



HOUSEHOLD WILLINGNESS TO PAY FOR PROVISION OF
IMPROVED URBAN WATER SUPPLY SERVICE IN CHAGNI TOWN,
AMHARA REGION, ETHIOPIA

BY
YAMERT BERIHUN

A Thesis Submitted to
College of Development Studies
Center for Environment and Development studies

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science
Water Resource Management

Addis Ababa University

Addis Ababa, Ethiopia

October, 2020

HOUSEHOLD WILLINGNESS TO PAY FOR PROVISION OF IMPROVED
WATER SUPPLY SERVICE IN CHAGNI TOWN AMHARA REGION
ETHIOPIA

YAMERT BERIHUN

A Thesis Submitted to
College of Development Studies

Presented in Partial Fulfillment of the Requirements for the Degree of Master of Science
Water Resource Management

Addis Ababa University

Addis Ababa, Ethiopia

October, 2020

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university or institution, and that all sources of materials used for this thesis have been duly acknowledged.

Name: Yamert Berihun

Signature: _____

Date: _____

Addis Ababa University

School of Graduate Studies

This is to certify that the thesis prepared by Yamert Berihun, entitled: Household Willingness to Pay for Improved Water Service in Chagni Town, Amhara Region, Ethiopia and submitted in partial fulfillment of the requirements for the Degree of Master of Science Water Resource Management complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the Examining Committee:

External Examiner: _____ Signature _____ Date _____

Internal Examiner: _____ Signature _____ Date _____

Advisor: _____ Signature _____ Date _____

Chair of Department or Graduate Program Coordinator

Abstract

Household Willingness to pay for provision Improved Urban Water Supply Service in Chagni Town, Amhara Region, Ethiopia

Yamert Berihun

Addis Ababa University, 2020

Good quality, reliable and affordable supply of drinking water is a basic need for human life. However, many people in LDCs are lacking this safe and quality water. Since Ethiopia is one of these LDCs its urban area population does not have access to such attributes of water. Therefore, reliability and quality are crucial for household water supply. In this study the CVM was used to analyze the determinants of households' WTP for improved water services by applying the single bounded dichotomous choice value elicitation format. The study used cross-sectional data collected from 300 randomly selected sampled households from Chagni town. The CV survey responses were analyzed through descriptive and econometric analysis using Probit and Tobit as empirical models.

The CV survey results revealed that 264 (87.96%) of the respondents were willing to pay a positive amount for improved water services. Therefore if the proposed water improvement scheme is implemented, in addition to satisfying the water needs of the households, the towns' utility management can collect more revenue from the sale of improved water. The CV survey results also show that the mean WTP of households for the proposed improved water service is 30 cents per jerry can depending on the method used.

Results from the probit and Tobit model showed that Household distance, respondent age, respondent family size, Initial bid per jerrican and available improver water service have significant effects on willingness to pay improved town water service, While the water born disease and initial bid price for water services have significant and negative effect on the probability of WTP for improved water services.

Therefore, policy makers need to take in to consideration these socio-economic and demographic factors and some other attributes of water in designing the improved water supply system of the towns.

Key words: Household Willingness to pay, Contingent valuation method, improved water service, Chagni town

Acknowledgement

First we would like extend our gratitude to the almighty God; next we would express our deepest gratitude and appreciation to course instructor Dr. Dawit Diriba for giving the chance to do this research thesis.

We are very grateful to our beloved families for sacrificing the very scarce family time to comfort us with our study at Addis Ababa University. The everlasting love, trust and faith you all have amazingly assisted us to effectively handle our entire Endeavor's including this research writing.

Table of content

Abstract.....	iii
Acknowledgement	iv
Table of content	v
List of Figures.....	vii
List of Tables	viii
Acronyms.....	vii
Chapter One	1
Introduction.....	1
1.1. Background	1
1.2. Statements of the problem.....	4
1.3. The research question.....	6
1.4. The objective of the study	6
1.5. Significant of the Study.....	7
1.6. Scope and Limitation of the Study.....	7
1.7. Organization of the Thesis	7
Chapter Two.....	9
Literature Review.....	9
2.1. The study of theoretical review	9
2.1.1. Non-Market Valuation.....	9
2.1.2. Valuation Methods	9
2.1.2.1. Direct Valuation Methods (Stated Preference Methods).....	11
2.1.2.2. Contingent Valuation Method (CVM)	11
2.1.2.3. Indirect Valuation Methods (Revealed Preference Methods)	15
2.1.2.3.1. Travel Cost Method (TCM).....	15
2.1.2.3.2. Hedonic Pricing Method	16
2.2. Empirical review.....	16
2.3. Conceptual Framework.....	22
Chapter Three.....	24
Method and material	24
3.1. Description of the study area	24
3.1.1. Population of the study area	24

3.1.2. Selection of the study area.....	25
3.1.3. Data source and type.....	25
3.1.4. Designing and approaching contingent valuation survey.....	25
3.1.5. Sampling design and procedure.....	26
3.1.6. Questionnaire design and elicitation format.....	27
3.2. Method of Data Analysis.....	28
3.2.1. Model Specification.....	29
3.2.1.1. The Probit Model.....	29
3.2.1.2. The Tobit Model.....	31
3.3. Empirical Analysis	32
3.3.1. Description of Explanatory Variables and expected signs.....	33
Chapter Four	37
Result and Discussion.....	37
4.1. Surveyed of Data analysis	37
4.1.1. Descriptive statistics.....	37
4.1.2. Socioeconomic and Demographic Characteristics of Households.....	44
4.1.3. Existing water supply system in Chagni towns.....	45
4.1.4. Households' Willingness to Pay for Improved Water Services	50
4.1.4.1. Willingness to Pay Estimation.....	50
4.1.4.2. Reasons for Maximum Willingness to Pay	51
4.1.4.3. Determinants of willingness to pay for improved water service.....	51
4.1.4.4. Aggregate WTP and aggregate Revenue for Improved Water supply services	55
Chapter Five.....	58
Conclusions and Recommendation.....	58
5.1. Conclusions	58
5.2. Recommendation.....	59
5.3. Policy Implications.....	60
Reference	61
Annexes.....	64
ANNEX 2.....	104

List of Figures

Figure 2.3.1: The Study of Conceptual Framework for Improved Water Services	22
Figure 3.1.1: Location of the Study Area (Chagni)	24
Figure 4.1.4.1.1: Total Demand curve of improved water services.....	57

List of Tables

Table3.5.1.1; Each Kebele of household samples	27
Table 4.1.1.1; Summary of Household profile	37
Table 4.1.1.2: Descriptive statistics of Categorical variables	38
Table 4.1.1.3 Review household water use profile characteristics	40
Table 4.1.1.4: Review of member WTP and Not WTP for improvement	41
Table 4.1.1.5: Descriptive statistics of continuous variables	43
Table 4.1.2.1: Sex, Marital status and employee structure of Householder	44
Table 4.1.3.1: Existing water service conditions of households	48
Table 4.1.4.1 MWTP report by survey household	50
Table 4.1.4.5.1: Total revenue willingness to pay improved water services (in cents)	56
Table 4.1.4.4.1: Probit model result in household WTP improved water service	52
Table 4.1.4.4.2: Tobit model results in household willingness to pay improved water service	54
Table 4.1.4.1.1: Household responses of WTP improved water service	51

Acronyms

CEM	Choice Experiment method
CV	Contingent Valuation
CVM	Contingent Valuation Method
HPM	Hedonic Pricing Method
HH	Households
MDG	Millennium Development Goals
MDGs	Millennium Development Goals
MWTP	Maximum Willingness to Pay
NOAA	National Oceanic and Atmospheric Administration
OLS	Ordinary Least Square
TC	Travel Cost
TCM	Travel Cost Method
TEV	Total Economic Value
UNSDG	United Nations Sustainable Development Goals
WHO	World Health Organization
WTA	Willingness to accept
WTP	Willingness to pay
WWAP	World Water Assessment Program

Chapter One

Introduction

1.1. Background

Urban water supply has developed in to an upward concern in many developing economy. Effective strategies in meeting the water and sanitation targets of the United Nations Sustainable Development Goals (UNSDG 6) by 2030 will require us to develop fast data gathering and effective policy response to water demand challenges, “Trends reflect continued water demand and supply unbalances, compromise on quality and equitable distribution of water, in the wake of growing population of cities”. Formulation and implementation of sustainable water management policies has become essential for ensuring efficient water delivery to urban areas, which is essential for socioeconomic development (Kenway and Lant, 2015).

The provision of clean water improves community health by preventing water-borne diseases, thus saving financial and natural capital resources, “Policy makers need evidence based recommendations to justify cost effective supply options to ensure adequate water supply for growing urban populations (WRPM, 2017). It is desirable to know, which pricing or non-pricing policies are effective, and to what extent, to provide to the increasing water needs of growing populations, through efficient water supply management in developing economies.

World Bank (1994) as cited by Simiret W.et al, 2011, an increase of 0.3% investment in household access to safe drinking water generates 1% increase in GDP, “Unreliable supply and shortage of water affect life of human beings in various ways”. However, according to the research, water problems are still prevalent, so if the focus is on water improvement service.

Nielson (2004) noted that contends that safe drinking water is not just a luxury, “It often makes the difference between life and death”. According to researcher also said that the importance of water is a matter of survival, so I give my personal options that the government should work on water services.

According to (Iwn w.e.al, 2000) the development world, access to clean water may see easy, but it is not easy for poor countries such as Ethiopia and sub-Saharan Africa to access it. However, Chagni town water service offices were having a hard time delivering it to the public, despite the fact that Ethiopian is called water tower in Africa. Looking at the overall coverage, it is clear that there is a widespread shortage of water service in the area of study, although ready access to safe water is taken for granted in developed countries, in poor countries large proportions of all urban and rural households do not have safe water access and water quality reporting of Ethiopian were declines in relatively of others.

MoWR (1999) stated that the Ethiopian water resource administration policy has developed policy to improvement water supply, it is intended to be a cost-effective solution, bus sometimes would say it would be if better if the water resource policy reviews the implementation and application guidelines and improved the water supply service accordingly. Moreover according to researcher every Ethiopian citizens easily get accesses to adequate water, quantity and quality of potable water to satisfy life of basic needs to achieved health care and socio-economy.

A vast literature is available on residential demand for drinking water in developing countries. However, the estimation of demand for drinking water is complex as households in these countries use multiple sources for drinking water (Nauges and Wittington, 2010). Most of the research will be used to the better understanding of household water use in Chagni town and is necessary for sustainable urban water supply management and expansion of water systems. According to Getachew, (2002), water supply and sanitation situation in Ethiopia is very poor as most of the population does not have access to safe and adequate water supply and sanitation facilities. As a result of the health problems in Ethiopia are due to infectious diseases attributable to unsafe or inadequate water supply.

Diarrheal diseases caused by improper management of water and sanitation are among the major causes of infant and child morbidity and death. To the contrary, water and sanitation programs have a direct effect on the prevalence of diarrheal diseases in the population. The combination of safe water supply and sanitation facilities established a

high potential in contributing to a remarkable decrease in the occurrence of a child and maternal morbidity and death. The water supply service level of Ethiopia in terms of coverage, quantity, quality, and reliability is among the lowest in the world. Due to unreliability of safe and unavailability of safe and sufficient water supply and adequate sanitation facilities, the estimated service level could be in much less situation. These combine effect of the poor water supply and sanitation facilities in the country have high impact on the economic development of the country and the living condition of the towns' communities (OWRMB, 2009).

Earlier studies conducted on water supply managements both at international and national levels focused mainly on city areas. But medium towns like Chagni were not addressed. Research not yet carried out. Furthermore, Chagni is one of the medium level towns in the regions. It is also serving as an administrative, commercial and transport Centre of the Amhara and Beneshangule Gumuz region borders distance nearly 200km from the Ethiopian Renaissance dam. The truth that Chagni town is the center of trade for which two region trade centers and contributed to its increase in population economic development and spatial expansion. This rapid growth of the town has brought about increase in the demand for urban water supply particularly clean water. On the other hand, the provision of urban infrastructure like water supply is clearly observed as critical challenges in the town.

These situations necessitate research work to look at the issues in the area closely and deeply in order to give clear description of the problems from various factors by assessing urban water supply willingness to pay of the study. According to the UN World Water Assessment Program, about 2.3 billion people suffer from diseases associated with unimproved water use, and more than 5 million people die from these illnesses each year. In spite of all these one of the millennium development goals (MDG) by 2015.

Although Ethiopian government formulated the country's water resource management policy in 1999 to alleviate the problem of access to safe water supply, large number of rural communities use unprotected springs, hand-dug wells and rivers (Lema and Beyene, 2009). Thus, Water demand analysis is important at providing appropriate information and knowledge for designing an effective water demand policy in general and a policy

that pursues the efficient use of water in particular (Pearce, 1999). In addition to this the Institutional set up of Water Supply Service office of Chagni town is the liable government structure for the transfer of water supply service. Not only the administrative capacity of WSS office but also the capability of the Municipality of the town is an important factor in bringing about amazing restoration in the area under discussion. However, the municipality did not involve in water supply activities excluding the head of office who served as Board member and mechanical leader of the extension in agreement with Master Plan of the town. The sustainability of the water supply structure is mainly dependent on the success of management unit to operate, manage and maintain the implemented system.

The Chagni town Water Supply Service Office (WSS) is responsible for the operation, maintenance and management of the now constructed water supply structures of the town. The system is of course demand responsive and hence the promoting community should have a great role in all matters of the project and the Water Management Board that can represent the community and enhance community's participation was operations.

1.2. Statements of the problem

Sufficient and efficient water supply is important for the growth of economy through developing proper system management on water supply and sanitation. Many countries use urban water supply in major macro economy. According to (Begashaw, 2002) Lack of access to enhance water causes higher infant mortality rates, low economic productivity, and low female enrollment in school. These consequences are more serious in the urban and rural populations that have virtually no sanitation facilities, though only eight percent of the total population has access to sanitation (Dessalegn, 1999).

A rapid and steady growth of population in and around the town has enforced Chagni town to give proper and timely response to urban service demands. This increase is expected more with the emergence of various governmental, non-governmental and private institutions, job seeking migrants and internally disproved people demands for additional urban services including water supply service. Chagni town is a lot of

inadequacy in the water service. The current service will not satisfy the demand of the fast growing population in the town.

According to the (Andrea C. et al, 2009) Despite the fact that water revenue and the waste as well as service outages are a problem, they are still a big problem. Although these issues have been raised as a problem with the service provider, they have not been resolved. However to improved water service, water efforts and services need to be modernized, but water supply service limited and limited in Chagni. In this regard, if the community is concerns about improving supply of water service so that problems do not arise from improved water shifts and services (medihn, 2006). The researchers versed in urban and rural water services. Moreover the researchers“ says both occurrence of service interruption and the common duration of an interruption are unexpectedly high. Water loss and non-revenue water are included as key water supply problems.

And the community needs to know how to make improvements in water service payment. However neglecting to improve most water service, water service office is at odds with the public. The demand and the analysis of unacceptable service charge for the community bay not are possible to cover all costs and to provide adequate, public and safe water supply. But the town water supply may not be enough and would like to point out that the government should work improved the town water supply service. In addition this study is important to know about the improvements of water service in the town and to use it as information in the future and the study will allow me to study Chagni and see the community water demand improvement.

Therefore it's important to inspect and study the water service improvement but, it is important to see and understand the water service charge for non-input customers who need to improved water services. In addition the current water payment improvement policy in the town does not take in to account the supply based and policy approach and found out in my study why there was so much feedback and perception when we lost the study that it was not community based water price improvement and was not based research.

In the implementation of these types of water policy, the residents of the town or those who receive the service must be willing to pay the user as needed to be provided or study

the price adjustment. In addition water support reform is an appropriate and key study idea for sustainable and equitable growth of the study area and for the development of Infrastructure and investment that encourage diversify people. And the purpose of the study is also important and timely to fill the gap and the gaps in the community and to work out and future solutions and solutions. In addition research, to improved water service billing is very important and will solve the town future.

As well as for improved water service and it is an evaluation of the impact of willingness to pay on the impact of the study. In addition this research papers are intended to illustrate the appropriateness of improved water service for Chagni and to provide the town with starting point for future reference. The study will be conducted in Chagni town administration, awi zone, Amahara region, where no improved water service survey has been conducted research willingness to pay is in the area of concerned.

1.3. The research question

Achieving the objective answer the following questions were.

1. What is the Assess the source, challenge and coverage of urban water supply service problem in Chagni?
2. What is the estimate household willingness to pay for improved urban water supply service the study area?
3. How to analyze determinants of household willingness to pay for improved urban water supply service?

1.4. The objective of the study

The general objective of the study is to examine the factors that influenced household willingness to pay improved water service in Chagni town. In a particular, the study has the following specific objectives;

1. To assess the source, challenge and coverage of urban water supply service problem in Chagni town;
2. To estimate household willingness to pay for improved urban water supply service the study area;
3. To analyze determinants of household willingness to pay for improved urban water supply service.

1.5. Significant of the Study

The researches were give attention to the dynamics estimate of households' willingness to pay for improved water services in Chagni town. The customers' necessary to pay for the service they get from the improved water service source. Consequently, particulars the amount of money the service users are willing to pay for the improved water service is vital for improved water service projects. On the truth and anew knowledge which is enhance social developments and integrated responsible on working. Moreover, the amount of capital Chagni town WTP for water services they obtain from the improved scheme and basics that decide their WTP would be assessed. Consequently, the result of this study give practical information for project planners can be used as an input for water development projects of the towns. In addition to expected to be a good reference material for studies about the topic in the town. Normally, the study can be important other input for diverse participant working in the water supply division, policy implication of papers on the government and non-government administrations could have reliable information for their coming investments on the facility of improved water supply services in the area.

1.6. Scope and Limitation of the Study

Even though clients improved water service contain Administration, households, Trade area, Guesthouses, manufacturing users and etc. This researches, deal only with improved water services of households in Chagni towns using cross-sectional data at a point in time. The water clients by Administration, Trade area, Guesthouses, manufacturing sectors in the town are not addressed in the research, it is, consequently, clear of the scope of this study. The study were alternative specific to one up to four Kebeles of Chagni towns and it discover only 300 hundred households from a total population of 36,400 households of four selected Kebeles were taken.

1.7. Organization of the Thesis

These integrated researches were tries to identify the framework of Household willingness to pay improved water service for Chagni town in Amahara region of Ethiopia which comprise of five essential chapters. Chapter one were introduction on which contains the background, statements of the problem, objective, research question,

Significances of the study area, scope and limitation, and organizations of the study area. Chapter two were provides review of literatures. Chapter three will Include methodology which is includes area description, research design, sample design, data source and type, methods of data collection and data analysis. Research findings are described and discussed in chapter four. Chapter five were present the conclusion of study.

Chapter Two

Literature Review

2.1. The study of theoretical review

A fairly literature introduction process is based on the method of contingent valuation survey, hypotheses based on the economics of natural resource and environment evaluations.

2.1.1. Non-Market Valuation

Wiktor L. (2004) researcher side the value a local resource is growing around the world and the numbers of economists have increased. In addition, the local products and services have received a lot of attention, according to researchers. According to researchers (Hanley et.al, 1997) how to value change in the towns, regions and international capacity, however, economists have come up with a good idea to support the management decisions to use non-transactional assessment as valid tools. Thus, non-marketing, pricing is a challenge for the community. Therefore, as a researcher would like to comment on the basis of the research paper that should be prepared for the community on non-marketing, pricing or estimation and for the value of the water resource and the environment.

Loomis (1987) stated that economists provide compressive social and economic advice on the flow of natural resource. However, we can classify the economic value in to separate categories: use value, non-use value and option values, their benefits can be described as follows; the first value is the future value of the resource and total willingness to pay for environmental resource is the total of option value, use value and non-use value. However, it shows that these values must be protected in the future, even if the community does not exist to protect the resources. In addition, another study provider outlines the three benefits (Tietenberg, 2003).

2.1.2. Valuation Methods

Loomis (1987) noted that economists provide compressive social and economic advice on the flow of natural resource. However, we can classify the economic value in to separate categories: use value, non-use value and option values, their benefits can be described as follows; the first value is the future value of the resource. However, it shows

that these values must be protected in the future, even if the community does not exist to protect the resources. In addition, another study provider outlines the three benefits (Tietenberg, 2003).

Loomis (1987) showed that the value of management and use of environmental resource is described in detail in term of survival, will, and option values. However, i think it would be helpful if the community aware of this research project. In addition, according to the researcher, each has its own benefits;

Direct use value: in terms of the benefits of environmental resource, we can say that they are worthwhile for the present or direct use in environments.

Indirect use value: according to the study, the indirect benefits of an environment that activities serve abut lands or indirect use of environments.

Option value: according to the provider, describe the value that you can use in the future, even if you do not use it now.

Quasi optional value: according to the author study, has made it clear that in his own option, there is development value that were benefits the future and are related to the benefit of environment resource for future generation.

Bequest value: according to the authors, the current generation is concerned about the environment and passing it on to the next generation, and the people are willing to conserve and pay for environment resources in term of conserving the knowledge and the nature of the environment.

Existence value: the community enjoys a sense of self sufficiency in protecting the environment, as well as the joy of protecting the environment, fish, animal, plant and other things. It is also clear that the values that are not used are less realistic because they are motivated by external stimuli and ignoring value also leads to mismanagements of environment (Tietenberg and Lewis, 2012, p.141).

In addition, thus the calculation of the total economic value of an environmental resource should contain all the above components of value. Since non-use values are derived from motivations other than direct personal use, they are obviously less tangible than the use values.

Environmental Valuation Techniques

Two broad valuation techniques: direct (stated preference) and indirect (revealed preference).

2.1.2.1. Direct Valuation Methods (Stated Preference Methods)

Two main stated preference methods are the contingent valuation method (CVM) and the choice experiment method (CEM). Both methods depend on a hypothetical market which is presented to the respondent in a questionnaire; A main advantage of stated preference methods over the revealed preference method is that we can ask respondents for their WTP regardless of whether they make use of the hypothetical commodity or not; In other words we can obtain use and non-use values whereas the revealed preference method only addresses the use value of the resource (Hanley et al, 1997).

2.1.2.2. Contingent Valuation Method (CVM)

The contingent valuation method is the earliest technique of the stated preference method of non-market valuation approaches. The CVM involves asking people directly what they would be willing to pay or willing to accept compensation for change in preferences. This method is called contingent valuation because the valuation is contingent on the hypothetical scenario put to respondents. The contingent valuation method has two major advantages over the indirect valuation methods. First, CVM deals with both the use and nonuse values of the environmental resource while the indirect methods deal only with the use value. Second, survey responses to willingness to pay or willingness to accept hypothetical questions go directly to the monetary measures of utility change (Perman et al., 2003).

The last and clear reason is the contingent valuation method deals with both the use and nonuse values of these environmental resource goods and services (Spash, 2008).

The steps involved in applying the CVM can be stated as follows (Perman et al, 2003):

1. Creating a survey instrument for the elicitation of individuals' WTP/WTA. This can be broken down into three distinct, but related, components:
 - a. Designing the hypothetical scenario,
 - b. Conclusive whether to ask about WTP or WTA,
 - c. Creating a scenario about the means of compensation.

2. Employ the CV survey instrument with a sample of the population of interest.
3. Analyzing the responses to the survey. This can be seen as having two components:
 - a. With on WTP/WTA to estimate average WTP/WTA for the population,
 - b. Considering the survey results so as to judge the accuracy of this estimate.
4. Figuring total WTP/WTA for the population of interest.
5. Conducting sensitivity analysis.

Strength of Contingent valuation

CVM has been increasingly advocated by economists and some specialists as a useful tool for gathering reasonably accurate data about how much a household can afford and is willing to pay and sanitation options presented to them (Wedgwood and Sanson, 2003).

Young (2005) stated that the primary attraction of CVM is that it can measure the economic benefits or damages of a wide assortment of beneficial or adverse effects in a way consistent with economic theory.

The most important part of contingent valuation methodology is creating a realistic contingent valuation scenario, which has accurately priced water supply „options“ that reflect the levels of prices that the water service provider would have to charge in order to provide the service; The household is asked about their preferences and is effectively asked at what price they would be willing to „buy“ the water, based on the level, quantity and quality of services (Wedgwood and Sanson, 2003).

Contingent valuation methods have two advantages over indirect methods (Wedgwood and Sanson, 2003).

- A. It be able to agreement among both use and non-use standards, while, the indirect methods cover only the previous, and include weak complementarily expectations.

- B. In principle, and unlike the indirect methods, CVM answers to WTP or WTA questions go directly to the hypothetically correct economic measures of utility changes and the CVM can be used for use and nonuse values, its actual use has mainly been in regard to the latter, Particularly most CVM applications have concerned existence, or passive-use, values (Perman et al, 2003).

Specifically, CV was seen both as an another method of valuation to travel-cost (TC) and hedonic pricing (HP) models and as being able to quantify some types of benefits, such as non-use or passive-use benefits, which lie outside the scope of TC and HP studies (Bateman and Willis, 2001). Given this, and the fact that indirect methods cannot address nonuse/existence values, the study were employ the CVM in the setting of trying to ascertain nonuse/existence values. In addition to this study suitably in the CVM.

Limitation of Contingent valuation

As compared with indirect methods it is seen by many economists as suffering from the problem that it asks hypothetical questions, whereas indirect methods exploit data on observed, actual, behavior (Perman et al, 2003). The major concern with the use of the contingent valuation method has been the potential for survey households to give biased answers.

Four types of potential bias have been the focus of a large amount of research (Tietenberg and Lewis, 2012):

- A. Strategic bias; occurs when the responsible community responds impartially to a particular outcomes.
- B. Information bias; it may arise whenever respondents are forced to value attributes with which they have little or no experience.
- C. Starting-point bias; it may arise in those survey instruments in which is ask to make sure off his/her answers from a predefined range of possibilities; How that range is defined by the designer of the survey may affect the resulting answers. A range of \$0–\$100 may produce a valuation by respondents different from, for example, a range of \$10–\$100, even if no bids are in the \$0–\$10 range.

D. Hypothetical bias; it can enter the picture because the respondent is being confronted by a contrived, rather than an actual, set of choices; Since he or she will not actually have to pay the estimated values, the respondents may treat the survey as casually, providing ill-considered answers, The National Oceanic and Atmospheric Administration convened a panel of independent economic experts to evaluate the use of contingent valuation methods for determining nonuse values. The panel made clear its conclusion that suitably designed surveys could eliminate or reduce these biases to acceptable levels and it provided specific guidelines for determining whether a particular study was suitably designed. Specifically, they recommended the use of referendum-type (yes/no) willingness to pay questions, personal interviews when likely, clear scenario descriptions, and follow-up questions (Arrow et al., 1993). Totally these suggestions are measured and then were applied in this research.

Contingent valuation (CV) elicitation format related bias

The most widely used elicitation formats in CV surveys are open-ended, bidding game, payment Card and single (double) bounded dichotomous choice (Timothy C. Haab and Kenneth E. McConnell 2002). The CV surveys on the following elicitation formats in:

- 1. Open ended format:** According to Mitchell and Carson (1989) answer to contingent valuation question if you write a research paper provider to respond the request in their own way without any assistance and to complete the request it is not an easy method, wrote the researcher and contingent valuation survey question households asked face to face interview with his or her willingness to pays. However the bodies that answer the question when asked to provide the value of willingness to pay on demand optional simplicity have the potential to be bargaining chip.
- 2. Closed ended dichotomous choice question format:** the researcher explained that the answer to the question of the weather yes or no the community would decide this closed binary option would be easier to answer while the content of the question is more important; it reduced incentive for strategic responses. However, be creating problems in which consumers are willing to pay they asked

if they would pay a certain amount by offering a better deal you can easily use the question to say yes or no (Bateman et al., 1992).

3. **Bidding game format:** According to researcher (Cummings et al., 1986) the analysis of bidding process is boring and difficult for the respondents, which can be boring the bidders as it shows a very strong and good initial bias. However, the respondents can only answer questions to avoid further inquiries also because they are willing to pay for the prepared response from. On the other hand, raising or lowering the amount you pay is a form of questioning that requires a willingness to pay. However, when look at this form, it is better and more efficient than the forms that say yes or no, this because customers are more likely to ask for payment (Hoehn and Randall, 1987).
4. **Payment card format:** according to the researchers the format of the payment card is a questioner format in which you can choice to accept and accept various assumptions. However the responsive community is a test of willingness to accept point or willingness to pay (Mitchell and Carson, 1981).

2.1.2.3. Indirect Valuation Methods (Revealed Preference Methods)

2.1.2.3.1. Travel Cost Method (TCM)

According to their study, they are widely used to list travel cost method. However the use of the travel cost method to value or evaluate such roads in recreational parks has been widely implemented. However the economists and sociologists say that by comparing the amount of money spent by community on various travel expenses, they can compare the location with the economic value of the area. However, according to the nature of our country is not implementing much of it because we are poor, this is because the user has a voluntary estimate to pay for various entertainment, but that can include transport cost and travel expenses. Researchers also consider the community's willingness to pay or willingness to accept for the economic cost of access to specific recreational areas by applying the above method. However, that travel cost may include the above. In result, these travel expenses symbolize the "price" of the recreational experience (Letson and Walter, 2002).

2.1.2.3.2. Hedonic Pricing Method

According to the researchers, this evaluation method that we use to evaluate the value or value of various goods and propriety. However, most of the time, many studies have been done at this point, although I did not use it in my study, included the ideas of the researchers to help to the studies. Still, when you look at different houses, you can pay attention to age, region, time of construction, adjacent signs, amount of money and effort. In addition, given the different quality and pollution, each asset has a clear value and the asset value requirements are equal to the total value of multiplied values (Blomquist and Worley 1981; Rosen 1974).

However, it is assumed that they have information on consumer behavior in order to fully identify, and that financial difference are valued by different commodities. Look at what the other study has written, it is important to apply the effort required to adequately implement the hedonic pricing method in order to apply the effect on the position adjustment funds. As the result, it is possible to determine the price or cost of water for Chagni town by recognizing these ways and creating suitable value of improve water resource (Leggett and Bockstael 2000).

2.2. Empirical review

Various researchers have offered a variety of research ideas, including volunteering to pay for improved water service. However, we have taken the following research as a reference to see and understand Chagni voluntary water bill. The following is reference one of these research activity;

Fekadu (2011) noted that they are willing to pay water supply in Holeta, and they will pay an improved water service fee in the study using contingent valuation method, A total of 141 sample households were interviewed during the survey, together with group discussion and key informant interview; The survey result showed that, if the towns water supply office provide improved water supply, more than 80% of the households were willing and able to pay for the service at a price more than a cost recovery tariff rate; Correlation results showed that income of households and household size were significantly affecting households" willingness to pay. However my researcher is similar to the author idea, so I took it as a reference.

Belaynesh (2013) stated that the researcher study, she looked at monitoring questions and researched the method of investigated a study on households demand for improved water service deliver in Sodo. However, she submitted a research paper in the form of a bidding process using a fixed price. And by selecting households, the researcher clearly used economic analysis and analysis method to collect information on more than 160 households in person.

In addition according to my research, in Chagni the researcher used the research process to face to face interview some 300 household in a person, I also used the idea because the research process is related to my research. Analysis showed that 45.5% of the households in the sample had a personal relationship. In addition the researcher wrote that only 18.49% of households but 99.37% of households who went access to improved water service, the researcher told us that they were willing to pay for an improved water service, but if the researcher raises more face-to-face question, the result may be better, because when there is a lot of follow-up requests, the result could be good.

On the other hand, by sharing the researcher ideas, he describe them using the tobit model, to identify and determine the amount of money the community is willing to pay, the household gender, education level, satisfaction level, initial bid pricing and etc. Even if my researches including all the details. In addition, the refusal to pay for water service in the study is based on household, water source, staying in the area, home ownerships were properly affected in the willingness to pay, the researcher also side that the lack of time and the initial bid price have affected the use and willingness to pay for water service. I think my researches can be better understood by highlighting the listed research points.

Fisseha (1997) and Duffel (1998) applied the CVM for measuring the WTP for improved water quality in Meki town and Ada'a-liben districts respectively; in both studies income and time (distance) spent to fetch water were reported to be the significant factors determining WTP of the household, while education and wealth were insignificant and in Duffels study family size and sex of the household and in Fisseha's study occupation were insignificant.

Gossaye Fanta (2007) show that the results of the study are somewhat similar to my results, the researchers' idea was good and I used it to help with my research. However,

the researcher studied the “contingent valuation method to examine the determinant of household willingness to pay improved water service the town of Debre-Zeit “on the subject of volunteering to pay for better water services. He conduct the research by intervening volunteer households and implementing the current water service delivery system, the proprietor implementation method used in these research process has been developed and imitated by one party and in recent interviews.

It is clear that households are willing to pay for improved water services using the probit models to implement and implement issues. However, according to the researcher, the monthly household income, the reliability of urban water service, the initial bid, the numbers of households and the amount of water contributed significantly to the results of the study, the result of my research have some similarity. Although it is clearly defined as gender dummy, education dummy and quality dummy I have also found the same results as the researcher.

In the same study made by Medhin (2006) according to the study, she used two methods to produce the result of the study, they have “used probit and Tobit models “in practice. However, when we look at the next of the study, they are similar to the one I studied. According his reference, my own study is as follows.

In addition, the study was conducted in Chagni town at an adjusted price for willingness to pay for improved water service. I used this question to ask about 300 households face-to face interview and in order to facilitate the research a single bounded format with open ended completion questions was performed in the research. By this criterion, my study used two methods to determine the accuracy of the research study, and have presented my research using the probit and Tobit models to pay for improved water service.

However, without compromising on the researchers’ idea above, we can see that the results of the probit model and the Tobit model show that the researcher’s willingness to pay is 20 cents per 20 liter jerry can. In my research finding, found 30 cents in 20 liter jerrican. Therefore, it can be seen from the research paper that all of our research results are somewhat similar.

Tsegaye (2005) stated that the researcher used the evaluation methods to ask fisherman to pay for the improvement of Lake Chamo. Used accordingly it has an average score of birr 4.65 per month. However, would like to point out that although the study did not provide

much benefit to my research, it is important to note that there is a need for payment for the improvement of water service due to the presence of fish in water.

In addition, the result of the study show that there is a significant and positive relationship between household pay and income at household education level and dummy variant (lake Chamo) Chamo, but for the sake of understanding or analysis, it is related to the age and gender of the male and the researcher used double-bounded format to elicit willingness to pay.

Terefe (2000) noted that the research shows the benefits of recreation around the from establishment of Tis Abay waterfalls to the community, it also uses probit and tobit model to describe the current financial security system and the cost of movement or travel cost, also described the study as a reference but did not use it much, and describing the current valuation method and travel cost models. According to the researchers, the value visitor is derived from the cost of travel in order to focus on the value of not using goods. However, it has a different price than the trip. Finally, the researcher said that the correct implementation of the recurring financing method and travel cost analysis will provide useful information for the benefit of the community.

Mitchell and Carson (1989) showed that this research paper is written in developed country, according to the researcher, among favorable institutions the community understanding of those who are willing to pay is important. Water-based recreational management and geographic feedback are generally high on signaling. According to the author of the study, they contact a national benefit survey on clean water pollution in the United States and analyzed the overall process for the implementation of the countries clean water service.

However, the researchers withdraw his general willingness to pay improved water service to the test of the water. In addition, our country, Ethiopia, a lot of research has been done on water service. But in our country, researchers say that much remains to be done. However, according to the Ethiopian report (2005), water choices are interpreted differently, according to the report, the community in Ethiopian city, including Addis Abeba, is dependent on water resources.

On the other hand, there are serious problems with the establishment of Ethiopian city. When take my study, Chagni is a town that is naturally growing, but it is still in trouble when you look at the water service situation. However I have learned from the information gathered that the community uses spring, river, well and etc. In addition, in controlled expansion is now a major problem in terms on service delivery and sewerage.

According to the author of the study, there are often job loss and low capacity in various towns in Ethiopia. However, with increasing the population of the community, the problems are even greater. Although the hall is connected to is electricity and distribution roads the town water supply is protected, due to the declining quality of water in various ways, the numbers of pathogens is changes on the course of the water causing the community to stop looking for improved water service bills.

The finding of study's that, it is common in Addis Abeba. So realized that there was a similar view of the community around research area, the researcher also cited the lack of adequate drainage or filtration sites to maintain water service and quality. Although our country, Ethiopia, is in its infancy, the current one, however, is a start up to expand and filter problems from time to time, and understanding that the problem is still being highlighted in various investment area, giving the current situation and the report that have been received at various time, and that they were be released in to the water without any treatments and the problem is very common in a capital city Addis Abeba. Finally my opinion and research process said that a good start and work awaits us in the future and that we must work. However, the researchers, notes that there are ongoing efforts to improve quality and quantity (J. Crampon, 2005)

According to Ethiopian water policy respects in there are number of action have been taken by Ethiopian government especially in recent time than ever. However with the current population growth of the country, city and industrial expansion and climatic threats need more and much more action is highly required. Ethiopian Ministry of water and energy (MoWE) former ministry of water resources (MoWR) has set a strong national policy in collaboration with Ministry of Health (MoWR for access to water supply and MoH for access to improved sanitation) and key agencies with the clear roles and strategies (USAID, 2007 & 2010). The Ethiopian government adapted universal access plan and have planned to achieve 100% of access in water supply and sanitation

for urban areas and 98% access to water supply in rural areas of the country as of 2012 E.C. with the cost of 2.5 billion US\$ (Ministry of Water and Energy, 2011).

Regional Water Bureaus and Woreda water desks have been stated here clearly for the discharge of their activities such as investment planning, technical assistance and monitoring, but their capacity is in doubt, in addition to boosting water quantities and qualities in Ethiopia the trends of communities in which highly dependent on public water point and used in house storage has to be changed.. The water for the communities by the city municipal distribution channels are so safe and free from pathogens in general, but lacks of timely maintenance, illegal connection to the pipe line are changing water quality after reservoirs and before uses (Ministry of Water and Energy, 2011).

MoWE (1999) were set a strong national policy and adapted Universal Access Plan (UAP), then there is lack of awareness in the clean waters among different administrative unit were also entire whole communities are one of missed in the national polices. This is also another challenging job and applies the Ethiopian clean water policy.

The Contingent valuation method can be successfully applied to low income countries, also from the above empirical studies on Contingent valuation method, it can be decided that households' WTP for improved water services is influenced by socio-economic conditions, existing water service conditions and household willingness to pay water services finally household's attitudes towards government policy on water (World Bank, 1993)

2.3. Conceptual Framework

The research uses the Contingent valuation methods which is a non-market valuation method to estimate the economic value of household willingness to pay water services. With the current property rights and institutes, water in the town areas is a non-market good, so non market valuation method is suitable to estimate WTP. The theoretical foundation of economic values for environmental and public goods like community water, are define in the perspective of their effects on human welfare (Krieger 2001; Agudelo, 2001). The conceptual framework assumed in the study is as shown in household willingness to pay accept or rejects in minimum and maximum with the improved water services in to the suitable amount to assess the economic benefits be contingent firstly on the nature of the change we are valuing (price / quality / quantity change). The measure was also depending on the way of the change and the concept of elicitation used willingness today. Accordingly, the decision on Willingness to pay from the household is affected by households' features, perceptions and preferences.

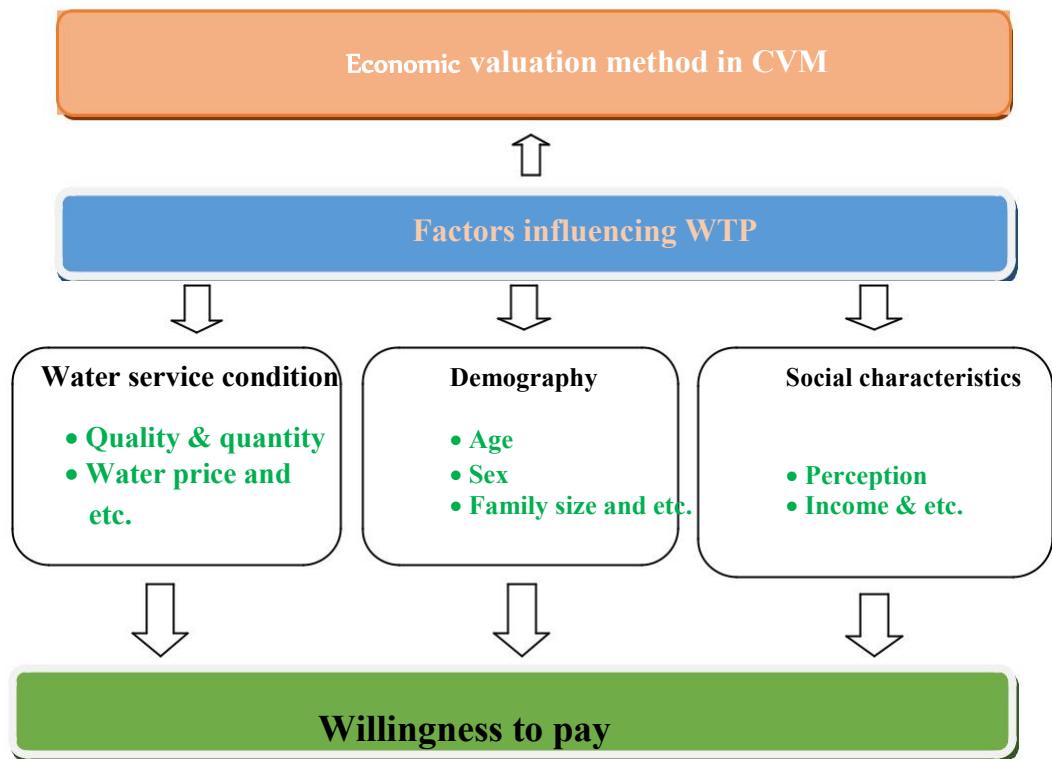


Figure 2.3.1: The Study of Conceptual Framework for Improved Water Services

The relation implemented in this study is clearly shown by the arrow. For instance the econometric, demographic and social characteristics were the measure factors influencing willingness to pay as a result of the improved water services as an alternative of

willingness to accept. According to Garrod and Willis (1999), asking willingness to pay or willingness to accept depends on properties rights. If the respondents do not own the right to the good, in our case being improved water services, then willingness to pay would be asked. Equally if the respondents were personal the right to the good then willingness to accept is the applicable measure. Carson (1991) suggests that willingness to pay water service should be used every time the individual might incur benefits from the proposed economic valuation methods (CVM). It is accordingly the study uses the contingent valuation methods to willingness to pay for an improvement in water services.

Chapter Three

Method and material

3.1. Description of the study area

The study conducted in Chagni town, one of the towns in North West of Ethiopia located in the Agew awi zone of Amahara region. Historical foundations of the town shows that it was established i the 1950 and administrated by Fitawrari Embiale Gessess. the geo-reference the town is a longitude and latitude of $10^{\circ}57'N$ $36^{\circ}30'E$ and an elevation of 1583 meters above sea levels, It is the administrative center of Guangwa Woreda. Based on the Ethiopian central statistical agency, (CSAE, 2015) shows that the Chagni town has estimated total population of 38,400.the climate of Chagni is hot. It has an average temperature of $32^{\circ}c$.

Figure 3.1.1: Location of the Study Area (Chagni)



Source; From Ethiopian map agency

3.1.1. Population of the study area

Chagni town takes a population estimated total population of 36,400 Central Statistical Agency of Ethiopia (CSAE, 2015); The population density is estimated in based on Central Statistical Agency of Ethiopia is 131.9/Km squares, Chagni is found the Ethiopian capital city of away from Addis Ababa in 564km.

3.1.2. Selection of the study area

The selected study area is located at the border of the Amahara region and Beneshangule Gumez regional of the country, The researcher working experience of severe water scarcity in the town is for more than a decade and the government and NGOs frequently challenges resolving the problem of urban water supply scarcity through the increase of water systems, Still the town problem is serious from time to time for this perspective.

3.1.3. Data source and type

The data used in this study are mainly primary and cross-sectional for the year 2020 obtained through a contingent valuation survey conducted in Chagni town. Using simple random sampling from four kebeles of the town's administration population, 300 face-to-face interviews were conducted. The study is also supplemented by secondary data from the Ministry of Water and Energy (MoWE), Chagni town's water service office and other relevant secondary sources from the kebeles administration.

Contingent Valuation Method

Is a method of estimating the value that a person places on good, the approach asks people to directly report their willingness to pay (WTP) to obtain a specified good, or willingness to accept (WTA) to give up a good, rather than inferring them from observed behaviors in regular market place.

3.1.4. Designing and approaching contingent valuation survey

The survey used in this research primarily collected of four units; 1) socio-economic conditions of respondents; 2) On existing water service conditions; 3) willingness to pay for improved water services. The first section of the survey involved detailed information about socio-economic conditions of households such as age, household size, average household income and education level. The second section present questions pertaining current household existing water service condition including attitudes towards the current domestic water quality, satisfaction, shortage and reliability. The third part of the survey presents the valuation situation in question and willingness to pay improved water services. Pretesting of the survey was conducted through survey to about 20 households in the study areas. This was done to minimize any biases which are often related with contingency valuation surveys. Through the survey, initial bids for the dichotomous

single bound model were elicited with the use of open-ended elicitation format. Pretesting of the survey also helped in redefining the hypothetical situation to an accurate one and which is in agreement to the needs of the study. The valuation situation thus tried to provide detailed information about the explanation of the proposed water services and short and long term benefits with respects to such a plan. This all was verbally showed to respondents in the sequence of the interview. Additionally, the use of dichotomous single bounded elicitation enhanced to minimize strategic bias which comes from respondents trying to influence the price to pay.

3.1.5. Sampling design and procedure

The study was interviews face-to-face households by selecting 300 sample households from those kebeles and is a method of contingent valuation questioners. In addition only use these questionnaires for self-employed households, and sample households were randomly selected from these four kebeles using probably proportion population to sample size.

Then the sample size was determined by following the formula given by Yamane (1967) which is more suitable when the population is similar and random sampling procedure is to take place. The formula is given as follow:-

$$n = \frac{N}{1 + N(e)^2}$$

Where, n= Sample size required,

N= Number of populations

e = Degree of precision error = 5%

Before, using proportional to household size, the number of samples from each of the 4 (four) randomly selected kebeles of the towns is calculated as follow in the table below.

Table3.5.1.1; Each Kebele of household samples

Town kebeles	Number of households	Number of household Samples
Kebele one	1995	69
Kebele two	2300	79
Kebele three	2170	74
Kebele four	2262	78
Total	8727	300

Source: The field survey and Chagni kebele office, (2020)

3.1.6. Questionnaire design and elicitation format

Mitchell and Carson (1989) noted that used surveying to make it easier for researches. However, when using the face-to-face questionnaire, the researcher asked the community for a reference and prepared the pricing method in front of the page at different time section. And it is believed that these opening sections were reducing strategic bias. The study includes an introductory paragraph on why it is necessary to study.

Portney (1994) stated that the researchers, explicit statement of advice was incorporated in to my research, and the researcher stated that have personally witnessed the voluntary payment of improved water services to households who are willing to pay in the future. However, the hypothesis that the interrogation was made in front of the respondents did not cover what happened in the past and the method and the process used by the researcher used above is very similar to what I did. In addition, draft surveys were conducted in four selected kebeles, and a total of 20 face-to-face interviews were conducted in each kebele, with pre-test and preliminary questioners of respondents.

Mitchell and Carson (1989) noted that as you can see in the research paper, also used inputs because needed to prepare for future research during investigational studies, and asking for this input also a face-to-face interview.

The researcher took advantage of the small structure included in the final stricter to make it easier to implement and refused to answer face-to-face questions by including

questions with community revenue at the end of the front end. The other is that have used two points ask questions and to complete the bids.

The elicitation questions were left open-ended during the pilot survey to get information from where and which value to start the willingness to pay questions. Hence, to consider this answer variance, we took the three most frequently said figures/modal values which were 10, 20, 30 and 1.50cents. The researcher used these prices as starting bids for the willingness to pay questions. These starting prices were randomly distributed in all the sample houses head interviewed. Household heads interviewed in the pre-test were not involved in the main survey. The attention of the questionnaire was on the estimation of the households' willingness to pay for improved water supply services.

Yibeltal Bantie (2011) as these researchers studied, they used an indicator idea using a double bonded pricing reference. However, the face-to-face questioning technique does not exceed the speed of statistics in a single bounded process. And the researchers were identified the minimum process as the main process. However, ineffectiveness of the supply model is due to the fact that this study is a one size fits all excuse for bias and the results are very high. It also has the advantage of providing a good understanding and information on households desire to pay. Finally the researches have taken their ideas for the research paper has made as a reference to the research articles.

Jones Bane (2005) showed that the final version of the survey questionnaire designed for this study has three sections: 1) Questions related with Households' socio-economic and demography conditions of water supply services. 2) On Household existing water service conditions. 3) Household Willingness to pay questions using single-bounded dichotomous choice elicitation format.

3.2. Method of Data Analysis

The study used both descriptive and quantitative techniques to analysis the data. Method of data presentation includes Table, Graphs, charts etc. For analysis; in the first part the study used descriptive statistics (percentages, means, standard deviations and t-test).

These were analyze and described quantitatively by making use of STATA-14 version, and tables. In the second part econometric issues, more specifically, used in probit models may be necessary Tobit models are adopted. Variables, which take part in

If a payment (also called the initial bid, β_i^*) it is caused by changes in quality ecological properties that are similar to or better than, something that is monitoring if the user or customer simply accepts the simply if;

$$u_{1j}(y_j - \beta_i^*, x_j, \varepsilon_{1j}) > u_{0j}(y_j, x_j, \varepsilon_{0j}) \dots\dots\dots 2$$

Although the study were conducted inferior people give birth to inferior offspring and, thus, propagate their inferiority his or her may have a probability to answer “yes” or “no”. Therefore, the opportunity to say “yes” to the respondent is an opportunity for him or her to think that he or she has been corrected. For individual j, the chance is:

$$P(\text{yes}) = P [u_{1j}(y_j - \beta_i^*, x_j, \varepsilon_{1j}) > u_{0j}(y_j, x_j, \varepsilon_{0j})] \dots\dots\dots 3$$

This type of incidental process provides an emergency process to list pairs of responses, if you assume that the value function is different in the real and information process.

$U_i(y_j, x_j, \varepsilon_{ij}) + \varepsilon_{ij}$. Specified the additive requirement of the utility function the chance report for respondent j become:

$$P(\text{yes}) = P [u_{1j}(y_j - \beta_i^*, x_j) + \varepsilon_{1j} > U_{0j}(y_j, x_j) + \varepsilon_{0j}] \dots\dots\dots 4$$

These opportunity events are the tips of the iceberg for the revenue and associated activities in the models listed.

The Probit model is able to be as;

$$T_i = \beta' X_i + \varepsilon_i \dots\dots\dots 5$$

Wherever;

β' Is vector of parameter of the model?

X_i Is vector of descriptive variables?

ε_i (The error term) and is assumed to have random normal distribution with mean zero and common variance δ^2 (Greene, 1993).

T_i = un observable households“ real willingness to accept for improved water supply service, T_i is only a latent variable. What we observe is a dummy variable $WTPI_i$, which is defined as:

$$WTPI_i = 1 \text{ if } T_i \geq \beta_i^* \dots\dots\dots 1$$

$$WTPI_i = 0 \text{ if } T_i < \beta_i^* \dots\dots\dots 2$$

In the single bounded elicitation format, the j th respondent is asked if s/he would be willing to pay the initial “bid”, (β_i^*) , to obtain, say, agreed development in ecological quality, quantity or together. The chance of a “yes” response, or a “no” response, pY or $PN(\beta_i^*)$ can be direct in conditions of random utility maximization selected by the respondent. It is clear that the willingness to pay of the community or the individual is arbitrarily altered by the researchers’ points of view. As the result, the community is aware of the maximum willingness to pay performance; T_i to the spectator is a random variable by agreed collective division function denoted by $G(T_i; \Theta)$ wherever Θ represent the parameters of this division, which are to be estimated on the foundation of the responses to the CV study. After that, follow the effort of Hanemann (1984), the response chance associated to the fundamental WTP allocation are:

$$PY \equiv p \{ \text{yes to } \beta_i^* \} \equiv p \{ \beta_i^* \leq T_i \} = G(\beta_i^*; \Theta) \dots \dots \dots 3$$

$$PN \equiv p \{ \text{no to } \beta_i^* \} \equiv p \{ \beta_i^* < T_i \} = 1 - G(\beta_i^*; \Theta) \dots \dots \dots 4$$

The follow-on log-likelihood role for the responses to a CV study with the single –

$$\ln L(\Theta) = \sum \{ diY \ln G(\beta_i^*; \Theta) + diN \ln [1 - G(\beta_i^*; \Theta)] \} \dots \dots \dots 5$$

Wherever $diY = 1$ if the i th response is yes and 0 if not, while $diN = 1$ if the i th response is no and 0 if not. According to the study “model process in response to modernization research, The main process for evaluating the willingness to pay is to give space and to obtain a moderate or average score to obtain the willingness to pay” (Hanomann, Loomis and Korninea, 1991). Thus, the mean willingness to pay (μ) the model for single bounded experimental modeling process can be clearly defined as;

$$= -\beta_0/\beta \dots \dots \dots 6$$

Where, β_0 = the constant (or intercept) term,

β = the coefficient of the bid posed to the respondent,

3.2.1.2. The Tobit Model

The Tobit model, also called a censored regression model, is designed to estimate linear relationships between variables when there is either left- or right-censoring in the dependent variables.

The OLS further process after the variable response is less than or equal to zero for the main course of the study and the tobit model is used to specify the maximum income for those who are willing to pay. This type of model has a better function in itself than in other processes, and it does a better job of modeling. Thus, people show a desire to pay and a process of paying agent: follow Johnston and Dindaro (1997) and Maddala (1997), the Tobit model can be specified as;

$$\begin{aligned}
 MWTP_i &= \beta_0 + \beta_i X_i + \varepsilon_i \dots \dots \dots 1 \\
 MWTP &= MWTP_i \text{ if } MWTP_i > \\
 &= 0, \text{ if } MWTP_i \leq 0
 \end{aligned}$$

Wherever MWTP is a vector of willingness to pay which is censored at 0; X is a medium of explanatory variables that are hypothesize to pressure willingness to pay; β_i is vector of unidentified parameters to be estimated equivalent to the matrix of explanatory variables X; ε_i is a disturbance term which is independently and usually spread with mean zero and familiar variance δ^2 With $\varepsilon_i \sim N(0, \delta^2(\text{square}))$ and; $MWTP_i$ is a laten variable matching to MWTP:

Keep in mind that a price of MWTP is practical when it is greater than zero:

Then, the estimable model with censored data at 0 is:

$$\begin{aligned}
 MWTP_i &= \beta_0 + \beta_1 RESX + \beta_2 REYS + \beta_3 IB + \beta_4 REAG + \beta_5 REIN \\
 &+ \beta_6 HOUSE + \beta_7 REFS + \beta_8 WBD + \beta_9 REMS + \beta_{10} RESF \\
 &\quad + \beta_{11} REED + \beta_{12} SORC + \beta_{13} HHHD + \beta_{14} REOC \\
 &\quad + \beta_{15} LSAT + \beta_{16} VOLM + \beta_{17} QLTY + \beta_{18} RLTY \\
 &\quad + \varepsilon \text{ if } MWTP_i > 0 = 0 \text{ Otherwise (if } MWTP_i \\
 &\leq 0) \dots \dots \dots 2
 \end{aligned}$$

3.3. Empirical Analysis

As a researcher has explained in the elaborate analysis, before the performance of the survey and before we look at each of the point, it covers a wide range of definition of what the town is willingness to pay for improved water service. However, it is important to consider the role of analytical research on variables and the contribution to responding to these strategic expressions. In addition, variability in equipment was largely dependent on the numbers of inclination and their contribution or need to pay. However, it is an

important and preliminary diction before the data analysis is carried out. It also reduced the accuracy of estimating the multiplicity of variables by placing multiple co-processes in the middle of variables. However, if the descriptive variable is too complex, it is difficult to examine the effect of one single descriptive variable (Maddala, 1992, pp. 269-270).

3.3.1. Description of Explanatory Variables and expected signs

RESX: The sex of the respondent. These variables were measured as a dummy variable taking the value of 0 for female headed households and 1 for male headed households, The variable was expected to negatively affect willingness to pay decision as in most rural households it is the women who bear the burden of collecting water thus would be more willing to pay than males (Moffat et al. 2007). According to Farolfi et al. (2007) found a similar result in that women are more willing to pay for improved water quality and quantity than males. On the other hand, the variable was also expected to exhibit a negative association with daily per capita water consumed and this is since it is women who do most daily household chores which require water similar, cleaning, washing, cooking, etc.

REED: The education level of the respondent. This is a continuous variable representing the number of years that the household head had spent in a formal school; Higher education levels were hypothesized to have a positive effect on both WTP decision and water consumption, It is assumed that formal schooling enhances households' knowledge about sanitary measures. Therefore, households' heads with more education were expected to know about the importance of clean (improved) water and thus be willing to pay for an improvement of such a service. Kanayo et al. (2013) and Ogunniyi et al. (2011) also including a similar result. Equally, consumption levels of water were higher for educated headed households as they know about the status of sanitation and thus demand more.

REED: The education level of the respondent. This is a continuous variable representing the number of years that the household head had spent in a formal school; Higher education levels were hypothesized to have a positive effect on both WTP decision and water consumption, It is assumed that formal schooling enhances households' knowledge about sanitary measures. Therefore, households' heads with

more education were expected to know about the importance of clean (improved) water and thus be willing to pay for an improvement of such a service. Kanayo et al. (2013) and Ogunniyi et al. (2011) also including a similar result. Equally, consumption levels of water were is higher for educated headed households as they know about the status of sanitation and thus were demand more.

RAGE: Age of the respondent. This variable is measured as a continuous variable and was expected to affect the decision taken by households on WTP for improved water services negatively. This is mainly because old people in most rural areas are generally poor and have no viable income source. Therefore, it was expected that the older the household head, the less likely for him/her to pay. Ogunniyi et al. (2011) found the same result that age of the household head was negatively and statistically significant to WTP for safe and clean water. Furthermore, it was not possible to hypothesize how the age of the household head will affect water consumed per capita. However, it was expected that as people grow older, they will use less water than younger ones thus a negative sign was expected.

RMINC: Monthly income of the household. This variable was measured in Emalangeni and is the average amount of income the household generates from various sources. Economic theory postulates that demand for improved goods increases with increases in income. Thus following the theory, the study hypothesized that income to be positively associated with both WTP for improved water services and per capita demand for water. This is mainly because households with higher incomes were demand more improved goods like water services than households with lower incomes, thus be demanding and willing to pay more. This hypothesis of the researchers are unfortunately respondent income is insignificant levels of the study finding. Additionally the results similar to the name authors of Khan et al. (2010), Farolfi et al. (2007), Ogunniyi et al. (2011) and Kanayo et al. (2013).

HOUSE: Ownership of house. This variable is taken as alternative for wealth, It is a dummy variable 1 if the respondent has house, 0 otherwise; The expected sign of the coefficient of this variable is positive since richer individuals demand for the improved water service is high because they are less resource constrained (Nauges and van den Berg, 2009).

REMS: Respondents Marital Status: When asked to name this descriptive variable, he is asked has or her married or unmarried. This is done with different identification codes when requested; these include 1 if the respondent was married and 0 if unmarried. It is expected that this variable were a positive effect on the health and other problems of low water supply service due to household responsibility in the future rather than marriage.

REDWS: Distance to water source Measured as a continuous variable in meters (m), the distance to water source was expected to positively affect the WTP decision while negatively affecting water consumption. This was because households who have the burden of travelling long distances to collect water would be willing to vote for an improvement than those living nearby. The hypothesis is similar with the findings of Farolfi et al. (2007), Banda et al. (2006) Kanayo et al. (2013) and Alaba (2001). Water consumption was expected to be negatively associated with distance because longer distances reduce water collection frequency. It is accordingly probable that a longer distance to water source decreases water consumption.

REFS: Respondents family size. Excessive willingness to pay was increasing the numbers of households and limited number of homeless people unless we create enough jobs for improved service needs. In addition, negative interactions are expected as the demand for each person income increases.

REYS: Respondents years of stay in the area. The usually knows better about the benefits when you live in the same area. However they are better off paying for the mentioned or proposed improvement and there were more families in that area, a positive relations expected.

HHDWU: Household daily water used (trip): this variable is a variable that indicates the amount of water that household's use every hours when households are expose to garbage for various reasons. However, it is possible to describe a negative relationship in terms of paying for this variable; households who use a lot of water may be happy and are not willing to pay for improvement water service (Farolfi et al. 2007).

IB: Initial bid. This is due to that fact that household's responses to this type of variable have a significant impact on the initial bidding, as they are more likely to receive a higher supply of binary options in the form of bids, and it has expected negative side. However,

since these coefficient responders were applied, it is difficult to validate the initial condition given in the blank format.

WBD: Respondents or members of the household who suffer from water born diseases are expected to be more willing to pay in order to improve tuber water service in Chagni towns. A positive relationship is thus expected.

RESF: Respondents sanitation facility. Based on Chagni town water supply and sewerage services data, sanitation facilities (flush toilet and pit latrine) were selected, which are believed to represent the sanitation facilities available in the town. A dummy variable one is given to flush toilet and, 0 otherwise. A positive sign is expected because flush toilet requires the use of water for its function as compared to other sanitation facilities and hence makes households to be more willing to pay for the improved water service.

SORC: Main source of water being used. It is a dummy variable, taking 1 if the household has private connection; 0 otherwise. Since a household with private connection is expected to be less interested, it is expected to be less likely to pay for the improved service than others who use public taps and others. The expected sign of this variable's coefficient is, therefore, negative.

LSAT: Respondents level of satisfaction with the existing service. It is a dummy variable which is 1 if the household is satisfied with the existing water service; 0 otherwise. A negative relationship is expected between willingness to pay and this variable as households that are satisfied with the existing water services are expected to have less willingness to pay for improved services.

QLTY: Respondents' awareness level of quality of the existing supply or Distance. Select of several theoretical a priori, condition household recognize a high-quality class after that present were be refusal incentive for them to include a preference the better arrangement. A dummy variable 1 were exist particular for household who differentiate elevated excellence and zero if not.

Chapter Four Result and Discussion

4.1. Surveyed of Data analysis

This part deals with the result and discuss obtained, the information from the contingent valuation survey was analyze in two ways. The first element used descriptive statistics, probit models and Tobit models.

4.1.1. Descriptive statistics

A number of the survey studies of household willingness to pay for the improved water service providing the sex composition of male and females 74.33% (223) and 25.67 % (77) respectively. The results indicated below in table 2 frequency and percent by sex. According to Table 4.1.1.1indicated that the household mean family size in number 2.91333 and 1.748144 with standard deviation and the minimum 1 and maximum 9 were recorded. Regarding households mean age of 38.48333 with a standard deviation of 12.69041 respectively.

Table 4.1.1.1; Summary of Household profile

Name of variables	Obs	Mean	Std.dev	Min	Max
Family size	300	2.91333	1.748144	1	9
Rage	300	38.48333	12.69041	18	74

Source: Data analysed

The respondents’ characteristics of willingness to pay for the improved water service by the sample household indicated that presence of association with respect to the demographic characteristics. Table 4.1.1.1 should the household categorical characteristics between willingness to pay for the service with chi square ttestes of independence to understand the presence of a significant link between willingness to pay services respondent characteristic. The research assessed different characteristic service of the study.

The total sample household respondents were (sex) male, 74.33% (223) and 25.67% (77) females. The total respondents in marital status (1=married, 2=single, 3=divorced)’ of the households were 70.67% (212), 28% (84) and 1.33% (4) were recorded. Moreover, the

sample households, education level (No schooling, primary completed and high school and above) of the respondents were 9.33% (28) and 90.67% (272) numbers of households recorded.

As shown in 4.1.1.2 the household, marital status and age chi square value 3.6834 and 2.3977 respectively were not statically significant. Therefore, there were no significant associations in between willingness to pay for households together marital status and age of the categorical variables.

Table 4.1.1.2: Descriptive statistics of Categorical variables

Variables	Category	Frequency	Percent	chi2	p-value
Respondents sex (Rsex)	Female=0	77	25.67	0.3652	0.546
	Male=1	223	74.33		
Respondents education (Reed)	No schooling=0	0	0	0.8715	0.351
	Primary complete=1	28	9.33		
	High school & above=2	272	90.67		
Respondent family size (Refs)	1-5=1	268	89.33	2.8627	0.239
	6-10=2	27	9		
	Above 11=3	5	1.67		
Respondents marital status (Rems)	Married=1	212	70.67	3.6834	0.159
	Single=2	84	28		
	Others=3	4	1.33		
The perception about distance (Padist)	Unsatisfied since it is painful=1	222	74	7.1442	0.028
	Satisfied because it gives me p=2	70	23.33		
	If others=3	8	2.67		
Rwstsmo (Respondents water shortage of season mostly occurs)	Summer=1	60	20	8.3928	0.039
	Winter=2	215	71.67		
	Spring=3	18	6		
	Autumn=4	7	2.33		
Rwtrbydiss (Respondents dissatisfaction)	Poor quality=1	91	30.33	5.4816	0.241
	Low quality=2	108	36		
	Long distance=3	20	6.67		
	High price=4	68	22.67		
	Others=5	13	4.33		
Household suffered from diseases (web)	Yes=1	118	39.33	3.9844	0.046
	No=2	182	60.67		
Iyhmhuplftnhh (Number of respondents use in pit latrine/flush toilet)	1-5=1	174	58	13.275	0.001
	6-10=2	90	30		
	11 & above=3	36	12		

Variables	Category	Frequency	Percent	chi2	P-valu
Existing status of water supply Quality (Qualt)	Very poor=1	109	36.33	12.5422	0.014
	Poor=2	91	30.33		
	Fair=3	40	13.33		
	Good=4	55	18.33		
	Very good=5	5	1.67		
Rhjewquantity (Existing status of water supply Quantity)	Insufficient=1	248	82.67	4.1907	0.041
	Sufficient=2	52	17.33		
Raycpumfts (Household currently paying any payments in water source)	Yes=1	50	16.67	3.2617	0.071
	No=2	250	83.33		
Improved water service available (Townwss)	Yes=1	42	14	157.7396	0
	No=2	258	86		
(Resf)Respondent type of sanitation system in house	Pit latrine=1	226	75.33	10.9666	0.004
	Flush toilet=2	73	24.33		
	Others=3	1	0.33		
Rhsaywplftyh(Respondent satisfaction in the pit latrine/ flush toilet)	Very satisfied=1	33	11	12.9551	0.002
	Satisfied=2	100	33.33		
	No satisfied at all=3	167	55.67		
(Repci) Respondent conclude concerning the planned improved water for the town)	Very good=1	38	12.67	6.9137	0.075
	Good=2	143	47.67		
	Satisfactory=3	94	31.33		
	Others=4	25	0.33		

Source: Field survey, 2020

The survey findings showed the respondents willingness to pay were 263 (87%) while 37 (12.33) were not willing to pay for water services respectively. The respondents were reason for we need really service, I can afford and I am not enough money.

Sample households for the respondent perception about distance, the respondent water shortage of season, the respondent suffered from disease, Number of respondents use in pit latrine/flush toilet, existing status of water quality, existing status of water quantity, improved water service available would, respondent sanitation system and satisfaction chi square value 0.028, 0.039, 0.046,0.001, 0.014, 0.041, 0.004 and 0.002 were statistically significant association with willingness to pay water service respectively. The rest variables were statistically not significant. Therefore, there were no significant associations with WTP in the categorical variables.

Table 4.1.1.3 Review household water use profile characteristics

Variable	Description	Obs	Mean	Std.dev	Min	Max
RESEX	Gender, variable 1 if male, 0 otherwise	300	0.7433333	0.4375237	0	1
REMS	Marital states, variable 1 if married, 0 otherwise	300	1.306667	0.489989	0	1
REAGE	Age of the respondent years	300	38.48333	12.69041	18	74
REMINC	Household monthly income	300	4771.19	2923.426	350	22500
REFS	Family size the respondent in number	300	1.123333	.3767342	1	9
REOWN	House the variable 1 if the respondent own house, 0 otherwise	300	0.3767342	.4767037	0	1
REYS	Respondent years of stay in the town in years	300	13.46333	10.60677	1	50
REED	Respondent education level variable 1 if formal education, 0 otherwise	300	1.913333	.304628	0	1
QUAL	Quality of water being used variable 1 if good, 0 otherwise	300	2.186667	1.161746	0	1
LAST	Level of satisfaction with existing service, variable 1 if satisfied, 0 otherwise	300	.16	.3850031	0	1
RESF	Respondent sanitation facility variable 1 if flush/toilet, 0 otherwise	300	1.25	.4413797	0	1
PURIF	Purification of water variables 1 if HH are purify water before drinking, 0 otherwise	300	0.3033333	.4604661	0	1
TOWNWS	Town water service office made improved water service available variable 1 if improved wtp, 0 otherwise	300	.86	.3475668	0	1
PADIS	Respondent perception variables if 1 about distance, 0 otherwise	300	1.286667	.5086104	0	1
RECP1	Respondent conclusion of water service proposed variables if 1 very good, 0 otherwise	300	2.353333	.8066336	0	1
YES/NO	Household willingness to pay for initial bid, variables if 1 yes, 0 otherwise	300	0.8766667	.3293688	0	1
IB	Respondent initial bid offered	300	0.3308333	.2674911	0.5	2
SOUR	Respondent water source variable 1 if piped, 0 otherwise	300	3.08	1.078957	0	1
WBD	Water born disease, variables 1 if yes, 0 otherwise	300	0.6066667	0.4893059	0	1

The respondent characteristics have mean sex of .7433333 with of plus or minus and minimum and maximum of 0 and 1 respectively. The survey indicated respondent marital status were 1.307 plus or minus of .489989. The Mean and standard deviation

respondent age and household monthly income were 38.5 (12.69) and. 4771(2923.43) respectively.

Regarding mean and standard deviation for family size and respondents own house were 1.123 (.376) and. 3767 (.4767). Moreover the outcome variable year of stay, respondent education, quality of water, level of satisfaction, purification of water before drinking, town water service office made improved service available, respondent perception about distance, respondent concluding of water service, respondent willingness to pay for initial bid yes/no, respondent initial bid offered, water source and water born disease mean with standard deviation areas shown in Table 4.1.1.3.

Table 4.1.1.4: Review of member WTP and Not WTP for improvement

Name of variables	Not WTP		WTP		t-test	Std.dev
	Mean	Std.Err	Mean	Std.Err		
Rag	38.108	1.977	38.536	0.7893	-0.1918	12.029
Rfs	2.324	0.205	2.996	0.11	-2.203	1.748
Rhmditfwfstyhat	2.027	0.249	2.041	0.084	-0.0605	1.389
Rhmtytgotspd	2.135	0.209	2.452	0.086	-1.3051	1.386
Rhmwyfucpd	3.324	0.284	3.326	0.138	-0.0073	2.089
Rhftwsfyhmeter (Distance)	0.909	0.161	1.128	0.726	-1.0795	1.1569
Rhmdpwyew	1.675	0.169	2.482	0.104	-2.8384	1.638
Rwimwpfojwfwsc	0.462	0.065	0.312	0.0146	3.2398	0.267
Riyhmhhuplftnhh	7.189	0.743	5.228	0.207	3.181	3.583
Rhmyogipmontheyfi (Rincome)	3437.324	425.302	4958.844	180.274	-3.0037	2923.426

Source: field Survey data analyses, 2020.

Non-Willing is a “No” answer for the first bid while willing is a “Yes” answer for the first bid.

From the sampled households, the mean age was found to be 38.48 years with the maximum and minimum years being 74 and 18, respectively. Households willing to pay the initial stated bid had a mean of 38.54 years, although their counterfactual had a mean age of 38.11 years. Results from a t-test showed statistical differences between the mean ages of the two groups, willing and non-willing respondents, as shown in Table 4.1.1.4. Households willing to pay the initially stated bid had a mean family (HH) size 2.99 of members, although those not willing had mean of 2.32.

The result from the t-statistic shows that there is no statistical difference between the means of the two groups as shown by the t-value in Table 4.1.1.4. Additionally, The result showed the mean household time consuming (Rhmtditfwfstyhat), to fetching water from source to the house was also estimated by households and the mean time consuming reported by non-willing households was 2:02 hours, although on the other hand, willing households mean time consumed was about 2:04 hours.

The result again showed significant differences between the means of the two groups as shown in Table 4.1.1.4. Furthermore, household also reported the daily number of trips (Rhmwyfucpd) they make to collect water per day. The results show that the minimum and the maximum were one and five trips per day respectively. The result from the t-test showed that there were no statistical differences between the mean number of trips per day for willing and un-willing households. The calculated mean number of trips for un-willing and willing households was estimated to be at 3.32 and 3.33, respectively.

On mean distance (Rhftwsfyh meter) from the water source was maximum distance toured at 100-600m. The mean distances for un-willing and willing households were 0.91 and 1.128, respectively. The mean difference between the two groups was shown in Table 4.1.1.4.

Additionally, respondents also stated the daily per week collect water trips (Rhmdpwyw) they make to collect water per week. This result showed that the minimum number of trips was once in a week, while the maximum was five trips day per week. The result from the t-test showed that there were no statistical differences between the mean number of trips days per week for willing and non-willing households. The calculated mean number of trips for willing and un-willing households was found to be at 2.48 and 1.67, respectively.

Table 4.1.1.5: Descriptive statistics of continuous variables

Name of variables	Mean	STD.err	STD.dev	Difference	T-test
Rage	38.48333	0.732681	12.69041	-0.4280136	-0.1918
Rhmtditfwfstyhat	2.04	0.080239	1.389786	-0.0147981	-0.0605
Rhmygtotspd	2.413333	0.080046	1.386445	-0.3173363	-1.3051
Rhmwyfucpd	3.326667	0.12064	2.08954	-0.0026719	-0.0073
Rhftwsfyhmeter	1.101671	0.066797	1.156963	-0.2192273	-1.0795
Rhmdpwyw	2.383333	0.09461	1.638701	-0.8072141	-2.8384
Rwimwpfojwfiwsc	0.330833	0.015444	0.267491	0.1498047	3.2398
Riyhmhhuplftnhh	5.47	0.20687	3.583094	1.961052	3.1637
Rhmyogipmontheyfi (Rincome)	4771.19	168.7841	2923.426	-1521.52	-3.0037

Source: Field survey data analyses, 2020

Household characteristics in participation

The mean respondent ages of sample households for willingness to pay were 38.48333. The mean differences between the variables were 0.4280136 and the t-test indicated that it was statistically insignificant difference. Therefore, the household more ages -0.4280136 numbers. The mean family size and fetch water from the source to the house at time for samples household were 2.913333 and 2.04 respectively.

Regarding the mean of the respondents' time to travel to water source per day of sample household of the willingness to pay for water service 2.41 was recorded. The mean difference between the household were recorded as 0.317. The t-test indicated that the statistically insignificant difference value in the 1.30 and the mean variables of water uses in collecting per day of sample household of willingness to pay water service 3.326 collect per days were recorded.

The mean differences in the household group were recorded as 0.00267. The t-test indicated that statically significant difference. The mean variable in water source from household home was 1.10km recorded. The mean difference between the households was recorded as 0.219 and the t-test indicated that statistically insignificant difference. Regarding the respondents use days per week collect water variable status indicators Rwimwpfojwfiwsc (initial bid), Riyhmhhuplftnhh (Number of use toilet) and Rhmyogipmontheyfi (Respondent income) mean difference between household variables were mean their difference was shown in Table 4.1.1.5 respectively. In addition to this initial bid (Rwimwpfojwfiwsc) and numbers of household use sanitation

(Riyhmhhuplftnhh) the t-test values were 3.2398 and 3.1637 which is strongly significant results of the continuous variables.

4.1.2. Socioeconomic and Demographic Characteristics of Households

Table 4.1.2.1: Sex, Marital status and employee structure of Householder

Respondent sex	Frequency	Percentage
Male	77	25.67
Female	223	74.63
Total	300	100
Marital status		
Married	212	70.67
Single	84	28
Divorce	4	1.33
Total	300	100
Employee structure of the respondent		
Employed	239	79.67
Own business	53	17.67
Daily worker	4	1.3
Others	4	1.3
Total	300	100

Source: Field survey data, 2020

On the result finding 77 (25.67%) were female respondents, at the same time as 223 (74.33%) were male respondents. From the total of 300 households were including head of their households and members of the households. The respondents were only interview in the absence of their household heads.

Based on the finding results Table 4.1.2.1, 212 (70.67%) of the households were married at the same time as 84 (28%) were single and 4 (1.33%) were divorce, The data about the respondents' age shows that minimum was about 18 years and maximum which ranges above 74 years of old, The range of family size of the households was about a smallest amount of 2 people in the house to a highest of 6 and over household member. The education form tell that 28 (9.33%) of the respondents have attend their official education (primary, secondary, and completed) while 272 (90.67%) were a high school and over educations.

Based on the survey result concerning the employ arrangement of the households, 239 (79.67%) respondents were employed in the formal part for salary, 53 (17.67%) run

their own businesses, 4 (1.33%) and 4 (1.33%) were daily worker and the rest of the respondents were without a job, retire and self-employed. The survey result also shows that 196 (65.33%) households were living in their own house. moreover the surveyed households have been living for 23.5 years on average in the town initial from a least of one year to a highest of 50 years.

Based on the survey result, the range monthly income source of the head households not including family income level ranges from a least of birr 350 to a highest of birr 22,500 per month, at the same time as in line with this, and in the face-to-face question, each household was assessed at accost of 22,500 birr per months. However, households use money to cover various expenses such as transportation, water, medicine, and rent for various companies, electricity and so on.

4.1.3. Existing water supply system in Chagni towns

Water sources for population

According to the survey result the existing source of water supply for Chagni town was rivers, ground water, natural springs, protected hand dug well. A total of three potential boreholes have been drilled within the town at diverse times. The Amahara Water Works Construction Consultant drilled four boreholes, between 1983 to 1994. Currently, all of the protected boreholes are used as a water source for the Chagni town. Additional, two protected hand dug well boreholes were drilled by Direct Restoration and Extension Programme. These wells have operating yield of 3.5l/s and works for 6 hours per day. The remaining one protected hand dug well is drilled by the same programme around Meteleya areas in kebele 01. These ground waters has operating yield of 11.5l/s and works for 8 hours/day. These boreholes drilled by the Immediate Rehabilitation and Extension Programme became operational the source of water for Chagni towns.

Coverage

Based on the survey interview results the supply system covers mainly the vital part of the town and government constructed residential areas in Debeta and Meteleya with total coverage of 20 percent. As per the official data of WSS office there are 2,000 domestic, 10,000 private or commercial organizations 50 governmental organizations and institutional connections they are estimated to serve the households. However, according to the standard set by World Food Organization 24 stand pipes

can serve maximum of 4,800 people, i.e. one for 200 people or 40 households (WSS, 2019)

Most of those inhabitants who do not have access to the piped system draw their water from private hand dug wells or collect from rivers or springs or buy from vendors who collect water from nearby river on donkey (Bajaj) back or buy from their neighbors or somewhere else who have their own private connection and selling it at higher price.

The spatial extension of pipe over any clearing area is confidently a pre-condition for supplying the community with piped water. The productivity of water supply is therefore, determined primarily by the thickness of pipe which again are in going influenced by other socio-economic and physical issues. Among these issues, the number and spatial supply of public water points, regularity of water supply and income level of the community are the major ones.

In spite of its status, the spatial extension of pipelines is limited to some parts of the town. Most parts of the marginal constructed up areas of the Chagni town are currently beyond the spread of pipelines. People living in these areas of the town highly suffer from completely absenteeism of water supply around their area. They usually go far off distances in search or fetching of water and carry it along and also spend much time even in queuing up near the water sources of areas.

Based on the survey results, the number of households that drink pipe water (who have access to pipe water) compared to other sources also found the households. They also use other sources such as wells, river, springs and rain water. The residual peoples collect water either from one or mixture of sources for their household consumption. This suggests there is absenteeism of regular water supply in the town, that is, more break takes place and also the other sources are not consistent. This indicates households should have containers together water such as pipe water and also construct ponds to collect rain water to resolve shortage of water during unexpected disruption.

Generally, Chagni water supply office in 2020, the water supply service through pipe water system covers only 52 per cent of the town's population and not only its value but also its fairness in supply has been limited by the problem of like budget deficit, poor water management system and etc. In communities where the degree of private meter connection is disadvantaged by financial limitations, the possible and cost-

effective system of water supply for household use is through public water points. This is because of the point that in spite of their shortcomings; public taps are the practical options for water supply at a minimum cost to a large number of people who cannot have enough money higher costs of house or plot connection.

Obviously, the choice of the type of water supply system is contingent primarily on financial rank of the population to be helped and on the amount of water accessible for supply. As common of the population decrease in the low revenue supports and the construction of water that can reach the customers is insufficient, public water are thought to be the suitable means of water supply in the town of Chagni. The efficiency of the service finished public water opinions, certainly, is contingent on the number and balanced supply with satisfactory and constant supply of water.

Though, the number of public water supply currently on service was very low as paralleled to the population size. Furthermore, the existing few public water opinions are not consistently circulated all over the town even though Chagni water supply service set number of population, distance from water opinion and the place where people not capable to afford private connection are living as the key measures to allocate it.

From the results of the water source used by the community as soon as the survey was conducted it uses 42(14%) rivers. On the other hand 136(45.33%) our well protected hand dug wells, 88(29.33%) uses a safe spring, they also have 31(10%) have natural springs and the study is based on these classification water source respectively.

Based on overall the data collected from the survey, each household able to respond to variety of reasons and set a quota. Accordingly, 107(36.52%) of low quality, 85(29.01) poor quality, 20(6.83%), 68(23.21%) long distance and high price, and away from home, there are currently water supply service problems. Reliable of existing source in general studies and only 27.72% of households live when needed. In addition, the researcher side in practice that the water used by the community were not been used for ant treatments or filtering. Of those surveyed, 91(30.33%) were asked why they did not treat before came, and 30.67% of household reported that they use sanitation over time. The family also side that they suffer from various water born diseases due to water pollution, these include cholera, typhoid, malaria and the like in their homes. 248(82.94%) households were commented.

Table 4.1.3.1: Existing water service conditions of households

The main case of household dissatisfaction	Frequency	Percentage
Poor quality	91	30.33
Low quality	108	36
Long distance	20	6.67
High price	68	22.67
Other	13	4.33
Total	300	100
Responsibility for improved water service		
Government	242	80.67
Community	48	16
Private	7	2.33
Other	3	1
Total	300	100

Source: Field survey data, 2020

About 240(80.94%) of the total population surveyed, and researcher side town officials should accept responsibility for providing improved water service. In addition, 7(2.34%) and 47(15.72%) households who responded to the request and those who had personality improved water service should be provided. However, the study found that it took a maximum of 90 to at least 30 minutes for the households to travel from their home to the source of water.

The study finding interview of Challenges of water service in Chagni town;

Insufficient water supply: There are limited numbers of wells with inadequate potential yield. This declines more during season. Furthermore, there is frequent interruption of the sources, which reduced the actual production to be less than the expected amount. There are no mechanisms developed to solve these challenges. Even the existing different sources of water are not coordinated to current water source; conserving or recharging natural ground aquifer such as afforesting water catchments areas that can regulate flow of water is not exercised.

Unfair distribution of Water: The rate of meter connection and the spatial distribution of community attitude pipes or water points do not meet the demands of the community. The supply system covers mostly a small area of the town.

Loss by seepage: water loss has further reduced the amount of water source that can reach the customers. This challenge is aggravated by choice of unsuitable

technologies that cannot meet appropriate standards. Actions to enhance sustainability of town water service systems must emphasize on high-quality of technology and development of supply chains in relation to technology that makes access to fittings easier and cost effective.

Rapid growth of population: the stable growth of town's population due to natural increase and migration joined with the development of the town forced high weight upon the efficacy office of Chagni town, water supply service office and it becomes challenging to accommodate the ever growing population. The problem is aggravated by the disappointed to plan optimum use of water for the town due to underestimation of population growth founded on general population growth rate although the growth rate for Chagni town is beyond that growth rate.

Limits to water consumption: Several physical and socio-economic influences limited water consumption by households in Chagni town. To mention some of them: inadequate supply and poor quality, the distance of housing from water point, unreliable supply due to weak pressure and frequent interruption etc. Between these influences, which limit the amount of water consumption, interruption of water service is a more serious problem. During unexpected water service interruption households meeting were multidimensional problems as stated in the previous units. The development of the town in terms of community, household size and income has its own influence too upon the water consumption by households.

The causes of water access the problems were:

Management problems: management problems caused by inefficient administrative structure, understaffing, low wages and lack of working motivation and incapability of the water supply services agency to retain skilled and experienced staff is the key constraint to service delivery.

Inadequate institutional coordination: key shareholders in Chagni town water service activities contain Woreda Water office, Mines and Energy Resources Development office, Chagni town water supply Board, WSS agencies and the community. But, there are no coordinated relations among the government office and WSS office except for technical support and the community is represented by the two-delegated members. Consequently, the poor institutional coordination were disadvantaged the efforts to achieve water service office goals.

Inadequate capacity: Lack of skilled manpower is the serious issue challenged by the water supply services office. This constraint is also the most limiting influence in the fulfillment of its service facility.

4.1.4. Households’ Willingness to Pay for Improved Water Services

To carry out the study in Chagni to achieve the overall purpose of the study, and according to result of the study, 300 households were surveyed 263(87.90%) each household has a pre-existing value, and the households were pay 30 cents for 20 liters of water at the beginning. In addition, in this survey households have a maximum 1.50 cents to a minimum of 0 cents. As the result, 36(12.04%) households who refused to pay the initial bid price were interviewed. Furthermore the study effect specify that for questions highest amount would similar to pay for water improved services were obtain from wthey do not pay in from 27 (25.08) water is without charge, 26 (8.70%) are I happy with resource, 89 (29.77) respondents have no sufficient currency to pay for enhanced water service, have a rest 74 (24.75) and 35 (11.71) respondents were you know that currency will not be used properly and have no faith on the institute.

Table 4.1.4.1 MWTP report by survey household

Higher willingness to pay description	Frequency	Percentage	Cumulative Percentage
0-30	176	58.66	58.66
31-60	105	35	93.65
61-90	6	2	96.65
91-200	13	4.3	100

Source: Field survey result, 2020

According to the table 4.1.4.1, they are willing to pay between 0 and 30 cents in 176(58.66%) the range of 0 and 30 of 15 cents, and 6(2%) on average 3 cents, 105(35%) side they were willing to pay an average of 45.5 cents of improved water service, and they also agreed to pay for a 20 liter jerry can of 13(4.3%) respondents were improved water services.

4.1.4.1. Willingness to Pay Estimation

The second point of the research was to estimate willingness to pay for improved water services in the research parts with a dichotomous choice method with a follow question. In this technique of elicitation questioners, initial bids were randomly

extend to survey. For these initial bids a pilot survey was conducted prior to the major survey using questions. The total sample of the pilot survey was 20 respondents. On the pilot survey, households were asked about the higher amount of money they would be willing to pay for a 20 liter Jeri can of fresh water.

Table 4.1.4.1.1: Household responses of WTP improved water service

WTP improved water service	Chagni town	
	Frequency	Percentage
No	36	12.04
Yes	264	87.96
Total	300	100

Survey: Field survey result, 2020

Beginning the initial bids, follow up bids were then measured to be the initial bid agreed 12 percent” no” answer to the issue of the initial bid given an 87.96 percent „yes” answer to the initial bid WTP.

4.1.4.2. Reasons for Maximum Willingness to Pay

Respondents were in the same way asked about the motives influencing their highest willingness to pay. Of the over-all households tested about (87.92%) specify their reason for willingness to pay although the residual (12.04%) were measured below „zero bids” respondents. The reasons of respondents were they want the service and afford a certain Willingness to pay. Furthermore household who were not eager to pay for an enhancement in their water services, were respondents with nothing willingness to pay, concerning I don’t have enough currency water should be provide without charge and, I don’t trust local management” as their cause of not paying local administration” as their reason of not paying for water service.

4.1.4.3. Determinants of willingness to pay for improved water service

According to survey model results on the last objective the research was, to find the determinants of willingness to pay, which is willingness to pay the pre-specified initial bid existing for improved local water in the research area. A probit model was used in the analysis where the dependent variable (WTP) was binary taking values of 1 for „willing” and 0 for not, willing”. Additional variables were involved in the model as independent variables. This included both dummy and continuous variables which were households” socioeconomic variables, observations and other related to water use.

Prior to the probit model, a Linear Probability Model (LPM) was run using OLS regresses and Multicollinearity were tested in using and The Contingency for dummy

variables were used to test for link amid dummy independent variables used in the model and results showed no serious links, after the tests were completed.

The probit model is used as the degree of overall significance of a model in probit model estimation. The outcome from the probit model displays that the explanatory variables involved in the model fits the model at probability level. Generally, the result from the probit model showed that the variables used in the model, fit the model very well. Marginal effects step the expected change in probability of a specific choice being made with respect to unit change in an explanatory variable (Greene, 2002).

Results and discussions of determinants of household willingness to pay

Greene (1993) noted that although there are different variables in the study, the coefficient of the equation provides a function and process of voluntary payment for each analytical household. However, in a particular process, a series of variables that indicate “yes” or “no” an outcome factor is possible and its dummy variable changing between 1 and 0. Also for dynamic variables and the researcher makes it clear that the model for both pairs and both is a product of formula and profit. However, the process and the point made aware of dynamic process and situation, researchers was working on for marginal effect and discreet variable and both coefficient of the probit model.

Table 4.1.4.4.1: Probit model result in household WTP improved water service

Variables	Coef.	Std.Err	P value	Marginal effect
RSEX	-3209	0.4592	0.484	0.0175
RMS	-0.0624	0.3498	0.857	-0.0099
RAGE	-0.0258	0.0139	0.064*	-0.0020
RMINC	0.0001	0.0001	0.395	3.18E-06
RFS	0.3535	0.1567	0.024**	0.0549
ROWN	0.5762	0.4064	0.156	0.0128
RYS	-0.0110	0.0192	0.562	-0.0004
REED	0.3438	0.5939	0.562	0.0181
QUAL	0.1677	0.1679	0.308	-0.0028
LAST	0.9922	0.7793	0.204	0.0362
RSF	0.6521	0.4145	0.116	0.0483
PURIF	-0.4004	0.3930	0.308	-0.0066
TOWNWSS	3.4274	0.5087	0.00001***	0.6786
PADIST	1.3163	0.5489	0.016**	0.0342
RECPI	0.2440	0.2203	0.267	0.0095
IB	-1.7777	0.6093	0.003***	-0.1708
SOUR	0.0685	0.1678	0.682	0.0054
WBD	-0.3577	0.3876	0.357	-.5528
Cons	-4.3188	1.9620	0.028	

***significant at 1%, **significant at 5%, *significant at 10%

Pseudo R² = 65.49%, Prob> chi2 = 0.0000, Number Obs. = 300

The explanation objective of estimate the model to study the mean willingness to pay for single bounded answer for improvement of water service survey, to reducing the problems of heteroscedasticity problems strong probit regression was used. The Pseudo R² of the data was 65.49% which show that result of regression explain of the total variations. The likelihood ratio for the models of -38.668 and the prob> chi2 is 0.0000.

Age of household head the age of the respondents head presented to be significant and negative coefficient for improved water service at 10% significant levels. The negative relationship between willingness to pay and age of the respondent head means that age increase the probability of a respondent saying 'yes' decrease and vice versa.

Equivalent the marginal effect result also had a negative sign. This essentially involve that, holding all other variables constant, at their means a year increase in the age of the respondent head reduced the probability of accepting by 0.17%. This results consequently indicates younger households head are willingness to pay for improved water service than older heads in the study area. As the results was not in line with the finding of Farolfi et al. (2007) but consistent with the finding of Ogunniyi et al. (2011).

Respondent family size the size of household head has a physically high influence on variables, daily water consuming service. This was shown by the p-value the variable was a positive coefficient of value and significantly water service 5% probability levels. As the result at 5% decrease in the household family size increase water consumed in household by 0.35%, ceteris paribus. As the result not true with a prior as increase in the respondent family size can increase the level of water service. Furthermore, the result was true with the related finding of Nauges and Van den Berg (2006) for water in Sri Lanka.

Distance the finding results of the study showed that distance to water source was statically significantly linked with water service. But with positive coefficient signs. The variable was significant at 5% level of significance in line of the study. Share the other variables constant. Similarly the marginal results also positive signs at 0.34%.

Improved availability of water service the town water service office made improved service availability in the respondents also other factors that influenced household willingness to pay improved water service. This finding shows by 1% significant levels in a positive sign. The marginal effect also similar results were priority expectations of the respondents' service availability of town water service.

Initial bid presented to the respondents has a negative result on the probability of accepting the bid and is significant at 1% significance level. This suggest that a 1% raise, in the initial bid were decline the likelihood that respondents are paying for improved water services by 0.17%.

Results and Discussions of the Tobit Model

Table 4.1.4.4.2: Tobit model results in household willingness to pay improved water service

Variables	Coef.	Std.Err	t value	marginal effect
RSEX	0.0209	0.0355	0.5552	0.0239
RMS	-0.0089	0.0310	0.7718	-0.0109
RAGE	-0.0023	0.0012	0.0488**	-0.0023
RMINC	3.31E-06	5.10E-06	5.16E-01	3.33E-06
RFS	0.0135	0.0084	0.1074	0.0602
ROWN	0.0166	0.0333	0.6171	0.0125
RYS	-0.0003	0.0015	0.8103	-0.0004
REED	0.0251	0.0523	0.6312	0.0199
QUAL	-0.0038	0.0135	0.7795	-0.0048
LAST	0.0431	0.0406	0.2891	0.0409
RSF	0.0638	0.0343	0.0629*	0.0583
PURIF	-0.0016	0.0325	0.9601	-0.0034
TOWNWSS	0.7805	0.0466	0.0000***	0.7856
PADIST	0.0368	0.0297	0.2149	0.0378
RECPI	0.0115	0.0183	0.5287	0.0103
IB	-0.2156	0.0576	0.0000***	-0.2009
SOUR	0.0077	0.0135	0.5687	0.0071
WBD	-0.0618	0.0302	0.0404**	-0.0659
Cons	0.0968	0.1725	0.5755	

37 left-censored observations at $aywpiwp \leq 0$, 263 uncensored observations, 0 right-censored observations

***significant at 1%, **significant at 5%, *significant at 10%

Pseudo R2 = 78.23%, Prob > chi2 = 0.0000, Numbers of obs. = 300

The age of household head the age of the respondents head present to be significant and negative coefficient for improved water service at 5% significant levels. With relationship between willingness to pay and age of the respondent heads, away that age increase the probability of a respondent saying, ‘yes’ decrease and vice versa. In the same way a negative sign in marginal effect, on the whole implies that, share all other variables stable at means a year increase in the age of the respondent head reduced the probability of accepting by 0.00231%.

Respondent sanitation facility respondent sanitation facility variables were 10% significant level in “the models which results” of the households who have pit latrine and flush toilets are more willingness to pay individuals who perform not have

(streets and bush) in the same way the marginal effect results also a positive signs, other beings constant.

Improved availability of water service variables were a highly significant at 1% probability levels and the coefficient of estimation is a positive sign of the Tobit models. Usually this results that an increase income of the households shifts the demand curve for clean and potable water to the right. This show was in line with the priory expectation of the study and theory of econometrics as higher income households have better chance of maximizing willingness to pay improved service value and like improved and high quality things.

Initial bid the coefficient estimate of starting bid price has negative signal and strongly significant at 1% level. as a result, the initial bid value increases by 1% the likelihood of household willingness to pay for improved water declines by -0.22%, holding all other things constant.

Water born disease the respondents were an additional influenced factor of willingness to pay. This finding was a negative coefficient estimation and 5% probability level of significant on the Tobit model results. Furthermore, the marginal effects were positive and significant associations with household willingness to pay. This means, trust the influence of other factors constant

4.1.4.4. Aggregate WTP and aggregate Revenue for Improved Water supply services

In the prior section it was shown factors significant for willingness to pay if there is improvement in water service: So in theory, what comes next is aggregation, which is the last division of the Contingent Valuation survey: Based on the willingness to pay follow-on from the open- ended surveys the whole willingness to pay and total revenue at diverse price and that households are willing to pay is considered, the demand curve for the improved water service has also been derived. The total population of Chagni area as explained in chapter two is counting 38,400 households Based on the Ethiopian central statistical agency, (CSAE, 2015). The division margins for the highest willingness to pay amount reported by households are used to make the aggregation of whole willingness to pay, total revenue and derive the required curve for the planned improved water system.

Table 4.1.4.5.1: Total revenue willingness to pay improved water services (in cents)

Maximum.WTP interval	Center WTP	Number of survey household	Surveyed HH Percent	Total No. HHs	Total WTP of HHs	Total HHs WTP at small amount	Revenue at total
0-30	15	176	58.66	23,946	35,919	38,402	576030
31-60	45.5	105	35	13,209	601,009	14,456	657748
61-90	75.5	6	2	825	62,287	1,247	94148
91-200	145.5	13	4.3	422	61,401	422	61401

As researcher have already talked about in the study, have listed the details and points of those who are willing to pay for the improvements of water service, as well as the reason given by various researchers.

Therefore the following is a mixed idea as follows and lists of details, and this is the final part of implementation contingent valuation study. They are generally willing to pay the price and households are willing to pay, based on a series of review. However, payment for improved water service demand curve has been found.

It is also described in chapter two in Chagni town, where the survey Ethiopian Central Statistics Agency (CSAE, 2015) was conducted. According to the agency report, the population of Chagni town is 38,400 households. However, the information obtaining by the householders aggregate all income to pay in the so-called division margin and be used to achieve or understand the proposed improved water service implementation process.

Although researcher often see a lot of questions for water improvements, the Chagni town water service improvement process can now increase the value of water quality management in the area.

However, when they are willing to pay a higher fee, which is similar to the total number of households and these types of researches were benefit from the need for improved water service. In addition, by applying a central willingness to pay the total amount of interest on a vertical line side, and the numbers of household willing to pay apply at least one jerican or 20 liter of water through the horizontal shafts. However, in these ideas, it can be graphically expressed to illustrate and visualized the demand for adjusted water service.

The researcher recognized that the above mentioned digital situation has been negatively expressed in terms of interest here and there. As with all budgets, the

demands of improved water service are rising and the cost of water use and maintenances is decline.

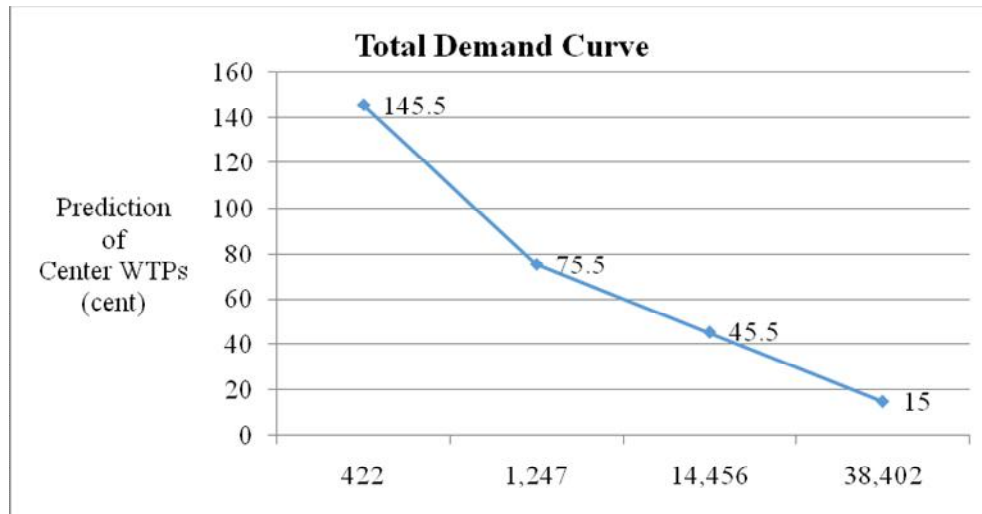


Figure 4.1.4.1.1: Total Demand curve of improved water services

We note down as of the above figure that the demand curve is negatively sloped representing that, like most fiscal goods, the demand for improved water services were decline with rising water use charge, trust all other things stable

Chapter Five

Conclusions and Recommendation

5.1. Conclusions

The study mainly used cross-sectional primary data while it is also supplemented by secondary data from different relevant sources, use based on face-to-face interview with selected households. Additionally, the households were also asked questions correlated to demographic and socio-economic characteristics, problems with the existing water services, their water use practices and some other general questions.

The descriptive statistics result analyzed conclusions discussed as follows: Cross-sectional data were gathered from a total of 300 sample households from willingness and un-willingness or YES/OR respondents which were 87.9% and 12.04% respectively from each household. Furthermore, the sample household frequency and percentile of male and female respondents were 223 (74.33%), 77(25.67%) respectively.

The existing sources of clean water for Chagni town has been river, protected water source and natural spring's water which reach the consumers through meter connection and community water point. Still, since the source is only from river, protected water source and natural springs water which is characterized by decreasing water volume, especially during peak dry season, the number of construction is not adequate even for those who have access to it. The amount of production is also further reduced by minimum working hour, limited number of source. Furthermore, the survey data discovered that about 42% of respondents were use in river sources and 45.33% household's use relatively confined sources.

Of the sample household of 85% respondents was dissatisfaction with water sources being used since of long distance, high price and poor quality of water sources. The surveys also indicate that 73.04% of respondent households are affected by seasonal scarcity in winter of water supply. The study result also shows that the mean water utilization per household per day was 3.33 jerican.

Furthermore, the area of water supply in Chagni town in terms of coverage both in accessibility, and sustainability is not at the required standard. The rate of meter connection is low and the allocation system is inefficient. The main constraints of allocation system identified are low density of pipe networks, limited number of

public water points and their inequitable allocation, low capacity of the reservoir and inadequate pressure on the pipe.

As a result, water use is affected in the town due to these physical factors in addition to socioeconomic factors such as population increase, household revenue and size that affected their water consumption.

The second point impartial of the research was to estimate the WTP used the probit model and Tobit models in Stata version 14: Outcomes presented that both bids offered to households were significantly linked with households' WTP decision. Additionally, the estimated mean willingness to pay for improved water per 20 liters from the model was set up to be at 30 cents.

The final objective point impartial of the research was to assess the determinants of willingness to pay for water service in the research areas. Tobit tools and probit tools were used to assess the determinants of willingness to pay for improved water service in using variables.

5.2. Recommendation

Based on finding of the survey to assess their willingness to pay for improved water service the following recommendations were suggested:

1. The results from the research presented that distance from water sources significantly influenced WTP. Plus to that, distance to water source also statistically affected household water consumption. This consequently shows that households moving long distances to collect water were more willing to pay for water as the distance affects their current consumption. There is consequently a need for the future water development in the study areas to decentralize the booth centers targeting households travelling longer distances for water.
2. The water service office has to design new plans. The willingness to pay results provide an initial indication of the need for improved future management plans that are necessary to provide acceptable, reliable, and sustainable water service. Developing capacities to achieve these changes needs to be combined with new project policies.
3. Enhancing community knowledge and practices Participatory action research will be promoted by encouraging the communities to build their own ways of

dealing with different development issues. Recognizing and popularizing those knowledge and experience of local communities in an immense potential for solving location specific problems.

4. Studies have to be done on the establishment and strengthening community-based institution building in which the institution responsible for overall planning implementation, control and management of resources and proper control of project outputs.

5.3. Policy Implications

The finding of this study shows, on household's willingness to pay for improved water services in Chagni town, the vital policy implications are;

- ✓ Ensuring of urban water administrations, due attention should be given in identifying the problems of water designing schemes of water service.
- ✓ To avoid water supply shortage during any seasons and policy makers the service providers must be careful at selecting the appropriate location and the scheming type of improved water system.
- ✓ Policy planner's attention the demand face of the market for water as opposed to the deliver side in service provided that expansion programs.
- ✓ Since the mean WTP of the households is much higher than the amount of money households paying for water sources, the service suppliers can implement the planned water improvement system to satisfy the water needs of the households even though at the same time collecting more revenue by selling the improved water at a higher price to improve the charges.

Reference

- Andrea, Castro, Moumié, M. (2009). A Water and Sanitation Needs Assessment for Mekelle City, Ethiopia.
- Australia Titenberg. (1998). as cited in Bah's work, Environmental and Natural Resource Economics, 6th ed. International Edition, Pearson Education, Inc.
- Bateman et.al. (1993). Valuation of Environment, Methods and Techniques, in Turner.
- Bateman, I.J and Turner, R.K. (1993). Valuation of Environment, Methods and Techniques, in Turner, R.K. (Eds), Sustainable Environmental Economics and Management: Principles and Practices, Belhaven Press, London.
- Begashaw. (2002). Lack of access to enhance water causes higher infant mortality rates, Low economic productivity, and low female enrollment in school.
- Blomquist and Worley (1981). The hedonic pricing approach has been used extensively to Estimate the value of property and housing prices.
- C. Nauges, D. Whittington. (2010). Estimation of water demand in developing Countries: An overview World Bank Research Observer, 25 (2) (2010).
- CSAE. (2015). Central Statistical Agency of Ethiopia.
- Cummings et al. (1986). It has a better efficiency than closed-ended format because it has a potential to elicit the respondents maximum WTP.
- Dessalegn. (1999). Access to sanitation in Ethiopia. IHE, Delft, the Netherlands.
- Getachew Abdi. 2002. Management aspects of rural water supply sustainability in Ethiopia.
- Gossaye Fanta. (2007) used the CVM to examine the determinants of households' WTP for improved water services in Debre-Zeit town.
- Greene. (1993). The error term and is assumed to have random normal distribution with mean zero and common variance δ^2 .
- Haab, T.C. And K. E McConnell. (2002). Valuing Environmental and Natural Resources: The Econometrics of Non- Market Valuation, Cheltenham: Edward Elgar.
- Hanemann, W.M. (1984). Welfare Evaluations in Contingent Valuation Experiments with Discrete Responses, American Journal of Agricultural Economics, 66:332-341.
- Hanley, N.F. Shogren, Janson and Ben (1997). Environmental Economics in Theory

- and Practice. Macmillan Press Limited, London. Hill Companies, Inc.
- Hutton, G. and Haller, L. (2004). Evaluation of the Cost Benefit of Water and Sanitation Improvement at the Global Level. WHO.
- Ian W. et al. (2000). Both urban and rural households do not have access to safe water. Urban UNICEF and WHO. (2011), gained to using piped supplies on premises public taps.
- Johnston, J. and Dandiro, J. (1997). *Econometrics Methods*, 4 th Edition, New York: McGraw
- Kanayo, O., Ezebuilo, U., and Maurice, O. (2013). Estimating the Willingness to Pay for Water Services in Nsukka Area of South-Eastern Nigeria Using Contingent Valuation Method (CVM): Implications for Sustainable Development's *HumEcol.* 41(2):93-106.
- Leggett, Christopher G. and Nancy E. Bockstael. 2000. "Evidence of the Effects of Water.
- Letson, D. and J. Walter Milon. (2002). *A Guide to Economic Valuation: Florida Coastal Environmental Resources*, Sea Grant, Florida.
- Maddala, G.S (2002) .*Introduction to Econometrics*, 3rd edition, John Wiley and Sons Ltd Singapore. *Management*, 39(2): 121-44
- Medhin. (2006) using a CV survey on household demand for improved water services in Addis Ababa.
- Mitchell, R.C. and Carson, R.T (1989). *Important Recent Developments in Valuating Environmental Goods Using Survey to Value Public Goods: contingent Valuation Method*, Resource for the Future, Washington D.C. 482.
- Mitchell, R. C., and Carson, R. T. (1981). *An Experiment in Determining Willingness to Pay for National Water Quality Improvements*. Draft report to the US Environmental Protection Agency, Washington DC.
- Mourato, S. (1998) 'Economic Valuation in Transition Economies: An Application of Contingent Valuation to Lake Balaton in Hungary', in M. Acutt and P. Mason(eds.) *Recent Advances in Environmental Economics*, Edward Elgar, London, forthcoming.
- MoWR. (1999). Minister of water resource, Ethiopia.
- Nauges, C., & Whittington, D. (2010). *Estimation of water demand in developing countries:*
- Nielson, P., (2004). *Realizing the dream. Our Planet*, 1 4(4):23-24.

- OWRMB. (2009).high impact on the economic development of the country and the living Condition of the towns' communities.
- Pearce, D (1999). Pricing Water: Conceptual and Theoretical Issues, Paper for European Commission for the Conference on Pricing Water: Economics, Environment and Society. Portugal, Sinatra.
- Perman, R. Ma, Y. McGillivray, J and Common.(2003).Natural Resource and Environmental Economics, Person Education Limited, Printed and Bounded by Bell and Bain Ltd .3rd Edition.pp. 263-294.
- R.K. (Eds) (, Sustainable Environmental Economics and management; principal and Practices, Belhaven Press, London.
- Spash, L. Clive (2008). The Contingent Valuation Method: Retrospect and Prospect, Socio Economics and the Environment in Discussion CSIRO Working Papers Series 2008-04.
- Terefe. (2000) adopted the CVM and travel cost (TC) models to estimate benefits from Establishment of park around Tis Abay waterfalls.
- Tietenberg and Lynne, L. (2012).Environmental and Natural Resource Economics.9th International Edition, Pearson Education, Inc.
- Tietenberg, T. (2003).Environmental and Natural Resource Economics, 6thedition.
- Tsegaye. (2005) used CVM by applying double-bounded format to elicit the WTP of fishermen to the improvement of Lake Chamo.
- United Nations (2007).access to safe and adequate drinking water by half by 2015.
- World Bank. (1994). by Simiret W.et al, 2011.
- WRPM. (2017). Policy makers need evidence based recommendations to justify cost Effective supply options to ensure adequate water supply for growing urban populations.
- Yibeltal Bantie. (2011) the Value of Improved Water Supply Services in Motta Town, East Gojjam and Ethiopia: Application of CVM, (Msc Thesis), Addis Ababa University, Department of Economics.

Annexes

Annex I

1. <u>hhcode</u> household code	Freq.	Percent	Cum.
1	1	0.33	0.33
2	1	0.33	0.67
3	1	0.33	1.00
4	1	0.33	1.33
5	1	0.33	1.67
6	1	0.33	2.00
7	1	0.33	2.33
8	1	0.33	2.67
9	1	0.33	3.00
10	1	0.33	3.33
11	1	0.33	3.67
12	1	0.33	4.00
13	1	0.33	4.33
14	1	0.33	4.67
15	1	0.33	5.00
16	1	0.33	5.33
17	1	0.33	5.67
18	1	0.33	6.00
19	1	0.33	6.33
20	1	0.33	6.67
21	1	0.33	7.00
22	1	0.33	7.33
23	1	0.33	7.67
24	1	0.33	8.00
25	1	0.33	8.33
26	1	0.33	8.67
27	1	0.33	9.00
28	1	0.33	9.33
29	1	0.33	9.67
30	1	0.33	10.00
31	1	0.33	10.33
32	1	0.33	10.67
33	1	0.33	11.00
34	1	0.33	11.33
35	1	0.33	11.67
36	1	0.33	12.00
37	1	0.33	12.33
38	1	0.33	12.67
39	1	0.33	13.00
40	1	0.33	13.33
41	1	0.33	13.67
42	1	0.33	14.00
43	1	0.33	14.33
44	1	0.33	14.67
45	1	0.33	15.00
46	1	0.33	15.33
47	1	0.33	15.67
48	1	0.33	16.00
49	1	0.33	16.33
50	1	0.33	16.67
51	1	0.33	17.00
52	1	0.33	17.33
53	1	0.33	17.67
54	1	0.33	18.00
55	1	0.33	18.33
56	1	0.33	18.67
57	1	0.33	19.00
58	1	0.33	19.33
59	1	0.33	19.67
60	1	0.33	20.00
61	1	0.33	20.33
62	1	0.33	20.67
63	1	0.33	21.00
64	1	0.33	21.33
65	1	0.33	21.67
66	1	0.33	22.00

67	1	0.33	22.33
68	1	0.33	22.67
69	1	0.33	23.00
70	1	0.33	23.33
71	1	0.33	23.67
72	1	0.33	24.00
73	1	0.33	24.33
74	1	0.33	24.67
75	1	0.33	25.00
76	1	0.33	25.33
77	1	0.33	25.67
78	1	0.33	26.00
79	2	0.67	26.67
80	1	0.33	27.00
81	1	0.33	27.33
82	1	0.33	27.67
83	1	0.33	28.00
84	1	0.33	28.33
85	1	0.33	28.67
86	1	0.33	29.00
87	1	0.33	29.33
88	1	0.33	29.67
89	1	0.33	30.00
90	1	0.33	30.33
91	1	0.33	30.67
92	1	0.33	31.00
93	1	0.33	31.33
94	1	0.33	31.67

95	1	0.33	32.00
96	1	0.33	32.33
97	1	0.33	32.67
98	1	0.33	33.00
99	1	0.33	33.33
100	1	0.33	33.67
101	1	0.33	34.00
102	1	0.33	34.33
103	1	0.33	34.67
104	1	0.33	35.00
105	1	0.33	35.33
106	1	0.33	35.67
107	1	0.33	36.00
108	1	0.33	36.33
109	1	0.33	36.67
110	1	0.33	37.00
111	1	0.33	37.33
112	1	0.33	37.67
113	1	0.33	38.00
114	1	0.33	38.33
115	1	0.33	38.67
116	1	0.33	39.00
117	1	0.33	39.33
118	1	0.33	39.67
119	1	0.33	40.00
120	1	0.33	40.33
121	1	0.33	40.67
122	1	0.33	41.00
123	1	0.33	41.33
124	1	0.33	41.67
125	1	0.33	42.00
126	1	0.33	42.33
127	1	0.33	42.67
128	1	0.33	43.00
129	1	0.33	43.33
130	1	0.33	43.67

131	1	0.33	44.00
132	1	0.33	44.33
133	1	0.33	44.67
134	1	0.33	45.00
135	1	0.33	45.33
136	1	0.33	45.67
137	1	0.33	46.00
138	1	0.33	46.33
139	1	0.33	46.67
140	1	0.33	47.00
141	1	0.33	47.33
142	1	0.33	47.67
143	1	0.33	48.00
144	1	0.33	48.33
145	1	0.33	48.67
146	1	0.33	49.00
147	1	0.33	49.33
148	1	0.33	49.67
149	1	0.33	50.00
150	1	0.33	50.33
151	1	0.33	50.67
152	1	0.33	51.00
153	1	0.33	51.33
154	1	0.33	51.67
155	1	0.33	52.00
156	1	0.33	52.33
157	1	0.33	52.67
158	1	0.33	53.00
159	1	0.33	53.33
160	1	0.33	53.67
161	1	0.33	54.00
162	1	0.33	54.33
163	1	0.33	54.67
164	1	0.33	55.00
165	1	0.33	55.33

166	1	0.33	55.67
167	1	0.33	56.00
168	1	0.33	56.33
169	1	0.33	56.67
170	1	0.33	57.00
171	1	0.33	57.33
172	1	0.33	57.67
173	1	0.33	58.00
174	1	0.33	58.33
175	1	0.33	58.67
176	1	0.33	59.00
177	1	0.33	59.33
178	1	0.33	59.67
179	1	0.33	60.00
180	1	0.33	60.33
181	1	0.33	60.67
182	1	0.33	61.00
183	1	0.33	61.33
184	1	0.33	61.67
185	1	0.33	62.00
186	1	0.33	62.33
187	1	0.33	62.67
188	1	0.33	63.00
189	1	0.33	63.33
190	1	0.33	63.67
191	1	0.33	64.00
192	1	0.33	64.33
193	1	0.33	64.67
194	1	0.33	65.00
195	1	0.33	65.33
196	1	0.33	65.67
197	1	0.33	66.00
198	1	0.33	66.33
199	1	0.33	66.67
200	1	0.33	67.00
201	1	0.33	67.33

202	1	0.33	67.67
203	1	0.33	68.00
204	1	0.33	68.33
205	1	0.33	68.67
206	1	0.33	69.00
207	1	0.33	69.33
208	1	0.33	69.67
209	1	0.33	70.00
210	1	0.33	70.33
211	1	0.33	70.67
212	1	0.33	71.00
213	1	0.33	71.33
214	1	0.33	71.67
215	1	0.33	72.00
216	1	0.33	72.33
217	1	0.33	72.67
218	1	0.33	73.00
219	1	0.33	73.33
220	1	0.33	73.67
221	1	0.33	74.00
222	1	0.33	74.33
223	1	0.33	74.67
224	1	0.33	75.00
225	1	0.33	75.33
226	1	0.33	75.67
227	1	0.33	76.00
228	1	0.33	76.33
229	1	0.33	76.67
230	1	0.33	77.00
231	1	0.33	77.33
232	1	0.33	77.67
233	1	0.33	78.00
234	1	0.33	78.33
235	1	0.33	78.67
236	1	0.33	79.00

237	1	0.33	79.33
238	1	0.33	79.67
239	1	0.33	80.00
240	1	0.33	80.33
241	1	0.33	80.67
242	1	0.33	81.00
243	1	0.33	81.33
244	1	0.33	81.67
245	1	0.33	82.00
246	1	0.33	82.33
247	1	0.33	82.67
248	1	0.33	83.00
249	1	0.33	83.33
250	1	0.33	83.67
251	1	0.33	84.00
252	1	0.33	84.33
253	1	0.33	84.67
254	1	0.33	85.00
255	1	0.33	85.33
256	1	0.33	85.67
257	1	0.33	86.00
258	1	0.33	86.33
259	1	0.33	86.67
260	1	0.33	87.00
261	1	0.33	87.33
262	1	0.33	87.67
263	1	0.33	88.00
264	1	0.33	88.33
265	1	0.33	88.67
266	1	0.33	89.00
267	1	0.33	89.33
268	1	0.33	89.67
269	1	0.33	90.00
270	1	0.33	90.33
271	1	0.33	90.67
273	1	0.33	91.00

274	1	0.33	91.33
275	1	0.33	91.67
276	1	0.33	92.00
277	1	0.33	92.33
278	1	0.33	92.67
279	1	0.33	93.00
280	1	0.33	93.33
281	1	0.33	93.67
282	1	0.33	94.00
283	1	0.33	94.33

284	1	0.33	94.67
285	1	0.33	95.00
286	1	0.33	95.33
287	1	0.33	95.67
288	1	0.33	96.00
289	1	0.33	96.33
290	1	0.33	96.67
291	1	0.33	97.00
292	1	0.33	97.33
293	1	0.33	97.67
294	1	0.33	98.00
295	1	0.33	98.33
296	1	0.33	98.67
297	1	0.33	99.00
298	1	0.33	99.33
299	1	0.33	99.67
300	1	0.33	100.00

Total	300	100.00	
-------	-----	--------	--

2 . RSEX

1=male			
0=female	Freq.	Percent	Cum.
0	77	25.67	25.67
1	223	74.33	100.00

	Freq.	Percent	Cum.
Total	300	100.00	
3 . REED			
.			
1=no schooling			
2=primary completed			
3=high school and above			
2	28	9.33	9.33
3	272	90.67	100.00
Total	300	100.00	

4 . REAGE

Household years	Freq.	Percent	Cum.
18	1	0.33	0.33
20	2	0.67	1.00
21	8	2.67	3.67
23	14	4.67	8.33
24	10	3.33	11.67
25	11	3.67	15.33
26	18	6.00	21.33
27	4	1.33	22.67
28	7	2.33	25.00
29	9	3.00	28.00
30	5	1.67	29.67
31	12	4.00	33.67
32	10	3.33	37.00
33	2	0.67	37.67
34	10	3.33	41.00
35	12	4.00	45.00
36	19	6.33	51.33

37	9	3.00	54.33
38	16	5.33	59.67
39	19	6.33	66.00
40	2	0.67	66.67
41	11	3.67	70.33
42	2	0.67	71.00
43	3	1.00	72.00
44	7	2.33	74.33
45	8	2.67	77.00
46	3	1.00	78.00
47	3	1.00	79.00
48	1	0.33	79.33
49	3	1.00	80.33
51	2	0.67	81.00
52	5	1.67	82.67
53	2	0.67	83.33
54	2	0.67	84.00
55	8	2.67	86.67
56	4	1.33	88.00
58	1	0.33	88.33
59	4	1.33	89.67
60	4	1.33	91.00
62	9	3.00	94.00
64	7	2.33	96.33
65	1	0.33	96.67
66	4	1.33	98.00
67	1	0.33	98.33
68	1	0.33	98.67
70	2	0.67	99.33
71	1	0.33	99.67
74	1	0.33	100.00
Total	300	100.00	

5 . sum
reag

Variable	Obs	Mean	Std. Dev.	Min	Max
reag	300	38.4833	12.69041	18	74
6 . REINC	.				
1=employe e	.				
2=own busines	.				
3=daily worker	.				
4=others	Freq.	Percent	Cum.		
1	239	79.67	79.67		
2	53	17.67	97.33		
3	4	1.33	98.67		
4	4	1.33	100.00		
Total	300	100.00			

7.RMS

1=married	.				
2=single	.				
3=others	Freq.	Percent	Cum.		
1	212	70.67	70.67		
2	84	28.00	98.67		
3	4	1.33	100.00		
Total	300	100.00			

8.R
FS

1=1-5	.				
2=6-10 3=	.				
11 and above	Freq.	Percent	Cum.		

1	268	89.33	89.33
2	27	9.00	98.33
3	5	1.67	100.00
Total	300	100.00	

9 . PADIST

1=river			
2=natural			
spring			
3=protected			
spring			
4=protected			
hand dug			
well			
5=Unphdw	Freq.	Percent	Cum.
1	43	14.33	14.33
2	31	10.33	24.67
3	88	29.33	54.00
4	135	45.00	99.00
5	3	1.00	100.00
Total	300	100.00	

10 hmtditfwfstyhat 1=30 min 2=40 min

3=1hr

4=1:30hr

5=other	Freq.	Percent	Cum.
1	166	55.33	55.33
2	43	14.33	69.67
3	34	11.33	81.00
4	27	9.00	90.00
5	30	10.00	100.00
Total	300	100.00	

11 hmttygtotspd

1=one 2=two 3=three 4=four 5=other	Freq.	Percent	Cum.
1	105	35.00	35.00
2	74	24.67	59.67
3	51	17.00	76.67
4	32	10.67	87.33
5	38	12.67	100.00
Total	300	100.00	

12 . hftwsfyhmeteror

Distance house to water source in kilometers	Freq.	Percent	Cum.
0	3	1.00	1.00
1.50e-06	1	0.33	1.33
.00002	1	0.33	1.67
.00005	1	0.33	2.00
.0001	2	0.67	2.67
.0002	1	0.33	3.00
.0005	2	0.67	3.67
.0008	3	1.00	4.67
.0009	1	0.33	5.00
.001	10	3.33	8.33
.002	4	1.33	9.67
.0025	1	0.33	10.00
.003	6	2.00	12.00

.004	8	2.67	14.67
.005	8	2.67	17.33
.006	6	2.00	19.33
.008	5	1.67	21.00
.01	2	0.67	21.67
.02	2	0.67	22.33
.025	2	0.67	23.00
.03	1	0.33	23.33
.05	7	2.33	25.67
.06	2	0.67	26.33
.1	4	1.33	27.67
.2	4	1.33	29.00
.25	2	0.67	29.67
.3	2	0.67	30.33
.5	30	10.00	40.33
.7	2	0.67	41.00
.8	1	0.33	41.33
.9	3	1.00	42.33
1	91	30.33	72.67
1.5	1	0.33	73.00
2	52	17.33	90.33
3	14	4.67	95.00
4	8	2.67	97.67
5	5	1.67	99.33
6	2	0.67	100.00
<hr/>			
Total	300	100.00	

13 . b hmdpwyw

command b is unrecognized
r(199);

14 hmdpwyw

day	Freq.	Percent	Cum.
1	154	51.33	51.33
2	29	9.67	61.00

3	25	8.33	69.33
4	32	10.67	80.00
5	60	20.00	100.00
Total	300	100.00	

16 . SAT .

1=Unsatisfi
ed since it
is painful
2=Satisfied
because it
gives me p.
3=If other

	Freq.	Percent	Cum.
1	222	74.00	74.00
2	70	23.33	97.33
3	8	2.67	100.00
Total	300	100.00	

18 wstsmo

1=summer

2=winter
3=spring
4=autumn

	Freq.	Percent	Cum.
1	60	20.00	20.00
2	215	71.67	91.67
3	18	6.00	97.67
4	7	2.33	100.00
Total	300	100.00	

19 .
wrfmtfwfyhh

1=mother]

	Freq.	Percent	Cum.
2=father			
3=boys			
4=girls			
5=other			
1	150	50.00	50.00
2	13	4.33	54.33
3	11	3.67	58.00
4	94	31.33	89.33
5	32	10.67	100.00
Total	300	100.00	

20 .
hmwyfucpd .

Number of
lable
family
water use

in no.litters	Freq.	Percent	Cum.
.5	2	0.67	0.67
1	31	10.33	11.00

2	93	31.00	42.00
3	63	21.00	63.00
4	53	17.67	80.67
5	32	10.67	91.33
6	8	2.67	94.00
7	4	1.33	95.33
8	3	1.00	96.33
9	1	0.33	96.67
10	8	2.67	99.33
15	2	0.67	100.00
Total	300	100.00	

21 . LAST

1=1 2=0	Freq.	Percent	Cum.
0	254	84.67	84.67
1	44	14.67	99.33

2	2	0.67	100.00
Total	300	100.00	

22 . tab wtrbydiss

	Freq.	Percent	Cum.
1=poor quality			
2=low quality			
3=long distance			
4=high price			
5=other			
1	91	30.33	30.33
2	108	36.00	66.33
3	20	6.67	73.00
4	68	22.67	95.67
5	13	4.33	100.00
Total	300	100.00	

23 . tab hamyhhsfd

	Freq.	Percent	Cum.
1=1 2=0			
0	118	39.33	39.33
1	182	60.67	100.00
Total	300	100.00	

Tuesday September 22 15:42:30 2020 Page 11

24 . QUAL

1=very poor
2=poor
3=fair

4=good 5=very good	Freq.	Percent	Cum.
1	109	36.33	36.33
2	91	30.33	66.67
3	40	13.33	80.00
4	55	18.33	98.33
5	5	1.67	100.00
Total	300	100.00	

25 . tab hjewquantity

1=insufficient 2=sufficient	Freq.	Percent	Cum.
1	248	82.67	82.67
2	52	17.33	100.00
Total	300	100.00	

26 . PURIF

1=1 2=0	Freq.	Percent	Cum.
0	209	69.67	69.67
1	91	30.33	100.00
Total	300	100.00	

27 . tab wytmrfiws

1=government 2=community 3=private 4=other	Freq.	Percent	Cum.
---	-------	---------	------

1	242	80.67	80.67
2	48	16.00	96.67
3	7	2.33	99.00
4	3	1.00	100.00
Total	300	100.00	

28 . tab aycppuwfts

1=1 2=0	Freq.	Percent	Cum.
0	50	16.67	16.67
1	250	83.33	100.00
Total	300	100.00	

29 . tab aywpiwp

1=1 2=0	Freq.	Percent	Cum.
0	37	12.33	12.33
1	263	87.67	100.00
Total	300	100.00	

30 .TOWNWSS

1=1 2=0	Freq.	Percent	Cum.
0	42	14.00	14.00
1	258	86.00	100.00
Total	300	100.00	

32 . tab useptayiptis

1=1 2=0	Freq.	Percent	Cum.
0	47	15.67	15.67
1	253	84.33	100.00
Total	300	100.00	

33 . tab maxwtpiwswgfiszwnp

1=WSBP free
of charge
2=ISWT
source
3=IDNHE
money

4=IKTMWNBU

5=other

reasn	Freq.	Percent	Cum.
1	75	25.00	25.00
2	27	9.00	34.00

Tuesday September 22 15:42:30 2020 Page 13

3	89	29.67	63.67
4	74	24.67	88.33
5	35	11.67	100.00
<hr/>			
Total	300	100.00	

34 . tab ipwfistencj

1=1 2=0	Freq.	Percent	Cum.
0	49	16.33	16.33
1	251	83.67	100.00
<hr/>			
Total	300	100.00	

35 . tab ipwfiswtewentycj

1=1 2=0	Freq.	Percent	Cum.
0	85	28.33	28.33
1	215	71.67	100.00
<hr/>			

Total	300	100.00	
-------	-----	--------	--

36 . tab eswtasdhufinhouse

1=pit			
latrine			
2=flush			
toilet			
3=others	Freq.	Percent	Cum.
<hr/>			
1	226	75.33	75.33
2	73	24.33	99.67
3	1	0.33	100.00
<hr/>			

Total	300	100.00	
37 . tab ofhhuplandflushtoiletstplftwoih			
1=1 2=0	Freq.	Percent	Cum.
0	107	35.67	35.67
1	193	64.33	100.00
Total	300	100.00	

38 . tab iyhmhhuplftnhh			
1=1-5			
2=6-10			
3=above 11	Freq.	Percent	Cum.
1	174	58.00	58.00
2	90	30.00	88.00
3	36	12.00	100.00
Total	300	100.00	

39 . tab hwydrbuplandaw			
1=1 2=0	Freq.	Percent	Cum.
0	175	58.33	58.33
1	124	41.33	99.67
2	1	0.33	100.00
Total	300	100.00	

40 .MINC			
The amount			
at month in			
Eth.birr			
income			
source of			
hh	Freq.	Percent	Cum.
350	1	0.33	0.33
400	2	0.67	1.00
450	1	0.33	1.33
460	1	0.33	1.67

640	1	0.33	2.00
800	1	0.33	2.33
1000	8	2.67	5.00
1150	1	0.33	5.33
1200	4	1.33	6.67
1210	1	0.33	7.00
1250	2	0.67	7.67
1340	1	0.33	8.00
1380	1	0.33	8.33
1500	3	1.00	9.33
1700	4	1.33	10.67
1750	4	1.33	12.00
1800	1	0.33	12.33
2000	12	4.00	16.33
2100	3	1.00	17.33
2300	7	2.33	19.67
2400	1	0.33	20.00
2500	4	1.33	21.33
2700	1	0.33	21.67
2748	1	0.33	22.00
2848	2	0.67	22.67
2872	2	0.67	23.33
2900	2	0.67	24.00
2980	1	0.33	24.33
3000	6	2.00	26.33
3004	2	0.67	27.00
3100	1	0.33	27.33
3137	2	0.67	28.00
3200	1	0.33	28.33
3400	1	0.33	28.67
3450	1	0.33	29.00
3500	8	2.67	31.67
3579	2	0.67	32.33
3600	3	1.00	33.33
3670	1	0.33	33.67

3691	1	0.33	34.00
3700	4	1.33	35.33
3701	1	0.33	35.67
3748	2	0.67	36.33
3750	1	0.33	36.67
3800	3	1.00	37.67
3838	2	0.67	38.33
3900	1	0.33	38.67
4000	12	4.00	42.67
4050	1	0.33	43.00
4082	1	0.33	43.33
4085	8	2.67	46.00
4100	3	1.00	47.00
4167	2	0.67	47.67
4200	1	0.33	48.00
4300	1	0.33	48.33
4500	4	1.33	49.67
4585	1	0.33	50.00
4650	1	0.33	50.33
4662	16	5.33	55.67
4664	1	0.33	56.00
4666	1	0.33	56.33
4670	1	0.33	56.67
4867	2	0.67	57.33
5000	18	6.00	63.33
5053	1	0.33	63.67
5060	2	0.67	64.33
5171	2	0.67	65.00
5180	1	0.33	65.33
5191	1	0.33	65.67
5192	1	0.33	66.00
5304	9	3.00	69.00
5307	2	0.67	69.67
5310	1	0.33	70.00

5347	1	0.33	70.33
5500	1	0.33	70.67
5600	2	0.67	71.33
5700	1	0.33	71.67
5710	1	0.33	72.00
5712	1	0.33	72.33
5718	2	0.67	73.00
6000	8	2.67	75.67
6036	9	3.00	78.67
6050	1	0.33	79.00
6063	3	1.00	80.00
6143	1	0.33	80.33
6291	1	0.33	80.67
6310	1	0.33	81.00
6500	4	1.33	82.33
6800	1	0.33	82.67
6808	1	0.33	83.00
6809	1	0.33	83.33
7000	9	3.00	86.33
7043	1	0.33	86.67
7074	1	0.33	87.00
7081	1	0.33	87.33
7200	2	0.67	88.00
7447	1	0.33	88.33
7600	1	0.33	88.67
7647	4	1.33	90.00
7648	1	0.33	90.33
7800	1	0.33	90.67
8000	4	1.33	92.00
8017	2	0.67	92.67
8324	1	0.33	93.00
8670	1	0.33	93.33
8700	1	0.33	93.67
9000	2	0.67	94.33

9400	1	0.33	94.67
10000	3	1.00	95.67
10305	1	0.33	96.00
10500	2	0.67	96.67
12000	3	1.00	97.67
12500	1	0.33	98.00
13247	1	0.33	98.33
14000	1	0.33	98.67
15000	2	0.67	99.33
22500	2	0.67	100.00
Total	300	100.00	
Total	300	100.00	

42 . ROWS

1=1 2=0	Freq.	Percent	Cum.
0	104	34.67	34.67
1	196	65.33	100.00
Total	300	100.00	

43 . RSY

Number of years live in the towns	Freq.	Percent	Cum.
1	15	5.00	5.00
2	10	3.33	8.33
3	20	6.67	15.00
4	19	6.33	21.33
5	14	4.67	26.00
6	18	6.00	32.00
7	6	2.00	34.00

8	11	3.67	37.67
9	7	2.33	40.00
10	47	15.67	55.67
11	6	2.00	57.67
12	11	3.67	61.33
13	5	1.67	63.00
14	1	0.33	63.33
15	20	6.67	70.00
16	5	1.67	71.67
17	2	0.67	72.33
20	25	8.33	80.67
21	2	0.67	81.33
22	2	0.67	82.00
23	2	0.67	82.67
24	1	0.33	83.00
25	7	2.33	85.33
27	4	1.33	86.67
28	1	0.33	87.00
30	11	3.67	90.67
31	2	0.67	91.33
32	1	0.33	91.67
33	1	0.33	92.00
35	12	4.00	96.00
37	2	0.67	96.67
40	7	2.33	99.00
43	1	0.33	99.33
45	1	0.33	99.67
50	1	0.33	100.00
<hr/>			
Total	300	100.00	

44 . tab hmdyspmhhexpenditure

1=food
2=schooling
3=rent
4=transport

5=telephone 6=medical	Freq.	Percent	Cum.
200	2	0.67	0.67
300	1	0.33	1.00
350	1	0.33	1.33
400	1	0.33	1.67
460	1	0.33	2.00
600	1	0.33	2.33
650	2	0.67	3.00
700	2	0.67	3.67
750	1	0.33	4.00
800	1	0.33	4.33
900	2	0.67	5.00
1000	17	5.67	10.67
1050	1	0.33	11.00
1150	2	0.67	11.67
1200	4	1.33	13.00
1300	4	1.33	14.33
1350	2	0.67	15.00
1360	1	0.33	15.33
1400	1	0.33	15.67
1500	6	2.00	17.67
1600	2	0.67	18.33
1700	5	1.67	20.00
1750	4	1.33	21.33
1800	3	1.00	22.33
1900	1	0.33	22.67
2000	20	6.67	29.33
2100	3	1.00	30.33
2120	1	0.33	30.67
2200	4	1.33	32.00
2250	2	0.67	32.67
2300	6	2.00	34.67
2350	2	0.67	35.33

2380	1	0.33	35.67
2400	6	2.00	37.67
2458	1	0.33	38.00
2500	10	3.33	41.33
2549	1	0.33	41.67
2600	5	1.67	43.33
2650	1	0.33	43.67
2670	1	0.33	44.00
2748	1	0.33	44.33
2750	1	0.33	44.67
2800	4	1.33	46.00
2850	2	0.67	46.67
2900	2	0.67	47.33
3000	20	6.67	54.00
3050	1	0.33	54.33
3100	3	1.00	55.33
3150	2	0.67	56.00
3200	3	1.00	57.00
3250	1	0.33	57.33
3300	1	0.33	57.67
3350	2	0.67	58.33
3400	3	1.00	59.33
3500	7	2.33	61.67
3579	2	0.67	62.33
3600	4	1.33	63.67
3700	4	1.33	65.00
3730	1	0.33	65.33
3740	1	0.33	65.67
3838	1	0.33	66.00
3850	2	0.67	66.67
3900	3	1.00	67.67
3950	3	1.00	68.67
4000	14	4.67	73.33
4050	1	0.33	73.67

4100	2	0.67	74.33
4200	1	0.33	74.67
4340	1	0.33	75.00
4460	4	1.33	76.33
4482	1	0.33	76.67
4500	7	2.33	79.00
4550	1	0.33	79.33
4600	2	0.67	80.00
4640	1	0.33	80.33
4666	1	0.33	80.67
4750	1	0.33	81.00
4800	2	0.67	81.67
4830	1	0.33	82.00
4950	1	0.33	82.33
5000	14	4.67	87.00
5025	1	0.33	87.33
5050	1	0.33	87.67
5100	1	0.33	88.00
5180	1	0.33	88.33
5304	1	0.33	88.67
5400	3	1.00	89.67
5402	1	0.33	90.00
5700	2	0.67	90.67
6000	5	1.67	92.33
6200	1	0.33	92.67
6600	1	0.33	93.00
7000	2	0.67	93.67
7045	2	0.67	94.33
7100	3	1.00	95.33
7530	1	0.33	95.67
7700	2	0.67	96.33
7840	2	0.67	97.00
8000	1	0.33	97.33
8200	1	0.33	97.67
8210	2	0.67	98.33

8450	2	0.67	99.00
8500	1	0.33	99.33
9500	1	0.33	99.67
15900	1	0.33	100.00
<hr/>			
Total	300	100.00	

45 . tab iyhhaaboutwbd

1=1 2=0	Freq.	Percent	Cum.
0	40	13.33	13.33
1	260	86.67	100.00
<hr/>			
Total	300	100.00	

46 . tab wdytrfwatersupply

1=government 2=community 3=private 4=others	Freq.	Percent	Cum.
1	217	72.33	72.33
2	60	20.00	92.33
3	12	4.00	96.33
4	11	3.67	100.00
<hr/>			
Total	300	100.00	

47 . RECPI

1=very good 2=good 3=satisfact ory 4=others	Freq.	Percent	Cum.
1	38	12.67	12.67
2	143	47.67	60.33
3	94	31.33	91.67
4	25	8.33	100.00
<hr/>			
Total	300	100.00	

|

48 . tab rsex aywpiwp,chi2

1=male	1=1 2=0		
0=female	0	1	Total
0	11	66	77
1	26	197	223
Total	37	263	300

Pearson chi2(1) = 0.3652 Pr = 0.546

49 . tab REED aywpiwp,chi2

1=no schooling	1=1 2=0		
2=primery completed	0	1	Total
3=high school and above	0	1	Total
2	5	23	28
3	32	240	272
Total	37	263	300

Pearson chi2(1) = 0.8715 Pr = 0.351

50 . tab REMS aywpiwp,chi2

1=married	1=1 2=0		
2=single	0	1	Total
3=others	0	1	Total
1	22	190	212
2	15	69	84
3	0	4	4
Total	37	263	300

Pearson chi2(2) = 3.6834 Pr = 0.159

51 . tab wypmtdfw aywpiwp,chi2

	1=Unsatisfied since it is painful	2=Satisfied because it gives me p. 3=If other	Total
1	34	188	222
2	3	67	70
3	0	8	8
Total	37	263	300

Pearson chi2(2) = 7.1442 Pr = 0.028

52 . tab wstsmo aywpiwp,chi2

	1=summer	2=winter	3=spring	4=autumn	Total
1	13	47	60		60
2	20	195	215		215
3	2	16	18		18
4	2	5	7		7
Total	37	263	300		300

Pearson chi2(3) = 8.3928 Pr = 0.039

53 . tab wtrbydiss aywpiwp,chi2

1=poor quality
2=low quality

	1=1 2=0		
3=long distance			
4=high			
price			
5=other	0	1	Total
1	15	76	91
2	9	99	108
3	1	19	20
4	9	59	68
5	3	10	13
Total	37	263	300

Pearson chi2(4) = 5.4816 Pr = 0.241

54 . tab WBD aywpiwp,chi2

	1=1 2=0		
1=1 2=0	0	1	Total
0	9	109	118
1	28	154	182
Total	37	263	300

Pearson chi2(1) = 3.9844 Pr = 0.046

55 . tab QUAL aywpiwp,chi2

	1=1 2=0		
1=very poor			
2=poor			
3=fair			
4=good			
5=very good	0	1	Total
1	21	88	109
2	4	87	91
3	3	37	40

4	9	46	55
5	0	5	5
Total	37	263	300

Pearson chi2(4) = 12.5422 Pr = 0.014

56 . tab hjewquantity aywpiwp,chi2

1=insufficient			
2=sufficient	1=1 2=0		
	0	1	Total
1	35	213	248
2	2	50	52
Total	37	263	300

Pearson chi2(1) = 4.1907 Pr = 0.041

57 . tab aycppuwfts aywpiwp,chi2

	1=1 2=0		
1=1 2=0	0	1	Total
0	10	40	50
1	27	223	250
Total	37	263	300

Pearson chi2(1) = 3.2617 Pr = 0.071

58 . tab TOWNWSS aywpiwp,chi2

	1=1 2=0		
1=1 2=0	0	1	Total
0	30	12	42
1	7	251	258
Total	37	263	300

Pearson chi2(1) = 157.7396 Pr = 0.000

59 . tab maxwtpiwsqfiszwnp aywpiwp,chi2

	1=1	2=0	Total
1=WSBP free of charge	0	1	
2=ISWT source	0	75	75
3=IDNHE money	3	24	27
4=IKTMWNB	15	74	89
5=other reason	11	63	74
	8	27	35
Total	37	263	300

Pearson chi2(4) = 16.2945 Pr = 0.003

60 . tab RSF aywpiwp,chi2

	1=1	2=0	Total
=pit latrine	0	1	
2=flush toilet	32	194	226
3=other	4	69	73
	1	0	1
Total	37	263	300

Pearson chi2(2) = 10.9766 Pr = 0.004

61 . tab hsaywplftyh aywpiwp,chi2

	1=1	2=0	Total
1=very satisfied	0	1	
2=satisfied	4	29	33
3=not satisfied at all			
Total	4	29	33

2	3	97	100
3	30	137	167
Total	37	263	300

Pearson chi2(2) = 12.9551 Pr = 0.002

62 . tab RECPI aywpiwp,chi2

1=very good	1=1 2=0		
2=good			
3=satisfactory			
4=others	0	1	Total
1	5	33	38

2	11	132	143
3	18	76	94
4	3	22	25
Total	37	263	300

Pearson chi2(3) = 6.9137 Pr = 0.075

63 . ttest REAGE, by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	38.10811	1.977647	12.02956	34.09725	42.11896
1	263	38.53612	.7893859	12.80169	36.98177	40.09047
combined	300	38.48333	.7326812	12.69041	37.04147	39.9252
diff		-.4280136	2.231815		-4.820129	3.964102

diff = mean(0) - mean(1)

t = 918

Ho: diff = 0

degrees of freedom = 298

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(T < t) = **0.4240** Pr(|T| > |t|) = **0.8480** Pr(T > t) = **0.5760**

64 . ttest REFS, by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	37	1.027027	.027027	.164399	.9722137
1	263	1.136882	.0244144	.3959347	1.088809
combined	300	1.123333	.0217508	.3767342	1.080529
diff		-.1098551	.0659526		-.239647

diff = mean(0) - mean(1) t = **657**

Ho: diff = 0 degrees of freedom = **298**
 Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(T < t) = **0.0484** Pr(|T| > |t|) = **0.0968** Pr(T > t) = **0.516**

65 . ttest hmtditfwfstyhat , by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
0	37	2.027027	.2495837	1.518158	1.520848 2.533206
1	263	2.041825	.0847173	1.373884	1.875012 2.208639
combined	300	2.04	.0802393	1.389786	1.882095 2.197905
diff		-.0147981	.2444301		-.4958258 .4662296

diff = mean(0) - mean(1) t = **-0.0605**

Ho: diff = 0 degrees of freedom = **298**
 Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(T < t) = **0.4759** Pr(|T| > |t|) = **0.9518** Pr(T > t) = **0.5241**

66 . ttest hmtgytotspd , by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	2.135135	.2092535	1.272839	1.710749	2.559521
1	263	2.452471	.0862971	1.399504	2.282547	2.622396
combined	300	2.413333	.0800464	1.386445	2.255808	2.570859
diff		-.3173363	.24315		-.7958451	.1611724

diff = mean(0) - mean(1) t = -1.3051

Ho: diff = 0 degrees of freedom = 298
 Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(T < t) = 0.0964 Pr(|T| > |t|) = 0.1929 Pr(T > t) = 0.9036

67 . ttest hmwyfucpd , by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	3.324324	.2848899	1.732917	2.746541	3.902108
1	263	3.326996	.1318218	2.13779	3.067431	3.586561
combined	300	3.326667	.1206396	2.08954	3.089256	3.564077
diff		-.0026719	.3675022		-.7259002	.7205565

diff = mean(0) - mean(1) t = -0.0073

Ho: diff = 0 degrees of freedom = 298
 Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(T < t) = 0.4971 Pr(|T| > |t|) = 0.9942 Pr(T > t) = 0.5029

68 . ttest hftwsfyhmeteror , by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	.9094816	.1611153	.980026	.5827247	1.236239
1	263	1.128709	.0726907	1.178845	.9855766	1.271841
combined	300	1.101671	.0667973	1.156963	.9702186	1.233123

diff		- .2192273	.2030866		- .6188929	.1804382
------	--	------------	----------	--	------------	----------

diff = mean(0) - mean(1) t = -1.0795

Ho: diff = 0 degrees of freedom = 298

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.1406 Pr(|T| > |t|) = 0.2812 Pr(T > t) = 0.8594

69 . ttest hmdpwyw , by(aywpiw)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	1.675676	.1691441	1.028863	1.332636	2.018716
1	263	2.48289	.1038873	1.684769	2.278329	2.68745
combined	300	2.383333	.0946104	1.638701	2.197147	2.56952
diff		- .8072141	.2843913		-1.366884	- .2475443

diff = mean(0) - mean(1) t = -2.8384

Ho: diff = 0 degrees of freedom = 298

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = 0.0024 Pr(|T| > |t|) = 0.0048 Pr(T > t) = 0.9976

70 . ttest wimwpfojwfiwsc , by(aywpiw)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	.4621622	.0658852	.4007641	.3285408	.5957836
1	263	.3123574	.0146971	.2383462	.283418	.3412968
combined	300	.3308333	.0154436	.2674911	.3004414	.3612253
diff		.1498047	.0462383		.0588098	.2407997

diff = mean(0) - mean(1) t = 3.2398

Ho: diff = 0 degrees of freedom = 298

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

Pr(T < t) = **0.9993**

Pr(|T| > |t|) = **0.0013**

Pr(T > t) = **0.0007**

71 . ttest MINC , by(aywpiwp)

Two-sample t test with equal variances

Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
0	37	3437.324	425.3081	2587.048	2574.76	4299.889
1	263	4958.844	180.2736	2923.546	4603.875	5313.814
combined	300	4771.19	168.7841	2923.426	4439.035	5103.345
diff		-1521.52	506.5529		-2518.394	-524.6458

diff = mean(0) - mean(1)

t = **-3.0037**

Ho: diff = 0

degrees of freedom = **298**

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(T < t) = **0.0014**

Pr(|T| > |t|) = **0.0029**

Pr(T > t) = **0.9986**

ANNEX 2

Iteration 0: log likelihood = **-112.05427**
 Iteration 1: log likelihood = **-47.582222**
 Iteration 2: log likelihood = **-39.878019**
 Iteration 3: log likelihood = **-38.687477**
 Iteration 4: log likelihood = **-38.668091**
 Iteration 5: log likelihood = **-38.668084**
 Iteration 6: log likelihood = **-38.668084**

Probit regression Number of obs =300
LR chi2(18) =146.77
Prob>Chi=0.0000

Log likelihood = **-38.668084** Pseudo R2=0.6549

Variable	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
RSEX	-.3208863	.4591829	-0.70	0.485	-1.220868	.5790957
RMS	-.0623574	.3498475	-0.18	0.859	-.748046	.6233312
REAGE	-.0258096	.0139267	-1.85	0.064	-.0531054	.0014863
MINC	.0000645	.0000756	0.85	0.393	-.0000836	.0002126
RFS	.3534562	.1566546	2.26	0.024	.0464188	.6604937
ROWS	.5762552	.4063754	1.42	0.156	-.220226	1.372736
RYS	-.0110324	.0191708	-0.58	0.565	-.0486064	.0265416
REED	.3438393	.5938681	0.58	0.563	-.8201209	1.507799
QUAL	.1676863	.1648942	1.02	0.309	-.1555004	.4908731
LAST	.9921606	.7792919	1.27	0.203	-.5352234	2.519545
RSF	.6521414	.4144885	1.57	0.116	-.1602411	1.464524
PURIF	-.4003771	.3930092	-1.02	0.308	-1.170661	.3699068
TOWNWSS	3.427391	.508696	6.74	0.000	2.430365	4.424417
PADIST	1.316287	.5489241	2.40	0.016	.2404157	2.392159
RECPI	.2440223	.2203161	1.11	0.268	-.1877892	.6758339
IB	-1.777677	.6093375	-2.92	0.004	-2.971957	-.5833974
SOUR	.0685302	.1678058	0.41	0.683	-.2603631	.3974235
WBD	-.3577268	.3876172	-0.92	0.356	-1.117443	.401989
_cons	-4.318819	1.962024	-2.20	0.028	-8.164316	-.4733235

Tobit regression

Number of obs = 300
 LR chi2(18) = 264.73
 Prob > chi2 = 0.0000
 Pseudo R2 = 0.7823

Log likelihood = -36.829197

myspiwp	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
REEX	.0208964	.0354701	0.59	0.556	-.0489244	.0907152
RMS	-.0089594	.0310548	-0.29	0.773	-.0700881	.0521693
REAGE	-.0022893	.0011602	-1.97	0.049	-.004573	-.5.55e-04
MINC	3.31e-06	5.10e-06	0.65	0.516	-6.73e-06	.0000134
RFS	.0134877	.0089654	1.61	0.108	-.002979	.0299543
ROWS	.0166129	.0333398	0.50	0.619	-.0490135	.0822393
RYS	-.0003575	.0014825	-0.24	0.810	-.0032757	.0025607
REED	.0250763	.0523363	0.48	0.632	-.077943	.1280956
QUAL	-.0038147	.0134922	-0.28	0.778	-.0303729	.0227434
LAST	.0431417	.040624	1.06	0.289	-.0368232	.1231065
RSF	.0638051	.0343559	1.86	0.064	-.0038216	.1314317
PURIF	-.0015982	.0324864	-0.05	0.961	-.0655448	.0623484
TOWNNS	.7804924	.0465673	16.76	0.000	.6888288	.872156
PADIST	.0367939	.0296616	1.24	0.216	-.0215924	.0951802
RECFI	.0115209	.0182954	0.63	0.529	-.024492	.0475339
IB	-.2155609	.0575495	-3.75	0.000	-.328842	-.1022798
SOUR	.0077239	.0135175	0.57	0.568	-.0188842	.0343319
WED	-.0617766	.0301627	-2.05	0.041	-.1211492	-.002404
_cons	.0967603	.1724982	0.56	0.575	-.2427872	.4363077

- A. 3 B. 4 C. 5 D. 6 E. Every day
6. What is your perception about moving this distance to fetch water? A. Unsatisfied since it is painful
B. Satisfied because it gives me pleasure C. If other (specify)
7. Do you get enough water from this source throughout the year? A. yes B. no
8. If your answer to the above is “No” in which season the shortage mostly occur? A. Summer
B. Winter C. Spring D. Autumn
- 8.1 At the time of shortage, what is your last alternative to get water? _____
9. Who is responsible for most of the time for fetching water from your household? A. Mother
B. father C. boys D. girls E. other (specify) _____
10. How much water do your families use/collect per day? _____ jerrican.
11. Are you satisfied with this source of water? A. yes B. no
12. If your answer to the above is “No” what is the reason behind your dissatisfaction? A. Poor quality
B. Low quantity C. Long distance D. High price E. Other (specify) _____
13. Have any members of your household suffered from diseases like diarrhea, typhoid, in past?
A. yes B. no
14. How do you judge the existing status of water supply?
14.1. In its Quality? A. Very poor B. Poor C. Fair D. Good E. Very good
14.2. In its Quantity? A. insufficient B. sufficient
15. Do you purify water through boiling or any other mechanism before consumption?
A. yes B. no
16. Who do you think is mainly responsible for improved water supply?
A. government B. community C. private D. other
17. Are you currently paying any payments to use water from this source? A. Yes B. If “yes” how
much do you pay per month/year? _____ birr.

ቃለ-መጠይቅ ለመክፈል ፈቃደኛ መሆንን የሚመለከቱ ጥያቄዎች

በአሁኑ ወቅት በቻግኒ ከተማ እንዲኖር በሚፈለገው የተጣራ ንጹህ ውሃ እና በጊዜው በአካባቢው ባለው የውሃ አቅርቦት መካከል ሰፊ ልዩነት አለ። በከተማው ባለው የውሃ ፍላጎትና አቅርቦት መካከል ባለው ሰፊ ክፍተት በምክንያትነት ወደከተማ የሚደረገው ከፍተኛ ፍልሰት /ከተማነት፣ የኢኮኖሚ እድገት፣ የህዝብ ብዛት መጨመር፣ ዝቅተኛ ሃይል ያለው ውሃ በቦታው መኖር እና የውሃ ጉድጓዶች ቁጥር ማነስ እና በወቅቱ ካለው የህዝብ ብዛትና የውሃ ፍላጎት ጋር ያለመጣጣም ተጠቃሽ ናቸው።

የውሃ አገልግሎትን ለማሻሻል ከሚያስፈልጉ ተግባራት መካከል ተጨማሪ የውሃ ጉድጓዶችን መገንባት፣ ተጨማሪ የውሃ መሳቢያ ሞተሮችን ለአዳዲስ የውሃ ጉድጓድ ቁፋሮዎች አቅርቦ ሥራ ማስጀመር፣ ተጨማሪ የውሃ ጋኖች/ሪዘርቮሮችን መገንባት፣ ከጥልቅ የውሃ ጉድጓዶች ወይም ከውሃ ምንጮች እስከ ህዝብ ሁኔታ መቅጃዎች ድረስ የውሃ ቁቦዎችን መዘርጋት እና የጋራ የውሃ መቅጃ ቢርካዎችን በተለያዩ የከተማዎች ክፍሎች መገንባትና ሥራ ማስጀመር ይገኙበታል። እነዚህን ሁሉ ለመተግበር ደግሞ ከሚያስፈልገው የኢንቬስትሜንት ወጪ ባሻገር ለጥገና እና ሥራ ማስኬጃ ወጪዎች ስለሚሰፈሩት የውሃ አቅርቦት ማሻሻያ ዕቅዱን ገቢራዊ ማድረግ ከፍተኛ ገንዘብ ይጠይቃል። በመሆኑም ነዋሪዎች ይህንን የፕሮጀክት ወጪ መጋራት ይኖርባቸዋል። ማህበረሰቡ እነዚህን ወጪዎች ለመጋራት ፈቃደኛ ሆኖ የተወሰነ የገንዘብ ወጪ መጋራት ከቻለ የማሻሻያ መርሃግብሩ ተፈጻሚ ይሆናል። ጥራቱን የጠበቀ ውሃ ለከተማው ማህበረሰብ ማቅረብ ማለት የጥራት ደረጃው የተጠበቀ የመጠጥ ውሃ ማቅረብ እና የማህበረሰቡን ጤናና አካላዊ ደህንነት መጠበቅ፣ ደረጃውን የጠበቀ ውሃ በቀን ለ24 ሰዓት ሳምንቱን እና ዓመቱን ሙሉ ሳያቋጥ እንዲደርስ ማድረግ እና በዚህም የተለያዩ ቤተሰቦች የመጠጥ ውሃ ፍለጋ ሩቅ ቦታ በመንከራተት የሚያጠፉትን ሰዓት በማስቀረት የበለጠ ውጤታማ እንዲሆኑ የሚያደርግ ነው። ነገር ግን ይህ አስተዳደራዊ እና የመነሻ ግንባታ ወጪ እርሶን ጨምሮ እያንዳንዳችሁ ከአሁኑ አዋጥታችሁ የምትሸፍኑት ሳይሆን በምትከፍሉት የውሃ ክፍያ ላይ ቀስ በቀስ እየተጨመረ በቀጣይ 20 ዓመታት ውስጥ ተከፋፍሎ በየወሩ በምትከፍሉት የውሃ ሂሳብ ላይ እየተካተተ የሚሸፈን ነው። በመሆኑም ውሃ በቤታችሁ ሲገባላችሁ በቀጥታ የመነሻ ክፍያውን አሁኑኑ ካልከፈላችሁ ልትባሉ አይገባም።

- 18. በዚህ የውሃ ማሻሻያ ፕሮግራም ላይ ለመሳተፍ ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 19. መልስዎ “አዎ” ከሆነ እንደሆነ የከተማዎ የውሃ አገልግሎት ጽ/ቤት ወጪዎን ሽፍኖ የውሃ መስመሩን ቢዘረጋ እርስዎ ለሚቀዱት ውሃ በጄሪካን (በ20 ሊትር ጄሪካን) _____ ለመክፈል ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 20. ለቁጥር 19 የቀረበው መልስ “አዎ” የሚል ከሆነ ቀጣዩን ጥያቄ ይጠይቁ። በተሸሻለው የውሃ አቅርቦት ላይ የአንድ ጄሪካን (20 ሊትር ዕቃ) ውሃ ዋጋ ከነበረው 2X ቢያድግ ወይም ዋጋው _____ ሳንቲም ቢሆንስ ለመክፈል ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 21. ለቁጥር 19 የቀረበው መልስ “የለም” ከሆነ ቀጣዩን ጥያቄ ይጠይቁ። በተሸሻለው የውሃ አቅርቦት ላይ የአንድ ጄሪካን (20 ሊትር ዕቃ) ውሃ ዋጋ ከነበረው ወደ 0.5X ቢቀንስ ወይም ዋጋው _____ ሳንቲም ቢሆንስ ለመክፈል ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 22. በዚህ በተሸሻለው የውሃ አቅርቦት ስርዓት ለአንድ ጄሪካን ሊከፍሉ የሚችሉት ከፍተኛ ዋጋ ስንት ሳንቲም ነው? በጄሪካን-----ሳንቲም።
- 23. ተጠያቂዎቹ ለተሸሻለው የውሃ አገልግሎት የሚከፍሉት ከፍተኛ ሂሳብ 0 (ዜሮ) ከሆነ ለመክፈል የማይፈልጉበትን ምክንያት ይጠይቋቸው።
 - 1) ውሃ ያለከፍያ መቅረብ ስላለበት
 - 2) ባለው የውሃ አቅርቦት ደስተኛ በመሆኔና በመርካቴ

- 3) በቂ ገንዘብ ስለሌለኝ
- 4) ገንዘብ በአግባቡ ሥራ ላይ እንደማይውል ስለማውቅ
- 5) ሌላ ምክንያት ካለ ቢያብራሩልን _____

ለሚቀርበው የተሸሻለ የውሃ አቅርቦት (ቢርካ) ክፍያ ለመፈጸም ፈቃደኛ መሆንን የሚመለከቱ ጥያቄዎች

ተሸሻሎ የሚቀርበው የቦኖ ውሃ አገልግሎት በየቤታቸው ቧንቧ ላላስገቡ እና ከጋራ የውሃ መቅጃ በዕቃ እየቀዱ ለሚጠቀሙ አባወራዎች የሚጠቅም ከሆነ፡-

- 24. በዚህ የውሃ ማሻሻያ መርሃግብር ላይ ለመሳተፍ ፍላጎት አለዎት? 1. አዎ 2. የለም
 መልሱም “አዎ” ከሆነ እና የሚቀርበው የተሸሻለ የጋራ የውሃ ቧንቧ (ቢርካ) ቤትዎ ባለበት አካባቢ ቢገነባ እና ከዚህ የጋራ የውሃ ምንጭ (ቢርካ) የሚገኘውን ማፍላት ሳይስፈልግም የሚጠጡት ዓይነት ጥራት ቢኖረው፤
- 25. ከተሸሻለው የጋራ የውሃ መቅጃ ቦታ የአንድ ጄሪካን ወይም (20 ሊትር ዕቃ) ውሃ ዋጋ _____ ሳንቲም ቢሆን ለመግዛት ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 26. በቁጥር 32 ለቀረበው ጥያቄ መልሱ “አዎ” የሚል ከሆነ ቀጣዩን ጥያቄ ይጠይቁ። በተሸሻለው የውሃ አቅርቦት ላይ የአንድ ጄሪካን ወይም (20 ሊትር ዕቃ) ውሃ ዋጋ ከነበረው 2X ቢያድግ ወይም ዋጋው _____ ሳንቲም ቢሆንስ ለመክፈል ፈቃደኛ ነዎት? 1. አዎ 2. የለም
- 27. ተሸሻሎ ለሚቀርበው የውሃ አገልግሎት ለአንድ ጄሪካን ወይም (20 ሊትር ውሃ) የሚከፍሉት ከፍተኛ የዋጋ መጠን _____ ሳንቲም ነው።
- 28. ተጠያቂዎቹ ለተሸሻለው የውሃ አቅርቦት የሚከፍሉት ከፍተኛ ሂሳብ 0 (ዜሮ) ከሆነ ለመክፈል የማይፈልጉበትን ምክንያት ይጠይቋቸው።
 - 1) ውሃ ያለክፍያ መቅረብ ስላለበት
 - 2) ባለው የውሃ አቅርቦት ደስተኛ በመሆኔና በመርካቴ
 - 3) በቂ ገንዘብ ስለሌለኝ
 - 4) ገንዘብ በአግባቡ ሥራ ላይ እንደማይውል ስለማውቅ
 - 5) ሌላ ምክንያት ካለ ቢያብራሩልን _____

በአሁኑ ወቅት ያለው የፍላጎ አወጋገድ ሁኔታ

- 29. በዚህ ቤት ጥቅም ላይ የዋለው የፍላጎ አወጋገድ ስርዓት ምንድን ነው?
 - ሀ) በቤት ውስጥ የመጻፍኛ ቤት ፋሲሊቲ ካለ
 - 1) የመጻፍኛ ቤት ጉድጓድ 2) ውሃ የሚደፋበት (ፋላሽ የሚደረግበት) መጻፍኛ ቤት
 - 3) ሌላ ካለ ይገለጽ
 - ለ) በቤት ውስጥ ምንም ዓይነት የመጻፍኛ ቤት ፋሲሊቲ ከሌለ
 - 1) የህዝብ መጻፍኛ ቤት መጠቀም 2) በመንገድ ዳር መጻፍኛት 3) በጫካ
 - 4) ሌላ ካለ ይገለጽ
- የመጻፍኛ ጉድጓድ እና ውሃ የሚደፋበት መጻፍኛ ቤት (ፍላሽ ላትሪን) ለሚጠቀሙ ብቻ
- 30. ያስቆፈሩትን መጻፍኛ ጉድጓድ ወይም ውሃ የሚደፋበት መጻፍኛ ቤት በቤት ውስጥ ካሉ ሌሎች ሰዎች ጋር በጋራ ትጠቀሙታላችሁ? 1. አዎ 2. የለም
- 31. መልስዎ “አዎ” ከሆነ በቤት ውስጥ ያለውን የጉድጓድ መጻፍኛ ቤት/ ውሃ የሚደፋበት መጻፍኛ ቤት ስንት የቤተሰብ አባላት ይጋሩታል? _____

32. ባለዎት የጉድጓድ መጻዳኛ ቤት/ ውሃ የሚደፋበት መጻዳኛ ቤት ምን ያክል ረክተዋል?

- 1) በጣም ረክቻለሁ
- 2) ረክቻለሁ
- 3) በፍጹም አልረካሁም

33. ለመጻዳኛ ቤት አገልግሎት የሚውል ውሃ ይገኛል?

- 1) አዎ
- 2) የለም

34. How much is your own gross income per (month) excluding your family's income? _____Birr.

Income source	Amount at month in Ethio, Birr.	
Salary		
Remittance		
Additional		
Total		

35. Would you please telling me your household members' income per (month) excluding your own income?

- 1. Person1 _____ birr
- 3. Person 3 _____ birr
- 5. Person 5 _____ birr
- 2. Person 2 _____ birr
- 4. Person4 _____ birr
- 6. Person 6 _____ birr

36. Do you have your own house? 1. Yes 2. No

37. How many years have you lived in the town? _____ Years.

38. How much do you spend per month for _____ in birr?

Household expenditure

Expenditure	Monthly Budget ethi-Birr
Food	
Schooling	
Rent	
Transport	
Telephone	
Medical	
Total	

39. Is your household aware about water born diseases? 1. Yes 2. No

40. Who do you think is responsible for water supply?

- 1. Government
- 2. Community
- 3. Private
- 4. Others specify

41. What do you conclude regarding the proposed improved water supply for the towns?

- 1. Very good
- 2. Good
- 3. Satisfactory
- 4. Others, specify