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College of Business and Economics

Department of Economics

Households Willingness to Pay for Camel Milk in Aba'ala Woreda, Afar Regional State

By:

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DECLARATION

I, Halefom Yigzaw Nigus, do hereby declare that the thesis entitled ***"Households Willingness to Pay for Camel Milk in Aba'ala Woreda, Afar Regional State"***, submitted to the Department of Economics, College of Business and Economics, Mekelle University in partial fulfillment of the requirements for the degree of Master of Science in Economics is my original work and all sources of material used for the thesis have been duly acknowledged. I solemnly declare that this thesis has not been submitted to any other institution anywhere and anytime.

HALEFOM YIGZAW NIGUS

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Date: _____

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MEKELLE, TIGRAY, ETHIOPIA

CERTIFICATION

This is to certify that the thesis entitled ***"Households Willingness to Pay for Camel Milk in Aba'ala Woreda, Afar Regional State"*** is the original work of Mr. **Halefom Yigzaw Nigus**, who carried out the thesis under my guidance. Furthermore, I confirm that, to the best of my knowledge this thesis has not been submitted to any other institution and does not form part of any thesis on the basis of which a degree or award was conferred on an earlier occasion by this or any other candidate.

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ABSTRACT

Although camel's milk is known for its various economic and health benefits, unlike the live camel, there is no market for it in Aba'ala woreda. In this study, the researcher have attempted to investigate how much value the households can assign (willing to pay) for camel milk and the determinants of willingness to pay (WTP) for it using a Contingent Valuation Method. The CVM was based on face to face interview and the surveyed sample households were asked double-bounded dichotomous choice questions followed by open-ended questions to elicit their WTP for camel milk. Out of the total 250 sample households only 3 were not willing to purchase and the remaining 247 were willing to purchase. In this study, three econometric models; Tobit, Probit and Bivariate Probit models were employed. The result from the Tobit model revealed that households' income, age, remittance and the randomly offered bid positively affected households' maximum WTP for camel milk. On the other hand, age square affects households' maximum WTP for camel milk negatively. In the Probit model, the main determinants of the households' probability of accepting the randomly assigned bid are income, remittance, age, age square, the randomly offered bid, education of the household head and adult ratio. Income of the household, remittance, age of the household head and education level of the household head positively and significantly affects the probability of accepting the randomly offered bid by the sample households. On the other hand, age square, the randomly offered bid and adult ratio negatively and significantly affects the probability of saying "yes". In this study the Bivariate Probit model was employed to verify the statistical efficiency gain of the double-bounded over the single-bounded dichotomous choice model. Therefore, it is found that the double-bounded dichotomous choice model does not increase statistical efficiency over the single-bounded dichotomous choice model. Hence, we can employ the single-bounded dichotomous choice model instead of the double-bounded dichotomous choice model.

Key Words: Aba'ala, Afar, Bid, Bivariate Probit, Camel Milk, CVM, Double Bounded, Probit, Single-Bounded, Tobit, WTP.

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LIST OF ABBREVIATIONS

BG	Biding Game
CSA	Central Statistical Agency
CV	Contingent Valuation
CVM	Contingent Valuation Method
DBDC	Double - Bound Dichotomous Choice
FAO	Food and Agriculture Organization
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussions
GDP	Gross Domestic Product
Ha	Hectare
km	Kilometer
mm	Millimeter
OE	Open - ended
OLS	Ordinary Least Square Method
PFE	Pastoralist Forum Ethiopia
PPPRSP	Pastoralist Perspectives of Poverty Reduction Strategy Program
RUM	Random Utility Model
SBDC	Single - Bound Dichotomous Choice
WTA	Willingness To Accept
WTP	Willingness To Pay

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Pastoralism is a social and economic system based on the raising and herding of livestock and it is a livelihood system practiced in the arid and semi-arid areas of Ethiopia. Pastoralism is one of the oldest socio-economic system in the country, in which livestock production in open grazing areas represents the major means of livelihood. Pastoralists cover about 60 percent of the national territory and constitute about 12 percent of the total population of the country (Mohammed, 2004; FDRE Ministry of Federal Affairs, 2008).

Livestock have multiple uses, which includes among other things, source of income for the household and for the nation as a whole, means of cash storage for households who are beyond the reach of the banking system, draught and pack services, milk and meat for household consumption and international trade, dung for fuel and manure as fertilizer. Moreover, in addition to these contributions, although not properly account in the official statistics of the country, the increasing trend in the informal export trade in live animals is believed to indicate how much important livestock are to the national economy (Kahsay *et al.*, 1999).

Ethiopia, with its vast arid and semi-arid areas, has the largest number of domestic livestock in Africa and much of it coming from the country‘s pastoral and agro-pastoral areas. These areas contain an approximately 30 percent of the national animal population or 9.3 million of cattle, 52 percent or 12.4 million of sheep, 45 percent or 8.1 million of goats and close to 100 % or about 1.8 million of camels (Catley, 2009).

In most developing countries like Ethiopia, livestock has an economic and social importance both at household and national levels and it contributes a significant share of the national export earnings. Moreover, livestock contributes approximately 15 to 17 percent of Gross Domestic Product (GDP), 35 to 49 percent of agricultural GDP and 37 to 87 percent of the household incomes (Sintayehu *et al.,* 2010). Especially lowland breeds of livestock play an important role

in the national economy of Ethiopia. According to Kahsay *et al.,* (1999) in the mid of 1980s, 90 percent of the total export of live animals was comprised of lowland breeds of cattle and sheep.

The pastoral and agro-pastoral areas of East Africa, in which Ethiopia is located, are known for their livestock population in general and camel population in particular. Camel is the hardiest animal that can withstand in the arid/semi arid drought climatic conditions. The Food and Agriculture Organization (FAO) estimates the total population of camels in the world today to be 22 million, of which 89 percent or about 19,588,394 are one-humped dromedary camels and the remaining 11 percent or about 2,421,037 are the two-humped Bactrian found in the cold deserts of Asia. Today, over 80 percent or about 18,304,243 of the world's camel population are found in Africa with the highest concentration in North East Africa, accounting for 63 percent or about 13,865,942 of the world camel population. Again according to an estimate made by FAO in 2008, Ethiopia, one of the North East African countries, is estimated to have the third largest camel herd in the world after Somalia and Sudan with 7,000,000, 3,700,000 and 2,300,000 respectively.

In Ethiopia, camel's demand for domestic consumption is lower than the export demand. Even the formal live animal exporters is experiencing a severe competition from the informal channel because of the high price of camel in the informal channel and limited market for the formal channel (because the end user market demands camels from Somalia, Sudan and Djibouti) (Getachew *et al.,* 2008)**.**

Afar regional state is one of the four major pastoral regions in Ethiopia located in north eastern part of the country. The region is divided in to five administrative zones, which are further subdivided into 29 woredas. The regional population is estimated to be more than 1.2 million of which 90% are pastoralists and 10% agro-pastoralists. The majority of the land is rocky and the annual precipitation is low (150-500 mm/annum) which makes crop cultivation unsuitable. People in the region therefore are dependent mainly on livestock production, especially in camel, cattle and small ruminants for their livelihood (Philpott *et al.,* 2005).

Camel has multiple uses for pastoralists and agro pastoralists such as the means of income generation, means of transportation, milk and meat for household consumption in the region and the pastoral areas of the country in general. Even if there is no regional data on the amount of camel milk production at national level, according to FAO Statistics, (2008), Ethiopia is the second largest camel milk producer in the world next to Somalia.

1.2. Statement of the Problem

Livestock plays an important role in the Ethiopian economy and much of it originates from the country‘s pastoral and agro-pastoral areas. However, even if pastoral and agro-pastoral areas contribute a significant portion of the livestock resources of the country, adequate statistical information is not available. Moreover, despite the contribution of the pastoral system to the national economy of the country, past development policies in Ethiopia showed that Pastoralism has been neglected for so many years and there have never been appropriate pastoral development policies and programmes in the country until recent years (Mohammed, 2004).

As repeatedly stated, camels play an important role in the arid and semi arid areas for its milk, meat and energy production. However, the economic contribution of camel to the livelihood of the pastoralist population in particular and national economy has never been properly accounted for two main reasons: (1) the milk and meat production is yet mainly used for domestic subsistence consumption, or, in case of surplus considered as a gift and significant amount camel milk is wasted (2) only few references are available, even if recording data are now more reliable than in the past. According to some convenient surveys, camels are essential for animal protein supply of human in the margin areas, contribute to the maintenance of pastoral activities and economic development (Faye, 2004).

The camels play a vital role in continuous supply of milk to the people in the arid and semi arid areas (Kebebew, 1999). Although camel's milk has been consumed for thousands of years in Africa and the Middle East, its economic and medical benefits were not documented until recently. Camel milk is famous for its nutritional qualities and health properties (Raziq *et al.*, 2011). (Agrawal *et al.*, 2003; Musinga *et al.*, 2008; LPPS, 2005), have demonstrated anti-diabetic properties of camel milk and its positive effect in controlling high blood pressure and

camel milk destroys Mycobacterium tuberculosis. Camel milk is also used for treating dropsy, jaundice, spleen ailments, asthma, anemia and piles. Many reasons are given as to why camel milk has many medicinal benefits. Camels feed on over 100 species of trees each day and each of these trees has different food supplements in terms of vitamins, proteins, carbohydrates etc.

Camel milk plays a vital role in achieving food security in pastoral and agro pastoral areas which is considered as "second god". Its production is stable in almost all seasons, which is very important for the pastoralist, when the milk of other animals is seized in the dry period (Raziq *et al*., 2008; Siloma, 2012). According to Somali Regional State Summary report, (2004), own produced camel milk and ghee is important food for Somali pastoralists. Camel milk is securing food for pastoralists in Afar region too (Pastoralist Forum Ethiopia, 2009).

According to FAO statistics, (2008), the camel milk production was around 1,475,861 Metric tons that is quite low and probably underestimated. A different statement can be formulated starting from the extrapolation of the yield awaited for a lactating female. According to the proportion of lactating females of 18 percent (Hjortaf Ornäs, 1988), and an average production of 1500 litres per year, the world production can be estimated to 5.7 million tons of which approximately 55 percent are taken by the calf (Faye, 2004).

Even if Ethiopia is the third largest producer of camel in the world, it is the second largest producer of camel milk in the world with 175,000 Metric tons after Somalia with 870,000 Metric tons and followed by Sudan, Mali, Kenya with 94,000, 55,700, 32,500 Metric tons respectively (FAO statistics, 2008).

In Ethiopia, under rain fed conditions, camels can be milked 13 kg per day. However, the camels are not intensively milked, but some milk is left for their calves, the exact amount is difficult to assess (Knoess, 1979). The Afar farmers rearing simultaneously cattle and camel get on average 1 to 1.5 litres of milk with afar zebu against 4 to 5 liters with Dankali camel (Richard and Gerard, 1985) and the region is well known for its production of camel and camel products. In Afar region, camel is everything for the pastoralists and agro-pastoralists living there. That is,

camel is their means of transpiration for salt and other goods, source of food in the form of meat and milk, source of income from the sale of live camel, source of prestige and social status.

In many parts of the world there is no camel milk market and this may be due to traditional cultural restrictions. For instance, although there is a growing popularity and demand for camel milk in Western countries, most have laws that prevent the importation and sale of camel milk. In Rajasthan, there are traditional cultural restrictions on the sale and processing of camel milk, and it is not marketed in the core camel breeding areas, such as Bikaner, Jodhpur and Jaisalmer (Sadri, 2004). According to Dahl, (1979) cited in Yagil, (1982) the milk of the Afar camels in Ethiopia is not allowed to be processed or sold.

There is camel milk market in Kenya (for instance, Isiolo District, Musinga *et al.,* 2008; Siloma, 2012), Mauritania (Gaye, n.d), Ethiopia (Somali regional state, Yohannes *et al.,* 2007), and Somalia. Consequently, some researchers have conducted a research on the camel milk value chain analysis and marketing of camel milk in those areas. However, unlike to the live camel there is no market for camel milk in Afar regional state even if camel milk has numerous economic and health benefits. To the best of the researcher’s knowledge, there is no documented information and research conducted on the households demand for camel milk and households' willingness to pay for it in the region. Therefore, this paper is intended to estimate the aggregate economic benefit of camel milk in Afar region which has not yet a market value (using stated preference method of contingent valuation method), estimate households' willingness to pay (WTP) and to investigate the factors that affects the commercialization of camel milk in the region and these areas are yet untouched. Hence, this research is undertaken to fill these information gaps.

1.3. Research Questions

The research has attempted to answer the following research questions:

- ✓ How much is the households' willingness to pay for camel milk in Aba'ala woreda?
- ✓ What are the main determinants of households' willingness to pay for camel milk in the study area?
- ✓ How much is the aggregate economic benefit that would be obtained using the households' willingness to pay in the study area?
- ✓ Why camel milk is not commercialized in Afar region in general and in Aba'ala woreda particular?

1.4. Objectives of the Study

1.4.1. General Objective

The general objective of the study is to estimate the economic benefit of camel milk using contingent valuation method (CVM) and to investigate the reasons for the absence of camel milk market in Afar regional state the case of Aba'ala woreda.

1.4.2. Specific Objectives

This research has attempted to address the following specific objectives.

- ➢ To estimate households' willingness to pay (WTP) for camel milk using contingent valuation method (CVM) in Aba'ala woreda.
- ➢ To examine the main determinants of households' willingness to pay (WTP) for camel milk in the woreda.
- ➢ To estimate the aggregate economic benefit of camel milk using households' willingness to pay (WTP).
- ➢ To investigate and analyze the reasons for the absence of camel milk market in Afar regional state in general and Aba'ala woreda in particular.

1.5. Significance of the study

Pastoralism is way of life and source of income, food for many Ethiopians living in the arid and semi arid areas of the country. However, this livelihood system has not given much attention in the development policies and programmes of the country.

Specifically, most of people of Afar regional state are highly dependent on this economic and social system. Among the livestock these pastoralists produce, camels are with a great share. But still, there is a misperception and a lack of understanding among people about the economic value and significance of producing camel and its by-products. Hence, this study may help to improve understanding about economic value of camel milk, demand for camel milk and the factors that hinders camel milk commercialization in Afar region.

The study is an important input for policy makers on how to make Pastoralism in general and commercializing of camel milk in particular as a vital contributor to the economic growth and development of the country in general and the region in particular. Confidently, it is an important ingredient in paving the way for the researchers who have the interest to conduct a research in this area.

Generally, this research is an important input for policy makers, researchers, government organizations and non government organizations.

1.6. Scope and Limitation of the study

The concept of economic benefit of camel milk is a very broad concept since it should include both the demand for and supply of camel milk hence, it needs a due concern. However, the researcher focused only on the demand side of the product and it is also delimited to only a single woreda (Aba'ala) in the region. Even though it is better to include other woredas, zones and the region as a whole, the researcher focuses on single woreda only, so as to make the work manageable, feasible, applicable and to set it succinctly.

The limitation of the study could be the type of data employed in this study. Since the data set used in this study is a cross-sectional data set which includes information on a sample of households taken at a given point in time therefore, it is difficult to give hard conclusions and policy recommendations based on data collected at a given point in time.

Camel milk may have different attributes due to differences in the types of the she camels. As a result, there may be differences in its quality, quantity, its composition and so forth. If such cases exists application of choice experiment rather than contingent valuation may be appropriate.

Moreover, this study focused only on the demand for camel milk (that is, the demand side of the product). However, dealing with the supply side of the product (camel milk) via households (camel milk producers) willingness to accept for camel milk might have made the study complete.

Another limitation of the study may be concerned with the study area. The study was conducted in Afar regional state, Aba'ala woreda. However, dealing with the demand for camel milk outside the region for instance Tigray, Amhara regions and so on may be imperative. That is, studying the demand for camel milk outside of the pastoral and agro-pastoral areas may provide information whether the product has high or low demand by the non-pastoral and urban residents. Finally, the study focused only the economic value (contribution) of camel milk; however, it was also better to study the health benefits of it and in estimating the expected total revenue from camel milk the county's per capita milk consumption is used.

1.7. Organization of the study

This thesis has five chapters. The first chapter presents the introduction part of the research which includes background of the study, statement of the problem, objectives of the study, and so on. The second chapter presents the related theoretical and empirical literatures. The third and the fourth chapters also present methodology of the study and data analysis and presentation of results respectively. In the fourth chapter the raw data is analyzed via both descriptive and econometric method of data analysis. The fifth chapter presents the conclusions and policy recommendations.

CHAPTER TWO

2. LITERATURE REVIEW

In this chapter a theoretical and empirical review of related literatures on economic valuation of non marketed goods and services is presented and discussed. This chapter emphasizes among the different valuation methods is, on the most commonly used method, that is, contingent valuation method.

2.1. THEORETICAL LITERATURE REVIEW

2.1.1. Definitions and Concepts

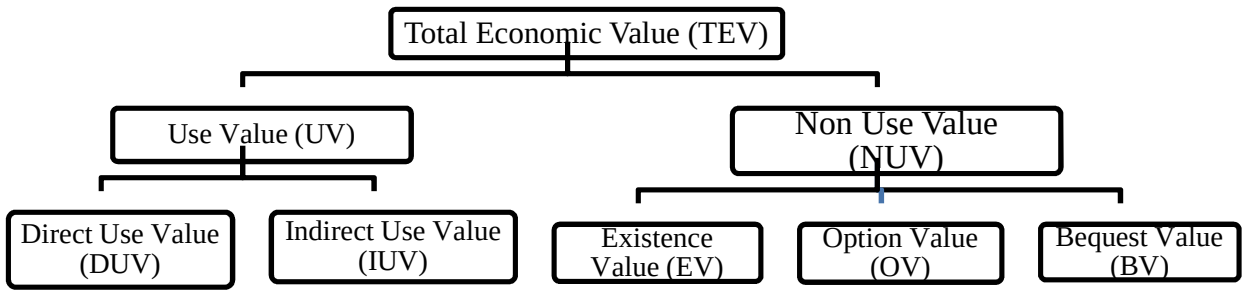
2.1.1.1 Total Economic Value (TEV)

Total economic value is composed of use value and nonuse value. Use value represents the utility enjoyed by people who directly use the good. Use values require actual participation to enjoy them. On the other hand, nonuse value refers to the value that people assign to preserve the good but do not use in a commercial or other manner. Both use and non-use values can be measured using willingness to pay or willingness to accept (Tietenberg and Lynne, 2012; Hanely and Barbier, 2009; Hackett and Sharpe, 2006).

$$TEV = \text{U}se \text{ value} + Non \text{ use value}$$

Use values are categorized in to direct use value (DUV) and indirect use value (IUV). On the other hand, nonuse values (also called passive use value) are inherent in the good. Nonuse or passive use values consist of existence value, bequest value and option value (Perman *et al.*, 2003).

Figure 2.1: Total Economic Value



2.1.1.2. Why Valuation?

Market does not exist for much of the value people derive from the goods and services. If market for goods and service does not exist, market price of these goods and services does not exist too. Therefore, there is no direct way to measure the value of goods and services. As a result, researchers have developed techniques which uses surveys that provide a detailed description of the goods and services, its current condition, a hypothetical improvement on its condition and a way in which persons would pay for the good or service (Tameko, Donfouet and Fondo, 2011).

Valuation is estimating the value of a non-marketed good or service with no market price via total willingness to pay for the good or service in question. Unlike to the marketed goods and services, non-marketed goods and services require the estimation of willingness to pay either via examining behavior, drawing inferences from the demand for related goods, or through responses to surveys. However, capturing all components of value is cumbersome and challenging (Tietenberg and Lynne, 2012).

2.1.1.3. Valuation Methods

Valuation methods can be divided in to two broad categories. These are stated (direct) and revealed (indirect) preference methods. Each of these broad categories of methods includes both indirect and direct techniques too (Ibid).

It is a common consensus that the stated preference techniques based on direct approaches can be used to estimate total economic value (both use and non-use values), whereas the revealed preference techniques can only be used to estimate use value (Perman *et al.*, 2003).

The Revealed Preference Methods

The revealed preference methods infer the value of goods and services based on actual observable or revealed behavior. As a result, prices are directly observable, and their use allows the direct calculation of the loss in value. Revealed preference methods examine people's behavior in markets related to good and service in question, and infer willingness to pay and willingness to accept amounts from this actual observable or revealed behavior (Tietenberg and Lynne, 2012; Hanely and Barbier, 2009).

The Stated Preference Methods

On the other hand, in the direct (stated) preference methods, there is direct estimation of value of goods and services based on the responses of individuals to the hypothetical valuation questions. This method might be used when the value is not directly observable (Tietenberg and Lynne, 2012). Stated preference methods, use carefully constructed structured questionnaires to estimate individual's willingness to pay and willingness to accept amounts (Hanely and Barbier, 2009).

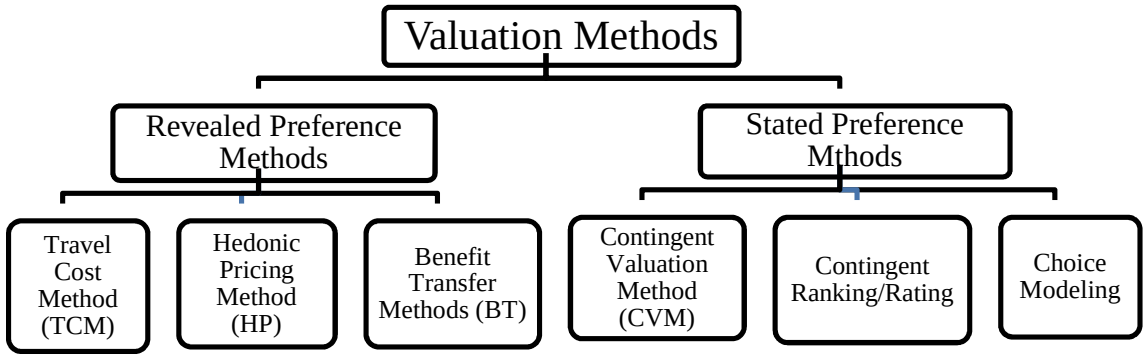
Table 2.1: Valuation Methods

Valuation Methods	**Applications**	**Limitations**
Market Price Method	Is used to estimate the value of goods and services which are marketable or bought and sold in markets.	This method is based on available market data. However, market data may not be available for large number of goods and services and it may limit the application of this method.
Hedonic Pricing Method	Often applied to estimate the relationship between housing prices and the levels of environmental services.	It is only applicable when property market is well developed and is limited to things to areas that are related to housing prices. It cannot to estimate non-use values.
Travel Cost Method	Revealed (indirect) preference method, often applied to value recreational sites, which have zero or nominal price	Can estimate use value but this method does not capture non use value.
Contingent Valuation Method	Stated (direct) preference method, most widely used method for estimating both use and non-use value. It is used to estimate the	Prone to provide biased estimates and results

	WTP or WTA based on survey techniques to value a particular good or service.	
Choice Experiment (CE)	CE assumes, respondent's WTP consistently relates to his/her preferences. A commodity is treated as the embodiment of a bundle of attributes, which are the things of real interest to consumers. Unlike the CVM, CE obtains the required response about a range of alternatives.	There is problem of respondent cognition. Moreover, the CE is more complex than the CVM. Like CVM, choice experiment (CE) faces problems in survey design and administration.
Contingent Ranking	It is implemented in the same manner as CVM. However, in this case respondents are asked to rank series of programs simultaneously or various combinations of environmental goods with respective costs from least preferred to the most preferred one.	The problem with the contingent ranking is that, it may be challenging for the respondents to arrive at a complete rank of the programs.

Source: Compiled and adapted from (Perman *et al.,* 2003; Ahmed and Gotoh, 2006; Heinemann and Kanninen, 1998)

Figure 2.2: Classifications of Valuation Methods



2.1.2. The Contingent Valuation Method (CVM)

The stated preference method includes different approaches such as contingent valuation method (CVM), contingent rating and choice modeling.

Contingent valuation method (CVM) is a direct method of estimating the value that a sample in a population place on a particular good or service. It uses survey techniques to elicit respondents' willingness to pay to get some good or service or willingness to accept to give away some good or service. The survey techniques which are used in the contingent valuation method include in person interviews, telephone survey, mail survey, internet survey and so forth. All techniques have their own advantages and disadvantages and no single survey technique provides better results for all types of questions (Ahmed and Gotoh, 2006).

Contingent valuation method (CVM) is a survey-based valuation method that is used to estimate market price of goods and services which are not marketable or goods and services not bought and sold in the marketplace (Carson, 2000). It is a stated (direct) preference method that involves directly asking respondents questions about their willingness to pay or willingness to accept. It is called contingent valuation since the valuation is reliant on the hypothetical market (Perman *et al.*, 2003).

2.1.2.1. The Advantages of CVM

Unlike the revealed preference methods, the stated preference methods in general and the contingent valuation method in particular are more flexible valuation methods. The contingent valuation method can be used to estimate an *ex ante* willingness to pay under demand and supply uncertainty. As compared to the revealed preference methods such as the hedonic pricing, travel cost method and so forth, one of the stated preference methods, the contingent valuation method, in particular have advantages; first, it can deal with both use and non-use values, second, the contingent valuation method answers to the willingness to pay or willingness to accept questions go directly to the theoretically correct monetary measures of utility changes (Perman *et al.*, 2003; Carson, 2000; Whitehead and Blomquist, 2005).

2.1.2.2. Elicitation Methods

There are different elicitation methods used to estimate willingness to pay from a sample of households. The most commonly and widely used elicitation formats are open-ended (direct question), bidding game, payment card, dichotomous choice method, double-bounded dichotomous choice method. The table 2.2 below reported the different elicitation methods and their corresponding advantages and dis advantages.

Table 2.2: Elicitation Methods

Elicitation Methods	**What is …?**	**Major Advantage**	**Major Disadvantage**
Bidding game	In this method, respondents are iteratively asked questions of consecutive bids. That is, respondents could be asked questions such as, "Would you continue to use this good or service if its price was to increase by Birr Z?" or "Would you be willing to pay Birr Z for this good or service?"In this case, if the respondent said "yes" s/he will be asked a repeated bid with a larger value; if "no", s/he will be asked a repeated bid with a lower value. This is continued until response	This method is not difficult for the respondents to understand. Besides, actual willingness to pay or willingness to accept values can be drawn with the help of guided series of questions.	This method is prone to starting point bias. It may lead to a large number of outliers. The use of this format in mail surveys is very limited. Moreover, there are no rules for setting the upward and downward increments between bids.

	of the respondent changed from “yes” to “no,” or from “no” to “yes,” and record this bid as the respondents' maximum willingness to pay.		
Open-ended	In this case respondents are asked to state their maximum willingness to pay or minimum willingness to accept amount for a certain good or service. Respondents could be asked questions like “What is the maximum amount that you are willing to pay?”	This method provides straightforward actual valuation of goods or services. Moreover, it is very informative because maximum willingness to pay can be estimated for each respondent. Another advantage of this technique is its simplicity for empirical estimation	This method may provide unrealistically large bids and unrealistic responses.
Payment card	In this method respondents are given a card with a list of bids and choose their maximum willingness to pay.	One advantage of this method is it avoids starting point bias. In comparison to bidding game, payment card elicitation method reduces the number of outliers.	Prone to bias relating to the range of the numbers used in the card (range bias). The use of payment cards to mail surveys is very limited.

Dichotomous choice method	Respondents are asked if they are willing to pay single randomly offered bid (price) for a certain good or service. The researcher asks respondent whether s/he is willing to pay a stated threshold. In this format respondents are randomly assigned with a single bid that they accept or reject.	This method has an advantage over open-ended question format in eliciting willingness to pay are the simplicity for respondents and reduced incentives for strategic responses. It minimizes non-response and avoids outliers.	This method requires relatively larger sample size to obtain accurate results. Moreover, this technique provided limited information about the respondent's willingness to pay, only that it is greater or less than a randomly offered bid. The statistical efficiency is lower as compared to double-bounded dichotomous choice method.
Double-Bounded Dichotomous choice method	In this method respondents are asked a follow up bid in addition to the randomly assigned initial bid amount. When the respondent says "yes" for the randomly assigned initial bid amount, the researcher increases the bid. If the respondent says "no" for the randomly assigned initial bid amount, the researcher reduces the threshold.	Double-bounded dichotomous choice method is preferred to single- bounded dichotomous choice method because it increases statistical efficiency and avoids many of the biases inherent in CVM. As opposed to the single-bounded format, a double-bounded format has also been	Danger that the respondents' exposure to the first offer would influence them to accept the follow-up offer. Moreover, almost all the limitations of the single-bounded dichotomous choice method still apply in the double-bounded dichotomous choice method.

		proposed in order to overcome the econometric precision that closed-ended questions lose compared with open-ended questions.	

Source: compiled and adapted from ((Bateman *et al*. 2000); Ming *et al.*, 2011; Hoyos and Mariel, 2010; Carson and Hanemann, 2005; Ahmed and Gotoh, 2006)

2.1.2.3. The Steps Involved In Contingent Valuation Method (CVM)

1 Designing a survey instrument to elicit individuals' WTP/WTA. That is, designing the hypothetical scenario, deciding whether to ask WTP or WTA and designing the payment vehicle or means of compensation.

2 Employ the CV survey with a sample of the population of interest.

3 Analyzing the WTP or WTA responses.

4 Use the sample data on WTP/WTA to compute total WTP/WTA, aggregate benefit and revenue.

5 Evaluating the survey responses and results (conducting sensitivity analysis) (Perman *et al.*, 2003).

2.1.2.4. The Methodological Biases in CVM

The major constraint in the use of contingent valuation method has been the possibility for survey respondents to give biased answers. That is, the contingent valuation surveys are prone to various types of bias (Tietenberg and Lynne, 2012).

The most commonly possible sources of bias in the contingent valuation method studies are; strategic bias, information bias, starting-point bias, hypothetical bias, sampling bias, non-response bias.

1 **Strategic Bias:** Occurs when the respondent provides a biased answer in order to influence a particular outcome. In this case respondents may deliberately understate (underbid) or overstate (overbid) their willingness to pay to influence a particular outcome (Ahmed and Gotoh, 2006; Tietenberg and Lynne, 2012).

2 **Starting-point bias:** occurs when the respondents' willingness to pay amount is influenced by a predetermined range of choices. This bias arises when a respondent is asked to check off his or her responses fall in the predetermined range of choices (bids) (Tietenberg and Lynne, 2012). This usually occurs in bidding games (Gundimeda, n.d).

3 **Hypothetical bias:** this bias arises because of the hypothetical nature of the markets and payments. It occurs since respondents' are confronted with the hypothetical scenario and they do not face an actual budget constraint. In this case the willingness to pay estimates are overstated or inflated since s/he will not actually have to pay the estimated value. Respondents might ignore real-world prices of consuming a good or service (Ahmed and Gotoh, 2006; Whittington, 2010; Gundimeda, n.d). Moreover,

> *"What people say they would pay in a contingent valuation method study is more than they would actually pay if asked to do so"* (Hanely and Barbier, 2009).

4 **Payment Vehicle bias**: this bias occurs if the difference in the willingness to pay or willingness to accept is dependent on the payment vehicle (methods of payment).

5 **Information bias:** arises if respondents' willingness to pay or willingness to accept is dependent on the amount of information they are given about a given good or service (Gundimeda, n.d). It occurs when respondents are asked to state their willingness to pay or willingness to accept for the good or service of which they have little or no knowledge (Ahmed and Gotoh, 2006).

6 **Interviewer and respondent Bias:** occurs when respondents answer "yes" in order to impress the interviewer, or to express motivation and hence overstate their willingness to pay.

7 **Non-response Bias**: arises when respondents refuse to answer or give ludicrously high willingness to pay or fallacious zero willingness to pay (Protest Zeros). Moreover, it occurs due to lower response rate (Ahmed and Gotoh, 2006).

8 **Sampling Bias:** arises due to the improper sampling design and implementation (Ahmed and Gotoh, 2006).

2.1.2.5. Willingness to Pay versus Willingness to Accept

The other challenge in the use of contingent valuation method is the divergence between willingness to pay and willingness to accept. The question is whether to ask willingness to pay or willingness to accept in the contingent valuation method.

The problem is, in many contingent valuation studies it is found that, willingness to accept is much higher than the willingness to pay. That is,

> *"Respondents tend to report much higher values for questions that ask what compensation the respondent would be willing to accept (WTA) to give something up than for questions that ask for the willingness to pay (WTP) for an incremental improvement in the same good or service"* (Tietenberg and Lynne, 2012).

Even if small differences between willingness to pay and willingness to accept are suggested by economic theory, empirical findings have found large differences. According to Hanemann *et al.*, (1991) when valuing non marketed goods or services with no close substitutes willingness to pay and willingness to accept yield quite different results. That is, the amount of willingness to accept is greater than the amount of willingness to pay. This divergence is due to income and wealth effects (Rahmatian, 2005; Carson *et al.*, 2001).

According to Kahneman, Knetsch, and Thaler, (1990) cited in Tietenberg and Lynne, (2012) the reason for the large difference between willingness to pay and willingness to accept is the psychological endowment effect. That is, the psychological value of something we own is greater than something we do not.

The choice between willingness to accept and willingness to pay to use in valuation of non marketable good or service is associated with the allocation of property rights. Asking willingness to accept is appropriate if the respondent owns the right to the good or service. On the other hand, asking willingness to pay is appropriate if the respondent does not own the right.

2.2. Empirical Literature Review

To the best of the researcher's knowledge, there is no any research conducted on this area using the contingent valuation method. Hence, all the literatures cited in this paper are researches conducted in other areas of study like improved water supply, waste management, and improved health service, benefit of reduced air pollution etc. Therefore, in this sub section the empirical literature on the above mention non market goods and services is reviewed.

According to Yibeltal, (2011), a research conducted on the value of improved water supply Service using an open ended questions estimated by OLS found that income and education positively and significantly affects households WTP. On the other hand, age of the household head affects households WTP negatively and significantly. Gossaye, (2007), using a Tobit model[1] also found that age of the respondent has negative sign and statistically significant effect on the households WTP. Household size, monthly income and initial bid are found to positively and significantly affect households WTP for improved water supply service.

A research conducted on the willingness to pay for improved water services in Sierra lion by Brima, (2003), showed that age of the respondent positively and significantly affects respondents' WTP for improved water services. On the other hand, age square of the respondent has negative and significant effect on the respondents' WTP for improved water services. Moreover, education and income variables are positive and significant determinants of households' willingness to pay for improved water services.

A research conducted by Aklilu, (2002), on the households' willingness to pay for improved solid waste management is also similar with the findings of the above cited researchers that is, age of respondents has a significant (1 percent level of significance) and negative effect on the

[1] The below cited researches also employed Tobit model

respondents' willingness to pay. Marital status, number of children in the household and income of household have a positive impact on the willingness to pay amount and these variables are statistically significant.

Medhin, (2006), has conducted a research on the household demand for improved water service in urban areas. Medhin has found that income and education have positive and significant effect on the households WTP. A research on the economic valuation of antiretroviral drugs in Ethiopia by Martha, (2003), also showed that the estimated coefficient for family size is negative and statistically significant. Moreover, income elasticity is positive and highly significant.

In this part of this sub section the main determinants of households' willingness to pay using single-bounded dichotomous choice question estimated through probit model is presented.

Hence, according to many findings income of the household positively and significantly affects households' willingness to pay. That is, households with higher income are more willing to accept the bid than households with lower income (Tilahun *et al*., 2013; Brima, 2003; Yibeltal, 2011; Medhin, 2006; Aklilu, 2002; Gossaye, 2007).

In most of the literatures education level of the household head positively affects households' willingness to pay (Medhin, 2006; Aklilu**,** 2002; Gebrelibanos and Edriss, 2012; Tilahun *et al*., 2013; Brima, 2003; Gossaye, 2007; Yibeltal, 2011).

A randomly offered initial bid amount to each household has a negative and statistically significant effect on the households' willingness to pay. According to the economic theory of demand, the higher is the bid price; the less likely households would be willing to pay, initial bid price has a negative effect on the households' willingness to pay and hence, the coefficient of this variable is negative (Tilahun *et al.,* 2013; Weldesilassie *et al.,* 2009: Gebrelibanos and Edriss, 2012; Solomon, 2004; Medhin, 2006).

The last and very important point is the comparison between single-bounded dichotomous choice and double-bounded dichotomous choice models. Theoretically and empirically, DBDC models

are found to be more efficient than SBDC models. The DBDC models increase efficiency as compared to SBDC models (Carson *et al.,* 1986; Haab and McConnell, 2002; Hanemann and Kanninen, 1998; Hanemann *et al.,* 1991; Ahmed and Gotoh, 2006; Whitehead, 2000; Weldesilassie *et al.,* 2009). On the other hand, it is also found that the DBDC models do not increase statistical efficiency when it is compared with the SBDC models (Yibeltal, 2011).

CHAPTER THREE

3. METHODOLOGY OF THE STUDY

3.1. Description of the study area

Afar region[2] is one of the four major pastoral regions in Ethiopia located in north eastern part of the country. The region is divided in to five administrative zones, which are further subdivided in to 29 woredas. The region covers around one-third of pastoral lowlands in the country and about 10 percent of the total area of Ethiopia (Yirgalem, 1999).

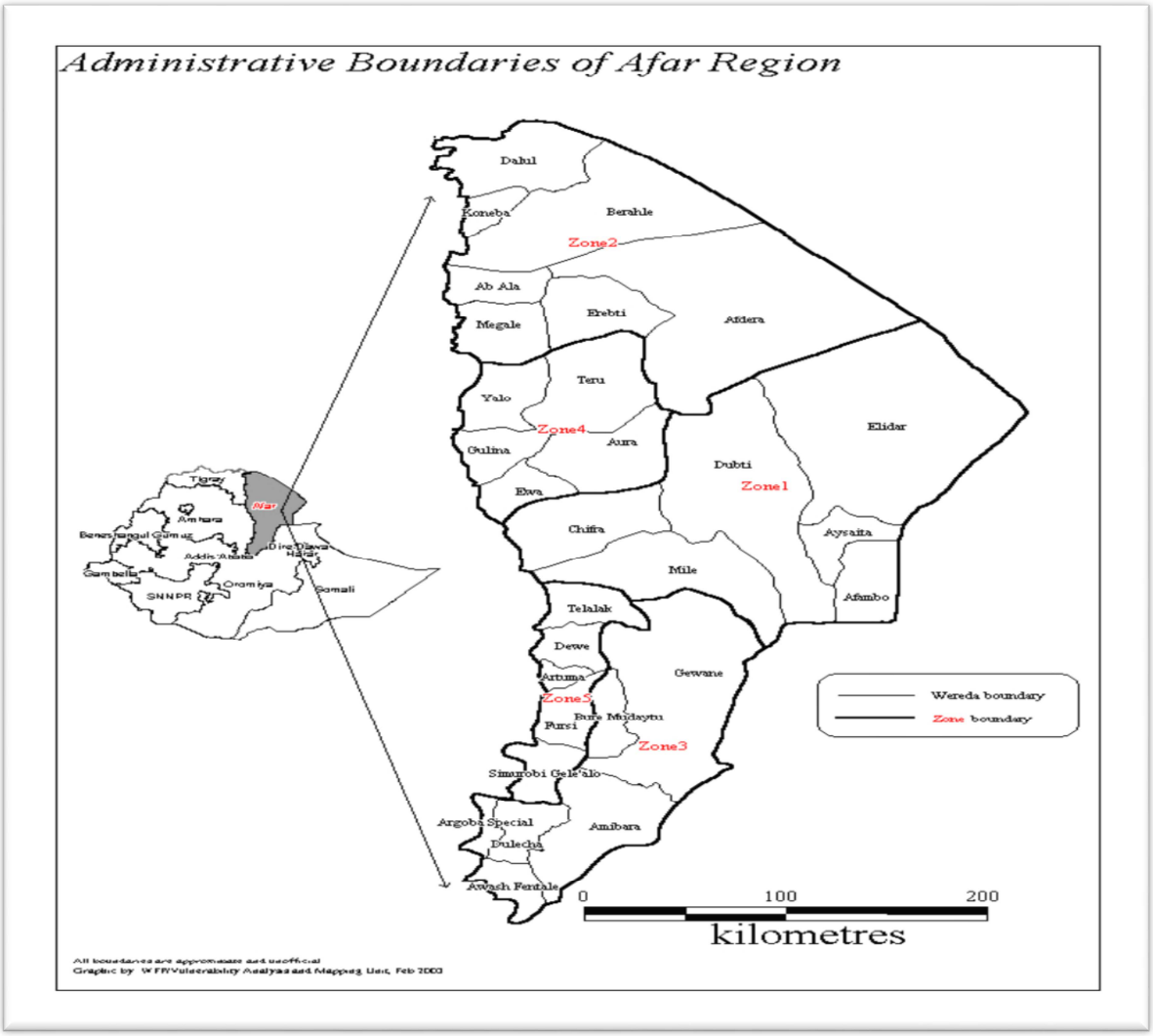
The Afar region has a total population of 1,390,273 consisting of 775,117 men and 615,156 women; urban inhabitants number 185,135 or 13.32 percent and rural inhabitants number 1,205,138 or 86.68 percent of the population. The number of households in the region is about 247,255 and household size is about 5.62 persons per household. The number of households and household size in the urban and rural areas of the region is about 46,702 and 3.96 and 200,553 and 6.00 persons per household respectively (CSA, 2007).

Majority of the land is dry and rocky, unsuitable for cultivation. Out of the total area of the region (estimated at 97,250km2) cultivable and arable land constitutes 5.24 percent and degraded and rocky land 63.7 percent. The region's altitude ranges from a maximum of 1500m above sea level to a minimum of 166m below sea level. Temperature varies from 25ºC during the wet season to 48ºC during the dry season which makes crop cultivation unsuitable. Rainfall is erratic and scarce, annual precipitation ranges from 200mm to 600mm. The region is frequently exposed to persistent droughts and is classified as one of the drought-affected regions in Ethiopia. People in the region therefore depend mainly on livestock production for their livelihood (PPPRSP, 2009).

[2]Throughout the paper Afar region is synonymously used as Afar National Regional State.

According to LCNRDB, (2005) cited in Philpott *et al.*, (2005), the livestock population in the region is estimated at 703,424 cattle, 1,003,000 heads of sheep, 2,014,418 heads of goats, 301,733 camels and 16,976 donkeys.

Figure 3.1: Location of the study area



Source: Philpott *et al.*, 2005

Abala woreda

The study area Aba'ala (formerly called Shiket) woreda is found in the northern part of Afar region, north - eastern part of Ethiopia. Aba'ala woreda lies approximately between 13°15' and 13°30' North latitude and 39°39' and 39°55' East longitude. It is about 50 km east of Mekelle

city, Tigray regional state. The study area is characterized by a semi-arid type of climate receiving a bimodal rainfall on average about 422 mm. The soils are generally sandy and salty. The texture is coarse, with both sands and gravel presents (Diress *et. al.,* 1999, Yirgalem, 1999).

Aba'ala, part of Administrative Zone 2, is bordered on the south by Megale, on the west by the Tigray Regional State, on the north by Berhale, on the northeast by Afdera, and on the east by Erebti. The major town of Aba'ala woreda is Aba'ala. The woreda has a total population of 37,963 (6,878 households) consisting of 20,486 men and 17,477 women; urban inhabitants number 10,301 (2,396 households) or 27.13 percent and rural inhabitants number 27,662 (4482 households) or 72.87 percent of the population. The household size of the woreda in general is about 5.52 persons per household which is lower than the regional household size. The household size for the urban and rural areas of the woreda is about 4.30 and 6.17 persons per household respectively which are above the regional urban and rural household size (CSA, 2007).

Livelihood of the people in the woreda is also dependent on livestock production. The livestock population in the woreda is estimated at 33,938 cattle, 34,144 heads of sheep, 149,450 heads of goats, 22,069 camels and 725 mules (CSA, 2004).

3.2. Data Source and Data Type

This research uses mainly primary data (Cross-sectional data) and secondary data. Primary data is collected from primary sources through dispersing a Contingent Valuation survey with a face to face interview. The primary data is mainly collected through structured questionnaire from the respondents found within the target area. The questionnaire has both close and open ended questions. Moreover, primary data is also collected from primary sources through focus group discussions (FGD).

Secondary data is collected from the zone and woreda agricultural, livestock offices and different researches centers. Different offices and personal contacts are also used to obtain additional information. Besides, secondary data is also collected from secondary sources such as Central Statistical Agency.

3.3. Sampling Methods and Sample Size

For the proper accomplishment of the study, the researcher used probability and purposive sampling method. When the size of population is known, the population is homogeneous and if they confined the same geographical area, simple random sampling method is the best.

Afar region is divided into five administrative zones and one special woreda, further subdivided into 29 woredas. Aba'ala woreda, part of the Administrative Zone 2, is purposefully selected for this study because even if there is a huge camel population in all kebeles except the two (Aba'ala and Hidmo) in the woreda and there is sufficient availability of camel milk, there is no camel milk market in the woreda. This woreda has eleven kebeles these are, Asangola, Undu-Asangola, Wuhdet or Aba'ala, Hidmo, Wakri-gubi, Haremeli, Arkudi, Wosema, Adi-kelu, Hariden and Gela-eso. Out of the eleven kebeles found in Aba'ala woreda Wuhdet or Aba'ala and Hidmo has no camel population because Wuhdet (Aba'ala) is major town of the woreda and Hidmo is also a Kebele which is nearest to the major town and majority of the population are Orthodox Tewahedo religion followers. Since the major objective of the study is to elicit households' willingness to pay (WTP) for camel milk and to examine the determinants of households' willingness to pay for camel milk in the woreda then Aba'ala is purposively selected based on the objective of the study.

Aba'ala town, based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), has a total population of 10,301 of whom 5,191 are men and 5110 are women. Moreover, about 80.53% of the populations are Islamic religion followers and since, most of the time camel milk is consumed by Muslims, then, the respondents are purposively selected that is, they are all Muslims. Out of the total Muslim population found in the study area about 250 household were selected using simple random sampling.

3.4. Elicitation Methods and Questionnaire Design

3.4.1. Elicitation Methods

There are about five major elicitation methods so far used in contingent valuation (CV) surveys. These are: the open-ended/direct question, bidding game, payment card, dichotomous choice method (single-bounded dichotomous choice) and dichotomous choice method with follow up

(double-bounded dichotomous choice). Open-ended question, single-bounded dichotomous choice and double-bonded dichotomous choice approaches are applied in this study. In the single-bounded dichotomous choice approach the respondents are asked a question requiring a "*yes" or "no"* response about whether they would accept the randomly offered bid or not. In the double-bounded dichotomous choice approach, the respondents are also asked a question requiring a "*yes" or "no"* response about whether they would accept the randomly offered follow up bid or not. Moreover, if the respondents say "*yes"*, another willingness to pay (WTP) question is asked using a higher bid (the bid would be doubled). If the respondents say "*no"*, another WTP question is asked using a lower bid (the bid would be halved).

Double-bounded dichotomous choice model is included in this study because double-bounded dichotomous choice model increase efficiency over single-bounded dichotomous choice model in three ways. First, the answer sequences *yes-no* or *no-yes* yield clear bounds on the WTP. For the *no-no* pairs and the *yes-yes* pairs, there are also efficiency gains. Finally, the number of responses is increased, so that a give function is fitted with more observations (Haab and McConnell, 2002).

3.4.2. Questionnaire Design

To come up with the first draft of the questionnaire, the researcher did focus group discussion at the beginning of September 2013. After designing the draft of the questionnaire pilot survey was conducted and total of 14 household heads were interviewed under this pilot survey which was done by seven experienced interviewers and the researcher himself. The pilot survey was very essential to decide whether the researcher should ask willingness to pay (WTP) or willingness to accept (WTA). Accordingly, the researcher have decided to ask on the main survey households willingness to pay (WTP) than households willingness to accept (WTA) and according to many literatures willingness to accept (WTA) is much higher and less acceptable than willingness to pay (WTP) (Tietenberg and Lynne, 2012). The pilot survey has also provided some information to make some modification in the design of the main survey questionnaire based on the responses so as to make it understandable for respondents. In addition to this, the pilot survey helped the researcher to set the three starting (initial) bids for the contingent valuation elicitation part of the questionnaire.

The contingent valuation (CV) survey begins with the opening statement on "Households' Willingness to Pay for Camel Milk". In this opening statement household are informed about the different merits of camel milk such as medicinal benefit (anti-diabetic properties of camel milk, positive effects of camel milk in controlling high blood pressure, camel milk destroys Mycobacterium tuberculosis and its advantage on treating dropsy, jaundice, spleen ailments, tuberculosis, asthma, anemia and piles), economic benefit and its vital role in achieving food security in pastoral and agro pastoral areas.

The contingent valuation (CV) scenario tries to give as much information as possible for the respondent about the hypothetical market. Important points, which are suggested by Mitchell and Carson (1989) and Arrow *et al.,* (1993), to be considered in the scenario, are incorporated as much as possible.

The double-bounded dichotomous choice question was used and the respondent was asked whether she/he is willing to accept the randomly offered bid, and if the individual accepts the randomly offered bid, she/he would be asked a higher amount (doubled) and if she/he refuses the randomly assigned bid she/he would be offered a lower bid (halved). The double-bounded dichotomous choice question was also followed by an open-ended question and if the willingness to pay in the later is less than the already agreed amount in the double-bounded dichotomous choice the respondent was asked the reason why? This would help to compare the results obtained from the different elicitation methods and also to disaggregate the total willingness to pay of the individual (Solomon, 2004).

The second part of the questionnaire have presented questions related with household characteristics such as household member's education level, age, sex, marital status, family size and the like. The third part of the questionnaire have also presented questions related with household asset ownership and value such as household land ownership, household livestock ownership and value, households livestock income, household other assets ownership and value.

The fourth and fifth parts of the questionnaire are about migration and remittance and income earned from off-farm activities. The sixth part of the questionnaire is also about household

expenditure such as household food expenditure, household other food and non food expenditure, household non food expenditure, household expenditure on health and education and household expenditure on investment goods.

A total of seven enumerators and one supervisor (the researcher himself) have participated in the main survey where all the enumerators were selected based on their previous experience in household survey and their knowledge of Afar language. Two days training of enumerators was conducted.

After incorporating the findings of the pilot survey and focus group discussion the following double-bounded dichotomous question was developed. Hence, the amount of initial bid and follow-up bids and their corresponding sample size distribution is presented in the below table.

Table 3.1: Bid design and number of randomly assigned sample households

Bids			Sample size
1st round bid	2nd round bid if "YES" in 1st round	2nd round bid if " NO" in 1st round	
15	30	7.5	83
10	20	5	84
5	10	2.5	80

3.5. Method of Data Analysis

3.5.1. Descriptive Method of Data Analysis

In order to analyze the socio-economic and demographic characteristics of the respondents, the researcher employed descriptive method of data analysis and statistical techniques like, mean, frequency, percentages, standard deviation and charts. Besides, descriptive method of data analysis was also used to analyze the reasons for the absence of camel milk market in the region in general and in the woreda in particular and their preferred type of milk.

3.5.2. Econometric Method of Data Analysis

For the proper estimation of economic value of camel milk, the researcher has also employed econometric method of data analysis. In the econometric method of data analysis part, a model is developed to clearly show the relationship between dependent variable and independent variables.

Empirical Models

In this study the respondents were asked a double-bounded dichotomous choice "yes" or "no" questions followed by open-ended questions to elicit their willingness to pay for camel milk per liter. Analysis of survey responses obtained from double-bounded, single-bounded and open-ended questions formats requires different models (FAO Corporate Document Repository, 2007). Thus, based on empirical studies, to analyze the survey responses the researcher has employed three different econometrics models: for the double-bounded dichotomous question responses, single-bounded dichotomous questions responses and open-ended survey responses.

Model for Analyzing Responses to the Open-ended Valuation Question

The Tobit Model

In the survey, only 3 (1.20 percent) of the total sample of 250 respondents were eliminated as invalid responses (protest zeros) that is, only three respondents were not willing to purchase camel milk if camel milk market is established in the woreda. On the other hand, about 247 (98.80 percent) of the total sample of 250 respondents were willing to purchase from the hypothetical camel milk market and their willingness to pay is above zero with some outliers. Since, the number of invalid responses (protest zeros) are very small then this may be too small to result in sample selection bias.

In this case, the dependent variable is a continuous variable and in the absence of sample selection bias, we can employ linear regression models like ordinary least square method (OLS) and the censored regression model such as Tobit model. Moreover, in order to decide which model should be employed in this research the researcher used some criteria for comparison purpose. As a result, Tobit was found to be superior to OLS because Tobit model has lower Akaike's information criterion (AIC)/ Bayesian information criterion (BIC). Given two models

fitted on the same data, the model with the smaller value of the information criterion is considered to be better. Moreover, Tobit model was found to have a better overall significance level. Hence applying OLS in this study may result in inefficient estimates. The comparison between the two models is given in Table 3.2. So the result from the OLS method is not reported in this study.

Table 3.2: Test for comparison of Tobit and OLS models

Diagnostic test type	Tobit	OLS
Prob > F	0.000	0.078
AIC	1243.859	1643.311
BIC	1284.637	1680.691
Number of observations	221	221
Number of significant variables	5	3

Source: Own survey, 2013

The Tobit model is used given that there is a censoring from below at lower limit and from above at upper limit (because of some outliers). Tobit model is appropriate for analyzing dependent variables that cannot take values below or above a particular limit. As it is clearly stated above if the dependent variable takes values below the lower limit and above the upper limit for some part of the population and positive continuous values for the rest of the population the Tobit model is appropriate. The Tobit model that the researcher employed here is censored both from below or left- censoring and from above or right- censoring. Hence, the form of the Tobit model following Verbeek (2000) is:

$$MWTP_i^* = X_i\beta + u_i \qquad (1)$$

$$i = 1, 2, 3, 4, 5 \ldots N,$$

$MWTP_i = 0$ If $MWTP_i^* = X_i\beta + u_i = 0$ or $MWTP_i^* = 0$

$MWTP_i = X_i\beta + u_i$ If $MWTP_i^* = X_i\beta + u_i > 0$ or $MWTP_i^* > 0$

Where, $MWTP_i$ = is maximum willingness to pay of the i^{th} household

X_i = is vector of independent or explanatory variables

β = Vector of Coefficients

u_i = is the error term where, $u_i \sim (0, \sigma^2)$

$MWTP_i^*$ = is the latent variable

$$X_i\beta = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_K X_K \quad (2)$$

The model thus describes two things. One is the probability that $MWTP_i = 0$ (given X_i), given by $P\{MWTP_i = 0\} = \mathrm{P}\{MWTP_i^* = 0\} = \mathrm{P}\{u_i = -X_i'\beta\} 1 - \Phi\left(\frac{X_i'\beta}{\delta}\right)$

The other is the distribution of $MWTP_i$ given that it is above the lower limit and below the upper limit. This is a truncated normal distribution with expectation;

$E(MWTP_i \mid MWTP_i > 0, X_i)$ is given below (where X_i is a scalar explanatory variable).

$$E[MWTP_i \mid MWTP_i > 0, X_i] = X_i'\beta + \sigma \frac{\phi(X_i'\beta)/\sigma)}{\Phi(X'_i\beta)/\sigma)} \quad (3)$$

The last term on the right-hand-side of the above equation is called the inverse of Mills ratio. It denotes the conditional expectation of a mean –zero normal variables given that it is larger than $-X_i\beta$.

The coefficients in the Tobit model can be interpreted in a number of ways. However, interpreting estimated coefficients from the tobit model is a bit more complex than interpreting estimated coefficients from the ordinary least squares model (OLS). Hence, driving (equation (3)) and interpreting the marginal effect of a change in X_i on the probability of having willingness to pay below the lower limit and above the upper limit makes it simple for interpretation and understanding. And this is given as follows;

$$\frac{\partial p[MWTP_i = 0]}{\partial x_{ik}} = -\phi(X_i'\beta/\sigma)\frac{\beta_K}{\sigma} \quad (4)$$

, β_k/σ can be interpreted in a similar way of interpreting β in the probit model.

The marginal effects of a change in the X_i on the probability of willingness to pay more than zero can be also computed by partially derivate equation (4) and is also given by;

$$\frac{\partial E[MWTP_i]}{\partial x_{ik}} = \beta_k \Phi(X'_i\beta/\sigma) \quad (5)$$

Meaning the marginal effect of change in the explanatory variable upon the outcome $MWTP_i$ is given by β_k multiplied by the probability of positive $MWTP_i$.

The estimated coefficients represent the marginal effect of X on $MWTP_i$. The marginal effect of the latent dependent variable of the estimated coefficients from the Tobit model represents:

$$\frac{\partial E[MWTP_i^* \mid X_i]}{\partial x_{i\,k}} = \beta_{\mathrm{k}} \tag{6}$$

Of course STATA can easily calculate these marginal effects.

Estimation of the Tobit model is usually done through maximum likelihood estimator and the loglikelihood function can thus be written as;

$$\log L_1(\beta, \sigma^2) = \sum_{i \in I_0} \log\left[1 - \Phi\left(\frac{x_i'\beta}{\sigma}\right)\right] + \sum_{i \in I_1} \log\left[\frac{1}{\sqrt{2\pi\sigma^2}} \exp\left(-\frac{1}{2}\frac{(MWTP_i - x_i'\beta)^2}{\sigma^2}\right)\right]$$

Thus, the model for the main determinants of household maximum willingness to pay can be specified as follows;

$$\mathrm{MWTP}_{\mathrm{i}} = \alpha + \beta_1 \ln incomehh + \beta_2 \mathrm{famsize} + \beta_3 \mathrm{agehh} + \beta_4 \mathrm{age2} + \beta_5 \mathrm{educhh} + \beta_6 \mathrm{lnremittan\ ce} + \beta_7 \mathrm{ownland}$$
$$\beta_8 sexhh + \beta_9 \mathrm{adul\_ratio} + \beta_{10} \mathrm{Bid1} + u_i$$

Where, α is a constant term and u_i is the error term.

According to Haab and McConnell, (2002); Hanely and Barbier, (2009) for the open-ended CV survey responses the mean than the median is an appropriate method for welfare measures because it is meaningful from a political consensus viewpoint. Maximum WTP of the respondents can be averaged to produce an estimate of mean WTP as follows:

$$MeanWTP = \mu = \frac{\sum MWTP_i}{n}$$

Where n = is the number of households in the sample excluding households with invalid response (protest zeros) and each $\mathrm{MWTP}_{\mathrm{i}}$ is a reported WTP amount by surveyed households.

Model for Analyzing Responses to the Single-Bounded Valuation Question

The Probit Model

The Random Utility Model (RUM) and Contingent Valuation

In the case of single-bounded valuation question the dependent variable takes only two values (1 if the household head is willing to purchase or if his/her response is yes and 0 otherwise). Here, intention of the research is to quantify the relationship between the income, household socio-economic and demographic characteristics and the probability of households' willingness to accept for a randomly offered bid values. The basic model for analyzing dichotomous contingent valuation (CV) responses is the Random Utility Model (RUM). Therefore, in this study, the RUM developed by Haab and McConnell, (2002) is employed. In the CV case, there are two choices or alternatives, so that indirect utility for respondent j can be written as;

$$v_{ij} = v_i\left(m_j, z_j, \varepsilon_{ij}\right) \tag{1}$$

Where i = 1 is the final state and i = 0 is for the status quo. In this case, utility is determined by m_j (the j^{th} respondent's income), Z_j (vector of households' socio-economic characteristics) and ε_{ij}, a component of preferences known to the individual respondent but not observed by the researcher.

If the household answers "Yes", s/he purchases the good[3] and his/her income is reduced by the amount of the bid (Tilahun *et al*., 2013). The respondent j answers "Yes" to a required payment of B_j or will accept the randomly assigned initial bid if and only if the following condition is satisfied.

$$v_1\left(m_j - B_j, z_j, \varepsilon_{1j}\right) > v_0\left(m_j, z_j, \varepsilon_{0j}\right) \tag{2}$$

Where B_j is the bid amount in Birr and ε_{0j}, ε_{1j} are the error terms which are assumed to be normally distributed with mean zero and constant variance.

The probability of a "Yes" response will be as follows;

$$\Pr(yes_j) = \Pr(v_1\left(m_j - B_j, z_j, \varepsilon_{1j}\right) > v_0\left(m_j, z_j, \varepsilon_{0j}\right) \tag{3}$$

[3] In this case, the good is camel milk

The above equation is too general for parametric estimation. Since almost all approaches begin by specifying the utility function as additively separable in deterministic and stochastic preferences then we can rewrite equation (1) as below:

$$v_j(m_j, z_j, \varepsilon_{ij}) = U_i(m_j, z_j) + \varepsilon_{ij} \tag{4}$$

With the additive specification of equation (4), the probability statement for respondent j becomes

$$\begin{aligned}\Pr(yes_j) &= \Pr[U_1(m_j - B_j, z_j) + \varepsilon_{1j} > U_0(m_j, z_j) + \varepsilon_{0j}] \\ &= \Pr[U_1(m_j - B_j, z_j) - U_0(m_j, z_j) > \varepsilon_{0j} - \varepsilon_{1j}] \\ &= F_\eta[\Delta U]\end{aligned} \tag{5}$$

Where $\eta = \varepsilon_{0j} - \varepsilon_{1j}$, $\Delta U = v_1 - v_0$ and $F_\eta(\Delta U)$ is the cumulative distribution function of η.

If the utility function is linear, then the deterministic part of the preference function is linear in income and covariates.

$$U_{ij}(m_j) = \alpha_i z_j + \beta_i(m_j) \tag{6}$$

The deterministic utility for the proposed CV scenario is;

$$U_{1j}(m_j - B_j) = \alpha_i z_j + \beta_1(m_j - B_j) \tag{7}$$

Where B_j is the price offered to the j^{th} respondent.

The status quo utility is;

$$U_{0j}(m_j) = \alpha_0 z_j + \beta_0(m_j) \tag{8}$$

With constant marginal utility of income the change in deterministic utility is;

$$U_{1j} - U_{0j} = \alpha z_j - \beta B_j \tag{9}$$

Where, $\alpha = \alpha_1 - \alpha_0$ and $\beta_1 = \beta_0$

Thus, the probability of "Yes" for respondent j can be estimated as;

$$\Pr(\alpha z_j - \beta B_j + \varepsilon_{ij} > 0) = \Pr(\varepsilon_{ij} < \alpha z_j - \beta B_j) = \Phi\left(\frac{\alpha z_j}{\sigma} - \frac{\beta B_j}{\sigma}\right) \tag{10}$$

Where Φ. is the cumulative normal distribution function, α is the parameter estimate of vector of households' socio-economic characteristics and β is the parameter estimate of the bid amount.

The likelihood function becomes for the probit model is;

$$L(\alpha,\beta|m,z,B)=\prod_{j=1}^{T}\left[\Phi\left(\frac{\alpha z_j}{\sigma}-\frac{\beta B_j}{\sigma}\right)\right]^{I_j}\left[1-\Phi\left(\frac{\alpha z_j}{\sigma}-\frac{\beta B_j}{\sigma}\right)\right]^{1-I_j} \quad (11)$$

The study employed the probit model and it is used to examine factors affecting the willingness to pay (WTP) of households for camel milk. The model takes the following form: (Cameron and Quiggin, 1994).

$$WTP_i^* = X_i^*\beta + \varepsilon_i$$

WTP^* is unobservable latent variable, that is unobservable households' willingness to pay for camel milk. But we can observe the dummy variable WTP_i which is defined as:

$$WTP_i = 1 \quad \text{If} \quad WTP_i^* > B^1$$

$$WTP_i = 0 \quad \text{If} \quad WTP_i^* < B^1$$

Where, WTP_i = is willingness to pay of the i^{th} household (1, if the response is "Yes" and 0, if the response is "No")

X_i = is Vector of independent or explanatory variables

β = Vector of Coefficients

ε_i = is the error term where, $\varepsilon_i \sim (0, \sigma^2)$

WTP_i^* = is the latent variable

B^1 = is the bid randomly offered to the respondents

$$\text{WTP}_i = \alpha + \beta_1 \ln incomehh + \beta_2 \text{Bid1} + \beta_3 \text{famsize} + \beta_4 \text{sexhh} + \beta_5 \text{agehh} + \beta_6 \text{age2} + \beta_7 \text{educhh} + \beta_8 \text{ownland} + \beta_9 \text{adul\_ratio} + \beta_9 \ln remi\tan ce + u_i$$

The mean is an appropriate welfare measure but not the median (Hanemann and Kanninen, 1998). Since the probit model is used to calculate the mean WTP, for the single bounded questions it can be defined as below:

$$MeanWTP = \mu = \frac{-\alpha}{\beta}$$

Where α = is the constant or intercept term

β = is the coefficient of the 'bid' posed to the respondent

The regression parameters will be estimated by Maximum Likelihood Estimator using STATA econometric software.

Model for Analyzing Responses to the Double-Bounded Valuation Question

The Bivariate Probit Model

Bivariate Probit model is a natural extension of the probit model which involves more than one equation, with correlated error terms, in the same way as the seemingly unrelated regressions model. This bivariate probit model is interesting in its own right for modeling the joint determination of two variables. The bivariate probit model provides a specification for analyzing a case in which a probit model contains an endogenous binary variable in one of the equations. According to Greene (2012), the general specification for a two-equation model is;

$y_{1i}^{*} = X_{1i}^{'}\beta_1 + \varepsilon_{1i}$, $\quad y_{1i} = 1 \text{ if } y_{1i}^{*} > 0$, *0 otherwise,*

$y_{2i}^{*} = X_{2i}^{'}\beta_2 + \varepsilon_{2i}$, $\quad y_{2i} = 1 \text{ if } y_{2i}^{*} > 0$, *0 otherwise,*

In a bivariate probit model, we are interested in two main things: the probability that $y_{1i} = 1 \text{ and } y_{2i} = 1.$

$$\Pr(y_{1i} = 1) = \Pr(\varepsilon_{1i} > -X_{1i}\beta_1)$$
and
$$\Pr(y_{2i} = 1) = \Pr(\varepsilon_{2i} > -X_{2i}\beta_2)$$

Given the above two models therefore, the assumption in a bivariate probit model is that the respective disturbances have zero mean and one variance, but are correlated with ρ, i.e.

$$\begin{pmatrix} \varepsilon_{1i} \\ \varepsilon_{2i} \end{pmatrix} N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}\right]$$

In this case, the generic bivariate probit model is presented as

$$\Pr(y_{1i} = 1, y_{2i} = 1) = \int_{-\infty}^{\varepsilon_{1i}} \int_{-\infty}^{\varepsilon_{2i}} (X_{1i}\beta_1, X_{2i}\beta_2, \rho) \mathrm{d}\varepsilon_{1i} \mathrm{d}\varepsilon_{2i}$$
$$= \Phi_2(X_{1i}\beta_1, X_{2i}\beta_2, \rho)$$

Where, Φ_2 is a bivariate normal distribution. This function can then be estimated using maximum likelihood (MLE) model to obtain the coefficient estimates.

The bivariate probit model becomes relevant if we have *a priori* information that the two equations may be dependent on each other, that is, the disturbance terms in the two equations (ε_{1i} and ε_{2i}) are correlated or cov (ε_{1i}, ε_{2i}) $\neq 0$. This effectively signifies that the probability of one (variable in one of the equations) will be dependent on the value/probability of the other. In this case, there may be a need to account for the dependence of the two decision-makings. Joint estimation in the present of dependence of equations with each other improves statistical efficiency. This is the spirit of the bivariate probit models. The bivariate probit model, although consuming relatively much time, is more likely to converge than the bivariate logit model (Greene, 2003).

Bivariate normal probability density functions are the most well-known bivariate distributions in which they let for a non-zero correlation between the two error terms (Cameron and Quiggin, 1994, Haab and McConnell, 2002). Hence, the researcher used the bivariate probit model in this study to estimate the mean WTP from the double bounded dichotomous choice.

The double-bounded version of discrete response CV comes as follow- up question on the initial question, by advancing a higher or lower bid depending on the response to the first bid (Hanemann and Kanninen, 1998). If we assume the unobserved willingness to pay of the respondent i (WTP_i^0) in the first question is between the lowest value (WTP_i^L) and the highest value (WTP_i^H) and if the respondent is asked whether she/he is willing to pay B^q amount for a one liter camel milk or not where q=1 if B is the first bid amount and q=2 if B is the second bid. Therefore, there are four possible response sequences: (a) both answers are yes; (b) both answers are no; (c) a yes answer followed by a no answer; and (d) a no answer followed by a yes answer (Haab and McConnell, 2002; Hanemann and Kanninen, 1998).

a. Yes-Yes, if the respondent answers "yes" for both the first bid and the second bid, that is, $WTP_i > B^1$ and $WTP_i > B^2$.
b. Yes-No, if the respondent answers "yes" for the first bid and "No" for the second bid, that is, $WTP_i > B^1$ and $WTP_i < B^2$ or ($B^1 < WTP_i < B^2$) that is, the highest willingness to pay is between WTP_i^L and WTP_i^H.
c. No - Yes, if the respondent answers "No" for the first bid and "yes" for the second bid that is, $WTP_i < B^1$ and $WTP_i > B^2$.

d. No - No, if the respondent answers "No" for both the first bid and the second bid, that is, $WTP_i < B^1$ and $WTP_i < B^2$ that is, the highest willingness to pay is between 0 and WTP_i^L.

Hence, the probability of the responses is given by;

Pr {Yes /Yes} P^{yy} = Pr ($WTP_i^1 > B^1$, $WTP_i^2 > B^2$)

Pr {No / No} P^{nn} = Pr ($WTP_i^1 < B^1$, $WTP_i^2 < B^2$)

Pr {Yes / No} P^{yn} = Pr ($WTP_i^1 > B^1$, $WTP_i^2 < B^2$)

Pr {No / Yes} P^{ny} = Pr ($WTP_i^1 < B^1$, $WTP_i^2 > B^2$)

The most general econometric model for the double-bounded data comes from the formulation (Haab and McConnell, 2002).

$$WTP_{qi} = \mu_q + \varepsilon_{qi}$$

Where WTP_{qi} represents the i^{th} respondent's willingness to pay, and q=1, 2 represents the first and second answers. The μ_1 and μ_2 are the means for the first and second responses. This general model incorporates the idea that, for an individual, the first and second responses to the CV questions are different, perhaps by the same covariates but with different response vectors and with different random terms.

To build the likelihood function, we first derive the probability of observing each of the possible two-bid response sequences (yes-yes, yes-no, no-yes, no-no). For instance, the probability that respondent j answers yes to the first bid and no to the second is given by;

$$\Pr(yes, no) = \Pr(\mu_1 + \varepsilon_{1i} \geq B^1, \mu_2 + \varepsilon_{2i} < B^2)$$

The other three response sequences can be constructed in the same way. The i^{th} contribution to the likelihood function is

$$L_i(\mu|B) = \Pr(\mu_1 + \varepsilon_{1i} \geq B^1, \mu_2 + \varepsilon_{2i} < B^2)^{YN} * \Pr(\mu_1 + \varepsilon_{1i} > B^1, \mu_2 + \varepsilon_{2i} \geq B^2)^{YY}$$
$$* \Pr(\mu_1 + \varepsilon_{1i} < B^1, \mu_2 + \varepsilon_{2i} < B^2)^{NN} * \Pr(\mu_1 + \varepsilon_{1i} < B^1, \mu_2 + \varepsilon_{2i} > B^2)^{NY}$$

Where YY=1 for a yes-yes answer, 0 otherwise, NY=1 for a no-yes answer, 0 otherwise, YN=1 for a yes-no answer, 0 otherwise and NN=1 for a no-no answer, 0 otherwise. This formulation is referred to as the bivariate discrete choice model. If the error terms are assumed to be normally distributed with means 0 and variances of $\sigma_1^2 and \sigma_2^2$ then WTP_{1i} and WTP_{2i} have a bivariate normal distribution with means $\mu_1 and \mu_2$, variances $\sigma_1^2 and \sigma_2^2$ and correlation coefficient ρ. The likelihood function for the bivariate probit model can be derived as below.

The probability of a no-no response, is

$$\Pr(\mu_1 + \varepsilon_{1i} < B^1, \mu_2 + \varepsilon_{2i} < B^2) = \Phi_{\varepsilon_1\varepsilon_2}\left(\frac{B^1 - \mu_1}{\sigma_1}, \frac{B^2 - \mu_2}{\sigma_2}, \rho\right)$$

Where, $\Phi_{\varepsilon_1\varepsilon_2}$ is the standardized bivariate normal cumulative distribution function with zero means, unit variances and correlation coefficient p. Similarly, the probability of a no-yes response is

$$\Pr(\mu_1 + \varepsilon_{1i} < B^1, \mu_2 + \varepsilon_{2i} \geq B^2) = \Phi_{\varepsilon_1\varepsilon_2}\left(\frac{B^1 - \mu_1}{\sigma_1}, -\frac{B^2 - \mu_2}{\sigma_2}, -\rho\right)$$

The probability of a yes-no response is

$$\Pr(\mu_1 + \varepsilon_{1i} \geq B^1, \mu_2 + \varepsilon_{2i} < B^2) = \Phi_{\varepsilon_1\varepsilon_2}\left(-\frac{B^1 - \mu_1}{\sigma_1}, \frac{B^2 - \mu_2}{\sigma_2}, -\rho\right)$$

and the probability of a yes-yes response is

$$\Pr(\mu_1 + \varepsilon_{1i} \geq B^1, \mu_2 + \varepsilon_{2i} \geq B^2) = \Phi_{\varepsilon_1\varepsilon_2}\left(-\frac{B^1 - \mu_1}{\sigma_1}, \frac{B^2 - \mu_2}{\sigma_2}, \rho\right)$$

Defining $y_{1i} = 1$ if the response to the first question is yes, and 0 otherwise, $y_{2i} = 1$ if the response to the second question is yes, and 0 otherwise, $d_{1i} = 2y_{1i} - 1$, and $d_{2i} = 2y_{2i} - 1$, the ith contribution to the bivariate probit likelihood function is

$$L_i(\mu / B) = \Phi_{\varepsilon_1\varepsilon_2}(d_{1i}\left(\frac{B^1 - \mu_1}{\sigma_1}\right), d_{2i}\left(\frac{B^2 - \mu_2}{\sigma_2}\right), d_{1i}d_{2i}\rho$$

The bivariate probit model is a parametric model of two-response surveys. In this study, the double -bounded dichotomous question data was analyzed via Stata econometric software.

Finally, the mean willingness to pay (MWTP) from bivariate probit model is calculated using the formula specified by (Haab and McConnell, 2002).

$$MeanWTP = \mu = \frac{-\alpha}{\beta}$$

Where α = is the constant or intercept term

β = is the coefficient of the 'bid' posed to the respondent

The regression parameters will be estimated by Maximum Likelihood Estimator using STATA econometric software.

Table 3.3: Description of dependent and independent variables

Variable name	Description	Variable Type
WTP1	Willingness to pay for one liter camel milk when price is Bid1	Dummy
WTP2	Willingness to pay for one liter camel milk when price is Bid2	Dummy
Bid1	Randomly offered initial bid amount	Continuous
Bid2	Randomly offered follow-up bid amount	Continuous
MWTP	Maximum willingness to pay for one liter camel milk	Continuous
famsize	Family size of the household	Continuous
sexhh	Sex of the household head	Dummy
agehh	Age of the household head in years	Continuous
age2	Age square of the household head	Continuous
educhh	Education status of the household head	Dummy
incomehh	Income of the household	Continuous
lnincomehh	log of income of the household	Continuous
remittance	Amount of remittance obtained by the household	Continuous
lnremittance	log of amount of remittance obtained by the household	Continuous
ownland	Land ownership of the household	Dummy
adult_ratio	Ratio of adult male to adult female	Continuous

3.6. Description of dependent and independent variables and their expected effect

In this section of the research, the description of both dependent (Maximum willingness to pay, Willingness to pay for the initial bid and Willingness to pay for both the initial bid and follow-up bids) and independent variables used are discussed. Moreover, the expected effect independent variables on the dependent variables have also presented. In order to identify the potential determinants (socio-economic and demographic characteristics of respondents) of willingness to pay, review of both theoretical and empirical literatures, previous researches on the households' willingness to pay using a contingent valuation method in different goods and services are properly documented.

3.6.1. Description of Dependent Variables

MWTP (Maximum willingness to pay)

Here, the respondents are asked to state their maximum willingness to pay for one liter of camel milk in Birr (open ended/direct question). In this case, the dependent variable MWTP (Maximum willingness to pay) takes a continuous value and the researcher employed a censored regression model, that is, the Tobit model.

WTP1: is Willingness to pay for one liter of camel milk when its price is Bid1 (initial bid). This is the dependent variable used in the probit model (single bounded dichotomous questions method). This variable is a dummy variable which takes the value of 1 if the respondent is willing to accept the randomly offered initial bids and 0 otherwise.

WTP2: is Willingness to pay for one liter camel milk when its price is Bid2 (the follow-up bid, the first bid was doubled if the respondents response for the first bid is "Yes" and it was halved if the respondents response for the initial bid was "No"). I necessitate this dependent variable in order to elicit the double-bounded dichotomous choice method and increase the gains in statistical efficiency.

In the double bounded dichotomous choice method there are two dependent variables these are; **WTP1** (Willingness to pay for one liter camel milk when its price is Bid1 or initial bid) and

WTP2 (Willingness to pay for one liter camel milk when its price is Bid2 or the follow-up bid). Here, the correlation (rho) of the two error terms in the two dependent variables should be identified and if their correlation (rho) is different from zero, we can employ a bivariate probit model otherwise not. In this case, the initial bid is supposed to affect the follow-up bid or the decision of the respondent on his/her willingness to pay with the second bid is dependent on the amount of the first (initial) bid (Greene, 2012; Haab and McConnell, 2002; Yibeltal, 2011; Hanemann and Kanninen, 1998).

3.6.2. Description of Independent Variables

agehh: is age of the household head in years and it takes continuous values. Even if there are no literatures on the effect of households' age on their willingness to pay for camel milk there are numerous literatures on other goods and services[4]. Hence, according to various literatures age of the household head negatively and significantly affect their willingness to pay (Brima, 2003; Medhin, 2006; Aklilu, 2002; Gossaye, 2007; Yibeltal, 2011; Solomon, 2004). Some other literatures have shown that age of the household head positively affects their willingness to pay (Amarech, 2007; Solomon, 2007). Therefore, there is no unidirectional relationship between age of the household head and their willingness to pay. In this research, age of the household head is expected to positively affect households' willingness to pay but until some point, that is, there may be an inverted "U" shaped relationship as a result the life cycle hypothesis and the results of this study may be in tandem.

age2: is age square of the household head which takes continuous value. Here, this variable is needed to check whether the life cycle hypothesis is valid in this study or not. Therefore, the expected sign of this variable is negative.

educhh: is education level of the household head. This variable is a dummy variable and it is equal to 1 if the household head is literate and 0 if the household head is illiterate. In most of the literatures education level of the household head positively affects households' willingness to pay (Gebrelibanos and Edriss, 2012; Tilahun *et al.*, 2013; Gossaye, 2007; Yibeltal, 2011; Amarech,

[4] To the best of the researcher's knowledge there is no any research conducted on this area using the contingent valuation method hence, all the literatures cited in this paper are researches conducted in other areas of study like improved water supply, waste management, and improved health etc.

2007; Solomon, 2007). In this study, more educated household heads are expected to have more knowledge and awareness about the economic and health benefits of camel milk. Thus, the expected sign of this coefficient is positive and education level of the household head expected to have a positive effect on the households' willingness to pay for camel milk.

sexhh: is sex of the household head which is a dummy variable and equals to 0 if the household head is male, 1 for female household head. This variable is one of the determinants of households' preference for camel milk. In many literatures the relationship between sex of the household head and his or her willingness to pay is not clear. Some found a positive but insignificant relationship between sex of the household head and his or her willingness to pay and some others found the other way relationship. (Amarech, 2007; Tilahun *et al.*, 2013; Gebrelibanos and Edriss 2012) found positive and statistically significant relationship between sex of the household heads and their willingness to pay, if the head of the household is male. In this case, male headed households are expected to have a higher willingness to pay than the female headed households. Thus, the expected sign of this coefficient is negative. This is because male headed households are expected to be financially better than female headed households and they have more decision power so that they can be more willing to pay and purchase.

famsize: is family size for the household adjusted for adult equivalence. The variable famsize is a continuous variable which takes a continuous value and it is one of the most determinant factors of households' willingness to pay for camel milk. In this study, family size is expected to negatively affect household's willingness to pay; that is willingness to pay decreases as family size increase perhaps reflecting the effect of income on per capita basis.

incomehh: is income of the household member which is a continuous variable. Here, income is the amount of birr obtained from all members of the household and from all sources). According to the general demand theory income and quantity demanded are positively related in the case of normal goods and are negatively related in the case of inferior goods. Hence, households with higher income are expected to have higher willingness to pay for normal goods and services. Almost all literatures prove the positive relationship between household income and households' willingness to pay. For instance, (Aklilu, 2002; Martha, 2003; Brima, 2003; Tilahun *et al.*, 2013)

did obtain a positive and statistically significant relationship between household income and households' willingness to pay.
In this study, it is also expected that household income affects households' willingness to pay positively and significantly. Thus the expected sign of this variable is positive.

remittance: is amount of remittance obtained by the household in the year 2012/13. This can be amount of Birr obtained from both domestic and international type of migration. This variable is a continuous variable and it is expected to have a positive effect on the households' willingness to pay. Therefore, the expected sign of this variable is positive.

adult_ratio: is the ratio of adult male to adult female and it takes a continuous value. In this study, members of the household whose age are greater or equal to 15 years of old and less than or equal to 64 years old are considered as adult. The expected sign of this variable is negative since a household with abundant adult male has less likely to have a higher income and higher willingness to pay.

Bid1: is a randomly offered initial bid amount to each household. Tilahun *et al.*, (2013); Gebrelibanos and Edriss, (2012); Solomon, (2004); Medhin, (2006), found a result which is consistent with economic theory of demand that is, the higher is the bid price, the less likely households would be willing to pay. In this study, the initial bid price is used as one of the most determinant independent variables of households' willingness to pay for the camel milk. In line with the economic theory of demand and with the findings of previous researches, in this study, initial bid price is expected to negatively affect the household head willingness to pay and hence, the coefficient of this variable is negative.

ownland: is land ownership of the household. This variable is a dummy variable, takes a value of 1 if the household head own cultivable land and 0 otherwise. This independent variable is also expected to positively affect the household head's willingness to pay.

CHAPTER FOUR

4. RESULTS AND DISCUSSIONS

The study mainly used primary (cross-sectional) data collected through structured questionnaire method from about 250 households drawn using simple random sampling technique from the woreda. In this chapter the results obtained using descriptive and econometric methods of data analysis are discussed. Hence, in the first part of this chapter households socio-economic and demographic characteristics (such as household heads age, education, sex, households preferred type of milk and so on) that affects households' willingness to pay for camel milk are analyzed via descriptive method of data analysis and the results are discussed. Moreover, the reasons for the absence of camel milk market in the woreda are also discussed. In the second part of this chapter the collected raw data was analyzed using econometric method of data analysis in order to investigate the determinants of households' maximum willingness to pay for camel milk using Tobit model and households' maximum willingness to pay is used to estimate aggregate economic benefit. Probit model was also employed to understand the factors that affect households' probability of accepting the initial bid offered to households. Furthermore, Bivariate Probit model was also used to investigate whether the double-bounded dichotomous choice elicitation format increases statistical efficiency compared with single-bounded dichotomous choice method and the mean willingness to pay from the closed-ended questions were also computed.

4.1. Descriptive Analysis

In this subsection the socio-economic and demographic characteristics of households is analyzed using, percentages, frequency distributions and charts.

4.1.1. Socio-Economic and Demographic Characteristics of Households

As stated in the above opening paragraph, the data used for this study is a primary data collected from randomly selected a total of 250 sample household heads. The detail summary statistics of surveyed household heads' is given in Appendix II. Of the total 250 sample surveyed household heads 47 (18.80 percent) were female headed and the remainder 203 (81.20 percent) were male headed households. The mean household size and family size adjusted for adult equivalent of the

total sample household heads is 6.26 and 6.24 respectively, which are higher than the regional and the woreda household size with 5.62 and 5.52 persons per household respectively. The sample households are with a minimum of 1 household member and with a maximum of 12 household members. From the total 250 sample household heads 222 (88.80 percent) are married and the remaining 28 (11.20 percent) are not. The data showed that the average dependency ratio is 1.007 with a minimum of 0 dependants and maximum of 6 dependants to 1 independent. The average dependency ratio 1.007 implies that the number of dependents and independents in the total sample households is almost equal. On the other hand, the data also showed that the average number of adults in a given household is about 3.56 with a minimum of 1 adult household member and maximum of 9 adult household members.

As far as age of the household heads is concerned, the average age of the sample households is 40.22 years which ranges from 20 to 100 years old. Of the 250 household heads about 150 (60 percent) of them did not attend any formal education (illiterate) and the remaining 100 household heads did attend formal education or they are literate. The average years of schooling is 4.62 ranged from illiterate or zero years of schooling to a maximum of more than 16 years of schooling, that is, Masters Degree. Out of the total literate household heads 17 (17 percent) of them did attend their primary education (from grade1-8) which excludes those household heads who were attending informal education but can read and write, 45 (45 percent) did attend their secondary education (from grade 9-12) and the remaining 38 (38 percent) did attend their tertiary education (Bachelor and Masters' Degree).

The sample surveyed households earn an average annual income of Birr 31,604 which ranges from a minimum of Birr 0 to maximum of Birr 181,200 per annum and Birr 152,799 is the mean monetary value of assets owned by the sample households. Moreover, the sample households spent an average of Birr 51,243 per annum with a minimum of Birr 8,322 and a maximum of Birr 328,068 for different purposes such as household's food and non food expenditure. The average remittance obtained by the sample households during the year 2012/13 is about Birr 2,714 which ranges from Birr 0 to Birr 52,000. Out of the 250 sample households 148 (59.20 percent) of them own land withholding rights and the remaining 102 (40.80 percent) of them do not own land.

4.1.2. Households willingness to purchase of camel milk

In the structured questionnaire, households were asked whether they are willing to purchase camel milk had it been camel milk market in the woreda. Hence, out of the 250 sample household heads 247 (98.80 percent) are willing to purchase camel milk and only 3 (1.20 percent) of them are not willing to purchase camel milk from the hypothetical camel milk market. Those 3 respondents who are not willing to purchase camel milk, they were asked to state their reasons and respond that, 1 of them said, it is because there are better substitutes of camel milk such cow and goat milk and "I do not like camel milk". The remaining 2 respondents reasoned out that, it is not allowed to purchase camel milk from market by their tradition.

Table 4.1: Households' willingness to purchase

Willingness to purchase of households	Frequency	Percent (%)	Cum.
Do not willing to purchase	3	1.20	1.20
Willing to purchase	247	98.80	100.00
Total	250	100.00	

Source: Own survey, 2013

4.1.3. Households willingness to pay given the initial and follow up bids

In order to determine household heads willingness to pay for camel milk, they were asked their willingness to pay by giving them randomly assigned three initial bids and randomly assigned follow up bids. Hence, given the randomly assigned initial bids, out of the 247 household heads who are willing to purchase camel milk 215 (87.04 percent) of them said "yes" or they were willing to accept the initial bids and the remaining 32 (12.96 percent) said "no" or they were not willing to accept the initial bids.

Household heads willing to pay given the initial bids, the follow up bids were doubled and for those household heads that were not willing to accept the initial bids, the follow up bids were halved. Hence, given the randomly assigned follow up bids 148 (59.93 percent) household heads said "yes" or they were willing to accept the follow-up bid and 99 (40.07 percent) household heads said "no" or they were not willing to accept the follow-up bid. Therefore, this result is

consistent with the economic theory of demand, that is, as the price of the product itself increases the quantity demand of that product decreases, ceteris paribus. Given the initial bid 215 (87.04 percent) household heads were willing to accept the initial bid. However, given the follow up bid only 148 (59.93 percent) were willing to accept it, which is decreased by 27.11 percent. The result is summarized in the below table.

Table 4.2: Households' willingness to pay given the initial and follow up bids

	WTP2		
WTP1	**no**	**yes**	Total
no	0	32	32
yes	99	116	215
Total	99	148	247

Source: Own survey, 2013

4.1.4. Households' maximum willingness to pay for camel milk

Household heads were also asked an open-ended question in order to state their maximum willingness to pay for one liter of camel milk from the hypothetical camel milk market. Hence, the data showed that households' willingness to pay for one liter camel milk is positive with a minimum value of Birr 8 and maximum value of Birr 100.

As it is indicated in the third chapter of this study, according to Haab and McConnell, (2002); Hanely and Barbier, (2009) for the open-ended CV survey responses the mean than the median is an appropriate method for welfare measures because it is less affected by outliers and it is also meaningful from a political consensus viewpoint. Hence, maximum WTP of the respondents can be averaged to compute an estimate of mean WTP as follows:

$$MeanWTP = \mu = \frac{\sum MWTP_i}{n}$$

Where n = is the number of households in the sample excluding household heads with invalid response (protest zeros) and each $MWTP_i$ is a reported WTP amount by surveyed household heads.

$$n = 247,\ \sum MWTP_i = 4395$$

Hence, $MeanWTP = \mu = \frac{4395}{247} = 17.79\ \text{Birr}$

As it is stated above, the mean willingness to pay for one liter of camel milk is Birr 17.79 and the total willingness to pay is $4395\ \text{Birr}$.

4.1.5. Households preference for different types of milk

Household heads willingness to pay for camel milk can be affected by their preferred type of milk. That is, household heads may have higher willingness to pay for the most preferred type of milk and lower willingness to pay for the least preferred type of milk. Hence, from the total 250 household heads 222 (88.80 percent) prefer camel milk, 21 (8.40 percent) prefer cow milk and the remaining 7 (2.80 percent) prefer goat milk.

Table 4.3: Households preference for different types of milk

Preference	**Frequency**	**Percent (%)**	**Cum.**
Camel milk	222	88.80	88.80
Cow milk	21	8.40	97.20
Goat milk	7	2.80	100.00
Total	250	100.00	

Source: Own survey, 2013

Moreover, the sample household heads who preferred camel milk than cow and goat milk were asked to state their reason why camel milk is their preferred type and their response was because of its medicinal and nutritional value which is consistent with the findings of many researchers such as (Agrawal *et al.*, 2003; Musinga *et al.*, 2008; LPPS, 2005; Yagil, 1982). According to Musinga *et al.*, (2008) in Kenya, Somalia, Sudan and Ethiopia the demand for camel milk has rapidly increased in recent years. Camel milk is not just consumed by pastoralists but being increasingly sold in urban areas in local and international markets because of its nutritional and health benefits. The milk is believed to offer a preventive cushion over peptic ulcers; moreover, it is three times richer than cows' milk in Vitamin C. It is rich in iron, non saturated fatty acids and Vitamin B. The milk also has anti-bacterial components that suppress bacteria and pathogens

from inducing disease. Camel milk is rich in vitamin C (Knoess, 1979). Camel milk compares very favorably with human milk and this stresses the importance of camel milk for human nutrition (Yagil, 1982).

4.1.6. Why there is no camel milk market in the woreda?

As it is clearly indicated in the first chapter, in many parts of the world camel milk market is missing. Although there is a growing popularity and demand for camel milk in Western countries, for instance, most of the countries have laws that prevent the importation and sale of camel milk. In Rajasthan, India, there are traditional cultural restrictions on the sale and processing of camel milk, and it is not marketed in the core camel breeding areas, such as Bikaner, Jodhpur and Jaisalmer (Sadri, 2004).

In Ethiopia, under rain fed conditions, camels can be milked 13 kg per day (Knoess, 1979). The Afar farmers rearing cattle and camel are estimated to get an average of 1 to 1.5 litres of milk with afar zebu against 4 to 5 liters with Dankali camel (Richard and Gerard, 1985), and the region is well known for its production of camel and camel products such as camel milk and camel meat. However, the milk of the Afar camels is not allowed to be processed and sold (Dahl, 1979) cited in (Yagil, 1982).

But, why there is no camel milk market in the region and in the woreda?

In this study the potential reasons for the absence of camel milk market are discussed. Both structured questionnaire and focus group discussion (FGD) were used in order to identify the main reasons for the absence of camel milk market in the region in general and the woreda in particular.

The results from the focus group discussion (FGD) showed that, camel milk owners are not willing to sale their camel milk not because of their religion rather it is due to other reasons. The data which is obtained from the focus group discussion showed that, according to the Islamic religion camel milk is considered as superior to other types of milk and this is consistent with the findings of other researches.

According to Raziq *et al., (*2008),

> *"Camel was originally domesticated for milk. God gifted cow camel to Prophet Saleh some 3500 B.C back to drink the milk only. The camel's milk was a gift from God for the Arab Bedouins. In the Holy Quraan the true worth of the camel has been described."*
>
> *"According to Khan, (1974) cited in Raziq et al., (2008), the desert dwellers when turned to God in complaint about the climate and lack of food, God heard their pleas and came to their aid; God sent them the she camel to drink her milk and they became well."*

According to a hadith, camels and their products are generally regarded as superior to others (Gaye, n.d). Therefore, both empirical literatures and the collected data from focus group discussion showed that, religion do not prohibit the sale of camel milk rather the religion considered camel and camel products as they are superior to others and other products.

The results from the focus group discussion (FGD) also showed that, the reasons for the absence of camel milk market is not also because of the camel milk owners are not willing to sale their camel milk. That is, the unwillingness to sale of the camel milk owners is not the main or internal reason but it is the traditional (tradition) restrictions and their perception. The Afar pastoralists perceive (believe) that if they sell their camel milk, their camels will all die. As a result, the camel milk owners are not willing to sale their milk.

The data from the structured questionnaire showed that, there are different reasons for the absence of camel milk market in the region in general and the woreda in particular. Therefore, out of the 250 respondents, only 2 (0.80 percent) of them responds that the reason for the absence of camel milk market is due to lack of demand for it, that is, consumers do not want to purchase camel milk. On the other hand, 78 (31.20 percent) of the respondents answered that the main reason for the absence of camel milk market is the tradition of the Afar people since it does not encourage sale of camel milk and 53 (21.20 percent) of the respondents answered that camel milk owners are not willing to sell, only 5 (2.00 percent) of the respondents said it is because of both consumer are not willing to purchase and producers are not willing to sale. Majority or 112

(44.80 percent) of the respondents said that, there is no camel milk market because of the tradition restricts camel milk market and the camel milk owners are not willing to sell their milk. However, no one mentioned religion as one of the reason for the absence of camel milk market in the woreda.

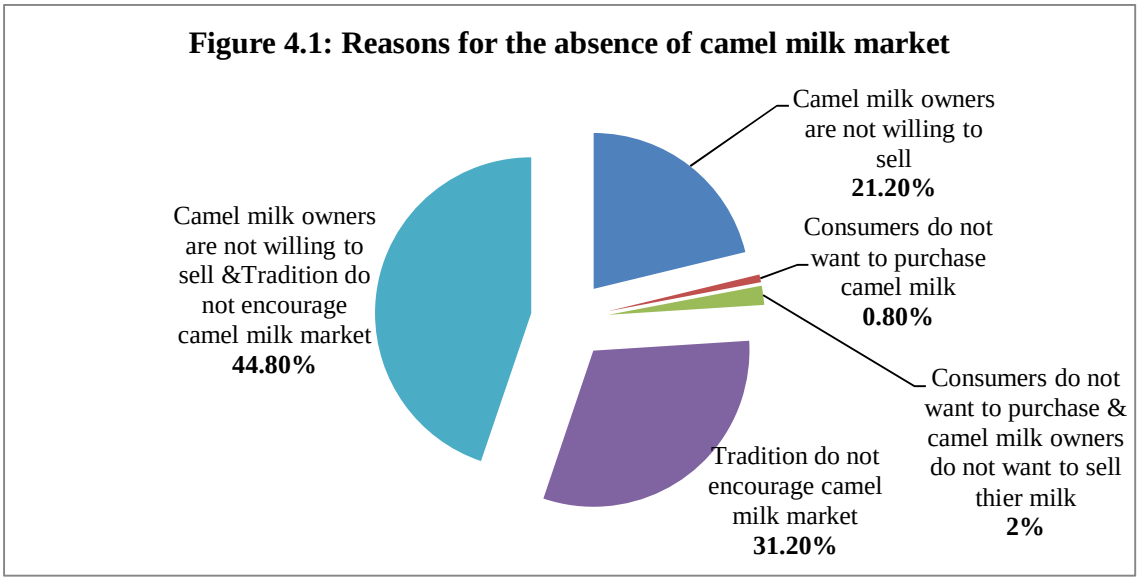
Table 4.4: The reasons for the absence of camel milk market in the woreda

Reasons for the absence of camel milk market	Frequency	Percent (%)	Cum.
Camel milk owners are not willing to sell	53	21.20	21.20
Consumers do not want to purchase camel milk	2	0.80	22.00
Both of the above	5	2.00	24.00
Tradition do not encourage camel milk market	78	31.20	55.20
Camel milk owners are not willing to sell & Tradition do not encourage camel milk market	112	44.80	100.00
Total	250	100.00	

Source: Own survey, 2013

The above statement is also depicted in the chart below, which shows that the main reasons for the absence of camel milk market in the woreda are the traditional restriction and the unwillingness to sell of camel milk owners and the tradition which does not encourage camel milk market.

Figure 4.1: Reasons for the absence of camel milk market



Source: Own survey, 2013

4.1.7. Distribution of "Yes" and "No" responses

In the double-bounded dichotomous choice model there are four possible response sequences: these are; both answers are yes (Yes-Yes); both answers are no (No-No); a yes answer followed by a no answer (Yes-No); and a no answer followed by a yes answer (No-Yes) (Haab and McConnell, 2002).

Table 4.5 Distribution of "Yes" and "No" answers

Responses	*YY*	*YN*	*%YY*	*%YN*
	NY	*NN*	*%NY*	*% NN*
Thresholds(all bids) *n*				
247	*116*	*99*	*46.96%*	*40.08%*
	32	*0*	*12.96%*	*0%*

Source: Own survey, 2013

From table 4.5 the numbers of respondents who respond "yes" to the first and "yes" to the second bid are 116. On the other hand, no one has responded "no" to the first bid and "no" to the second bid. Moreover, the number of respondents who respond "no" to the first bid and "yes" to the second bid and "yes" to the first and "no" to the second bid are 32 and 99 respectively.

4.1.8 Distribution of "Yes" and "No" answers to first and second bids

The distribution of "Yes" and "No" answers to the corresponding initial and follow up bids are given in table 4.6. There are three randomly assigned initial bids for a liter of camel milk and if the respondent accepts the first bid, the initial bid would be doubled; on the other hand, if the respondent does not accept the initial bid, the initial bid would be halved.

When the initial bid was Birr 5 per liter, all respondents who are randomly been offered this bid opted to accept it. That is, 80 out of 247 respondents were randomly offered this bid and all of them accepted the initial bid. However, when the initial bid is doubled 71 out of 80 respondents accepted it; the remaining 9 respondents did not accept the bid and none of the respondents answer "NY" and "NN". As far as the second initial bid is concerned, the second initial bid

which is randomly offered to 84 household heads is Birr 10 per liter. In this case only 32 respondents answer "YY" (yes to first and yes to the follow up bids) and none of them answer "NN" (no to first and no to the follow up bids). On the other hand, 48 of the respondents answer "YN" (yes to first bid and no to the follow up bids) and only 4 respondents answer "NY" (no to first bid and yes to the follow up bids). Regarding the third initial bid, which is Birr 15, majority (42 out of 83) respondents answer "YN" (yes to first bid and no to the follow up bids) and no one answers "NN" (no to first and no to the follow up bids). However, only 13 respondents answer "YY" (yes to first and yes to the follow up bids) and 28 of them answer "NY" (no to first and yes to the follow up bids).

Table 4.6 Distribution of "Yes" and "No" answers to first and follow up bids

Responses		YY	YN	%YY	%YN
		NY	NN	%NY	% NN
Thresholds	n				
$1^{st}(2^{nd})$					
5(10/2.5)	80	71	9	88.75 %	11.25 %
		0	0	0.00%	0.00%
10(20/5)	84	32	48	38.09%	57.14%
		4	0	4.76%	0.00%
15(30/7.5)	83	13	42	15.66%	50.60%
		28	0	33.73%	0.00%

Source: Own survey, 2013

4.2. The Econometric Analysis

In this part of the chapter, econometric method of data analysis is used to estimate the coefficients of the socio-economic and demographic variables that affect households' willingness to pay for camel milk. In order to estimate the coefficients for the socio-economic and demographic variables Tobit, Probit and Bivariate Probit models with maximum likelihood estimation method are employed. Tobit model is used in order to estimate the coefficients of independent variables for the open-ended contingent valuation questions (to estimate factors that affect households' maximum willingness to pay for camel milk). Moreover, Probit and Bivariate Probit models are also employed in order to estimate coefficients of independent variables for the single-bounded and double-bounded dichotomous choice models respectively.

When we use cross-sectional data we may encounter problem of heteroscedasticity (Greene, 2008). In order to correct the heteroscedasticity problem we can estimate the robust standard errors instead of the usual standard errors (Wooldridge, 2002). Thus, the econometric models which are used in this study are corrected for heteroscedasticity problem using the robust command in Stata and from correlation matrix (correlation coefficient analysis), it is observed that there is no multicollinearity problem among independent variables except for age and age square. Age square variable is included in order to verify the life cycle hypothesis. According to Gujarati, (2004) rule of thumb, multicollinearity is a serious problem, when a correlation coefficient between two independent variables is greater than or equal to 0.8. Therefore, from correlation matrix generated using the survey data it is shown that there is no series multicollinearity problem in this study. Detail explanation on the correlation between the independent variables is available in Appendix IV.

In this section, the results obtained using the three models is presented and discussed. First, the result of Tobit model is discussed and next the Probit and Bivariate Probit models are presented and discussed.

4.2.1. Tobit Model Results and Discussion

In table 4.7 the result for Tobit estimates of maximum willingness to pay for camel milk is presented. As it is clearly shown in the table below, the null hypothesis which says the coefficients of all independent variables including the constant term are equal to zero is rejected even at 1 percent level of significance since the P-Value (*Prob > F*) is equal to 0.0000. Hence, this implies that the model is overall significant.

Interpretation of the Tobit coefficients depends on whether one is concerned with the marginal effect of the independent variables on the latent variable, observed dependent variable and the uncensored observed dependent variable. In this study the researcher is interested to understand the determinants of actual maximum willingness to pay of the respondents. Therefore, out of the four marginal effects (marginal effect on the latent variable, actual variable, conditional on being uncensored and on the probability, that an observation is uncensored) the marginal effect on the actual variable is used in this study. The marginal effect results are given in Appendix VI.

As reported in table 4.7, log-transformed household income positively and significantly affects households' maximum willingness to pay for camel milk. Coefficient of the variable has the expected sign and is consistent with the general demand theory which says, there is a positive relationship between income and quantity demanded in the case of normal goods and there is negative relationship in the case of inferior goods and it is also in line with the results obtained by Gossaye, (2007); Aklilu, (2002); Medhin, (2006); Martha, (2003); Brima, (2003); Yibeltal, (2011), who did find a positive and statistically significant relationship between households' income and their willingness to pay. Other things remain constant, as income of the household increases by 1 percent the predicted value of households' maximum willingness to pay for camel milk increases by 0.85 Birr.

The parameter estimate for remittance is also significant and has the expected sign. It affects households' maximum willingness to pay for camel milk positively and significantly. The positive relationship between remittance and households' maximum willingness to pay for camel milk may be through the impact of remittance on the households' ability to pay for camel milk. That is, households' who obtained remittance either from abroad or from domestic sources can

afford purchase of camel milk and hence, they may be willing to pay higher price than those who did not obtain remittance. As reported in table 4.7, as remittance obtained by the household increases by 1 percent the predicted value of households' maximum willingness to pay for camel milk increases by 0.36 Birr, holding other independent variables constant.

Age of the household head has a positive and significant effect on the maximum willingness to pay for camel milk. Hence, ceteris paribus, one year increase in the age of the household head increases the predicted value of households' maximum willingness to pay by 0.294 Birr. This result is consistent with the expected sign and with the finding of (Brima, 2003). But, it is not in line with the findings of (Yibeltal, 2011; Medhin, 2006; Aklilu, 2002; Gossaye, 2007).

Due to the absence of unidirectional relationship between age of the household heads and their maximum willingness to pay let us check whether there is linear or non linear (for instance, an inverted "U" shaped relationship as a result of the life cycle hypothesis) relationship using another independent variable age square.

Age square is another main determinant variable of households' maximum willingness to pay for camel milk. The age square variable is included to verify whether the life-cycle hypothesis is valid or not in this study. According to the life-cycle hypothesis individuals have an income which is relatively low at the beginning and end of their life, when their productivity is low and earned high income during the middle years of their life, when their productivity is high (Branson, 2006). Therefore, as reported in table 4.7, in line with the expectation, age square affects households' maximum willingness to pay negatively and significantly. This result is also in line with the finding of Brima, (2003) and corroborates the life cycle hypothesis. This implies that household heads found in the middle age are more willing to pay than the very young and old age household heads and this may be related to the productivity of the household heads. Household heads found in the middle age are more productive than the very young and old age ones. Consequently, the middle age household heads earn higher income and as a result, their maximum willingness to pay tends to be higher than the young and old age ones. Thus, as age square of the household head increases by one year the predicted value of households' maximum willingness to pay decreases by 0.003 Birr, keeping other things constant.

The initial bid (Bid1) is included in order to test the existence of starting point bias. It is found that, the initial bid has a positive effect on the households' maximum WTP for camel milk and it is statistically significant even at 1 percent level of significance. This implies that households' willingness to pay amount is upwardly biased. This result is in line with the finding of (Gossaye, 2007).

Land ownership of the household, as it is expected, has positive sign. But, this result is statistically insignificant. The sign of sex variable is negative as it is hypothesized. The sign of the sex variable implies that, male headed households have higher willingness to pay than female headed households. However, this result is statistically insignificant even at 10 percent level of significance.

Family size adjusted to adult equivalent and adult ratio which is the ratio of adult male to adult female have the expected negative sign. These variables are, however, statistically insignificant. Education level of the household head is also another statistically insignificant variable with the unexpected negative sign. The negative sign of the coefficient of this variable indicates that, household heads with higher level of education have lower maximum willingness to pay than the household heads either with lower level of education or household heads who are illiterate or both. However, as it is already stated in the above statement the coefficient of this variable is not statistically significant.

Table 4.7: Tobit Estimates of Maximum Willingness to Pay for camel milk

			Unconditional Expected Value	
Variable	Coef	P>|z|	dF/dx	P>|z|
lnincomehh	.8485956*	0.066	.8448549	0.065
	(.4598385)		(.4577)	
lnremittance	.364167***	0.007	.3625617	0.006
	(.1334302)		(.13282)	
famsize	-.1167314	0.624	-.1162169	0.623
	(.2374825)		(.23648)	
sexhh	-1.445593	0.182	-1.43766	0.181
	(1.080513)		(1.07379)	
agehh	.295313**	0.034	.2940113	0.033
	(.1387591)		(.13814)	
age2	-.0029195**	0.013	-.0029066	0.012
	(.0011608)		(.00116)	
educhh	-.0293881	0.980	-.0292584	0.980
	(1.159338)		(1.15422)	
Bid1	.4411978***	0.000	.439253	0.000
	(.1123441)		(.11177)	
ownland	1.555184	0.107	1.548624	0.106
	(.9610046)		(.95692)	
adul_ratio	-.2110696	0.606	-.2101392	0.605
	(.4086518)		(.40682)	
_cons	-1.223401	0.806		
	(4.967903)			

Number of obs = 221

F(10, 211) = 4.76

Prob > F = 0.0000

Pseudo R^2 = 0.0288

Source: own survey, 2013 ***, ** &* Statistically Significant at **1%**, **5%** and**10%** respectively

Figures in parenthesis are ***Standard Errors***

According to Haab and McConnell, (2002), for the open-ended contingent valuation survey responses the mean measure is an appropriate method for welfare measures.[5]

4.2.2. Probit Model Results and Discussions

As stated in the introductory part of this section, the probit model is also employed in order to analyze the factors that affect households' willingness to pay for camel milk given a randomly assigned initial bid for the single-bounded dichotomous choice questions. The probit model is corrected for the problem of multicollinearity. From the correlation matrix (correlation coefficient analysis) it is observed that there is no serious multicollinearity problem among independent variables. The probit model is also corrected for the heteroscedasticity problem using the robust command in Stata (robust standard errors are estimated).

The Probit estimates of households' willingness to pay for camel milk result is obtained using Stata10 and it is given in table 4.8. From the probit estimates it is possible to interpret the coefficients of the independent variables based on the sign and significance level of those coefficients in determining households' willingness to pay for camel milk. That is, the coefficients of the probit model give only the significance and the direction (sign) of the effect of independent variables on the households' probability of accepting the randomly offered bid.

The dependent variable in this case is households' willingness to pay for one liter of camel milk when its price is Bid1 (bid which is randomly assigned to the sample households). This variable is a dummy variable which takes the value of 1 if the respondent is willing to accept the randomly offered bid and 0 otherwise.

The result for the probit estimates of households' probability of accepting the randomly offered bid is presented in table 4.8. At the bottom of table 4.8 we see that 221 observations in the data set were used in the analysis. The Pseudo R^2 is the measure of goodness of fit, which is 0.3956. This implies that 39.56 percent of the variation in the households' probability of accepting the randomly offered bid is explained by the independent variables in the model. The Wald chi2

[5] The mean measure which is an appropriate method for welfare measures for the open-ended contingent valuation survey responses is already computed and given in the descriptive analysis part of this chapter, in page 50 and it is about 17.79 Birr.

(10) 48.86 with a p-value (Prob > chi2) 0.0000 tells us the probit model as a whole is statistically significant, as compared to the model with no predictors. The hypothesis that all the coefficients of the independent variables are simultaneously equal to zero that is, none of these potential factors affect households' probability of accepting the randomly offered bid for camel milk is rejected even at 1 percent level of significance.

As reported in table 4.8, the coefficient for the log-transformed income is significant at the 5 percent level and has the expected positive sign. The results intuitively suggest that household income has a positive effect on the probability of accepting the randomly offered bid. That is, households with higher income are more willing to accept the bid than households with lower income. This result confirms the general demand theory which says, there is a positive relationship between income and quantity demanded in the case of normal goods and negative relationship in the case of inferior goods and this result is the same as the result obtained in the Tobit model. This result is also in line with the findings of (Tilahun *et al*., 2013; Brima, 2003; Yibeltal, 2011).

The parameter estimate for the log- transformed remittance is significant and has the expected positive sign. It affects households' probability of accepting the randomly offered bid positively and significantly. That is, households' who obtained remittance are willing to pay higher price than those who did not obtain remittance.

Age of the household head affects households' decision whether to accept the randomly offered bid or not positively and it is statistically significant even at 1 percent level of significance. This implies that, as age of the household head increases, the probability of accepting the randomly offered bid also increases. This result is in line with the finding of Brima, (2003), however, it is not consistent with the findings of (Gossaye, 2007; Aklilu, 2002; Gebrelibanos and Edriss, 2012; Solomon, 2004).

Another determinant of households' probability of accepting the randomly offered bid is age square of the household head. As presented in table 4.8, age square of the household head negatively affects households' probability of accepting the randomly offered bid for camel milk

and this effect is statistically significant even at 1 percent level of significance. This result confirms the life-cycle hypothesis and it is also consistent with the finding of (Brima, 2003).

Education level of the household head is statistically significant with the expected positive sign. The positive sign of the coefficient of this variable indicates that, more educated household heads may have more knowledge and awareness about the economic and health benefits of camel milk and literate household heads are more willing to (accept the bid) pay for camel milk than illiterate household heads. This result is consistent with the findings of (Gebrelibanos and Edriss, 2012; Tilahun *et al*., 2013; Brima, 2003; Gossaye, 2007; Yibeltal, 2011).

The amount of a randomly offered bid to each household has a negative and statistically significant effect on the households' probability of accepting the randomly assigned bid. In line with the economic theory of demand (the higher is the bid; the less likely households would be willing to pay) and as it is expected, it has a negative effect on the households' probability of accepting the randomly assigned bid. The result is also consistent with the findings of (Tilahun *et al.*, 2012; Gebrelibanos and Edriss, 2012).

Adult ratio is the ratio of adult male to adult female. As reported in table 4.8, households' with high adult ratio have lower probability of accepting the randomly offered bid than those households' with low adult ratio. The coefficient of this variable is statistically significant (at 5 percent level of significance). This may be due to the fact that in pastoral areas females are more responsible for most of the works and they may be the main source of income for the household. Therefore, households with low adult ratio implies that there are more adult female members relative to adult male members in the household and this may induce the households to be more willing to accept the randomly offered bid.

As it is shown in table 4.8, the land ownership variable has a positive but statistically insignificant effect on the households' probability of accepting the randomly offered bid. The sign of family size is positive, which is not the same as the expected sign and the variable sex of the household head has a negative sign as it is expected. However, both of those variables are also statistically insignificant even at 10 percent level of significance.

Table 4.8: Probit Estimates of Willingness to Pay for camel milk

			Marginal effect	
Variable	Coef	P>|z|	dF/dx	P>|z|
lnincomehh	.2775299*	0.057	.0138153	0.057
	(.1459164)		(.0092926)	
lnremittance	.1069086*	0.064	.0053219	0.064
	(.0578183)		(.0038721)	
famsize	.0352217	0.672	.0017533	0.672
	(.0832732)		(.0040042)	
sexhh	-.4039628	0.283	-.0262242	0.283
	(.3763361)		(.0351099)	
agehh	.1326656***	0.002	.006604	0.002
	(.0432669)		(.0036863)	
age2	-.0011767***	0.001	-.0000586	0.001
	(.0003674)		(.000032)	
educhh	.6291706*	0.059	.0294758	0.059
	(.3328379)		(.0200142)	
Bid1	-.2876709***	0.000	-.0143201	0.000
	(.0538829)		(.0054574)	
ownland	.4693767	0.157	.0221079	0.157
	(.3319035)		(.0159592)	
adul_ratio	-.2989663**	0.017	-.0148824	0.017
	(.1252236)		(.008888)	
_cons	-.9555023	0.535		
	(1.541429)			

Number of obs = 221 *McFadden's R2: 0.396*
Wald chi2(9) = 48.86 *Maximum Likelihood R^2: 0.265*
Prob > chi2 = 0.0000 *AIC: 0.569*
Pseudo R^2 = 0.3956 *BIC: -1029.782*
McKelvey and Zavoina's R^2: 0.691 *BIC': -13.993*

Source: own survey, 2013 ***, ** &* Statistically Significant at **1%**, **5%** and**10%** respectively
Figures in parenthesis are ***Standard Errors***

4.2.3. Marginal Effects After Probit

As it is already discussed in section 4.2.2, from the probit estimates it is easy and possible to interpret the coefficients of the independent variables based on the sign and significance level of those coefficients. That is, the coefficients of the probit model only give the significance and sign of effect of independent variables on the dependent variable. The magnitude interpretation of the probit model coefficients is not as simple as the magnitude interpretation of coefficients obtained via OLS method and the coefficients from the probit model are difficult to interpret because they measure the change in the unobservable variable associated with a change in one of the independent variables. Hence, a more useful measure is what we call the marginal effects.

According to Cameron and Trivedi, (2005), in the statistics literature, a very common interpretation of the probit model coefficients is in terms of marginal effects. Therefore, the marginal effects after probit model are given in table 4.8.

One of the fundamental determinants of households' decision to accept the randomly offered bid or not is income of the household. The marginal effect estimates of table 4.8 shows that keeping other factors constant, a 1 percent increase in the income of the household, increases households' probability of accepting the randomly offered bid by 1.38 percent. As reported in table 4.8, the marginal effect showed that, other things remain constant, a 1 percent increase in the remittance obtained by the household, increases households' probability of accepting the randomly offered bid by 0.53 percent.

The marginal effect estimates showed that, ceteris paribus, one year increases in the age of the household head leads to an increase in the probability of saying "yes" or accepting the randomly offered bid by 0.66 percent. The variable age square is also another determinant variable with negative sign. Thus, as age square increases by one year, households' probability accepting the randomly offered bid decreases by .006 percent, holding other independent variables constant.

The initial bid (Bid1) has a negative sign and it is also statistically significant (at 1 percent level of significance). When the initial bid (Bid1) increases by one Birr, the probability accepting the initial bid decreases by 1.43 percent, holding other things constant.

When we compare the probability of accepting the randomly offered bid between illiterate and literate households, the later are more willing to accept the randomly offered bid than the formers. Ceteris paribus, the probability of accepting the randomly offered bid by the literate household heads is 2.95 percent higher than the illiterate household heads.

As reported in table 4.8, the marginal effect showed that, when adult ratio of the household increases by one unit the probability of accepting the randomly offered bid decreases by 1.49 percent.

The variables such as family size (adjusted for adult equivalence), sex of the household head and land ownership with holding rights are statistically insignificant even at 10 percent level of significance.

4.2.4. Bivariate Probit Model Results and Discussions

In this study, sample households were asked a double-bounded dichotomous choice question in addition to the open-ended and single-bounded dichotomous questions. The main objective of using double-bounded dichotomous choice model is, in many theoretical and empirical literatures, the double-bounded dichotomous choice model increases efficiency in comparison to single-bounded dichotomous choice model. According to Haab and McConnell, (2002), the double-bounded dichotomous choice models increase efficiency when it is compared to single-bounded dichotomous choice models because the answer sequences yes-no or no-yes yield clear bounds on willingness to pay, there are also efficiency gains for the no-no, yes-yes pairs and since there is an increase in the number of responses then this enhances the fitness of a given function. In the double-bounded dichotomous choice model households were asked first the initial bid and based on their initial responses, they were given new prices, lower (halved) if their initial responses were no, higher (doubled) if their responses were yes.

Therefore, since there are two dependent variables in this case then it is possible to apply the bivariate probit model. The bivariate probit model is a natural extension of the probit model that allows more than one equation, with correlated error terms and this model is interesting in its own right for modeling the joint determination of two variables (Greene, 2012).

In order to apply the bivariate probit model, first we have to check whether the correlation between the two error terms ('rho', ρ) is different from zero or not. If the correlation between the two error terms is different from zero we can employ the bivariate probit model. Therefore, in this study, the bivariate probit model is employed because, as it is clearly shown in table 4.9, the 'rho' (ρ), the correlation coefficient of the two error terms is different from zero which is -0.997 and this correlation is statistically significant even at 1 percent level of significance. Moreover, the correlation coefficient of the two error terms is close to one and it implies that the error term of willingness to pay for the first question is almost perfectly correlated with the error term of willingness to pay for the follow-up question.

The *Wald chi2 (4) 82.45* with a p-value (*Prob > chi2) 0.0000* tells us that the probit model as a whole is statistically significant, as compared to the model with no predictors.

In table 4.9, the randomly offered initial bid (Bid1) affects the households' probability of accepting the initial bid negatively and significantly (at 1 percent level of significance) as in the probit model. This implies that, as the initial bid which is randomly offered to the households increases by one Birr, the probability of accepting that bid decreases by 20.6 percent, ceteris paribus. The randomly offered follow-up bid (Bid2) has also a negative and statistically significant (at 1 percent level of significance) effect on the households' probability of saying "yes" or accepting the bid. Hence, other things remain constant, as the follow-up bid randomly offered to the households increases by one birr the probability of accepting that bid decreases by 10.34 percent.

Table 4.9: Bivariate Estimates of the Double Bounded Dichotomous Choice Format

Variable	Coef.	P>|z|
WTP1		
Bid1	-0.206***	0.000
	(0.036)	
_cons	3.689***	0.000
	(0.505)	
WTP2		
Bid2	-0.1034***	0.000
	(0.0197)	
_cons	1.356***	0.000
	(0.230)	
athrho	-3.353***	0.000
	(0.493)	
rho(ρ)	*-0.997*	
	(0.002)	

Wald test of rho=0: chi2 (1) = 46.1381 Prob > chi2 = 0.0000

Number of obs = 247
Wald chi2(2) = 82.45
Prob > chi2 = 0.0000

Source: own survey, 2013 ***, Statistically Significant at **1%** level of significance
Figures in parenthesis are ***Robust Standard Errors***

4.2.5. Single-Bounded Versus Double-Bounded Dichotomous Choice Models Estimates

Theoretically and empirically, double-bounded dichotomous choice (DBDC) models are found to be more efficient than the single-bounded dichotomous choice (SBDC) models. The double-bounded dichotomous choice models increase efficiency when compare to single-bounded dichotomous choice models (Carson *et al.*, 1986; Haab and McConnell, 2002; Hanemann and Kanninen, 1998; Hanemann *et al.*, 1991; Ahmed and Gotoh, 2006; Whitehead, 2000; Weldesilassie *et al.*, 2009).

On the other hand, it is also found that the DBDC models do not increase statistical efficiency when it is compared with the SBDC models (Yibeltal, 2011). In this study, the SBDC model was estimated using probit model and the DBDC model was also estimated using the bivariate probit model. Thus, the estimated result for the two models is given in table 4.10.

Table 4.10 Comparison of Probit and Bivariate Probit estimates of households' WTP for camel milk

WTP1	**Probit Model**			**Bivariate Probit Model**		
	Coef.	Robust Std. Err.	P>|z|	Coef.	Robust Std. Err.	P>|z|
Bid1	-.2590397***	.0459288	0.000	-.2047082***	.0360218	0.000
_cons	4.298207***	.6310378	0.000	3.665008***	.4974224	0.000
	Number of obs = 247 Wald chi2(1) = 31.81 Prob > chi2 = 0.0000 Pseudo R^2 = 0.2727			Number of obs = 247 Wald chi2(2) = 81.36 Prob > chi2 = 0.0000		

Source: Own survey, 2013 ***, Statistically Significant at **1%** level of significance

In a finite sample, we can verify whether DBDC model has an efficiency gain over the SBDC model using (a) the precision of the estimates of the coefficients of the constant term and the randomly offered bid (b) the goodness of fit of the estimated willingness to pay model (c) the precision of the estimates of welfare measures derived from the underlying coefficient estimates (Hanemann *et al.*, 1991).

In table 4.10 it is clearly put that, following the (Hanemann *et al.*, 1991) verifying methods of the gains in statistical efficiency of the DBDC model over the SBDC model, there are no efficiency gains of using DBDC model over the SBDC model. That is, the coefficient of the bid and the constant term of both models are statistically significant at 1 percent level of significance and the standard errors of the bid and the constant term of both models are also approximately the same. Moreover, the two models have almost approximately the same value of z- statistics. This result is consistent with the finding of (Yibeltal, 2011). Therefore, the bivariate probit model estimates (DBDC model) instead of the probit model estimates (SBDC model) was used to calculate the mean willingness to pay of households' for camel milk and the results for the mean willingness to pay for camel milk is given below.

To calculate the mean willingness to pay (Mean WTP) from bivariate probit model the formula which was developed by Haab and McConnell, (2002) is adopted.

$$MeanWTP = \mu = \frac{-\alpha}{\beta}$$

Where α = is the constant or intercept term

β = is the coefficient of the 'bid' posed to the respondent

Thus, the mean WTP using the coefficient of the initial bid and the first constant term is given as follows;

$$MeanWTP_1 = \mu_1 = \frac{-\alpha_1}{\beta_1}$$

$$MeanWTP_1 = \mu_1 = \frac{-3.6893}{-.2064473}$$

$$MeanWTP_1 = \mu_1 = 18.87 \quad \text{Birr per liter}$$

The mean WTP using the coefficients of the second or follow-up bid and the second constant term is also given as follows;

$$MeanWTP_2 = \mu_2 = \frac{-\alpha_2}{\beta_2}$$

$$MeanWTP_2 = \mu_2 = \frac{-1.356406}{-.1034572}$$

$$MeanWTP_2 = \mu_2 = 13.11 \quad \text{Birr per liter}$$

Following Gebrelibanos and Edriss, (2012), the mean WTP for camel milk using the coefficients of the bivariate probit model is given as the mean (average) WTP from the coefficients of the first bid and constant term and the follow-up bid and constant term.

$$MeanWTP = \mu = \frac{MeanWTP_1 + MeanWTP_2}{2} = \frac{\mu_1 + \mu_2}{2}$$

$$MeanWTP = \mu = \frac{18.87 + 13.11}{2}$$

$$MeanWTP = \mu = \frac{31.98}{2}$$

$$MeanWTP = \mu = 15.99 \quad \text{Birr per liter}$$

Generally, using the coefficients of the bid and the constant term in table 4.9, the mean willingness to pay for camel milk from the bivariate probit model estimate (double-bounded probit estimate) was estimated using the above formula to be 15.99 Birr per liter per household and the mean WTP varies between 13.11 Birr to 18.87 Birr per liter per household.

Hence, when the mean willingness to pay from the open-ended and the close-ended questions (single-bounded dichotomous choice format and double-bounded dichotomous choice format) are compared, the mean willingness to pay of the open-ended, which is 17.79 Birr per liter, is greater than the mean willingness to pay of close-ended questions, which is 15.99 Birr per liter.

4.3. Estimating Aggregate Willingness to Pay and Aggregate Economic Benefits

In the preceding section of this chapter, the discussion was on the determinants of households' willingness to pay for camel milk.

Now, the turn is to estimate the aggregate willingness to pay, aggregate revenue and deriving the demand curve. In order to estimate the aggregate willingness to pay first we have to determine the willingness to pay interval (Birr per liter) and mid points of willingness to pay. Next, we have to compute the number of sample households. In this case, we have to have enough information about the number of households with valid responses and the protest zeros (invalid responses). Finally, the number of total households should be determined.

As indicated in the methodology part, according to CSA, (2007), Aba'ala woreda has a population of 37,963 (6,878 households) consisting of 10,301 (2,396 households) urban inhabitants and 27,662 (4482 households) rural inhabitants. The study area which is the major town of Aba'ala woreda has a total population of 10,301 (2,396 households) and about 80 percent (2,396*0.80 which is equals to 1917 households) of the populations in the area are Muslims.

In the study, out of the total 250 sample households there were only 3 (1.2 percent) protest zeros and there were 247 (98.80 percent) valid responses. Based on this information, the total expected number of protest zeros is computed by multiplying the total number of households in the study

area and the percentage share of protest zeros in the sample, that is, 1.2 percent *1917 which is equal to 23 households and those households are excluded from further analysis. On the other hand, the total number of valid responses is calculated by multiplying the percentage share of valid responses in the sample, that is, 98.80 percent*1917 which is equal to 1894 households and those households are included in the study for further analysis. The grand total willingness to pay in column (5) is equals to 30,618.19 Birr. As it is shown in table 4.11, as mid points of willingness to pay in column (2) increases, the total number of households who are willing to pay at these corresponding mid points in column (9) decreases.

Table 4.11 Aggregate Willingness to Pay and Aggregate Economic Benefits of Camel Milk

WTP Interval (Birr per liter **(1)**	Mid points of WTP[6] **(2)**	Sample Households		Total number of households [7] **(4)**	Total WTP (in Birr)[8] **(5)**	Sample households WTP at least that amount		Total households WTP at least that amount[9] **(7)**	Total revenue (in Birr)[10] **(8)**
		Freq.	Percent**(3)**			Freq.	Percent**(6)**		
0-15	7.5	129	52.23	989.24	7,419.30	247	100	1894.00	14,205.00
16-30	23	104	42.1	797.37	18,339.51	118	47.77	904.76	20,809.48
31-45	38	9	3.65	69.13	2,626.94	14	5.67	107.39	4,080.82
46-60	53	4	1.62	30.68	1,626.04	5	2.02	38.26	2,027.78
60-100	80	1	0.40	7.58	606.40	1	0.40	7.58	606.40
Total		**247**	**100**	**1894.00**	**30,618.19**				

Source: Own survey, 2013

The grand total willingness to pay in column (5) which is equals to (30,618.19 Birr) is obtained by summing up total willingness to pay at each mid points of willingness to pay.

[6] Is computed from (1) by summing the first and the second values and divide by two, for instance, $\frac{0+15}{2} = 7.5$

[7] Is also computed by multiplying (3) and (1894) , for instance, $0.5223*1894 = 989.24$

[8] Is computed $(5) = (2)*(4)$

[9] Total households WTP at least that amount is calculated as $(7) = (6)*1894$

[10] Aggregate revenue is computed as $(8) = (2)*(7)$

From the below table 4.12, using the mean willingness to pay obtained from the open-ended questions the aggregate economic benefit is estimated. From the Tobit model it is found that the mean willingness to pay was 17.79 and the aggregate economic benefit is computed by multiplying the mean willingness to pay and the expected households with valid responses.

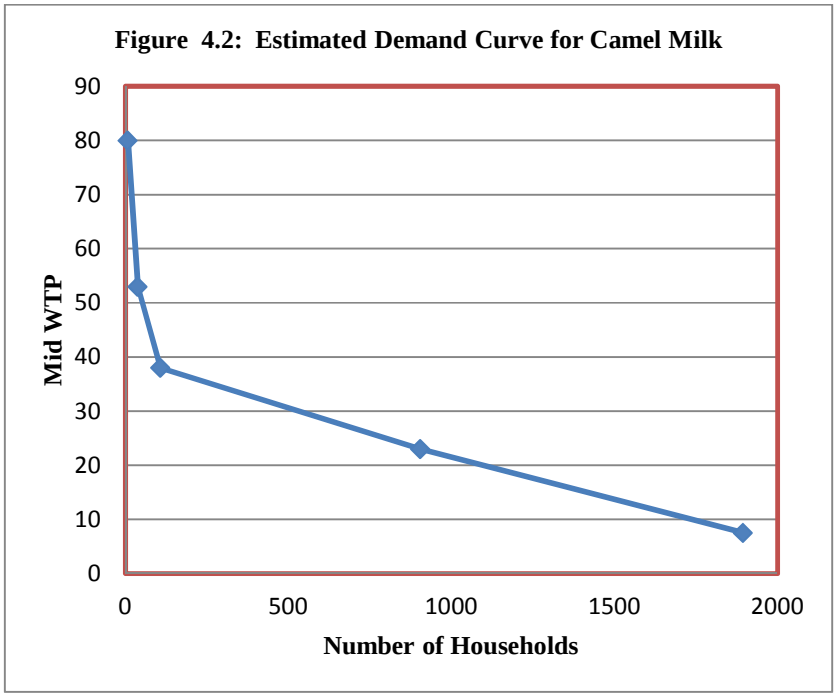
Table 4.12 Aggregate Willingness to Pay and Aggregate Economic Benefits of Camel Milk (Open-Ended)

Total number[11] of households	Expected HHs[12] to have a protest Zeros	Expected HHs[13] with valid responses	Mean WTP[14]	Aggregate[15] benefit
1917	23	1894	17.79	33,694.26

Source: Own survey, 2013

Besides the estimation of aggregate willingness to pay and aggregate economic benefit, the last and very crucial point in this section is deriving the demand curve. The demand curve for camel milk is derived from table 4.11. As it is clearly depicted in figure 4.2, the demand curve is derived with mid bid point willingness to pay on the vertical axis and number of households with valid response in the woreda on the horizontal axis. Therefore, as it is shown in figure 4.2 the demand curve for camel milk, in line with the economic theory of demand, it is downward sloping and convex to the origin. This implies an increase in the price of camel milk decreases the quantity demand for camel milk, ceteris paribus.

[11] is the total number of households
[12] Expected HHs to have a protest Zeros 23 = 1917*0.012
[13] Expected HHs with valid responses 1894 = 1917*0.988
[14] $MeanWTP = \mu = \frac{\sum MWTP_i}{n}$ from the Tobit model
[15] Aggregate benefit 33,694.26=17.79*1894



4.4. How much money the camel milk producers would obtain had it been camel milk market in the woreda?

The researcher could not find the per-capita milk consumption of each region in the country. However, according to Werner Daniel and Zamsky Joseph, (2007) per-capita milk consumption in Ethiopia is 19.2 kg or about 19.8 litres. The study area has a total population of 10,301 (2396 households) with an average 4.30 persons per household (CSA, 2007). Out of the total population more than 80 percent are Muslims, that is, 0.80 *10301 is approximately equal to 8241. Of the 250 total sample households 98.80 percent of them are valid responses and we can use this figure to compute the total number of valid responses from the 8241 Muslim population. Hence, 0.988*8241 is equal to 8142 of the total Muslim population found in the woreda are actually willing to purchase camel milk had it been camel milk market in the woreda. If we assume the per-capita milk consumption is at least equals to the country's per-capita milk consumption then, the total amount of money that would be obtained by the camel milk producers is 19.80*17.79*8142 is equal to Birr 2,867,954.364 per year.

4.5. Checking for Validity Tests

According to Hanely and Barbier (2009), one of the most important questions from a policy perspective in the use of contingent valuation method is, on how good are the contingent valuation method estimates. Therefore, in order to check the validity of the contingent valuation method estimates several validity tests have emerged. Some of the validity tests that can be adapted to this study are discussed as follows.

i. **Convergent validity:** is a test for whether the hypothetical willingness to pay for a given product estimated using contingent valuation method is significantly different from willingness to pay for the product using some other technique. In this study only a contingnet valuation method is used. But, different elicitation methods such as open ended, single bounded dichotomous choice model and double bounded dichotomous choice models are employed in this study. The price of camel milk obtained by the three elicitation methods, open ended, single bounded dichotomous choice model and double bounded dichotomous choice models are almost equal, which are 17.79, 16.59 and 15.99 Birr respectively. Moreover, The results from result from both econometric and descriptive analysis are also almost equal.

ii. **Calibration factor**: is also another vital validity test since it addresses one of the fundamental weakness of contingnet valuation method. In the contingnet valuation method we ask hypothetical prices, not the real ones. Therefore, a calibration factor should be calculated by comparing a willingness to pay value obtained from a contingnet valuation survey with a comparable real willingness to pay value. As it is already stated in the first chapter of this research there is camel milk market in the Somila Regional state. Sisay, (2013) found that the price of camel milk in Dire Dawa, Harar, Jigjiga, Babilie and Kebribeyah during wet and dry seasons are 18 and 22, 16 and 18, 20 and 22, 13 and 15 Birr respectively. In this study, using the contingnet valuation method, the prices of camel milk are found to be 17.79 Birr from the open ended question and an average price of 15.99 Birr from the dichotomouse question with a minimum of 13.11 Birr and a maximum price of 18.87 Birr. Moreover, Aba'ala woreda in every aspect is comparable not with Dire Dawa, Harar and Jigjiga but, with Babilie and Kebribeyah.

Therefore, the hypothetical willingness to pay found in this study and the real willingness to pay (real prices) are almost the same. As a result, we can say that, the contingent valuation method estimates of this study have satisfied the caliberation factor validity test.

iii. **Protest rates:** are another indicator of the quality of a contingent valuation method survey. The threshold protest rate is 40 percent. However, a protest rate of over 40 percent indicates that there is something wrong with the design of contingent valuation method survey. In this study, a face to face interwiew was used. As a result, the response rate were very high. Of the 250 respondets only 3 respondnets were not willing to purchase the camel milk had it been camel milk market in the woreda. On the other hand, the remainder 247 or 98.8 percent of the respondents were willing to purchase camel milk from the hypothetical camel milk market. Moreover, the willing respondents' minimum willingness to pay is 8 Birr. Therefore, since the protest rates (1.2 percent) are very far away from the 40 percent threshold level, the contingent valuation method has almost no problem with the validity test.

iv. **Construct validity:** asks whether the effect (sign and significance level) of factors that affect the hypothetical willingness to pay is consistent with the priori and theoretical expectations. Therefore, inline with the prior expectation and economic theory of demand income of the household affects respondents willingness to pay positively and significantly. The randomly assigned bid negatively and significantly affect the probability of saying "yes". This result is also consistent with prior expectation and law of demand since the law of demand tells us, ceteris paribus, there is negative relationship between price of the product and its corrosponding quantity demanded. As expected, the variable education status of the respondents has a positive and significant effect on the probability of accepting the randomly assigned bid. That is, literate respondents have higher willingness to pay than the illiterate respondents. The coefficients of other factors that affect willingness to pay have also the expected sign. Hence, the construct validity test is also satisfied in this study.

CHAPTER FIVE

5. CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1. Conclusions

To estimate Households Willingness to Pay for Camel Milk in Aba'ala woreda using contingent valuation method, both descriptive and econometric method of data analysis were used. Three econometric models were employed; Tobit, Probit and Bivariate Probit.

The result from the Tobit model revealed that households' income, remittance, age and the randomly offered bid positively and significantly affects households' maximum willingness to pay for camel milk. On the other hand, age square of the household head negatively and significantly affects households' maximum willingness to pay for camel milk and it confirms the life cycle hypothesis.

In the probit model, income, remittance, age of the household head and education level of the household head positively and significantly affects the probability of accepting the randomly offered bid by the sample households. On the other hand, age square, the randomly offered bid and adult ratio negatively and significantly affects the probability of saying "yes".

Finally, in the Bivariate Probit model result, initial bid (Bid1) was found to have a negative and significant effect on the households' probability of accepting that bid. This implies that, as the initial bid randomly offered to the households increases, the probability of accepting that bid decreases. The randomly offered follow-up bid (Bid2) has also a negative and statistically significant effect on the households' probability of saying "yes" or accepting the follow-up bid (Bid2).

The results from double-bounded and single-bounded dichotomous choice models were also compared in order to check whether the former has statistical efficiency gain over the later or not. Thus, from the results it is observed that the double-bounded dichotomous choice model does not have statistical efficiency gain over the single-bounded dichotomous choice model. In this study, the mean willingness to pay per liter of camel milk from the open-ended questions

and dichotomous choice questions were computed. Therefore, the mean willingness to pay for camel milk from the open-ended question was Birr 17.79 per liter. On the other hand, the mean willingness to pay for camel milk from dichotomous questions was Birr 15.99 per liter. Thus, in this study, the mean willingness to pay for camel milk from open-ended questions is greater than the dichotomous choice questions.

The last but very crucial objective of the study was to estimate the aggregate economic benefit of camel milk using households' willingness to pay. In the study, out of the total 250 sample households there were only 3 (1.2 percent) protest zeros or invalid responses and 247 (98.80 percent) valid responses. Based on this information, the total expected number of protest zeros is equal to 23 households and those households are excluded from further analysis. On the other hand, the total number of valid responses is equal to 1894 households and those households are included in the study for further analysis and both of them constitutes 1917 total number of household. Based on this information, the aggregate economic benefit from the dichotomous choice model is equals to Birr 30,618.19 per liter of camel milk and the aggregate economic benefit from the open-ended question is about Birr 33,694.26 per liter of camel milk.

The demand curve for camel milk is derived from aggregate willingness to pay and the aggregate economic benefit. Thus, the demand curve is derived with mid bid point willingness to pay on the vertical axis and number of households with valid response in the woreda on the horizontal axis. Therefore, in line with the theory of demand, the demand curve for camel milk is downward sloping and convex to the origin. This implies an increase in the price of camel milk decreases the quantity demand for camel milk, ceteris paribus.

5.2. Policy Recommendations

Ethiopia has the largest number of domestic livestock in Africa. Moreover, it has the third largest camel population and is the second camel milk producer in the world (FAO, 2008). However, the country did not obtain benefits commensurate with its livestock population in general and camel population in particular.

From the contingent valuation survey responses of the sample households it is observed that, camel milk has a higher demand in the woreda. That is why, almost all of the sample households or 98.80 percent of the respondents were willing to purchase camel milk had it been camel milk market in the woreda.

Generally, based on the findings of this study the following policy implications are drawn.

- From the descriptive analysis about 222 out of 247 respondents prefer camel milk than cow and goat milk. This implies that the demand for camel milk is to far higher than the demand for cow and goat milk. Thus, had it been camel milk market in the woreda both the consumers and camel milk owners would be beneficiary. Therefore, the government and any other concerned body should enhance the awareness of the camel milk producers on the demand of camel milk in the woreda.

- From the study it is obtained that the reason for the absence of camel milk market is the existence of traditional restrictions. However, this traditional restrictions are absent in other countries of the world such as in Kenya, Mauritania, Somalia and so forth. Moreover, these traditional restrictions are also absent in the Somali Regional State of Ethiopia. Consequently, both the consumers and producers of camel milk are beneficiary. Hence, the government or any other concerned body should provide an evidence on the benefits of camel milk market from other regions of the country (Somali regional state) and other countries like Keneya and much effort should be exerted on the awareness creation (in collaboration with religious and tribal leaders) and breaking up of the traditional cultural restrictions.

- The mean willingness to pay for camel milk from the contingent valuation survey responses is almost about two times of the price of cow milk (Birr 17.79 per liter). As a result, the camel milk producers may be profitable had it been camel milk market in the woreda. Therefore, the government and concerned bodies should also provide such information to the camel milk producers in order to induce them to sale their milk in the market.

- The camel milk is an important source of income and employment especially for women in the pastoral and agro-pastoral areas. In other countries like Kenya and Mauritania and in the other parts of the country (Somali Regional State) camel milk owners are highly beneficiary due to the exitence of camel milk market. In these countries women are the main actors involving in the sale of camel milk through small and micro enterprises. Thus, the government and any other concerned body should pave the way for such type of enterprises to benefit the pastoral and agro-pastoral households in general and women in particular.

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Appendices

Appendix I- Description of variables used in the analysis

Variable name	Variable label		
wtpurchase	Willingness to purchase of household 1= if s/he is willing 0= otherwise		
notwtp	Why would you not purchase camel milk?		
WTP1	Are you willing to pay.....ETB for one liter fresh camel milk?		
WTP2	Are you willing to pay ... ETB for one liter fresh camel milk?		
Bid1	Initial bid		
Bid2	Follow up bid		
MWTP	Maximum willingness to pay		
sexhh	Sex of the household head,	0= male, 1= female	
agehh	Age of household head		
age2	Age square of household head		
educhh	Education of the household head,	1=literate, 0=illiterate	
headmarrid	Martial status of hh head,	1=married, 0=others	
incomehh	Income of household		
adulthh	Number of adult for the household		
adul_ratio	Ratio of adult male to female		
famsize	Family size for the household head		
remittance	Amount of remittance received in the last 12 months		
totassvalue	Total asset value of the household		
tot_exp	Households' total expenditure		
ownland	Ownership of land with holding rights	1= own land	0= otherwise
preference	Households' preferred type of milk		

Appendix II - Summary statistics of variables used in the study

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
wtpurchase	*250*	*.988*	*.1091037*	*0*	*1*
notwtp	*3*				
WTP1	*247*	*.8704453*	*.3364947*	*0*	*1*
WTP2	*247*	*.5991903*	*.4910576*	*0*	*1*
Bid1	*247*	*10.06073*	*4.069562*	*5*	*15*
Bid2	*247*	*17.34413*	*8.212065*	*5*	*30*
MWTP	*247*	*17.79352*	*9.638268*	*8*	*100*
sexhh	*250*	*.188*	*.3914959*	*0*	*1*
agehh	*250*	*40.22*	*11.67686*	*20*	*100*
age2	*250*	*1753.452*	*1089.166*	*400*	*10000*
educhh	*250*	*.4*	*.4908807*	*0*	*1*
headmarrid	*250*	*.888*	*.3159991*	*0*	*1*
incomehh	*250*	*31604.43*	*29193.01*	*0*	*181200*
adulthh	*250*	*3.564*	*1.95684*	*1*	*9*
adul_ratio	*244*	*1.356352*	*.9947528*	*0*	*6*
famsize	*250*	*6.236*	*2.329379*	*1*	*12*
dependecyr~o	*250*	*1.006825*	*.8549358*	*0*	*6*
childep_ra~o	*250*	*.9873873*	*.8627261*	*0*	*6*
remittance	*250*	*2714*	*8105.554*	*0*	*52000*
totassvalue	*250*	*152799.2*	*156306.4*	*0*	*1012000*
tot_exp	*250*	*51243.91*	*53311.31*	*8322*	*328068*
ownland	*250*	*.408*	*.492449*	*0*	*1*
preference	*250*	*.888*	*.3159991*	*0*	*1*
hhsize	*250*	*6.256*	*2.340164*	*1*	*12*
nomilkmkt	*250*				

Appendix III - Conversion factors for adult equivalents (AE)

Age group (Years)	Male	Female
< 10	0.60	0.60
10 -13	0.90	0.80
14 -16	1.0	0.75
17-50	1.0	0.75
> 50	1.0	0.75

Source: Storck *et al.,* (1991)

Appendix IV -Correlation Matrix

```
. corr lnincomehh lnremittance famsize sexhh agehh age2 educhh Bid1 ownland adul_ratio
(obs=221)

             | lninco~h lnremi~e  famsize    sexhh    agehh     age2   educhh     Bid1   ownl
> and adul_r~o
-------------+---------------------------------------------------------------------------
> ------------
  lnincomehh |   1.0000
lnremittance |   0.2603   1.0000
     famsize |   0.2728   0.2396   1.0000
       sexhh |  -0.1178  -0.0211  -0.1435   1.0000
       agehh |   0.1824   0.1744   0.4943  -0.1069   1.0000
        age2 |   0.1603   0.1426   0.4266  -0.0983   0.9757   1.0000
      educhh |  -0.1283  -0.2130  -0.3174  -0.1241  -0.5244  -0.4672   1.0000
        Bid1 |  -0.0256  -0.1309  -0.0320  -0.0589  -0.0090   0.0075  -0.0158   1.0000
     ownland |   0.1979   0.1311   0.2559  -0.0772   0.2513   0.2394  -0.1956  -0.0606   1.0
> 000
  adul_ratio |   0.2011   0.2887   0.2860  -0.0472   0.1587   0.1177  -0.1040   0.0045   0.1
> 284   1.0000
```

Appendix V - Tobit regression

```
. tobit MWTP lnincomehh   lnremittance  famsize  sexhh agehh age2 educhh  Bid1 ownland  adul
> _ratio, robust ll(8) ul(25)

Tobit regression                                  Number of obs   =        221
                                                  F(  10,    211) =       4.76
                                                  Prob > F        =     0.0000
Log pseudolikelihood = -609.92936                 Pseudo R2       =     0.0288
```

MWTP	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnincomehh	.8485956	.4598385	1.85	0.066	-.0578706	1.755062
lnremittance	.364167	.1334302	2.73	0.007	.10114	.627194
famsize	-.1167314	.2374825	-0.49	0.624	-.5848737	.3514108
sexhh	-1.445593	1.080513	-1.34	0.182	-3.575576	.6843905
agehh	.295313	.1387591	2.13	0.034	.0217813	.5688448
age2	-.0029195	.0011608	-2.52	0.013	-.0052077	-.0006313
educhh	-.0293881	1.159338	-0.03	0.980	-2.314757	2.255981
Bid1	.4411978	.1123441	3.93	0.000	.2197372	.6626584
ownland	1.555184	.9610046	1.62	0.107	-.3392162	3.449584
adul_ratio	-.2110696	.4086518	-0.52	0.606	-1.016633	.5944938
_cons	-1.223401	4.967903	-0.25	0.806	-11.01648	8.569679
/sigma	6.383394	.3937898			5.607128	7.15966

```
  Obs. summary:         13  left-censored observations at MWTP<=8
                       169     uncensored observations
                        39 right-censored observations at MWTP>=25
```

Appendix VI - Marginal effects after Tobit

```
. mfx, predict(ystar(.,.))

Marginal effects after tobit
      y  = E(MWTP) (predict, ystar(.,.))
         =  16.718749
```

variable	dy/dx	Std. Err.	z	P>|z|	[	95% C.I.	]	X
lninco~h	.8485956	.45984	1.85	0.065	-.052671	1.74986		8.14272
lnremi~e	.364167	.13343	2.73	0.006	.102649	.625685		1.4381
famsize	-.1167314	.23748	-0.49	0.623	-.582189	.348726		6.29864
sexhh*	-1.445593	1.08051	-1.34	0.181	-3.56336	.672173		.190045
agehh	.295313	.13876	2.13	0.033	.02335	.567276		40.3484
age2	-.0029195	.00116	-2.52	0.012	-.005195	-.000644		1767.95
educhh*	-.0293881	1.15934	-0.03	0.980	-2.30165	2.24287		.411765
Bid1	.4411978	.11234	3.93	0.000	.221007	.661388		10.0226
ownland*	1.555184	.961	1.62	0.106	-.32835	3.43872		.411765
adul_r~o	-.2110696	.40865	-0.52	0.606	-1.01201	.589873		1.35309

(*) dy/dx is for discrete change of dummy variable from 0 to 1

```
. mfx, predict(ystar(0,.))

Marginal effects after tobit
      y  = E(MWTP*|MWTP>0) (predict, ystar(0,.))
         =  16.727541
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
lninco~h	.8448549	.4577	1.85	0.065	-.052213	1.74192	8.14272
lnremi~e	.3625617	.13282	2.73	0.006	.102234	.622889	1.4381
famsize	-.1162169	.23648	-0.49	0.623	-.579704	.34727	6.29864
sexhh*	-1.43766	1.07379	-1.34	0.181	-3.54225	.666929	.190045
agehh	.2940113	.13814	2.13	0.033	.023254	.564768	40.3484
age2	-.0029066	.00116	-2.52	0.012	-.005172	-.000642	1767.95
educhh*	-.0292584	1.15422	-0.03	0.980	-2.29149	2.23297	.411765
Bid1	.439253	.11177	3.93	0.000	.22018	.658326	10.0226
ownland*	1.548624	.95692	1.62	0.106	-.326901	3.42415	.411765
adul_r~o	-.2101392	.40682	-0.52	0.605	-1.0075	.587218	1.35309

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1

. mfx, predict(e(0,.))

Marginal effects after tobit
      y  = E(MWTP|MWTP>0) (predict, e(0,.))
         =  16.801604
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
lninco~h	.8196044	.44352	1.85	0.065	-.049678	1.68889	8.14272
lnremi~e	.3517256	.12881	2.73	0.006	.099267	.604185	1.4381
famsize	-.1127434	.22962	-0.49	0.623	-.562793	.337306	6.29864
sexhh*	-1.387387	1.03131	-1.35	0.179	-3.40873	.633951	.190045
agehh	.285224	.13403	2.13	0.033	.02253	.547918	40.3484
age2	-.0028197	.00112	-2.52	0.012	-.005017	-.000623	1767.95
educhh*	-.0283832	1.11969	-0.03	0.980	-2.22293	2.16616	.411765
Bid1	.4261248	.10815	3.94	0.000	.21416	.63809	10.0226
ownland*	1.50407	.93042	1.62	0.106	-.319515	3.32765	.411765
adul_r~o	-.2038586	.39453	-0.52	0.605	-.977122	.569405	1.35309

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1

. mfx, predict(pr(0,.))

Marginal effects after tobit
      y  = Pr(MWTP>0) (predict, pr(0,.))
         =   .9955919
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
lninco~h	.0017179	.00111	1.54	0.123	-.000467	.003902	8.14272
lnremi~e	.0007372	.00036	2.03	0.043	.000025	.00145	1.4381
famsize	-.0002363	.00047	-0.50	0.617	-.001162	.000689	6.29864
sexhh*	-.0035497	.00325	-1.09	0.275	-.009928	.002829	.190045
agehh	.0005978	.00034	1.77	0.077	-.000065	.001261	40.3484
age2	-5.91e-06	.00000	-1.97	0.049	-.000012	-3.4e-08	1767.95
educhh*	-.0000596	.00235	-0.03	0.980	-.004666	.004546	.411765
Bid1	.0008932	.00038	2.36	0.018	.000152	.001634	10.0226
ownland*	.0030193	.00207	1.46	0.145	-.001036	.007075	.411765
adul_r~o	-.0004273	.00085	-0.50	0.614	-.002089	.001234	1.35309

```
(*) dy/dx is for discrete change of dummy variable from 0 to 1
```

Appendix VII - Akaike's/ Bayesian Information Criteria for Tobit and OLS models respectively

```
. estat ic
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	221	-627.9844	-609.9294	12	1243.859	1284.637

Note: N=Obs used in calculating BIC; see **[R] BIC note**

```
. estat ic
```

Model	Obs	ll(null)	ll(model)	df	AIC	BIC
.	221	-819.6987	-810.6557	11	1643.311	1680.691

Note: N=Obs used in calculating BIC; see **[R] BIC note**

Appendix VIII - Tests for basic assumptions

```
. hettest

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of MWTP

         chi2(1)      =    19.89
         Prob > chi2  =   0.0000
```

```
. vif
```

Variable	VIF	1/VIF
agehh	28.30	0.035335
age2	24.57	0.040698
famsize	1.60	0.626623
educhh	1.59	0.629693
lnremittance	1.21	0.825148
adul_ratio	1.18	0.846537
lnincomehh	1.16	0.858813
ownland	1.13	0.885885
sexhh	1.10	0.911932
Bid1	1.04	0.963382
Mean VIF	6.29	

```
. ovtest

Ramsey RESET test using powers of the fitted values of MWTP
       Ho:  model has no omitted variables
                 F(3, 207) =      0.64
                  Prob > F =      0.5928
```

```
. linktest
```

Source	SS	df	MS		
Model	1694.47208	2	847.236039	Number of obs =	221
Residual	19860.7587	218	91.1043977	F(2, 218) =	9.30
				Prob > F =	0.0001
Total	21555.2308	220	97.9783217	R-squared =	0.0786
				Adj R-squared =	0.0702
				Root MSE =	9.5449

MWTP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
_hat	1.216218	2.46762	0.49	0.623	-3.647229	6.079664
_hatsq	-.0060958	.0692615	-0.09	0.930	-.1426036	.130412
_cons	-1.870577	21.65916	-0.09	0.931	-44.55873	40.81758

Appendix IX - Probit Regression

```
. probit WTP1 lnincomehh lnremittance famsize sexhh agehh age2 educhh Bid1 ownland adul_rati
> o, robust

Iteration 0:   log pseudolikelihood = -85.903267
Iteration 1:   log pseudolikelihood = -58.961541
Iteration 2:   log pseudolikelihood = -53.309593
Iteration 3:   log pseudolikelihood = -52.003099
Iteration 4:   log pseudolikelihood = -51.916425
Iteration 5:   log pseudolikelihood =  -51.91593
Iteration 6:   log pseudolikelihood =  -51.91593

Probit regression                                 Number of obs   =        221
                                                  Wald chi2(10)   =      48.86
                                                  Prob > chi2     =     0.0000
Log pseudolikelihood =  -51.91593                 Pseudo R2       =     0.3956
```

WTP1	Coef.	Robust Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnincomehh	.2775299	.1459164	1.90	0.057	-.0084611	.5635209
lnremittance	.1069086	.0578183	1.85	0.064	-.0064132	.2202304
famsize	.0352217	.0832732	0.42	0.672	-.1279907	.1984342
sexhh	-.4039628	.3763361	-1.07	0.283	-1.141568	.3336424
agehh	.1326656	.0432669	3.07	0.002	.047864	.2174672
age2	-.0011767	.0003674	-3.20	0.001	-.0018968	-.0004567
educhh	.6291706	.3328379	1.89	0.059	-.0231798	1.281521
Bid1	-.2876709	.0538829	-5.34	0.000	-.3932795	-.1820624
ownland	.4693767	.3319035	1.41	0.157	-.1811422	1.119896
adul_ratio	-.2989663	.1252236	-2.39	0.017	-.5444	-.0535326
_cons	-.9555023	1.541429	-0.62	0.535	-3.976648	2.065643

Appendix X- Marginal Effects after Probit Regression

```
. dprobit WTP1 lnincomehh lnremittance famsize sexhh agehh age2 educhh Bid1 ownland adul_rat
> io, robust

Iteration 0:   log pseudolikelihood = -85.903267
Iteration 1:   log pseudolikelihood = -58.961541
Iteration 2:   log pseudolikelihood = -53.309593
Iteration 3:   log pseudolikelihood = -52.003099
Iteration 4:   log pseudolikelihood = -51.916425
Iteration 5:   log pseudolikelihood =  -51.91593
Iteration 6:   log pseudolikelihood =  -51.91593

Probit regression, reporting marginal effects           Number of obs =    221
                                                        Wald chi2(10) =  48.86
                                                        Prob > chi2   = 0.0000
Log pseudolikelihood =  -51.91593                       Pseudo R2     = 0.3956
```

WTP1	dF/dx	Robust Std. Err.	z	P>|z|	x-bar	[95% C.I.]	
lninco~h	.0138153	.0092926	1.90	0.057	8.14272	-.004398	.032028
lnremi~e	.0053219	.0038721	1.85	0.064	1.4381	-.002267	.012911
famsize	.0017533	.0040042	0.42	0.672	6.29864	-.006095	.009601
sexhh*	-.0262242	.0351099	-1.07	0.283	.190045	-.095038	.04259
agehh	.006604	.0036863	3.07	0.002	40.3484	-.000621	.013829
age2	-.0000586	.000032	-3.20	0.001	1767.95	-.000121	4.1e-06
educhh*	.0294758	.0200142	1.89	0.059	.411765	-.009751	.068703
Bid1	-.0143201	.0054574	-5.34	0.000	10.0226	-.025016	-.003624
ownland*	.0221079	.0159592	1.41	0.157	.411765	-.009172	.053387
adul_r~o	-.0148824	.008888	-2.39	0.017	1.35309	-.032303	.002538
obs. P	.8687783						
pred. P	.9793349	(at x-bar)					

```
(*) dF/dx is for discrete change of dummy variable from 0 to 1
    z and P>|z| correspond to the test of the underlying coefficient being 0
```

Appendix XI- Post estimation tests for probit model

```
. fitstat

Measures of Fit for probit of WTP1

Log-Lik Intercept Only:      -85.903     Log-Lik Full Model:          -51.916
D(210):                      103.832     LR(10):                       67.975
                                         Prob > LR:                     0.000
McFadden's R2:                 0.396     McFadden's Adj R2:             0.268
Maximum Likelihood R2:         0.265     Cragg & Uhler's R2:            0.490
McKelvey and Zavoina's R2:     0.691     Efron's R2:                    0.337
Variance of y*:                3.232     Variance of error:             1.000
Count R2:                      0.900     Adj Count R2:                  0.241
AIC:                           0.569     AIC*n:                       125.832
BIC:                       -1029.782     BIC':                        -13.993
```

```
. estat class

Probit model for WTP1

                 True
Classified |         D            ~D |       Total
-----------+------------------------+------------
     +     |       188            18 |         206
     -     |         4            11 |          15
-----------+------------------------+------------
   Total   |       192            29 |         221

Classified + if predicted Pr(D) >= .5
True D defined as WTP1 != 0
--------------------------------------------------
Sensitivity                     Pr( +| D)   97.92%
Specificity                     Pr( -|~D)   37.93%
Positive predictive value       Pr( D| +)   91.26%
Negative predictive value       Pr(~D| -)   73.33%
--------------------------------------------------
False + rate for true ~D        Pr( +|~D)   62.07%
False - rate for true D         Pr( -| D)    2.08%
False + rate for classified +   Pr(~D| +)    8.74%
False - rate for classified -   Pr( D| -)   26.67%
--------------------------------------------------
Correctly classified                        90.05%
--------------------------------------------------
```

```
. linktest

Iteration 0:   log likelihood = -85.903267
Iteration 1:   log likelihood = -55.426158
Iteration 2:   log likelihood = -53.078054
Iteration 3:   log likelihood = -52.404626
Iteration 4:   log likelihood = -51.962295
Iteration 5:   log likelihood = -51.79354
Iteration 6:   log likelihood = -51.78243
Iteration 7:   log likelihood = -51.782391
Iteration 8:   log likelihood = -51.782391

Probit regression                                 Number of obs   =        221
                                                  LR chi2(2)      =      68.24
                                                  Prob > chi2     =     0.0000
Log likelihood = -51.782391                       Pseudo R2       =     0.3972

------------------------------------------------------------------------------
        WTP1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        _hat |   .8705089   .3026432     2.88   0.004     .2773392    1.463679
      _hatsq |    .090087   .1802022     0.50   0.617    -.2631028    .4432768
       _cons |  -.0086878   .1842412    -0.05   0.962     -.369794    .3524184
------------------------------------------------------------------------------
Note: 0 failures and 7 successes completely determined.
```

Appendix XII - Bivariate Probit regression

```
. biprobit WTP1 WTP2 Bid1 Bid2, robust

Fitting comparison equation 1:

Iteration 0:   log pseudolikelihood = -95.228194
Iteration 1:   log pseudolikelihood = -71.808779
Iteration 2:   log pseudolikelihood = -68.289467
Iteration 3:   log pseudolikelihood = -67.780173
Iteration 4:   log pseudolikelihood = -67.764318
Iteration 5:   log pseudolikelihood =   -67.7643

Fitting comparison equation 2:

Iteration 0:   log pseudolikelihood = -166.31464
Iteration 1:   log pseudolikelihood = -153.46307
Iteration 2:   log pseudolikelihood = -153.4108
Iteration 3:   log pseudolikelihood = -153.4108

Comparison:    log pseudolikelihood = -221.1751

Fitting full model:

Iteration 0:   log pseudolikelihood = -221.1751
Iteration 1:   log pseudolikelihood = -196.13935
Iteration 2:   log pseudolikelihood = -193.57982
Iteration 3:   log pseudolikelihood = -193.1245
Iteration 4:   log pseudolikelihood = -193.06269
Iteration 5:   log pseudolikelihood = -193.05338
Iteration 6:   log pseudolikelihood = -193.0524
Iteration 7:   log pseudolikelihood = -193.05227
Iteration 8:   log pseudolikelihood = -193.05226

Bivariate probit regression                     Number of obs   =        247
                                                Wald chi2(4)    =      82.45
Log pseudolikelihood = -193.05226               Prob > chi2     =     0.0000

------------------------------------------------------------------------------
             |               Robust
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
WTP1         |
        Bid1 |  -.2064473   .0360192    -5.73   0.000    -.2770436    -.135851
        Bid2 |  -.0216094   .2144079    -0.10   0.920    -.4418411    .3986223
       _cons |     3.6893   .5052925     7.30   0.000     2.698945    4.679655
-------------+----------------------------------------------------------------
WTP2         |
        Bid1 |  -.0839635   .1644853    -0.51   0.610    -.4063489    .2384218
        Bid2 |  -.1034572   .0197295    -5.24   0.000    -.1421264    -.064788
       _cons |   1.356406   .2302937     5.89   0.000      .905039    1.807774
-------------+----------------------------------------------------------------
     /athrho |  -3.353675   .4937317    -6.79   0.000    -4.321371   -2.385979
-------------+----------------------------------------------------------------
         rho |  -.9975592   .0024073                     -.9996473   -.9832145
------------------------------------------------------------------------------
Wald test of rho=0:                chi2(1) =  46.1381    Prob > chi2 = 0.0000
```

Appendix XIII

"Households Willingness to Pay for Camel Milk: Application of Contingent Valuation Method (CVM) in Afar Region, Ethiopia" Household Questionnaire

Woreda: _____ (Woreda)

Tabia: _____ (Tabia)

Household ID Code: _____

Household distance from woreda Market (Kilometres or Hours): _____/ _____

Household distance from Local Market (Kilometres or Hours): _____/ _____

Household distance from asphalt road (Kilometres or Hours): _____/ _____

Household distance from gravel road (Kilometres or Hours): _____/ _____

Household distance from Mekelle (Kilometres or Hours): _____/ _____

Average transport per person/ per Quintal: _____/ _____

Date of interview: _____

Time Started: _____

Time Finished: _____

Interviewer's Name: _____

Supervisor's Name: _____

Part - I: Opening statement on Households' Willingness to Pay for Camel Milk

Although camel's milk has been consumed for thousands of years in Africa and the Middle East, its medical benefits toward modern diseases were not known until recently. The ***anti-diabetic*** properties of camel milk have been demonstrated in several other studies (Agrawal *et al.*, 2003, Musinga *et al.*, 2008, LPPS. 2005). Camel milk has positive effects in controlling ***high blood pressure*** and camel milk destroys Mycobacterium ***tuberculosis***. Camel milk is used for treating ***dropsy, jaundice, spleen ailments, tuberculosis, asthma, anaemia and piles***.

Camel milk plays a vital role in achieving food security in pastoral and agro pastoral areas. Camel milk production is stable in almost all seasons, which is very important for the pastoralist, when the milk of other animals is ***seized*** in the dry period (A. Raziq *et al., 2008*). According to Somali Regional State Summary, 2004 report, own produced milk and ghee are important foods for Somali pastoralists.

Many reasons are given as to why camel milk has many medicinal benefits. Camels feed on over ***100 species*** of trees each day and each of these trees has different food supplements in terms of vitamins, proteins, carbohydrates etc. these food supplements come with the milk which is consumed by humans. Camel milk is securing food for pastoralists in Afar region (Pastoralist Forum Ethiopia, 2009).

The payment vehicle is in cash (just give and take) like the payment vehicle for the cow milk market and the method of delivery is not door to door rather the camel milk will be sold in the common market.

Hence, assume that there is camel milk market in the region in general and in the woreda, Tabia in particular. Therefore, in this questionnaire you will be asked whether you are willing to purchase camel milk or not and how much would you pay for one liter of camel if you are willing to purchase.

The Contingent Valuation Questions

1) Are you willing to purchase fresh camel milk from the camel milk market?

A) Yes B) No

If your answer No, please respond to question #2; otherwise answer question #3.

2) Why would you not purchase camel milk?

1 I do not like camel milk
2 I do not have budget to purchase camel milk
3 It is not allowed by my culture
4 It is not allowed by my religion
5 There are better substitutes for camel milk
6 I do not like milk in general
7 Others ……..

3) Are you willing to pay ..... ***(Z)*** ETB for one liter fresh camel milk?

A) Yes B) No

If the answer for this question is yes, how much percent are you certain to pay the above price? ……

If the answer for this question is yes, proceed for question 4 and otherwise go to question 5.

4) Are you willing to pay ..... ***(2Z)*** ETB for one liter fresh camel milk?

A) Yes B) No

5) Are you willing to pay ..... ***(0.5Z)*** ETB for one liter fresh camel milk?

A) Yes B) No

Then ask

6) What is the maximum amount that you are willing to pay for one liter fresh camel milk? ----- ETB

7) If yes in 3 and yes in 4 and If the respondent maximum willingness to pay in Q.4 is greater than in Q.6, then ask, You said that you are willing to pay -------ETB (in Q.4) but when I ask you your maximum willingness to pay you said-------- ETB (inQ.6) which is less than the amount you already agreed to pay previously Why? ----------

---

---

8) If yes in 3 and no in 4 and If the respondent maximum willingness to pay Q.3 is greater than in Q.6, then ask, You said that you are willing to pay ------- ETB (in Q.3) but when I ask you your maximum willingness to pay you said----- ETB (in Q.6) which is less than the amount you already agreed to pay previously Why? ----------

---

---

9) If no in 3 and yes in 5 and If the respondent maximum willingness to pay Q.5 is greater than in Q.6, then ask You said that you are willing to pay ------- ETB (in Q.5) but when I ask you your maximum willingness to pay you said----- ETB (in Q.6) which is less than the amount you already agreed to pay previously Why? ----------

---

Code

Code A: Relation to the Household

1 Household head
2 Husband /Wife
3 Natural Son/ Daughter
4 Step Son/Daughter
5 Grandchild
6 Father/Mother
7 Father (In-Law)/Mother (In-Law)
8 Sister (In-Law)/Brother (In-Law)
9 Son (In-Law)/Daughter (In-Law)
10 Step Father/Step Mother
11 Niece/Nephew
12 Uncle/Aunt
13 other relatives
14 Servant
15 Other Unrelated people

Code B: Marital Status

1 Single
2 Married
3 Divorced
4 Separated
5 Widowed

Code C: Educational level

0 = Too young to attend (Child)
1 -15 = Attended formal education
16 = Masters Degree and above
17 = Never attended but can read and write
18 = Illiterate (cannot read and write)

Code D: Religion

1 Islam
2 Orthodox
3 Protestant
4 Catholic
5 Other _____(Please Specify)

Section A. Household Characteristics

[Interviewer: Write members in this order 1st= Head 2nd= Spouse (s) 3rd= Children of head/spouse (s) 4th= other

A1.11 Name of the Household Member	A1.12 ID	A1.13 Relation to Household Head **Code(A)**	A1.14 Sex 0= Male 1= Female	A1.15 Age (Year)	A1.16 Marital Status **Code (B)**	A1.17 Educational level **Code (C)**	A1.19 Do you have saving Account	A1.110Are you a pastoralist or Agro pastoralist? 0= Other 1= Agro Pastoralist 2= Pastoralist
	01							
	02							
	03							
	04							
	05							
	06							
	07							
	08							
	09							
	10							
	11							
	12							
	13							
	14							
	15							

Section B. Household Asset ownership and Value

Section B1. Household Land ownership, Input used and Output produced

B1.11 Do you have any land with holding rights? 1= Yes 0= No **(If no go to next section)**

B1.12 If yes, how many hectares of land do you have? _____

B1.13 How many plots of land do you have? ____

B1.14 How many hectares of land were cultivated last year (2012/13)? _____

B1.15 Plot Name	B1.16 Plot size	B1.17 Distance from home to plot (Hours or Kms)	B1.18 Did you use any manure? 1=Yes 0=No	B1.19 if yes, amount of manure used in kg (if none write 0)	B1.110 Value in Birr	B1.111 Did you use fertilizer? 1=Yes 0=No	B1.112 if yes, Quantity used in kg (if none write 0)	B1.113 Value in Birr	B1.114 Did you use improved seed? 1=Yes 0=No	B1.115 if yes, Quantity used in kg (if none write 0)	B1.116 Value in Birr	B1.117 Labour Days			B1.118 Oxen Days (pair of oxen)	B 1.119 Do you use irrigation? 1=Yes 0=No	B1.120 Do you use soil conservation activities? 1=Yes 0=No	B1.121 If yes, which soil conservation method do you use? **1** Stone terrace **2** Soil bunds **3** Vegetative planting **4** Control ploughing **5** Conservation tillage system **6** Other
												Ploughing	**Weeding**	**Harvesting**				
01																		
02																		
03																		
04																		
05																		
06																		

B1.122 Did you participate in extension programs? 1= Yes 0=No

B1.123 If yes, since when did you participate in the extension programs (Month/Year)? _____ /_____

B1.124 Who is eligible to participate in extension programs? 1= Poor 2= Rich 3= Any one

B1.125 Did you have an access to credit? 1=Yes 0=No

B1.126 Who is eligible to take credit from lending institutions? 1= Poor 2= Rich 3= Any one

B1.127 How far is the lending institutions from your home in kilometres? _____

B1.128 Did you obtain food aid in the last 12 months? 1=Yes 0=No

B1.129 If yes, how much (1=Kilogram 2=Quintal 3=litre, 4= #) food did you obtain in the last 12 months? Food (Crop...) _____ Oil _____ other_____

B1.130 Did you participate in safety net programs? 1=Yes 0=No

B1.131 If yes, since when did you participate in the safety net programs (Month/Year)? _____ /_____

B1.132 Who is eligible to participate in safety net programs? 1= Poor 2= Rich 3= Any one

B1.133 Is there any social network in your community? 1=Yes 0=No

B1.134 If yes, are you a member of this social network? 1=Yes 0=No

B1.135 If yes, since when were you a member of this social network (Month/Year)? _____ /_____

B1.135 What is the soil type of your plots? 1= Lem 2= Lem-tuef 3= tuef

Section B.2 Household Crop Output and Sales of Crop

B2.11 Plot Name	B2.12 Crop **Code (A)**	B2.13 How much output did you harvest during last year (2012/13)			B2.14 Did you sell any part of the output harvested? 1=Yes 0=No	B2.15 If yes, answer the following questions			B2.17 How much of this output did you give to other households?	B2.17c Value in Birr
		B2.1a Quantity	B2.13b Units **(Code B)**	B2.13c Value in Birr		B2.15a Quantity	B2.15b Unit **Code (B)**	B2.15c Sales Revenue (Birr)		
01										
02										
03										
04										
05										
06										

Code A: Crop Type

1 *Teff* ***2*** *Wheat* ***3*** *Barley* ***4*** *Maize* ***5*** *Sorghum* ***6*** *Oats* ***7*** *Beans* ***8*** *Linseed* ***9*** *Groundnuts*

10 *Sesame* ***11*** *Pulses* ***12*** *Lentil* ***13*** *Chat* ***14*** *Guava* ***15*** *Tomato* ***16*** *Potato* ***17*** *Onion* ***18*** *Vegetables*

(Kosta, Salad, Cabbage, Carrot) ***19*** *Sugarcane* ***20*** *Banana, Papaya, Orange, Avocado, Mango* ***21*** *Eucalyptus*

22 *Other (Please Specify).....*

Code B: Quantity

1..... Kilogram *2..... Quintal*
3..... Litter *4..... Minelik*
5..... Number *6..... Other.....*

Section B.3. Household Livestock ownership and Value

B3.11	B3.12 Number owned at Present	B3.13 Present Market Value	B3.14 During last year how many ... died or get lost?	B3.15 During last year how many ... were slaughtered?	B3.16 During last 6 months how many... were born?	B3.17 Did you buy ... last year (2005 E.C or 2012/103)			B3.18 Did you sell any ... last year (2005 E.C or 2012/103)		
						B3.17a Number bought(If none write 0)	B3.17b Total Purchased value of all bought **(Birr)**	B3.17c Financing means of the Purchase **Code A**	B3.18a Number sold	B3.18b Total sales value of all sold	B3.18c Reason for sell **Code B**
Camels											
Cows											
Heifer											
Bulls											
Ox											
Calves **(under 1 year)**											
Goats											
Sheep											
Donkey											
Horse											
Mule											
Chicken											
Bee hives											

Code A: Financing means of the Purchase	**Code B:** Reason for sell	
1..... Income from farm	*1..... To help relatives*	*2..... To buy food*
2..... Other income	*3..... To buy livestock*	*4..... To buy seeds*
3..... Income from sale of livestock	*5..... To buy other goods*	*6..... To pay for labour*
4..... Income from sale of other assets	*7..... To repay loans*	*8..... To pay tax*
5..... Savings	*9..... To buy building material*	*10..... To pay for health expense*
6..... Loan/Gift from relative	*11..... To pay for education expense*	*12..... To pay for travel purpose*
7..... Loan from other household	*13..... Other.....*	
8..... Loan from lending institutions		
9..... Other.....		

Section B.4. Household other assets ownership and Value

B4.11 Asset Description	B4.12 Number owned at present	B4.13 Present market value (in Birr)
House		
Trees		
Farming equipment		
Watch		
Radio		
Land Phone		
Mobile Phone		
Bed		
Table		
Chair		
Car		
Bajaj		
Bicycle		
Motor Bicycle		
Cart		
Flour Mill		
Refrigerator		

Section B5. Households Livestock Income

We will ask you about the yield obtained, consumed and sold

B5.11 Description of the yield	B5.12 How much yield have you produced in the last 6 months? *"Enter 0 if yield was not produced"*	B5.14 On average how much of this yield was consumed per month in the last 6 months? *"Enter 0 if yield was not sold"*	B5.15 How much of this yield did you sell in the last 6 months? *"Enter 0 if yield was not sold"*	B5.16 How much of this yield did you give to other households in the last 6 months?	B5.17 How much of this yield have used for household consumption per day in the last one months? *"Enter 0 if yield was not consumed"*	B5.18 How much of this yield have used for household consumption per day in the last 24 hours? *"Enter 0 if yield was not consumed"*
Camel Milk(L)						
Cow Milk(L)						
Goat Milk(L)						
Hides/Skins(#)						
Butter(Kg)						
Eggs(#)						
Honey (Kg)						
Beef (Kg)						
Other						

Section C. Migration and Remittance

We will ask you about household members who migrated, remittance's they send and how this remittance is used

C1.11 ID	C1.12 Did (Name) migrate outside this area for job search previously **1=Yes 0=No** If no go to section D	C1.12 Name of the migrant	C1.13 Gender of the migrant **0= Male 1= Female**	C1.14 In what year did s/he leave the household	C1.15 Why did s/he leave? **Code (A)**	C1.16 Migration type **1=Domestic 0=International**	C1.17 Have you received remittance from (Name) in the past 12 months? **1= Yes 0=No**	C1.18 If yes, how much money did (Name) send in the past 12 month?	C1.19 Have you used this money to buy food? **1=Yes 0=No**	C1.110 If yes, how much money did you spend on food in the past 12 month?

ID	C1.111 Have you used this money to buy livestock? **1=Yes 0=No**	C1.113 If yes, how much money did you spends on livestock in the past 12 month?	C1.114 Do they send Goods in the past 12 Month?	C1.115 Present market value **(in Birr)**	C1.116 Did you receive any transfer income from NGO/GO? **1=Yes 0=No**	C1.117If yes, how much money did you did you receive in the past 12 month?

Code A: Off - farm activities

1..... Manual work
2..... Tailor
3….. Blacksmith
4….. Weaver
5…. Trade
6..... Craft worker/ potter
7..... Food sellers (tella/tej/injera…)
8..... Driver/mechanic
9..... Teacher (modern)
10.....Teacher (religious)
11..... Health worker
12..... Party official/ Administrator
13..... Soldier/ Police
14..... Selling Chat
15..... Selling fuel wood and charcoal
16..... Selling other forest products
17..... Mining
18..... Other

Section D: Off - farm Income

We will ask you about household's income and source of income

D1.11 ID	D1.12 Did (Name) do any of the off - farm activities **1= Yes 0= No**	D1.13 If yes, which off-farm activity did you do in the past 6 months? **(Code A)**	D1.14 How many weeks per month did (Name) do in the past 6 months?	D1.15 How many hours a week did (Name)do in the past 6 months	D1.16 wage/ income per day (Birr) (If in kind, convert in to Birr using local price)	D1.17Income per month (Birr) (If in kind, convert in to Birr using local price)

Section E: Household expenditure

We will ask you about household's expenditure

Section E1: Household food expenditure in 2005 or 2012/13

Code A: Quantity

1= Kilogram 2= Quintal 3= Litter 4= Minelik 5= Number 6= Other.....

	E1.11 Food item	E1.12 Total food expenditure in **August** month (2005 or 2012/13)			
		E1.12a Quantity	E1.12b Unit **Code (A)**	E1.12c Per Unit Cost **(Birr)**	E1.12d Total expenditure **(Birr)**
Cereals	Teff				
	Wheat				
	Barley				
	Sorghum				
	Maize				
	Rice				
Pulses	Beans				
	Lentil				
	Pea				
Oil Crops	Sesame				
	Linseed				
	Sun flower (suf)				
	Nug				
Spices	Berbere				
	Sugar				
	Shiro				
	Cooking oil				
	Salt				
	Onion (key shinkurt)				
	Garlic (nech shinkurt)				
	Jingibil				

	E1.13 Food item	E1.14 Total food consumed in the last **SEVEN** days			
		E1.14a Quantity	E1.14b Unit **Code (A)**	E1.14c Per Unit Cost **(Birr)**	E1.14d Total expenditure **(Birr)**
Milk and Animal Products	Meat (Camel, Ox, Sheep, Goat)				
	Chicken				
	Honey				
	Egg				
	Camel Milk				
	Powder Milk				
	Milk (Cow, Sheep, Goat)				
	Butter (kibe)				
	Cheese (Aybe)				
Vegetables	'Kosta'				
	Salad (selata)				
	Cabbage (tikel gomen)				
	Carrot				
	Potato				
	Tomato				
	Keysir				
	Karia				
Fruits	Zeytun				
	Banana				
	Papaya				
	Orange				
	Sugarcane				
	Avocado				
	Mango				

Section E2: Household other food and non food expenditure in 2005 or 2012/13

E2.11 Food item	E2.12 How frequently do you use this item? **(Code A)**	E2.13 Quantity	E2.13 Units **(Code B)**	E2.14 Per Unit Cost **(Birr)**	E2.15Total expenditure **(Birr)**
Tea					
Coffee					
Soft drinks (Coca cola, Miranda, Pepsi etc)					
Chat					
Cigarette					
Tella					
Tej					
Beer					
Arequi					
Others 1 …….					
Others 2…….					

Code A: 1= Daily 2= Weekly 3= Monthly 4= 3 Months 5= 6 Months 6= Yearly 7 = Other.....

Code B: 1= Kilogram 2= Quintal 3= Litter 4= Minelik 5= Number 6= Other.....

Section E3: Household non food expenditure in 2005 or 2012/13

Would you tell me the household's non-food expenditure last year (2005 E.C or 2012/2013 G.C)

E3.11 Item	E3.12 Total Expenditure	E3.13 Amount paid by other household
Clothes/ shoes/ for ADULTS (MEN & WOMEN)		
Clothes/ shoes/ for CHILDREN (BOYS & GIRLS)		
Kitchen equipment (cooking pots, Medeija)		
Energy (Kerosene, Fuel wood, charcoal, match)		
Soap, OMO		
Ceremonial expense		
Water bill		
Electricity bill		
Cosmetics		
Perfume		
Barberry or Beauty salon		
Other		

Section E4: Household expenditure on health and education in 2005 or 2012/13

E4.11 Item	E4.12 How frequently do you use this item? **(Code A)**	E4.13 Quantity	E4.14 Units **(Code B)**	E4.15 Per Unit Cost **(Birr)**	E4.16 Total expenditure **(Birr)**
Exercise Book					
Book					
Uniform					
Registration fee					
Pen					
Pencil					
Other education fees					
Medical expenses					
Others 1……..					
Others 2 …….					
Others 3…….					

Section E5: Household expenditure on investment goods in 2005 or 2012/13

E5.11 Item	E5.12 Did you **purchase or build** ..... in 2005? 1= Yes 0=No	E5.13 If yes, **quantity**...?	E5.14 Per unit cost **(Birr)**	E5.15 Total expenditure **(Birr)**
House				
Radio				
Tape Recorder				
Television				
Land Phone				
Mobile Phone				
Table				
Chair				
Bed				
Car				
Bajaj				
Bicycle				
Motor Bicycle				
Cart				
Flour Mill				
Refrigerator				

Section F: Camel milk and reasons for the absence of camel milk market

F1.11 Which one is your preferred milk?

- Camel milk
- Cow milk
- Goat milk and Sheep milk.
- Other……..

F1.12 Why you prefer camel milk than the other types of milk?

- Its medicinal value
- Its nutrional value
- Its religouse value
- Its social value
- Other.....

F1.13 Why there is no camel milk market in the woreda/Tabia?

- Camel milk owners are not willing to sell
- Consumers do not want to purchase camel milk
- Both of the above
- Tradition do not encourage camel milk market
- Religion do not encourage camel milk market
- Others ……..

Thank You very much for your cooperation!!!