ILRI
International Livestock Research Institute

Research Report 21

Improving smallholder farmers' marketed supply and market access for dairy products in Arsi Zone, Ethiopia

Improving smallholder farmers' marketed supply and market access for dairy products in Arsi Zone, Ethiopia

Asfaw Negassa

ILRI
INTERNATIONAL LIVESTOCK RESEARCH INSTITUTE

International Livestock Research Institute

Food and Agriculture Organization of the United Nations

Author's affiliation

Asfaw Negassa, formerly with ILRI (International Livestock Research Institute), Addis Ababa, Ethiopia, now with IFPRI (IFPRI (International Food Policy Research Institute), Addis Ababa, Ethiopia

Editing, design and layout—ILRI Publication Unit, Addis Ababa, Ethiopia.

ISBN 92–9146–198–9

Correct citation: Asfaw Negassa. 2009. *Improving smallholder farmers' marketed supply and market access for dairy products in Arsi Zone, Ethiopia*. Research Report 21. ILRI (International Livestock Research Institute), Nairobi, Kenya. 107 pp.

Table of Contents

List of Tables

List of Figures

Abbreviations

AI	Artificial insemination
EC	Ethiopian Calendar (1996 EC corresponds to 2003–04; and 2000 EC corresponds to 2007–08)
ETB	Ethiopian birr
FAO	Food and Agriculture Organization of the United Nations
ha	hectare
hh	household
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
NGO	Non-governmental organization
TLU	Tropical livestock unit

Acknowledgements

The International Livestock Research Institute (ILRI) would like to thank the Food and Agriculture Organization of the United Nations (FAO) for providing financial assistance for this research through the Crop Diversification and Marketing Development Project (GTFS/ETH/067/ITA) financed by the governments of Ethiopia and Italy and implemented by the Ministry of Agriculture and Rural Development, Oromia Bureau of Agricultural and Rural Development and FAO.

This research tremendously benefited from the technical support of many people both at ILRI and FAO at different stages of the study. The author would like to thank the following: Mohammad Jabbar, Derek Baker, Hassen Ali, Emmanuelle GuerneBleich, Fikere Mulugeta, Hizikias Ketema, Jemberu Eshete, Susan Minae, Anthony Bennett and Jerome Mounsey. This paper also benefited from comments and suggestions of the participants of a validation workshop organized by ILRI and FAO. Particularly, the author is grateful for the constructive comments and suggestions provided by Chipeta Mafa, Berhanu Gebremedhin, Moti Jaleta, Aynalem Haile, Juergen Greiling, Getachew Felleke, Adrian Vernooij and Richard Fulss.

The author would also like to thank Elias Mulugeta and Mahlet Mulugeta for their technical assistance and field supervision of various surveys. People from the Arsi Zone Bureau of Agricultural and Rural Development also provided very kind support in identifying the sample households and gave timely advice on the appropriate channels to contact the selected households for the survey. In this regard, the author would like to gratefully acknowledge the help of Gemechu Tulu and Tefera Feleke. The author would also like to thank the cooperation of sample households involved in different surveys and the enumerators who administered the survey instruments.

Finally, the author is also very grateful to Selamawit Dominique and Messelu Derejie for their administrative and secretarial assistance at ILRI and FAO field offices, respectively. The author alone is responsible for the content of the paper.

Executive summary

The potential economic and social advantages of market-oriented smallholder dairy production in improving the welfare of farm households and its multiplier effects on other sectors of the economy are well known. For example, it generates regular income for the farm households. The milk from dairy production also provides a highly nutritious food for all age groups of farm household members and particularly for infants and lactating mothers thus reducing the problem of malnutrition among rural households.

Realizing such potential economic and social advantages of smallholder dairy production, various governmental and non-governmental organizations and donor agencies have been trying to develop market oriented smallholder dairy production in developing countries like Ethiopia. The Food and Agriculture Organization of the United Nations (FAO) project in partnership with Oromia Bureau of Agriculture and Rural Development on improving smallholders' marketed supply and market access for dairy and dairy products in Arsi Zone is a good example. However, to be effective, the efforts to improve the productivity of smallholder dairy production and improve its market orientation needs to be supported and informed by detailed understanding of the current and dynamic conditions of production, marketing, processing and consumption of milk and dairy products in the project area and beyond.

The major objective of this study was to provide a comprehensive review documenting dairy supply and demand and the role of collective action in Arsi Zone/Ethiopia. The specific objectives were:

- To assess current and prospective demand for milk and milk products in Asella (the zonal headquarters) and Adama,
- To assess the current milk production, consumption and marketing behaviour of farmers in selected *woredas* taking both participants and non-participants in farmer milk cooperatives in order to asses current and prospective supply of milk, and
- To assess the role of collective action, e.g. farmer groups and other possible forms in overcoming problems of remunerative marketing and market access by smallholder milk producers, with a particular focus on the role and implications of gender

Research methodology

The analytical framework for this research was based on the value chain concept. There are three main actors in the dairy value chain which are considered in this study: dairy producers, milk marketing cooperatives and consumers. Primary data were collected through 3 surveys of 200 smallholder dairy producers, 24 dairy marketing cooperatives in Arsi Zone and 200 urban consumers. The main data collected from the smallholder dairy producers

were related to household demographics, dairy production and marketing practices and consumption behaviour. Data collected from the consumer survey focused on household demographics and patterns of dairy purchase and consumption. Data from the survey of dairy marketing cooperatives concentrated on generating information that can be used to assess the opportunities and challenges of collective action in the commercialization of smallholder dairy production and the prospects of scaling-up. Both descriptive and econometric analyses of the survey data were made. In addition to the administration of the three formal surveys, several informal interviews were also conducted with officials and key informants in Arsi Zone. The purposes of these informal interviews were to obtain information that supplements the data that was collected through sample surveys. Additional secondary data at the zonal and lower administrative levels were also collected.

Findings from the dairy producer survey

Smallholders' dairy cowherds are characterized by low reproductive and productive performances. Dairy farmers own few dairy cows (either local or crossbred). In general, these dairy cows are characterized by low milk yield, long calving interval, long age at first calving and short lactation length.

Various household members have different responsibilities for different dairy farm operations and dairy herd managements. Thus, the training and extension service provisions need to identify responsible household members and target them accordingly. For example, most of the time wives are responsible for dairy farm operations such as milking cows, cleaning of milk containers, milk storing and preserving etc. On the other hand, most of the time husbands are responsible for dairy herd management such as feeding dairy cattle, health management, heat detection and mating.

There are three dairy cattle feeding regimes practised in the zone. These feeding regimes are zero grazing, private grazing and communal grazing. The zero grazing system is practised by most of the dairy producers. Straws and crop residues are extensively used and animals are grazed on the crop stubbles. Crop residues are also separated and sold for animal feeds. Lack of feed is one of the most important constraints reported by dairy producers.

There is a limited water supply for dairy cows. Streams and rivers are the major sources of water supply for dairy farmers in the zone and this represents considerable energy wastage for dairy cows in terms of travel time required to the watering points. Furthermore, only 42% of sample dairy farmers reported that their dairy cows have continuous access to water supply.

There are limited controls of dairy diseases and parasites by the dairy producers. Across the whole sample, only 22%, 54%, 54% and 20% reported vaccination against foot-and-mouth disease, black leg, anthrax and lumpy skin diseases, respectively. Furthermore, only about 34% and 53% of sample dairy producers reported the treatment against ticks and liver flukes, respectively. The treatment for mastitis, brucellosis and salmonellosis was reported by less than 25% of dairy producers.

The membership in milk marketing cooperative is associated with higher quantities of milk produced, marketed and consumed. For example, during the wet season of 2006–07 production calendar, the quantity of milk produced, marketed and consumed by the dairy producers who are the members of the cooperative was 98, 46 and 23 litres per week, respectively while for the non-members the respective figure was 65, 7 and 18 litres per week, respectively. The proportion of milk marketed was also higher for the dairy cooperative members. The proportion of milk marketed (milk off-take rate) was 46% and 8% for members and non-members, respectively.

Low level of production is one of the main reasons for not selling milk in the market. About 43% and 47% of the dairy farmers did not sell milk in the market during the wet and dry season, respectively, in 2006–07 (1999 Ethiopian Calendar [EC])[1]. The main reason given for not selling milk in the market was low-level of milk production which was not sufficiently larger than the family home consumption needs.

Milk marketing cooperatives are the main market outlets for and buyers of fluid milk. The main market outlet for cheese and butter is the town market and the main buyers are urban consumers. The three most important uses of income generated from dairy sell are for buying dairy feed (72%), to cover health expenses (71%) and to repay loans (67%).

Membership in a milk marketing cooperative is the key determinant of decisions to sell and the quantities of milk and butter sold by the dairy producers. Membership in a milk marketing cooperative significantly increases (decreases) the likelihood of household to sell milk (butter) and the quantities of milk (butter) sold. The female-headed households are more likely to sell milk and butter as compared to the male-headed households. The female-headed households also sold significantly higher quantities of milk than male-headed households did. However, the effect of household-head gender on the quantities of butter sold is not significant.

1. 1996 EC corresponds to 2003–04; and 2000 EC corresponds to 2007–08.

Findings from the milk marketing cooperative survey

Milk marketing cooperatives are few in number and recent. There are about 24 milk marketing cooperatives in Arsi Zone with average service year of 4 and 67% of them are legally licensed. About half of the cooperatives are initiated by the government.

Cooperatives are managed by dairy producers who are the members of milk marketing cooperative. The cooperatives are managed by cooperative members who are mostly male, about 40 years old and mostly had only primary school education. The cooperative management positions are the chair, secretary, auditor, treasurer, accountant, record keeper and one member.

Cooperatives are engaged mainly in bulking raw milk from the members (also from non-members), processing and marketing of processed dairy products. The milk deliveries are received at the collection centre mainly in the morning only (87%) and the evening milk is usually not collected. The capacity of the cooperative is limited in terms of the quantities of milk collected and processed, geographic coverage and number of peasant associations and dairy producers involved. The dairy cooperative's product offerings are limited mainly to butter, skimmed milk, yoghurt and cheese and the sale of fresh fluid milk is not very common.

Milk quality testing is rarely practised. There are certain quality requirements for the milk deliveries at the collection centres. However, only 44% reported that the quality test is done at the time of milk delivery.

Cooperatives practice direct marketing of dairy products with no formal vertical business linkages. The main point of dairy product sale by cooperative is the cooperative milk collection centre itself. The main buyers are rural and urban consumers in the area. The cooperatives are engaged in direct marketing of dairy products to the consumers and as such there are no contractual arrangements and strong vertical linkages to the supermarkets, institutional users and private and/or public processing plants.

Cooperatives provide limited services to their members. Less than 10% reported that cooperative has received loan, veterinary services, grant money, buildings and AI services for its members. However, significant number of cooperatives reported that they have supplied milk collection equipment, provided training in management and provided administrative support and market information to their members.

Milk collection premises are unhygienic. The main characteristic features of milk collection centres are that they comprise small rooms consisting of cream separator, butter churner, milk storage cans, few tables and chairs or benches and drinking cups. There are obvious

hygienic concerns such as lower frequency of cleaning per week, unavailability of running water, inadequacy of room size for milk collection, use of single room for milk collection and retailing of dairy products for immediate use and take-home services, presence of messes and rubbishes on the floor, lack of waste disposal pits and limited use of toilets.

Quantities of milk collected and milk prices vary seasonally. The monthly collections are relatively lower during the months of January to April that correspond to the dry season.

There are annual trends in the quantities of milk collected and dairy products sold by cooperatives. The average annual raw milk collected by dairy cooperatives declined from 1996 EC to 2000 EC and similar patterns are observed for most of dairy products sold by the cooperative. The monthly gross profit shows clear seasonal pattern where months of May to July show low average gross profit. On the other hand, there is no clear trend in the average gross profits of the cooperative.

Cooperatives have limited milk collecting, storage and processing equipment and facilities. All of the cooperatives have cream separator and more than 95% have butter churner and only about 44% of them have power supply. Collection centres lacked cooling facilities and some necessary equipment. Due to lack of cooling facilities the cooperatives neither have the capacity to collect milk from very distant areas nor store milk over longer period of time. The cooperatives immediately process milk into butter and the opportunity of transporting fresh milk to other regional markets does not exit. In general, the collection and processing capacity of the existing milk marketing cooperatives are limited in terms of the milk catchments area to be served.

Constraints: The most frequently reported constraints are poor animal breeds owned by members (92%), low milk supply (88%) and lack of feed (83%). All respondents cited technical support needs in record keeping, financial management, quality control, marketing and cooperative administration, while 68% of respondents said they needed technical support in packaging. More than 65% reported willingness to pay for these services. The mean rating of the support needed also indicate that quality control ranked number one which is followed by administration.

Opportunities: So far the activities of cooperative are limited to bulking, minor processing and marketing of the dairy products. Therefore, there are opportunities for more value adding processing. There are no observable business linkages along the dairy value chain. There are opportunities for strong vertical coordination through linkages such as with local institutional milk buyers, supermarkets and private milk processors. The other option to be considered is the vertical integration of the milk marketing cooperatives through the establishment of union of cooperatives at the zone level which collect, process, and market milk and milk products

from the milk marketing cooperatives. Currently, there is one cooperative union which is under establishment. The union can also potentially provide the opportunities for economies of scale for coordination various services among the cooperative members.

Findings from the consumer survey

Only a few types of dairy products are purchased and consumed. There are four main dairy products locally produced and consumed in the area: raw milk, edible butter, cosmetic butter and cheese. Fewer purchases and limited consumption of these dairy products are observed except for raw milk. On average raw milk is purchased 25 times per month while soft cheese, edible butter and cosmetic butter are purchased about three times a month. These purchase patterns are the same for both wet and dry seasons.

Peri-urban and urban dairy producers are still very important sources of milk for urban consumers. The major consumers purchase points for raw milk is a neighbour dairy producer through contractual arrangement (76%). On the other hand, for other dairy products like soft cheese, edible butter and cosmetic butter, the major points of purchase are town markets and the main sellers are traders. The use of supermarkets is limited.

Per capita dairy product consumption and expenditure are very low for urban consumers. The monthly per capita dairy products consumption and the expenditure on dairy products are observed to be very low. For example, the average monthly per capita consumption for all households during the wet season for raw milk, soft cheese, edible butter and cosmetic butter is 4.44 litres, 0.41 kg, 0.44 kg and 0.11 kg, respectively. This indicates the potential to expand milk consumption provided the prices are affordable. The average monthly per capita expenditure on raw milk, soft cheese, edible butter and cosmetic butter based on all samples is Ethiopian birr (ETB)[2] 14, 4, 16 and 2 respectively.

The dairy products are consumed mainly in three forms. For example, raw milk is taken alone (37%), taken with other foods (45%) or processed into other dairy products (18%). Cottage yoghurt, pasteurized milk, and cosmetic butter are mostly taken alone while powder milk and edible butter are taken with other foods. The household processing of dairy products purchased is mainly limited to fresh milk and skimmed milk. It is observed that the household preference in the fresh milk allocation is given to infants followed by younger children while adults and elderly members are least considered for fresh milk consumption.

For all dairy products, product safety and quality were ranked by the consumers in their purchase decisions. For example, for fresh milk the important dairy product attributes

2. As of 28 July 2009, USD 1 = Ethiopian birr (ETB) 12.4665.

considered in decision to purchase it in order of importance are: safety and quality, price, freshness, availability and taste. Packaging and brand names are still not well developed in promoting the dairy products consumption.

Unavailability is the main reason for not consuming dairy products: It is observed that large proportion of households reported that their lack of dairy product purchase and consumption is related to the fact that the dairy products are not available on the market for purchase. For example, about 27% of the consumers reported that they would like to purchase fresh milk but it is not available on the market. Similar observations are made for other dairy products. These indicate that there are potential markets for dairy products if availabilities of dairy products in the local markets improve.

The most important sources of information used by the consumers are market visits, neighbours and friends. Dairy consumers have limited exposure to promotional activities for dairy products through television (45%) and radio (24%). The use of modern communication media like radio and television are very limited. This shows that there is a potential to expand dairy product consumption through the use of modern communication technologies and educating consumers and providing information that facilitate their abilities to process information and make purchase and consumption decisions.

The outlook for dairy products is good. It is observed that significant proportion of the sample consumers think that their current monthly consumption level is inadequate for fresh milk (72%), edible butter (62%), cheese (43%) and cosmetic butter (38%). More than 95% of those who reported inadequate level of consumption also indicated their interest to increase their level of consumption. Given low levels of per capita dairy product consumptions and the consumer's interest to increase their level of consumption, there is good prospect for dairy products market expansion. Increased availability at affordable prices and promotional activities are required to increase the dairy products consumption levels.

Marital status of household head and household income are key determinants of purchase and quantities of milk and butter consumed by the urban consumers. Married households are more likely to purchase milk and butter. As the household income increases the probability to purchase butter also increases while the impact of household income on the household decision to purchase milk is not significant. Married households purchase significantly larger quantities of milk and butter than unmarried households. The higher is the household income the higher is also the quantities of milk and butter consumed.

Conclusion and implications

This study has indicated that the membership of smallholder dairy producers in a milk marketing cooperative is a key factor in determining their decision to participate in milk and butter markets and their levels of market participation. The quantities of milk and butter produced, marketed and consumed by the members of cooperatives are significantly larger than those of non-members. However, the current level of cooperative milk collection, processing and marketing is very much limited.

The quantity of milk collected is low. There are few numbers of milk marketing cooperatives and milk collection centres. The numbers of dairy producers who are the members of the milk marketing cooperatives are also few compared to the total population of dairy producers in the area. Usually, there is only one milk collection centre per one milk marketing cooperative. The milk marketing cooperatives do not exist in all areas, particularly in remote off-all-weather roads. The range of dairy products handled and the processing capacity of the cooperatives are also limited. The major dairy products sold by the cooperatives are skimmed milk, butter, cheese and yoghurt. Therefore, there is a clear justification for scaling-up cooperative marketing activities, to organize more dairy producers into milk marketing cooperatives, increase milk collection centres and widen the cooperatives' geographic coverage.

There is very good market prospect for increased production of dairy products through scaling-up. Analysis of consumer patterns of purchase and consumption of dairy products points to good prospects for expanding the market for dairy products. This is because the current per capita consumption of dairy products is very low and the consumers think their current level of consumption is inadequate and are interested to increase their level of consumption provided that the dairy products are available at affordable prices. In general, the demand for dairy and dairy products is unsatisfied locally and there are also clear regional and national market opportunities.

Efforts to scale-up cooperative marketing activities and to enhance the local capacity for smallholder dairy development requires detailed understanding of the production, marketing and consumption situations for dairy and dairy products in the project area and beyond. In this regard, in this study effort has been made to collect, analyse and generate information that informs the scaling-up efforts by the governmental and non-governmental organizations and the donor agencies. In the future, a continued research support is also needed to monitor changes in the production, marketing and consumptions environments and draw implications for smallholder dairy development.

Options for strategic interventions

Based on the research findings, highlighted below are some strategic interventions suggested for improving the productivity and market orientation of smallholder dairy producers, scaling-up of cooperative dairy development activities and promoting dairy products consumptions.

Supply side

- Given the fact that smallholder dairy farmers own few heads of dairy cows and increasing the number owned is unlikely due to limited farm sizes, the improvement of dairy cow's reproductive and productive performances is critical to the smallholder dairy development and competitiveness. There is a need to increase milk yield, reduce age at first calving, shortening calving intervals and increasing the lactation length. It is important to improve smallholder dairy producers' access to improved dairy breeds, AI services and improved breeding managements. These roles can be played by a mix of different actors (governmental and non-governmental organizations, union of cooperatives, donor agencies, and the private sectors).
- Improving animal feeds availability and utilization (improved pastures, forage and fodder crops and crop residues).
- Improving water supply to dairy farms.
- Improving animal health through vaccination and treatments against major diseases and parasites.
- Linking smallholder dairy farmers to financial institutions (commercial banks and micro-finances) in order to invest in improved dairy cows and other important dairy related operations and businesses.
- Continuous research support in breeding, nutrition, animal health and management.
- Extension services in dairy production and management.

Collective action

- Technical support to the marketing cooperatives is required in several areas: in cooperative management, financial management and record keeping, milk quality testing, dairy product development and milk collection, storage, transportation and processing.
- Instituting rigorous quality testing procedures and building cooperatives' quality testing capacities in terms of human resources and equipment and facilities. There is also a need to introduce quality based price payments in order to enhance the quality of milk delivered at the milk collection centres.
- Increasing horizontal integration of cooperative activities: this involves organizing more smallholder dairy producers into a milk marketing cooperatives in several locations and establishing more milk collection centres for new and existing cooperatives.

- Increasing vertical integration and increasing vertical business linkages: strengthening the already established zonal level union of cooperatives. It is also important to establish and strengthen formal vertical business linkages of the milk marketing cooperatives and union of cooperatives with institutional dairy and dairy product users, processors, supermarkets etc.
- Improving service provisions to cooperative members (animal health, breeds, feeds, and technical skills).
- Improving the hygienic situation of milk collection centres in order to ensure the safety and quality of dairy and dairy products which build the consumers' and customers' confidence in the dairy products produced and handled by the cooperatives. There is a need to provide regular training for the workers at the milk collection centres on hygienic milk handling and milk quality testing.
- Improving cooperative capacity to collect, store, transport, process more milk from smallholder farmers, for example, bulk cooling tanks and refrigerated transport facilities.
- Expanding dairy product ranges available to consumers and customers through value-adding processing. It is also important to develop brand name (e.g. Arsi Dairy).
- Improving access to loans for the cooperatives business activities based on careful financial feasibility assessment of the business plans. Care must be taken in providing free and/or subsidized financial supports which might undermine the sustainability of the cooperative business activities in the long run.
- Establishing dairy products quality and safety standards and grades.
- Formulating and implementing dairy product safety and quality regulations.

Demand side

- Improving availability of safe and quality dairy products at competitive prices.
- Increasing ranges of dairy products available to the consumers.
- Promoting activities of dairy products to improve utilization.
- Providing market information on prices and nutritional and health benefits of dairy products.
- Continuous assessment of the market dynamics which guide the production and marketing strategies and decision-making.

1 Introduction

1.1 Background

In the context of developing countries, the potential advantages of market-oriented smallholder dairying in improving the welfare of farm households and its multiplier effects on other sectors of the economy are well known (Walshe et al. 1991; Hemme et al. 2003; Bennet et al. 2006). First, it generates income for the farm households on regular basis which can be used for different purposes, e.g. purchase of goods for household consumption, school fees and medical expenses. Income generated from the sale of milk can also be used for productive investment in other farm or non-farm sectors. Second, milk from dairy production provides a highly nutritious food for people of all age groups and particularly for infants and lactating mothers thus reducing the problem of malnutrition among rural households. Third, the value adding activities such as the processing, marketing and distribution of milk and milk products also create employment opportunities in the rural and urban sectors. It is also argued that in situations where the arable land is shrinking and where there is high population density, the dairy farming may be one of the few agricultural activities that can support viable smallholder farming (Staal et al. 1997). In general, there are also several other functions attached to the livestock production such as manure production, store of wealth, risk mitigation, and display of social status (Moll et al. 2007).

Realizing these potential economic and social advantages, FAO in partnership with the Ministry of Agriculture and Rural Development and Oromia Bureau of Agricultural and Rural Development initiated the project, 'improving smallholders' marketed supply and market access for dairy and dairy products' in Arsi Zone. This is a sub-project under the project, 'crop diversification and marketing development', which is financed by the governments of Ethiopia and Italy. The project aims at demonstrating the potential to raise smallholder dairy farms productivity to commercial level. The project also focuses on those community groups or individuals with potential to scale up milk production and value addition and links such farmers to formal markets.

Arsi Zone could be considered one of the most productive agricultural zones in Oromia Region with a great potential to supply milk to local towns and major urban centres. The zone is strategically located in terms of its geographic proximity to the major urban centres. It is well connected to the major cities such as Addis Ababa and Adama through all-weather roads. This provides the opportunity to expand the market for its dairy and other agricultural products beyond the local and rural markets to the large urban markets like Addis Ababa and Adama. A major all-weather road construction is also underway which links the zone to the major milk deficit towns in the South such as Awaasa, Shashemene, and Bale Robe. There are other situations that favour increased demand for dairy products produced in the zone such

as increased urbanization, population growth, emergence and expansion of supermarkets, cafés and restaurants and growth in western-style dietary habits requiring dairy and dairy products as major food ingredients. However, the key question is whether the smallholder would be able to seize these emerging market opportunities.

To be effective, the on-going FAO project efforts to improve the productivity of smallholder dairy production and improve its market orientation need to be supported and informed by detailed understanding of the current conditions of production, marketing and consumption of milk and dairy products in the area. For example, there is a limited understanding of what factors can increase the level of commercialization of dairy production in the area. There is a need for detailed and systematic research to describe the production practices of dairy producers and identify areas for project interventions. Lack of detailed understanding of local production and marketing conditions and incorporating these in the development programs will result in the failure of smallholder dairy interventions.

In order to efficiently and effectively respond to the changes in consumer demands in the domestic markets, the dairy producers and other market actors require detailed information on the current milk consumption patterns and food quality and safety requirements of the consumers. However, there is also lack of in-depth information on the consumption and expenditure patterns, quality, and health and safety requirements by the dairy consumers in the project area. For example, how the consumer economic, socioeconomic, demographic variables impact on the likelihood of purchasing dairy products? What is the current level of dairy consumption by income groups? In general, there is a need to continuously monitor the dynamic changes in the consumer demand for milk and milk products quality and safety. It is also important to assess the market size and prospects for expanding milk production in the area. In this regard, there is a need to assess the likelihood of locally purchasing and absorbing an increased dairy production due to project interventions. In other words, what is the future prospect or outlook for dairy products in the project area?

The small-scale nature of smallholder dairy production could also be one of the factors limiting dairy producers' entry into and level of their participation in the emerging milk markets. It is argued that in many developing countries, milk production remains small-scale, scattered and poorly integrated to the market chain (Bennet et al. 2006). The implication of this observation is that smallholder dairy producers face higher transaction costs as compared to large farms in accessing and competing in the input and output markets due to their small-scale operations. It has been observed that high transaction costs for production and marketing limit market participation by asset- and information-poor households (Staal et al. 1997). In this regard, the milk marketing cooperatives through milk collection centres provide external economies of scale in the collection, bulking, transporting, processing

and marketing of dairy products and provide regular income and sale guarantee to their members. Lack of economies of scale may also constrain smallholder farmers' adoption of new technologies as some of large fixed investments required for dairy operations are not feasible and profitable at smaller levels of production.

Milk marketing cooperatives can also serve as focal points where the necessary technical production, marketing and processing and extension services required by milk producers can be organized by private sector, public sector and non-governmental organizations (NGOs) with minimum transaction costs. Furthermore, cooperatives can improve the bargaining power of smallholder dairy producers. The establishment of cooperative union can also further vertically integrate the smallholder dairy producers in terms of value addition and marketing activities. In general, the cooperatives represent significant institutional change which can alter the economic opportunities available to smallholder dairy farmers by altering the scale of operations. In Arsi Zone, there are several milk cooperatives which are operational and one zone-level cooperative union is under formation with the support of FAO project interventions. However, the extent to which cooperatives are fulfilling the various roles indicated above and the problems they are facing are not well documented. Detailed information and assessment of cooperatives would assist the designing of development programs to enhance their role and vertically integrate them.

1.2 Study objectives

The main objective of this study was to provide a comprehensive review documenting dairy supply and demand and the role of collective action study in Arsi Zone/Ethiopia. The specific objectives were:

- To assess current and prospective demand for milk and milk products in Asella (the zonal headquarters) and Adama.
- To assess the current milk production, consumption and marketing behaviour of farmers in selected *woredas* taking both participants and non-participants in farmer milk cooperatives in order to asses current and prospective supply of milk.
- To assess the role of collective action (e.g. farmer groups) and other possible forms in overcoming problems of remunerative marketing and market access by smallholder milk producers, with a particular focus on the role and implications of gender.

1.3 Outline of the report

The remainder of this report is organized as follows. An overview of the global food system which sets the context is presented in Section 2. Theoretical and empirical models to model household milk production and marketing decisions are presented in Section 3. Methods of data collection and data analyses are presented in Section 4. Results and discussions of the

survey findings for producers, cooperatives and consumers are discussed in Sections 5, 6 and 7, respectively. The report ends with conclusions and implications.

2 Literature review

This section provides an overview of demand driven global food system which sets the context within which private sector and public sector interventions in the livestock sector have to be contemplated. It is shown that the global consumption, production and trade of livestock products in developing countries have increased rapidly in the last two decades and are expected to continue to rise (Delgado et al. 1999; Delgado 2003; Hall et al. 2004). This trend has been termed as the 'livestock revolution' (Delgado et al. 1999). Factors that have led to this increased demand include population growth, urbanization, changes in lifestyle and consumer preferences, rise in incomes in growing urban centres of developing countries, international influence (globalization and more liberal international trade) and technological changes in production, communication, and transport sectors (de Haan et al. 2003; Hall et al. 2004).

There are opportunities and risks created by livestock revolution for smallholder livestock producers and consumers. The particular opportunities and threats that the global food market presents to the poor farmers and consumers in developing countries are very well documented (Faiguenbaum et al. 2002; de Haan et al. 2003; Reardon et al. 2003; Reardon and Swinnen 2004; Reardon et al. 2004; Reardon and Timmer 2005). The opportunities could be in the form of increased market outlets for live animals and live animal products, increased employment opportunities, and improved availabilities of choices and qualities of products at lower prices to the consumers. Furthermore, it is argued that the changing consumer preferences in the domestic and export markets have also created an opportunity for producers to gain new markets and develop niche markets with potential price premiums.

The livestock revolution has also increased the risks and challenges facing smallholders. At the same time, there have been rising consumer demands for food safety and quality, enhanced environmental protection and other quality attributes (Hall et al. 2004). Consumers are demanding food products with certain characteristics, such as products perceived to be safe, healthy, and convenient or produced in ways that are beneficial to the environment and take animal welfare and equitable labour concerns into consideration. That is, the consumers are not only demanding greater choices of food with different characteristics but also requiring assurances that the products they consume are produced in environmentally responsible manner and meet ethical standards (e.g. labour and employment standards, and animal welfare standards). In other words, the consumers want to be knowledgeable or well informed in terms of how food is produced and issues such as food safety and ethics requiring information both on product attributes and process attributes.

Furthermore, producers are also required to meet an increasing need for supply assurance in terms of required quantity, quality, space, and time, need to have the flexibility and ability to respond to the changing consumers' needs and demographics, increasing product innovation and differentiation, and increasing competitive pressure to lower systemic costs. Thus, in this global food market, the challenge facing the producers and processors is how to respond to these dynamic changes in consumer demands. In general, the traditional way of production and marketing is challenged.

The required functions and capacitates to enter and maintain a presence in high value markets are significant. It requires the ability to produce and meet the basic quality standards and the ability to supply on reliable basis to strict quality, timing, and quality control requirements, whether in domestic or export markets. The livestock producers must adapt if they want to capitalize on the opportunities that are available by meeting these consumer demands or else the producers will be out of the game in the global food markets. There is a need to bridge the information gap between the producers and consumers in order to build confidence in the markets. Producers are required to learn new management expertise, new skills in contract evaluation and negotiation, understand specific quality traits required by buyer, contractual obligations of both parties and risks involved.

The response of industries to address food quality and safety demands of consumers required to ensure traceability of the livestock product movements from farm to fork. This response, in turn, is requiring tighter vertical coordination and concentration of production and marketing activities among the actors both vertically and horizontally within the chain. In developed countries like USA, closer vertical coordination has emerged because addressing the food quality and safety issues result in higher relative transaction costs for the traditional spot market transactions (Young and Hobbs 2002). Detailed discussion of transaction cost approach in supply chain management is found in Hobbs (1996). It is argued that the drivers of change affect the product characteristics and consequently the nature of vertical coordination from spot market to vertical integration.

The objective to decrease the transaction costs led to the emergence of vertically coordinated firms and global supermarkets. Through close working relationships or ownership of the processing and distribution firms are able to tailor their products to the needs of particular market segments. Thus, communication, coordination, and cooperation are central to international competitiveness through their effect in reducing transaction costs.

There are several implications of tighter vertical coordination and value chains for smallholder farmers in developing countries. In general, the potential exclusion of small-scale producers from the growing market is the main concern for the people concerned with development of poor farmers in developing countries (Reardon et al. 2003; Reardon

et al. 2004). It is argued that the emergence of strict vertical coordination and supermarkets in response to the forces of globalization and urbanization may force out the small farmers unless they are able to supply what supermarkets demand.

Furthermore, small farmers are also facing threats of losing traditional domestic market outlets to supermarkets. This is because an increasing number of urban consumers might depend on supermarkets rather than traditional markets as their main food sources thus reducing market outlets for small farmers. There is need for policies and strategies on how to incorporate small-scale farmers in vertically coordinated commercial livestock production and marketing systems. There is also need to encourage the development of local market access and improve opportunities for small-scale farmers. Farmers need access to resources and training to be able to actively participate in the rapidly transforming domestic and global livestock and livestock product markets. All these issues point to the need to understand the patterns of value-chain organizations and involvement of small-scale producers which is crucial in designing successful interventions. Intervention strategies and policies to enhance small farmers' participation in the domestic and export markets needs to be informed regarding where and how to intervene to enable the small farmers to gain from the participation in the high value chain market on a sustainable basis.

In general, the need to meet diverse consumer demand requires commercial interactions and coordination along the value chain which is central to competitiveness in the global food market. Value chains are evolving in order to ensure adherence to food safety regulations, provide food quality assurance and allow traceability. Many development interventions also consider the value chain approach to be an important entry point for small farmers, either individually or collectively, into the high-value domestic and export markets.

In general, new strategic approach is required. Building up farmers' production capabilities is no longer sufficient to ensure sustainable income growth. Availability of land and the climate conditions within a given country represent a competitive advantage for raising cattle. Nonetheless, there are several constraints for the country to achieve real competitive advantages due to the lack of coordination and efficient governance of the product chain (Zylbersztajn and Filho 2003). Producer-support activities must be linked to market demand and that farm-level activities must be looked at within the context of the whole value chain and the linkages within that chain. Thus, the main argument is that value coordination must be taken as one of the sources of competitive advantage.

3 Modelling household marketing and consumption decisions

3.1 Theoretical framework

Theoretical framework used in modelling farm households' choice of whether to enter into dairy products markets and their choice of the level of market participation is conditional upon their entry into the market (Key et al. 2000). This theoretical framework extends the standard household model by incorporating the assumption that households face large transaction costs in food markets which influence their decision to enter into the market and their level of market participation conditional upon their entry into the market. In this regard, Key et al. (2000) identified two types of transaction costs: fixed and proportional transaction costs. Fixed transaction costs are assumed to determine household's decision whether or not to enter into the market. Often the problem is that high fixed transaction costs can result in market failure in which case the households fail to enter into the market. For example, high fixed transaction costs due to lack of transport and communication infrastructure, distance and/or trade barriers make costly for the households to discover trading opportunities and hence fail to enter into the market. On the other hand, proportional transaction costs are costs which vary with the volume of transaction and determine households' decisions on by how much to participate in the market conditional upon their market participation decisions. Some of the recent applications of the extended standard household model include Heltberg and Tarp (2002), Lapar et al. (2003), Holloway et al. (2004) and Bellemare and Barrett (2006). Barrett (2008) also provided a recent detailed review and synthesis of market participation literature.

One of the key concepts related to the existence of transaction costs is that with large transaction costs in the food market, the purchase price for food (Pb) is substantially higher than the price received (Ps) by a potential seller, i.e. transaction costs create bands between purchase and sale prices (Sadoulet and de Janvry 1995). Higher transaction costs increase the margin between buyer and seller prices. Thus, when food is traded, the decision price is the market price facing the buyer or the seller and when food is not traded, the decision price is the unobservable internal shadow price (P*). From this it follows that at a given point in time the household optimally chose to be a buyer only when the purchase price is lower than its own shadow price, and to be a seller only when the sale price is higher than its own shadow price. Thus, the empirical models to investigate household's optimum choices whether to enter into the market and their level of market participation conditional upon their entry into the market have to take into account the existence of these two types of transaction costs.

3.2 Specifications of empirical models

In this study, the specifications of the empirical models used to determine the factors influencing households' decision to enter into the market and their level of participation in the market conditional upon their entry into the market follows the selectivity models widely discussed in the market participation literature (e.g. Gotez 1992; Key et al. 2000; Heltberg and Trap 2002; Holloway et al. 2004; Bellemare and Barrett 2006). In selectivity models, the decision to participate in the market can be seen as a sequential two-stage decision-making process due to the influence of various types of transaction costs on household market participation decisions. In the first stage, farm households make a discrete decision whether or not to participate in the market. As discussed above, this decision is mainly influenced by fixed transaction costs. In the second stage, conditional on their decision to enter into the market, the households make a continuous decision on the level of their participation in the market, e.g. how much fresh milk to sell or how much fresh milk to consume. This decision is mainly influenced by the variable transaction costs. In the first stage, we used the standard probit model to analyse the household's discrete decision to enter into in the market. In the second stage, we used the censored regression model with correction for selection bias to model the effects of variables influencing the level of market participation in terms of the quantities of a given product sold. Similar modelling approach is also used to analyse the household consumption decision. Consumption decision can also be considered as a two-stage decision-making process in which case the households first decide whether or not to purchase a given dairy product and in the second stage, conditional upon their decision to purchase, the households decide on the level of their consumption. Specifications for the empirical probit and censored regression models are discussed next. Standard probit model to assess the household market-entry (purchase or consumption) decision follows random utility model and its specification is given below following Wooldridge (2003).

$$
\begin{aligned}
y^{*} &= z'\alpha + \varepsilon_1 \\
y &= 1 \;\; if \;\; y^{*} > 0 \\
y &= 0 \;\; if \;\; y^{*} \leq 0
\end{aligned}
\qquad (1)
$$

where, y^* is a latent (unobservable) variable representing households' discrete decision whether or not to participate in the market, it is associated with the desired level of participation or utility derived from market participation; z is a vector of independent variables hypothesized to affect household's decision to participate in the market; α is a vector of parameters to be estimated which measure the effects of various explanatory variables on the household's decision whether to participate in the market; ε_1 is normally distributed disturbance term with zero mean and constant standard deviation of σ_1, the

disturbance term captures all unmeasured variables that influence the likelihood of the producer's decision to participate in the market; *y* is a discrete response (dependent) variable for status of households' participation in the market which takes on the value of 1 if the household participates in the market and 0 otherwise. If some of *z* is endogenous, the probit parameter estimates are not consistent.

Standard normal density functions or the probability of the farm household choosing and not choosing to participate in the market are given, respectively, as:

$$P(y=1) = P(y^* \succ 0) = \Phi(z'\alpha)$$
$$P(y=0) = P(y^* \leq 0) = 1 - \Phi(z'\alpha) \quad (2)$$

Signs of parameter estimates and statistical significance of the coefficients from the probit model estimation indicate the direction of the response associated with the presence or level of a particular variable. For example, positive parameter estimate of a given variable indicates that the probability of a farm household choosing to participate in a market increases with the presence or level of that variable while a negative parameter estimate has the opposite effect. However, the probit parameter estimate does not show by how much a particular variable increases or decreases the likelihood of choosing to participate in the market. For this purpose we need to calculate the marginal effects of the independent variables on the probability of household to choose to participate in the market. For continuous independent variables, the marginal effect of the probit model is calculated by multiplying the coefficient estimate (α) by the standard probability density function given above by holding the other independent variables at their mean values:

$$\frac{\partial P(y=1)}{\partial z} = \alpha\Phi(z'\alpha) \quad (3)$$

On the other hand, the marginal effects of the dummy independent variables are analysed by comparing the probabilities that result when the dummy variables take their two different values while holding all other independent variables at their sample mean values (Wooldridge 2002). Finally, the log-likelihood function which is maximized to obtain the parameter estimates and the corresponding marginal effects for the probit model is given as:

$$Ln\ L(\alpha|y,z) = \sum_{y=1} \ln(\Phi(z'\alpha) + \sum_{y=0} \ln(1 - \Phi(z'\alpha)) \quad (4)$$

Probit model is estimated using maximum likelihood estimation commands given in STATA Version 10. ML estimates are consistent, asymptotically normal, and asymptotically efficient.

Conditional on the decision to enter into the market, the variables influencing household market participation (quantity of milk sold or consumed) in the market is modelled using Tobit or censored regression model. Tobit model was developed by Tobin (1958) for a situation where the dependent variable is censored from above, below, or both. It is indicated that in a situation where the dependent variable is censored the Ordinary Least Squares estimators are biased downwards and the use of Tobit regression model is recommended (Green 1993). In our case, the dependent variables (the amount of dairy and dairy products marketed or consumed) involve lower limit censoring at zero for a significant fraction of the observations. Greene (1993) argued that when the dependent variable is censored the conventional regression methods fail to account for the qualitative difference between limit (zero) observations and non-limit (continuous) observations. Therefore, the Tobit model is estimated using the maximum likelihood method and is given as follows:

$$\begin{aligned} v^* &= x'\beta + \varepsilon_2 \\ v_i &= v^* \; if \; v^* \succ 0 \\ v_i &= 0 \; if \; v^* \leq 0 \end{aligned} \tag{5}$$

where v^* is a latent variable representing the desired or optimal sale or consumption level of household which is observed if $v^* > 0$ and unobserved otherwise; v is the observed quantity of a given dairy product sold or consumed depending on whether the household is a dairy producer or a consumer; x is a vector of independent variables affecting the level of household's participation in the market which is a subset of z; β is a vector of parameters to be estimated; and ε_2 is assumed to be independently normally distributed disturbance term with zero mean and constant standard deviation of σ_2. According to this specification, the observed sale (or consumption) is equal to the desired sale (or consumption) if the desired sale or consumption is greater than zero. Otherwise, zero sale or consumption is observed. Furthermore, the desired purchase or sale can take on negative values; however, values of v^* less than or equal to zero are unobserved, hence v^* is censored at zero. Condition for the censored regression model is that at least some of the observations must be censored, or v^* would always equal to v and the true model would be a linear regression instead of being Tobit regression model.

Because v^* is normally distributed, v has a continuous distribution over strictly positive values. There are two important density functions for Tobit estimation. First, the density of v equal to zero given x is given as:

$$P(v = 0 \mid x) = P(v^* \prec 0 \mid \mathrm{x}) = 1 - \Phi\left[\frac{x'\beta}{\sigma}\right] \tag{6}$$

Second, the density of *v* given *x* for *v* greater than zero is given as:

$$P(v \succ 0 \mid x) = P(v^* \succ 0 \mid x) = \frac{1}{\sigma}\phi[(v - x'\beta / \sigma)] \tag{7}$$

In order to interpret the estimation results, the marginal effects of the independent variables on some conditional mean functions should be examined. Interpretation of the estimation results from the censored regression model based on the parameter estimates of the independent variables is also not straight forward as in the case of the simple linear regression model. In tobit regression model, there are four marginal effects: (a) the change in the mean of the latent dependent variable which is given by the β coefficients, (2) the changes in the probability of being uncensored, (3) the changes in the unconditional expected value of the observed dependent variable, and (4) the changes in the conditional expected value of the dependent variable. Following Green (1993) and Wooldridge (2003) the mathematical expressions for the four marginal effects mentioned above are derived from the censored regression model as follows, respectively:

$$\frac{\partial E(v^* \mid x)}{\partial x} = \beta \tag{8}$$

$$\frac{\partial P(v \succ 0 \mid x)}{\partial x} = (\beta / \sigma)\phi(x'\beta / \sigma)$$

$$\frac{\partial E(v \mid x)}{\partial x} = \beta\Phi(x'\beta / \sigma)$$

$$\frac{\partial E(v \mid x, v \succ 0)}{\partial x} = \beta(\{1 - \delta(x'\beta / \sigma)[x'\beta / \sigma + \delta(x'\beta / \sigma)]\}$$

Where δ is given as follows:

$$\delta = \left(\frac{\phi(x'\beta)}{\Phi(x'\beta)}\right) \tag{9}$$

Finally, the empirical log-likelihood function to be maximized in order to obtain the various Tobit parameter estimates and marginal effects is given based on the probability density functions given in equations (6) and (7) as follows:

$$\ln L(\beta,\sigma|v,x) = \sum_{v>0} \ln(\frac{1}{\sigma}\phi(v - x'\beta/\sigma) + \sum_{v=0} \ln[1 - \Phi(x'\beta/\sigma) \quad (10)$$

One problem with the above censored model specification is that the two-stage decision-making processes are not separable due to unmeasured household-level variables affecting both the discrete and continuous decisions thereby leading to the correlation between the errors in the Probit and Tobit equations. This situation is known as the selectivity bias. If the two errors are correlated, the estimated parameter values on the variables affecting the level of market participations are biased (Wooldridge 2002). Thus, we need to specify a model that corrects for selectivity bias while estimating the determinants of the level of participation in the market. For this purpose, in the first step, Mills ratio is created using predicted probability values obtained from the first-stage probit regression of the decision to participate in the market. Then, in the second step, in order to test and correct for selectivity bias, we include the Mills ratio as one of the independent variables in the level of participation regression. This two-stage estimation approach which allows correcting for selectivity bias is called Heckman's two-stage procedure. Thus, the level of participation regression with correction for sample selection bias becomes:

$$v = x'\beta + \lambda\left(\frac{\phi(x'\beta)}{\Phi(x'\beta)}\right) + \varepsilon_3 \quad (11)$$

where $\phi(.)/\Phi(.)$ is the Mills ratio; λ is the coefficient on the Mills ratio; ϕ denotes standard normal probability density function; Φ denotes the standard cumulative distribution function; ε_3 is normally distributed disturbance term with zero mean and standard deviation of σ_3 and ε_3 is not correlated with ε_1 and ε_2 and the other independent variables. Under the null hypothesis of no sample selection bias λ is not significantly different from zero. If there is no significant selection bias the Tobit model will be estimated without the inclusion of inverse mills ratio in the regression. Further, if some of the independent variables in the level of participation equations are endogenous the Tobit parameter estimates are inconsistent. In such cases the use the instrumental variable Tobit in estimating the parameters in the level of participation equation in which Mills ratio is also considered as one of the instruments

is recommended. Maximum likelihood Tobit estimation is implemented using STATA econometric software version 10. Validity of normality and heteroskedasticity assumptions are critical to the Tobit model estimations. Since heteroskedasticity problem is very evident in cross-sectional data the standard error estimation for Tobit model was made under the assumption that the standard errors are not constant using interval regression method in STATA.

4 Data collection and analysis

Three formal surveys were conducted in this study: smallholder dairy producers, dairy marketing cooperatives and urban consumers. The main data collected from the producer survey were related to household demographics, dairy production, marketing and consumption behaviour (de Janvry et al. 1991). Data collected from the consumer survey focused on the household demographics, dairy purchasing behaviour and consumption patterns. The survey of dairy marketing cooperatives concentrated on generating information that can be used to assess the opportunities and challenges of collective action in the commercialization of smallholder dairy production. In addition to the administration of the three formal surveys, several informal interviews were conducted with officials and key informants in Arsi Zone in order to obtain supplementary information. Additional secondary data at the zonal and lower administrative levels were also collected. The following sections discuss in detail the sampling procedure used.

4.1 Dairy producer survey

There are seven districts in Arsi Zone which are covered by the FAO crop diversification and marketing development project: Tiyo, Hetosa, Dodota, Bekoji, Munesa, Digelu Tijo and Lemu Bilbilo. Secondary data obtained from the zonal office and collected by FAO project personnel in the field, together with information obtained from the field visits by the research team were used to determine the appropriate sampling procedure. Some of the key secondary data used for the sampling purpose include: list of project districts, number and list of peasant associations by districts and number of dairy marketing cooperatives active by districts and peasant associations.

The survey used a multistage stratified sampling along the administrative structure and membership in a dairy marketing cooperative. In general, the study districts were similar in terms of their agro-climatic conditions, production and marketing patterns and marketing infrastructure. Therefore, there was no need to include all the project districts in sampling of dairy producers. Thus, in the first stage, three project districts with active dairy marketing cooperatives (Tiyo, Digelu Tijo and Bekoji) were purposively selected.

In the second stage, a list of all of the peasant associations for these three districts was obtained. For each peasant associations in each district, information was obtained on whether the cooperatives were active. The three districts were further subdivided into peasant associations with and without active dairy marketing cooperatives and peasant associations were randomly selected from each group. Households in areas where cooperatives were active were classified as cooperative members or non-members and households were sampled from these two groups. Households were also sampled from peasant associations

where cooperatives were not active. Thus, 17 peasant associations were sampled from the three districts and cooperatives were active in 11 of these.

4.2 Milk collection cooperative survey

There were 24 dairy marketing cooperatives in 5 of the 7 FAO project districts at the time of this study. Distribution of dairy marketing cooperatives varied among the project districts; there were seven each in Lemu Bilbilo and Tiyo, five in Munesa, four in Hetosa and only one in Digelu Tijo. There was only one cooperative per peasant association and one milk collection centre per cooperative. All dairy marketing cooperatives were surveyed by structured questionnaire and interviews of cooperative officers or managers. Also examined were cooperative records on income and expenditure related to dairy production and marketing activities.

4.3 Urban consumer survey

Consumer survey was designed to provide representative household milk consumption data for Assella and Adama towns. This required stratifying each town in order to draw representative samples. Stratification took into account the different economic structure, income group, religion etc. of the town in order to draw samples from different strata. Based on discussions with officials in Asella and Adama town municipalities, households were classified into three income groups based on their location of residence which reflects their income status. In the second stage, list of *kebeles* in each stratum were obtained and sample of *kebeles* were selected. Finally, the sample households were selected from the selected *kebeles* using systematic sampling procedure. Total sample size was 200 households, 100 from each town. In terms of the income groups, the proportion of low-, middle- and high-income households included in the survey was 49%, 23% and 28%, respectively. These proportions were also determined based on the discussion with the municipalities in each town.

5 Empirical results for dairy producer survey

5.1 Introduction

Smallholder dairy production and marketing is still at early stage of development in Ethiopia and understanding the existing dairy production and marketing system is critical in designing and implementing dairy development programs. In this section, we provide the discussion of the results of descriptive and econometric analyses of smallholder dairy production and marketing systems in Arsi Zone. The results may also have implications for other similar areas in Ethiopia. The results are based on a sample survey of cross-sections of 200 smallholder dairy producers conducted in June and July 2008. The major objective of this study is to identify factors that enhance or inhibit smallholder dairy producer's decision to participate in the market and their level of market participation. In other words, what are the drivers of commercialization of smallholder dairy production? Identifying these factors is useful in designing and implementing appropriate dairy development policies and institutions in order to improve market orientation of smallholder dairy producers. In this regard, one of the key research questions in the smallholder dairy producer survey was that what is the effect of dairy producer's membership in a cooperative on the dairy producer's likelihood to sell dairy products and, conditional on decision to sell, on the quantities of dairy products sold? Thus, the discussions of the results of descriptive analyses are provided for the whole sample and by cooperative membership status. This grouping provides a general insight on how the members and non-members of milk marketing cooperatives are different in terms of their milk production and marketing behaviour.

5.2 Results of descriptive analysis

5.2.1 Productivity of smallholder dairy production system

Size of livestock holdings for sample dairy producers in Arsi Zone by their status of membership in a milk marketing cooperative is summarized in Table 1. Sampled dairy producers own an average of 11 head of cattle, with cooperative members owning relatively more animals than non-members. There was no statistically significant difference between members and non-members of cooperatives in terms of the size of holdings for different livestock species except for crossbred cows. Additionally, cooperative members own significantly more crossbred cows than non-members.

Table 1. *Size of livestock holdings of milk marketing cooperative members and non-members in Arsi Zone, Ethiopia*

Species owned	Members	Non-members	All
Cattle	11.49 (0.73)	10.61 (0.84)	11.05 (0.55)
Local cows	1.82 (0.17)	2.15 (0.24)	2.00 (0.15)
Crossbred cows	1.50 (0.11)	0.91 (0.09)*	1.21 (0.07)
All cows	3.32 (0.22)	3.06 (0.66)	3.19 (0.17)
Shoats	9.14 (1.15)	8.66 (1.26)	8.90 (0.85)
Pack animals**	3.23 (0.26)	2.53 (0.24)	2.88 (0.18)
Poultry	4.16 (0.49)	3.66 (0.62)	3.91 (0.40)

Standard deviation in parentheses. * Difference between the members and non-members is statistically significant ($p < 1\%$). ** Pack animals include donkeys, horses and mules.
Source: Survey data.

In general, the dairy farmers own few heads of dairy cows. It is observed that the average number of local dairy cows for the whole sample is 1.99 and the average number of local dairy cows owned by cooperative member and non-member dairy farmers is 1.82 and 2.15, respectively. On the other hand, the average number of crossbred dairy cows owned for the whole sample is 1.21 and the average number owned by cooperative members and non-members is 1.50 and 0.91, respectively. The dairy farmers own fewer crossbred dairy cows than locally bred ones.

Some of the important breeding and production performance indicators for smallholder dairy production system in Arsi Zone are assessed by breed types and farm household's membership status in a milk marketing cooperative and are summarized in Table 2. Smallholder dairy herds are not only few in numbers but also characterized by low productivity such as low milk yield, long calving interval, long age at first calving and short lactation length. Relatively, the dairy herd structure is dominated by the local bred and the local bred dairy cows are observed to be less reproductive or productive almost on every performance indicator as compared to the crossbred dairy cows. Low productivity could be a serious constraint to smallholder dairy development and competitiveness and there is a need to improve the productivity of dairy herd structure of smallholder farmers.

5.2.2 Dairy farm operations and management

Important smallholder dairy farm operations are milking cows, cleaning of milk containers, milk storing and preserving, quality control, barn cleaning, milk marketing, milk processing and butter marketing (Table 3). Key dairy herd management practices are feeding dairy cattle, watering, health management, pasture management and heat detections in cows.

Table 2. *Production performance of small-scale dairy production systems in Arsi Zone, Ethiopia*

Production parameters	Members		Non-members		All	
	Local	Crossbred	Local	Crossbred	Local	Crossbred
Rainy season milk production (litres/cow per day)						
Morning	3.05 (1.72)	6.72 (4.94)	3.50 (3.10)	4.18 (2.50)	3.30 (2.58)	5.67 (4.28)
Evening	2.45 (1.30)	5.49 (4.14)	2.80 (2.48)	3.37 (2.19)	2.65 (2.04)	4.61 (3.61)
Total	5.50 (2.95)	12.21 (8.98)	6.30 (5.48)	7.55 (4.61)	5.95 (4.53)	10.28 (7.81)
Dry season milk production (litres/cow per day)						
Morning	1.91 (1.17)	4.69 (4.35)	2.09 (2.02)	3.20 (2.32)	2.01 (1.67)	4.05 (3.68)
Evening	1.54 (0.93)	3.72 (3.58)	1.67 (1.43)	2.52 (2.09)	1.61 (1.22)	3.20 (3.08)
Total	3.45 (2.04)	8.41 (7.83)	3.78 (3.38)	5.66 (4.40)	3.62 (2.83)	7.23 (6.70)
Average lactation period (months)	6.39 (1.51)	8.49 (2.46)	6.56 (1.76)	8.71 (2.34)	6.48 (1.65)	8.58 (2.40)
Average birth weight (kg)	15.13 (4.44)	25.01	15.71 (4.53)	24.51 (6.63)	15.43 (4.48)	24.82 (7.18)
Average age at first calving (years)	3.62 (0.77)	2.83 (0.63)	3.66 (0.84)	2.93 (0.66)	3.64 (0.80)	2.87 (0.64)
Average calving interval (months)	17.01 (5.57)	13.80 (4.33)	17.18 (6.51)	14.70 (6.09)	17.10 (6.06)	14.15 (5.09)
Average AI service actually used per conception (number)						
Minimum	1.20 (0.41)	1.46 (1.39)	1.41 (0.59)	1.19 (0.40)	1.32 (0.53)	1.36 (1.14)
Maximum	2.64 (0.75)	2.57 (1.04)	2.83 (1.47)	2.58 (1.06)	2.76 (1.23)	2.58 (1.04)

Standard deviation in parentheses.
Source: Survey data.

Various household members have different responsibilities for different dairy farm operations and dairy herd management. This information is important in terms of targeting training and extension service provision activities to different household members based on their responsibilities in dairy cow farm operations and management. For example, in most dairy farm operations, the major role is played by women. Also significant is that 30% of households reported children as being responsible for dairy operations (mainly in milk marketing and watering of animals). Both husbands and wives have roles in herd management. In general, women are the major contributors to most of the dairy farm operations.

Table 3. *Person mainly responsible for dairy farm operations and herd management*

Activities	Percentage reporting			
	Husband	Wife	Children	Others
Dairy farm operations				
Milking cows	3	93	2	2
Cleaning of milk containers	1	90	8	1
Milk storing and preserving	1	95	2	1
Milk quality control	1	96	1	1
Barn cleaning	7	79	11	3
Milk marketing	12	56	29	2
Milk processing	1	86	10	3
Butter marketing	4	96	1	0
Herd management				
Feeding dairy cattle	47	38	9	6
Watering	37	24	30	8
Health management	71	24	4	1
Pasture management	56	20	15	9
Heat detection	67	24	6	3
Responsible for mating after heat detection	76	17	6	2

Source: Survey data.

5.2.3 Dairy cattle feeding system

Types of dairy cattle feeding systems are given in Table 4. Dairy farmers practised three grazing systems and combinations thereof: communal grazing, private grazing and zero grazing. Straw and crop residues are extensively used and animals are grazed on crop stubble. Crop residues are also pelted and sold as animal feeds. There are no apparent private- or public-sector efforts in improving the use of crop residues in the area. There are also no improved forages and pastures on private grazing lands.

5.2.4 Sources of water supply

Streams and rivers were the major sources of water supply used by dairy farmers (Table 5). This represents considerable energy wastage for dairy cows in terms of travel time involved to and from the watering points and contributes toward lower dairy cow productivity. In terms of frequency of providing water to dairy cattle, the proportions of *ad libitum* (continuous) and rationed provisions of water are similar. Thus, water supply for dairy production is not available to the households continuously.

Table 4. *Dairy cattle feeding regimes practised by smallholder farmers*

Feeding regimes	Proportion of farmers (%)
Communal grazing only	18
Private grazing only	42
Zero grazing only	3
Communal and private grazing	7
Communal and zero grazing	3
Private and zero grazing	16
Communal, private and zero grazing	4
Others	7

Source: Survey data.

Table 5. *Sources of water supply*

Sources of water	Member	Non-member	All
Communal water collection points (%)	1	2	1
Own water well (hand pump) (%)	0	0	0
Own water well (motor pump) (%)	0	1	0
Own rainwater tank/well (%)	0	0	0
Running water from own house (%)	6	3	5
Communal hand pump water well (%)	1	0	0
Streams or rivers (%)	83	95	89
Frequency of providing water to dairy cattle			
Ad libitum (%)	44	40	42
Rationed (%)	56	60	58
If rationed, number of times per week (number)	10 (4)	8 (3)	9 (4)

Standard deviation in parentheses.
Source: Survey data.

5.2.5 Dairy cattle housing and shelter

Description of the type of housing used for dairy cattle at night is reported in Table 6. It is observed that animals are mostly kept in a separate dairy cattle house during the night and the dairy cattle can also be kept in a kraal and in fences around the homestead. For those who use houses, most of the houses are tin-roofed. In terms of the availability of shelter to the animal, only about 41% of the households reported that they provide shelter for the animals. Thus, dairy cows are exposed to hot weather stresses during dry season which has implication for their productivity.

Table 6. *Type of housing for dairy cattle and whether shelter is used during the day*

	Member	Non-member	All
Inside family house (%)	5	8	6
Separate dairy cattle house (%)	83	68	75
Kraal (%)	17	20	18
Fenced homestead (%)	14	27	20
If housed, nature of roof			
Thatched (%)	52	54	53
Tin (%)	33	19	26
Shelter available for animals during the day (%)	55	27	41

Source: Survey data.

5.2.6 Breeding methods and service providers

Local breeding methods practised by dairy farmers are given in Table 7. Dairy farmers practice three breeding methods: crossbred bulls, indigenous bulls and artificial insemination (AI). Across the whole sample, the private sector is the most important service provider for crossbred and indigenous bulls while more than 95% reported the AI service is provided by the government. AI service centre is on average 6 km away from the farmers' residence. NGOs are also involved in bull service provision. On average, there were more AI services per conception than natural services probably due to poor AI techniques, poor quality semen or poor heat detection techniques.

5.2.7 Disease and parasite control practices for dairy cattle

Dairy farmers' disease and parasite control practices for dairy cattle and the costs incurred are given in Table 8. Dairy farmers are characterized by limited control of dairy cattle diseases and parasites. Across the whole sample, it is observed that vaccination against major diseases such as foot-and-mouth disease, black leg, anthrax and lumpy skin diseases are practised by less than 55% of the households. Similarly, the proportion of households who treat dairy cattle against worms and parasites, mastitis, brucellosis and salmonellosis is very low (less than 25%). Most of the households disinfect the udder with hot water and soap.

Table 7. *Local breeding methods practised by service providers, distances from the farm, rate of conception and payments*

Items	Member			Non-member			All		
	Crossbred bulls	Local bulls	AI	Crossbred bulls	Local bulls	AI	Crossbred bulls	Local bulls	AI
Service providers (% yes)									
Government	12	5	95	8	7	100	10	6	96.67
Private agency	46	40	5	68	45	0	55	43	3.33
Own	20	40	0	13	24	0	17	31	
NGOs	22	15	0	10	24	0	17	20	
Distance from home (km)	1.8 (3.0)	4.4 (12.0)	5.8 (5.3)	2.1 (2.9)	0.6 (0.9)	6.7 (10.3)	2.0 (3.0)	2.4 (8.3)	6.14 (7.54)
Service per conception (number)	1.7 (0.7)	1.7 (0.7)	2.4 (1.3)	1.8 (1.0)	1.6 (0.9)	2.6 (1.5)	1.7 (0.8)	1.6 (0.8)	2.48 (1.33)
Payment in 1999 EC (ETB/ service)	5.4 (1.6)	10.0 (8.8)	5.4 (1.1)	6.3 (2.7)	4.5 (2.1)	5.7 (0.6)	5. 8 (2.1)	7.8 (6.9)	5.50 (0.94)

Standard deviation in parentheses.
Source: Survey data.

Table 8. *Disease and parasite control practices for dairy cattle and its costs (1999 EC)*

Practices	Members		Non-members		All	
	Use (% yes)	Total cost (ETB)*	Use (% yes)	Total cost (ETB)*	Use (% yes)	Total cost (ETB)*
Vaccination against major diseases						
Foot-and-mouth disease	20	2.2 (8.4)**	24	2.9 (0.8)	22	2.5 (9.6)
Black leg	51	5.2 (11.6)	57	6.1 (19.2)	54	5.6 (15.7)
Anthrax	48	4.5 (11.7)	59	6.1 (20.3)	54	5.3 (16.6)
Lumpy skin	16	0.5 (3.8)	23	0.4 (3.3)	20	0.4 (3.6)
Treatment against worms/parasites						
Ticks	36	1.9 (4.3)	33	2.9 (7.6)	34	2.4 (6.1)
Liver flukes	57	19.6 (45.9)	48	20.9 (64.3)	53	20.2 (55.6)
Treatment against sickness						
Mastitis	17	3.3 (13.5)	9	1.7 (10.4)	13	2.5 (12.1)
Brucellosis	13	2.2 (8.2)	9	1.3 (6.1)	11	1.86 (7.3)
Salmonellosis	24	2.4 (7.6)	19	2.8 (9.8)	22	2.6 (8.7)
Disinfection of cow's udder						
With cold water and salt	10	NA	5	NA	8	NA
With cold water and soap	6	NA	7	NA	7	NA
With hot water and soap	39	NA	22	NA	31	NA

Note: *The official exchange rate was USD 1 = ETB 12.4665 as of 28 July 2009. **Standard deviations are given in parentheses. NA: data not available.
Source: Survey data.

5.2.8 Constraints to dairy farm operation

Dairy producers were asked to give their perspectives on most important constraints affecting their dairy farm operations and their responses are summarized in Table 9. The three most frequently reported constraints are lack of feed (70%), lack of capital (43%) and lack of extension services (23%). Dairy producers were also asked to rank the problems they have reported. In this regard, lack of feed is reported as a very important problem by 63% of the households who reported that problem. Similarly, lack of capital is reported as a very important problem by 45% of the households who reported the problem.

5.2.9 Quantities produced, marketed, processed and consumed

Total quantities of dairy products produced, processed, consumed and sold per week per household by seasons and membership status in a milk marketing cooperative are given in Table 10. There was a statistically significant difference between members and non-members of milk marketing cooperatives in terms of the quantities of milk produced, consumed and

sold.[3] Cooperative members produced, consumed and sold significantly more milk than non-members. For example, during the rainy season the average quantity of raw milk produced by the dairy farmers who are the members of milk marketing cooperative was 98 litres per week while it was 65 litres for non-members. Across the whole sample, about 57% of dairy farmers sold milk. Of the total milk produced, about 46% and 8% was marketed by members and non-members of milk marketing cooperative, respectively. For the whole sample, the weekly per capita milk consumption was 0.46 litres while the per capita consumption was 0.53 litres and 0.39 litres for cooperative member and non-member, respectively. In general, this study clearly shows that cooperative membership is associated with higher level of milk commercialization as well as higher level of milk consumption.

Table 9. *Dairy producers' perspectives on constraints in dairy farm operation*

Problems	Percentage reporting the problem	Importance of the problem (% reporting)		
		Very important	Important	Less important
Lack of capital	43	45	37	18
Lack of labour	17	21	47	32
Lack of knowledge	15	10	37	53
Livestock diseases	18	11	61	28
Lack of feed	70	63	25	11
Lack of water	13	58	35	8
Lack of experience	5	0	40	60
Lack of market	13	30	33	37
Lack of information	6	0	38	61
Lack of contract	3	17	0	83
Lack of extension service	23	15	36	49
Poor reproductive performance	13	30	15	56
Lack of milk technology	12	8	33	58
Spoilage of products	8	0	0	100
Low price	8	35	29	35
Lack of road (access)	4	0	37	62
High price variability	4	33	22	44

Source: Survey data.

The main reason reported for not selling the milk is the low level of production which is not sufficiently larger than the family home consumption need (Table 11). The other important reasons given for not selling are: poor road situations, lack of milk preservation technology, lack of demand, distance from market and low level of prices.

3. Discussion is limited to wet season only although similar patterns were also observed in the dry season.

Table 10. *Total quantity of dairy products produced, processed, consumed and sold per week per household during 1999 EC*

Dairy products	Members		Non-members		All	
	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season
Raw milk						
Quantity produced (litre/week per hh)	98.50 (68.97)	65.92 (56.72)	65.18 (55.39)	47.02 (46.15)	81.84 (64.58)	56.57 (52.49)
Quantity spoiled (litre/week per hh)	0.31 (1.17)	0.13 (0.56)	0.72 (3.13)	0.40 (1.77)	0.52 (2.37)	0.26 (1.31)
Quantity home consumed (litre/week per hh)	22.93 (23.57)	16.11 (15.44)	17.73 (15.67)	12.78 (10.02)	20.33 (20.13)	14.46 (13.11)
Quantity home consumed (litre/week per capita)	0.53 (0.69)	0.36 (0.41)	0.39 (0.36)	0.28 (0.20)	0.46 (0.55)	0.33 (0.33)
Quantity offered to guests (litre/week per hh)	1.37 (3.53)	0.65 (2.11)	0.87 (2.59)	0.91 (3.84)	1.12 (3.10)	0.78 (3.08)
Quantity given as gift (litre/week per hh)	0.69 (2.00)	0.26 (1.12)	0.44 (1.42)	0.23 (0.98)	0.57 (1.74)	0.24 (1.05)
Sold milk (percent yes)	0.95 (0.22)	0.87 (0.33)	0.20 (0.40)	0.17 (0.38)	0.57 (0.50)	0.53 (0.50)
Quantity sold (litre/week per hh)	45.61 (40.44)	30.29 (35.50)	6.74 (18.68)	5.97 (18.75)	26.18 (36.97)	18.26 (30.90)
Milk selling price (ETB/litre)	2.11 (0.42)	2.24 (0.38)	2.05 (0.65)	2.41 (0.62)	2.10 (0.47)	2.27 (0.43)
Processed milk						
Quantity processed (litre/week per hh)	27.59 (29.52)	18.47 (24.01)	38.67 (40.25)	26.74 (29.79)	33.13 (35.64)	22.56 (27.27)
Quantity processed into butter (litre/week per hh)	23.89 (27.31)	17.34 (23.57)	34.06 (40.01)	24.77 (28.69)	29.01 (34.57)	21.01 (26.42)
Quantity processed into yoghurt (litre/week per hh)	3.40 (8.92)	1.79 (4.05)	4.17 (8.70)	2.93 (5.63)	3.79 (8.80)	2.36 (4.92)
Quantity processed into cheese (litre/week per hh)	22.90 (26.33)	15.58 (23.26)	34.39 (37.34)	21.55 (27.13)	28.67 (32.76)	18.53 (25.36)
Butter						
Total produced (kg/week per hh)	1.70 (1.35)	1.31 (1.27)	1.94 (2.07)	1.75 (2.83)	1.83 (1.78)	1.56 (2.30)
Total consumed (kg/week per hh)	1.04 (1.16)	0.88 (1.06)	0.91 (1.16)	0.80 (1.01)	0.97 (1.16)	0.83 (1.03)
Quantity home consumed (kg/week per capita)	0.02 (0.04)	0.02 (0.03)	0.02 (0.02)	0.02 (0.02)	0.02 (0.03)	0.02 (0.03)

Dairy products	Members		Non-members		All	
	Rainy season	Dry season	Rainy season	Dry season	Rainy season	Dry season
Sold butter (percent yes)	0.53 (0.48)	0.45 (0.50)	0.56 (0.47)	0.52 (0.50)	0.55 (0.48)	0.49 (0.50)
Total sold (kg/week per hh)	0.73 (0.90)	1.16 (5.20)	1.39 (1.69)	1.59 (3.09)	1.06 (1.39)	1.36 (4.32)
Selling price (ETB/(kg)	38.22 (5.25)	40.64 (6.06)	38.23 (7.58)	39.55 (7.37)	38.23 (6.65)	40.00 (6.83)
Proportions						
Proportion of milk consumed (%)	25.74 (19.45)	27.51 (17.67)	33.55 (24.30)	32.33 (19.52)	29.65 (22.34)	25.40 (28.18)
Proportion of milk sold (%)	45.66 (21.35)	42.95 (24.69)	8.12 (18.22)	7.86 (19.09)	26.89 (27.31)	29.87 (18.71)
Proportion of milk processed (%)	25.71 (20.66)	25.75 (21.78)	55.57 (28.19)	53.75 (24.24)	40.64 (28.83)	39.37 (26.89)
Proportion of butter sold (%)	69.18 (27.58)	73.11 (22.59)	61.63 (28.16)	67.11 (23.33)	65.89 (27.94)	69.47 (23.08)

Standard deviation in parentheses.

Source: Survey data.

Table 11. *Major reasons for not selling milk*

Reasons	Importance of the reason given (percent reporting)		
	Very important	Important	Less important
Consume all the production	93	5	2
Market too far	26	53	21
Not enough buyers	29	47	23
Roads are not in good conditions	50	10	30
Milk prices not rewarding	9	45	45
Lack of preservation technology	37	50	12
Not in culture to sell milk	30	50	20

Source. Survey data.

5.2.10 Uses of income from dairy production

Important uses of income generated from dairy product sales are given in Table 12. Dairy income is used to pay for school expenses, buy grain for home consumption, buy other food, buy inputs for crop production, repay loan, cover health expenses, buy soaps and clothes, buy dairy animals, invest in dairy related activities and buy dairy feeds. About 72% of the respondents reported that the use of dairy income to buy dairy feed is very important. About 67% and 71% of the dairy farmers also reported that dairy income is important to repay loan and to cover health expenses, respectively.

Table 12. *Important uses of income generated from dairy products sales*

Uses of income generated from dairy sales	Importance of use (percentage reporting)		
	Very important	Important	Less important
School expenses	34	30	36
Buy grain for home consumption	34	43	23
Buy other food	26	39	30
Expenditures for inputs for crop production	29	29	43
Loan repayment	33	67	0
Health expenditures	29	71	00
Buy soap and clothes	9	49	42
Purchase of dairy animals	33	50	17
Invest in other dairy related activities	25	75	0
Buy dairy feed	72	14	13

Source: Survey data.

5.2.11 Main market outlets and buyers for dairy products

Market outlets and main buyers of dairy products are given in Tables 13 and 14, respectively. Milk marketing cooperatives are the main market outlet and buyers for raw milk, while the

town market and urban consumers respectively are the main markets and buyers of cheese and butter

Table 13. *Market outlets for dairy product sales by dairy producers*

Market outlets	Dairy products		
	Raw milk	Cheese	Butter
Farm gate (%)	2	4	0
Village market (%)	1	17	30
Town market (%)	5	70	61
District market (%)	0	7	7
Cooperative (%)	86	2	1
Private milk group (%)	4	0	0

Source: Survey data.

Table 14. *Main buyers of dairy and dairy products produced by smallholder farmers*

Main buyers	Dairy products		
	Raw milk	Cheese	Butter
Rural consumers (%)	11.4	11.11	12.50
Urban consumers (%)	7.02	74.07	50.00
Milk cooperative (%)	70.18	0.00	3.13
Traders (%)	3.51	14.81	34.38
Hotel owners (%)	4.39	0	0
Restaurant owners (%)	3.51	0	0

Source: Survey data.

5.3 Results of econometric analysis

5.3.1 Description of variables

The list and descriptive statistics of the dependent and independent variables included in the various regression analyses are given in Table 15. There are two types of dependent variables: the dummy variables whether the dairy producers have sold raw milk or butter and the quantities of raw milk and butter sold in the market conditional on the dairy producer's decision to sell. The dummy variable is equal to one if the household has sold a given product and zero otherwise. For the whole sample, the percentage of households who sold fluid milk and butter are 57% and 45%, respectively. The average quantity of fluid milk and butter sold per week are 26 litres and 0.71 kg, respectively.

Table 15. *Name and description of dependent and independent variables used in the regression analysis for dairy producer survey*

Variable names	Variable description	Mean		
		Member	Non-member	All
Dependent variables				
SOLD_MILK	Dummy variable equal to 1 if sold fluid milk; 0 otherwise	0.95 (0.22)	0.20 (0.40)	0.57 (0.50)
QSOLD_MILK	Quantity of fluid milk sold (litre/week)	45.61 (40.45)	6.74 (18.68)	26.18 (36.97)
SOLD_BUTTER	Dummy variable equal to 1 if sold butter; 0 otherwise	0.40 (0.48)	0.51 (0.48)	0.45 (0.48)
QSOLD_BUTTER	Quantity of butter sold (kg/ week)	0.50 (0.81)	0.92 (1.52)	0.71 (1.24)
Independent variables				
AGE	Age of household head (years)	42.22 (12.42)	44.96 (14.34)	43.59 (13.45)
GENDER	Dummy variable equal to 1 if household head is male; 0 otherwise	0.87 (0.34)	0.90 (0.30)	0.89 (0.32)
EDUC_1	Dummy variable equal to 1 if household head is illiterate; 0 otherwise	0.14 (0.35)	0.24 (0.42)	0.19 (0.29)
EDUC_2	Dummy variable equal to 1 if household head has primary school education; 0 otherwise	0.42 (0.50)	0.43 (0.50)	0.43 (0.50)
EDUC_3	Dummy variable equal to 1 if household head has secondary school education; 0 otherwise	0.44 (0.50)	0.33 (0.47)	0.39 (0.49)
HSIZE	Household size (number)	7.10 (2.65)	6.94 (2.53)	7.02 (2.59)
CATTLE_TLU	Cattle owned (TLU)	8.83 (5.20)	8.28 (6.31)	8.56 (5.90)
SHOATS_TLU	Shoats owned (TLU)	0.82 (1.03)	0.78 (1.14)	0.80 (1.08)
VILLA_HOUSE	Dummy variable equal to 1 if house owned is villa; 0 otherwise	0.05 (0.22)	0.03 (0.17)	0.04 (0.20)
TINR_HOUSE	Dummy variable equal to 1 if house owned is tin-roofed; 0 otherwise	0.80 (0.40)	0.75 (0.45)	0.78 (0.42)
HUT_HOUSE	Dummy variable equal to 1 if house owned is hut; 0 otherwise	0.15 (0.36)	0.22 (0.42)	0.19 (0.39)
FSIZE	Land holding (ha)	2.60 (2.33)	2.60 (2.31)	2.60 (2.31)
EXTENSION	Dummy variable equal to 1 if obtained extension service; 0 otherwise	0.74 (0.44)	0.65 (0.48)	0.70 (0.46)

Variable names	Variable description	Mean		
		Member	Non-member	All
CREDIT	Dummy variable equal to 1 if obtained credit service; 0 otherwise	0.05 (0.22)	0.04 (0.20)	0.05 (0.21)
DISTA_TOWN	Distance to district town (km)	8.62 (6.92)	8.15 (5.80)	8.39 (6.38)
DISTA_ ALWROAD	Distance to all-weather road (km)	1.66 (2.27)	5.36	3.40 (15.55)
RADIO	Dummy variable equal to 1 if owns radio; 0 otherwise	0.82 (0.39)	0.78 (0.42)	0.80 (0.40)
TELEPHONE	Dummy variable equal to 1 if owns telephone; 0 otherwise	0.25 (0.44)	0.17 (0.38)	0.21 (0.41)
TELEVISION	Dummy variable equal to 1 if owns television set; 0 otherwise	0.29 (0.46)	0.20 (0.40)	0.25 (0.43)

Note: For dummy variables, multiplying the mean value by 100 gives the percentage value.
Standard deviation in parentheses.
Source: Survey data.

5.3.2 Determinants of probability to sell raw milk and butter

Results of the first-stage probit model estimation of the determinants of the probabilities of the household to sell fresh raw milk and butter are given in Table 16. The coefficients of Probit model estimations are given in the first and fourth columns. The marginal effects of the independent variables on the probabilities of household's to sale raw milk and butter are computed and provided in the second and fifth columns. The marginal effect for a given independent variable is evaluated at the means of all other independent variables. The associated z-values and the statistical significance levels for the estimated coefficients are also given in the third and sixth columns.

The overall goodness of fit for the probit model parameter estimates is assessed based on several criteria. First, the log-likelihood ratio test is applied to assess the overall joint significance of the independent variables in explaining the variations in the dairy producer's likelihood to sale raw milk or butter. The null hypothesis for the log-likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness-of-fit of the probit model are statistically significant at a probability of less than 1% for both raw milk and butter. This shows that jointly the independent variables included in the probit regression model explain the variations in the household's probability to sell fluid milk and butter. Second, the McFadden's Pseudo-R^2 is calculated and the obtained values indicate that the independent variables included in the regression explain significant proportion of the variations in the dairy farmer's likelihood to sale raw milk or butter.

Table 16. *First-stage probit estimation results of determinants of probability to sell fluid milk and butter*

Explanatory variables	Fluid milk			Butter		
	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value
AGE	0.0066 (0.0106)	0.0023 (0.0037)	0.62	–0.0007 (0.0089)	–0.0003 (0.0035)	–0.08
GENDER	–0.8037 (0.3840)	–0.2298 (0.0912)	–2.09**	–0.6550 (0.3444)	–0.2443 (0.1151)	–1.90*
EDUC_2	–0.1000 (0.41)	–0.0355 (0.1457)	–0.24	0.8884 (0.3127)	0.3395 (0.1108)	2.84***
EDUC_3	0.1508 (0.4627)	0.05292 (0.1617)	0.33	0.5550 (0.3421)	0.2172 (0.1298)	1.62
HSIZE	–0.0333 (0.0705)	–0.0118 (0.02467)	–0.47	–0.0138 (0.0506)	–0.0055 (0.0201)	–0.27
CATTLE_TLU	0.01122 (0.0334)	0.0043 (0.0121)	0.36	–0.0155 (0.0260)	–0.0062 (0.0104)	–0.59
SHOATS_TLU	–0.0611 (0.1357)	–0.0216 (0.0481)	–0.45	0.1079 (0.1113)	0.0430 (0.0443)	0.97
VILLA_HOUSE	0.1229 (0.4970)	0.0422 (0.11661)	0.25	–0.0144 (0.5783)	–0.0058 (0.2304)	–0.02
TINR_HOUSE	0.9967 (0.3285)	0.3731 (0.1171)	3.03***	–0.1494 (0.2919)	–0.0592 (0.1150)	–0.51
FSIZE	–0.1130 (0.0738)	–0.0400 (0.0270)	–1.53	0.0070 (0.0608)	0.0028 (0.0242)	0.12
COOP. MEMBER	2.6154 (0.3561)	0.7694 (0.05493)	7.34***	–0.4106 (0.2237)	–0.1622 (0.0872)	–1.84*
CREDIT	0.2127 (0.4739)	0.0714 (0.1513)	0.45	–0.0336 (0.5331)	–0.0134 (0.2125)	–0.06
EXTENSION	0.1437 (0.2783)	0.0514 (0.1003)	0.52	0.0907 (0.2526)	0.0361 (0.1006)	0.36
DISTA_TOWN	0.0446 (0.0196)	0.0158 (0.0070)	2.28**	0.0062 (0.0162)	0.0025 (0.0064)	0.38
DISTA_ALWROAD	–0.0032 (0.0052)	–0.0011 (0.0018)	–0.61	0.0054(0.0046)	0.0022 (0.0018)	1.18
RADIO	–0.1802 (0.3123)	–0.0619 (0.1049)	–0.58	–0.2457 (0.2779)	–0.0968 (0.1079)	–0.88
TELEPHONE	0.0309 (0.4270)	0.0109 (0.1494)	0.07	0.6778 (0.3197)	0.2567 (0.1110)	2.12**
TELEVISION	0.6281 (0.4374)	0.1998 (0.1188)	1.44	–0.9662 (0.3219)	–0.3646 (0.1069)	–3.00***
CONSTANT	–1.2652 (0.7123)		–1.78*	0.6888 (0.6877)		1.00
N		164			163	
Correct predictions:						
–Sale (%)		94			66	
–Non-sale (%)		83			68	

Explanatory variables	Fluid milk			Butter		
	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value
–Overall (%)		89			67	
Linktest		–0.19*			0.36	
Pseudo R^2		0.56			0.13	
Wald χ^2 (18)		96.60***			29.94***	
Log likelihood		–48.35			–98.40	

Notes: The dependent variable is a dummy variable which takes on the value 1 if the household had sold milk, 0 otherwise.
Figures in parentheses are robust standard errors.
***, **, and * indicate statistical significance at p < 1%, 5%, and 10%, respectively.
Source: Survey data.

The probit model explains 56% and 13% of the variations in the likelihood of households to sell fluid milk and butter, respectively. Third, the correct prediction rate of the probit model is obtained. In the case of raw milk, it is observed that the probit model predicts about 89% of the cases correctly while in the case of butter the probit model predicts 67% of the cases correctly. Fourth, the linktest is also conducted to test for the omitted variable problem. The null hypothesis of no omitted variable is not rejected at a probability of less than 5% for both fluid milk and butter. Fifth, the standard errors of the parameters estimated are also corrected for the non-constant variances.

The age of the head of household is observed to be positively associated with the household's likelihood to sell raw milk while it is negatively associated with the household's likelihood to sell butter but is not statistically significant in either case. The gender of household is negatively associated with the likelihood of household selling raw milk and butter. However, the effect of gender is statistically significant only for fluid milk at a probability of less than 5%. The negative coefficient on gender, given the omitted category for gender dummy variable is female-headed households, suggests that female-headed households are more likely to sell either fluid milk or butter. For example, in the case of fluid milk as compared to male-headed households, female-headed households are about 23% more likely to sell raw milk in the market. This might be because female-headed households are more cash constrained than male-headed households.

The effect of the education level of the head of household head on the household likelihood to sell raw milk is not significant. However, the effect of the education level of the head of household on the household's likelihood to sell butter is positive and statistically significant at a probability less than 5%. The positive coefficient on the dummy variable for primary education indicates that the dairy producers with primary education are more likely to sell their raw milk than households with illiterate heads. The effect of household size on the likelihood of dairy producer to sell raw milk and butter is as expected negative but statistically not significant. The negative coefficients indicate that as the household size increases the likelihood that the household sell raw milk or butter decreases. This seems reasonable as the household consumption needs increase with the size of the household, the amount of milk and butter left for sale in the market decreases and this decreases the likelihood of the household selling raw milk or butter in the market.

As expected, the number of cattle owned by the household is positively associated with household's likelihood to sell raw milk but is not statistically significant. On the other hand, the number of shoats is negatively associated with the household's likelihood to sell raw milk but similar to the size of cattle owned the effect is not statistically significant. The negative association between the size of shoats owned and the household's likelihood to sell raw

milk indicates that as the size of shoats increase the need for the household to sell milk to generate cash decreases and this increases the household's likelihood to consume milk at home instead of selling it in the market.

The type (quality) of house owned by the dairy producers is a proxy for the wealth of the household. There are three major types of houses owned by the dairy farmers in the study area: hut, tin-roofed and villa houses. The type of house owned by the household is observed to have a positive and statistically significant impact on the household's likelihood to sell raw milk. This indicates that wealthy dairy producers are more likely to sell raw milk. For example, the ownership of tin-roofed houses increases the likelihood of households selling the raw milk by more than 30% as compared to the ownership of huts which is the omitted category for the type of house dummy variable. The effect of the type of house owned on the likelihood of household selling butter is negative but statistically not significant.

Contrary to theoretical expectation, it is observed that there is negative association between farm size and the household's likelihood to sell fluid milk. The effect of farm size on likelihood of selling butter is positive. However, the effect of farm size is not statistically significant for either raw milk or for butter. Thus, farm size has no significant effect on the commercialization of smallholder dairy production. The implication of this result is that smallholder dairy farmers can also participate in the market without much of the problem related to small farm sizes.

The household membership in a milk marketing cooperative is found to be strongly and positively associated with the likelihood of household to sell raw milk and the effect is statistically significant at a probability of less than 1%. Sellers are more likely to be a member of a cooperative. For example, the membership increases the probability of household to sell raw milk by 77%. This clearly indicates the important role the milk marketing cooperatives are playing in terms of improving smallholder dairy producers' access to the market by reducing the fixed transaction costs to participate in the raw milk market such as the costs of searching and negotiating with buyers. However, the membership cooperative is observed to have a negative effect on the household's likelihood to sell butter. Cooperative members are less likely to sell butter as compared to the non-members. This result is reasonable since in most cases the cooperatives accept whatever amount of raw milk is supplied from its members and members have little milk left for processing and producing butter for the market.

Access to credit and extension services is often mentioned as an important condition to increase smallholder commercialization. As expected, the household's access to credit for dairy farm operation is positively associated with the likelihood of selling raw milk. However, the effect of credit is not statistically significant at a probability of less than 5%. The

effect of access to credit on the household's likelihood to sell butter is negative though not statistically significant. The effects of household access to extension service on the likelihood of household to sell raw milk and butter are positive but are not statistically significant at a probability of less than 5%. The distances to the town and to all-weather road are expected to negatively affect households' likelihood to sell raw milk. However, the effect of distance to the town is found to be positive and statistically significant at a probability of less than 5%. This result is hard to interpret. On the other hand, the effect of distance to all weather roads is found to be negatively associated with the household's likelihood to sell raw milk in the market though these effects are not significant statistically. The effects of households' access to different communication technology were not found to be significant in terms of influencing the likelihood of household's selling raw milk but are significant for butter.

5.3.3 Determinants of quantities of raw milk and butter sold

The results of Heckman two-stage and tobit regression estimations for quantity of milk and butter sold conditional on household's decision to sale these products are given in Tables 17 and 18. The coefficients on the Mill's ratio (lambda) in the Heckman two-stage estimation are not significant at the probability of less than 5% for both fluid milk and butter. This indicates there is no sample selection bias, there are no unobservable household characteristics influencing the household's likelihood to sell raw milk and butter and thereby affecting the quantities of products sold. Thus, since there is no sample selection bias, the determinants of the quantities of raw milk and butter sold are analysed and reported based on the results of Tobit model. Four marginal effects for the Tobit model are calculated at the means of all other variables and given in columns 2 to 5 of Tables 17 and 18. The model chi-square for Tobit model regression indicates that the overall goodness of fit of the Tobit model is statistically significant at a probability of less than 1% for both fluid milk and butter. This indicates that jointly the variables included in the Tobit model explain the variations in the household's quantity of raw milk and butter sold.

Table 17. *Second-stage Heckman and Tobit estimation results of determinants of the levels of household sale of fluid milk*

Explanatory variables	Heckman estimates		Tobit marginal effects at mean values		
	Coefficient (β)	Latent variable (β) ∂E(v*)/ x	Probability of being uncensored ∂P(v>0|x)/∂x	Conditional expected value ∂E(v|v>0)/∂x	Unconditional expected value ∂E(v)/∂x
AGE	–0.4761 (0.2738)	0.0043 (0.2899)	0.0001 (0.0030)	0.0017 (0.1164)	0.0025 (0.1643)
GENDER	–11.4107 (10.1149)	–29.8280 (9.7768)***	–0.2767 (0.0765)***	–14.3449 (5.5508)**	–20.1997 (7.5920)**
EDUC_2	–5.7874 (9.7524)	9.0727 (10.1372)	0.0941 (0.1043)	3.6872 (4.1698)	5.2078 (5.8895)
EDUC_3	–6.2488 (10.3179)	16.4812 (10.8859)	0.1691 (0.1091)	6.8153 (4.6344)	9.6263 (6.5304)
HSIZE	–3.7733 (1.3688)***	–1.9864 (1.4510)	–0.0207 (0.0152)	–0.7978 (0.5823)	–1.1257 (0.8222)
CATTLE_TLU	2.3593 (0.7638)***	1.9933 (0.8011)**	0.0208 (0.0085)**	0.8005 (0.3236)**	1.1296 (0.4581)**
SHOATS_TLU	–0.9963 (3.5300)	–3.8783 (3.7538)	–0.0405 (0.0392)	–1.5576 (1.5087)	–2.1979 (2.1299)
VILLA_HOUSE	7.6859 (16.5843)	10.1738 (19.6368)	0.1028 (0.1903)	4.3994 (9.1088)	6.2557 (12.9820)
TINR_HOUSE	6.6837 (10.7305)	25.9178 (9.8567)***	0.2688 (0.0979)***	9.3231 (3.1167)***	12.6823 (4.0023)***
FSIZE	4.8811 (1.7760)***	2.8968 (1.8240)	0.0302 (0.0191)	1.1634 (0.7344)	1.6417 (1.0378)
COOP. MEMBER	–4.0392 (22.48839)	71.9164 (7.2738)***	0.6529 (0.0500)***	30.0047 (2.9189)***	40.1240 (3.6473)***
CONSTANT	74.2960 (30.5928)**	–42.3440 (21.5332)*			
LAMBDA	–20.0917 (19.8632)	–			
RHO	–0.7018	–			
SIGMA	28.6279	37.7135			
N	164	190			
Linktest	–	0.01*			
Pseudo R^2	–	0.11			
Wald χ^2	–	143.45***			
Log likelihood	–	–587.61			

Notes: The dependent variable is the quantity of raw milk sold. Figures in parentheses are robust standard errors.
***, **, and * indicate statistical significance at p> 1%, 5%, and 10%, respectively. Number of observations left-censored are 80.
Source: Survey data.

Table 18. *Second-stage results: determinants of the levels of household sale of butter*

Explanatory variables	Heckman estimates		Tobit marginal effects at mean values		
	Coefficient (β)	Latent variable (β) ∂E(v*)/∂x	Probability of being uncensored ∂P(v>0|x)/∂x	Conditional expected value ∂E(v|v>0)/∂x	Unconditional expected value ∂E(v)/∂x
AGE	–0.0389 (0.0104)***	–0.0218 (0.0136)	–0.0048 (0.0030)	–0.0077 (0.0048)	–0.0105 (0.0066)
GENDER	–0.7780 (0.3966) *	–0.7096 (0.4660)	–0.1548 (0.0987)	–0.2751 (0.1968)	–0.3846 (0.2792)
EDUC_2	–1.0565 (0.4403) **	0.5097 (0.4802)	0.1121 (0.1045)	0.1830 (0.1745)	0.2505 (0.2395)
EDUC_3	–0.9862 (0.4597) **	0.3473 (0.5250)	0.0765 (0.1150)	0.1244 (0.1899)	0.1702 (0.2607)
HSIZE	0.1110 (0.0531) **	–0.0483 (0.0662)	–0.0107 (0.0146)	–0.0171 (0.0234)	–0.0233 (0.0319)
CATTLE_TLU	–0.0260 (0.0271)	–0.0085 (0.0375)	–0.0019 (0.0083)	–0.0030 (0.0133)	–0.0041 (0.0181)
SHOATS_TLU	0.1068 (0.1453)	0.3637 (0.1687) **	0.0802 (0.0373) **	0.1286 (0.0596) **	0.1754 (0.0815) **
VILLA_HOUSE	1.3379 (0.5646) **	0.7701 (0.8187)	0.1668 (0.1698)	0.3070 (0.3656)	0.4314 (0.5215)
TINR_HOUSE	0.5368 (0.2852) *	–0.1318 (0.3927)	–0.0291 (0.0866)	–0.0472 (0.1423)	–0.0646 (0.1957)
FSIZE	0.2273 (0.0726) ***	0.2325 (0.0862) ***	0.0513 (0.0193) ***	0.0822 (0.0306) ***	0.1121 (0.0419) ***
COOP. MEMBER	–0.5315 (0.2785) *	–0.8492 (0.3057) ***	–0.1856 (0.0659) ***	–0.3010 (0.1086) ***	–0.4093 (0.1475) ***
CONSTANT	2.9249 (0.7201) ***	1.1499 (0.9337)			
LAMBDA	0.3150 (0.5425)				
RHO	0.3168	–			
SIGMA	0.9943	1.8069			
N	163	189			
Linktest	–	0.18			
Pseudo R^2	–	0.06			
Wald χ^2	–	32.42***			
Log likelihood	–	–248.89			

Notes: The dependent variable is the quantity of butter sold. Figures in parentheses are robust standard errors.
***, **, and * indicate statistical significance at a probability of less than 1%, 5%, and 10%, respectively. Number of observation left-censored at zero is 95.
Source: Survey data.

The age of household head is positively associated with the quantity of raw milk sold while it is negatively associated with the quantity of butter sold. However, the magnitudes of the effects are small and statistically not significant. The gender of the head of household is negatively and strongly associated with the quantity of fluid milk sold. The female headed households are 28% more likely to have a positive quantities of milk sold. Conditional on positive quantity of milk sold, female-headed households sell about 14 litres of milk more than the male-headed households. Similar to fluid milk, the effect of gender on the quantity of butter sold is negative. However, unlike fluid milk, the effect of gender on the quantity of butter sold is not statistically significant.

The effects of education of the head of household on the quantities of fluid milk and butter sold are positive but these effects are not statistically significant. It is interesting to note that the effects of household size on the quantities of milk and butter sold are negative as expected but these effects are not statistically significant.

The effect of the number of cattle owned by the household is positive as expected and statistically significant at a probability of less than 5%. The increase in the size of cattle owned increases both the potential and actual quantities of raw milk sold. The increase in the cattle size also significantly increases the likelihood that the household would sell positive quantities of fluid milk. However, the effect of the size of cattle owned on the quantity of butter sold is negative and is not statistically significant. The effect of the size of shoats owned by the household has no significant effect on the quantities of fluid milk sold while there is statistically significant positive relationship between the quantity of butter sold and the size of shoats owned.

The type of house owned by the household is an indicator for the wealth of the household and is positively and strongly associated with the potential and actual market supply of fluid milk. The households with tin-roofed houses are 27% more likely to have positive quantities of milk sold as compared to households with hut houses. The magnitude of the effect of the type of house owned on the quantity of milk sold is very large. For example, conditional on positive quantity of milk sold, the tin-roofed households sell about 9 litres of milk per week more than the households with hut houses. Thus, the wealth factor plays significant role on the quantities of milk sold. The type of house owned has no effect on the quantity of butter sold. The farm size is positively associated with the quantity of milk sold but is not statistically significant. On the other hand, it is observed that there is positive and statistically significant effect of farm size on the quantity of butter sold.

The membership of household in a milk marketing cooperative is found to be positively and significantly increase the quantity of milk sold. Thus, after controlling for other variables, membership has a very significant positive effect both on the household's probability to

sell raw milk; and conditional on the sell of the raw milk, on the volume of the raw milk sold. However, the effect of membership on the quantity of butter sold is strongly negative. Membership in a milk marketing cooperative decreases the quantity of butter sold by the household, *ceteris paribus*.

5.4 Section summary

After controlling for demographic and socioeconomic characteristics of the dairy producers, the econometric analysis shows that the most important determinant of commercialization of smallholder dairy production is membership in a milk marketing cooperative. Membership significantly increased the likelihood of smallholder dairy producer to selling milk and butter in the market. Conditional on sale of milk and butter, membership in a dairy marketing cooperative also significantly increases the volume of milk and butter sold in the market. Membership in a milk marketing cooperative has also significantly increased the quantities of milk produced, and consumed by cooperative member dairy producers. Thus, encouraging non-member households to join cooperatives and enhancing the role of these institutions are the keys to commercializing smallholder dairy production.

6 Empirical results for milk marketing cooperative survey

6.1 Introduction

Currently, there are several milk marketing cooperatives operating in Arsi Zone. However, detailed information is lacking on the organizational, management and operational characteristics of these institutions. This information is important to design and implement various interventions aimed to enhance the role of cooperatives in facilitating smallholder dairy farmers' access to the market. This study provides a review of the status of the existing milk marketing cooperatives and identifies the constraints and opportunities they are facing. All of the 24 milk marketing cooperatives, which were operational at the time of this study, were surveyed. The following sections present the survey findings based on descriptive analyses. Due to limited sample size, econometric analysis of the milk marketing cooperative survey data was not done.

6.2 Results of descriptive analysis

6.2.1 History of milk marketing cooperative establishment

The historical background of the milk marketing cooperative establishment is summarized in Table 19. The main reasons for establishing milk marketing cooperatives, in order of importance, were to overcome problems of lack of market outlet for milk, low milk prices, high milk price variability and low producer bargaining power.

Table 19. *Historical background of milk marketing cooperative establishment*

Variables	Descriptive statistics
Service year	4
Licensed (% yes)	67
Reasons for establishing cooperative (mean rating)	
Lack of market outlet for milk	4.1 (1.3)
Milk price too low	3.3 (1.2)
Too much variability in milk price	2.9 (1.7)
Lack of individual bargaining power	2.5 (2.1)
Initiators of marketing cooperative	
Government (% yes)	46
NGOs working in the area (% yes)	17
Donors (% yes)	29
Others (% yes)	8

Variables	Descriptive statistics
Start-up conditions	
Working capital (ETB)	5101 (8198)
Registered members—male (number)	26.7 (19.5)
Registered members—female (number)	2.8 (1.5)
Full time employee (number)	3.6 (2.5)
Open membership (% yes)	92
Voting	
One person one vote (% yes)	71
In proportion to patronage (% yes)	29
Cooperative management	
Producer managed (% yes)	79
Professional management (% yes)	21
Source of capital for start-up	
Members fee (% yes)	80
Members' equity fee (% yes)	100
Loan from private commercial bank (% yes)	6
Grant from NGOs (% yes)	31
Government fund (% yes)	56
Source of additional capital	
Membership fees (% yes)	70
Sell share to existing members (% yes)	91
Sell share to new members (% yes)	77
Retained patronage funds (% yes)	32
Loan from private commercial bank (% yes)	11
Loan from government commercial bank (% yes)	11
Loan from cooperative bank (% yes)	6
Loan from union (% yes)	6
Loan from microfinance institution (% yes)	6
Grant from NGOs (% yes)	35
Government fund (% yes)	28
Accepts milk from non-members (% yes)	75
Price paid to non-members as compared to members	
Lower (% yes)	42
Same (% yes)	58

Standard deviations in parentheses.
Source: Survey data.

Almost half of the cooperatives were initiated by the government and the rest were initiated by donors and NGOs working in the area. The important issue regarding the initiation of the

cooperatives is that whether the cooperatives initiated by the government can be allowed to freely operate as a business enterprise without government interferences. In other words, the government initiation of the cooperative should not lead to political and bureaucratic interferences which negatively affect the business activities of the cooperatives. This is important given the recent memory of bad cooperative management and performance during the socialist regime among many smallholder farmers. Therefore, it is essential for those engaged in cooperative establishment to make clear to the members regarding the cooperatives roles, functions, benefits and its sustainability.

The source of capital for start-up was mainly from the membership fee (80%) and members' equity share fee payment (100%) while about 56% of the cooperatives reported the use of government fund to start the milk marketing cooperative. The major sources of additional capital even after the cooperative has been established were membership fees (70%), sell of share to existing members (91%) and new members (77%). About 75% of the cooperatives reported they collect milk not only from the members but also from the non-members. However, as compared to the members, the non-members are paid lower prices in 42% of the cases and paid same price in 58% of the cases. The reason why some farmers are not members but would prefer to sell to the cooperatives at lower prices than the cooperative members needs investigation. The main bottleneck for new entry was observed to be high initial share payment to be on the par with old cooperative members. Some noted that the old cooperative members have increased the share value to use it as entry barrier to other producers who wish to join the cooperative.

6.2.2 Cooperative management

The existence of effective cooperative management system is essential to manage and adapt the cooperative to dynamic market environments and to effectively manage the relationships among the cooperative members and the cooperative and other market actors in the dairy product value chain. The cooperatives studied are managed by farmer cooperative-members and the management team is mostly composed of the chair, secretary, auditor, treasurer, accountant, record keeper and one cooperative member. The demographic characteristics of cooperative management position holders were analysed in terms of their gender, age, level of education, cooperative membership status, primary activity and marital status (Table 20).

Table 20. *Management structure and background of cooperative management staff*

Characteristics	Office position						
	Chair-person	Secre-tary	Auditor	Treas-urer	Ac-countant	Record keeper	Member
Gender (% male)	100	96	100	100	100	50	100
Average age (years)	49.3 (8.1)	41.1 (7.3)	48.0 (7.3)	42.1 (6.2)	39.7 (8.1)	28.0 (5.2)	40.5 (15.4)
Member of cooperative (% yes)	100	100	100	100	100	33	100
Level of education							
Illiterate (% yes)	8	0	0	0	0	0	0
Adult education (% yes)	12	0	0	9	4	0	14
Primary school (% yes)	50	42	87	43	22	83	57
Secondary school (% yes)	17	58	12	48	70	17	29
College diploma (% yes)	8	0	0	0	0	0	0
University degree (% yes)	4	0	0	0	4	0	0
Primary activity (% yes)							
None	0	17	0	0	11	0	12
Farming	92	8	75	10	22	33	87
Livestock keeper	4	25	0	20	33	50	0
Employee in private sector	0	0	0	0	22	0	0
Civil servant	0	8	0	0	0	17	0
Businessman/woman	0	33	0	60	11	0	0
Labourer on farm	0	0	0	0	0	0	0
Labourer off-farm	0	0	0	0	0	0	0
Retired with pension	4	0	12	0	0	0	0
Others	0	8	12	10	0	0	0
Marital status (% yes)							
Married to one wife	79	100	87	100	95	0	100
Married to many wives	21	0	12	0	5	17	0
Single	0	0	0	0	0	67	0
Widowed	0	0	0	0	0	17	0
Divorced	0	0	0	0	0	0	0
Separated	0	0	0	0	0	0	0
Number of observations	24	24	9	21	22	6	8

Standard deviation in parentheses.
Source: Survey data.

Most cooperative office position holders have a minimum of primary level education except accountants who mostly have at least secondary level education. In general, cooperatives are managed by relatively older and less educated dairy producers; this has implications on the capacity to manage the cooperative in very complex and dynamic market situations. The cooperative management team is mainly composed of men. However, given the heavy involvement of women in dairy farm operations, there is need to encourage women's participation in cooperative leadership and governance to ensure their inclusion in decision-making at the cooperative managerial levels. The nature of members' participation and responsibility in milk marketing cooperative is summarized in Table 21.

Table 21. *Decision-making by milk marketing cooperatives*

Variables	Descriptive statistics
Member participation type	
Participate in the election (% yes)	100
Amendment of by-laws (% yes)	100
Decision regarding distribution of profits (% yes)	96
Decision regarding budgets (% yes)	87
Decision on fixing prices (% yes)	61
Member's responsibility	
Payment of members registration fee (% yes)	100
Payment of share (% yes)	100
Attendance of meetings (% yes)	92
Attendance of general meeting (% yes)	96
Supply quality milk to the cooperative (% yes)	91
Borrowing from the bank, owning asset and opening bank account	
Own asset (% yes)	83
Open bank account (% yes)	61
Members responsible for cooperative debt (% yes)	71

Source: Survey data.

Based on cooperative management staff perspectives, the cooperative members' satisfaction with various cooperative activities and services were assessed (see Table 22). In more than 65% of the cases, the cooperative management staff reported member satisfaction with cooperative services. However, there are also areas where the cooperative management noted that members were dissatisfied, for example, in terms of trust among members, member's views of cooperative benefits, and level of member's participation in the planning of business activities.

Table 22. *Perspectives of cooperative management staff on members' satisfaction with cooperative services*

Parameters	Level of satisfaction (percent reporting)				
	Very dissatisfied	Dissatisfied	Neither dissatisfied nor satisfied	Satisfied	Very satisfied
Members compliance with by-laws	4	9	9	43	35
Level of trust among members	0	13	8	50	29
Level of trust between members and cooperative management	5	9	5	50	32
Members view of the benefits of the cooperative	4	13	0	54	29
Level of members participation in their cooperative planning of business activities	4	17	13	39	26
Level of members participation in their cooperative decision-making	4	0	13	48	35

Source: Survey data.

6.2.3 Milk collection, processing and marketing

The operational details of milk collection, processing and marketing by milk marketing cooperatives are summarized in Table 23. The cooperatives are engaged in bulking raw milk, milk processing and marketing of milk and dairy products. Milk is transported by individual farmers to the collection centres on foot or using pack animals. Most (79%) milk deliveries are received at the collection centre in the morning only with the remaining deliveries being of both morning and evening milk. Bulked milk is processed mostly into butter although other dairy products like skimmed milk, cheese and yoghurt are also produced. There are no cooling facilities in any of the collection centres hence the need to process the milk immediately. This limits the possibility of supplying fresh raw milk to local or regional markets. For this reason, raw milk is mostly received from farmers situated near the milk collection centres.

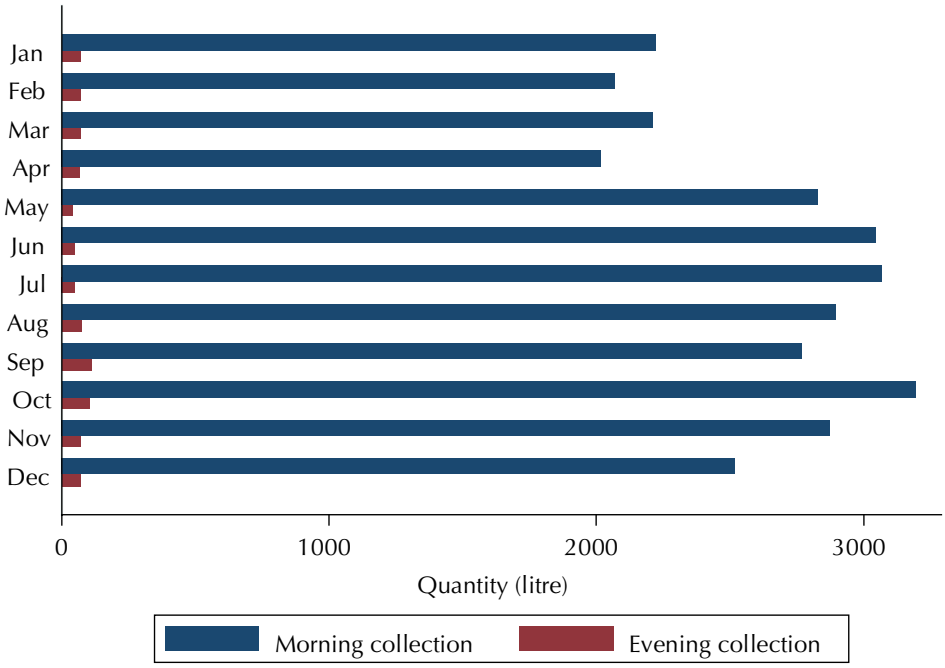
The average monthly morning and evening raw milk collections are 2609 and 71 litres, respectively. The seasonal patterns of milk collection activities and the products sold by the cooperatives are shown in Figures 1 and 2. The monthly collections are relatively lower during the months of January to April which correspond to the dry season. During the months May to December, there are no clear seasonal patterns for skimmed milk and yoghurt but for butter and cheese there are clear seasonal patterns similar to that of raw milk.

Table 23. *Operational details of milk collection, processing and marketing*

Variables	Descriptive statistics
Frequency of milk collection (% yes)	
Morning collection only	79
Both morning and evening collections	21
Containers used for milk delivery (% yes)	
Plastic can	100
Aluminium can	74
Milk quality requirement for delivery at the centre (% yes)	
Must not be diluted	96
Must not be acidic	67
Meet fat content requirement	96
Meet total solid requirements	61
No drug used for the cow	54
No cow dung found in the milk	83
Frequency of milk quality test at delivery time (% yes)	
Always	43
Often	17
Sometimes	22
Never	17
Responsibility of determining buying price (% yes)	
Price fixed by cooperative management	75
Price fixed by general assembly	30
Responsibility of determining selling price (% yes)	
Price fixed by cooperative management	75
Price fixed by general assembly	30
Method of price determination (% yes)	
Use prevailing market price	75
Through negotiation with customers	55
Based on the cost of the cooperative	58
Frequency of milk buying price change in a year	
Once (% yes)	9
Twice (% yes)	30
Thrice (% yes)	30
More than three (% yes)	17
No change at all (% yes)	9
Frequency of milk selling price change in a year	
Once (% yes)	4
Twice (% yes)	35
Thrice (% yes)	17

Variables	Descriptive statistics
More than three times (% yes)	30
No change at all (% yes)	9
Milk price change pre-announced to members (% yes)	74
Number of days before the new price is effective	9.1 (5.9)

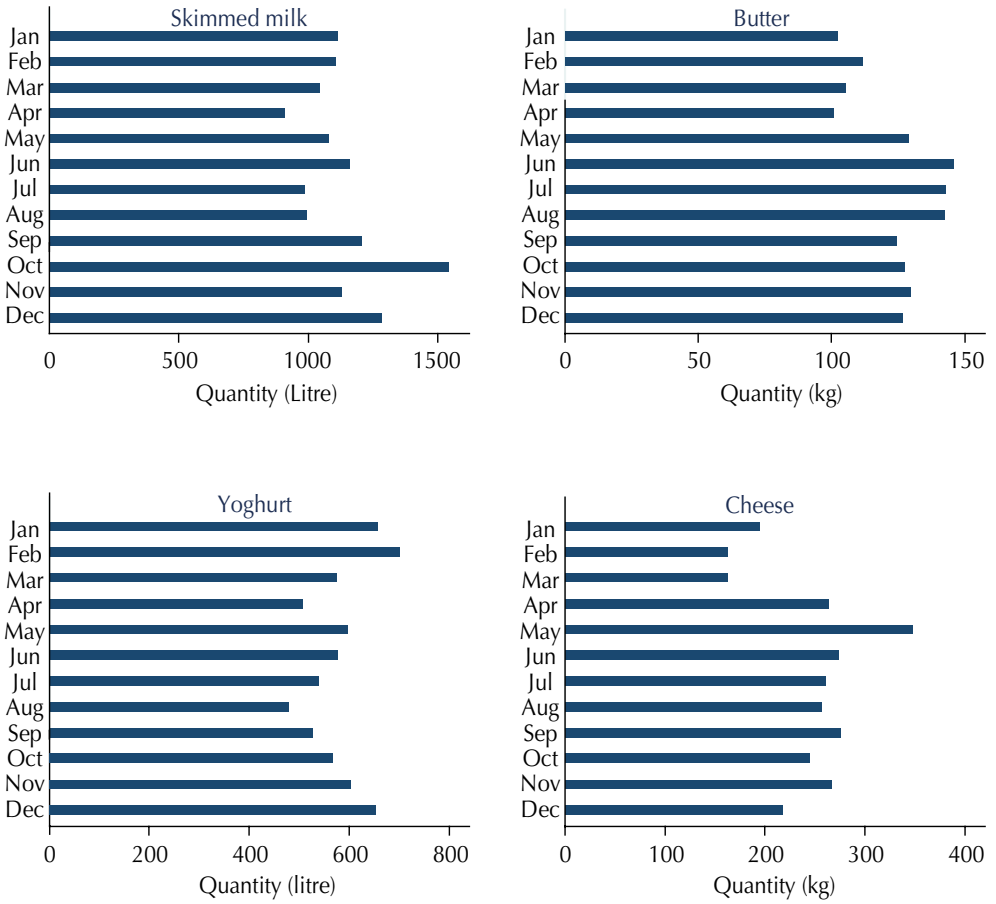
Standard deviations in parentheses.
Source: Survey data.



Source: Survey data.

Figure 1. *Monthly average quantities of raw milk collected (2003–04 to 2007–08).*

The trends in annual average quantities of raw milk collected and dairy products sold by the cooperatives are given in Figures 3 and 4. The average annual raw milk collected by dairy cooperatives declined from 1996 EC to 2000 EC and similar patterns are also observed for most of dairy products sold by the cooperative. The dairy products sold by the cooperatives also showed steady decline over the last several years except for yoghurt which does not show any clear annual pattern. One of the reasons for the decline in milk collected was lack of flexibility in purchase price by the cooperatives in the face of market and price dynamics.

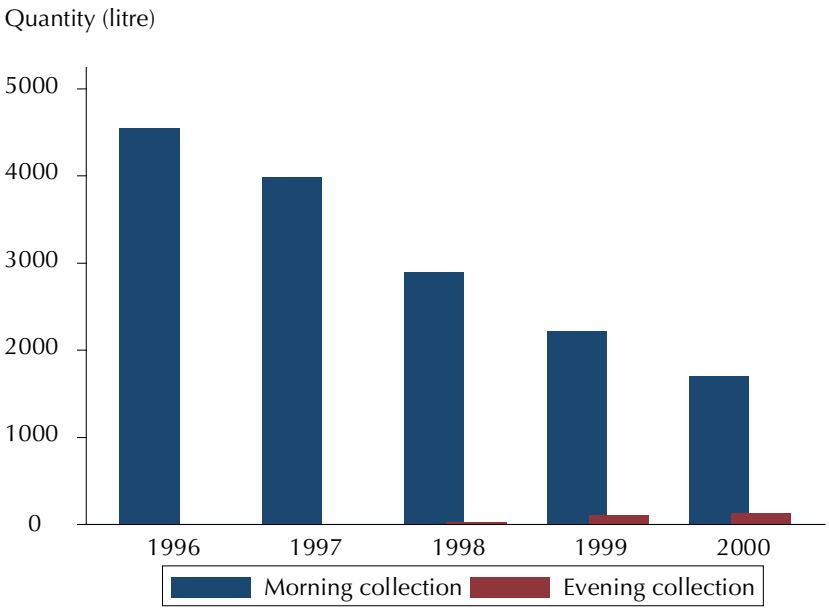


Source: Survey data.

Figure 2. *Monthly average quantities of dairy products sold by cooperatives (2003–04 to 2007–08).*

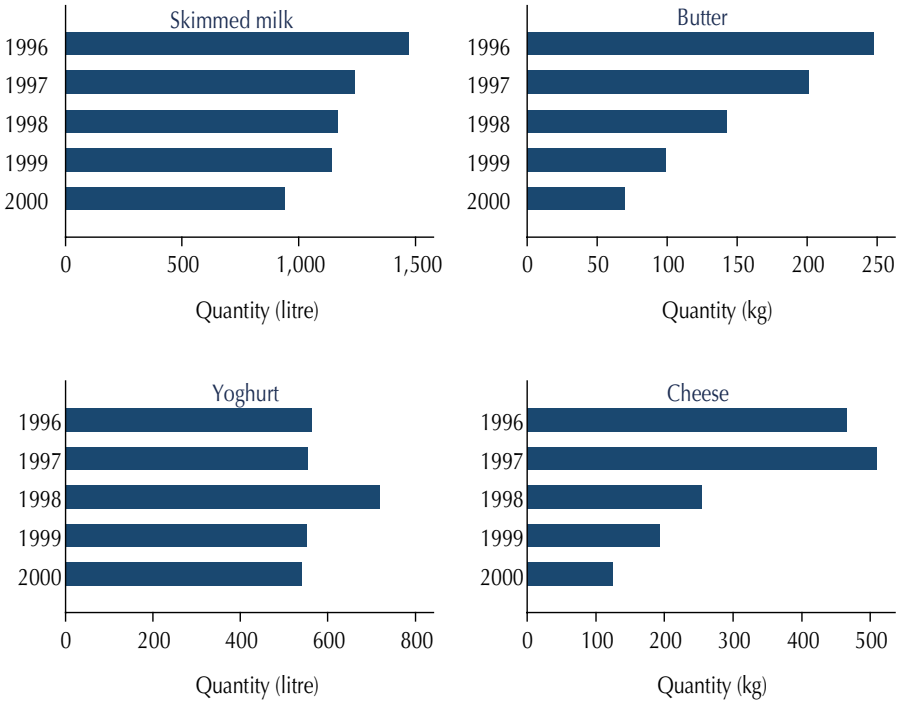
The milk buying (delivery) and selling prices at the collection centres are fixed either by the cooperative management (75%) or by the general assembly (25%). However, average prices vary seasonally (Figure 5); average prices for raw and skimmed milk were ETB 2/litre and ETB 1.50/litre respectively. Prices of dairy products tended upward (Figure 6).

The criteria used in determining the buying and selling prices are: use of prevailing market price (75%), negotiation with customers (55%) and costs of milk marketing cooperatives (58%). Once fixed, the buying prices rarely change during the course of the year which limits the responsiveness of the cooperatives to price changes. For example, about 70% of the respondents reported that the buying price changed at most three times in a year. However, the selling price changes more frequently; 30% of the respondents reported that the selling price changed more than three times within a year.



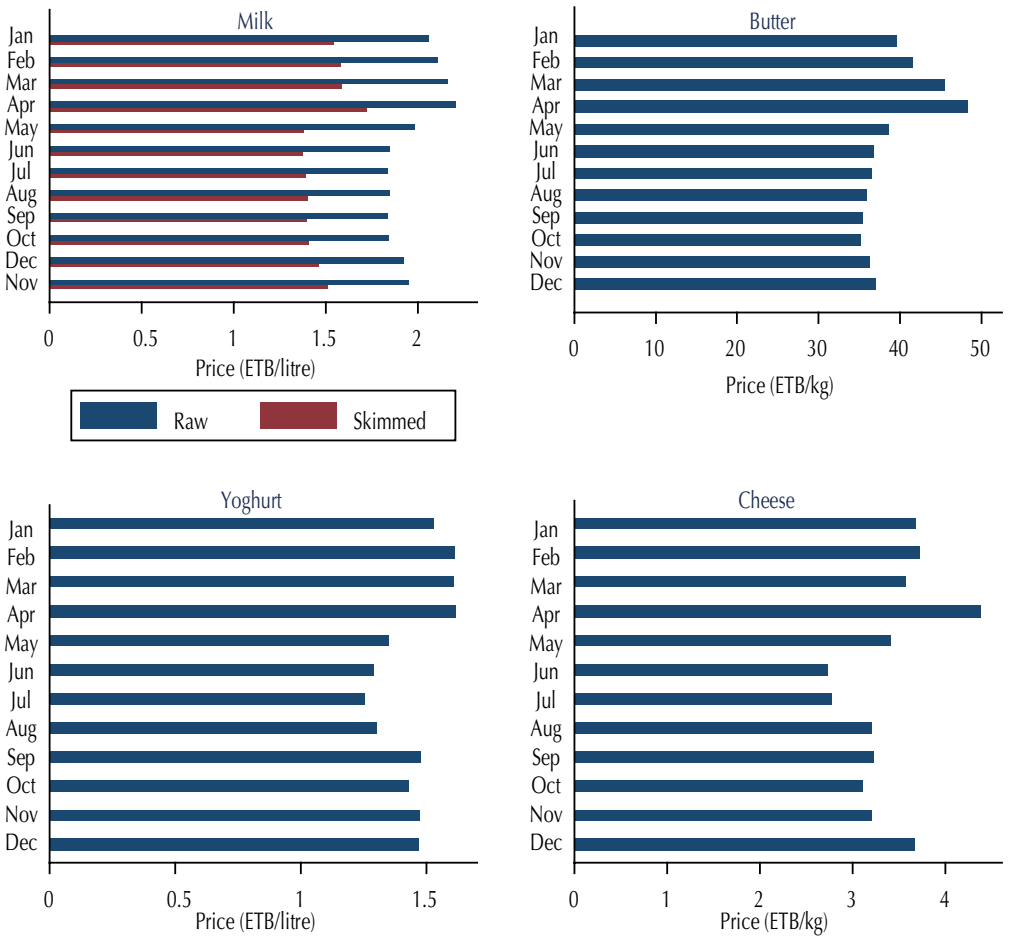
Source: Survey data.

Figure 3. *Trends in monthly average quantities of raw milk collected from 1996–2000 EC.*



Source: Survey data.

Figure 4. *Trends in monthly average quantities of dairy products sold from 1996–2000 EC.*

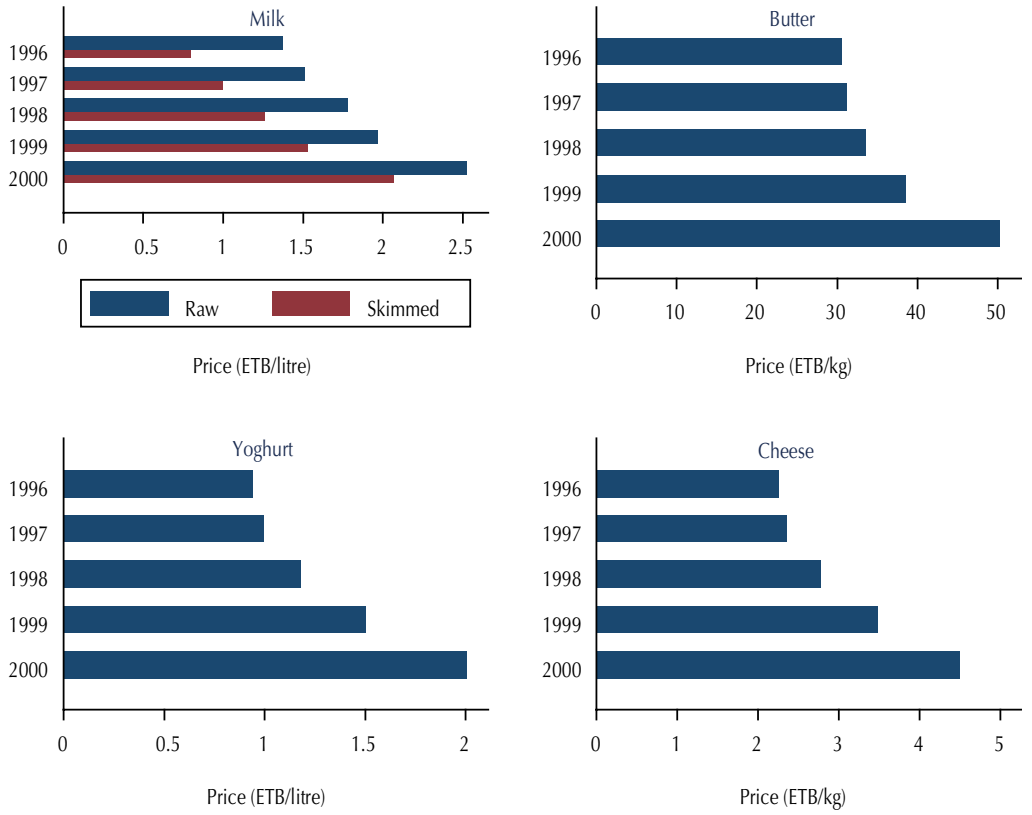


Source: Survey data.

Figure 5. *Monthly average prices of dairy products sold by cooperatives (2003–04 to 2007–08).*

The buying and selling price changes are pre-announced to members in 74% of the cases about nine days before implementation. At the time of milk delivery, the quantity of milk is registered and its quality inspected. Members are usually paid once per month for their milk deliveries and the dividend is paid on average once a year.

The dairy products marketed by the cooperatives, main market outlets and buyers are reported in Table 24. The cooperative collects raw fresh milk from the members and/or non-members and process it into skimmed milk, yoghurt, butter and cheese. It is observed that only 15% of the cooperatives reported that they sell raw whole milk while the majority reported processing of raw milk and selling it in the forms of skimmed milk (96%), yoghurt (85%), butter (100%) and cheese (72%). In general, cooperative product offerings are limited to cottage products and there is a potential to develop different dairy products.



Source: Survey data.

Figure 6. *Trends in monthly average prices of dairy products sold by cooperatives (2003–04 to 2007–08).*

The major market outlets for dairy products sold by the milk marketing cooperatives are the cooperatives themselves and village markets. The main buyers of the dairy products sold by the cooperatives are rural and urban consumers in the area. Significant proportions of small traders are also involved in butter and cheese trade. Cooperatives are engaged in direct marketing of dairy products to the consumers and as such there are no contractual arrangements or strong vertical linkages to the supermarkets, institutional users, private or public dairy processors.

The average maximum milk collection capacity of cooperatives is about 78 litres per day (Table 25). Cooperatives have limited milk collection capacity. For example, only 48% and 52% of the cooperatives reported that they can buy all the milk supplies during the rainy and dry seasons, respectively. A similar pattern was reported for the fasting period in that significant proportion of cooperatives indicated that they could not accept all milk supplied during the fasting periods, indicating a constraint of seasonal consumption pattern on cooperative milk operation. There is a need to build cooperative capacity to process more milk to overcome the problem of seasonality.

Table 24. *Dairy products marketed by cooperatives, market outlets and buyers*

Particulars	Dairy products				
	Raw milk	Skimmed milk	Yoghurt	Butter	Cheese
Product sold (% yes)	15	96	85	100	72
Main market outlet (% yes)					
Farm gate	0	9	6	5	0
Village market	0	2	29	14	23
Town market	33	9	6	19	15
Cooperative	67	61	59	57	61
Main buyer (% yes)					
Rural consumers	50	48	53	29	31
Urban consumers	25	22	27	29	31
Traders	0	9	7	14	23
Others	25	21	13	29	14

Source: Survey data.

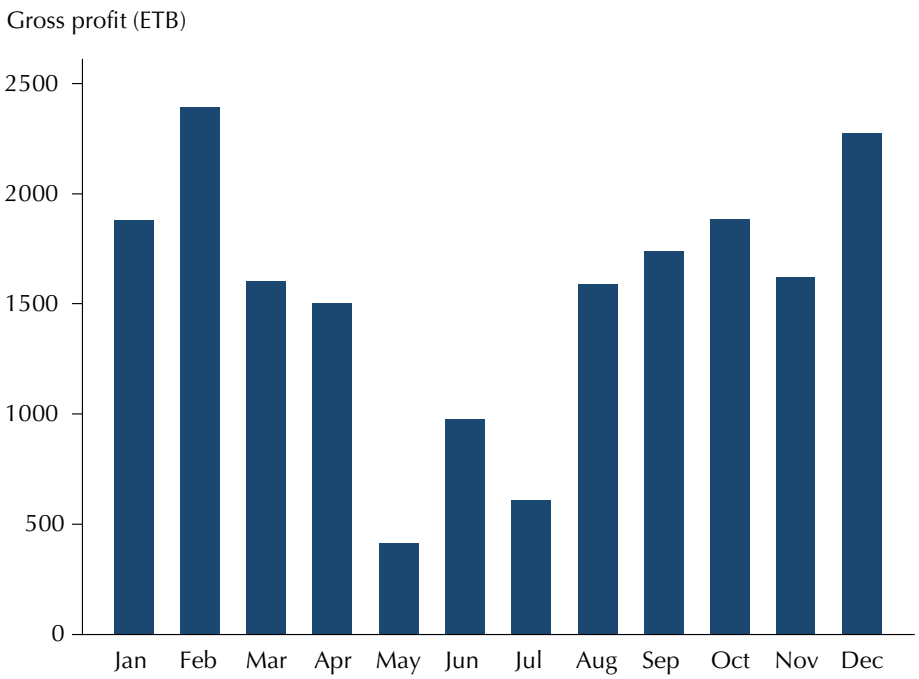
Milk is prone to contamination and is very perishable which makes quality control a critical aspect of milk collection, processing and marketing operations. Proper handling of milk before and after delivery is very important to ensure the safety and quality of milk and dairy products. At the time of milk delivery, the milk collectors check for freshness of milk and whether milk is free of foreign materials. Milk suppliers caught adulterating milk at the milk collection centre are either suspended for a limited period of time (35%) or indefinitely (44%). The adulterator can also receive warning and price reduction. The cooperative account is internally audited on average eight times per year and the frequency of external auditing per year is about one time. The cooperative account is also discussed with the members on average four times per year.

The gross profit was obtained by subtracting the purchase prices and other expenses from the revenue of dairy products sales by the cooperatives. The monthly gross profit shows clear monthly pattern where months of May to July experience low average gross profits (Figure 7). On the other hand, there is no clear trend in the monthly average gross profits of the cooperatives (Figure 8). However, the gross profits showed high annual fluctuations.

Table 25. *Capacity of raw milk collection by milk marketing cooperative*

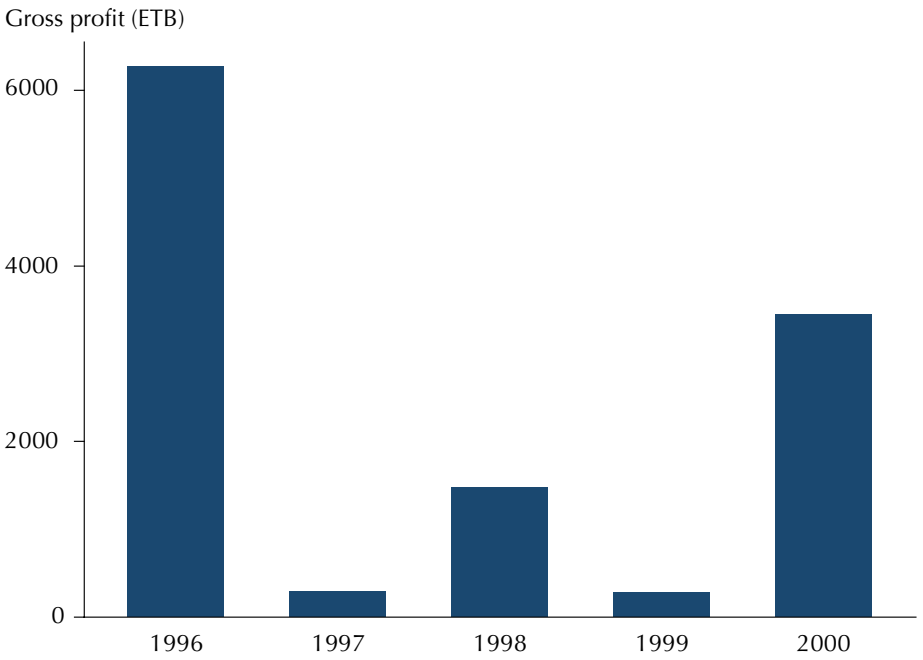
Variables	Descriptive statistics
Capacity of milk collection	
Can buy all supplied during wet season (% yes)	48
Can buy all supplied during dry season (% yes)	52
Can buy all supplied during fasting season (% yes)	52
Can buy all supplied during non-fasting season (% yes)	48
Maximum milk collection capacity per day (litre)	77.8 (42.8)
Auditing of cooperative accounts	
Frequency of internal auditing per year (number)	8.2 (9.9)
Frequency of external auditing per year (number)	0.7 (0.5)
Frequency of discussing accounts with members (number)	4.3 (4.4)
Measures taken against milk adulteration	
Warning will be issued (% yes)	1
Price reduction (% yes)	6
Suspend for a given period of time (%)	35
Suspend for life (% yes)	44

Standard deviations in parentheses.
Source: Survey data.



Source: Survey data.

Figure 7. *Monthly average gross profits (2003–04 to 2007–08).*



Source: Survey data.

Figure 8. *Trends in monthly average gross profits from 1996–2000 EC.*

6.2.4 Service provisions by milk marketing cooperative

In addition to colleting milk from members, the cooperatives also provide a range of services to their members. The type of services provided to the members of milk marketing cooperative and service providers are summarized in Tables 26 and 27. It is observed that limited services are provided to the members. For example, less than 10% reported that cooperative has received loan, veterinary services, received grant money, received buildings and AI services for its members. However, significant number of cooperatives reported that they have supplied milk collection equipment (86%), provided training in management (68%) and provided administrative support (45%) and market information (73%) to their members. About 41% reported that they have provided training in record keeping to their members. There are various service providers to the members of the milk marketing cooperatives, the important service providers being the NGOs (83%) and zone's cooperative promotion office (39%).

Table 26. *Level of satisfaction of cooperative management with services provided*

Type of services	Service provided (% yes)	Percentage reporting				
		Very dissat-isfied	Dissat-isfied	Neither dis-satisfied nor satisfied	Satisfied	Very satisfied
Loan to cooperative members	9	50	0	0	0	50
Feed supply to members	23	0	0	0	80	20
Provision of milk collection equipment	86	0	0	0	53	47
Veterinary service	9	0	0	0	50	50
Training in management	68	0	0	0	67	33
Administrative support	45	0	0	0	80	20
Quality control	55	0	0	0	75	25
Provision of market information	73	0	0	0	75	25
Training in finance	23	0	0	0	80	20
Training in record keeping	41	0	0	0	89	11
Grant (cash)	9	0	0	0	100	0
Provision of building	9	0	0	0	100	0
Provision of AI service to members	9	0	0	0	50	50
Provision of extension service	64	0	0	0	71	29
Market assessment support	27	0	0	17	50	33

Source: Survey data.

Table 27. *Organizations providing support to the cooperatives*

Organizations	Proportion providing support (%)
Cooperative promotion office	39
NGOs	83
Private partner	4
Donors	4
Others	56

Source: Survey data.

6.2.5 Milk collection facilities and equipment

The description of milk marketing cooperatives housing and management practices related to milk collection premises are summarized in Table 28. The milk collection centres contain cream separators, butter churners, milk storage cans and some basic furniture. In more than 80% of the cases the building design was carried out for ease of cleaning. However, there are major areas of hygienic concern based on the researchers and enumerators assessment of the premises of milk collection centres such as: fewer frequency of cleaning per week,

unavailability of running water, inadequacy of room size for milk collection, use of single room for milk collection and retailing of dairy products for immediate use and take-home services, presence of messes and rubbishes on the floor and lack of waste disposal pits.

Table 28. *Description of management practices at milk collection centres*

Particulars	Descriptive statistics
Building design done with ease of cleaning (% yes)	83
Equipment arrangement done with ease of cleaning in mind (%)	83
Frequency of cleaning per week (number)	5.5 (2.3)
Clean running water available for cleaning floor (% yes)	62
Potable water available for cleaning milk collection equipment (%)	79
Floor size is adequate for milk collection and sale of dairy products (% yes)	58
Mess or rubbish on the floor (% yes)	48
Walls and doors washable (% yes)	42
Floors cleanable (% yes)	87
Hot water available on the building (% yes)	46
Milk collection equipment clean and kept closed (% yes)	96
Frequency of cleaning milk equipment per day (number)	1.7 (0.8)
Filter milk before mixing in a big container (% yes)	100
Waste disposal pit used (% yes)	65

Standard deviation in parentheses.
This information is based on respondents' answers, crosschecking by enumerators and observations.

The description of buildings used for milk collection centre is given in Table 29. In most of the cases, the buildings are tin-roofed with mud walls and cement floors. The use of toilet around the milk collection centre is reported only for 59% of the cases. There is also inadequate partitioning of the rooms at milk collection centres. There are few numbers of rooms; in most of the cases the milk collection centres have just two rooms. As a result some unhygienic practices are observed, for example, receiving of milk from farmers and retail sale of processed dairy products are done in the same room.

The list of selected equipment and durable goods owned by the cooperatives are given in Table 30. It is observed that all of the cooperatives have cream separator and more than 95% have butter churner and only about 44% of them have power supply. It is important to note that there are no cooling facilities at any of the collection centres and not all important equipment are present at all of the milk collection centres. The cooperatives neither have the capacity to collect milk from very distant areas nor to store milk over longer period of time. The cooperatives immediately process milk into butter and skimmed milk and the opportunity of transporting fresh milk to other regional markets or processors does not exit as a result. The collection and processing capacity of the existing milk marketing cooperatives are limited in terms of the milk catchments area to be served.

Table 29. *Description of the building used for milk collection centre*

Particulars	Descriptive statistics
Type of building (% yes)	
Vila	8
Tin-roofed house	92
Nature of walls (% yes)	
Cemented	29
Concrete	4
Mud covered	67
Straw	0
Nature of roof (% yes)	
Thatched roof	4
Tin-roofed	96
Nature of floor (% yes)	
Beaten ground	29
Cemented	46
Concrete	21
Wood	4
Toilet use (% yes)	
Use toilet	59
Nature	36
Other	5
Total number of rooms occupied (mean)	1.4 (0.6)
1 room (%)	9
2 rooms (%)	43
3 rooms (%)	39
4 rooms (%)	4
5 rooms (%)	4

Standard deviations in parentheses.
This information is based on respondents' answers, crosschecking by enumerators and observations.

6.2.6 Constraints and opportunities

Table 31 reports the main constraints that milk marketing cooperatives are facing in marketing dairy products. The most frequently reported constraints are: poor animal breeds owned by members (92%), low milk supply (88%) and lack of feed (83%). In terms of the impor-

tance of the reported constraints skilled labour seems to be the most important constraint followed by the lack of information about prices and market demand and capital shortage.

Table 30. *Selected equipment and durable goods owned by cooperatives*

Items	Owned (% yes)	Mean quantity owned
Telephone	5	0.5 (0.7)*
Electricity	43	0.9 (0.3)
Carts	5	0.2 (0.5)
Weighing scale	67	1.1 (0.5)
Butter churner	96	1.1 (0.2)
Milk buckets of different sizes	75	1.9 (1.2)
Tables	83	1.8 (1.1)
Chairs	62	3.4 (2.2)
Cream separator	100	1.2 (0.7)
Milk cans	78	3.7 (5.3)
Milk storage equipment	83	3.3 (3.4)
Butter storage equipment	83	2.1 (1.1)
Yoghurt storage equipment	61	2.7 (3.9)
Milk can cleaner	58	1.0 (0.4)
Drying frames for cans	21	1.0 (1.1)
pH meter	17	0.6 (0.6)
Lactometer	71	1.5 (0.8)
Thermometer	83	2.0 (1.0)
Milk drinking cups	83	9.8 (8.3)
Jerry can	61	2.1 (2.1)
Milk filters	86	1.6 (1.2)

Standard deviations in parentheses.
Source: Survey data.

The cooperative management perspective was also obtained regarding the areas where technical support is needed to expand cooperative milk collection, processing and marketing activities (Table 32). The areas which need support are identified to be: packaging (68%), record keeping (100%), financial management (100%), quality control (100%), marketing (100%) and administration (100%). More than 65% reported that they are ready to pay for these services. The mean rating of the support needed also indicate that quality control ranked number one which is followed by administration.

Table 31. *Cooperative management perspectives on the constraints to expansion of milk collection, processing and marketing*

Constraints	Percent reporting	Mean rating of constraint
Skilled labour	50	8.9 (1.4)*
Capital	71	7.8 (2.1)
Price fluctuation	46	5.6 (3.0)
Low price	58	6.8 (1.8)
Low milk production	75	7.1 (2.4)
Low milk supply	87	6.8 (2.7)
Lack of market for fluid milk	54	7.0 (2.7)
Lack of market for milk products	58	5.1 (3.4)
Limited processing capacity	33	5.4 (3.4)
Low milk quality	33	5.3 (3.6)
Poor animal breeds owned by members	92	7.2 (2.9)
Lack of milk collection equipment	33	7.1 (3.4)
Lack of experience	62	6.1 (1.9)
Lack of knowledge	67	7.1 (2.2)
Lack of feed	83	7.0 (2.9)
Lack of water	50	6.4 (2.2)
Lack of information about prices and market demand	46	8.0 (1. 7)
Lack of contractual relationship with buyers of milk and milk products	46	7.7 (1.8)
Lack of extension service	42	5.6 (3.1)
Lack of milk technology	50	6.7 (3.2)
Spoilage of products	12	4.3 (1.1)

Standard deviation in parentheses.
Source: Survey data.

Table 32. *Cooperative management perspective on the areas where training technical support is needed to expand their activities*

Areas of support needed	Support needed (% yes)	Prepared to pay for service (% yes)	Mean rating of support needed
Packaging	68	30	6.7 (6)
Record keeping	100	67	8.1 (2)
Financial management	100	67	7.7 (5)
Quality control	100	67	8.5 (1)
Marketing	100	67	7.7 (4)
Administration	100	67	7.8 (3)

Standard deviations in parentheses.
Source: Survey data.

So far the activities of milk marketing cooperatives are limited to bulking, basic processing and marketing of the dairy products. There are no observable business linkages along the dairy product value chain. There are opportunities for strong vertical coordination through linkages such as with local institutional milk buyers, supermarkets and private milk processors. The other option to be considered is the vertical integration of the milk marketing cooperatives through the establishment of union of cooperatives at the zone level which collect, process, and market milk and milk products from the milk marketing cooperatives. Currently, there is one cooperative union which is under establishment.

6.3 Section summary

The principal dairy products that are handled by the dairy cooperatives are: butter, skimmed milk, cheese and yoghurt. These products are mainly destined for local consumers. There is no fresh fluid milk available for sale from the cooperatives. The average milk collected by each milk collection centre is 78 litres fluid milk per day. This means that the total amount of milk that can be collected by all milk collection centres is 1872 litres per day. This amount of milk is very small to engage in further value adding activities like milk chilling plant or processing plant operations. Thus, there is a need to expand the capacity of the existing milk collection centres required to procure and market increasing volume of milk and milk products. With the increase in number of milk collection centres and cooperatives, the volume of milk to be collected and processed also increases. As the volume increases there is a need to form a cooperative union which buys all cooperatives milk, then processes and markets fluid milk and milk products. There is a need to strengthen the local zone level cooperatives union which would serve as a mechanism in further vertically integrating the cooperative to local and regional markets.

The scaling-up is needed because the quantity of milk collected is small and the membership coverage is limited given the potential number of dairy producers that could be the members of the milk marketing cooperative and the geographic areas that could be included. There are very few milk collection centres and the milk marketing cooperatives do not exist in all areas, particularly in remote off-all-weather roads. Usually, where the cooperatives exist, in one peasant association there is only one marketing cooperative with only one milk collection centre. Furthermore, the cooperative members account for insignificant proportion of the total farmers in the peasant associations which indicate limited membership in the milk marketing cooperative. The range of dairy products handled and the processing capacity of the cooperatives are also limited. The major dairy products sold are cottage skimmed milk, butter, cheese and yoghurt.

There is opportunity for scaling up the cooperative marketing activities and increase milk collection. The analyses of consumer purchase and consumption patterns indicate that there is very good prospect for dairy product market expansion. The demand for milk and milk products is unsatisfied locally and there are also regional and national market opportunities given unmet demand. However, it is important to investigate the reason for limited membership in the cooperative, especially why some dairy farmers sell milk to the cooperatives but prefer to remain non-members.

The cooperative capacity needs to develop not only to meet local demand but also to exploit regional market opportunities. There is a need to organize dairy producers into milk marketing cooperatives by increasing the membership of existing cooperatives and/or establishing new milk marketing cooperatives and increase the number of milk collection centres. There is also a need to move to distant markets to expand their sales opportunities. However, for up-scaling to work there is a need to either link the milk collection centres to existing milk processing plants or vertically integrate them through the development of a cooperative union in order to assure market for increased milk production.

7 Empirical results for consumer survey

7.1 Introduction

Historically, there have been continued efforts to promote smallholder dairy production in Ethiopia by the government and non-governmental organizations (for recent studies and review of past dairy interventions in Ethiopia see Ahmed et al. 2004; Bernard et al. 2008 and Yigrem et al. 2008). However, very little attention has been given in terms of understanding the local purchase and consumption patterns for dairy products by the consumers in the production area. For example, what are the most important demographic and socioeconomic variables which influence consumers' dairy product purchase and consumption decisions? To what extent can the existing local market absorb an increase in dairy production through various project efforts and what promotional strategies, pricing methods and product development strategies can be used to maintain sustainable consumption base for an increased dairy production resulting from project interventions?

In general, to be effective, private sector dairy marketing strategies and the public sector efforts to promote the production and consumption of dairy products in a given area need to be informed about the consumers dairy products purchase and consumption behaviours. The perspective of the final consumer is very important in identifying marketing actions and strategies to improve dairy products production and consumption. This section presents the results of descriptive and econometric analyses of dairy products consumers' purchase and consumption behaviours in the FAO dairy project area based on sample survey of cross-sections of urban consumers in two towns. This study is an attempt to bridge the empirical gap in the understanding of dairy consumers' behaviours in the area which has implications for different actors involved (dairy producers, dairy agribusiness firms, governmental and non-governmental organizations etc.) in dairy development.

7.2 Results of descriptive analysis

7.2.1 Dairy product categories, purchase frequencies and seasonality

The dairy product categories purchased and consumer purchase frequencies during wet and dry seasons are given in Table 33. There are four dairy product categories produced locally which are widely consumed in the area: fluid milk, edible butter, cosmetic butter and soft cheese. The other dairy products that exist in the market but less frequently purchased are cottage yoghurt, skimmed milk, powder milk, pasteurized milk and imported butter. For each of these dairy product categories, the percentages of consumers who reported purchases are less than 10%. This shows the consumption of imported dairy products is very limited in the area which indicates currently there is low level of competitive pressures from imported

dairy products on locally produced dairy products. Household dairy product purchases are similar for wet and dry seasons. In terms of the frequencies of purchases, the most frequently purchased dairy product is fluid milk.

Table 33. *Monthly patterns of household dairy product purchases during wet and dry seasons, 1999 EC*

Dairy products	Wet season		Dry season	
	Household reporting purchase (%)	Frequency of purchase per month	Household reporting purchase (%)	Frequency of purchase per month
Raw milk	93	25.1 (8.9)*	91	25.5 (8.7)
Soft cheese	56	3.4 (2.7)	54	3.7 (3.0)
Edible butter	87	2.7 (5.5)	85	3.0 (6.2)
Cosmetic butter	59	2.7 (1.4)	59	2.7 (1.4)
Cottage yoghurt	8	10.7 (9.5)	8	11.3 (9.6)
Skimmed milk	5	13.4 (10.1)	4	12.2 (8.2)
Powder milk	7	9.9 (11.0)	7	7.3 (10.1)
Pasteurized milk	3	12.7 (9.0)	3	22.0 (20.3)
Imported butter	3	8.0 (11.4)	2	8.2 (12.4)

Note: *Indicates that figures in parenthesis are standard deviations.
Source: Survey data.

The average number of fluid milk purchases per month is 25 (almost once every day) while soft cheese, edible butter and cosmetic butter are purchased three times a month on average. However, for other less important dairy products such as cottage yoghurt, skimmed milk, powder milk, pasteurized milk and imported butter the frequencies are very much higher than other dairy products except for fluid milk. In general, it is observed that the consumer purchase patterns are along the traditional dairy product consumption pattern dominated by fluid milk and butter. This shows there is a potential to expand the dairy product consumption in the area through developing new dairy products and promotional activities that educate and encourage the consumption of other non-traditional dairy products. An opportunity currently exists to introduce locally manufactured dairy products, as consumers currently have little enthusiasm for imported dairy products; later introduction of locally manufactured dairy products may face competition from imports.

7.2.2 Main market outlets and sellers of dairy products

The major places of purchases and main sellers for the major dairy products consumed in the area are summarized in Table 34. The majority of the consumers (76%) reported buying fresh whole milk from a neighbour dairy producer through a contractual arrangement. The other less important sources of fresh milk are village markets and town markets. However,

it is interesting to note that none of the consumers reported the milk marketing cooperatives as their source for fresh milk supply. The milk marketing cooperatives are not the major fresh milk suppliers to the consumers in the area. Less than 5% of the consumers reported cooperative as the source of their purchase of soft cheese and butter. The major places of purchase and main sellers for other dairy products like soft cheese, edible and cosmetic butter are significantly different from that of fresh fluid milk. The major places of purchases for soft cheese, edible butter and cosmetic butter are town markets while the main sellers of these products are retailers as opposed to producers for fresh fluid milk. Thus, there is variation in the marketing of different dairy products in the area. In general, the use of retail stores, supermarkets for fresh milk purchase is virtually non-existent in the area.

Table 34. *Places of purchases and main sellers of major dairy products during wet and dry season, 1999 EC*

Items	Wet season				Dry season			
	Fresh whole milk	Soft cheese	Local edible butter	Butter for cosmetics	Fresh whole milk	Soft cheese	Local edible butter	Butter for cosmetics
Place of purchase (%)								
Farm gate	11	7	1	9	9	7	2	7
Village market	5	11	14	15	4	11	13	16
Town market	5	69	82	62	2	70	81	63
Contract with neighbours	76	8	1	13	81	8	3	14
Milk cooperative centre	0	4	1	1	1	4	2	0
Others	4	1	0	0	3	0	0	0
Main seller (%)								
Dairy producer	88	27	5	42	89	26	5	39
Milk cooperative	0	5	4	0	1	5	4	1
Brokers	1	2	4	3	1	1	4	3
Traders	6	61	82	50	4	64	83	54
Hotel owners	0	4	2	3	1	4	2	3
Restaurant owners	0	0	0	0	1	0	0	0
Retail shops	3	2	2	3	3	1	1	1
Others	1	0	0	0	1	0	0	0

Source: Survey data.

7.2.3 Per capita consumption and expenditure structure

Monthly per capita consumption of dairy products by income group is given in Table 35 while monthly per capita dairy product consumption expenditure by income group is given in Table 36. Very low levels of per capita dairy products consumption are observed for the

households. For example, the average monthly per capita consumption for all households during the wet season was 4.44 litres for raw milk, 0.41 kg for soft cheese, 0.44 kg for edible butter and 0.11 kg for cosmetic butter. The per capita consumption increases with income though not significantly.

Table 35. *Monthly per capita consumption of dairy products by income group during wet and dry season (litre or kg), 1999 EC*

Dairy products	Income group				
	Lowest 25%	Second quartile	Third quartile	Top 25%	All households
Wet season					
Raw milk	4.6 (6.1)*	3.7 (4.6)	4.5 (5.2)	5.2 (4.4)	4.4 (5.1)
Soft cheese	0.5 (0.9)	0.3 (0.4)	0.4 (0.6)	0.5 (0.5)	0.4 (0.6)
Edible butter	0.3 (0.4)	0.3 (0.2)	0.6 (1.0)	0.7 (1.4)	0.4 (0.9)
Cosmetic butter	0.1 (0.3)	0.1 (0.4)	0.0 (0.1)	0.1 (0.2)	0.1 (0.3)
Dry season					
Raw milk	3.6 (4.1)	3.4 (3.4)	4.7 (5.2)	4.7 (3.2)	4.0 (4.0)
Soft cheese	0.3 (0.5)	0.2 (0.3)	0.4 (0.7)	0.6 (0.6)	0.4 (0.6)
Edible butter	0.5 (1.5)	0.2 (0.2)	0.6 (1.0)	0.7 (1.3)	0.5 (1.1)
Cosmetic butter	0.2 (0.4)	0.1 (0.4)	0.1 (0.2)	0.1 (0.2)	0.1 (0.3)

Units: Litres (for milk) or kilograms (for butter and cheese). Standard deviations in parentheses.
Source: Survey data.

Table 36. *Monthly per capita dairy product consumption expenditure by income group during wet and dry seasons*

Dairy product	Income group				
	Lowest 25%	Second quartile	Third quartile	Top 25%	All households
Wet season					
Raw milk	13.3 (18.6)	11.4 (13.2)	14.1 (15.6)	17.3 (18.7)	13.8 (16.6)
Soft cheese	4.1 (9.2)	2.3 (3.7)	4.4 (6.9)	4.7 (6.44)	3.8 (6.7)
Edible butter	12.6 (17.1)	9.0 (8.5)	26.3 (47.7)	19.0 (28.1)	15.9 (27.7)
Cosmetic butter	3.8 (12.9)	1.6 (3.8)	1.6 (3.0)	2.1 (3.7)	2.3 (7.2)
Dry season					
Raw milk	9.7 (10.0)	10.5 (10.7)	15.1 (16.0)	14.6 (11.7)	12.2 (12.1)
Soft cheese	3.5 (5.9)	1.9 (2.8)	4.6 (7.4)	5.83 (7.3)	3.8 (6.1)
Edible butter	21.4 (71.0)	8.8 (7.7)	25.3 (48.1)	26.8 (51.9)	19.8 (49.4)
Cosmetic butter	4.4 (13.0)	2.2 (5.7)	2.1 (3.6)	1.9 (3.2)	2.7 (7.6)

Units: Ethiopian birr; Standard deviations in parentheses.
Source: Survey data.

Consumption is also lower during the dry season but not very much lower as one would expect. The observed low levels of per capita consumption indicate there is a potential to expand the market for dairy products through the promotion of the consumption of

dairy products in the area. The observed monthly per capita dairy product consumption expenditures are also very low. The average monthly per capita consumption expenditure was ETB 14 for raw milk, ETB 4 for soft cheese, ETB 16 for edible butter and ETB 2 for cosmetics.

7.2.4 Dairy products utilization and priorities in use among household members

Dairy products are consumed in three forms: alone, with other foods or processed into other dairy products (Table 37). Cottage yoghurt, pasteurized milk, and cosmetic butter are mostly taken alone while powder milk and edible butter are taken with other foods. The household processing of purchased dairy products is mainly limited to fresh milk, skimmed milk and imported edible butter.

Table 37. *Forms in which dairy products are consumed*

Dairy products	Percent reporting	Form of consumption (percent reporting)		
		Taken alone	Taken with other foods (e.g. with tea, coffee, porridge etc.)	Processed into other dairy products
Fresh whole milk	93	37	45	18
Skimmed milk	6	42	42	17
Powder milk	6	33	58	8
Cottage yoghurt	1	100	0	0
Pasteurized local milk	3	80	20	0
Soft cheese	55	18	54	8
Local edible butter	86	12	67	72
Imported edible butter	4	29	43	29
Butter for cosmetics	59	95	5	0

Source: Survey data.

Priorities in the allocation of fluid milk among the household members are given in Table 38. Allocation is based on the consumers preference ranking based on a scale of one (most important) to four (least important). At household level, fresh milk is allocated first to infants followed by younger children, adults and finally, the elderly. Given that fresh milk consumption is very important for all age groups, the priority in allocation among different members has to do with the household budgetary constraints and availability of fresh milk. Adults are given priority in butter consumption.

Table 38. *Priority in the household allocation of major dairy products consumed*

Products consumed	Mean preference rank			
	Infants	Children	Adults	Elderly
Fresh whole milk	1.1 (0.36)	1.4 (0.5)	1.9 (0.75)	2.2 (1.0)
Yoghurt—cottage	1.0 (1. 0)	1.6 (0. 7)	1.3 (0.5)	1.8 (1.0)
Cheese—soft	1.4 (0.7)	1.3 (0.6)	1.2 (0.4)	1.4 (1.0)
Butter (edible)	1.3 (0. 7)	1.3 (0.6)	1.2 (0.5)	1.6 (1.0)
Butter (cosmetics)	1.8 (0.8)	1.6 (0.7)	1.3 (0.6)	1.7 (1.0)

Standard deviations in parentheses.
Source: Survey data.

7.2.5 Consumer perceptions of important dairy product attributes

One important question in analysing the consumption patterns of households concerns the criteria that consumers use to make their purchase decisions. The dairy product attributes important in consumers' purchase decisions are investigated and the results are given in Table 39. The important dairy product attributes considered are price, flavour, safety and quality, availability, health benefits, package, brand name, freshness and fat content. For example, for fluid milk, the important dairy product attributes considered to purchase it in order of importance are: safety and quality, price, freshness, availability and taste.

Table 39. *Household's preference rating for important dairy product attributes*

Dairy products	Mean preference rating								
	Price	Taste	Safety and quality	Avail-ability	Health benefits	Package	Brand name	Freshness	Fat content
Fresh whole milk	7.4 (2.8)	6.6 (2.8)	9.0 (1.8)	6.6 (2.8)	5.6 (3.3)	1.8 (2.5)	0.9 (2.1)	6.9 (3.0)	4.9 (3.1)
Powder milk	7.3 (2.9)	5.7 (3.2)	8.0 (2. 9)	7.4 (2. 2)	6.5 (2.0)	3.4 (3.5)	3.2 (4.2)	4.5 (3.8)	4.4 (3.6)
Skimmed milk	7.4 (2.5)	7.6 (3.2)	9.1 (2.1)	6.8 (2.4)	6.6 (2.6)	0.4 (0.8)	0.1 (0.3)	7.7 (1.6)	6.6 (1.3)
Cottage yoghurt	4.7 (3.8)	8.2 (1.6)	8.9 (1.7)	8.1 (1.4)	7.2 (2.3)	2.5 (0.7)	0.0 (0.0)	6.8 (1.8)	6.4 (2.6)
Pasteur-ized local milk	7.1 (2.9)	7.2 (1.6)	8.3 (3.3)	6.2 (3.0)	5.4 (3.2)	2.0 (1.1)	0.5 (0.7)	5.1 (3.0)	3.3 (2.3)
Edible butter	7.4 (2.4)	6.7 (2.9)	9.1 (1.7)	6.8 (2.5)	5.6 (3.1)	2.0 (2. 7)	0.8 (1.7)	6.8 (2.8)	4.8 (3.6)
Cosmetic butter	6.9 (3.2)	7.6 (2.5)	9.3 (1.6)	6.7 (2.7)	5.6 (3.4)	1.8 (2.7)	1.1 (2.2)	7.7 (2.1)	5.4 (3.6)

Standard deviations in parentheses.
Source: Survey data.

For all dairy products evaluated, the product safety and quality is ranked as number one attribute considered by the consumers in their purchase decisions. Packaging and brand names are still not well developed in promoting the dairy products consumption through developing product images.

7.2.6 Consumer perceptions on availability and purchase intentions of dairy products

In this study effort was made to assess to what extent the unavailabilities of dairy products are limiting dairy products consumptions. Consumer perceptions on the availability of dairy product and how it is related to their purchase intentions are presented in Table 40. It is observed that large proportion of households reported that their lack of dairy product consumption is related to the fact that the dairy products are not available on the market for purchase. For example, about 27% of the consumers reported that they would like to purchase fresh milk but it is not available on the market. Similar observations are made for other dairy products. These indicate there are potential markets for dairy products if availabilities of dairy products improve in the local markets.

Table 40. *Consumer perceptions of availability of dairy products*

Dairy products	Percent reporting product unavailable
Fresh fluid milk	27
Powder milk	14
Skimmed milk	21
Cheese	39
Yoghurt	34
Pasteurized milk	54
Butter (edible)—table	33
Butter (edible)—cottage	25
Butter (cosmetics)	18

Source: Survey data.

7.2.7 Sources of information on dairy product prices and markets

The major sources of information for consumers on prices and markets for dairy products are given in Table 41. The most important sources of information used by the consumers were market visits, neighbours and friends. The use of modern communication media like radio and television was very limited. This shows that there is a potential to expand dairy product consumption through the effective use of modern communication technologies and educating consumers and providing information that facilitate their abilities to process

information and make purchase and consumption decisions that encourage their dairy product consumption.

Table 41. *Consumer usage of information sources on dairy product prices and markets*

Sources of information used	Percent reporting
Radio	11
Television	11
Cooperatives	5
Market visits	94
Friends	82
Neighbours	88

Source: Survey data.

7.2.8 Recent changes in dairy product market situations

The recent changes in the major dairy product consumption behaviour of households are assessed and the results are presented in Table 42. The changes are assessed for important consumption variables: quantity consumed, amount of expenditure, prices, quality and availability. For example, what is the change in quantity of fresh milk consumed now as compared to five years ago? In general, for all dairy products considered, more than 65% of the respondents reported that the quantities consumed, prices and amount of expenditures were lower five years ago compared to now while the quantity consumed was higher five years ago. Interestingly, most also reported better quality and availability of dairy products five years ago as compared to now. The increase in prices and expenditure could be due to the increased inflationary pressure in the national economy. However, the decreases in qualities and availabilities present real challenges and opportunities for the private and public sectors concerned with dairy development.

7.2.9 Promotional activities for dairy products

Household's exposures to various promotional activities related to dairy product consumption are assessed and the results are presented in Table 43. It is observed that large proportion of households had exposure to dairy product promotion activities through television (45%) and radio (24%). The uses of other media like billboards, flyers and internet are very limited, only about 5% or less. Again, this shows that more promotional effort is needed to reach the majority of the consumers in order to expand markets for milk consumption.

Table 42. *Changes in current levels of consumption, expenditure, price, quality and availability of dairy products*

Product attributes	Percent reporting			
	Fresh whole milk	Soft cheese	Local edible butter	Butter for cosmetics
Change in quantity consumed				
Do not consume	5	18	11	9
Less than today	10	10	8	7
Same as today	7	4	11	18
More than today	78	68	71	66
Change in amount of expenditure				
Do not consume	1	11	7	4
Less than today	75	70	75	70
Same as today	5	3	7	8
More than today	19	16	11	19
Change in prices				
Do not consume	2	15	9	9
Less than today	87	75	79	78
Same as today	1	0	1	2
More than today	10	9	11	11
Change in quality				
Do not consume	2	10	5	4
Less than today	10	6	9	10
Same as today	25	17	20	17
More than today	63	67	66	69
Change in availability				
Do not consume	3	10	5	3
Less than today	9	11	10	8
Same as today	16	10	18	12
More than today	72	68	67	77

Comparisons made with levels five years ago.
Source: Survey data.

Table 43. *Household exposure to various promotional items for dairy products*

Items	Percent reporting
Television	45
Radio	23
Billboards	4
Flyers in the market	5
Internet	1

Source: Survey data.

7.2.10 Outlook for dairy products

An assessment of the outlook for dairy product consumption based on the consumer survey is presented in Table 44. Consumers were asked to evaluate their current levels of consumption per month as adequate or inadequate and if the response was inadequate they were asked to indicate their purchase intention to increase their consumption levels. A significant proportion of households reported that monthly consumption levels were inadequate for fresh milk (72%), edible butter (62%), cheese (43%) and cosmetic butter (38%). More than 95% of those who reported inadequate levels of consumption also indicated their interest to increase their level of consumption per month. Thus, there are good prospects for expansion of dairy markets and increased consumption of dairy products in future. Increased availability at affordable prices and promotional activities are required to increase the dairy products consumption levels.

Table 44. *Outlook for consumption of major dairy products*

Product attributes	Own assessment of current level of consumption per month (percent reporting)				Interest to increase current level of consumption per month (percent reporting)
	Adequate	Inadequate	Cannot judge	Do not consume	
Fresh milk	26	72	2	1	96
Cheese—cottage	22	43	4	31	95
Butter (edible)	28	62	2	8	96
Butter (cosmetics)	43	38	6	13	94

Source: Survey data.

We also assessed factors limiting consumer ability or interest to increase their current levels of their consumptions for different dairy products and the results are presented in Table 45. These factors include: limited income, limited supply, high price, lack of refrigeration, low supply, poor taste, fear of disease and adulteration. For example, in the case of fresh milk high price followed by low income were the key factors that limited consumer interest in increasing levels of consumption. Similar patterns are observed for other dairy products in that high prices are found to be the most important factor limiting their capacity and interest to increase their level of dairy products consumptions.

Table 45. *Factors limiting consumer ability to increase dairy consumption*

Dairy products	Mean rating							
	Low income	Limited supply	High price	Lack of refrigeration	Low supply	Poor taste	Fear of diseases	Adulteration
Fresh whole milk	7.6 (3.6)	5.7 (3.2)	8.8 (2.0)	2.9 (3.2)	5.6 (3.2)	4.7 (3.1)	3.3 (3.1)	5.9 (3.3)
Skimmed milk	6.7 (3.3)	6.5 (2.6)	8. 7 (1.6)	1.8 (2.7)	6.8 (2.7)	7.1 (2.8)	4.1 (3.0)	6.1 (3.5)
Powder milk	7.3 (3.2)	4.6 (3.0)	8.4 (2.1)	1.7 (2.9)	4.2 (3.2)	4.9 (3.8)	5.2 (3.7)	4.4 (3.5)
Cottage yoghurt	7.6 (3.2)	7.2 (2.3)	8.4 (2.1)	2.1 (2.9)	5.3 (2.5)	5.5 (2.4)	2.7 (2.8)	3.9 (3.7)
Pasteurized local milk	8.5 (3.0)	8.6 (2.1)	9.2 (1.0)	4.5 (4.3)	8.7 (1.5)	7.5 (1.2)	6.4 (1.5)	7.2 (4.0)
Local edible butter	8.0 (3.3)	6.1 (3.0)	9.0 (1.7)	2.9 (3.3)	5.9 (3.1)	5.2 (3.1)	3.7 (3.0)	6.9 (3.7)
Butter for cosmetics	7.4 (3.7)	6.7 (3.2)	8.8 (2.0)	3.0 (3.4)	6.2 (3.1)	6.0 (3.1)	3.8 (3.3)	7.3 (3.7)

Standard deviations in parentheses.
Source: Survey data.

7.3 Results of econometric analysis

7.3.1 Description of variables

Results of econometric analysis presented in this section are based on data from a sample survey of cross-sections of 200 urban household consumers, 100 representative households each in Asella and Adama towns of Oromia Region. The two most important final dairy products consumed in the study area and hence considered for further econometric analyses are raw milk and butter. Related to these products, there are two dummy and two continuous dependent variables. The dummy variables represent the status of household purchase of raw milk or butter. For example, the dummy variable for the purchase of raw milk equals one if the household reports the purchase of raw milk and zero otherwise. Similarly, the dummy variable for the purchase of butter is equal to one if the household purchases butter and zero other wise. It is observed that 94% and 88% of the survey households reported the purchase of fluid milk and butter, respectively (Table 46). The continuous dependent variables are the quantities of raw milk or butter purchased by the households. Conditional on the purchase, the average monthly per capita consumption are 4.44 litres for fluid milk and 0.44 kg for butter.

Quantities consumed are self-reported by the survey respondents. The descriptive statistics of the independent variables included in the various regression analyses are also given in Table 46.

Table 46. *Name and description of dependent and independent variables used in the regression analysis for consumer survey*

Variable names	Variable descriptions	Mean
Dependent variables		
PURCW_MILK	Dummy variable equal to 1 if purchased raw milk; 0 otherwise	0.94 (0.25)
PURCW_EBUTTER	Dummy variable equal to 1 if purchased edible butter; 0 otherwise	0.88 (0.33)
CONSW_MILK	Average per capita monthly raw milk consumption (litre)	4.44 (5.10)
CONSW_EBUTTER	Average per capita monthly edible butter consumption (kg)	0.44 (0.87)
Independent variables		
GENDER	Dummy variable equal to 1 if sex of household head is male; 0 otherwise	0.66 (0.48)
AGE	Age of household head (years)	46.25 (13.84)
HSIZE	Household size (number)	5.22 (2.14)
AGE_1	Number of household less or equal to 6 years old	0.66 (0.87)
AGE_2	Number of household greater than 6 years and less or equal to 12 years old	0.75 (1.01)
EDUC_1	Dummy variable equal to 1 if household head is illiterate or only has adult education; 0 otherwise	0.18 (0.38)
EDUC_2	Dummy variable equal to 1 if household head has primary school education; 0 otherwise	0.19 (0.39)
EDUC_3	Dummy variable equal to 1 if household head has secondary school education; 0 otherwise	0.41 (0.49)
EDUC_4	Dummy variable equal to 1 if household head has college or higher education; 0 otherwise	0.21 (0.41)
MARRIED	Dummy variable equal to 1 if household head is married; 0 otherwise	0.76 (0.43)
TOWN	Dummy variable equal to 1 if household resides in Asella town; 0 otherwise	0.50 (0.50)
DOCTOR	Dummy variable equal to 1 if doctor suggested milk consumption; 0 otherwise	0.29 (0.45)
FASTING	Dummy variable equal to 1 if household practices fasting; 0 otherwise	0.67 (0.47)
TOTAL_EXPEND	Monthly per capita total expenditure (ETB)	189.21 (136.06)
RADIO_AD	Dummy variable equal to 1 if household has seen dairy product ads on radio; 0 otherwise	0.23 (0.42)
TV_AD	Dummy variable equal to 1 if household has seen dairy product ads on television; 0 otherwise	0.43 (0.50)
ORADIO	Dummy variable equal to 1 if household owns radio; 0 otherwise	0.89 (0.32)
OTV	Dummy variable equal to 1 if household owns television; 0 otherwise	0.81 (0.39)

OTELL	Dummy variable equal to 1 if household owns land line telephone; 0 otherwise	0.67 (0.47)
OTELM	Dummy variable equal to 1 if household owns mobile phone; 0 otherwise	0.59 (0.49)
OFRIDGE	Dummy variable equal to 1 if household owns fridge; 0 otherwise	0.38 (0.49)

Standard deviation in parentheses.
Source: Survey data.

7.3.2 Determinants of the probabilities to purchase fluid milk and butter

Analyses of consumer demand for fluid milk and butter are conducted in two stages. In the first-stage, the determinants of consumer likelihood to purchase fluid milk and butter are analysed. The dependent variables for the first-stage analyses are dummy variables for the status of the purchase of fluid milk and butter which take on the value one if the household has purchased the product and zero otherwise. In the second-stage, conditional on the purchase of a given product, the determinants of the quantity consumed by the household is analysed. Thus, the dependent variables in the second-stage regression analyses are the quantities of fluid milk and butter consumed by the household which are censored from below at zero. As discussed above, there are several dairy products which are consumed in the area. However, only fluid milk and butter are considered for the econometric analyses. The selections of raw milk and edible butter are based on the relative importance of these products in terms of the percentage of consumers who reported the purchase of these products at the time of survey. The other factor considered in the selections of these products is the number of observations available from the survey data for these products which allows meaningful econometric analysis.

Results of the first-stage probit model estimation of the determinants of the probability to purchase raw milk and butter are given in Table 47. The coefficients of probit model estimations are given in the first and fourth columns while the marginal effects of the independent variables on the probabilities of household purchase of raw milk and butter are in the second and fifth columns. The marginal effect for a given independent variable is evaluated by holding all other independent variables at their mean values. The associated z-values and the statistical significance levels for the estimated coefficients are given in the third and sixth columns.

The overall goodness of fit for the probit model parameter estimates is assessed based on several measures of goodness of fit. First, the log-likelihood ratio test is applied to assess the overall joint significance of the independent variables in explaining the variations in the consumer's likelihood to purchase raw milk or butter. The null hypothesis for the

log-likelihood ratio test is that all coefficients are jointly zero. The model chi-square tests applying appropriate degrees of freedom indicate that the overall goodness of fit of the probit model are statistically significant at a probability of less than 1% for both raw milk and butter. This shows that jointly the independent variables included in the probit regression model explain the variations in the household's probability to purchase raw milk and butter. Second, the McFadden's Pseudo-R^2 is calculated and the obtained values indicate that the independent variables included in the regression explain significant proportion of the variations in the consumer's likelihood to purchase fluid milk or butter. Third, the correct prediction rate of the probit model is obtained assuming a 50–50% classification scheme. In the case of raw milk, it is observed that the probit model predicts about 94% of the cases correctly while in the case of butter the probit model predicts 89% of the cases correctly. Fourth, the linktest is also conducted to test for the omitted variable problem. The null hypothesis of no omitted variable is not rejected at a probability of less than 5%, suggesting that the model is well specified. Fifth, the standard errors of the parameters estimated are also corrected for the non-constant variances. Overall, the probit model appears to provide a very good prediction of the likelihood that consumers purchase fluid milk and butter.

The gender of the head of the household is negatively associated with the likelihood of household purchase of fluid milk and butter (Table 47). Given the base (omitted) category for gender dummy variable is female-headed household; the negative coefficient indicates that female-headed households are more likely to purchase raw milk for consumption as compared to male-headed households. However, the effect of gender is not statistically significant, suggesting that gender has no influence on the household's likelihood to purchase milk or butter.

Age of the head of household was negatively associated with the household's likelihood to purchase raw milk and the effect is statistically significant at a probability of less than 1%. The negative coefficient indicates that as the head of household gets older the likelihood of raw milk purchase decreases, *ceteris paribus*. However, the magnitude of the effect of change in the age of the head of household on the household's probability to purchase raw milk for consumption is very small. For example, a one-year increase in the age of the head of household increases the likelihood of milk purchase by household only by less than 1%. Similarly, the effect of age on the likelihood of household to purchase butter is negative but the effect is not statistically significant.

The effects of both the absolute number of household size and age composition of household size on the likelihood of household to purchase raw milk and butter are analysed. The absolute number of household size is positively associated with the household likelihood to purchase milk and butter, suggesting that as the family size increases the likelihood of household purchasing fluid milk and butter for consumption increases, *ceteris paribus*.

Table 47. *First-stage probit results of determinants of probability to purchase raw milk and butter*

Explanatory variables	Fluid milk			Butter		
	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value	Coefficient (β)	Marginal effect ∂P(y=1|x)/∂x)	z-value
GENDER	–0.0866 (0.2528)	–0.0024 (0.0071)	–0.34	–0.8204 (0.2760)	–0.0993 (0.0315)	–2.97
AGE	–0.0315 (0.0124)	–0.0009 (0.0005)	–2.55**	–0.0107 (0.0108)	–0.0016 (0.0016)	–0.99
HSIZE	0.0505 (0.1095)	0.0014 (0.0031)	0.46	0.0580 (0.0803)	0.0084 (0.0115)	0.72
AGE_1	0.2187 (0.3456)	0.0063 (0.0103)	0.63	–0.1033 (0.1611)	–0.0150 (0.0232)	–0.64
AGE_2	–0.1169 (0.1669)	–0.0034 (0.0052)	–0.70	–0.0930 (0.1115)	–0.0135 (0.0165)	–0.83
EDUC_2	–0.2580 (0.4605)	–0.0091 (0.0195)	–0.56	–0.14 (150.4559)	0.0218 (0.0745)	–0.31
EDUC_3	–1.1908 (0.3407)	–0.0531 (0.0254)	–3.50***	0.2076 (0.4393)	0.0294 (0.0612)	0.47
EDUC_4	–	–	–	–0.1700 (0.5568)	–0.0264 (0.0921)	–0.31
MARRIED	1.3548 (0.3239)	0.1060 (0.0544)	4.18***	0.7049 (0.3115)	0.1349 (0.0743)	2.26**
TOWN	–0.4931 (0.3704)	–0.0148 (0.0152)	–1.33	0.3593 (0.2599)	0.0526 (0.0403)	1.38
DOCTOR	0.2350 (0.3488)	0.0061 (0.0086)	0.67	0.2516 (0.2871)	0.0337 (0.0373)	0.88
RADIO_AD	0.5254 (0.4361)	0.0114 (0.0100)	1.20	0.1363 (0.4046)	0.0187 (0.0517)	0.34
TV_AD	–0.6682 (0.4130)	–0.0236 (0.0200)	–1.62	0.3379 (0.3346)	0.0474 (0.0459)	1.01
FASTING	–0.6392 (0.4019)	–0.0158 (0.0130)	–1.59	–0.4228 (0.2982)	–0.0559 (0.0345)	–1.42
TOTAL_EXPEND	–0.0009 (0.0015)	–0.0001 (0.0001)	–0.60	0.0044 (0.0018)	0.0006 (0.0002)	2.40**
ORADIO	0.8558 (0.3530)	0.0545 (0.0385)	2.42**	0.3547 (0.3354)	0.0621 (0.0683)	1.06
OTV	–0.3691(0.3715)	–0.0084 (0.0070)	–0.99	–0.0841 (0.3105)	–0.0117 (0.0420)	–0.27
OTELL	0.2335 (0.3166)	0.0075 (0.0122)	0.74	0.1788 (0.2994)	0.0271 (0.0479)	0.60
OTELM	0.0156 (0.3588)	0.0004 (0.0105)	0.04	0.0292 (0.3376)	0.0043 (0.0494)	0.09
OFRIDGE	0.9391 (0.5770)	0.0246 (0.0139)	1.63	0.2667 (0.3428)	0.0370 (0.0463)	0.78
CONSTANT	2.9210 (1.2431)		2.35**	0.2800 (0.8582)		0.33
N	193			193		

Correct predictions:		
–Purchase	94	88
–Non-purchase	67	100
–Overall	94	88
Linktest	0.05	–0.07
Pseudo R^2	0.33	0.18
Wald χ^2 (19)	48.92***	30.58*
Log likelihood	–30.29	–61.42

The dependent variable is a dummy variable which takes on the value 1 if the household had purchased a given dairy product, 0 otherwise.
Figures in the parentheses are robust standard errors
***, **, and * indicate statistical significance at a probability of less than 1%, 5%, and 10%, respectively.
Source: Survey data.

However, the effect of household size is not statistically significant. The age composition of household size is captured in terms of the number of children aged less than 6 years (age_1) and between 6 and 12 years (age_2). Households with more children aged less than six years old are more likely to purchase milk for consumption. However, this effect is not statistically significant while the opposite is true in the case of butter. On the other hand, the number of children aged between 6 and 12 years old is negatively associated with likelihood of household purchase of fluid milk and butter but again not statistically significant. Overall, the size and age composition of household size have no significant effect on the household's likelihood of fluid milk and butter purchases. This result does not conform to a priori theoretical expectation that as the number of younger children in the family increases the likelihood to purchase milk or butter significantly increases.

The level of education is related to the ability to process more complex information and make decisions. The effect of the education level of the head of household on the household likelihood to purchase raw milk is found to be negative in all cases. The omitted category for education dummy variable is household heads with no formal schooling (illiterate or just adult education). Thus, the negative coefficient on the education dummy variable indicates that households with heads of households having higher level of education are less likely to purchase fluid milk. However, the effect of the level of education is statistically significant only for heads of households with secondary education. For example, households with secondary schooling of the head of household are 5% less likely to purchase fluid milk for consumption. Furthermore, there is no difference between the households with illiterate heads and households with heads having at least primary education in terms of the likelihood to purchase raw milk. The effect of education level of the head of household on the household's likelihood to purchase butter is found to be not significant.

The marital status of the head of household appears to be positive and significant determinant of a household's likelihood to purchase fluid milk and butter for consumption. For example, households with married head of household are about 11% and 13% more likely to purchase fluid milk and butter for consumption as compared to households with unmarried head of household.

The dummy variable town captures the effect of variation in household's place of residence on the likelihood of household to purchase raw milk and butter. There is no statistically significant effect of household's place of residence on the household's likelihood to purchase fluid milk and butter. However, the signs on town dummy variable for fluid milk and butter are different; the sign is negative for fluid milk while it is positive for butter. Given the omitted category for the location of residence dummy variable is Adama town, the negative sign for fluid milk indicates that households residing in Asella town are less likely to purchase

fluid milk than households residing in Adama town, *ceteris paribus*. On the other hand, the positive sign for butter indicates households residing in Asella town are more likely to purchase butter than households residing in Adama town, *ceteris paribus*.

The effect of doctor's suggestion of milk consumption on the likelihood of households to purchase milk and butter was positive as expected although the effect is not statistically significant. The effects of household's exposure to various dairy products consumption promotional activities on the household likelihood to purchase milk for consumption are also analysed. The effect of radio ads is found to have positive effects on the likelihood of household to purchase milk and butter while the effect of television advertisements is negative for both fluid milk and butter. However, the effects of radio and television advertisements are not statistically significant in all cases. The lack of statistical significance might be due to limited promotional activities.

As expected, households who are fasting are less likely to purchase raw milk and butter. However, the effect of fasting is not statistically significant in all cases. The per capita total expenditure on food and non-food products is used as a proxy for the household's per capita income. The effect of household income on the likelihood of household to purchase milk and butter is found to be negative and positive, respectively. However, it is observed that only the effect of average per capita income of household on the likelihood of household to purchase butter is statistically significant.

The effects of the ownership of communication equipment like radio, television and telephone on the likelihood that household to purchase raw milk and butter are also assessed. It is observed that the effect is significant only for the ownership of radio in the case of milk at a probability of less than 5%. The households who own radio are about 6% more likely to purchase fluid milk than households without a radio. As expected, the ownership of fridge is observed to have a positive effect on the household's likelihood to purchase fluid milk and butter for consumption. However, the effect is not statistically significant in all cases. This might be because of small purchases and immediate consumptions which lessen the need for fridge to increase the shelf life of milk and butter.

7.3.3 Determinants of quantities of raw milk and butter consumed

Results of Heckman two-stage and tobit regression estimations for quantity of milk and butter consumed conditional on household's purchases are given in Tables 48 and 49. The coefficient on the mill's ratio (lambda) in the Heckman two-stage estimation is not significant at the probability of less than 5% in both cases.

Table 48. *Second-stage Heckman two-step and Tobit results of determinants of levels of household raw milk consumption*

Explanatory variables	Heckman estimates		Tobit marginal effects at mean values		
	Coefficient (β)	Latent variable (β)∂E(v*)/∂x	Probability of being uncensored ∂P(v>0|x)/∂x	Conditional expected value ∂E(v|v>0)/∂x	Unconditional expected value ∂E(v)/∂x
GENDER	–0.9196 (1.6572)	–0.6645 (0.9305)	–0.3897 (0.5523)	–0.5337 (0.7531)	–2.97
AGE	–0.0106 (0.0575)	0.0032 (0.0306)	0.0019 (0.0178)	0.0025 (0.0244)	–0.99
HSIZE	–0.3696 (0.4077)	–0.3975 (0.2245)*	–0.2303 (0.1305) *	–0.3166 (0.1791) *	0.72
AGE_1	0.1603 (0.9026)	0.0979 (0.5030)	0.0567 (0.2915)	0.0780 (0.4007)	–0.64
AGE_2	0.0604 (0.7761)	0.1379 (0.4318)	0.0799 (0.2503)	0.1099 (0.3441)	–0.83
EDUC_2	–0.8459 (1.9453)	–1.0668 (1.00781)	–0.5983 (0.5850)	–0.8294 (0.8167)	–0.31
EDUC_3	–1.8529 (1.7535)	–1.5427 (0.9038) *	–0.8826 (0.5113) *	–1.2162 (0.7045) *	0.47
MARRIED	2.2744 (2.1521)	1.7804 (1.0680) *	0.9803 (0.5585) *	1.3636 (0.7831) *	–0.31
TOWN	–0.0150 (1.5026)	0.1546 (0.7991)	0.0896 (0.4631)	0.1231 (0.6365)	2.26**
DOCTOR	0.3460 (1.5384)	0.0677 (0.8526)	0.0393 (0.4956)	0.0540 (0.6807)	1.38
FASTING	–2.0511 (1.5669)	–1.7279 (0.8572) **	–1.0297 (0.5265) **	–1.4010 (0.7067) **	0.88
TOTAL_EXPEND	0.0050 (0.0053)	0.0037 (0.0029)	0.0021 (0.0017)	0.0029 (0.0023)	0.34
CONSTANT	6.1927 (3.8145)	6.2317 (2.1090)			1.01
LAMBDA	8.9841 (5.5918)				–1.42
RHO	1.00				2.40**
SIGMA	8.98	5.0846			1.06
N	193	193			–0.27
Linktest	–	0.21*			0.60
Pseudo R^2	–	0.01			0.09
Wald χ^2 (12)	–	15.56			0.78
Log likelihood	–	–562.84			0.33

The dependent variable is the quantity of raw milk consumed. Figures in parentheses are robust standard errors. ***, **, and * indicate statistical significance at a probability of less than 1%, 5%, and 10%, respectively. The number of observations left-censored is 12 in the Tobit model estimation. Source: Survey data.

Table 49. *Second-stage Heckman two-step and Tobit results of determinants of levels of household edible butter consumption*

Explanatory variables	Heckman estimates		Tobit marginal effects at mean values		
	Coefficient (β)	Latent variable (β)∂ E(v*)/∂x	Probability of being uncensored ∂P(v>0|x)/∂x	Conditional expected value ∂E(v|v>0)/∂x	Unconditional expected value ∂E(v)/∂x
GENDER	0.0642 (0.2292)	–0.2179 (0.1669)	–0.0889 (0.0666)	–0.1032 (0.0812)	–0.1468 (0.1151)
AGE	0.0065 (0.0068)	0.0038 (0.0059)	0.0016 (0.0025)	0.0018 (0.0027)	0.0025 (0.0039)
HSIZE	–0.0744 (0.0471)	–0.0432 (0.0409)	–0.0180 (0.0171)	–0.0199 (0.0189)	–0.0284 (0.0270)
AGE_1	0.1608 (0.1024)	0.1330 (0.0913)	0.0555 (0.0382)	0.0613 (0.0422)	0.0875 (0.0602)
AGE_2	0.1076 (0.0854)	0.0599 (0.0756)	0.0250 (0.0316)	0.0276 (0.0349)	0.0394 (0.0497)
EDUC_2	0.2054 (0.2776)	0.1685 (0.2471)	0.0684 (0.0974)	0.0804 (0.1220)	0.1145 (0.1730)
EDUC_3	0.2039 (0.2823)	0.3737 (0.2352)	0.1526 (0.0937)	0.1761 (0.1137)	0.2503 (0.1603)
	–0.1215 (0.3027)	–0.0121 (0.2681)	–0.0051 (0.1122)	–0.0056 (0.1231)	–0.0080 (0.1755)
MARRIED	–0.3190 (0.2416)	–0.0582 (0.1925)	–0.0241 (0.0791)	–0.0271 (0.0907)	–0.0387 (0.1293)
TOWN	0.2693 (0.1681)	0.3711 (0.1410) ***	0.1540 (0.0583) ***	0.1713 (0.0656) ***	0.2435 (0.0926) ***
DOCTOR	–0.3025 (0.1714)*	–0.1879 (0.1501)	–0.0797 (0.0647)	–0.0844 (0.0657)	–0.1202 (0.0935)
FASTING	0.2090 (0.1849)	0.0185 (0.1524)	0.0077 (0.0637)	0.0085 (0.0700)	0.0122 (0.0998)
TOTAL_EXPEND	0.0012 (0.0008)	0.0024 (0.0005)***	0.0010 (0.0002)***	0.0011 (0.0003) ***	0.0016 (0.0004) ***
CONSTANT	0.2817 (0.5467)	–0.3223 (0.4027)			
LAMBDA	–0.8827 (0.7224)				
RHO	–0.9239				
SIGMA	0.9554	0.8805 (0.0489)			
N	191	191			
Linktest	–	0.3618*			
Pseudo R^2	–	0.07			
Wald χ^2 (13)	–	35.20***			
Log likelihood	–	–233.71			

Notes: The dependent variable is the quantity of edible butter consumed. The figures in the parenthesis are robust standard errors; ***, **, and * indicate statistical significance at a probability of less than 1%, 5%, and 10%, respectively. The number of observations left-censored in the Tobit model estimation is 25.
Source: Based on survey data.

This indicates there are no sample selection biases in that there are no unobservable household characteristics influencing the household's likelihood to consume milk and butter and hence the quantities of milk and butter consumed. Thus, since there is no sample selection biases the determinants of the quantity of raw milk and butter consumed are analysed based on Tobit model. Four marginal effects are calculated for the Tobit model at the means of all other variables and are given in columns 2 to 5 of Tables 48 and 49. The model chi-square for Tobit model indicates that the overall goodness-of-fit of the Tobit model is statistically significant at a probability of less than 1% for fluid milk and butter. This indicates that jointly the variables included in the Tobit model explain the variations in the household's quantity of raw milk and butter consumed.

The gender of the head of household is negatively associated with the quantities of fluid milk and butter consumed. However, the effects are not statistically significant in all cases. The age of household head is positively associated with the quantity of raw milk and butter consumed by the household. However, the effect is also not statistically significant in all cases. It is interesting to note that the effect of household size on the quantity of milk and butter consumed is negative as expected but is statistically significant at a probability of less than 10% in the case of fluid milk. The effects of the age composition of household size on the quantities of milk and butter consumed are positive but statistically not significant. The effect of education on the quantity of milk consumed is statistically significant at a probability of less than 10% while in the case of butter it is not significant at this probability level.

The effect of the location of the residence of household is positive for both milk and butter but is statistically significant only for butter. The per capita butter consumption is higher for Asella town than Adam town. The doctor's advice appears to have a positive effect on milk consumption while it has negative effect on the butter consumption but these effects are not statistically significant. As expected, fasting has negative and statistically significant impact on the quantity of milk consumed. However, the effect of fasting on quantity of butter consumed is not statistically significant. In agreement to the theoretical expectation, the household income is observed to have positive effect on both fluid milk and butter consumption. However, statistically significant relationship is found only between household income and the consumption of butter. Income does not seem to constrain the consumption of milk.

7.4 Section summary

It is observed that significant proportion of the households reported that they think their current monthly consumption level is inadequate for fresh milk (72%), edible butter (62%), cheese (43%) and cosmetic butter (38%). These indicate potential market exists for increased

milk production. In general, given low levels of dairy products consumptions and the consumer's interest to increase their level of consumption, there is good prospect for dairy products market expansion in the area. Increased availability at the affordable prices and promotional activities are required to increase the dairy products consumption levels. In general, the market for dairy products exists and the outlook is also good.

8 Conclusion and implications

Membership of smallholder dairy producers in a milk marketing cooperative is a key factor in determining their decision to participate in milk and butter markets and levels of market participation. Quantities of milk and butter produced, marketed and consumed by the members of cooperatives are significantly larger than those of non-members. However, the current levels of cooperative milk collection, processing and marketing activities are not large enough to have significant impact.

The quantity of milk collected is low. There are few numbers of milk marketing cooperatives and milk collection centres. The numbers of dairy producers who are the members of the milk marketing cooperatives are also few compared to the total population of dairy producers in the area. Usually, there is only one milk collection centre per one milk marketing cooperative. The milk marketing cooperatives do not exist in all areas, particularly in remote off-all-weather roads. The range of dairy products handled and the processing capacity of the cooperatives are also limited. The major dairy products sold by the cooperatives are skimmed milk, butter, cheese and yoghurt. Therefore, there is a clear need for scaling-up cooperative marketing activities, to organize more dairy producers into milk marketing cooperatives, increase milk collection centres and widen the cooperatives' geographic coverage.

Analysis of patterns of consumer purchase and consumption of dairy products points to promising prospects for expansion of markets for dairy products through scaling-up efforts. This is because the current per capita consumption of dairy products is very low and the consumers think their current level of consumption is inadequate and are interested in increasing their level of consumption, provided that dairy products are available at affordable prices. In general, demand for milk and dairy products is unsatisfied locally despite the presence of regional and national market opportunities.

Efforts to scale up cooperative marketing activities and enhance local capacity for smallholder dairy development requires continuous assessment of the dynamics of production, marketing and consumption situations for milk and dairy products in the project area and beyond. In this regard, this study has made efforts to collect, analyse and generate information to inform scaling-up efforts by the government, NGOs and donor agencies.

References

Ahmed MA, Ehui S and Assefa Y. 2004. *Dairy development in Ethiopia.* EPTD Discussion Paper 123. IFPRI (International Food Policy Research Institute), Washington, DC, USA.

Barrett C. 2001. *Livestock pricing and markets performance.* Research Brief 01–05–PARIMA. Global Livestock Collaborative Research Support Program (GL–CRSP), University of California Davis, USA.

Barrett C. 2008. Smallholder market participation: Concepts and evidence from Eastern and Southern Africa. *Food Policy* 33(4):299–317.

Bellemare MF and Barrett CB. 2006. An ordered Tobit model of market participation: Evidence from Kenya and Ethiopia. *American Journal of Agricultural Economics* 88(2):324–337.

Bennett A, Lhoste F, Crook J and Phelan J. 2006. *The future of small scale dairy.* FAO (Food and Agriculture Organization of the United Nations) Livestock Report. FAO, Rome, Italy.

Bernard T, Seyoum A and Gabre-Madhin E. 2008. Impact of cooperatives on smallholders' commercialization behaviour: Evidence from Ethiopia. *Agricultural Economics* 39:47–161.

Delgado C. 2003. Rising consumption of meat and milk in developing countries has created a new food revolution. *Journal of Nutrition* 133(11):3907S–3910S.

Delgado C, Rosegrant M, Steinfeld H, Ehui S and Courbois C. 1999. Livestock to 2020: The next food revolution. Food, Agriculture and the Environment Discussion Paper 28. IFPRI (International Food Policy Research Institute), Washington, DC, USA, FAO (Food and Agriculture Organization of the United Nations), and ILRI (International Livestock Research Institute), Nairobi, Kenya. 83 pp.

Faiguenbaum S, Berdegue J and Reardon T. 2002. The rapid rise of supermarkets in Chile: Effects on dairy, vegetable, and beef value chain. *Development Policy Review* 20(4).

Gotez S. 1992. A selectivity model of household food marketing behaviour in sub-Saharan Africa. *American Journal of Agricultural Economics* 74:444–452.

Greene W. 1993. *Econometric analysis.* 2nd edition. Macmillan, New York, USA.

de Haan H, Stamoulis K, Shetty P and Pingali P. 2003. The world food economy in the twenty-first century: Challenges for international co-operation. *Development Policy Review* 21:683–698.

Hall DC, Ehui S and Delgado C. 2004. The livestock revolution, food safety and small-scale farmers: Why they matter to us all. *Journal of Agricultural and Environmental Ethics* 17:425–444.

Heltberg and Tarp F. 2002. Agricultural supply response and poverty in Mozambique. *Food Policy* 27:103–124.

Hemme T, Garcia O and Saha A. 2003. *A review of milk production in Haryana-India with special emphasis on small milk producers.* Pro-Poor Livestock Policy Initiative Paper No. 2. FAO (Food and Agriculture Organization of the United Nations), Rome, Italy.

Hobbs JE. 1996. A transaction cost approach to supply chain management. *Supply Chain Management* 1(2):15–27.

Holloway G, Nicholson C, Delgado C, Staal S and Ehui S. 2004. A revised Tobit procedure for mitigating bias in the presence of non-zero censoring with an application to milk market participation in the Ethiopian highlands. *Agricultural Economics* 31:97–106.

de Janvry A, Fafchamps M and Sadoulet E. 1991. Peasant household behaviour with missing markets: Some paradoxes explained. *Economic Journal* 101:1400–1417.

Key N, Sadoulet E and de Janvry A. 2000. Transactions costs and agricultural household supply response. *American Journal of Agricultural Economics* 82:245–245.

Lapar ML, Holloway G and Ehui S. 2003. Policy options promoting market participation among smallholder livestock producers: A case study from the Philippines. *Food Policy* 28:187–211.

Moll H, Staal S and Ibrahim MNM. 2007. Smallholder dairy production and markets: A comparison of production systems in Zambia, Kenya and Sri Lanka. *Agricultural Systems* 94:593–603.

Reardon T and Swinnen JFM. 2004. Agrifood sector liberalization and the rise of supermarkets in former state-controlled economies: A comparative overview. *Development Policy Review* 22(5):515–523.

Reardon T and Timmer CP. 2005. Transformation of markets for agricultural output in developing countries since 1950: How has thinking changed? In: Evenson R and Pingali P (eds), *Handbook of agricultural economics*. Volume 3A. Elsevier Press, Maryland, USA.

Reardon T, Berdegué JA, Timmer CP, Cabot T, Mainville D, Flores L, Hernandez R, Neven D and Balsevich F. 2004. *Links among supermarkets, wholesalers and small farmers in developing countries: Conceptualization and emerging evidence*. Michigan State University, Michigan, USA.

Reardon T, Timmer CP, Barrett, CB and Berdegué J. 2003. The rise of supermarkets in Africa, Asia and Latin America. *American Journal of Agricultural Economics* 85(5):1140–1146.

Sadoulet E and de Janvry A. 1995. *Quantitative development policy analysis*. Johns Hopkins University Press, Baltimore, USA.

Staal S, Delgado C and Nicholson C. 1997. Smallholder dairying under transaction costs in East Africa. *World Development* 25(5):779–794.

Tobin J. 1958. Estimation of relationships for limited dependent variables. *Econometrics* 26: 24–36.

Walshe MJ, Grindle J, Nell A and Bachmann M. 1991. *Dairy development in sub-Saharan Africa: Study of issues and options*. World Bank Technical Paper 135. Africa Technical Department Service.

Wooldridge J. 2002. *Econometric analysis of cross section and panel data*. MIT Press, USA.

Yigrem S, Beyene F, Tegene A and Gebremedhin B. 2008. *Dairy production, processing and marketing systems of Shashemene–Dilla area, South Ethiopia*. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper No. 9. ILRI (International Livestock Research Institute), Nairobi, Kenya. 62 pp.

Young L and Hobbs J. 2002. Vertical linkages in agri-food supply chains: Changing roles for producers, commodity groups, and government policy. *Review of Agricultural Economics* 24(2):428–441.

Zylberstztajn D and Filho C. 2003. Competitiveness of meat agri-food chain in Brazil. *Supply Chain Management* 8(2):155–165.

ISBN 92–9146–198–9