ESTIMATING WILLINGNESS TO PAY FOR IMPROVED WATER SERVICE IN SHARARO TOWN, CENTERAL ETHIOPIA: A Contingent Valuation Approach

Thesis Submitted to Department of Economics, Salale University in Partial Fulfillment of Requirement for the award of Masters of Science in Development Economics

By: Eshetu Tulu

May, 2024

Salale University, Ethiopia

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SALALE UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

DEPARTMENT OF ECONOMICS

A Thesis Submitted to Department of Economics, College of Business and Economics, Salale University for the Partial Fulfillment of the Requirements for the Award of Masters of Science in Development in Economics

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DECLARATION

I, Eshetu Tulu declare that, the research entitled; "Estimating Willingness to Pay for Improved Water Service in Shararo Town, Central Ethiopia: A Contingent Valuation Approach Submitted in partial fulfillment in award of Master of Development Economics, to the college of Business and Economics, Salale University Ethiopia through Department of Economic done my first work completed under guidance by Teshome Kafala (Assistant Professor) and Samuel Sahile (Lecturer). Any source used was duly acknowledged in this study.

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CERTIFICATE

This is to certify that the thesis entitled **"Estimating Willingness to Pay for Improved Water Service in Shararo Town, Central Ethiopia: A Contingent Valuation Approach"** submitted to Department of Economics College of Business and Economics, Salale University by Eshetu Tulu Gemeda for the degree of Masters of science in Development Economics **is** original work done by the candidate under my supervision. I further certify that the entire thesis represents the independent work of **Eshetu Tulu,** and all the thesis work was undertaken by the candidate under my supervision and guidance. This thesis has been submitted for examination with my approval.

Name of main advisor _____Signature_____ Date_____

Name of co-advisor _____Signature _____Date_____

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The undersigned certify that I have read and hereby recommend Department of Economics, Salale University, to accept the thesis entitled "**Estimating Willingness to Pay for Improved Water Service in Shararo Town, Central Ethiopia: A Contingent Valuation Approach**" which had been submitted by Eshetu Tulu Gemeda in partial fulfilment of the requirements for the award of a Master Degree in Development Economics.

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ACKNOWLEDGMENT

First of all, I would like to thank Almighty God for giving me patience and strength throughout the program. Then I would like to thank my mentor Teshome kafala (Asst Prof) for his valuable comments, guidance and support on careless checking and constructive suggestions. I am also grateful to the respondents for their willingness to participate in the survey and their persistence to respond to the length questions. Without their cooperation this thesis would have been impossible. It is impossible to acknowledge all the individuals, but I would like to acknowledge with special thanks to some of them who have helped me to perform this thesis. The last but not the least, my special thanks also go to my wife Wubit Alemu for her commitment and truthful support in all my activities.

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ABBREVIATIONS

CM	Choice Modelling
CS	Consumer Surplus
CSU	Compensated Surplus
CV	Compensated Variation
CVM	Contingent Valuation Method
DBDC	Double Bounded Dichotomous Choice
DfID	Department for International Development
ESU	Equivalent Surplus
ETB	Ethiopian Birr
WSSA	Water Supply and Sewage Authority
EV	Equivalent Variation
FDRE	Federal Democratic Republic of Ethiopia
GoE	Government of Ethiopia
HPM	Hedonic Price Method
JMP	Joint Monitoring Programme
MDGs	Millennium Development Goal
MWTP	Mean Willingness to Pay
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
OWNP	One Wash National Program
SDGs	Sustainable Development Goal
TCM	Travel Cost Method
UNICEF	United Nations International Children ‘s Educational Fund
VIF	Variance Inflation Factor
WHO	World Health Organization
WTA	Willingness to Accept
WTP	Willingness to Pay

ABSTRACT

The study aimed to determine how much households in shararo town, central Ethiopia were willing to pay for improved water services. Since water is a vital resource for sustaining life and promoting socio-economic growth, it is crucial to understand its economic value, even though it is not traded in markets. To estimate the willingness to pay, the study used the Contingent Valuation Method (CVM). This method involves conducting a survey and collecting primary data from 378 randomly selected households. The survey employed a specific approach called the Double-Bounded Dichotomous Choice (DBDC) elicitation format, which involved in-person meetings The study also found that the majority of the sampled willingness to pay for water service were female, the mean age of individuals who are likely to willingness to pay for water service is 35.28 years, the mean income of these individuals is 4806.33 Ethiopian Birr per month, and they have a mean of year of the schooling of the individuals is 11.61 years. The logistic regression model had a binary dependent variable (WTP) and 13 explanatory variables, of which 9 were found to be statistically significant. The logistic regression model is statistically significant in predicting willingness to pay for water service. Key factors influencing willingness to pay include sex, education level, family size, employment status, water service quality, awareness, disease exposure, satisfaction, and bid amount. The Double Bounded Dichotomous Choice (DBDC) method was effectively used to estimate the willingness to pay (WTP) for improved water service in Shararo town. The DBDC analysis yielded a mean willingness to pay of 0.40 EB per 20 liters, with a total annual WTP of 8,824,545 ETB *for the Shararo town population. In light of these findings, the study recommended the implementation of future projects in the study area, as there is a clear opportunity to provide improved water services that would not only benefit the community but also have the potential for financial sustainability.*

Key words: Bid, Contingent Valuation Method, Double-Bounded Dichotomous Choice Logit model, Willingness to pay

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Globally recognized standards, such as those established by the World Health Organization (WHO) and other regulatory bodies, provide guidelines for water quality and access. These standards aim to ensure that water resources meet certain criteria to safeguard public health and support sustainable development (World Health Organization, 2016).

For decades, the international community has recognized the widespread problems associated with inadequate water and sanitation. Yet, nearly 700 million people lack access to improved water supplies and almost 2.5 billion people lack adequate sanitation even today (Connor ,2015).

Furthermore, midtowns should ideally have a daily per capita use of 50 liters or more of drinking water, according to worldwide requirements. In severe circumstances, the consumption should exceed 20 liters. However, you mentioned that Ethiopians consume less than 15 liters of water per day per person, which falls below the globally recognized standard (Hemidat, 2019). The water industry plays a significant role in job creation, providing employment opportunities across various sectors and skill levels. It contributes to economic growth and development while ensuring the provision of essential water services to communities. (Kalumbi et al, 2020).

According to Herrera, V. (2019) efforts are being made to invest in water infrastructure, promote water governance and management, develop appropriate technologies, and implement policies that prioritize universal access to clean water and sanitation. These efforts contribute to achieving the Sustainable Development Goals set by the United Nations, particularly Goal 6, which aims to ensure availability and sustainable management of water and sanitation for all.

As of 2017, according to WHO, approximately 90% of the global population had access to basic water services, while only 71% had access to services that were considered safely managed. This indicates that there is still work to be done to ensure that water services meet quality standards and are reliably and safely managed worldwide. These factors interact and compound each other, further challenging water availability and exacerbating water scarcity. Addressing these challenges requires integrated approaches that focus on sustainable water management,

conservation, water efficiency, and adaptation strategies to mitigate the impacts of population growth, droughts, political unrest, pollution, and climate change (Du Plessis et al, 2019).

According to the Chapman et al, (2022) Monitoring is an activity that observes or tracks changes, usually for a specific purpose, over a period of time. Water monitoring is carried out for the purposes of determining water quality and/or water quantity. Water quality monitoring was defined as "*Collection of information at set locations and at regular intervals in order to provide the data which may be used to define current conditions and establish trends".*

According to the George-Williams, et al, (2024) the water challenges in Africa requires a multi-faceted approach that includes investment in water infrastructure, sustainable water resource management, improved sanitation facilities, and capacity building. It also necessitates addressing broader issues such as governance, financing, and community participation to ensure the long-term sustainability of water and sanitation solutions.

According to the 2017 Joint Monitoring Programme (JMP) report by WHO/UNICEF, urban areas experienced a remarkable increase in service coverage, with 93% of the population having access to improved water supply. Among these, 56% have water piped directly onto their premises, while 37% obtain water from other improved sources. To support effective water supply programs, the DFID (Department for International Development) has been actively involved in Ethiopia. Their efforts complement the Ethiopian government's strategy for sustainable water supply, particularly in drought-affected region (Gebremichael, 2019).

Several indicators point to the lack of better water as the main barrier to Ethiopia's socioeconomic progress. As to the FDRE (2020) report, the Ethiopian government has established goals to ensure that clean water supply is available in 100% of urban regions and 98% of rural areas, respectively. However, the Growth and Transformation Plan of 2010 and the Universal Access Plan of 2005 achieved the goal first. Funds for the target's execution are provided by the government and foreign donors through the One Wash National Program (OWNP).

Additionally, the Government of Ethiopia raises the funding allotted for water delivery every year in order to ensure the programs' effectiveness (Tadesse, et al., 2013). However, 10 years after the policies were put into practice, the total amount of water supplied in both rural and urban areas across the country fell short of the projected levels (Minota, T.,2014). These initiatives, whether led by NGOs, government agencies, or international partners, play a crucial

role in addressing water scarcity and promoting sustainable development in Ethiopia. The journey toward better water access continues, and collaboration remains essential for achieving lasting impact (Mourad, K. A, 2020).

The previously mentioned data indicates that Ethiopia continues to fall low of its goal of supplying better access to water for its people. This means that the nation has to develop more water projects, whether they are run by the government or by private companies. In addition to the issues listed above, one major issue facing emerging nations' fast expanding urban areas is a shortage of clean, safe water. This includes central Ethiopia, of which the town of Shararo is not an exception. As part of the solution to the serious issue in Shararo town, this study aims to determine the household's readiness to pay for the better water supply.

2.1. Statement of the Problem

Community water systems are responsible for providing potable (drinkable) water to residents, businesses, and institutions within a specific area, such as a city or town. These systems are typically owned and operated by local governments or water authorities (Grönwall, J., 2016).

The water crisis is indeed a significant global challenge, and its severity is exacerbated by climate change. The combination of increasing population, industrialization, and climate variability has put tremendous pressure on water resources around the world (Cramer, et al., 2018). Improving the disparities in water access and ensuring sustainable water management in developing nations require international cooperation, financial support, and capacity building (Connor, R., 2015).

Even while improved water service is more readily available in urban areas than in rural ones worldwide, it is still extremely low in developing countries. The people who live in cities in Asia and Africa will be most affected by the shortage of clean water, according to (UNICEF, 2018). Furthermore, Water scarcity is a pressing global issue that affects many regions around the world. While the specific information on the projected percentage of the global population residing in water-scarce regions by 2025, it is true that water scarcity has been a growing concern in recent years. (Shemer, 2023).

According to Dos Santos et al (2017) reports from African nations, including Ethiopia, support the goal of providing affordable water supply services while acknowledging the financial

challenges associated with it. Ethiopia is indeed not an exception in facing the dilemma of balancing the cost-of-service provision and the affordability of water tariffs.

One of the primary obstacles to delivering better water in urban areas of poor countries is a lack of sufficient funding. Access to clean and improved water requires significant investments in infrastructure development, maintenance, and operation (Dos Santos et al., 2017). In the instance of Ethiopia, this is accurate (Fedeler, K., 2021) the projects typically involve constructing man-made infrastructure rather than relying solely on natural sources of water. This includes building or upgrading water treatment plants, distribution networks, storage facilities, and other necessary components.

According to Kidanie, K. A. (2015) the cost of providing water supply services in Ethiopia is considerable, while the amount charged to users is relatively low. Ethiopia, like many developing countries, faces challenges in adequately funding water supply services due to limited financial resources and the need to keep tariffs affordable for the population. As a result, the government and development organizations often subsidize the cost of water services to ensure accessibility for all, particularly those in low-income areas.

Conducting research on user willingness to pay (WTP) is crucial before implementing a cost recovery tariff for improved water service in urban areas. Assessing the WTP helps in determining the affordability of water tariffs for users and ensures that the proposed tariffs align with their willingness and ability to pay (Singh, S. N., 2020). Enhanced water supply, as a non-market good, does not have a readily observable market price that can serve as a signal for its value. Unlike market goods, the market mechanism alone may not be sufficient to determine the appropriate pricing for improved water services (Liang et al., 2018).\

In developing nations like Ethiopia, where access to improved water supply is limited, understanding users' willingness and ability to pay is crucial for project expansion, effective water use, sustainability, and profitability (Abeya Dinka, B., 2016). In addition, evaluating household willingness to pay for an enhanced water service enables the identification of different affordability segments, understanding the value perception of users, and establishing a tariff rate for cost recovery

One of the Ethiopian towns with a serious water shortage is Shararo. The existing supply of water falls short of the needs highlights the challenges faced by the town in meeting the water demands of its residents. According to the reports from the town's water supply and sewage bureau in 2023, shortages of workers and financial limitations are identified as the main barriers to providing better water service to families in Shararo. The water project in Shararo is implemented by the Government of Ethiopia (GoE) but takes more than ten years to become operational indicates a significant delay in project implementation. Delayed implementation can lead to prolonged water shortages and hinder the timely provision of improved water services to the community (BoTWSSA, 2019).

There have been several studies in many countries around the world examining the willingness to pay for better water services. For example, in the case of cross-country, Studies, Abualtayef et al, (2019) conducted in Palestine; Asim & Lohano (2015) in Pakistan; Odwori, EO (2020), Kenya, and research on Ethiopia by researchers such as, Mezgebo and Ewnetu (2015) conducted in Nebelet town; Bogale & Urgessa (2012) In Eastern Ethiopia; Abeya Dinka, B., (2016) and Kidanie, KA (2015). Although the above researchers tried to identify specifically, the main reasons for the willingness to pay for better water services there is a lack of literature on the variable Awareness of household. The lack of literature on the variable of household perceptions regarding willingness to pay for improved water services indicates a research gap in these studies.

This research gap was indicative of limited knowledge and understanding of how awareness specifically affects households' willingness to pay for improved water services. This study opens future research opportunities to fill this gap and contributes to the current literature.

1.3. Research Questions

In the regard of the above problems, this study intends to answer the following questions

- Are households in the study area willing to pay for better water service?
- What factors will be affecting the households WTP decision for the service?
- How much aggregate money the households will be willing to pay for the improved service?

1.4. Objective of the Study

1.4.1. General Objective of the Study

The general objective of study is to determine the willingness of Shararoo residents to pay for better water services.

1.4.2. The Specific Objectives of the Study

The specific objectives of the study are;

- To examine the household's willingness to pay for improved water service in the study area.
- To identify the factors affecting the household's willingness to pay for improved water service in the study area.
- To estimate aggregate households WTP in monetary value by applying the stated preference method called CVM.

1.5. Significance of the Study

Increasing urbanization and population growth in Shararoo highlights the need for basic infrastructure, including improved water services, to meet the growing needs of residents. However, there is a huge imbalance in the city between supply and demand for better water services.

The motivation of the study is the severity of the drinking water problem in Shararo. This indicates that access to safe and reliable drinking water is a major issue in the study area. Therefore, the primary requirement of this study provided basic information to various stakeholders, including policy makers, NGOs, local government, federal government, international organizations, and the city's water supply company. This study aims to assess the ability and willingness of consumers to pay for improved water services.

The second implication of this study is valuable information about factors that may affect households' willingness to pay for improved water services (WTP). This study has contributed to the cumulative knowledge in economic and policy aspects of water.

1.6. Scope of the study

The scope of the study focuses on households in Shararoo and improved water service utilization. This study used cross-sectional data collected from a sample of families at a particular point in time. The survey did not include water use surveys by government agencies, institutions, or other entities in the city. Specifically, it focuses on water services for households. Collecting data from the entire population or all households in the city is not possible within the constraints of this study. Therefore, data collection was limited to the household sample. Conducting a survey of the whole population is beyond the capacity of this study due to resource and time constraints.

1.7. Organization of the Paper

This paper is organized in to five chapters. The first chapter containing background of the study, statement of the problem, objective of the study, including specific objectives, and basic research questions, significance of the study, scope of the study, and organization of the study. The second chapter consists of review of relating literature. The third Chapter deals with the methodology employed in the study. Data analysis and presentation of results are presented in chapter four; while chapter five has summary of studies, conclusions of the study and recommendations and the reference of the source and appendix of the research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Theoretical background and basic terms of Economic Valuation

The theoretical background of economic valuation refers to the foundational principles and concepts that underpin the process of assigning economic value to environmental goods and services. Economic valuation is a method used in environmental economics to quantify the value of natural resources, ecosystems, and environmental amenities in monetary terms (Freeman III et al., 2014). This approach is based on the idea that the environment provides various benefits to society, and these benefits can be measured and incorporated into economic decision-making processes. (De Jonge, et al., 2012).

The theoretical background of economic valuation encompasses several key concepts and theories, including welfare economics; market failure, non-market valuation methods, and the concept of externalize (Uno & Bartelmus., 2013). Welfare economics is focuses on the allocation of resources to maximize social welfare and examines how changes in resource allocation affect individual and societal well-being. Market failure is referring to situations where the free-market mechanism fails to allocate resources efficiently, leading to sub optimal outcomes. Non-market valuation techniques include stated preference methods (e.g., contingent valuation and choice experiments) and revealed preference methods (e.g., hedonic pricing and travel cost method) (Ouchi, W. G., 2019). Externalities play a significant role in shaping the theoretical foundation of economic valuation. Environmental externalities, such as air and water pollution, deforestation, and habitat destruction, have far-reaching impacts on society that are not reflected in market prices (Goodstein & Polasky, 2017).

The economic value of goods or services is measured by a change in human wellbeing arising from the provision of those goods or services. It is a measure of the maximum amount an individual is willing to forgo other goods and services in order to obtain some level of goods or

services. Individual welfare depends not only on the quantity of private goods and services but also on quality. One can benefit from non-market goods and services that flow from the environment and natural resources. Natural resources such as forests, fisheries, and clean water and environmental and ecosystem services such as clean air, visual amenities, and outdoor recreation are valuable because they yield flows of services to people (Freeman *et al*., 2003).

2.2. Methods of Valuing Environmental and Natural resources

Numerous techniques are employed to assess the value of environmental or public goods and services. The approaches that have been classified typically fall into three categories: revealed preference methods, benefit transfer methods, and stated preference methods (Mavsar et al., 2013). As an alternative to the second and third approaches, the first is employed. The second category consists of those that draw conclusions about preferences and economic values based on observable human behavior (Tietenberg and Lewis, 2012). The third approach estimates the worth of environmental goods and services using data from surveys.

There are direct and indirect procedures in each category, and surveys are needed for both. There are advantages and disadvantages to each method of doing these surveys, which include self-administered, telephone, mail, and in-person interviews. However, due to the low literacy rates and typically inadequate postal and telephone infrastructure in developing nations, face-to-face surveys were thought to be the most appropriate (Alberini and Cooper, 2000).

2.2.1. Revealed Preference Methods

Since revealed preference approaches entail real behavior, they are observable (Wittink, 2011). The approach necessitates investigating people's preferences as demonstrated by their behavior in markets, which is closely linked to the environmental good under consideration's non-marketed worth. Using this approach, information on the trade-off between money and the environmental good is deftly inferred from the observation of a genuine choice in a market (Deacon and Kolstad, 2000).

The hedonic pricing technique (HPM), which has been used to estimate pollution costs, and the trip cost method (TCM), which estimates the usage value of recreational areas, are both included in the revealed preference approach. Because TCM and HPM rely on the real market conditions, they are typically not able to predict non-use values (Lyons, 2004). Because of this, this study

employed the expressed preference technique, taking into account the significance of non-use values for enhanced water delivery.

2.2.2. Stated Preference Methods

The expressed preference approach is a technique that gathers information using survey methods to determine someone's willingness to pay for a marginal improvement or to prevent a marginal loss of natural resources. Choice modeling and contingent valuation approaches are the primary valuation strategies used in these categories (Haab and McConnell, 2002; Honu, 2007). Using a questionnaire poll, this approach infers the monetary worth of a non-market product from planned behavior. Stated preference approaches question respondents about their preferences for a particular environmental item or service in an effort to directly elicit their environmental values. This approach aims to quantify the monetary worth of environmental benefits, such as enhanced scenic views, improved air or water quality, etc. (Tietenberg and Lewis, 2012).

In order to create financial potential from the user to achieve the aim of environmental improvement or damage reduction, the expressed preference approach estimates a consumer's WTP in monetary value for the non-market environmental benefit (Carson, 2012). Because expressed preference techniques may produce estimates of the whole range of environmental costs and benefits associated with both usage and non-use, interest in them has grown.

2.2.2.1. Choice Modeling

According to (Johnston et al., 2017), choice modeling is a stated preference technique where respondents are asked to select between two or more multi-attribute options. According to Pearce and Ece (2002), choice modeling is the term used to describe a range of methods for determining respondents' willingness to pay (WTP) based on sets of ratings or rankings of different choices.

The method was first created in response to the difficulties that arose while modeling Australian telecom decisions using conjoint analysis methodologies. Convergent ranking and rating systems are extensions of conjoint analysis, a popular marketing method. This kind of method is often characterized by the necessity that survey participants evaluate options that are characterized by their constituent qualities, or "attributes," at varying degrees.

Each strategy has advantages and disadvantages of its own. Its strength is that, because of the abundance of information on respondents' preferences in its application, it allows the analyst to

give policy makers a wide range of information. However, one of its drawbacks is that it requires a more involved questioning procedure that puts more demand on respondents' cognitive abilities in order to provide a richer data set (Lyons, 2004). Furthermore, the customary CM practice of offering more than two options in a choice set gives respondents greater leeway to exhibit strategic behavior biases in a CM application.

2.2.2.2. Contingent Valuation Method

Using the service demand curve as a guide, the contingent value approach determines a customer's willingness to pay for better service. It is based on the individual utility maximization framework of the neoclassical idea of economic value. It entails obtaining the willingness to pay (WTP) of a sample of the populace for the provision of a certain commodity or service (Wattage, 2011).

The first economist to use a CV survey was Davis (1963), despite Ciriacy-Wantrup (1947) proposing the concept. Davis was studying the economic benefits of recreation in Maine's forests. However, historically speaking, the approach was in use for around 20 years prior to 1963 or beginning in 1943 as a substitute for revealed preference methods like the trip cost method (TCM), particularly in the field of outdoor leisure from 1943 to 1989. This time span spans from the invention of a technique to the Exxon Valdez catastrophe.

Following the Exxon Valdez oil spill in 1989, there has been a great deal of discussion on the method's validity. This has led to more study on the theoretical and empirical basis of expressed preferences for non-market valuation methodologies. Ultimately, from 1992 to the present, the CVM has gained acceptance as a potent non-market valuation technique on both a political and academic level (Hoyos and Mariel, 2010).

Because it estimates resource values for passive usage, which other techniques of valuation are unable to estimate, contingent valuation is the sole practical approach for non-market assessment of environmental resources (Krutila, 1967). (Carson et al., 2000). It is called a "stated preference method" because it asks respondents explicitly about their preferences for the commodity and because the value estimates that are derived depend on the information that was previously supplied to the respondent in the survey. Here, the word "contingent" indicates that the choices are expressed for the hypothetical circumstances that are being presented.

CVM directly evaluates the economic values for all sorts of ecosystem and environmental services that has both use and passive values. Although it is the most disagreeable approach; it is

recently the most used way to estimate the value for non-marketable products, since it has two benefits over indirect methods. Initially, it has the ability to handle both use and non-use values, whereas indirect approaches are limited to the former and need weak complementarily assumptions. Second, in contrast to indirect approaches, CVM answers to WTP or WTA questions correspond directly to the monetary measures of utility changes that are theoretically true (Hoyos and Mariel, 2010).

Quantifying compensatory and comparable fluctuation of a resource or environmental quality is the aim of CVM. When the respondent is obliged to pay for the good—such as when paying for an improvement in water quantity or quality—compensating variance makes greater sense. Conversely, comparable variation is primarily employed in situations when the respondent may lose the product; as a result, it is the lowest amount of compensation that the person will take in lieu of the loss (Perman et al., 2003). You may elicit both strategies by asking respondents what their WTP or WTA is.

Similar to other techniques used in the financial assessment of natural and environmental resources, CVM possesses its own advantages as well as some drawbacks. The method's main advantages over alternative approaches include, but are not limited to, its great flexibility, ability to accommodate various non-use values, and ease of analysis and description of the results. Conversely, the method's flaw is its incapacity to take future generations' preferences into account. Additionally, the procedure is susceptible to many biases; yet, the survey results might be legitimate and dependable if they are administered carefully (Honu, 2007).

The CVM method has been widely used despite the method's persistent weakness, and there is now a wealth of documented evidence supporting the use of contingent valuation to determine the welfare assessment of changes in environmental quality (Bateman et al., 2002; Gunatilake et al., 2007). Furthermore, according to Albani and Cooper (2000), it makes sense to value non-market commodities and services in developing nations.

2.2.2.3. The Link between Welfare Economics and Contingent Valuation Method

For a very long time, the effect of non-marketable goods and services on consumer welfare was disregarded. However, non-marketable products and services also have an influence on the wellbeing of consumers in addition to marketable goods and services. The economic worth of environmental and natural resources is determined by how they affect human wellbeing (Gunatilake, 2003). Furthermore, the wellbeing of future generations is included, and in this

context, it is referred to as bequest value. As a result, determining the economic values of public or environmental goods is an effort to gauge the advantages or effects that these goods have on certain utilities.

As (Freeman et al., 2014) state that there are several ways in which shifts in non-marketable commodities and services impact human wellbeing or utility. For example, altering the price of the commodities and services under discussion might alter the cost of the production inputs, which in turn can alter the quantity and quality of other public goods.

Additionally, for the purposes of this study, it is assumed that better water service quality can reduce aversion costs, the cost of water used as a factor of production, and can promote community sanitation, all of which can improve clean air and scenery and, in turn, reduce infection and child mortality risks. Likewise, a rise in quantity enhances the daily water intake of all the homes within the research region.

Evaluating the effectiveness of various public resource allocation choices is the main goal of policy makers in their quest to enhance social welfare. The use of Pareto improvement, which is a benefit to one person without making any other person worse off, is a more acceptable welfare metric for policy in the provision of public goods or resource distribution. The foundation of the Pareto improvement theory is the premise that the total advantages of a public intervention should outweigh its costs (Dixon, 2008). Allocating resources in this way can lead to increased efficiency.

When it is impossible to improve the situation of one or more people without making at least one other person worse off, then resource allocation is efficient (Perman et al., 2003); the opposite is also true. For environmental or public goods to be provided in a locative efficient manner—that is, in a way that prevents future improvements without making people's welfare worse—Pareto improvement is therefore a prerequisite, not a sufficient one. Usually Consumer Surplus (CS), the region beneath the Marshallian demand curve and above the price level, has been used to evaluate welfare changes resulting from changes in environmental or public goods.

However, because CS is ineffective at maintaining utility, there have been reservations over its application as a welfare tool. Furthermore, there is a feature of environmental or public goods the absence of a price that makes it challenging to apply the ideas of the Marshallian demand function and consumer surplus.

Public or environmental commodities are not tradable in the absence of a price since they do not have the features of private property. As a result, the cost and other information required to compute the Marshallian demand curve cannot be seen immediately. Because of this, the welfare's change measurement may be misleading when using CS. It is crucial to use a welfare metric that is clearer and more accurate as a consequence.

Hicks (1943) corrected the regular demand functions and created four alternative welfare metrics to resolve this uncertainty. The use of Hicksian compensatory welfare measures is predicated on the idea that the utility level of the customer stays constant prior to the alteration in the delivery of environmental services (Nicholson and Snyder, 2008). Formulating the duality of the maximization issue yields the spending function given the ordinary demand function. As a result, we assume that an individual will reduce spending subject to a certain level of utility since the expenditure function lets us hold the utility function constant.

The Hicksian demand functions, as opposed to the Marshalian demand function, which maintained income as constant, are obtained by solving the minimization problem. These functions display the quantities consumed at different prices while assuming that income is modified to maintain utility (Freeman et al., 2014).

The four alternative welfare measures compensating variation, equivalent variation, compensating surplus, and equivalent surplus are a refinement of the standard CS. The area under the Hicksian demand curve represents the compensatory and equivalent variations, which measure changes in price, and the compensating surplus and equivalent surplus, which measure changes in quality or quantity. Additionally, comparable surplus and equivalent variation maintain utility constant at the alternative level, whereas compensating surplus and compensating variation maintain utility constant at the original level (Gunatilake, 2003).

The term Compensating Variation (CV) refers to the change in income that is required to maintain an individual at their initial level of utility (U_0), as the consumer will only be made whole by the income adjustment. In the event of a price drop, CV is the change in income required to maintain a person at the same level of utility as before the price drop, i.e., maximum WTP. Likewise, in the event of a price rise, CV is defined as the minimum Willingness to Accept (WTA) the quantity of money needed by the customer to maintain the same level of utility as before the price increase (Gunatilake et al., 2007).

The term Compensating Surplus (CSU) refers to the monetary income adjustments required to maintain the consumer at their initial utility level despite changes in quantity or quality. The CSU for an improvement is the amount of money that must be taken out of the consumer's income in order to maintain the same utility level as before the environmental improvement, or the maximum WTP. Comparably, in terms of deterioration, CSU is the minimal WTA that must be paid to the customer in order to maintain their level of usefulness previous to environmental harm (Haab and McConnell, 2002). The money income adjustment required to keep a person at his ultimate level of utility (U1) during a provision shift is known as the Equivalent Variation (EV) (Gunatilake et al., 2007). When there is a price drop, EV is defined as the extra money that is given to the customer to get them to the same level of utility that they would reach with their existing income, less the minimal WTA, in lieu of the price drop. Similar to this, in the case of a price rise, EV is defined as the highest WTP that must be paid by the customer in order to prevent the price increase while still bringing him or her to the same level of utility that they would reach with current expenditures. The EV calculates the highest income a customer would be prepared to forego a price increase.

Equivalent Surplus (ESU**)** is the money income adjustment required, in the event of quality or quantity changes, to maintain the consumer at the ultimate level of utility. In the case of an improvement, ESU is the extra revenue that must be provided to the customer in order to raise him or her to the same degree of utility that, in light of the environmental improvement, minimal WTA, would be possible with the present income. Similar to this, in the case of deterioration, the maximum WTP to prevent the deterioration is determined by taking away from the customer the amount of money that would be required to return them to the same level of utility with their present income in the event that environmental harm happened (Gunatilake et al., 2007).

2.2.2.4. Approaches of Contingent Valuation Method

CVM mostly depends on respondents' expressed preferences; several methods can be used to elicit WTP or WTA. The following is a discussion of the methodologies (elicitation formats):

Open-ended format: This is the conventional approach, which involves asking respondents the maximum amount of money they are willing to pay or accept without a referendum. While this method has advantages, such as being quick to administer and avoiding the "anchoring effect," it has been shown to be inconsistent with economic theory. According to Arrow et al. (1993),

asking respondents about WTP in an open-ended format presents a challenge because it can be challenging for them to instinctively assign an economic value to a non-market good. As a result, respondents are often faced with this task. Furthermore, it has been demonstrated that using this elicitation approach yields a high non-response rate and a significant number of dubious high or low answers. Researchers have proposed the following elicitation forms in an effort to enhance the CVM elicitation format.

Checklist (Payment card) style: In this format, participants select their maximum WTP by presenting a card with a list of bids organized either by interval ranges or point estimations (Hoyos & Mariel, 2010). The interviewee highlights one of the available values on the card, which represents a range. Although this format manages to solve several open-ended format issues, it still suffers from beginning point bias, which causes bias in the WTP outcome. Due to these shortcomings, a more suitable format is required.

Bidding game format: Mitchell and Carson (1981) created the bidding game format after identifying the beginning point bias in the payment card format. Using a format such as "would you be willing to pay X Birr for this item?" respondents were given a series of questions until the maximum was reached or they were repeatedly asked to express their maximum WTP. A new question with a higher value for X is posed in the event of a positive response, and a new question with a lower value for X is posed in the event of a negative response.

The bidding game ends when the respondent switches from “yes” to “no” or from “no” to “yes” (Hoyos and Mariel, 2010). But this format also suffers from different problems, for instance, lack of incentive compatibility and starting point bias, and fatigue effects are another problem because the question is very long.

Discrete option that is dichotomous: a single-bounded referendum that is either take-it or leave-it Bishop and Heberlein (1979) introduced this format to the CV survey for the first time. In this style, respondents are asked if they are willing to pay or accept a certain sum in a given scenario, or alternatively, they are asked whether they would be prepared to spend a specific amount of money for the improvement of the environment and natural resources.

Furthermore, the respondent merely needs to evaluate a certain price, just like any other buyer (Wattage, 2011). The approach still has starting point bias, and in order to achieve statistical precision on the WTP estimate, it still requires large sample numbers and appropriate model parameters.

Dichotomous discrete with follow-up question: This type of discrete option is identical to the previous one, but it also includes a maximum WTP follow-up question. It has been demonstrated that the aforementioned (dichotomous discrete choice single-bounded referendum) approaches have compatibility issues, where survey participants can sway possible outcomes by disclosing values that differ from their actual willingness to pay. In an effort to improve estimate precision, the discrete dichotomous double bound approach was developed.

This approach was first created by Hanemann (1985), and it primarily entails asking respondent's two yes-or-no WTP questions, with the second question serving as a follow-up and the bid price changing depending on whether the respondent answers positively or negatively to the first. It has been demonstrated that using this strategy yields more accurate estimations than using only one question (Song et al., 2019).

Although the double bound CVM has the potential for bias, Calia and Strazzera (2000) note that the method is justified because it reduces mean square error, which reduces the confidence interval of the WTP measures and leads to more conventional WTP estimates. Haab and McConnell (2002) state that there are three ways in which the double-bounded model is more efficient than the single dichotomous option model. First, the yes-no or no-yes response sequences produce distinct

Limitations on WTP. Since it is closer to genuine WTP than the open one, there are further efficiency improvements for the no-no and yes-yes pairings. These arise from the fact that extra questions further restrict the portion of the distribution where the respondent's WTP can lie, even if they do not entirely bind WTP. Ultimately, more replies are provided, increasing the number of observations that may be used to fit a given function. For the same reasons, this study estimated WTP for enhanced water services in the study region using the dichotomous double bound along with a follow-up inquiry.

2.2.2.5. The Basics of the Contingent Valuation Method

The natural and environmental resource value evaluation process is carried out in stages using DBDC formats. Generally speaking, there are five phases that make up the approach as it is described by Tietenberg and Lewis (2012). The first stage is to create a hypothetical market; the goal is to create a scenario that as nearly resembles a real-world event as feasible. In this phase, the researcher specifies the payment's justifications. In this study, the money is justified by an improvement in the service. Not only should the provision rule construction be explicit, but also

the payment vehicle or manner. Gathering information from the sampled houses comes next, following the construction of the hypothetical market. The third phase, mean WTP estimation, comes after data gathering. The process of determining the bid curve is the fourth phase, and aggregating the data is the last one.

Several academic works attest to the fact that, during the past three decades, CVM has been widely applied in the economic assessment of public and environmental assets. Nevertheless, despite widespread usage and advancements over the years, the CVM remains highly contested and faces significant criticism over the biases inherent in the system. Due to the nature of its methodology and survey instrument, the CVM has several biases in both theoretical and practical contexts.

The following is a discussion of the anticipated biases that may occur in the valuation of environmental and public goods, per Tietenberg and Lewis (2012). Free-Riding and Strategic Behavior prejudice: This kind of prejudice occurs when a responder gives a false response in an attempt to sway the intended result (Gall-ely, 2010). Incorrect WTP/WTA may result from the responder understating their responses under the impression that others would cover the costs of providing it or believing that other people's payments will be adequate to guarantee the supply of a benefit that they will thereafter enjoy.

When a respondent is very interested in a good and realizes that the sample mean will determine whether or not to provide it, they may engage in strategic behavior bias, inflating their true willingness to pay (WTP) in an attempt to increase the sample, mean and guarantee provision. People's self-centered actions are the source of this prejudice.

Hypothetical Bias: Because CVM relies on respondents' hypothetical responses, it is susceptible to hypothetical biases, particularly in cases when the respondent is unfamiliar with the good that will be evaluated. Therefore, when the resource is well-known, this bias is not significant (Murphy and Stevens, 2004). Anchoring effect and starting point bias: This type of bias happens in dichotomous choice formats when a respondent's first bid affects the WTP value. Payment cards, the bidding game, and dichotomous choice with a single referendum as they provide initial bids are the major techniques used to demonstrate this bias. Good surveys can mitigate this kind of bias, which results in underestimated WTP (Chien et al., 2005).

Payment Vehicle Bias: This type of bias results from the possibility that the payment option that is offered to respondents may affect how much WTP they ultimately decide to accept. A payment mechanism such as raising taxes would not have an impact on an unemployed responder; hence, the respondent might inflate their WTP. Similar to this, since higher taxes are a payment method that impacts them, a working responder can understate WTP. By offering a suitable payment method that takes into account all service users, the prejudice can be eliminated (Vondolia et al., 2011).

Another significant bias that is anticipated in CV surveys is non-response bias. This kind of prejudice happens when respondents are either unable or unwilling to react. If it is random, though, there are other methods for solving it, such as enlarging the sample size (Gunatilake, 2003).

Interviewer bias is the result of the interviewer's personality swaying the responder to accept or pay a certain amount. The interviewer may steer the responder toward the number they are anticipating, or the respondent may try to appease the interviewer by inflating WTP.

Information Bias: Since a CVM is a stated preference technique, information given to a responder plays a crucial role in identifying actual WTP that may go unnoticed. Even if information bias in CVM research involves passive bias, it is still preferable to provide the respondent with accurate information in order to obtain a truthful answer (WTP/WTA).

2.3. Empirical Literature Reviews

The many empirical results and studies about the willingness to pay for better water services in Ethiopia and other countries are covered in this section. Additionally, the process for determining the monetary values of non-marketable commodities and services was covered.

Joseph, M. (2014) conducted an analysis to estimate WTP to improve community water utilities in the Dodoma and Singida Regions of Central Tanzania. They used Multinomial Logit to model factors affecting households' WTP for improved water services, that is, maintain the status quo, increase rates of water discharge, increase the number of water distribution points/water reticulation, and other improvements.

The study conducted by Coster & Otufale (2014) focused on examining households' willingness to pay (WTP) for improved water supply in Osogbo Metropolis, Nigeria. The researchers

employed a binary logit model to estimate the truncated mean WTP by regressing the responses to the WTP question on the initial bid value variable. Their results showed that the percentage of income that a household is willing to pay for improved water supply and the willingness to pay for connection charges to the improved source are significantly affect households WTP.

The study conducted by Bolten, C. E. (2008) employed the Contingent Valuation Method with a bidding game to analyze households' willingness to pay for improved water services in Makeni, Sierra Leone. The results revealed that starting point bias affects the final willingness to pay bids of the respondents. The OLS results indicated that willingness to pay was positively related to income, education, and water quality.

The study conducted by Abualtayef et al, (2019) conducted on the Households' affordability and willingness to pay for water services in Khan Younis city, Palestine. The affordability analysis indicates that consumers are able to pay if they are provided with the improved water supply service at a price equal to the average incremental cost of providing the improved water supply.

The study conducted by Aklilu Asado (2020) focused on households' willingness to pay for improved water service in bonga town, kaffa zone using the Contingent Valuation Method (CVM). The study employed open-ended and closed-ended questions to elicit households' willingness to pay for improved water services. The results indicated that piped water was the main source of water for the town, suggesting the importance of examining households' preferences and willingness to pay for this primary water source.

The study conducted by Wondimu, & Bekele, (2012) focused on examining the determinants of individual willingness to pay (WTP) for quality water in Wonji Shoa Sugar Estate. The Contingent Valuation Method (CVM) was used to estimate the total WTP value and derive aggregate demand and aggregate benefit for the quality water supply service. The Tobit model, implemented using Limdep software, was employed to identify the socioeconomic factors that affect households' WTP.

Similarly, a set of contingent valuation studies reveals a number of factors: age, household size, volume of water consumed, reliability of the existing water supply, bid value and monthly income (Gossaye, 2007); price per bucket of vendor water, water purification practice, monthly

income and wealth of the respondent (Kinfe, 2008); income, education level, reliability on the existing water supply and perception of service quality (Simret, 2009).

The contingent valuation studies conducted by Gossaye (2007) and Bartsch et al (2008) examined various factors that influence households' willingness to pay for improved water supply services. These studies collectively provide insights into the factors that influence households' willingness to pay for improved water supply services. Age, household size, volume of water consumed, reliability of the existing water supply, bid value, monthly income, and price per bucket of vendor water, water purification practice, education level, and perception of service quality were identified as significant factors.

The research conducted in various urban areas of Ethiopia suggests that households in these areas were willing and able to pay for improved water supply services. The findings various research indicated that if the town provides improved water supply services, households are willing to pay at a cost recovery tariff level. These suggest that consumers recognize the value of improved water supply and are willing to contribute financially to access such services. The research suggests that households in urban areas of Ethiopia are willing to pay for improved water supply services and that their socio-economic characteristics should be considered when designing tariff rates

2.4. Research Gaps

The research gaps identified in the literature analysis include missing variables, format problems with elicitations, payment vehicle format difficulties, non-response rate reduction techniques, and other methodological concerns. These gaps indicate areas where further research and methodological improvements are needed to accurately assess and estimate the economic values of enhanced water services.

The literature assessment on improving water quality and other nonmarketable environmental products and services in developing economies, including Ethiopia, suggests that low-income nations can effectively implement the contingent valuation method (CVM). CVM is a widely used non-market valuation technique that allows researchers to estimate the economic value of goods and services that do not have readily observable market prices. (Workie, L. T., 2017).

The literature supports the use of the contingent valuation method (CVM) as the appropriate approach to assess the economic value of improved water services, considering both use and

non-use values. The study utilized CVM to evaluate households' willingness to pay for enhanced water supply, enabling a comprehensive assessment of the economic worth of these services (Loomisa et al., 2018).

The research gap identified in the literature review is the limited knowledge and understanding of how awareness specifically influences households' willingness to pay for improved water service. While several studies have examined willingness to pay for improved water service in various countries, including world, Africa, and Ethiopia, For instance, for cross countries case, Researches conducted by, Abualtayef et al, (2019) in palestine; Asim & Lohano (2015) in Pakistan; Odwori, E. O. (2020), Kenya, and regarding Ethiopia researches undertaken by researchers such as, Mezgebo and Ewnetu (2015)in Nebelet town; Bogale & Urgessa (2012)in Eastern Ethiopia;; Abeya Dinka, B., (2016) and Kidanie, K. A. (2015) and many more. Even though the above researchers specially, have tried to identify the major factors willingness to pay for improved water service there is lack of literature on the variable of Awareness of the household.

By filling this research gap, future studies can provide insights into the importance of awareness campaigns, education, and information distribution in promoting households' willingness to pay for improved water service. Understanding the relationship between awareness and willingness to pay can help policymakers and practitioners design more effective strategies and interventions to enhance water service provision and ensure sustainable financing.

Table 2.1 Summary of Research Gaps

Author	focus on the study	findings of author	research gaps
Mezgebo, G. K., & Ewnetu, Z. (2015).	Households' willingness to pay for improved water services in urban areas: A case study from Nebelet town, Ethiopia.	According to this researcher Households' willingness to pay for improved water services in urban areas influenced by factors affecting variables like influenced by factors affecting variables like tenure, affordability, and water expense.	This researcher did not include in their studies many variables such as, distance, awareness, and quality of water This study shows that gap in the literature on the variables
Bogale, A.,	Households'	The study established that	This study evaluated

& Urgessa, B. (2012).	willingness to pay for improved rural water service provision: application of contingent valuation method in Eastern Ethiopia	education and sex have positive and strong effects on willingness to pay for improved rural water service provision.	that education and sex have negative relationship and strong effects with factors affecting willingness to pay water services in shararo town. That has result gap between two studies.
Eridadi, H. M., Yoshihiko, I., Alemayehu, E., & Kiwanuka, M. (2021).	Evaluation of willingness to pay toward improving water supply services in Sebeta town, Ethiopia.	According to this researcher Evaluation of willingness to pay toward improving water supply services is influenced by factors affecting variables like gender, age, marital status, education level, and average monthly income. This researcher did not include in their studies many variables such as, distance and awareness.	This researcher did not include in their studies many variables such as, distance, awareness, and quality of water This study shows that gap in the literature on the variables
Hundie, S. K., & Abdisa, L. T. (2016)	Households' willingness to pay for improved water supply: application of the contingent valuation method; evidence from Jigjiga town, Ethiopia.	The study established that bid and income have positive relationship with factors affecting willingness to pay for improved water supply: application of the contingent valuation method; evidence from Jigjiga town, Ethiopia.	This study evaluated that income is negative relationship and weak impact on willingness to pay water services in shararo town. That has result gap between two studies.

Minota, T. A. M. I. R. A. T. (2014)	Determinants of households' willingness to pay for improved water supply services in Dilla Town, Southern Ethiopia:	According to this researcher probit model was analyze and discuss factors that affect households' probability of accepting the initial bid posed to them and the mean willingness to pay from the closed-ended questions.	This researcher did not use logit model to analyses the factor affecting willingness to pay for improved water supply. This study shows that gap in the literature on model

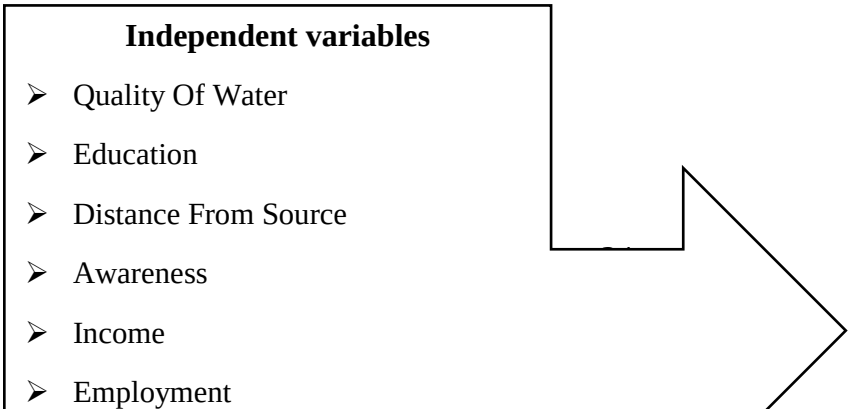
Source: Develop By Self (2024)

2.5. Conceptual/ Theoretical Framework

The conceptual or theoretical framework of a study provides a structure and foundation for understanding the research problem and guiding the research process. It establishes the theoretical underpinnings, concepts, and relationships that will be explored and tested in the study.

The conceptual framework should identify and explore the factors that may influence households' willingness to pay for improved water services. These factors can include socio-economic characteristics (e.g., income, education), awareness of the importance of improved water services, perceptions of the benefits and costs, and access to alternative water sources. Non-use values can include the value individuals place on knowing that improved water services are available, the positive impact on environmental conservation, or the preservation of future water resources (Desalew, A., 2019).

The conceptual framework should consider the implications of households' willingness to pay for improved water services for policy and decision-making. This includes understanding how willingness to pay can inform pricing mechanisms, financing strategies, and resource allocation for water service improvements. It should highlight the existing research gap or knowledge deficit that the study aims to fill. In this case, the gap could be the limited understanding of how awareness specifically influences households' willingness to pay for improved water services.



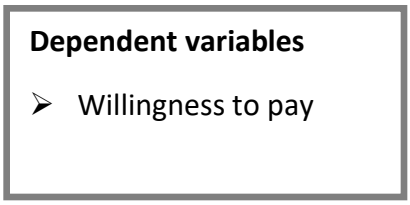


Figure 2.1 Conceptual framework

Source: Developed by the researcher (2024)

CHAPTER THREE

METHODOLOGY OF THE STUDY

3.1. Description of the Study Area

The study is conducted on Shararo town, North shoa, Oromiya Regional State, Ethiopia. Shararo town's geographical coordinates indicate that it is situated at latitude 9°35'0" N and longitude 38°50'0" E. It is located approximately 89 km north of the capital city, Addis Ababa (also known as Finfinne). The town is positioned on the main road connecting Addis Ababa (Finfinne) to Bahirdar. The town's agricultural significance is highlighted by its reputation for milk production, which contributes to the overall dairy belt of Oromia Regional State. This information suggests that the agricultural sector, particularly milk production, plays a significant role in the local economy and livelihoods of the community.

When conducting the study on households' willingness to pay for improved water services in Shararo town, researchers can take into account the specific socio-economic and agricultural characteristics of the area. This may include considering the income levels of households, their reliance on agricultural activities, and the potential linkages between improved water services and agricultural productivity (Agricultural Office of Debre Libanos Woreda, 2024).

According to Shararo town administration for casted from Censes of 2016 in (2024), the number of populations in the town increases at an alarming rate because of different factors many

peoples are migrated from rural to urban or town. Additionally, people who are live in town are highly depending on livestock production. All of this needs water. For such increasing population, availing the necessary infrastructure, including improved water service is necessary as well as compulsory for the concerning bodies.This research was proposed to estimating willingness to pay for water service in shararo town.

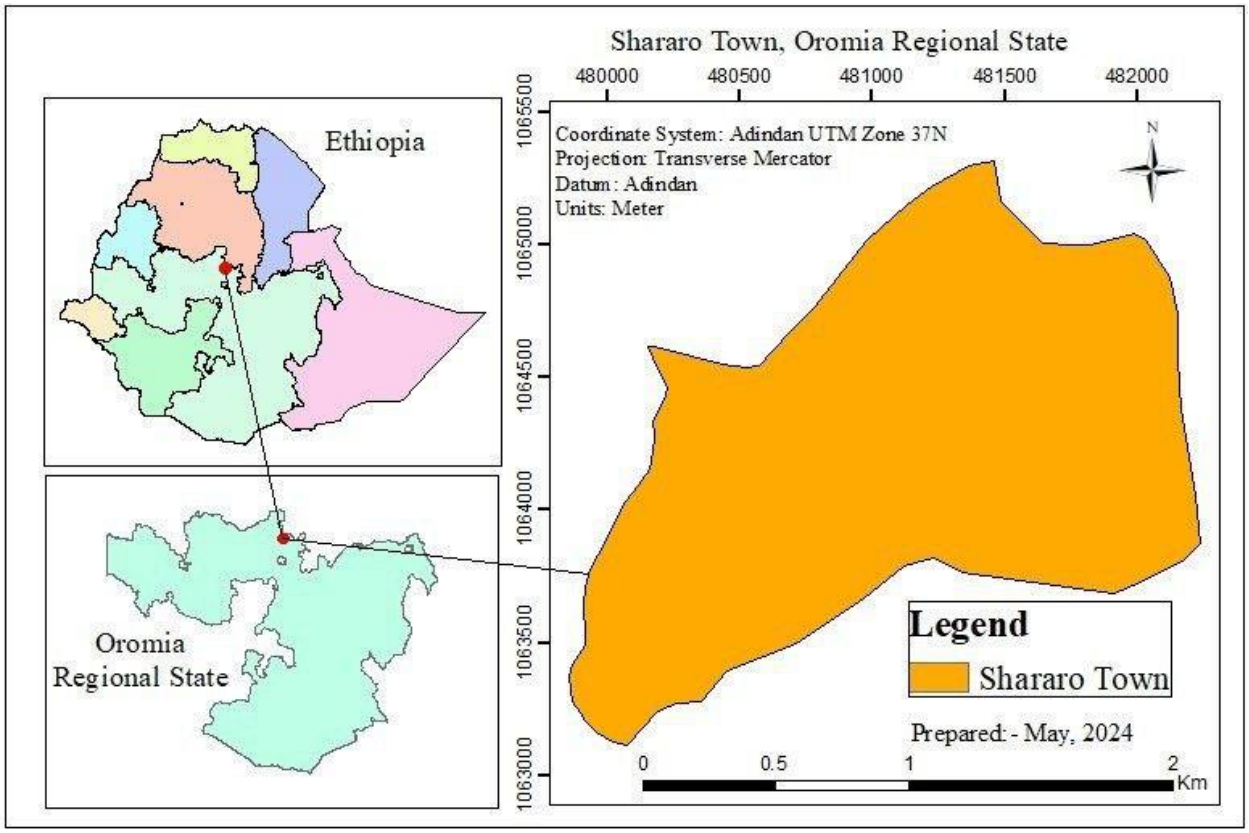


Figure 3.1. Map of study area

Source: Agricultural Office of Debre Libanos Woreda, 2024

3.2. Research Design and Research Approach

When conducting a research study to estimate willingness to pay (WTP) for improved water service using a contingent valuation approach. Contingent valuation is used method to estimate willingness to pay. Contingent valuation is a widely used method for estimating individuals' willingness to pay (WTP) for a particular good or service. In the background of estimating WTP for improved water service, contingent valuation involves presenting respondents with a hypothetical scenario that describes the proposed improvement in water service and its

associated benefits. Respondents are then asked to state the maximum amount of money they would be willing to pay to obtain or maintain that improved water service.

3.3. Types and Sources of data

When estimating the willingness to pay (WTP) for improved water services using the contingent pricing method, the study used a variety of categories and data sources. This study employs primary data through questionnaire willingness to pay (WTP) is an effective method to estimate the contingent pricing method. By including demographic and socio-economic characteristics of the respondents, as well as their attitudes towards current water services, valuable insights were provided into the factors affecting WTP (Tenaw & Assfaw 2022).

3.4 Methods of Data Collection

Data for this study were collected from primary sources. Collecting data from primary sources is indeed a comprehensive approach to estimating willingness to pay (WTP) for improved water services using a contingent pricing approach. Primary data collection really managed to increase the reliability and generalizability of the results.

The primary sources of data are interviewing the sample households, focus group discussions, key informant interviews and direct field observation methods. But in this study Questionnaire is employed as the primary data collection method. Through the incorporation of quantitative methods and primary data sources, a stronger understanding of WTP was achieved for triangulated information and improved water services. This approach increased the reliability and validity of the research findings. This research methodology enabled a detailed study of WTP for improved water service data collection methods and sources. Using qualitative and quantitative data and considering multiple perspectives will enhance the reliability and validity of the study findings. Sampling design for estimating willingness to pay (WTP) for improved water service includes questionnaire design and administration.

Questionnaire Design

Questionnaire design was considered a fundamental component in contingent value (CV) testing to ensure reliability. Traditionally, open-ended questions were used to elicit consumers' WTP for improved water services until the 1980s. However, due to difficulties encountered by

respondents, a discrete or close-ended closed-ended format was developed and has been widely used ever since.

Survey Administration

Among the various ways of collecting information from sampled populations, NOAA (Arrow et al., 1993) recommends the use of in-person interviews for reliability in eliciting WTP. This method was observed to yield high response rates. Clear information to respondents is critical to accurate data collection. Respondents were informed that the improved services would be provided on a contractual basis to pay the cost reimbursement price and that obtaining the improved services would require payment.

It also strengthens the need for design questions and research administration to estimate the WTP for better water services design. This question included the introduction, the current water service, the demand for payment, and the socio-economic profile. This research is used by two boundary elicitation forms with monitoring questions to increase the efficiency and statistical efficiency and energy.

3.5 Sample Design

The sampling design is restricted to estimating WTP for improved water services, given a systematic approach to conducting research in the city of Shararo. This study aims to estimate the WTP for improved water services among a certain target population.

3.5.1. Target Population

The Target Population is the specific population group identified for which WTP estimates are required. The study population for this study consists of two kebele families in Shararoo. This implies that the focus is on a specific geographic area, allowing for a more focused analysis of WTP in that area. The sampling design locations are households with simple random chance method chosen as the sampling method. This method helps ensure that each family in the study population has an equal chance of being included in the sample, which enhanced the representativeness of the findings.

3.5.2. Sampling Technique and Sample Size

3.5.2.1 Sampling Technique

The sampling design states that a simple random sampling technique was adopted to select the sample households from the total households in the city. This means that each family in the city has an equal chance of being selected for the city of Shararo. The sampling design as indicated by Gunatilake et al, (2003) mentioned that simple random sampling is recommended for CV research. Contingent valuation is a commonly used method of estimating the economic value of non-market goods such as improved water services. The use of simple random sampling in suggests that the sampling design is consistent with established best practices for conducting CV research.

3.5.2.2. Determining Sample Size

The sample design describes the sample size for the study determined using the formula proposed by Yemane (1967). The formula is a desired level of confidence, a level of accuracy, and takes into account the population. In this case, a confidence level of 95% and an exact level of 5% will be chosen to reduce the sample size due to the relatively similar characteristics of the households in Shararo. Using the Yemane (1967) formula, the adjusted sample size calculation is as follows:

$$N = \frac{N}{1+N(e^2)} = \frac{6750}{1+6750(0.05^2)} = \frac{6750}{17.875} = 378$$ Where,

n = Sample size

N = the number population

e = the level of precision (i.e. 0.05)

1= the probability of the event occurring

According to the above formula, the sample size 378 household will be selected.

Table 3.1. Distribution of sample respondent probability proportional to size by kebele

Kabele's name	Total Household in each kebele	Sample size determination		Sampled HH
01 kebele	4500	$n01 = n(\frac{N1}{N}) = \frac{378(4500)}{6750}$		252

02 kebele	2250	$n02 = n(\frac{N1}{N}) = \frac{378(2250)}{6750}$		126
Total	6750			378

Source: computed based on data obtained from shararo municipality office

3.6. Description of Payment Vehicle

When deciding to estimate willingness to pay (WTP) toll vehicle specifications for improved water services, many factors such as Valued assets, Socio-economic characteristics of the sample, Firm Structure and Previous research (Wang et al., 2018).

Research contingent value (CV), where hypothetical scenarios are used, it is important to make the specifications of the payment vehicle as realistic as possible. There was a participant who was able to understand how the payment mechanism worked and perceived it as a plausible method of paying for improved water services. (Cuccia, T, 2020) English.

In the town of Shararo, it decides whether to use a monthly surcharge or surcharge on the monthly water bill as a payment vehicle. This method allows participants to express their willingness to pay for improved water services without the need for immediate payment during the interview. Having to make this clear to participants, we need to emphasize that it is only a statement of their willingness to pay, not their current ability to pay. The choice and details of payment vehicles should be carefully considered to ensure effectiveness examine CVs and individuals needs for water services keeping track of the fees they have to pay for the improved.

3.7 Method of data analysis

This method included the statistics and statistical ideas to examine the relationship between independent changes and the payment needs (WTP) that appeared in Shararo. Software Stata, Version 15, is used for data analysis, including econometric analysis of statistical software packages.

3.7.1 Descriptive statistics

Descriptive statistical analysis methods were used to estimate frequencies, percentages, and means to illustrate the pattern of the independent variable by willingness to pay for improved water supply in the study area. The test (t-test, χ^2 test) was used to assess the association between categorical variables and WTP. An independent t-test was used to compare the significance of continuous explanatory variables for willingness to pay decisions. On the other hand, inferential

statistical analysis with the help of Logit, and using the dichotomous restricted multiple-choice method, was performed through STATA version 15 software.

3.8 Model Specification

The use of Logit regression and two-limit dichotomous selection methods for inferential statistical analysis is a common practice in econometrics and environmental economics.

3.8.1 Logit Model

A Logit model is a type of regression model used when the dependent variable is binary or categorical. I estimate the probability of an event occurring based on a set of independent variables. The Logit model was used to analyze the relationship between certain independent variables and the probability of making a particular choice in a two-limit dichotomous choice study.

In the Logit model, the dependent variable; WTP in this study is the log of odds ratio (Gujarati, 2004), and it is a linear function of the regressor or explanatory variable.

Logistic distribution of binary response variable or household WTP as;

$Pi = E(WTPi = \frac{1}{Xi} = \frac{1}{1+e^{-Zi}} = \frac{1}{1+e^{-X\prime\beta}}$----------1

And, Households Not Willing to pay $(1 - pi)$ is expressed

$(1 - pi) = 1 - \frac{e^{zi}}{1+e^{zi}}$----------2

Where: X is a vector of explanatory variables determining the individual 's choice of whether or not to pay, β is the set of parameters or coefficients of explanatory variables

For simplicity, equation 2 can rewritten as; pi $= \frac{e^{X'\beta}}{1+e^{X\prime\beta}}$ ----------3

Equation 3 is called cumulative distribution function, and represents the probability of something happening; in this case household willing to pay.

Since pi is non-linear in β's and Xi, it is not possible to apply the OLS procedures to estimate the parameters. So what is required is that linearizing equation 3, because the problem is more apparent than the real case. Given the probability that household willing and not willing to pay, we can write the odd ratio or relative risk, i.e. the ratio of households willing to pay to households not willing to pay can be derived as follows;

$\frac{pi}{1-pi} = \frac{1+e^{zi}}{1+e^{-zi}}$, by simplification it becomes $e^{zi} = e^{x\prime\beta}$ ----------4

Finally, by taking the natural log of the odds ratio (equation 4) we can derive the logistic distribution.

i.e. $Li=\ln\left(\frac{willing}{Notwilling}\right) = Zi = X\beta'$----------5

For estimation purpose, equation 5 can be modified as

$Zi= X\beta'+ui= \alpha+\beta iXi+ui$----------6

Where X and β are as defined above.

Thus, the log-odd are a linear function of the explanatory variables

Letting an individual's true but completely unobserved willingness to pay for improved water service by WTPi* (latent variable),

$WTPi^*=X'\beta+ui=\alpha+\beta iXi+ui$

$WTPi^*=\alpha+\beta_1 AGE+\beta_2 SEX+\beta_3 MS+B_4\ FAMSIZE +\beta_5 EDU+\beta_6 ES+\beta_7 INC+ +\beta_8 SATS+\beta_9 DEX+$

$\beta_{10} SUBS +\beta_{11}\ QLTY+\beta_{12} DS+ \beta_{13} AWRN + \beta_{14} BID1 + ui$ ----------7

Where;
AGE: Age of the Respondent.
SEX: Sex of the Respondent.
MS: Marital Status of the Respondent.
FAMSIZE: Family Size
EDU: year of schooling
ES: Employment Status.
INC: Average Monthly Income.
SATS: Satisfaction from the Existing Service.
DEX: Household's Diseases Exposition.
SUBS: Type of Substitute Service.
QLTY: Quality of Water Being Used.
AWRN: Awareness of the Household

DS: Distance from the Source

BID1: Initial Bid.

α: constant intercept and β_1---------β_{13} coefficients of explanatory variable

WTPi*- is the i^{th} households true but unobservable willingness to pay for improved water service and is binary choice dependent variable.

The equation suggests that the latent variable WTPi* is modeled as a function of the explanatory variables X, with each variable having its own coefficient. Using suitable statistical methods, estimates parameters (α and β1 to β13), allows us to get the estimate of the results of the variables on the WTPI*.

3.8.2. Estimation of mean WTP from Double Bounded Dichotomous Choice Model

The third objective of this study is to estimate the Willingness to Pay (WTP) in monetary values using the Contingent Valuation Method (CVM). The study employed a dichotomous choice with follow-up questions to elicit the WTP decision of households for improved water service in Shararo town. To address the limitations of the open-ended and payment card formats, Hanemann et al. (1991) developed the dichotomous choice method, also known as the closed-ended format. In this approach, individuals are asked whether they are willing to pay a specific amount (X Birr) for the service, and they can respond with either "Yes" or "No."

The dichotomous choice method can be further classified into single and double bounded formats. The single bounded approach, which is similar to the probit model, is commonly used in many empirical studies to estimate mean WTP. The double-bounded dichotomous choice approach is a survey technique commonly used in contingent valuation studies to estimate the economic value of non-market goods or services. It will be involved presenting respondents with two bid values, one higher and one lower, and asking them to choose between the two options or state their willingness to pay (WTP) for a specified level of the non-market good or service.

In the context of DBDC (Double-Bounded Dichotomous Choice) models, Haab and McConnell (2002) introduced two latent variables, WTP1i* and WTP2i*, which correspond to the underlying willingness-to-pay (WTP) values for the two binary dependent variables, WTP1i and WTP2i.

The DBDC model is commonly used to estimate individuals' WTP for a specific good or service using survey data. In this model, respondents are presented with two binary choices related to

their willingness to pay for the good. The two dependent variables, WTP1i and WTP2i, represent the choices made by individual i in response to the two price levels presented.

The DBDC model representation of the true, but unobserved household WTP (WTP1i* and WTP2i*) can be expressed as follows, assuming the error terms are normally distributed with a mean of zero and a correlation coefficient of p:

$WTP1i^* = \alpha 1 + \beta 1X1i + \varepsilon 1i$

$WTP2i^* = \alpha 2 + \beta 2X2i + \varepsilon 2i$…….8

The specification of the above model as follows

$$WTP1i^* = \begin{cases} 1, if\ WTP1i * > 0 \\ 0, otherwise \end{cases}$$

$$WTP2i^* = \begin{cases} 1, if WTP2i * > 0 \\ 0, otherwise \end{cases}$$ ----------9

In the background of the double dichotomous choice model, respondents are presented with a dichotomous choice (e.g., "yes" or "no") regarding their willingness to pay for a specific good or service. Depending on their initial response, a follow-up bid is provided. If the respondent answers "no" to the initial bid, the follow-up bid is typically lower than the initial bid. Conversely, if the respondent answers "yes" to the initial bid, the follow-up bid is typically higher than the initial bid.

The procedure for estimating the average WTP for the city of Shararo is adapted from Haab and McConnell (2002) and Lopez-Feldman (2012), where the improvement is based on the price of water services. These studies are likely to use econometric techniques to estimate the parameters of the two-choice model and obtain an estimate of the mean WTP based on the observed data derived from the contingent price questions.

Given these scenarios, and assuming p^1 the initial bid and p^2 the second bid; the bound on WTP of a given individuals decision are described as follow;

$p^1 \leq$ WTP $< P^2$, when the individual answers yes for first and no for second bid

$p^1 >$WTP$\geq P^2$, when the individual answers no for first and yes for second bid

WTP $\geq p^2$, when the individual answers yes for first and second bid respectively

WTP $< p^1$, when the individual answers no for first and second bid respectively

The most general econometric model for the double –bounded data come from of Haab and McConnell (2002) formulation. The linear function to estimate the mean willingness to pay can be modeled as;

WTPi (xi, ui) =xiβ+ui ----------10

Where; xi is a vector of explanatory variables, β is a vector of parameters and ui is an error term. Generally, it expected that the individual will answer 'yes' to initial question when his/her WTP is greater than the suggested amount, or when WTPi > p^1 and the same true for follow up.

Let WTP1i =1 and WTP2i =1, when the i^{th} individual answers "yes-yes" and WTP1i = 0 and WTP2i = 0 when he answers "no-no," and under normal assumptions; the probability of observing two possible bid response sequences (yes-no, yes-yes, no-yes, and no-no) given the values of the explanatory variables is given by:

First, the probability of observing ''yes-no'' response can be shown as;

Pr (yes, no) =pr (WTP1i =1, WTP2i=0)

Pr ($p^1 \leq$ xiβ + ui <p^2)

Pr ($\frac{p^1-x'i\beta}{\sigma} \leq \frac{ui}{\sigma} < \frac{p^2-x'i\beta}{\sigma}$) = Φ ($\frac{p^2-x'i\beta}{\sigma}$) –Φ($\frac{p^1-x'i\beta}{\sigma}$)

Finally, by rearranging and simplifying the probability of an individual i, answers yes for initial and no for follow up question become;

$$\Pr(\text{yes, no}) = \Phi\left(x'\frac{\beta}{\sigma} - \frac{p^1}{\sigma}\right) - \Phi\left(x'\frac{\beta}{\sigma} - \frac{p^2}{\sigma}\right) \quad \text{---------- 11}$$

Second, the probability of observing ''yes-yes'' response can be shown as;

Pr (yes, yes) = pr (WTP1i=1, WTP2i=1)

Pr ($x'i\beta$ +ui >p^1, $x'i\beta$ +ui ≥p^2)

Pr ($x'i\beta$ + ui > $p^1/x'i\beta$ + ui ≥p^2) *pr ($x'i\beta$ +ui ≥p^2)

By definition we know that p^2>p^1, then

Pr ($x'i\beta$+ui > $p^1/x'i\beta$+ui≥p^2) = 1

Therefore, pr (yes, yes) = pr (ui≥ p^2-$x'i\beta$)

= 1-Φ ($\frac{p^2-x'i\beta}{\sigma}$)

Finally, by symmetry it become;

$$= \Phi\left(x'i\frac{\beta}{\sigma} - \frac{p^2}{\sigma}\right) \quad \text{---------- 12}$$

Third, the probability of ''no-yes'' is

Pr (no, yes) = pr ($p^2 \leq$ WTP <p^1)

Pr (no, yes) = pr ($p^2 \leq x'i\beta$ +ui <p^1)

= pr ($\frac{p^2-x'i\beta}{\sigma}$) ≤ $\frac{ui}{\sigma}$ < $\frac{p^1-x'i\beta}{\sigma}$)

$$= \Phi\left(\frac{p^1 - x'i\beta}{\sigma}\right) - \Phi\left(\frac{p^2 - x'i\beta}{\sigma}\right)$$

$$= \Phi\left(x'i\frac{\beta}{\sigma} - \frac{p^2}{\sigma}\right) - \Phi\left(x'i\frac{\beta}{\sigma} - \frac{p^1}{\sigma}\right) \text{ ---------- 13}$$

In this equation, Φ represents the cumulative distribution function of the standard normal distribution. By working in the values of the explanatory variables, estimated parameters β, and bid amounts p^1 and p^2, you can calculate the probability of observing a "no-yes" response sequence for an individual.

The Forth, the probability of ‘‘no-no’’ response probability can be solved analogously.

Where; WTP1i and WTPi2, are the dichotomous variables that capture the response to the first and second closed questions.

After solving for the probabilities of two-bind response, the estimation can be done by constructing likelihood function to directly obtain estimates for β and σ using maximum likelihood estimation.

The function and that needs to be maximized in order to find the parameters of the model is:

$$\sum_{i=1}^{N}[d\ i^{yn} ln(\Phi\ (x'\frac{\beta}{\sigma} - \frac{p^1}{\sigma}) - \Phi\ (x'\frac{\beta}{\sigma} - \frac{p^2}{\sigma})) + di^{yy} \ln(\Phi(x'i\frac{\beta}{\sigma} - \frac{p^2}{\sigma})) + di^{ny} ln(\Phi(x'i\frac{\beta}{\sigma} - \frac{p^2}{\sigma}) - \Phi(x'i\frac{\beta}{\sigma} - \frac{p^1}{\sigma})) + di^{nn} ln(1-\Phi(x'i\frac{\beta}{\sigma} - \frac{p^2}{\sigma}))] \text{ ---------- 14}$$

Where; Φ(x)-is standard cumulative normal di^{yn} ,di^{yy},di^{ny} and di^{nn} are indicator variables that take the value of one or zero depending on the relevant case for each individual, that is to say, a given individual contributes to the logarithm of the likelihood function only in one of its four parts.

Finally, the mean WTP can be computed by a formula

Mean WTP = $\bar{x}i'\hat{\beta}$ ---------- 15

Where; $\bar{x}i'$-is a vector of sample average of explanatory variables, $\hat{\beta}$ is a vector of parameters.

3.9. Model Diagnostic Test

When making decisions based on model diagnostic tests for estimating willingness to pay (WTP) for improved water service in Shararo Town, Central Ethiopia using a contingent valuation approach, they are the following steps:

Specification Test: After estimating the probability function, you can perform a specification test to determine whether the model is correctly specified. Use the "ovtest" command to conduct the test. If the test indicates that the model is not correctly specified, you may need to include

relevant variables or exclude irrelevant variables from the model to improve its specification (Kam & Trussler, 2017).

Goodness of Fit Test: Assess the overall fit of the model by conducting a goodness of fit test. It will be chosen between the Likelihood Ratio (LR) test and the Hosmer and Lemeshow's goodness-of-fit test. If the LR test statistic or the HL test statistic is statistically significant, it suggests that the estimated model fits the data well. A significant result indicates a good fit, while a non-significant result may suggest a lack of fit (Lemeshow et al., 2013).

Multicollinearity Test: Test for multicollinearity among the explanatory variables in this model. Multicollinearity occurs when there is a high correlation between the independent variables. Use the "corr" command in software, such as STATA, to check for correlations. Look at the tolerance and variance inflation factor (VIF) values. If the VIF is 10 or greater or the tolerance is 0.1 or less, it suggests severe multicollinearity. In such cases, you may need to address the issue by removing highly correlated variables or using techniques like principal component analysis (Imdadullah et al., 2016).

Heteroscedasticity Test: Determine whether there is heteroscedasticity in the model, which means the variance of the error term is not constant across all observations. Use the "hottest" command in software, such as Stata, to perform the heteroscedasticity test. Examine the P-value of the White test. A significant result indicates the presence of heteroscedasticity. In such cases, the researcher will be used robust standard errors or consider transforming the variables to address heteroscedasticity (Astivia & Zumbo (2019).

3.10. Description of Variables and Expected Outcomes

3.10.1. Dependent Variables (Willingness to pay)

The dependent variable is the willingness to pay (WTP) for improved town's water services. It is a binary variable that takes a value of 1 if the household is willing to pay and 0 if the household is not willing to pay. To measure the willingness to pay, there are two binary dependent variables. The first binary variable is based on the answer to the first bid offered, while the second binary variable is based on the answer to the follow-up question or second bid. Each of these variables takes a value of 1 if the household is willing to pay the specified amount and 0 if the household is not willing to pay.

3.10.2. Independent Variables

Based on the scope of the study and the analysis of relevant literature, the following variables have been identified as explanatory variables that are expected to have a significant impact on the household's willingness to pay decision for improved water service in the study area:

AGE: Age of the respondent. It is a continuous variable representing the age of the individual participating in the study. The expected sign for the AGE variable is negative (-).

SEX: Sex of the respondent. It is a dummy variable that represents the sex of the respondent. If the respondent is male, the SEX variable takes the value of 1. If the respondent is female, the SEX variable takes the value of 0. The expected sign for the SEX variable is negative (-). As the researchers expect the respondent's sex to have a negative effect on the outcome.

MS: Marital status of the respondent. It is a dummy variable that represents the marital status of the respondent. If the respondent is married, the MS variable takes the value of 1. If the respondent is unmarried, the MS variable takes the value of 0. The expected sign for the MS variable is positive (+). For the researchers expect the respondent's marital status to have a positive effect on the outcome or dependent variable being proposed.

FAMSIZE: family size. It is a continuous variable that represents the total number of individuals living in the respondent's household. The variable takes on numerical values corresponding to the size of the respondent's family or household. The expected sign for the FAMSIZE variable is negative (-). Because the researchers expect the size of the respondent's family or household to have a negative effect on the outcome.

EDU: year of schooling. Year of schooling achieved by the respondent (continuous variable). The expected sign for the EDU variable is positive (+), indicating that higher levels of education may lead to a greater willingness to pay.

DS: Distance from Source. The nearness to the water source might impact willingness to pay. The farther people are from the water source, the less direct benefit they perceive. Hence, willingness to pay may decrease as distance increases. The expected sign for the DS variable is negative (-).

ES: Employment status. It is a dummy variable that indicates whether the respondent is employed or not employed. If the respondent is employed, the ES variable takes the value of 1. If the respondent is not employed, the ES variable takes the value of 0. he expected sign for the ES variable is positive (+). As the researchers expect the respondent's employment status to have a positive effect on the outcome or dependent variable actuality deliberate.

INC: Average Monthly income. It is a continuous variable representing the average monthly income of the respondent or the respondent's household. The expected sign for the INC variable is positive (+).

SATS: Satisfaction from the existing service. It is a dummy variable that measures the satisfaction level of the respondent with the current water service. If the respondent is satisfied with the current water service, the SATS variable takes the value of 1. If the respondent is dissatisfied with the current water service, the SATS variable takes the value of 0. The expected sign for the SATS variable is positive (+). Because the researchers expect the respondent's satisfaction with the current water service to have a positive effect on the outcome or dependent variable being studied.

DEX: Household's diseases exposition. It is a dummy variable that indicates whether the respondent's household has been exposed to water-related diseases. If the household has been exposed, the DEX variable takes the value of 1. If the household has not been exposed, the DEX variable takes the value of 0. The expected sign for the DEX variable is positive (+). That means the researchers expect the household's exposure to water-related diseases to have a positive effect on the outcome or dependent variable presence deliberate.

SUBS: Type of substitute service. It is a dummy variable that represents the type of alternative water service used by the respondent's household. If the alternative service is good, the SUBS variable takes the value of 1. If the alternative service is poor, the SUBS variable takes the value of 0. The expected sign for the SUBS variable is positive (+), not negative. Because the researchers expect the availability of a good alternative (substitute) water service to have a positive effect on the outcome or dependent variable existence considered.

QLTY: Quality of water being used. It is a categorical variable indicating the perceived quality of the water currently being used by the respondent's household, where 1 represents good quality,2 represents average quality and 3 represents poor quality. Better water quality is directly related to willingness to pay. People value safe and clean water. The expected sign for the QLTY variable is negative (-)

AWRN: Awareness of the household. It is a dummy variable that indicates whether the respondent has awareness or knowledge about the benefits of improved water service. If the respondent has awareness or knowledge, the AWRN variable takes the value of 1. If the respondent does not have awareness or knowledge, the AWRN variable takes the value of 0. The expected sign for the AWRN variable is positive (+). Because the researchers expect the respondent's awareness or knowledge

about the benefits of improved water service to have a positive effect on the outcome or dependent variable being studied.

BID1: Initial Bid. It is a variable represents the initial bid or stated willingness to pay for improved water service by the respondent. The higher the value of BID1, the greater the respondent's initial stated willingness to pay.

3.10 Ethical Consideration

It is crucial to observe the principles of research ethics in conducting research. First, a letter from the Department of economics was submitted to the municipality in order to obtain permission to conduct the study. The purpose of the study was explained to the head of the city administration. Second, respondents provided information about the purpose of the study, and their responses were kept confidential, not used for any purpose other than the purpose of the study. Third, they are also informed that they have the right to answer any questions. Finally, respondents were informed of their right to know the results of the study from time to time. Additionally, the name of the respondent was removed from the questionnaire.

CHAPTERN FOUR

RESULTS AND DISCUSSION

4.1. Demographic And socio–Economic Characteristics of Respondents

In this chapter, the focus is on presenting the empirical findings and discussing the results that were obtained. To achieve the study objective and provide answers to the research questions, the data collected from the contingent valuation survey was analyzed in two parts. In the first part of the analysis, descriptive statistics were used to summarize the data and provide an understanding of the discrete independent variables. The significance relationship between of these variables was assessed using t-tests, which compare means between two groups, and chi-square tests, which examine the relationship between categorical variables.

In the second part of the analysis, the DBDC (Double Bounded Dichotomous Choice) approach developed by Lopez-Feldman (2012) was employed to estimate the willingness to pay (WTP) from the survey data using econometric techniques. This approach is commonly used in contingent valuation studies to estimate the economic value that individuals place on a specific good or service. In particular, a Logit model was applied to examine and discuss the factors that influence the household's probability of accepting the initial bid presented to them in the survey. The Logit model is a statistical technique used to analyze binary outcomes, such as a household accepting or rejecting a specific bid.

The results of this analysis contribute to understanding the reasons of households' acceptance or rejection of the initial bid and provide insights into the factors influencing their willingness to pay for the improved water supply.

Overall, this chapter presents a comprehensive analysis using both descriptive statistics and econometric techniques to examine the relationships between variables and estimate the households' willingness to pay. It offers valuable insights into the factors that affect households' decision-making processes related to the water supply and contributes to the broader objectives of the study.

4.2. Presentation of Result and Discussion on the Results

The presentation of results and discussion is an important part of any research study. In the context of studying the estimating willingness to pay for water services in shararo town, the presentation of results and discussion can provide valuable understandings into the factors affecting of willingness to pay for improve water services.

4.2.1. Socio-Economic and Demographic Characteristics of Households

Table 4.1: Demographic and socio-economic characteristics of respondents on continuous variable

	N	Minimum	Maximum	Mean	Std. Deviation
Age of respondent	378	15.00	65.00	35.2804	9.96443
Education of respondent	378	1.00	20.00	11.6058	3.66149

Income of respondent	378	500.00	15000.00	4806.3386	3264.74873
Family size	378	2	8	4.28836	1.316664
Valid N(listwise)	378				

Source: Own survey, 2024

As results shown in Table 4.1, the dataset consists of 378 observations on three variables: age of the respondents, education, and monthly income of the household head.

For the variable "Age of respondent," the minimum recorded age is 15.00 and the maximum is 65.00. On average, the respondents where mean age is calculated to be around 35 years old and the standard deviation of the ages is 9.96443, suggesting that the older respondents may have different preferences and priorities compared to younger respondents, which could influence their WTP.

As result of table “Number of years in school," the minimum value is 1.00, indicating that at least some respondents have completed only one year of schooling. The maximum value is 20.00, suggesting that there are individuals in the sample with a relatively high level of education. The mean number of years in school is 11.61, indicating that, on average, the respondents have completed a little over 11 years of schooling. The standard deviation is 3.67, which suggests some variability in the educational attainment of the respondents.

The monthly income of the household head, the minimum reported income is 500.00, and the maximum is 15,000.00. The mean monthly income is 4,806.34, implying that, on average; the household heads mean monthly income was earned around 4,806 birr per month. The standard deviation is 3,264.74, indicating that the Individuals with higher incomes generally have more financial resources available to spend and may be more willing to pay a premium for products or services that align with their preferences and needs.

Finally, the data on family size shows that the mean family size is 4.28836, with a standard deviation of 1.316664. The minimum family size is 2, and the maximum is 8. This range in family size indicates larger families may have different needs and priorities compared to smaller households, which could affect their WTP for certain products or services. .

Table 4.2: Demographic characteristics of respondents on sex of respondent

		Frequency	Percent	Cumulative Percent
Valid	male	185	48.9	48.9
	female	193	51.1	100.0
	Total	378	100.0	

Source: Own survey, 2024

Based on the above table result, sex of respondent shows that out of the total 378 respondents, 48.9% (185 individuals) identified as male, while 51.1% (193 individuals) identified as female.

		Frequency	Percent	Cumulative Percent
Valid	unmarried	116	30.7	30.7
	married	262	69.3	100.0
	Total	378	100.0	

Source: Own survey, 2024

According to the data provided, the marital status of the respondents can be analyzed. Out of the total 378 respondents, 30.7% (116 individuals) reported being unmarried or not currently in a marital relationship. This includes individuals who may be single, divorced, widowed, or in other non-marital relationship statuses. On the other hand, the majority of respondents, 69.3% (262 individuals), reported being married or in a marital relationship. This group includes individuals who are legally married or in a recognized marital partnership.

4.3. T Test and Chi Square of the Independent Variable

4.3.1 Chi-square dummy and categorical variables

A chi-square (χ^2) statistic is a measure of the difference between the observed and expected frequencies of the outcomes of a set of events or variables. The chi-square test is a useful tool for analyzing categorical data and determining whether there are significant associations between two variables which are related or independent from one another. A p-value less than or equal to 0.05 is considered statistically significant, indicating that the observed relationship between variables is unlikely to have occurred by chance.

Table 4.4. Chi square of dummy variable

No	Variable	Level	WTP	df	χ^2	P value

			Non willing	Willing	Total			
1	Marital status	Unmarried	15.1%	15.6%	30.7%	1	0.447	0.505
		Married	31.5%	37.8%	69.3%			
		Total	46.6%	53.4%	100%			
2	Sex	Male	18%	31%	49%	1	13.997	0.000
		Female	28.6%	22.4%	51%			
		Total	46.6%	53.4%	100%			
3	Employment status	Unemployed	27.5%	20.4%	47.9%	1	16.577	0.000
		Employed	19%	33.1%	52.1%			
		Total	46.6%	53.4%	100%			
4	satisfaction	Unsatisfied	29.6%	15.1%	44.7%	1	47.729	0.000
		Satisfied	16.9%	38.4%	55.3%			
		Total	46.6%	53.4%	100%			
5	substitution	Poor	26.4%	25.1%	51.5%	1		
		Good	20.1%	28.4%	48.5%			
		Total	46.5%	53.5%	100%			
6	Disease exposed	No	27.8%	15.1%	42.9%	1	37.965	0.000
		Yes	18.8%	38.4%	57.1%			
		Total	46.6%	53.4%	100%			
7	awareness	No	28%	18.8%	46.8%	1	23.757	0.000
		Yes	18.5%	34.7%	53.2%			
		Total	46.6%	53.4%	100%			

Source: Own survey, 2024

The above table indicated the significance and insignificance result of the independent variable on the factors affected of WTP. The chi-square value of marital status is 0.447, and the p-value is 0.505. Since the p-value is greater than 0.05 (commonly used significance level), there is no significant association between marital status and WTP. The chi-square value of sex is 13.997, and the p-value is 0.000 (less than 0.05). Therefore, there is a significant association between sex and WTP.

The chi-square test was conducted to assess the relationship between employment status and willingness to pay. The variable Employment status has two levels: Unemployed and Employed. The chi-square value is 16.577, and the p-value is 0.000 (less than 0.05). Hence, there is a significant association between employment status and WTP. The variable "Satisfaction" has two levels: Unsatisfied and Satisfied. The chi-square value of satisfaction is 47.729, and the p-value is 0.000 (less than 0.05). Therefore, there is a significant association between satisfaction and WTP.

The chi-square test was conducted to explore the relationship between disease exposure and willingness to pay. The chi-square value is 37.965, and the p-value is 0.000 (less than 0.05). Hence, there is a significant association between disease exposure and WTP. The chi-square value awareness is 23.757, and the p-value is 0.000 (less than 0.05). Therefore, there is a significant association between awareness and WTP.

Table 4.5. Chi square of categorical variable

No	variables	Level	WTP			df	χ^2	P value
			non willing	willing	total			
	Distance	Less than 100m	15.6%	19.8%	35.4%	2	0.891	0.641
		100m-200m	13%	15.3%	28.3%			
		Above 200m	18%	18.3%	36.2%			
		Total	46.6%	53.4%	100%			
	Quality	Good	16.4%	23%	39.4%	2	3.188	0.203
		Average	18.3%	20.1%	38.4%			
		Poor	11.9%	10.3%	22.2%			
		Total	46.6%	53.4%	100%			

Source: Own survey, 2024

The researchers conducted chi-square tests to assess the relationship between two variables - distance and quality - and the respondents' willingness to pay (WTP) for improved water service. For the distance variable, the chi-square value was 0.891, and the p-value was 0.641. Since the p-value of 0.641 is greater than the standard significance level of 0.05, the researchers concluded that there is no significant association between the distance from the respondent's home to the water source and their willingness to pay. This study is opposite study by Bogale and Urgessa (2012) in rural Ethiopia found that as the distance to the water source increased, the households' WTP for improved water access also increased.

Similarly, for the quality variable, the chi-square value was 3.188, and the p-value was 0.203. The p-value of 0.203 is greater than the 0.05 significance level, the researchers determined that there is no significant association between the perceived quality of the water service and the respondents' willingness to pay. This not agrees with the study by Gebrehiwot et al. (2015) in urban Ethiopia revealed that households were willing to pay more for improvements in water quality, such as cleanliness and taste.

4.3.2 T test of continuous variables

A t-test is a statistical test used to determine whether the mean of two groups of continuous data is significantly different from each other. The independent samples t-test is used when we have two independent groups of data and want to compare the mean values of a continuous variable between these two groups. The test determines whether there is a statistically significant difference between the means of the two groups

Table 4.6.T test of continuous variable

No	Variables	Factors	No	Mean	Std.dev	Min	Max	T value	P value
1	Age	Non willing	176	35.8693	10.5651	15	60	1.073	0.126
		Willing	202	34.7673	9.4062	16	65		
		total	378	35.2804	9.9644	15	65		
2	Income	Non willing	176	5106.3636	3613.7066	500	15000	1.672	0.000
		Willing	202	4544.9306	2911.0672	900	15000		

		Total	378	4806.3386	3264.7487	500	15000		
	Education	Non willing	176	12.3579	3.5748	4	20	3.794	0.114
		Willing	202	10.9504	3.6182	1	20		
		Total	378	11.6058	3.6614	1	20		

Source: Own survey, 2024

T-tests is conducted on three continuous variables, AGE, income, and education. The t-value for age is 1.073, indicating a relatively small difference in the means of the "Non willing" and "Willing" sets. The corresponding p-value is 0.126, suggesting that this difference is not statistically significant. Therefore, there is no significant difference in age between the Non willing and willing groups.

The second t-test compares the mean monthly income of (Non willing and Willing affecting WTP for improves water service. For the variable income, the T-value is 1.672 and the P-value is 0.000, which is less than the conventional threshold of 0.05, suggesting that the difference in income between the two groups is statistically significant. Thus, there is a significant difference in monthly income between the Non willing and willing groups.

The t-value for this test is 3.794, and the corresponding p-value is 0. 114. Based on these results, we can conclude that there is not a statistically significant difference in the mean year of schooling between the two groups. Therefore, there is no significant difference in the number of years in school between the Non willing and willing groups.

4.4. Demand and willingness to pay of water service

Household's attitude towards current water supply situation of the town is presented in the following section by discussing main source of water, existing price of water, quantity and quality of current water supply source.

4.4.1. Current Water Consumption Pattern of the Town

The residents of shararo town were using water from different sources. Because of the shortage of improved water services in the town, the residents are forced to use even rivers, although their numbers were very low.

Table 4.7. Current source of water for respondents

No	Source of Water	Percentage
1	Private tub	17.2%
2	Common tub	56.9%
3	Springs	14.3%
4	Rivers	10.8%
5	Others source(lake)	0.8%
	Total	100%

Source: own survey, 2024

According to the table result was indicated the distribution of respondents' current sources of water, with the majority (56.9%) getting water from a common tub. Sizable portions (17.2%) of respondents get their water from private tubs, which is the second highest source after common tubs. Natural water sources like springs (14.3%) and rivers (10.8%) make up a considerable portion of the total, suggesting many respondents rely on these untreated water sources. Only 0.8% of respondents get water from other sources like lakes, indicating these are relatively uncommon compared to the main water sources designed.

Table 4.8. Willingness to pay for the proposed bid

Willingness to Pay	Private tub	Common tub	Springs	rivers	Others(lake)	Total	χ^2
No	8.7%	21.2%	4.2%	7.9%	0.0%	42.1%	25.984
Yes	8.5%	35.7%	10.1%	2.9%	0.8%	57.9%	
Total	17.2%	56.9%	14.3%	10.%8	0.8%	100%	

Source: own survey ,2024

According to the above table result was indicated that the overall willingness to pay for the proposed bid is 57.9% and 42.1% of the respondents are not willing to pay for the proposed bid. The willingness to pay for individual structures, the data shows that the common tub feature has the highest percentage of respondents willing to pay at 35.7%. This suggests that the common tub is a highly valued feature among the respondents.

Also, the private tub feature has a relatively even split, with 8.5% willing to pay and 8.7% not willing to pay. The springs feature also shows a higher willingness to pay, with 10.1% of respondents indicating they are willing to pay for this feature. In contrast, the rivers feature has a lower willingness to pay, with only 2.9% of respondents willing to pay for water service and the "others (lake)" collection has a very low willingness to pay at 0.8%.

The chi-square statistic of 25.984 was indicated a statistically significant relationship between the willingness to pay and the different features included in the proposed bid. This means that the respondents' willingness to pay is not independent of the specific features being offered, and the differences in willingness to pay across the features are unlikely to be due to chance.

Table 4.9. consumption of water service each day per liters

	N	Minimum	Maximum	Mean	Std. Deviation
on average how much water do you use on consumption activities each day per liters	378	10.00	350.00	89.4048	69.59312
Valid N (listwise)	378				

Source: Own Survey ,2024

The wide range in water consumption, from a minimum of 10 liters per day to a maximum of 350 liters per day, suggests that individuals in this population likely have very different preferences and needs when it comes to water usage. Those consuming at the lower end of the range may have a lower willingness to pay for additional water, as their basic needs are already met with 10 liters per day. The mean consumption of 89.4 liters or 9 bucket per day provides a rough standard for representative water needs. Consumers using substantially less than this average may have a lower WTP, while those using substantially more may exhibit a higher WTP.

4.4.2 Current price of water

Survey about the current government water tariff of the town’s water supply is based on a progressive water tariff calculation aiming to support the majority low-income customer and high consumers to pay progressively higher as their consumption

Table 4.10. The average of payment for water consumption per monthly

	N	Minimum	Maximum	Mean	Std. Deviation
How much are you paying on average per month for the current water supply service? _____ Birr per month	295	50.00	500.00	233.6746	95.15763
Valid N (listwise)	295				

Source: Own survey, 2024

The average monthly payment of 233.67 Birr per month or 7.789 per day for the current water supply service can provide some insights into the willingness to pay for water services. However, it is important to note that willingness to pay can be influenced by various factors and may not solely depend on the average payment amount.

4.4.3. Quantity and quality of current water supply source

Table 4.11. The result of quality of water service

		Frequency	Per cent	Cumulative Per cent
Valid	Good	149	39.4	39.4
	Average	145	38.4	77.8
	Poor	84	22.2	100.0
	Total	378	100.0	

Source: Own survey, 2024

According to the table results the category "good" has a frequency of 149, which corresponds to 39.4% of the total responses. This means that 39.4% of the respondents rated the quality as "good. The category "average" has a frequency of 145, accounting for 38.4% of the total responses. Therefore, 38.4% of the respondents rated the quality as "average. “The category "poor" has a frequency of 84, representing 22.2% of the total responses. Hence, 22.2% of the respondents rated the quality as "poor."

Table 4.12. The result of quantity of water service

		Frequency	Percent	Cumulative Percent
Valid	adequate	57	15.08	15.08
	moderate	150	39.68	54.76
	inadequate	171	45.24	100.0
	Total	378	100.0	

Source: Own survey, 2024

According to the result of the table, out of the total 378 respondents, 15.08% (57 individuals) reported having adequate water service. This was suggested that these respondents felt their water needs were met sufficiently, implying that they had access to an appropriate and satisfactory quantity of water. The majority of respondents, 39.68% (150 individuals), defined their water service as moderate. This was suggested that while they did not consider their water service to be perfect or abundant, it was still deemed acceptable for their needs.

However, a significant portion of the respondents, 45.24% (171 individuals), reported inadequate water service. This suggested that they faced challenges and difficulties in obtaining an adequate quantity of water. Their water supply may have been insufficient, unreliable, or affected by everyday interruptions. This group of respondents likely faced daily struggles in meeting their water requirements. The results of the survey on the quantity of water service can have implications for the willingness to pay for water. The perception of inadequate water service may influence individuals' willingness to pay a higher price for improved access or a more reliable water supply.

Table 4.13. The result of Frequency of water service

		Frequency	Percent	Cumulative Percent
Valid	less than 3 days	130	34.4	34.4
	3-4 days	114	30.2	64.6
	more than 4 days	134	35.4	100.0
	Total	378	100.0	

Source: Own survey, 2024

According to the result of table the category "less than 3 days" has a frequency of 130, which corresponds to 34.4% of the total responses. This means that 34.4% of the respondents indicated a frequency of less than 3 days. The category "3-4 days" has a frequency of 114, accounting for

30.2% of the total responses. Therefore, 30.2% of the respondents indicated a frequency of 3 to 4 days. The category "more than 4 days" has a frequency of 134, representing 35.4% of the total responses. Hence, 35.4% of the respondents indicated a frequency of more than 4 days

4.5. Results of Econometric Analysis and Discussions

4.5.1. Factors Affecting Household's WTP for Improved Water Service in the Study Area

The second specific objective of the study was to analyze the factors that affect households' willingness to pay decisions for improved water service in shararo town. To accomplish this objective, a logistic regression model was employed as an econometric model. However, it is crucial to conduct a model diagnostic test before applying the logistic regression analysis to ensure that the model fits the data well.

The purpose of the model diagnostic test is to assess the goodness-of-fit of the logistic regression model. This test helps determine if the model adequately captures the relationship between the independent variables (factors) and the willingness to pay decisions of households.

The rationale behind running model diagnostic tests is to check whether the logistic regression model is correctly specified, to assess the correlation between explanatory variables, and to examine the overall significance of the model. In this study, a Ramsey specification test was conducted to test for model misspecification, and the result indicated that misspecification was not a problem for this model. To interpret the test result, we compare the p-value to a chosen significance level (commonly 0.05). In this case, the p-value (0.0181) is less than 0.05, indicating that we have sufficient evidence to reject the null hypothesis**. See Appendix.3a**

Additionally, a VIF (Variance Inflation Factor) test was used to check for multicollinearity, and the result showed that multicollinearity was not an issue in the model. The "Mean VIF" is also provided, which represents the average VIF across all variables in the model, and it is calculated as 1.42. **See Appendix.3C**

The Breusch-Pagan/Cook-Weisberg test is a statistical test used to detect heteroskedasticity. It is based on the assumption that if heteroskedasticity exists, then there is a relationship between the squared residuals and the independent variables in the model. The test was conducted on the fitted values of the variable WTP (presumably estimated values from your regression model). The test statistic is chi2(1), which follows a chi-square distribution with 1 degree of freedom. The calculated test statistic value is 8.76. To determine the significance of the test, we compare

the probability (p-value) associated with the test statistic, which is given as Prob > chi2 = 0.0031. The p-value represents the probability of observing a test statistic as extreme as the calculated value, assuming the null hypothesis is true. **See appendix.3B**

After the diagnostic tests, a Logit model was used for the analysis. The dependent variable (WTP) was a binary response variable, taking a value of 1 for willing to pay and 0 for not willing to pay. The independent variables used in the model included dummy variables, categorical variables, and continuous variables. The overall significance of the logistic regression model was assessed using the chi-square ($\chi 2$) test, and the significance p-value indicated a good fit for the model. In logistic regression, the pseudo-R-squared is often used to measure the variance explained by the independent variables. The study found that the independent variables in the model explained the dependent variable well.

A total of 13 explanatory variables were used in the logistic regression model, and 9 of them were found to be significant at a probability level of less than1%, 5% and10%. The combined effect of all the repressors on the WTP decision was significant, as indicated by the significant chi-square and p-value.

The regression output of the Logit model was presented in table 4.14, which presumably contains the coefficients and odds ratios of the explanatory variables. However, it is mentioned that the coefficients and odds ratios only show the direction of the effect, not the magnitude. Logistic regression coefficients represent the change in the log odds associated with a unit change in the variable, holding other variables constant.

To determine the magnitude of the effect of the explanatory variables on the dependent variable, it is necessary to calculate the marginal effect (dy/dx) of each explanatory variable. The marginal effect provides the expected change in the probability of a particular choice being made with respect to a unit change in an explanatory variable, holding other variables constant.

Table 4.14. Results of the logistic regression and marginal effects for selected for the effects of independent variables on willingness to pay for water service

Logistic regression	Number of obs	378
	LR chi2(14) =	184.40
	Prob > chi2 =	0.0000
	Pseudo R2 =	0.3594
Log likelihood = -164.36775		

WTP	Coefficient	St. Error	Z	p>z	Marginal Effect (dy/dx
AGE	.0296409	.0246766	1.20	0.230	.0067566
SEX	-.8230209***	.2865858	-2.87	0.004	-.1876066
MARS	.2536895	.4203795	0.60	0.546	.0585827
EDU	-.2050313***	.0627088	-3.27	0.001	-.0467366
FAMSIZE	-.257724**	.1136154	-2.27	0.023	-.0587479
INCOME	-.0000576	.0000506	-1.14	0.255	-.0000131
EMPLOYMENT	.9955991***	.3338453	2.98	0.003	.22485
DISTANCE	.0260447	.1661844	0.16	0.875	.0059368
QLTY	-.4315007**	.1931013	-2.23	0.025	-.0983601
DISEASE EXP.	.5839963**	.2909312	2.01	0.045	.1331357
SATS	.9152364***	.2822865	3.24	0.001	.2087166
SUBS	.2477385	.2687958	0.92	0.357	.0564717
AWRN	.7938346***	.2986274	2.66	0.008	.1820271
BID1	2.428539***	.3495113	6.95	0.000	.4632128
CONSANT	2.823565	1.066801	2.65	0.008	

Source: Own survey, 2024

Note: St. Error =Standard Error, dy/dx=Marginal effects *** p < 0.01, **p<0.05 *p<0.1

The LR chi-square value of 133.45 and the associated p-value of 0.000 indicate that the overall model is statistically significant in predicting the outcome variable. The Pseudo R-square 0.3594 implies that about 35.94% of the determinants of willingness to pay could only is determined by nine explanatory variables. This is the output of a logistic regression analysis that also includes marginal effects, which show how the predicted probability of the outcome changes with a one-unit increase in each independent variable.

The table shows the results of logistic regression models to the independent variables and marginal effects after logistic for each independent variable included in the analysis. The "dy/dx" column shows the change in the predicted probability of willingness to pay for water service associated with a one-unit increase in the corresponding independent variable. The standard error, z-value, and p-value provide information about the statistical significance of the marginal effect.

Sex (SEX): The coefficient for sex is -0.8230209 with a standard error of 0.2865858.the consistent p-value of 0.004 indicate that the sex coefficient is statistically significant at the 0.01 level. This means there was strong evidenced that gender has a meaningful impact on the willingness to pay for water service. The marginal effect of approximately -0.1876 suggests that being male decreases the probability of being willing to pay for water service by around 18.76% points, compared to being female, holding all other factors constant. The results are similar to the results of the logistic regression analysis are consistent with the findings of a previous study by size Lema, Z, et al, (2012).

Education (EDU): Years of schooling has a negative marginal effect of -0.0467366 and the p-value is 0.001. The marginal effect of the education variable shows that a one-unit increase in education level decreases the probability of WTP by 4.67% points. This was implied that respondents with higher levels of education are less likely to be willing to pay for water service improvements, possibly because they have different preferences compared to those with lower education levels. Individuals with more education have different preferences and arrange water service improvements household expenditures over water service improvements. Their prices are lower compared to the less educated water service. This could lead to lower willingness to pay among educated respondents compared to those with fewer years of education. This study result was opposite with the finding of (Mathiwos kifle, 2020)

FAMSIZE: The coefficient for family size (FAMSIZE) is -0.257724, with a standard error of 0.1136154. The negative coefficient suggests that larger family sizes are associated with a lower willingness to pay for water service, although the statistical significance is marginal ($p = 0.023$). The marginal effect (dy/dx) indicates that larger family sizes decrease the likelihood of willingness to pay by 0.0587, Because the larger families may rely on shared resources within their household, such as communal water sources or systems that distribute water among family members. This can be a practical solution to manage water consumption and reduce individual expenses. This study result was opposite with the finding of Chalchisa, A., Bekele, K., & Tazeze, A. (2022).

Employment status (employed or unemployed): The coefficient for employment status is 0.9955991, which is statistically significant at the 0.003 level. This means can be highly self-confident that employment status has a real, non-zero effect on the willingness to pay for water

service. The marginal effect calculation indicates that an increase in employment status increases the probability of willingness to pay for water service by approximately 0.2249. This means that if all other factors are held constant, a change in an individual's employment status from unemployed to employed would be associated with a 22.49%-point increase in the probability of them being willing to pay for water service. The results are similar to the results of the logistic regression analysis are consistent with the findings of a previous study by size of Mathiwos kifle. (2020)

Quality (QLTY): The coefficient for the quality variable was -0.4315007, which is statistically significant at the 0.025 level (p-value = 0.025). This means that we can be 97.5% confident that the relationship between quality and willingness to pay is not due to chance. the marginal effect calculation suggests that a decrease in quality decreases the probability of the willingness to pay for water service by approximately 0.0984 or 9.84%points. This highpoint the practical significance of the relationship between quality and willingness to pay. This study finding is opposite to the results found in the previous study by Tamirat Minota (2014).

Awareness (AWRN: The coefficient for awareness is 0.7938346, which is statistically significant with a p-value of 0.008. This indicates that awareness is a strong, significant predictor of willingness to pay for water service. The marginal effect quantifies the actual change in probability associated with a one-unit increase in awareness. Specifically, it suggests that a one-unit increase in the awareness measure leads to approximately a 0.1820 increase in the probability of an individual being willing to pay for water service.

Disease exposes (DEX): The coefficient for the "Disease exposes" variable is 0.5839963, with a p-value of 0.045. This means that individuals who have a higher exposure to disease are more likely to be willing to pay for water service compared to those with lower disease exposure. The marginal effect of 0.1331 was suggested that as disease exposure increases by one unit (from a low to a moderate level of exposure), the probability of that individual being willing to pay for water service increases by13.31%points. The results are similar to the findings of Chalchisa, A., Bekele, K., & Tazeze, A. (2022).

Household's satisfaction from the existing service (SATS): The coefficient for Satisfaction is 0.9152364 and the associated p-value is 0.001. This means the relationship between satisfaction

and willingness to pay is statistically significant at the 1% level. The marginal effect was suggested that an increase in satisfaction increases the probability of the willingness to pay for water service by approximately 0.2087. This means that a 1 unit increase in satisfaction was associated with a 20.87%point increase in the probability that a household is willing to pay for the water service. This not agrees with Kinfe and Berhanu (2007); Giday and Zeleke (2015); Saleamlak (2013) who recognized a negative relationship between willingness to pay for improved water service and level of satisfaction.

BID1: initial bidding of water service. The coefficient for bid amount (BID1) is 2.428539, with a standard error of 0.3495113. The z-value of 6.95 is statistically significant ($p < 0.000$). The bid amount (BID1) has the largest positive marginal effect of 0.4563025. This means a one-unit increase in the initial bid raises the probability of WTP by 45.6 % points. The magnitude of this effect highlights how the bid amount itself is a very strong predictor of willingness to pay. This study result was opposite with the finding of (Bogale, A., & Urgessa, B. (2012).

4.6. Estimation of Mean WTP from Double Bounded Dichotomous Choice Model

The third specific objective of this study was estimating the user ‘s willingness to pay for improved water service in shararo town. To estimate the users' willingness to pay (WTP) for improved water service in Shararo town, the study likely employed a contingent valuation method (CVM) or a similar approach. The contingent valuation method is commonly used to assess individuals' valuation and willingness to pay for public goods or services that are not typically traded in the market.

The study likely used a survey questionnaire to collect data from users in Shararo town. The questionnaire was included relevant questions to elicit respondents' willingness to pay for improved water service. The specific format and design of the survey depend on the study's methodology and research objectives. The Double Bounded Dichotomous Choice (DBDC) method was used in the study. In this method, households were randomly offered an initial bid for the improved water service. Depending on their response to the first bid (either "yes" or "no"), a follow-up bid, which was either double or half of the initial bid, was offered. The table provided in the study presents descriptive statistics of the initial and follow-up bids, as well as the responses of the households.

Table 4.15. summary of responses to double bounded questions across bid sets

Would you be willing to pay the initial bid or cost of EB0.60 per bucket? (BID1)	Would you be willing to pay double (2x) the initial bid/cost, which would be EB1.20 per bucket, or half (0.5x) the initial bid/cost, which would be EB0.30 per bucket? (BID2)	
	No	Yes
No	161	80
Yes	49	88

Source: own survey ,2024

According to the above table result the responses to two related questions about willingness to pay for water service. The first question (BID1) asked if the respondent would be willing to pay an initial bid or cost of EB0.60 per bucket. The second question (BID2) then asked if the respondent would be willing to pay either double (EB1.20) or half (EB0.30) that initial bid.

As the above table result indicated that 161 respondents said "No" to the initial bid in BID1 and then also said "No" to either the higher or lower bid in BID2. This was suggested these respondents were not willing to pay the initial bid or either of the alternative prices presented in BID2. In contrast, 80 respondents said "No" to the initial bid in BID1, but then said "Yes" to either the higher or lower bid in BID2. This was indicated that while they were not willing to pay the initial bid, they were willing to pay one of the alternative prices.

Also, 49 respondents said "Yes" to the initial bid in BID1, but then said "No" to either the higher or lower bid in BID2. This was implied that while they were initially willing to pay the EB0.60 per bucket, they were not willing to pay either the higher or lower alternative prices. Finally, 88 respondents said "Yes" to the initial bid in BID1 and then also said "Yes" to either the higher or lower bid in BID2. This was suggested these respondents were consistently willing to pay across the different price points presented.

By asking respondents if they are willing to pay the initial bid, and then if they are willing to pay either double or half that initial bid, researchers can better understand the respondents' price understanding. The breakdown of responses across the different combinations (no-no, no-yes,

yes-no, yes-yes) gives valuable understandings into the distribution of willingness to pay at different price points.

4.6.1 Estimation of Mean Willingness to Pay

Table 4.16. Estimation of the mean from Double Bounded Dichotomous Choice Format

Variable	obs	mean	Std.err	Std.dev	95% conf. interval	
BID1	378	.3624339	.0247575	.4813403	.3137538	.4111139
BID2	378	.4444444	.0255919	.4975626	.3941238	4947651
DIFF	378	-.0820106	.029789	.5791645	-.140584	-.0234372

Source: own survey,2024

The paired t-test results show that there was a statistically significant difference between the mean values of BID1 and BID2. The mean value for BID1 is 0.36 per 20 litters, with a standard error of 0.024755. In contrast; the mean value for BID2 is 0.44 per 20 litters, with a standard error of 0.0255919

The mean difference between BID1 and BID2 is -0.082 per 20 litters, with a standard error of 0.029789. The negative value of the mean difference indicates that the mean value of BID1 is lower than the mean value of BID2.

The t-statistic, which measures the strength of the evidence against the null hypothesis (that the mean difference is equal to 0), is -2.7530 with 377 degrees of freedom. The p-value for the one-tailed test with the alternative hypothesis that the mean difference is less than 0 is 0.0031, which is statistically significant at the 5% level. This means that there is strong evidence to reject the null hypothesis and conclude that the mean value of BID1 is significantly lower than the mean value of BID2.**See Appendix .4A**

Similarly, the p-value for the two-tailed test with the alternative hypothesis that the mean difference is not equal to 0 is 0.0062, which is also statistically significant at the 5% level. However, the p-value for the one-tailed test with the alternative hypothesis that the mean difference is greater than 0 is 0.9969, which is not statistically significant. **See appendix .4B**

Table 4.17. logistic regression results relationship between the (BID1 and BID2) amounts and WTP for the water service.

Logistic regression	Number of Obs=378

					Lr Chi2(2) =309.09	
					Prob>Chi2=0.0000	
					Pseudo R2 =0.3594	
WTP	Coef.	Std. Err	z	p>/z/	95%conf. interval	
BID1	2,735983	.3857292	7.09	0.000	1.979967	3.491998
BID2	5.640251	.7477065	7.54	0.000	4.174773	7.105729
-CONS.	-1.904582	.2338577	-8.14	0.000	-2.362935	-1.44623

Source: Own Survey ,2024

The logistic regression model was used to analyze the relationship between two bid variables (BID1 and BID2) and the willingness-to-pay (WTP) response.

The model statistics reveal that the overall model is highly statistically significant, with an LR chi-square value of 309.09 and a p-value less than 0.000. This means that the model, as a whole, is effective in predicting the WTP response based on the two bid variables. The Pseudo R-squared value of 0.6024 suggests that the model has a good fit to the data, explaining a substantial portion of the variation in the WTP response.

Examining the coefficient estimates, the results show that both bid variables are positive and statistically significant (p-values < 0.001). The coefficient for BID1 is 2.736, indicating that as the first bid amount increases, the log-odds of a positive WTP response increase by 2.736 units. The coefficient for BID2 is 5.640, which is much larger, suggesting that the second bid variable has a stronger impact on the probability of a positive WTP response.

These findings were indicated that the two bid variables are strong predictors of willingness-to-pay, with the second bid variable (BID2) having a more significant influence on the probability of a positive WTP response than the first bid variable (BID1). This form of analysis is commonly used in contingent valuation studies to estimate the monetary value that individuals place on a good or service.

4.6.2. Aggregation means of Willingness to Pay

According to the data is from Table 4.16, which shows the mean and standard error for two bid variables - BID1 and BID2. This data was based on 378 observations collected in Shararoo Town. The Contingent Valuation Method (CVM) is a widely used technique in environmental

and natural resource economics to estimate the economic value that people place on environmental goods and services. It was involved directly asking people, in a survey, how much they would be willing to pay for specific environmental services. In this study, the found that the estimated mean willingness to pay per 20-liter bucket of improved water service is 0.4035 B.

This mean WTP per bucket can be used to calculate the average household's WTP per day, month, and year, based on their average daily water consumption. The first step is to calculate the average household's willingness to pay per day. To get the average willingness to pay per day, multiply the willingness to pay per bucket (0.4034 ETB) by the average number of buckets used per day (9). This gives us an average willingness to pay per day of 3.6306 ETB. Next, calculate the average household's willingness to pay per month. To do this, take the average willingness to pay per day (3.6306 ETB) and multiply it by the number of days in a month (30). This gives us an average willingness to pay per month of 108.918 ETB. Finally, calculate the average household's willingness to pay per year. take the average willingness to pay per month (108.918 ETB) and multiply it by the number of months in a year (12). This was given us an average willingness to pay per year of 1307.016 ETB.

The total WTP represents the aggregate willingness to pay for the improved water service across all households in Shararo Town. To calculate this total WTP, we need to take the average or mean WTP per household and multiply it by the total number of households. According to the information provided, the estimated current number of households in Shararo Town is 6,750. The statement provides the average household's monthly WTP as 108.945 ETB. Therefore, the total monthly WTP is 735,378.75 per month. Finaly the total annual WTP, we simply multiply the total monthly WTP by 12 months was 8,824,545 ETB per year. This final result of 8,824,545 ETB per year represents the total willingness to pay for improved water service in Shararo Town on an annual base.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATION

Under this chapter, conclusions and recommendations of the study are presented. The chapter begins with the study's an overall conclusion, followed by some recommendations based on the main findings as follows.

5.1. Conclusion

The main purpose of this study was to estimate willingness to pay for improved water service shararo town. In this result, the factors that caused to estimating willingness to pay for improved water service shararo town are education, family size, income, distance, employment status, satisfaction, substitution, disease exposition and awareness. A total of 378 sampled household participated in the questionnaire, and the model used Stata version 15 was analyzed used frequency, percentage, mean, chi square, logistic regression and marginal effects. The study also found that the majority of the sampled willingness to pay for water service were female, the mean age of individuals who are likely to willingness to pay for water service is 35.28 years,

the mean income of these individuals is 4806.33 Ethiopian Birr per month, and they have a mean of year of the schooling of the individuals is 11.61 years.

According to the finding in logistic regression and marginal effects model, the relationship between the dependent and independent variable having positive and negative effect. The logistic regression model had a binary dependent variable (WTP) and 13 explanatory variables, of which 9 were found to be statistically significant. The logistic regression model is statistically significant in predicting willingness to pay for water service. The explanatory variables which are positive relationship and significant impacts on estimate to willingness to pay water service are awareness, disease exposition, Household's satisfaction from the existing service, and employment status. The other variables like sex, education in year of schooling, quality of water are negative relationship and significant impact with willingness to pay for water services in shararo town. The rest variables like that age, marital status, family size, Substitute source during a shortage of primary source and initial bidding have weak relationship with the factor effects of willingness to pay for water services in shararo town.

The study was used the Double Bounded Dichotomous Choice (DBDC) method to estimate the users' willingness to pay (WTP) for improved water service in Shararo town. In the DBDC method, respondents were first asked if they were willing to pay an initial bid of EB0.60 per bucket. Depending on their response, they were then asked if they were willing to pay either double (EB1.20) or half (EB0.30) the initial bid. The results showed a statistically significant difference between the mean values of the first bid (BID1 = 0.36 EB) and second bid (BID2 = 0.44 EB). The total mean willingness to pay is 0.40 EB per 20 liters. The total annual WTP for Shararoo Town (6,750 households) was 8,871,921 ETB per year (108.945 ETB/household/month x 6,750 households x 12 months/year).

5.2. Recommendation

Based on the finding of the study, the following policy recommendations are made. The study recommends the following points which need to be considered in the planning and implementation of the water project in the shararo town area.

- The finding reveals that the negative impact of sex on the willingness to pay for water services. The government should promote gender equality and work towards eliminating any gender-based disparities in access to and affordability of water services. This can be

achieved through policy initiatives, awareness campaigns, and targeted interventions that aim to empower and uplift women and ensure equal opportunities for all genders.

- The government should assess the existing pricing structures for water service to ensure that they are equitable and considerate of households with larger family sizes. This may involve implementing tiered pricing systems that take into account household size when determining water rates. By adjusting the pricing structures to reflect the varying needs of households, the government can ensure that larger families are not disproportionately burdened.
- The government should assess the affordability and accessibility of water services, particularly for individuals with higher education levels. If the cost of water services is perceived as too high or if access is limited, it may negatively influence their willingness to pay. By ensuring that water services are affordable, accessible, and transparently priced, the government can address concerns related to the cost-benefit ratio and increase the likelihood of willingness to pay.
- The government should focus on creating and promoting employment opportunities for individuals. By improving employment rates and reducing unemployment, more individuals will have the means and stability to afford and value water services. This can be achieved through various initiatives, such as job creation programs, vocational training, and support for entrepreneurship.
- The government should prioritize efforts to improve the quality of water services. This can involve investing in infrastructure upgrades, implementing stringent quality control measures, and ensuring compliance with water quality standards and regulations. By providing clean, safe, and reliable water services, the government can increase the perceived value and willingness of individuals to pay for them
- The government should improve health education programs to increase awareness about the risks and consequences of disease exposure. This can include providing information on waterborne diseases, hygiene practices, and the importance of clean water in preventing the spread of diseases. By educating individuals about the health implications of disease exposure, they may be more motivated to invest in water services.
- The government can assess the current pricing structures for water service and consider adjusting them to reflect the positive relationship between bid amounts and willingness to

pay. This may involve revising tariff rates or introducing tiered pricing systems that incentivize higher bid amounts

- The government could consider providing subsidies or financial assistance to support the initial to promotion of the water service, making it more accessible and affordable for low-income households.

Generally, implementation of the approaching project in the town is highly recommended, as residents of the town are aware of the problems of the service in the shararo town, and shows maximum willingness to pay for improved water service if the projected situation implemented and provide the proposed services. To the end, public services including improved water service were provided by political orders rather than as a response to market signals, and become a control. Thus, the absence of competition in the area is one reason for poor service provision. Hence, for good service provision, there must be knowledgeable service providers. Therefore, there is a need for government to create enabling the policy for public-private corporation in the improvement and provision of water supply service in shararo town, and in north Shewa zone commonly.

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Appendix.1

SALALE UNIVERSITY

COLLEGE OF BUSINESS AND ECONOMICS

POST GRADUATE PROGRAM

DEPARTMENT OF ECONOMICS

Questionnaires on Estimating Willingness to Pay for Improved Water Service in Shararo Town, Central Ethiopia: A Contingent Valuation Approach

Dear respondent Good Morning/Good Afternoon

This questionnaire was developed by Eshetu Tulu, MSc in development economics, and a student at Salale University. This questionnaire is designed to obtain information on the current water supply situation of shararo town and residents' willingness to pay for improved water supply services. The data is intended to develop a mechanism to help improve the sustainability

of the water supply situation of the town by creating conducive environment for community participation in the project. Therefore, your view could be used as an important input to officials and policy makers in their attempt to improve the water supply situation of the town. Thus, your participation and giving your own proper answer to these questions without any doubt is very important for the attainment of research goal. It is based on your own consent to respond. The results of the survey will be reported in summary form and will be anonymous to the respondent.

Thank you for your cooperation.

Date of interview: Date _____ month _____ year _____ Time started_____

Time finished_____

SECTION I. QUESTIONS ON SOCIO ECONOMIC AND DEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS

Write circle on the given letters or write appropriate answer in the space provided accordingly Household address and interview results; Code No. _____

Address: shararo town_____Kebele _____House number _____ Name of interviewer_____ _____Date of interview_____

1. Age of household head---------- in years.
2. Sex (observation)
   A. Male B. female
3. Marital Status A. Married B. unmarried
4. Number of years in school----------years.
5. Are you the head of this household?
   A. Yes B. No

6. How many people live in this household including you? ____
7. What is your source of income? A. Wages B. Pension benefits C. Trade D. labor force E. other, describe
8. How much is your monthly income (of the household head)? ----------
9. How do you rank or order water service costs relative to other costs? A. High B. Reason C. Low
10. Do you have your own house? A. Yes B. No
11. What is your employment status A. Employed B. Unemployed

If employed, continue with questions 12 and 13, if not jump to 14

12. If you are ‗employed' what is your job? A. Employed for salary B. Private Business (private enterprise) C. Self-employed D. other, specify
13. If you are ‗employed', where are you currently employed?

A. Duly employed professional (teacher, civil servant, administration, health worker, secretary)

B. Informal skilled worker employed (garment work, carpentry, metal work, trade, etc.)

14. If ―unemployed‖, state the reason for unemployment_____ A. Lack of job availability B. Unwillingness to work C. Low wages D. Another, state_____

SECTION II: QUESTIONS ABOUT THE WATER DEMAND AND THE PATTERN OF WATER USE IN THE TOWN

Under this section, I would like to ask you about the status of the water service and any questions you have about using the service.

15. Where does your family get water?

A, Private tub B. Common tub C. Springs D. River E. others, specify _____

If spot is individual or collective, continue with question number 16

16. Where is your source of water located? A. Indoor campus B. Outdoor campus

If you are outdoors, answer questions 17 and 18.

17. How far is your house away from this source? A. Less than 100m B. 100-200m C. above 200m
18. Who is the owner of the pipe?

A. My own B. My neighbors C. The municipality D. Others, Light_____

19. Who usually collects water from this source?

A. Husband B. Wife C. Daughter D. Son E. Other, specify_____

20. How much time do you spend to collect water from this source? ____ minutes/day.
21. On average, how much water do you use on indoor activities each day? _____ (liter)
22. How would you rate the water service from this source in terms of quality, quantity, and weekly frequency?
    21.1. Quality: A. Good B. Average C. Poor
    21.2. Quantity: A. Adequate B. Moderate C. Inadequate
    21.3. Frequency: A. less than 3 days B. 3-4 days C. more than 4 days
23. Overall, are you satisfied with the current water service? A. Satisfied B. Unsatisfied
    22.1. What makes you say that? _____
24. In times of scarcity, your family may ask, 'What is an alternative or secondary source?
    A. Public pipe B. Bore hole C. Spring D. Others, Explain_____
25. Representative Service how to grade A. Good B. Poor
26. Do you believe the alternative is risk-free? A. Yes B. No
27. Who would you say is most responsible for providing better water services?
    A. Government B. Society C. Private D. Others, describe_____
28. For question number 27, what are the reasons for not having a sewer connection if not private or communal taps?
    A. No service required B. I can't pay the charges C. Lack of access to services D. Others, the expression_____
29. Do any of your family members suffer from poor water quality diseases such as diarrhea, typhoid, cholera and other waterborne diseases? A. Yes B. No
30. If —YES to question number 29, by what method would you treat him/her?
    A. Using traditional medicine B. Visiting doctors C. Others, explain_____
31. Do you think unprotected water poses a health risk? A. Yes B. No
    If yes, answer question number 32, 33 and 34, if no jump to 35
32. Have you heard of water-related problems, such as diseases caused by contaminated water?
    A. Yes B. No
33. If YES to question no 32, what are your sources of information?
    A. Radio B. Television C. Newspapers D. others, explain_____
34. If YES to question number 32, what should be done to reduce the risk?

A. Clean water should be provided by the government B. The user must purify (boil) existing water before using it C. Other, describe_____

35. Will you pay for the current water service? A. Yes B. No
36. If YES to question number 35, how much are you paying on average per month for the current water supply service? _____ Birr per month.
37. How do you evaluate these payments for services reduced?
    A. Fair and affordable B. Too cheap C. Too expensive D. Difficult to decide
38. If NO to question number 35, why not pay?
39. Do you have an awareness of the demand for payment services? A. Yes B. No
40. If YES to question number 39, where do you get an awareness of the need to pay for water services? A. Personal Experience B. Government Regulations and Policies C. Media D. Society

III. QUESTIONS ON WILLINGNESS TO PAY QUESTIONS

Now I am going to ask you the fundamental value you place on improved water service**.** The value of improved water service provision in monetary terms can vary greatly depending on factors such as location, individual circumstances, and the specific benefits and costs associated with the service**.**

Now a day as you know there is a big difference between the supply and the demand for clean potable drinking water in shararo town, the residents always raised questions regarding water supply services. There are different reasons for the shortage of water supply below its demand in the town. To balance the supply and demand for the water service, it requires the construction of additional water pumps to be operational and construction of pipelines from the boreholes or other water sources to the public and private taps in the town.

Supposing that the improved water supply system in Shararo town could offer the features you mentioned—24-hour service with good pressure, available 7 days a week, prompt repair and efficient customer service, safe drinking water from the tap, and accurate meter readings—it would indeed require financial investment. The costs associated with implementing and

maintaining such a system would likely be reflected in higher monthly bills for customers. The approach of sharing costs among residents through a surcharge on water bills, while spreading out connection costs over a longer period, allows for the implementation of the proposed water project while considering the financial feasibility and affordability for the residents of Shararo town.

41. Do you understand the idea/scenario? A. Yes B. No

If NO, repeat the scenario until the respondent understands

42. Will you election to get the project done? A. Yes B. No

43. If YES to question number 42, read the following statement (interview)

Assume that the town water service office has made improved water service available, for which the authority pays EB /0.60/per bucket (20 liters).

That fee will help the authority run and maintain the continuity of the service.

44. Are you willing to pay this amount? A. Yes B. No

If YES to the statement, continue with question numbers 45 and 46 If NO, jump to number 47 and 48

45. What is the reason for saying yes? (Allow them to answer on their own. If they answer yes, then ask with the following)

A. I really want/need improved water service. B. The posed bid is not very high

C. Current water service health hazards D. I like the idea of having a personal connection to the water supply system E. Don't know/not sure F. Other (please specify): _____

46. Would you willing to pay double (2x) of the above bid or cost (EB/1.20/per bucket (20 liter)?

A. Yes B. No

47. Would you willing to pay half (1/2) of the above bid or cost (EB /0.3/ per bucket?

A. Yes B. No

48. If ―No for question number 46, what is your reason to say no?

A. It is the responsibility of government B. I don ‘t think that I should have to pay for the good

C. The posed bid is too high; I cannot afford it (being poor) D. I don‘t trust the proposed project (government) E. I am not worried about the health risks of the existing water service

F. Don‘t know/not sure G. Other, specify_____

Appendix.2

YUNIVARSITII SALAALEE

KOOLEEJII BIIZINASII FI DIINAGDE

SAAGANTAA EEBBIFAMA BOODAA

KUTAA DIINAGDE

Gaaffilee Tajaajila Bishaan Fooyya'eef Kaffaltii Fedhii Tilmaama Giddugaleessa Itoophiyaa Magaalaa Shararoo: Mala Gatii hin murtoofnee

Kabajamtoota deebii kennitoota

Gaaffiin Kun kan qophaa’e Eshetu Tulu, MSC Economics misoomaa, fi barata Yunivarsiitii Salale tiin. Gaaffiin Kun haala dhiyeessii bishaanii yeroo ammaa magaalaa shararoo fi fedhii jiraattonni tajaajila dhiyeessii bishaanii fooyya’aa ta’eef kaffaltii kaffaluuf qaban odeeffannoo argachuuf kan qophaa’edha. Daataan Kun hirmaannaa hawaasaa pirojekticha keessatti akka

hirmaatu haala mijataa uumuun itti fufiinsa haala dhiyeessii bishaanii magaalattii fooyyessuuf mala gargaaru qopheessuuf kan yaadame ta'uu ibsameera. Kanaafuu, ilaalchi keessan qondaaltotaa fi qaamolee imaammata baasan haala dhiyeessii bishaanii magaalattii fooyyessuuf yaalii godhan keessatti galtee barbaachisaa ta'ee itti fayyadamuu ni danda'ama. Haala kanaan gaaffilee kanaaf hirmaannaan kee fi deebii sirrii mataa keetii shakkii tokko malee kennuunis galma ga'iinsa galma qorannootiif baay'ee barbaachisaa dha. Deebii kennuudhaaf hayyama mataa keetii irratti hundaa'a. Bu'aan qorannichaa bifa gabaabduun kan gabaafamu yoo ta'u, deebii kennaaf maqaan isaa kan hin ibsamne ta'a.

Tumsa keessaniif galatoomaa.

Guyyaa gaaffii fi deebii: Guyyaa __ /__/____ Yeroon jalqabe_____yeroo itti xumure_____

KUTAA I. GAAFFII AMALOOTA HAWAASII DIINAGDEE FI DIMOGRAAFII DEEBII IRRATTI

Xalayaalee kennaman irratti geengoo barreessuu ykn bakka kenname keessatti deebii sirrii ta'e barreessuu

Teessoo manaa fi bu'aa af-gaaffii**;** Koodii Lakk_____

Teessoo: magaalaa shararoo_____Kebele _____Lakkoofsa manaa _____

Maqaa nama gaafatu_____ _____Guyyaa af-gaaffii_____

1. Umurii mataa maatii---------- waggaadhaan.
2. saalaa (ilaalcha)

   A. Dhiira B. dubartii
3. Haala Gaa'elaa A. kan fuudhe/herumte B. Kan hin fuune/ Heerumte
4. Baay'ina waggoota mana barumsaa----------waggoota.

5. Ati mataa mana kanaati? A. Eeyyee B. Lakki
6. Ofii kee dabalatee nama meeqatu mana keessani keessa jiraataa? ____
7. Maddi galii keessanii maali? A. Mindaa B. Faayidaa sooramaa C. Daldala D. humna hojjetaa E. kan biraa, ibsi
8. Galiin ji'a ji'aan (kan mataa maatii) meeqa? ----------
9. Baasii tajaajila bishaanii baasii biroo wajjin wal bira qabamee akkamitti sadarkaa?
   A. Ol'aanaa B. Sababni C. Gadi aanaa
10. Mana mataa keetii qabdaa? A. Eeyyee B. Lakki
11. Haalli hojii kee maali A. Qaxara B. Hojii dhabd

    Yoo qacaramte gaaffi 12 fi 13 itti fufi, yoo hin qacaramne moo gara 14 tti utaali.
12. Yoo qacaramte' hojiin kee maali? A. Mindaadhaaf kan qacarame B. Daldala Dhuunfaa C. Ofiin kan hojjete D. kan biraa, ibsi
13. Yoo qaxarama ' taate, yeroo ammaa eessatti qacaramte?
    A. Ogeessa sirnaan qacarame (barsiisaa, hojjetaa mootummaa, bulchiinsa, hojjetaa fayyaa, barreessaa
    B. Hojjetaa ogummaa al-seerummaa qabu kan qacarame (hojii huccuu, hojii mukaa, hojii sibiilaa, daldala fi kkf)
14. Yoo ―hojii dhaba taate, sababa hoji dhabdummaa ibsi_____

    A .Hojii argachuu dhabuu B. Fedhii hojjechuu dhabuu C. Mindaa gadi aanaa D. Kan biraa, mootummaa_____

KUTAA II: GAAFFII WAA'EE FAARFANNAA BISHAAN FI AKKAATA ITTI FAYYADAMA BISHAAN MAGAALAA

Kutaa kana jalatti, waa'ee haala tajaajila bishaanii fi gaaffii tajaajilicha fayyadamuu ilaalchisee qabdan kamiyyuu ibsa.

15. Maatiin keessan bishaan eessaa argatu?

    A, Tuboo dhuunfaa B. Tuboo walin C. Burqaawwan D. Laga E. kanneen biroo, ibsi _____

    Yoo tuuboo is dhuunfaa ykn waloo, gaaffii lakkoofsa 15 itti fufa.
16. Maddi bishaanii keessan eessatti argama? A. Mooraa mana keessaa B. Mooraa ala

    Yoo ala jirta ta'e gaaffi 17 fi 18 deebisi.

17. Manni keessan madda kana irraa hangam fagaata? A. 100m gadi B. 100-200m C. 200m ol
18. Abbaan qabeenyaa tuuboo eenyu?
    A. Kan koo B. Ollaa koo C. Bulchiinsa magaalaa D. Kanneen biroo, Ibsaa_____
19. Yeroo baayyee eenyutu bishaan madda kana irraa walitti qaba?
    A. Abbaa manaa B. Haadha manaa C. Intala D. Ilma E. Kan biraa, ibsi_____
20. Madda kana irraa bishaan walitti qabuuf yeroo meeqa dabarsitu? ___Daqiiqaa/guyyaa.
21. Giddu galeessaan guyyaatti sochii mana keessaa irratti bishaan liitira meeqa fayyadamta? _____ (liitira)
22. Tajaajila bishaanii madda kana irraa argamu qulqullina, baay'ina, fi irra deddeebiin torbanitti akkamitti madaaltu?
    21.1. Qulqullina: A. Gaarii B. Giddugaleessa C. Gadhee
    21.2. Baay'ina: A. Ga'aa B. Giddugaleessa C. Ga'aa hin taane
    21.3. Irra deddeebiin: A. guyyaa 3 gadi B. Guyyaa 3-4 C. guyyaa 4 ol
23. Walumaagalatti tajaajila bishaanii amma jiruun gahadha jettuu?
    A. eyyee gahadha B. lakki gaha mitti
    22.1. Maaltu akkas akka jettu si taasisa? _____
24. Yeroo hanqinaatti maatiin keessan, 'Maddi biraa ykn maddi lammaffaa maalidhaa?
    A. Ujummoo ummataa B. Boolla boollaa C. Birraa D. Kanneen biroo, Ibsi_____
25. Tajaajila Bakka Bu'aa akkaataa sadarkaadhaan A. Gaarii B. Gadhee
26. Filannoon biraa balaa irraa bilisa ta'uu ni amantaa? A. Eeyyee B. Lakki
27. Tajaajila bishaanii fooyya'aa ta'e kennuudhaaf eenyutu irra caalaa itti gaafatamummaa qaba jettu? A. Mootummaa B. Hawaasa C. Dhuunfaa D. Kanneen biroo, ibsu_____
28. Gaaffii lakkoofsa 27f, sababoonni walitti hidhamiinsa bishaan boollaa qabaachuu dhabuu yoo sababoota dhuunfaa ykn hawaasaa hin taane maali?
    A. Tajaajilli hin barbaachisu B. Kaffaltii kaffaluu hin danda'u C. Tajaajila argachuu dhabuu D. Kanneen biroo, ibsi_____

29. Miseensonni maatii keessanii dhukkuboota qulqullina bishaanii gaarii hin taane kan akka garaachaa, taayifooyidii, koleeraa fi dhukkuboota bishaaniin daddarban birootiin rakkatan jiraa? A. Eeyyee B. Lakki
30. Gaaffii lakkoofsa 29f ―EEYYEE yoo ta'e, mala kamiin isa/ishee yaaltanii?
    A. Qoricha aadaa fayyadamuu B. Doktoroota daawwatan C. Kaan, ibsi_____
31. Bishaan eegumsa hin qabne balaa fayyaa fida jettanii yaaddu? A. Eeyyee B. Lakki
    Yoo eeyyee ta'e gaaffii lakkoofsa 32, 33 fi 34 deebisi, yoo hin taane gara 35 tti utaali.
32. Rakkoo bishaaniin walqabatu, kan akka dhukkuba bishaan faalameen dhufu dhageessaniittu? A. Eeyyee B. Lakki
33. Yoo, gaaffii lak 32 EEYYEE jettan, maddoonni odeeffannoo keessan maali?
    A. Raadiyoo B. Televijiinii C. Gaazexaa D. kanneen biroo, ibsi_____
34. Gaaffii lakkoofsa 32f EEYYEE yoo ta'e, balaa kana hir'isuuf maaltu godhamuu qaba?
    A. Bishaan qulqulluu mootummaan dhiyeessuu qaba
    B. Fayyadamaan bishaan jiru osoo hin fayyadamin dura qulqulleessuu (boba'uu) qaba
    C. Kan biroo, ibsi_____
35. Tajaajila bishaanii amma jiruuf kaffaltii ni kaffaltuu? A. Eeyyee B. Lakki
36. Gaaffii lakkoofsa 35f EEYYEE yoo ta'e, tajaajila dhiyeessii bishaanii amma jiruuf ji'atti giddu galeessaan meeqa kaffalaa jirtu? _____ Birrii.
37. Kaffaltii tajaajila kennameef kana akkamitti madaaltu? A. Haqaa fi gatii madaalawaa B. Garmalee gatii salphaa C. Garmalee qaala'aa D. Murteessuun rakkisaa
38. Gaaffii lakkoofsa 35f LAKK yoo ta'e maaliif hin kaffaltu?
39. Fedhii tajaajila kaffaltii irratti hubannoo qabduu? A. Eeyyee B. Lakki
40. Gaaffii lakkoofsa 39f EEYYEE yoo ta'e, barbaachisummaa kaffaltii tajaajila bishaanii irratti hubannoo eessaa argattu? A. Muuxannoo Dhuunfaa B. Dambii fi Imaammata Mootummaa C. Miidiyaa D. Hawaasa

III. GAAFFIILEE KAFFALTII FIDUU IRRATTI

Amma gatii bu'uuraa tajaajila bishaanii fooyya'aa irratti kaa'an isin gaafachuuf deema .Gatiin kenniinsa tajaajila bishaanii fooyya'aa gama maallaqaatiin wantoota akka bakka, haala dhuunfaa,

fi adda ta'e irratti hundaa'uun garaagarummaa guddaa qabaachuu danda'a faayidaa fi baasii tajaajila kanaan walqabatu.

Amma guyyaa tokko akkuma beektan magaalaa shararoo keessatti dhiyeessii fi fedhii bishaan dhugaatii qulqulluu gidduu garaagarummaa guddaatu jira, jiraattonni yeroo hunda tajaajila dhiyeessii bishaanii ilaalchisee gaaffii kaasaa turan. Magaalattii keessatti hanqinni dhiyeessii bishaanii fedhii isaa gadi ta'eef sababoonni adda addaa ta'uu ibsameera. Dhiyeessii fi fedhii tajaajila bishaanii madaaluuf ijaarsi paampii bishaanii dabalataa hojiirra ooluu fi ijaarsa ujummoo boolla bishaanii ykn madda bishaanii biroo irraa gara tuubii mootummaa fi dhuunfaa magaalattii keessa jirutti ijaaramuu qaba.

Sirni dhiyeessii bishaanii fooyya'e magaalaa Shararoo keessatti argamu amaloota ati kaafte dhiyeessuu danda'a jennee haa fudhannu—tajaajila sa'aatii 24 dhiibbaa gaarii qabu, torbanitti guyyoota 7 kan argamu, suphaa ariifataa fi tajaajila maamiltootaa gahumsa qabu, bishaan dhugaatii qulqulluu tap irraa, fi dubbisa meetiraa sirrii ta'e —dhugumatti invastimantii maallaqaa barbaada ture. Baasii sirna akkasii hojiirra oolchuu fi kunuunsuu wajjin walqabatee bahu maamiltootaaf kaffaltii ji'aa ol'aanaa ta'een calaqqisuu hin oolu. Akkaataan baasii jiraattota gidduutti kaffaltii dabalataa kaffaltii bishaanii irratti qooduun, baasii walitti hidhamiinsaa yeroo dheeraaf babal'isuun, pirojektii bishaanii yaadame kana hojiirra oolchuuf kan dandeessisu yoo ta'u, jiraattota magaalaa Shararootiif dandeettii faayinaansii fi gatii madaalawaa ta'uu isaa ilaala.

41. Yaadni/seenaariyoo ni hubattaa? A. Eeyyee B. Lakki

    Yoo LAKK jette, hanga hubatutti senaariyoo irra deebi'i dubbisi deebii kennaan.

42. Pirojektichi akka hojjetamuuf sagalee kennituu? A. Eeyyee B. Lakki

43. Gaaffii lakkoofsa 42f EEYYEE yoo ta'e, ibsa armaan gadii dubbisi (af-gaaffii)

    Waajjirri tajaajila bishaanii magaalaa tajaajila bishaanii fooyya'aa akka argamu taasiseera, kanaaf abbaan taayitichaa baaldi tokkoof (liitira 20) EB /0.60/ kaffala jennee haa fudhannu.

    Kaffaltiin sun abbaan taayitichaa itti fufiinsa tajaajilichaa akka geggeessuu fi eeguuf gargaara.

44. Maallaqa kana kaffaluuf fedhii qabduu? A. Eeyyee B. Lakki

    Yoo hima sanatti EEYYEE ta'e, lakkoofsa gaaffii 45 fi 46 itti fufi Yoo LAKK ta'e gara lakkoofsa 47 fi 48 tti utaali.

45. Sababni eeyyee jechuuf maali? (Ofii isaaniitiin akka deebii kennan hayyamaa. Yoo eeyyee jedhanii deebisan, sana booda kanneen armaan gadiitiin gaafadhaa)

    A. Tajaajila bishaanii fooyya'aa ta'e baay'een barbaada/barbaachisa. B. Caalbaasiin dhiyaate baayyee ol'aanaa miti

    C. Balaa fayyaa tajaajila bishaanii yeroo ammaa D. Yaadni sirna dhiyeessii bishaanii wajjin walitti dhufeenya dhuunfaa qabaachuu natti tola E. Hin beeku/mirkaneeffachuu miti F. Kan biroo (maaloo ibsi): _____

46. Caalbaasii ykn baasii armaan olii (EB/1.20/baaldi tokkoof (liitira 20) dachaa (2x) kaffaluuf fedhii ni qabdaa?A. Eeyyee B. Lakki
47. Kanneen armaan olii keessaa walakkaa (1/2) kaffaluuf fedhii ni qabdaa caalbaasii ykn baasii (EB /0.3/ baaldi tokkoof? A. Eeyyee B. Lakki
48. Yoo ―Gaafii lakkoofsa 46f lakki, sababni lakki jettu maali?

    A. Itti gaafatamummaa mootummaati B. Ani hin'. t waan gaarii kaffaluun qaba jedheen yaada

    C. Caalbaasii posed garmalee olka'aa dha (hiyyeessa ta'uu) D. Pirojektii yaadame (mootummaa) hin amanu E. Ani waa'ee balaa fayyaa tajaajila bishaanii jiruu

    F Hin beeku/mirkaneeffachuu hin dandeenye G. Kan biraa, ibsi_____

APPENDIX: 2

A. Result for logistic regression

```
. logit WTP age sex ms yearschooling famsise INC ES DS QLTY SATS SUBS DEX AWRN  BID1

Iteration 0:   log likelihood = -256.56546
Iteration 1:   log likelihood = -166.82373
Iteration 2:   log likelihood = -164.37937
Iteration 3:   log likelihood = -164.36775
Iteration 4:   log likelihood = -164.36775

Logistic regression                               Number of obs   =        378
                                                  LR chi2(14)     =     184.40
                                                  Prob > chi2     =     0.0000
Log likelihood = -164.36775                       Pseudo R2       =     0.3594
```

WTP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
age	.0296409	.0246766	1.20	0.230	-.0187243	.0780061
sex	-.8230209	.2865858	-2.87	0.004	-1.384719	-.2613232
ms	.2536895	.4203795	0.60	0.546	-.5702392	1.077618
yearschooling	-.2050313	.0627088	-3.27	0.001	-.3279383	-.0821243
famsise	-.257724	.1136154	-2.27	0.023	-.4804061	-.0350419
INC	-.0000576	.0000506	-1.14	0.255	-.0001568	.0000416
ES	.9955991	.3338453	2.98	0.003	.3412742	1.649924
DS	.0260447	.1661844	0.16	0.875	-.2996708	.3517601
QLTY	-.4315007	.1931013	-2.23	0.025	-.8099722	-.0530292
SATS	.9152364	.2822865	3.24	0.001	.3619651	1.468508
SUBS	.2477385	.2687958	0.92	0.357	-.2790916	.7745685
DEX	.5839963	.2909312	2.01	0.045	.0137817	1.154211
AWRN	.7938346	.2986274	2.66	0.008	.2085356	1.379134
BID1	2.428539	.3495113	6.95	0.000	1.743509	3.113569
_cons	2.823565	1.066801	2.65	0.008	.7326723	4.914457

B. Result for marginal effects

```
Marginal effects after logit
      y  = Pr(WTP) (predict)
         =  .64849653
```

variable	dy/dx	Std. Err.	z	P>|z|	[95% C.I.]		X
age	.0067566	.00565	1.20	0.232	-.004312	.017825	35.2804
sex	-.1876066	.06521	-2.88	0.004	-.31541	-.059803	1.51058
ms*	.0585827	.09814	0.60	0.551	-.13377	.250936	.693122
yearsc~g	-.0467366	.01441	-3.24	0.001	-.074986	-.018487	13.9815
famsise	-.0587479	.0259	-2.27	0.023	-.109509	-.007987	4.28836
INC	-.0000131	.00001	-1.14	0.256	-.000036	9.5e-06	4806.34
ES*	.22485	.07351	3.06	0.002	.080774	.368926	.521164
DS	.0059368	.03789	0.16	0.875	-.068324	.080197	2.00794
QLTY	-.0983601	.04388	-2.24	0.025	-.18436	-.01236	1.82804
SATS*	.2087166	.06341	3.29	0.001	.08444	.332993	.55291
SUBS	.0564717	.06127	0.92	0.357	-.063622	.176566	.510582
DEX*	.1331357	.06605	2.02	0.044	.003686	.262586	.531746
AWRN*	.1820271	.06835	2.66	0.008	.04806	.315994	.571429
BID1*	.4632128	.04821	9.61	0.000	.368718	.557707	.362434

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

APPENDIX: 3

Linear regression for Diagnostic test

A. Result for Specification Test

```
. estat ovtest

Ramsey RESET test using powers of the fitted values of WTP
       Ho:  model has no omitted variables
                 F(3, 360) =      3.39
                  Prob > F =      0.0181
```

B. Results for Heteroscedasticity Tests

```
. estat hettest

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

         chi2(1)      =     8.76
         Prob > chi2  =   0.0031
```

C. Result for variance inflation factors

```
. estat vif
```

Variable	VIF	1/VIF
age	3.02	0.330882
yearschool~g	2.04	0.490309
ms	1.99	0.501826
ES	1.40	0.714544
INC	1.31	0.762865
AWRN	1.21	0.823143
SATS	1.21	0.826720
DEX	1.20	0.835892
QLTY	1.13	0.886510
famsise	1.12	0.895606
SUBS	1.09	0.913256
BID1	1.09	0.914401
sex	1.06	0.941766
DS	1.05	0.952399
Mean VIF	1.42	

APPENDIX: 4

Estimated Mean Willingness to Pay

A. Result for Estimation of the mean from Double Bounded Dichotomous Choice Format

Variable	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
BID1	378	.3624339	.0247575	.4813403	.3137538	.4111139
BID2	378	.4444444	.0255919	.4975626	.3941238	.4947651
diff	378	-.0820106	.029789	.5791645	-.140584	-.0234372

mean(diff) = mean(BID1 - BID2) t = -2.7530
Ho: mean(diff) = 0 degrees of freedom = 377

Ha: mean(diff) < 0 Ha: mean(diff) != 0 Ha: mean(diff) > 0
Pr(T < t) = 0.0031 Pr(|T| > |t|) = 0.0062 Pr(T > t) = 0.9969

B. Result for logistic regression results relationship between the (BID1 and BID2) amounts and WTP for the water service.

Logistic regression Number of obs = 378
LR chi2(2) = 309.09
Prob > chi2 = 0.0000
Log likelihood = -102.01828 Pseudo R2 = 0.6024

WTP	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
BID1	2.735983	.3857292	7.09	0.000	1.979967	3.491998
BID2	5.640251	.7477065	7.54	0.000	4.174773	7.105729
_cons	-1.904582	.2338577	-8.14	0.000	-2.362935	-1.44623