explanatory variables included in the econometric model had a significant effect on choosing at least one market channel. The sex of the household was significantly associated with the use of a district retailer and rural collector outlet at 5% and 1% significance level, respectively. The male headed producers were more likely to deliver milk to collector and district retailer outlets than female headed households. This implies that male farmers had a higher chance to sell milk to different market outlets. This finding is supported by Ayyano et al. (2020); Girma and Abebaw (2012), who reported that male headed producers are less likely to deliver milk to the collector outlet than female headed household. Income from non-dairy sources affected the choice of dairy cooperative, consumers and rural collector. Income from non-dairy enables producers to cope with different risks in production and assess the best channel. This is supported by Zegeyesh et al. (2017); Abebe et al. (2018).

Income from dairy sources affects producers' decisions to choose district retailers, wholesalers and consumers' milk market outlets. This dairy income motivates dairy producers to intensify production and choose the best channel that maximizes higher income. This result agrees with the finding of Ayyano et al. (2020). Type of breed used negatively and significantly affected access to the district retailer's milk market outlets. This is probably because most farmers own local breeds with low yields as a result of the farmers' choice regarding the spot market outlet rather than the distance channel. This finding is supported by Ketema et al. (2016), namely, that ownership of exotic livestock breeds influenced the choice to sell milk to wholesalers. Access to market information positively and significantly affected wholesalers and consumer milk market outlets. Access to market information enables farmers to choose the best alternative outlet. This is supported by Tarekegn et al. (2017), and Bezabih et al. (2015). Access to dairy extension services significantly affected access to rural collector milk market outlets. Access to extension services is expected to increase the ability of farmers to acquire relevant market price information and improve linkage with input and output markets. This finding is similar to Tegegn (2013).

The number of milking cows affected access to dairy cooperative milk market outlets, and this was at 5% significance level. This is because the number of milking cows can directly increase the marketable supply of milk and as milk production increases, farmers' capability to supply increases to more than one channel's milk outlet. This is in line with the finding of Ayyano et al. (2020) who stated that as the number of milk animals' increases, the probability of selling milk to market channels increases whilst all other factors held constant. Membership of the cooperative positively and significantly affected access to a dairy cooperative, consumers and district retailer outlets at 1%, 1% and 5% significance level. Being a member of a dairy cooperative contributes towards reduced transaction costs and strengthens farmers' bargaining power, compared to non-members. The findings were consistent with those of Kuma et al. (2013), who stated that the probability of accessing cooperative milk outlets increases with group membership, compared to accessing the market as an individual farmer.

Family size is significantly associated with selling milk to consumers at 10% significance level. This result shows that households with large family sizes are more likely to choose a consumer outlet. This is because a large household size implies the availability of cheaper labour, which can increase the possibility of producing marketable surplus, which in turn increases the choice of market channel to earn higher income. This finding agrees with Ozkan et al. (2022). The education level of households has a positive association on choosing wholesaler and rural collector outlets at 5% and 10% significant level, respectively. The positive association between wholesaler and education was due to the fact that education enhances the capability

of farmers in making decisions regarding the choice of marketing outlet. The findings are consistent with those of Berhanu and Moti (2012) who concluded that education enhances managerial competencies and successful implementation of improved production, marketing and processing activities. In contrast, there is a positive relationship between education level and selling to rural collector outlets because educated household heads are busy with other responsibilities like meeting, training and other office related work Zegeyesh et al. (2017).

CONCLUSIONS AND RECOMMENDATIONS

The Ethiopia agricultural transformation agenda is empowering smallholder farmers to create viable livelihoods from agriculture and enhancing their access to markets. However, poor rural farmers are always challenged to deliver milk to the final market faster and are excluded from international markets. The objective of this study was to identify determinants of farmers' choosing a milk market outlet. The study used primary data obtained from a survey conducted on 123 randomly selected households. The data were analysed using a multivariate probit. The result of the model revealed that income from dairy source, market information and educational level of household positively and significantly affected wholesaler outlet. The choice of consumer outlet is influenced by family size of household, membership of a dairy cooperative, market information, non-dairy income and income from dairy sources. Number of milking cows, membership in a dairy cooperative and non-dairy income significantly determined the choice of dairy cooperative outlet. The choice of district retailer's market outlet is positively and significantly affected by sex of households, membership of dairy cooperative and income from dairy sources. Type of breed used negatively and significantly affects district retailers' market outlets. The choice of rural collector outlet is negatively influenced by non-dairy income, access to extension contact and positively affected education level household and sex of households. Farmers' membership of a dairy cooperative increases the probability of them choosing appropriate market outlets. Therefore, policies should be designed that encourage farmers' cooperatives, increase milk production per cows and improve the breed of milking cows. The result of the study indicates that extension service and market information have a great role in increasing the choice of suitable market channels. Therefore, an intervention should be promoted that creates market information for dairy production extension services and provides adequate information on the selection of market outlet. Farmers must engage in non-dairy income generating activities which could enable them to produce more, thereby selecting market channels they need. Furthermore, access to markets and road facilities would promote the effective marketing of milk through all outlets.

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