ECONOMIC VALUATION OF ANTIRETROVIRAL DRUGS IN ETHIOPIA: APPLICATION OF CVM

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LIST OF ABBREVIATION

AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
ART	Antiretroviral Therapy
ARV	Antiretroviral drugs
CVM	Contingent Valuation Method
DOH	Dawn of Hope
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
MOH	Ministry of Health
NGOs	Non-governmental organizations
OI	Opportunistic infection
PLWHA	People living with HIV/AIDS
PMTCT	Prevention of Mother to Child Transmission
TB	Tuberculosis
UNAIDS	Joint United Nations Programme on AIDS
UNWECP	United Nations Workplace Education and Care Project
WHO	World Health Organization
WTA	Willingness to Accept
WTP	Willingness to Pay

ABSTRACT

In this study, the willingness to pay of people living with HIV/AIDS for anti-retroviral drugs is assessed. A contingent valuation survey was carried out on 440 adults living with HIV/AIDS. The research result indicates that the mean willingness to pay for the drugs is Birr 163.6 and the median is Birr 100, per month. A multivariate statistical analysis of the determinants of individual's willingness to pay reveals that individuals with larger family size, with others paying for their treatment cost other than themselves and with spouse deceased are less willing to pay for the drugs. Individuals with higher income are more willing to pay. Older respondents are also willing to pay more. Among the explanatory variables, income was found to be highly significant in influencing WTP by the different estimation techniques employed in the research implying low income levels of respondents prevent them from acquiring the drugs, if the drugs be marketed. This calls for the participation of many stakeholders in the acquisition and distribution of anti-retroviral drugs if equityisdesired.

Key words: *Contingent valuation method, Willingness to pay, antiretroviral drugs, CLAD*

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

The HIV/AIDS pandemic continues to be an alarming problem for Ethiopia where 2.6 million, including about 250,000 children are HIV positive and an estimated 400,000 Ethiopians have already developed AIDS. The number of PLWHA is growing rapidly in the country in general and in Addis Ababa in particular. The incidence of voluntary HIV testing and counselling as well as early entry into the continuum of care directed at PLWHA is very low. These circumstances are aggravated in Addis Ababa by a general lack of awareness of the confidential services that are available to HIV/AIDS clients (UNAIDS, 2002). Of the total residents of Addis Ababa, 17% live with HIV/AIDS. In other words, one in six adults (15-49 years old) is already infected with the virus. Frighteningly, a vast majority of those already infected are unaware of their status.

It is estimated that by 2004, of the total death in Addis Ababa, 60% will be an outcome of AIDS- this in other words means out of five people that die, three would be due to AIDS

(MOH, 2000). While the epidemic results death on people in all age range, the effect it has on those between 15 to 49 years old is overwhelming. By 2009, it is estimated that 80 people in this age group will die every day because of AIDS. The consequence of such a death toll will definitely have an adverse effect on the socio-economic development of the country.

There is no cure for HIV/AIDS, but in developed countries, AIDS is being turned into a manageable and treatable illness instead of death sentence with the use of life prolonging HIV/AIDS drugs. Data from the United States show that the combination therapies known as highly active anti-retroviral therapies (HAART) reduced AIDS –related mortality by 75% and AIDS- related morbidity by 73% over three years. Similarly in the Brazilian state of São Paulo, AIDS-related mortality has declined by 32% since protease inhibitors became available in 1996 (FHI, 1998).

However, in the African region, the number of HIV infected people who can access and afford ARV therapy is still very small. Of the 25 million people that are living with the virus, only 10,000-25,000 people were receiving ARV therapy in the year 2001 (UNAIDS/WHO, 2001). The high price of many AIDS drugs –especially ARV drugs- is one of the main barriers to their availability in developing countries. Fortunately, the price of ARV drugs is coming down (*discussed in detail in the next chapter*) as a direct response by major drug companies to the UNAIDS and WHO ARV Accelerated Initiatives in several countries. Similarly, some companies in Brazil, Thailand and India are producing generic products that are much cheaper and affordable to more people in the developing countries.

Hence, it is anticipated that in the next few years there will be a bigger number of people in Africa who will be accessing ARV drugs.

1.2 STATEMENT OF THE PROBLEM

Ethiopia is ranked as the 168th country in human development, where most of its population has "low access" to essential drugs. In terms of priority in public expenditure, over a nine years period (1990-1999) the public expenditure on health slightly increased from 0.9% to 1.2% of GDP. On the other hand, the total expenditure on military expenditure increased from 8.5% to 9.4% of GDP over the same period. The Gini[1] index, which measures inequality over the entire distribution of income or consumption, indicates that it is 55.1% for the country. With regard to human poverty index, the country is ranked as 87th out of 88 developing countries (UNDP, 2002).

With regard to the HIV profile of the country, Ethiopia is the 16th highest in HIV/AIDS prevalence and the third largest number of people living with the virus next to South Africa and India. Official reports estimate that 2.2 to 2.6 million people are currently infected with HIV/AIDS where around two million are adults and 200 to 250 thousand children (MOH, 2002 and UNAIDS, 2002). While the number of new AIDS cases reported to the Ministry of health in 2001 are 15,202 this figure was estimated to be as high as 219,400. The peak ages for AIDS cases are 25 to 29 for both males and females. This implies that given the average incubation period between the time of infection and emergence of full

blown AIDS is about eight years, the mean age at which people become infected is 15 to 24 years.

Of the total infected population, about 91% of infections occur among the economically active age group, 15-49 years. This indisputably has a huge social and economic impact on the country as a whole.

For 2001, the estimated adult HIV prevalence rate was 6.6% where the highest prevalence was observed among the age group 15-24. Compared to rural prevalence rate, which is 3.7% the urban prevalence rate is double this figure, 13.7%.

In 1989, the life expectancy of Ethiopians was estimated at 45 years, expected to be 53 years by 2001 and 59 years by 2014. However, due to the increase in HIV-related deaths, instead of 53 years in 2001 the life expectancy declined to 46years and 50 instead of 59 by 2014.

Ethiopia is identified to be hit by the ***Next Wave*** of HIV/AIDS among four other countries - Nigeria, Russia, India and China (NIC, 2002). By 2010, it is estimated that the five countries, which comprise over 40% of the world's population, will have the largest number of HIV/AIDS case on earth if nothing is done presently. The following table shows the estimates of current and future HIV/AIDS-infected population and adult prevalence rate in the Next-Wave countries for 2002 and 2010.

[1] The Gini coefficient will be equal to 0 when the distribution is completely egalitarian while if the society's total income accrues to only one person/household unit, leaving the rest with no income at all the coefficient will be equal to 1, or 100%.

Table 1.1. Current and future HIV/AIDS-infected population and adult prevalence rate, 2002 and 2010

	2002			2010	
Country	# of infected Population (government data in millions)	# of infected population (Expert estimates in millions)	Adult Prevalence rate (%)	# of infected (Expert estimates in millions)	Adult Prevalence rate (%)
China	3.5	4-6	6-10	10-15	18-26
Ethiopia	2.2*	3-5	10-18	7-10**	19-27
Russia	0.18	1-2	1.3-2.5	5-8	6-11
India	4.0	5-8	0.9-1.4	20-25	3-4
Nigeria	0.8	1-2	0.14-0.27	10-15	1.3-2

Source: NIC, 2002

* MOH, 2002 **MOH estimates this figure to be 2.9

From the above table it can be seen that Ethiopia's adult prevalence in the future (19%-27%) will be the highest among the five countries. Because of the high current rate of adult prevalence, widespread poverty, low educational levels, and the government's limited capacity to respond more actively, 7-10 million Ethiopians will probably be infected by 2010 (NIC, 2002).

The development of ARVs helps to improve the survival and quality of life of many people living with HIV/AIDS. Despite the remarkable success of the drugs, however, their prices are very expensive. According to UNAIDS (2002), the projected annual expenditure requirements for HIV/AIDS care and support by 2005, excluding the costs of infrastructure required for delivery of effective HIV treatment are US$ 4,400 million. Out of this more than half, 69%, is taken by sub-Saharan Africa. The estimated figure for South and South East Asia is 15%, East Asia and Pacific 1.8%, Latin America and Caribbean 12 %. The

remaining 0.45% and 1.13% go to East Europe and Central Asia, and North Africa and Middle East, respectively.

In particular, it is estimated that treatment of all people living with HIV/AIDS with HAART could represent 1% of the GDP in Latin America, 14.6% in South East Asia and 66.9% in the sub-Saharan Africa (Walkowiak, 1999).

It is argued that the provision of a fully subsidized ARV treatment program by the Ethiopian government is not considered affordable. However, it is believed that it is affordable to the country to have a fully government financed prevention of mother-to-child transmission programme, which is estimated to cost 2.28 million USD per year (Policy framework, 2002).

Clinical trials for vaccine against HIV are underway and have progressed to phase III human testing in the US, Canada, Netherlands, and Thailand. However, a vaccine is developed to protect against certain viral subtypes of HIV in the test countries, which probably will not be effective against the most common subtypes of HIV in countries which will be hit by the Next Wave of HIV/AIDS-Nigeria, Ethiopia, Russia, India and China (NIC, 2002). This leaves the countries to focus on anti-AIDS education to bring behavioural change to prevent new cases and ARV drugs to prolong the lifetime of people already living with the virus until a highly effective vaccine is developed for these countries.

The direct result of the inaccessibility of ARV drugs in health structures in Ethiopia is the development of ARV distribution channels outside the health care system. Currently,

although ARV drugs are not officially available in the country, some patients are nonetheless receiving ARV treatment (UNAIDS, 2002). The drugs are traded in the "parallel market" for prices from Birr 1,000 to Birr 5,000 (US$115-$575) per month.

1.3 OBJECTIVES OF THE STUDY

The Ethiopian government is considering provision of the drugs for free only in the case of prevention of mother-to-child transmission (PMTCT) of the virus. The provision of ARV, when the drugs are available in the market, will be based on user fees for other individuals living with the virus. With respect to this the Ethiopian government seems to strike a middle ground between abandoning all other drugs and buy only ARVs and distribute the drugs for free to all PLWHA, and leaving this totally to the private sector.

The objectives of the study are:

- To estimate the willingness to pay of people living with HIV/AIDS for anti-retroviral drugs
- To identify the determinants of willingness to pay of people living with HIV/AIDS (PLWHA) for the drugs
- To estimate the demand function of respondents for antiretroviral drugs

HYPOTHESIS OF THE PAPER

The hypothesis of the paper on the value of life is based on the assumption stated by Johansson (1995). Individuals prefer to stay alive even if this virtually means with a zero income i.e.,

$$V(p, 0, z>0) > 0$$

$$V(p, y, z=0) = 0 \qquad \forall\, y > 0$$

Where: V = the indirect utility function

p = fixed, strictly positive prices

y = income

z = individual's health status which is "normalized" so as to range between zero and some finite positive level, which is often arbitrarily set equal to one, where 0 is the worst possible health status and 1 is the best possible health status.

In other words, $V(p, 0, z_1) > V(p, y, z_0)$ where z_1 means being alive, z_0 means being dead, and $y > 0$. Thus, it is not possible to define a willingness to pay such that the inequality is turned into equality i.e., even if the individual pays his/her entire income the inequality remains.

The specific study hypotheses to be tested are:

- There is no demand for antiretroviral drugs in Ethiopia
- Major determinants of willingness to pay for antiretroviral drugs are income, employment status, years of living with the virus and treatment cost of opportunistic

infections whereas most socio-demographic characteristics of individuals are not significant factors for determining the willingness to pay for ARV drugs.

CHAPTER TWO

ARV DRUGS: AN OVERVIEW

HIV is a retrovirus acquired through contact with body fluids, primarily through sexual intercourse and Utero-from infected mothers to newborn children or contact with infected blood. The virus survives by replicating inside CD4[2] blood cells, which normally protect the body against infection. Currently two families of this virus are known- HIV-1 and HIV-2 where the latter was discovered three years later. These exhibit extensive genetic diversity, although both result in AIDS. The transmission rate of HIV-2 appears to be lower compared with HIV-1 and the rate of progression to disease may also be slower.

There are four phases of HIV infection[3]. Soon after entering the body, HIV starts to replicate and destroy CD4 cells. Generally a decrease in CD4 count is correlated with HIV disease progression, which can be identified by running a blood test. This first phase is

[2] CD4 test, cluster differentiation test, could be used to measure how much damage has been done by HIV to a person's immune system.
[3] Mainly extracted from Sande and Moelling, (2000) . Guide to HIV/AIDS Therapy, 9th ed.

called the *acute HIV syndrome stage;* in this stage the virus causes flu-like symptoms and/or a rash, which disappear after a few days.

A few weeks after the first stage, the viral load (level of virus in the body) levels gradually decrease and CD4 cell counts rise again. This phase of the disease is called the *asymptomatic stage*. Patients sometimes remain in this stage of infection for several months or even years. During this time, the virus continues to replicate and attack CD4 cells, although the harmful effects of HIV on the immune system do not necessarily cause symptoms. As the virus continues to replicate in the second stage, the viral load eventually increases and the CD4 cell count decreases once more.

In the third phase, the *symptomatic stage,* patients may begin to develop recurring symptoms of enlarged lymph nodes, weight loss, fever, diarrhoea, rashes, sores, or oral infections.

Full-blown AIDS is the last stage of HIV infection in which people consequently suffer from certain conditions, including opportunistic infections- infections that develop due to lowered immunity. People with AIDS may die from these opportunistic infections rather than from the virus itself.

Although HIV infection is incurable and there is no vaccine that has been proven to prevent the virus, it does not mean that there is no way of prolonging life for carriers of the virus.

Anti-retroviral drugs boost the immune system and help it to fight HIV infections. This can mean that instead of becoming sicker, a person with AIDS can regain good health. If the drugs are taken properly they work by suppressing the HIV virus so that it drops to a very low level in the body. When this happens, the immune system gradually recovers and

regains its ability to fight infections, which is reflected by a rise in the CD4 count. In healthy adults there are between 700 and 1500 CD4 cells per cubic millimetre of blood. A count below 500 is considered a sign of a depressed immune system; below 200 heightens the risk of opportunistic infections; below 100 signifies severe immune damage (Panos, 2001). Studies show that dramatic reductions in the viral load can be achieved by using ARV drugs.

There are currently three types of anti-retroviral drugs: **Nucleoside Reverse Transcriptase Inhibitors, Non-Nucleoside Reverse Transcriptase Inhibitors**, and **Protease Inhibitors.** The ideal treatment strategy for people living with HIV/AIDS is triple combination, which involves the use of one protease inhibitor and two reverse transcriptase inhibitors (Unicef/UNAIDS, 2001).

Studies show that using triple combination therapy reduces not only viral load by 99% but also the rate of mortality due to HIV/AIDS by as much as half. Among those in triple combination therapy, 65 to 81 percent had reduced their level of virus to undetectable levels after six months of treatment (Forsythe, 1998).

Table 2.1 Classification and function of ARVs

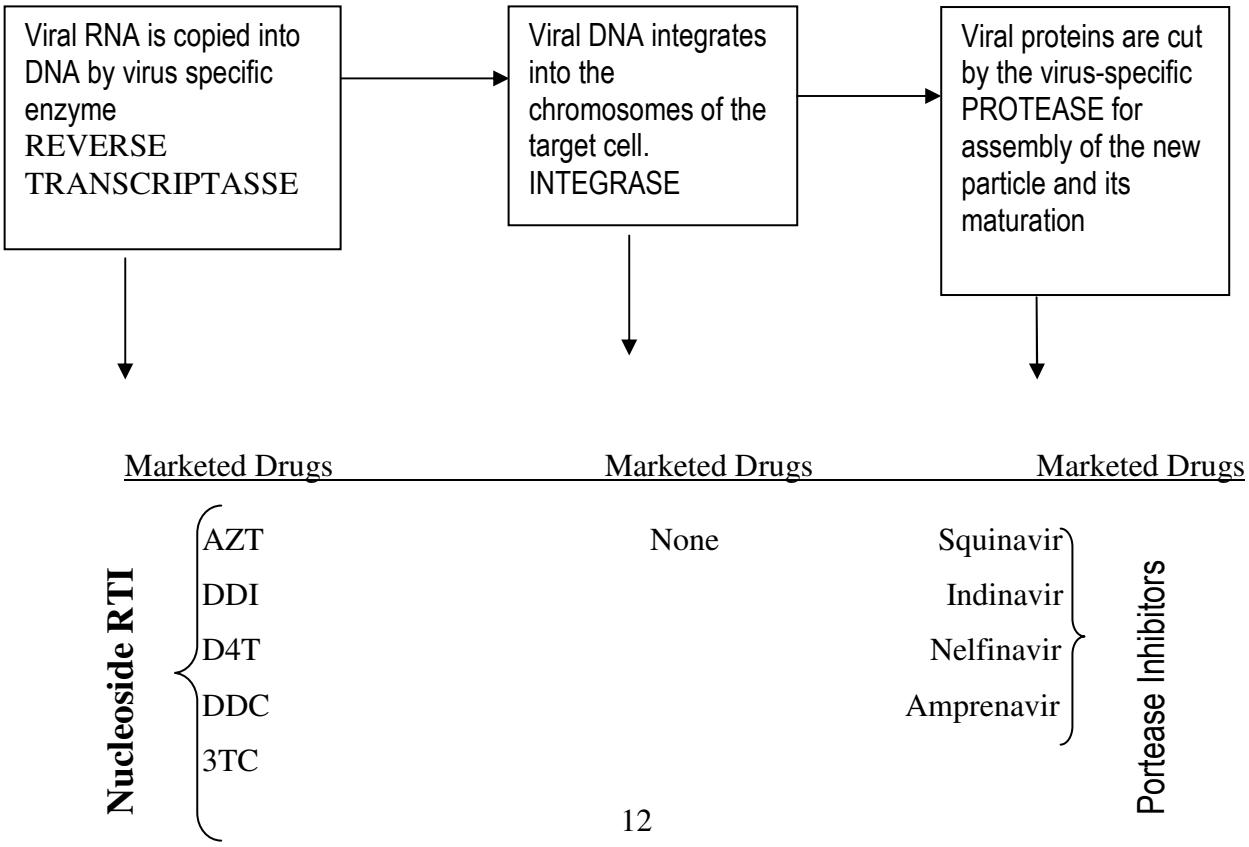
Type of ARV drugs	Classification	Function
Zidovudine (ZDV, also Known as AZT)	Nucleoside RTI*	- Prevention of MTCT** of HIV -Also used in combination therapy
Nevirapine (NVP)	Non Nucleoside RTI	-Prevention of MTCT -Used in combination therapy
Abacavir	Nucleside RTI	Used in combination therapy to suppress replication of HIV

Delavirdine mesylate	Non-Nucleoside RTI	”
Didenosine (ddI)	Nucleoside RTI	”
Efavirenz	Non-Nucleoside RTI	”
Indinavir	Protease Inhibitor	”
Lamivudine (3TC)	Nucleoside RTI	”
Nelfinavir	Protease Inhibitor	”
Ritonavir	Protease Inhibitor	”
Saquinavir	Protease Inhibitor	”
Stavudine (d4T)	Nucleoside RTI	”
Zalcitabine (ddC)	Nucleoside RTI	”

Source: Sande and Moelling, 2000.
*RTI = reverse transcriptease inhibitors
**MTCT = mother-to-child transmission
Therapeutic antiretroviral drugs target essential enzymes of the virus to supress HIV/AIDS

as shown in the following diagram:

Fig. 2.1 Essential enzymes and ARV drugs



Abacavir

Non-Nucleoside RTI { Nevirapine, Delavirdine, Efavirez

Source: Unger et al. (2000)

Improvement of a patient's quality of life is determined by the starting time of taking the ARV drugs. Prescribing the drugs both too early and too late in a patient's illness has its own adverse effects. This is especially true for patients with *asymptomatic* HIV infection.

Table 2.2. Too early and too late prescription of ARVs

Prescription	Benefits	Risks
Delayed	-Avoid negative effects on quality of life (i.e., inconvenience from taking the drugs) - Avoid drug-related adverse effects - Delay in development of drug resistance - Preserve maximum number of available and future drug options when HIV disease risk is highest	-Possible risk of irreversible immune system depletion -Possible greater difficulty in suppressing viral replication -Possible increased risk of HIV transmission.
Early	-Control of viral replication easier to achieve and maintain -Delay or prevention of immune system compromise -Lower risk of resistance with complete	- Drug-related reduction of quality of life - Greater cumulative drug related adverse effects -Earlier development of drug

	viral suppression -Possible decreased risk of HIV transmission.	resistance if viral suppression is sub-optimal -Limitation of future ARV treatment options.

Source: HIV 101, 2001

Therefore, if the drugs are prescribed too early, the drugs' side effects may be noxious, while the health of the person living with the virus may deteriorate if prescription is too late. Most guidelines focus on CD4 counts because it is possible to begin therapy by determining the infection level. Even if the US and the British ARV guidelines *mandate* commencement of ARV therapy if a patient's CD4 count is below 350 and *recommend* treatment if the count is in the range of 350 to 500, clinical trial and observational data indicate that since the risk of opportunistic diseases increases markedly when the CD4 cell count declines to <200 cells/mm^3, patients with this level of CD4 cell count or clinically defined AIDS should be offered the therapy (HIV101, 2001). This is also supported by Gebregiorgis (2001) who argues that least developed countries should stick to a CD4 count of <200, as this is the only proven standard for treatment. However, in resource-poor settings CD4 and viral load counts are unlikely to be available on all patients. When to start ARVs is then determined by clinical symptoms such as oral candidiasis, weight loss greater than 10%, and chronic diarrhoea (Cock, 2001).

The assumed positive impacts of ARVs are reduction in the need for inpatient hospital visits; the probability of an increase in the productivity of individuals as workers extend their time within the workforce; the reduction of the number of new infections. This assumes that a reduction in viral load leads to reduced infectivity and also that there is a

decline in risky behaviour, including an increase in the practice of voluntary counselling and testing. However, recent studies indicate that for a certain percentage of all people living with AIDS, ARVs are ineffective (Forsythe, 1998). It may also induce people to become careless and spread the disease if HIV infection is perceived to be a treatable disease. Moreover, the costs of ARVs may far exceed any economic benefit.

It is generally accepted that the most effective form of treatment is a combination of three ARVs, including one protease inhibitor. However, because the protease inhibitors are new and relatively expensive, many developing countries don't view providing access to this full complement drugs as an affordable option (Forsythe, 1998). Floyd and Gilks (1997) identified that triple combination therapies' cost range from US$ 662 to $993 per month, double combination therapies range in costs from US$ 403 to $773 per month, while the one therapy, Nevirapine, costs US$272 per month. At the beginning of year 2000 the price of combination ARV drugs to treat one patient for one year was typically between US$ 10,000 to $12,000 almost everywhere (UNAIDS, 2001).

Generally, medical drugs are produced by two kinds of companies:

- Pharmaceutical companies primarily undertake R&D and hold patents in their new discoveries, which only they have the right to manufacture and sell. Most of these pharmaceuticals also known as originators or the research-based industry are based in the North and dominated by few large multinational companies.

- Generics Manufactures, on the other hand, primarily produce medicines based on the formulae of the patented companies. They may do some additional research to produce their own versions. These are based both in the North and the developing world (Panos, 2002). Generic or non-patented drugs can be much cheaper than patented ones because in the case of imitation the cost stream is much smaller than investing in innovation.

The primary goal of both pharmaceutical and generic companies is to make profit. For pharmaceuticals, profit comes from the sales of patented drugs. Even if pharmaceutical companies recognize that ARVs are very expensive to be affordable for developing countries, they are also concerned that if they offer discounts there might be arbitrage opportunities (Forsythe, 1998). For generics, profit generally comes form selling drugs that are non-patented, no longer patented or patented elsewhere- at prices lower than those of their competitors. Generic ARVs are being produced in countries that ignore patents, such as Brazil, India and Thailand. However, these countries are not free from pressure from the giant companies.

To ensure steady future demand for the drugs, the pharmaceutical companies ask developing countries to sign extended contracts for the purchase of ARVs. Recently, however, prices offered to low-and-middle income countries fell dramatically.

Two international attempts have been made to increase access to the drugs. The first effort, Accelerating Access Initiative, was launched in May 2000 by the joint UN programme on HIV/AIDS (Panos, 2002). By the end of 2000, prices of US$500 to US$800 were being

negotiated by low- and-middle income countries for therapies based on patented and generic drugs. By December 2001, certain generic combinations were on offer for as low as US$350 per person per year (Unicef/UNAIDS, 2001). The second international attempt to increase access to drugs was the Global Fund for HIV/AIDS, Tuberculosis and Malaria. This was launched in October 2002, which announced that generic drugs could be purchased with its grants (Panos, 2002).

Recently, five leading pharmaceutical companies (Boehringer Ingelheim, Bristol-Myers Squibb, Glaxo Wellcome, Merck and co., and HoffmanLa Roche) have dropped their third world prices for components of HAART, which for those who can afford has turned to be good news.

ARV TREATMENTS AT MACRO LEVEL

Analysing ARV treatments at macro level could involve - affordability, cost effectiveness, potential of cost saving and access and equity.

Affordability: this is assessed by obtaining information on the number of people eligible for ARV treatment, ARV treatment cost per person and total resources of the country. A WHO/UNAIDS (1998) estimation of the total cost required to have an ARV treatment programme to treat the whole adult HIV/AIDS infected people in Ethiopia reveals that this will cost 1.35 billion USD per year. If only people with actual AIDS cases are to be treated,

then 200 million USD per year is required. This does not include the total cost required for capacity building – the human and physical resources required for ARV treatment. These are:

- Sufficient number of counsellors
- Counsellors trained in drug adherence counselling
- Sufficient number of mid wives for MTCT interventions
- Laboratory services capable of offering the sophisticated tests required for monitoring ARV treatments
- Extra clinic space for counselling and testing services
- Adequate number of physicians trained in the usage of ARVs
- Patient follow-up to ensure compliance with drugs and/or manage side effects
- Strengthened health education concerning safe feeding practices for mothers receiving treatment to prevent MTCT.
- Secure buildings for drug storage
- Drug resistance monitoring capacity etc (WHO/UNAIDS, 1998).

According to one survey in Addis Ababa carried out by UNWECP in 2001, the majority of hospitals and higher clinics in the city deliver fragmented services to HIV/AIDS clients/patients. Not all hospitals and higher clinics have laboratories for HIV screening or confirmatory testing. Furthermore, the majority of health facilities do not use supportive laboratory services to conduct staging of the disease or to monitor the progress of ARV treatment in their patients. There are only five licensed diagnostic facilities that perform limited types of HIV tests. Of these facilities only two conduct CD4 cell count and viral load tests (UNAIDS, 2002) .

The total cost of capacity building in Ethiopia is estimated to be 52 million USD per year (Policy Framework, 2002). The Ethiopian government therefore does not consider a fully subsidized ARV treatment program to be affordable to the country. However, the total cost of treatment and testing for the prevention of MTCT program is estimated at 2.28 million USD per year, which is believed to be affordable to the country. The cost of PMTCT programmes was estimated by using the following figures:

Proportion of women that have access to antenatal care (35%ANC coverage)= 1,140,000

The cost for screening (1.5USD per screening)=1,710,000

Total cost for treatment = 570,000

Total cost for treatment and testing cost 570,000+1,710,000 = 2.28 mill USD

Cost Effectiveness: the decision to use ARV treatment by an individual is based on the *willingness and ability to pay*. However, the decision whether ART is likely to represent a good use of resources managed on behalf of communities is based on cost-effectiveness analysis. The guidance module on ARV treatments of WHO/ UNAIDS (1998) suggests that prevention of MTCT is the most cost effective. Triple combination therapy for infected adults, however, is cost effective in countries with per capita incomes over USD 8,000.

Cost Saving Potential: If ARV treatments prevent HIV- related health problems like TB, then they will result in some cost savings. However, Floyd and Gilks (1998) note that therapies would only be cost saving in countries with average per capita incomes of at least US$ 8,776.

Equity and Access: This is concerned with the distribution of resources for ARV treatment. Equity addresses the issue of who is likely to benefit from ARV treatment, which has an important implication for financing policy. The second issue addressed is the fairness of such an access. WHO/UNAIDS (1998) guidance module states that since ARV treatments require specialized staff and equipment, urban populations are more likely to have access to them than rural populations and some marginalized and vulnerable groups.

With respect to financing, different options can be considered including public funding, national insurance and social security schemes, private insurance, voluntary sector or charitable funding, local or community funding, out-of-pocket payment /private funding/, donor financing and development loans. The WHO/UNAIDS guideline states that:

"unless the public sector can afford to provide a substantial portion of the funding required for ARV therapy, or unless social insurance is wide spread, it is unlikely that provision to anything but a small minority of patients is feasible" p. 24

THE FDRE POLICY ON ARV DRUGS

The ARV drugs supply and use policy of the Federal Democratic Repulic of Ethiopia was formulated in 2002, fifteen years after one of anti-retroviral agent (AZT/Zidovudine) was a common medical practice to prescribe to AIDS patients in other parts of the world.

The objectives of this policy include:

- Reducing transmission of HIV from mother to child.

- Prolonging and improving the quality lives of PLWHA thereby making them productive and contribute to the well being of their families and development of their country.
- Reducing accidental HIV infection within health care institutions.

With regard to supply strategies of ARV drugs the policy, among some other more, outlines the following:

- The government shall supply ARV drugs used for prevention of MTCT to the appropriate health care institutions through coordination of all stakeholders.
- ARV drugs shall be exempted from taxation; supplied at a reduced price through government's negotiation with manufacturers, importers and distributors; and be purchased through a system of bulk and generic substitutions.
- The private sector will be encouraged to be involved in locally manufacturing, importing and distributing ARV drugs.

CHAPTER THREE

LITERATURE REVIEW

The first section of this chapter describes some of the methods of economic valuation including revealed preference method, stated preference method and human capital approach. This will be followed by a review of the theoretical foundation of willingness to pay. The last section of the chapter reviews empirical CV studies in health economics.

3.1 Methods of Economic Valuation

Several practical methods can be used to measure willingness to pay for goods and services in general and health services in particular. The three most frequently used and/or

suggested methods are indirect methods using market data, survey techniques, and the human capital approach (Johansson, 1995). The first two are the most common ways of estimating economic values attached to non-marketed goods and services. If a good or service has positive economic value, then preferences show up through individuals' willingness to pay (WTP) for the good or service in question. WTP in the market is made up of two components: the price or what is actually paid and the consumer's surplus or the excess of WTP over the price. The latter is then a measure of the net gain from the purchase of a marketed good. On the other hand, in a pure non-market context, all WTP is consumer's surplus because there is no market price. A disservice, or "bad", has negative economic value shown up by the *WTP to avoid* the bad in question, as a willingness to accept (WTA) compensation to tolerate the disservice (Summary Guide, 2002). For cost benefit analysis based on the Hicks-Kaldor compensation test, WTP would seem to be the appropriate measure for gainers from some resource allocation decision, and WTA the proper measure for losers from that same allocation (Bateman and Turner, 1997).

Market-Based / Revealed Preference/ Methods

These methods are referred to as indirect methods since the preference revelation is indirect via a market. In these methods market prices are used to evaluate risks. For example, the economic value of noise nuisance can be reflected in house prices where houses in noisy areas are likely to be cheaper than comparable houses in quieter but otherwise similar areas (Summary Guide, 2002). This method is used to study individuals' averting behaviour where by they buy themselves a risk reduction for money. WTP can be estimated either by

observing the prices that people pay for goods in various markets or by observing individual expenditures of money or time to obtain goods, or to avoid their loss, and by inferring WTP amounts (Abelson, 1996). Revealed preference uses direct observation of actual values for complementary effects. The different approaches used to measure value impacts are:

- *Travel cost model*, which is used to value recreational assets via the expenditures on travelling to the site. The idea is to collect information about preferences from people's actual behaviour. In other words, people do not buy the commodity (visit an area) unless they find it worth its price (travel cost). However, this method captures only use values and does not consider planned future visits (Freeman, 1998).

- *Direct choice model or random utility model* uses choices between alternative options to reflect the well-being/ utility that accrues from those options.

- *Averting behaviour* estimate*s* expenditures involved to avoid unwanted effects. An instance is the presence of an air conditioner in a home or in a car to reduce exposure to air pollution. However, not only the cost of averting behaviour is inherently difficult to measure but also measuring the cost of averting behaviour is complicated by the fact that many avoidance activities produce joint products.

- *Hedonic Pricing* measures the effects that show up in labour markets (or property markets). This is the most common indirect method used to study wage differentials in the labour market. Given firms' and workers' institutional environment, wage differentials can

be explained as firms' different offers of wages depending on what health risks are involved, and workers' different preferences for safety. If a firm has undertaken risk reduction measures, the maximum wage it is willing to offer will be lower than otherwise.

In general, some argue that revealed preference studies, whether based on labour market data or consumer behaviour, make untested assumptions about individuals' risk perceptions (Krupnick et al, 2000).

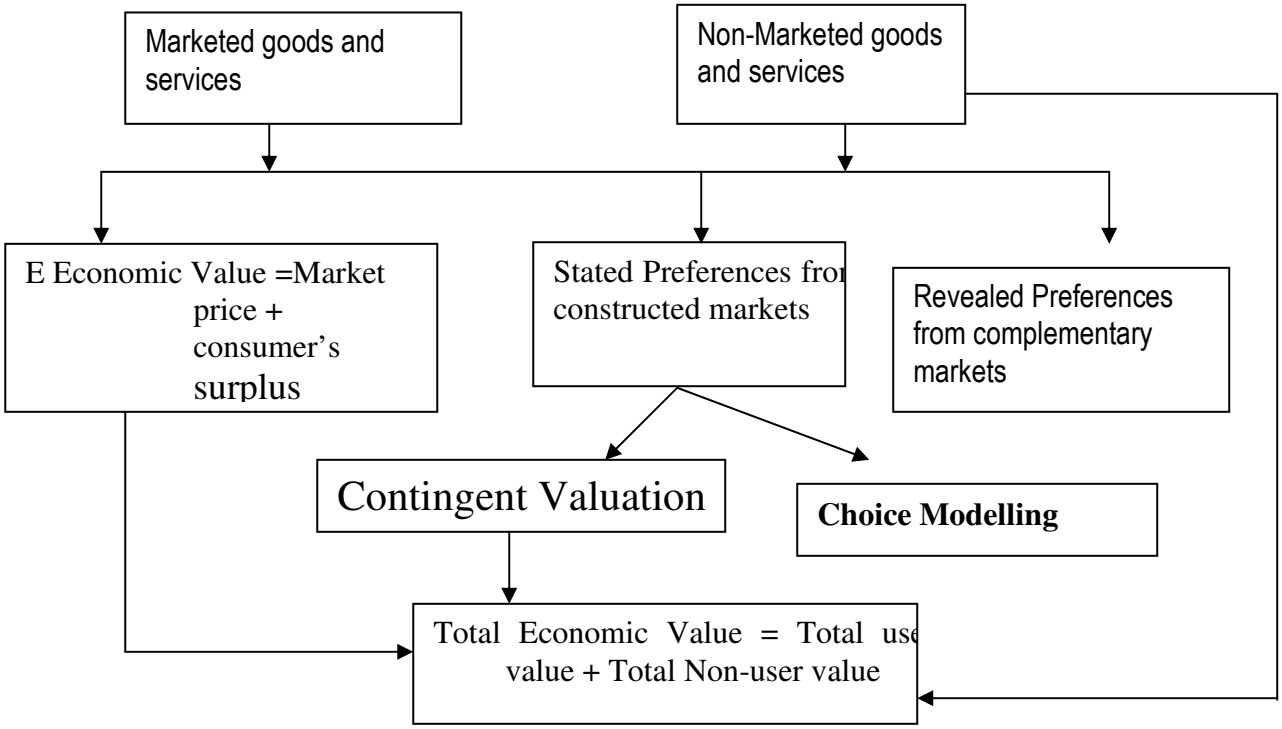
Stated Preferences Method

This is the modern name for the survey method. Stated preference approaches are based on constructed markets. That is, under this approach people are asked to state the economic value they attach to those goods and services under consideration. The stated preference approach elicits economic values by using two methods: *the contingent valuation method* where respondents to a questionnaire are asked for their WTP and *choice modelling* which refers to a variety of procedures for inferring WTP from sets of rankings or ratings of alternative options presented to respondents (Summary Guide, 2002).

Mitchell and Carson (1993) acknowledge Robert K. Davis (1963) to be the first to use CVM for the estimation of the benefits of outdoor recreation. This method provides the only way of directly measuring willingness to pay and willingness to accept.

The following figure summarizes the concepts that have been introduced so far.

Fig.3.1 Economic valuation



Summary Guide, 2002

From the above figure it is obvious that the objective of economic valuation technique is to uncover the total economic value of the good in question. The value may accrue to users-persons who make direct or indirect use of the good and to those who make no direct use of the good (non-users); an instance for the latter is the WTP for endangered species, even though the individual may not have seen, or expect to see, the species in question.

Human Capital Approach

Under this view, the value of an individual is equal to the value of his/her contribution to total production, and assumes that this value can be measured as his/her earnings

(Johansson, 1995). This implies that the value of preventing someone's statistical death or injury is equal to the gain in the present value of his/her future earnings.

$$\text{Value} = \sum \Pi_{t+i} E_{t+i} / (1+r)^i \qquad \forall\ i = 1 \ldots .T$$

Where: Π_{t+i} = probability of the individual surviving from age t to age t+i

E_{t+i} = expected earnings of the individual at age t+i

r = discount rate

T = age of retirement from the labour force

According to this approach. The value of preventing the death of an individual who is presently at age t is the discounted present value of that individual's earnings over the remainder of his/her expected life (Freeman, 1998).

The implication of the approach is that not only is the statistical life of retired people has zero value but also the statistical life of children is likely to be worth less than that of adults in or near their best period of earnings. The latter is due to the fact that because of discounting and the time lag before children become productive participants in the economy, the human capital approach places a much lower value on saving children's lives compared with saving the lives of adults in their peak earnings years. People whose value of production is not reflected by wage payments (like housewives) are also difficult to handle within the human capital approach framework. Another shortcoming of this method is it does not take into account the indirect damage due to death and injuries. Furthermore, this approach is highly criticized for being not consistent with the individualistic foundation of welfare economics since it does not take people's own preferences on changes in the health risks into account.

3.2 THE CONTINGENT VALUATION METHOD

Contingent valuation is a method of estimating the value that a person places on a good or service. Rather than inferring from observed behaviours in regular market places, the approach asks people to directly report their willingness to pay to obtain a specified good or service, or willingness to accept to give up a good or service.

3.2.1 Theoretical Foundation of WTP Approach

When an estimation of WTP is carried out for marginal changes in the probability to die within a given period of time then one is dealing with an *ex post* scenario while it is *ex ante* if the concern is with the WTP for marginal changes of the expected life span (Zweifel, 1997).

Let's consider a simple model in which individual's utility is a function of risk of death and wealth (Y). Survival (ϕ) is designated by a dummy variable where,

$$\phi = \begin{cases} 1 & \text{if} \quad \text{“life”} \\ 0 & \quad \text{“death”} \end{cases}$$

Hence, $U(\phi, Y)$

The assumptions made by this model are:

i. U[1,Y] > U[0, Y] i.e., the individual at any level of wealth prefers life to death.

ii. $U_y[1, Y] > U_y[0, Y]$ Where: $Uy = \partial U(\phi, Y)/ \partial Y$

iii. $U_y[\phi, Y] > 0$, $U_{yy}[\phi, Y] < 0$ i.e., U (ϕ,Y) is twice continuously differentiable, strictly increasing, and strictly concave.

Assumption ii states that the marginal utility of wealth in case of survival is higher than in the case of death.

$$U_1(Y) = U[1,Y],\ U_0[Y] = U[0, Y] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The above are the two conditional utility functions, which can be written as:

$$U(\phi, Y) = \phi\, U_1(Y) + (1-\phi)\, U_0(Y) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

If the dummy variable (1-ϕ) is replaced by Π, the probability of death, then the expected utility of the individual can be obtained by weighing the utility payoffs obtained in the states of nature "life" and "death" by their respective probabilities and adding them up. Hence,

$$EU(\Pi, Y) = (1-\Pi)U_1(Y) + \Pi\, U_0(Y) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

The total derivative of (3) gives us:

$$dEU[\Pi, Y] = \frac{\partial EU}{\partial Y} dY + \frac{\partial EU}{\partial \Pi} d\Pi = 0 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

$$= \{(1-\Pi)U_1'[Y] + \Pi U_0'[Y]\} dY + (U_0[Y] - U_1[Y]) d\Pi$$

To get the marginal rate of substitution between changes in risk and wealth, let's solve with respect to dY/dΠ,

$$m[\Pi, Y] = \left.\frac{dY}{d\Pi}\right|_{dEU=0} = \frac{U_1[Y] - U_0[Y]}{(1-\Pi)U_1'[Y] + \Pi U_0'[Y]} > 0 \quad \text{.....(5)}$$

The above equation states how much the individual's wealth must increase in order to compensate him/her for an infinitesimal increase in the risk of death (or decrease in the probability of survival). In other words, the monetary value of a marginal reduction of the death risk corresponds to the individual's marginal rate of substitution between his/her wealth and his/her probability of survival. The numerator shows the utility difference between "life" and "death" at a given level of wealth, which is positive due to assumption (i) and the denominator shows the expected value of the marginal utility of wealth, which is positive as well, due to assumption (iii).

If we differentiate dY/dΠ with respect of Π then,

$$\partial m / \partial \Pi = d^2Y / d\Pi^2 = \frac{-(U_1[Y] - U_0[Y])(U_0'[Y] - U_1'[Y])}{\{(1-\Pi)U_1'[Y] + \Pi U_0'[Y]\}^2} > 0 \quad \text{.....(6)}$$

implying the response of the marginal rate of substitution to an increase in the initial level of the death risk Π. The expression is positive because the first term in parentheses in the numerator is positive due to assumption (i) and the second is negative due to assumption (ii). Therefore, the marginal rate of substitution and hence the marginal WTP for infinitesimally small changes in death risk rises with an increase from its initial level.

Similarly, to examine how the marginal rate of substitution, m(Π, Y), changes with a variation of the initial level of wealth, let's differentiate (5) with respect to y

$$\partial m(\Pi,Y)\big/\partial Y = \frac{EUy\left(U_1'[Y]-U_0'[Y]\right)-\left(U_1[Y]-U_0[Y]\right)EUyy}{(EUy)^2} > 0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where: EUy = $\partial EU\big/\partial Y = (1-\Pi)U_1'[Y]+\Pi U_0'[Y] > 0$

EUyy = $\partial^2 EU\big/\partial Y^2 = (1-\Pi)U_1''[Y]+\Pi U_0''[Y] < 0$

In line with assumptions (i) and (ii), the numerator on the right hand-side of (7) is positive and so is the denominator. Therefore, the marginal WTP for a reduction of the death risk increases with wealth.

3.2.2 Methodological Basis

A contingent valuation survey generally provides a direct way of eliciting WTP values by asking a sample of households what they would be willing to pay for a good or service. Telephone survey, mail survey, and in-person interviews are the various methods used to directly query individuals about their WTP. Telephone and in-person interviews allow respondents to ask questions whereas not only is this not possible in mail survey but also this method does not provide one the luxury of conducting follow-up questions about WTP depending on the answers given to previous questions. It is argued that telephone and mail surveys are less cheap, particularly in developed countries, but produce less quality WTP data. In-person interviews in general help to produce the highest quality WTP data, though

very expensive since these are labour intensive. In most LDC situations telephone and mail surveys may not be practical, leaving in-person surveys as the method of choice.

a) Bias Issues

CVM surveys are prone to various types of bias, which occur in the design as well as in the execution of the survey.

- ***Hypothetical bias***: If the researcher does not create a believable and meaningful set of questions that will simulate a market for the good/service in question with sufficient plausibility or if the scenario is not consistent with reality, then the responses people give to the hypothetical questions are likely to be careless, which do not reflect their taste preferences. Bateman and Turner (1997), however, argue that WTP formats unlike WTA formats, do not suffer from hypothetical bias because usually respondents are familiar with payment rather than compensation scenarios.

- ***Strategic bias/free riding***: If respondents believe payments of their WTP will be collected from them, and believe also that there is a good chance the good/service will be provided even if they understate their true WTP amounts, they tend to underbid their WTP - this is *strategic classic free rider*. On the other hand, respondents may 'over pledge' i.e., they would be expected to overbid if they believe they will not actually have to pay the amount they state, yet believe that the stated amount can influence provision of the good/service.

- ***Starting point bias***: This type of bias occurs when the respondent's WTP amount is influenced by a value introduced by the scenario. Confronted with a Birr figure where s/he is uncertain about the value of the good/service in question, a respondent may regard the proposed amount as conveying an approximate value of the good's/service's true value and anchor her/his WTP amount on the proposed amount. Hence such "bidding hint" lead respondents to take cognitive short-cuts to arrive at a decision rather than thinking seriously about their true WTP. Therefore, this is an effect such that the final amount at the end of a bidding game (*see next section*) is systematically related to the initial bid value**.**

- ***Payment Vehicle bias***: WTP may depend on choice of payment vehicle where different payment vehicles may cause strategic behaviour. This bias occurs when the payment vehicle is either misperceived or is itself valued in a way not intended by the researcher. Bateman and Turner (1997) suggest that researchers can effectively eliminate such problems by avoiding controversial payment methods and instead use that vehicle which is most likely to be used in real life to elicit payment for the good in question.

- ***Question ordering bias/ sensitivity of sequencing***: WTP varies with where in a sequence of goods a particular good appears. This is potentially troublesome in CV surveys when values are elicited for several different programmes or different levels of a programme. For some goods there is a natural sequence to the provision of the good that prescribes the order of questions, and respondents answering later questions are intended to take their answers to earlier questions into account. Here the question order may influence the amounts given

for one or more of the goods that are being valued, despite the interviewer's instructions to the respondents to disregard previous answers.

- ***Interviewer and respondent Bias:*** Respondents may have a tendency to answer with yes in order to express motivation or just to please an interviewer for a programme instead of giving true preferences. For instance, if the interviewer is highly educated or attractive the respondent may feel inhibited about expressing a low WTP bid. Hence in this ***Yea-saying bias***, elicited WTP are too high. This can be minimized by using mail or telephone rather than face-to-face method of interview. On the other hand, in ***Nay-saying bias***, respondent may have the tendency to counter the interviewer if the former dislikes the latter. In this case too low WTP are elicited.

- ***Non-response Bias***: Respondents may refuse to answer or they may give ludicrously high WTP or untrue zero WTP (Protest Zeros). This may be because they oppose the payment vehicle or are ambivalent. If protest zeros are removed from the sample, higher WTP may result.

- ***Warm glow effect***: Also known as ***mental account bias*** or ***part-whole bias***. WTP may not vary with the size of the programme because respondents do not reveal preferences but general approval. That is, the individual's WTP responses fail to distinguish between specific good which is under analysis and the wider group of goods into which that specific good falls. The dimensions of a good that are particularly prone to this misperception are its geographic distribution, its benefit composition, and the package of policies of which it is a

part. Geographical part-whole occurs when a respondent values a good whose spatial attributes are larger or smaller than the spatial attributes of the researcher's intended good. Benefit part-whole bias is related to the fact when a respondent includes a broader or a narrower range of benefits in valuing a good than intended by the researcher. If a respondent values a broader or a narrower policy package than the one assumed by the researcher then it is policy-package part-whole bias.

- ***Information bias***: Respondents may not be familiar with the commodity being valued or WTP may vary with information provided. Bateman and Turner (1997), however, note that the important factor is to ensure that such information is seen to be true, constant across the sample, and not designed to induce bias towards a particular result, polemic and implicit value judgement being inadmissible.

Other biases that may occur during a CV survey include: ***Framing effects bias*** where WTP depends on how the question is framed. For instance, whether the glass is seen as half full or half empty (Summary Guide, 2002); ***Preference imprecision bias*** occurs when respondents are unable to cite precise WTP; ***Reference dependency bias*** refers to the situation when WTP varies with the reference point as perceived by the respondent.

Apart from the afore mentioned problems of CVM, Whittington (2002) tried to categorize the sources of problems in CVM when applied in a developing country. He identified three main reasons why many CV studies conducted in developing countries are so bad. The first is poor survey implementation due mainly to poorly trained enumerators and the resulting ***enumerator bias***. This is the principal-agent problem in which the researcher (principal)

typically does not know the enumerators (the agents) before the survey and has no long-term relationship with them.

The second problem identified by Whittington is poorly crafted contingent valuation scenarios. This is the same as ***hypothetical bias***, in which case CV researchers themselves cannot construct hypothetical choices that make economic sense to respondents.

Failure to test for the effect of variations in survey design on the results of contingent valuation studies is the third problem with CV surveys conducted in developing countries. For instance in iterative bidding (*see next section*) researchers may not do split-sample experiment to test whether respondents' WTP would be influenced by the magnitude of the initial price that they received and the sequence of follow-up questions. However, in my opinion these biases may also be common in developed countries and could not be argued to be peculiar for developing countries.

In general, although there are several sources of bias in CVM and some particularly pronounced in developing countries, Abelson (1996) notes that most of them can be dealt with appropriate survey techniques. Similarly, Bateman and Turner (1997) also highlight that CVM surveys can be designed to reduce bias problems to an acceptable level.

b) Elicitation Techniques

By using different formats it is possible to elicit WTP from a sample of households. According to different literatures on CVM, it seems that no elicitation method is exempt from one or more than one bias discussed in the previous section.

⇨ **Open-ended format**: Individuals may be asked to state their maximum WTP or minimum WTA amount with no value being suggested to them. For instance, respondents could be asked "What is the maximum you would be willing to pay for….?". This elicitation technique produces continuous bid variables. The method is straightforward and no anchoring bias occurs because it does not provide cues about what the value of the change might be. The other advantage of the technique is it is very informative since maximum WTP can be identified for each respondent. However, the format leads to unrealistically large bids and generally unreliable responses. This is because it might be very difficult for respondents to come up with their true maximum WTP 'out of the blue'. In addition, free riding behaviour may occur, which will result in a downwardly biased estimates of WTP.

⇨ **Referendum/ Take-it-or-leave-it/close-ended bidding**: Under this format individuals are presented with a single payment that they accept or reject. This method asks "Are you willing to pay $X?" It is argued that this method is incentive compatible i.e., it is in the respondent's strategic interest to accept the bid, if his/her WTP is greater than or equal to the price asked or reject otherwise so that the respondent is telling the truth. Even though it minimizes non-response and avoids outliers, there could be some degree of Yea-saying. Apart from the existence of starting point bias it is criticized for being inefficient in that less information is available from each respondent i.e., the researcher only knows whether WTP is above or below a certain amount. Hence, larger samples and stronger statistical assumptions are required, which make surveys expensive.

⇨ **Double-bounded dichotomous choice**: the question might run as "Would you pay $X amount?" If the response is yes then the next question is " and would you pay $X+Y" or "and would you pay $X-Y" if the response to the first question is no. The actual WTP then lies between X and Y if s/he accepted to pay $X in the first question but rejected $X+Y in the second. Though the double bounded dichotomous choice method is more efficient than single bounded dichotomous choice as more information is elicited about each respondent's WTP , all the limitations of the latter procedure still apply. Other cons of this technique include anchoring and yea- saying biases in addition to the possible loss of incentive compatibility (truth telling) due the fact that the second question may not be viewed by respondents as being exogenous to the choice situation.

⇨ **Iterative Bidding**: under this elicitation format individuals are asked to respond either to increasing figures until they reach their maximum WTP or to reducing figures if they are not WTP the initial figure suggested. It is believed that this method facilitates respondents' thought process and encourages them to consider their preferences carefully. Because of the initial bid prices usually anchoring bias exists. Moreover, it may lead to a large number of outliers and yea saying. Another drawback of the method is it cannot be used in mail surveys and other self completed questionnaires.

⇨ **Payment card elicitation technique**: this format is developed by Mitchell and Carson in 1986, as an alternative to bidding game (Mitchell and Carson, 1993). Respondents are provided with a range of values from which to select. The question would be like "which of the amounts listed below best describes your maximum WTP?" One advantage of this

method over bidding game is it avoids starting point bias. Bateman and Turner (1997), however, indicate that anchoring of bids within the range given in the card may occur with most respondents assuming that such a range contains the "correct" valuation (*range bias*). In comparison to bidding game, payment card elicitation method reduces the number of outliers. Though values in the card serve as a benchmark, there may be vulnerability to bias relating to the range of the numbers used in the card and the location of the benchmarks.

3.3 EMPIRICAL LITERATURE REVIEW

CVM techniques have been widely used for the purpose of estimating environmental benefits in particular. Recently, however, a lot of studies have tried to assess health care/services by applying CVM. Johansson (1995) emphasizes that CVM is appropriate for health studies since biases are minimized and the problems in using the CVM are somewhat smaller, or at least different, when the method is applied to health care, which is primarily a private good than when it is applied to large environmental changes or other public projects mainly characterized by externalities.

Different researchers used CVM to elicit WTP for different programmes. For instance, Cameron (1988) surveyed the WTP of patients, physicians, and managed care executives for diagnostic certainty for peptic ulcer disease and gastroesophageal reflux disease; Bishai and Lang (2000) elicited the WTP for a month reduction in waiting time for cataract surgery using bidding elicitation method; Pol and Cairns (1999) applied dichotomous choice question with follow up to examine inter-temporal preferences for non-fatal changes

in own health; Tambour and Zethracus (1998) used CVM to estimate the WTP for hormone replacement therapy; Bonato et al (2001) elicited the WTP for three possible health care programmes dealing with Alzheimer's diseases which is an acquired syndrome of decline memory and at least one other cognitive function most common among aged people.

The review of 42 health care contingent valuation studies by Diener et al (1998) that were published between 1984-1996 shows the use of CVM in valuing different health care programmes is increasing. The reviewers classified health care interventions as *medical, surgical, pharmaceuticals* and *hypothetical*- upon which the CVM is applied. Some of the studies were performed to assist in pricing and demand forecasts for a product and some to assist with programme evaluation. The latter was specially concerned with the implication of the introduction of a new health care programme or the removal of an existing programme. The vast majority of the studies reviewed by Diener et al (1998) have been compensating variation- WTP designs. The review of the 42 studies indicted that 55% of contingent valuation studies in health care surveyed persons either currently diseased or undergoing the treatment intervention- *ex post analysis*; 36% of the studies obtained responses from non-users that are at future risk of contracting the disease or in need of the intervention- *ex ante analysis*, while 10% of the studies asked respondents from the general population which may include respondents from the afore mentioned groups. The majority of the studies not only used target groups but also valued certain outcomes, and valued goods from a purely private market perspective. It was also found that all of the elicitation methods described in the above sub-section were employed almost equally by the 42 studies reviewed by Diener et al. (1998).

In 1997 and 1998, two studies estimated the WTP for reduced incontinence symptoms. The first was by Johansson et al (1997) in Sweden where 461 patients with urge or mixed incontinence were asked to state their WTP for a reduction in incontinence symptoms using mail survey. The result showed that in terms of magnitude of risk reduction, patients with incontinence problems were willing to pay more for a 50% than 25% reduction in the number of micturitions and leakages. The second study conducted in the United States by O'Conor et al (1998) also found that the mean WTP for a 50% reduction to be much higher (US$ 245) than for a 25% reduction (US$ 88) in micturitions and leakages.

Another health care study using CVM was done by Krupnick, et al (2000). In this intensive study, they administered a mortality risk reduction survey on 930 persons aged from 40 to 70 years in Ontario. By treating risk reduction as a private good (i.e., estimating each respondent's WTP to reduce his/her own risk of dying), they estimated what older people would pay for a reduction in their risk of dying in addition to assessing the impact of health status on WTP. They reported that age has no effect on WTP until roughly age 70 and above and the health status with the exception of having cancer, has no effect. However, the researchers found that being mentally healthy raises WTP substantially. In this study the elicitation technique used was follow-up dichotomous choice to obtain WTP for risk reductions of a given magnitude, occurring at a specified time. In one sub sample, respondents were first asked if they were WTP for a product that, when used and paid for over the next ten years, will reduce baseline risks by 5 in 1000 over the next 10 years period (5 in 10,000 annually). In the second WTP question, risks were reduced by 1 in 1000

(1 in 10,000 annually). This question was used to serve two purposes- on the one hand, it's possible to test whether respondents were willing to pay anything today for a future risk reduction and on the other hand, to test for internal consistency of responses because WTP today for a future risk change should be less than WTP today for an immediate risk change. Their finding suggests that responses were consistent with economic theory, and that WTP was sensitive to the magnitude of the risk reduction. Regardless of the estimation procedure they used, it was found that mean WTP for the 5 in 1000 risk reduction was statistically greater than mean WTP for 1 in 1000 risk reduction, which made their estimates pass the scope test and proved sensitive to size of the risk reduction.

Another application of the CVM related to health care and services was carried out by Belaineh Taye (2002) in Ethiopia. He estimated the WTP of 300 households in West Shoa zone for insecticide-impregnated bed nets against malaria by using the open-ended elicitation technique. He tried to present two scenarios to the households on how to acquire the bed nets- in cash and in credit. His result shows that the WTP for insecticide impregnated bed net in credit was higher (Birr65.05) than the WTP in cash (Birr 44.26).

Probably the first application of CVM for the evaluation of HIV/AIDS services anywhere in the world is Forsythe's PhD dissertation (2001) on the economic evaluation of HIV/AIDS services in Kenya. Apart from evaluating the costs and benefits of four HIV/AIDS services- voluntary counselling and testing (VCT), chronic care services, ARV therapy, and a hypothetical AIDS vaccine- he assessed the factors that influence how people value these services. In addition to these the researcher also tried to evaluate the

validity of CV in assessing benefits for HIV/AIDS programmes in developing countries. To obtain the data, the study employed the payment card elicitation technique. WTP was elicited using three survey instruments- VCT clients at the time of being counselled and tested were asked about their WTP only for VCT; VCT clients six months after having received their results were asked to state their WTP for chronic care services and ARVs while in the third survey instrument, people within the general community were asked to state their WTP for VCT, chronic care services, ARVs, an AIDS vaccine and their willingness to contribute to an AIDS charity. Respondents were also encouraged to rank the four services from highest community priority to the lowest. It was found that VCT was given a high value intervention while AIDS vaccine was rated as the second highest community priority. ART was ranked the least of all the health services. The findings of Forsythe's study indicate that PLWHA cited that they were willing to pay 11% of their monthly household expenditures for ARV therapy. The amount of WTP obtained from the data ($10.92 per month) was relatively smaller than the actual prices of the therapy ($210-282 per month). The estimation thus indicates that in Kenya the price of ARV therapy would need to be about $120 a year in order to be affordable for the government. With regard to determinates of WTP it was found that household spending was closely related to WTP responses across all four services. A focus on ARVs reveals that spending on medications also had high correlation to WTP. The variables- number of visits to health centre and having ever received chronic care service- were found to have weak correlation to WTP for ART.

While Forsythe claims that his research is the first application of CVM for the evaluation of HIV- related programmes, it is not the only one. Whittington et al. (2002) analysed the private demand for HIV/AIDS vaccine in Guadalajara, Mexico. By considering a hypothetical vaccine that would provide lifetime protection against HIV/AIDS, they estimated the WTP of *uninfected adults*. The CV survey was administered to 234 adults aged 18-60 years. The results of the estimates of private demand indicate that individuals anticipate sizable personal benefits from such a vaccine, and that they would be willing to allocate a substantial proportion of their income to be protected in this way from HIV infection. It was also found in the research that individuals with higher incomes, with spouses deceased or partners, and with perceived risks of becoming infected are WTP more for the vaccine while older respondents are WTP less.

CHAPTER FOUR

METHODOLOGY

4.1 Data source and type

The application of WTP in the areas concerning changes in individuals' economic welfare and reductions in the probability of death (due to illness or accident) is based on individuals' preferences. This presupposes that individuals treat longevity more or less like any other good rather than as a hierarchical value. This economic approach for the valuation of individual's WTP to increase his/her own life expectancy can be derived by focusing on *ex ante* perspective- before the uncertainty about the individual's death during a specified period of time is resolved; or *ex post* perspective- each individual knowing if s/he is to die "now" or live a while longer. The former perspective is criticized for being morally unacceptable (Freeman, 1993).

In this paper it is assumed that the availability of ARV drugs is most probably highly valued by PLWHA than people without it. This is also attested by the findings of Forsythe (2001) where HIV-positive clients had a higher WTP to have access to ARVs relative to HIV-negative clients. Therefore, this study followed an *ex post* approach where by the contingent valuation survey was used to solicit the willingness to pay for the drugs by people living with the virus. Furthermore, instead of asking individuals from the society whether they are HIV positive (especially due to stigma) and would pay for the drugs, only

residents of Addis who were willing to reveal themselves as carriers of the virus were interviewed. This was administered through in-person interviews.

4.2 Sampling procedure

There are two national associations of PLWHA registered as NGOs to enable them to operate. These are Dawn of Hope and Mekdim Ethiopia whose primary objective is to protect the rights of members and to contribute to HIV/AIDS prevention activities. The target population of this research is people living with the virus. The sample respondents were drawn from the members Dawn of Hope and Mekdim Ehiopia. Attempt has also been made to contact some medical doctors who have clients living with the virus.

From the above target group, sample was drawn by using ***opportunity sampling***, which is a method of *non-probabilistic sampling*. This is the simple expedient of including as subjects whoever happens to be available from the population of interest. When members of the respective associations contacted the association for some reason or another interviews were conducted. Since the interviewers themselves were workers in the associations, it was also possible to solicit responses when they visited members in their homes. At the same time, clients with the virus of some doctors were also interviewed when they visited their doctors for diagnosis. The total sample size of the survey was 440, which was obtained according to the availability of people. A sample of 270 respondents from Dawn of Hope, 165 from Mekdim Ethiopia and 5 patients from some doctors were included in survey.

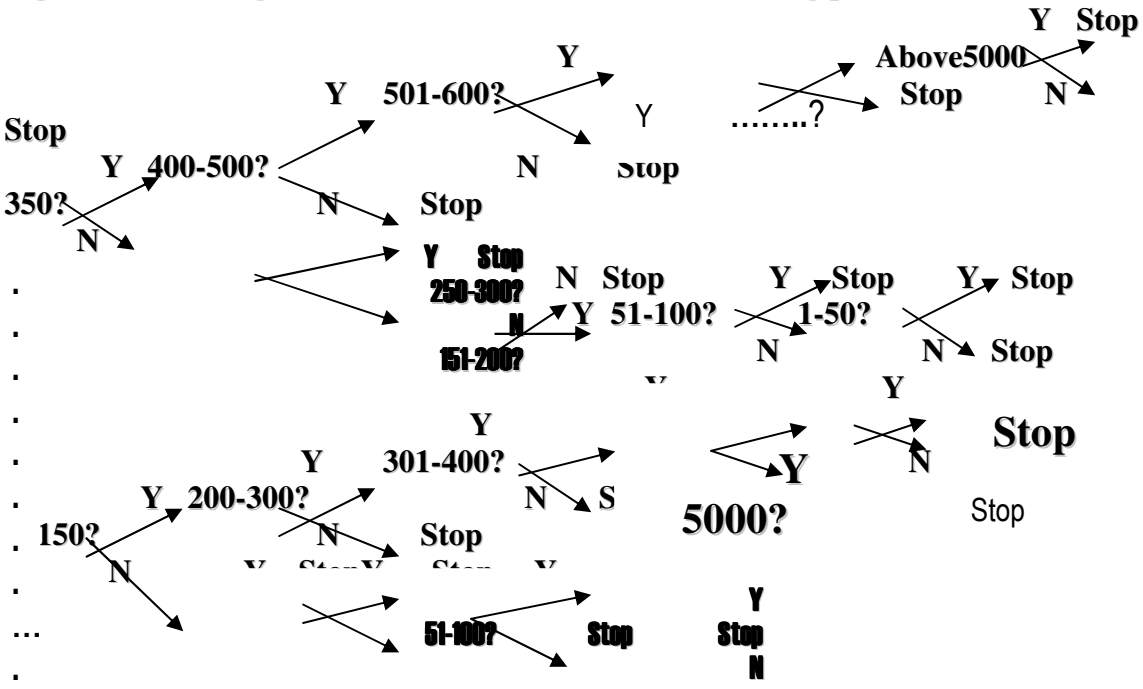
4.3 Questionnaire Design

The CV survey begins with the description of the objective of the paper. This is followed by socio-demographic questions. Part two of the questionnaire presented questions that help to identify the knowledge, attitude and practice of respondents with respect to the drugs.

The next section of the questionnaire was the payment question, in which respondents were presented with an initial bid amount and increasing (decreasing) amounts until the respondent declined (or accepted) to pay. Respondents were asked if they would purchase the drugs at $350 per year (approximately Birr 250 per month) or not. This threshold figure is based on the current price of the drugs in the other parts of the world (UNAIDS, 2002 and Walgate, 2002).

However, since starting point bias occurs when the respondent's WTP amount is specified by a value introduced by the scenario, the paper used five different initial bid amounts (350, 300, 250, 200, 150) in order to take care of the "starting point bias" problem - an effect related to the initial bid value. Those who responded "No" would be asked if they would be willing to purchase the drugs at a lower cost. If they were still unwilling to buy the drugs at all then they were asked to state or name the reason why they would not. On the other hand, those who responded "Yes" were given a follow-up question in which s/he is willing to pay a higher price (See Annex III for the copy of questionnaire used).

Figure 4.1. Bidding Game with Birr 350 to Birr 150 starting points.



The intervi ing the drug lengthens life years by indefinite years and ten years. This will also provide a test for consistency of results with economic theory, in which WTP should be sensitive to the magnitude of risk/mortality reduction.

Respondents then were asked some questions to identify the determinants of WTP. In the last part of the survey questionnaire, respondents were asked about their attitude towards government's responsibilities.

All respondents were interviewed in Amharic. When translating the questionnaire from English to Amharic great care was taken so as not to offend or irritate respondents.

4.4 Methods of Data Collection

A total of twelve persons (10 enumerators and 2 supervisors) participated in the survey. All of the twelve participants were workers in the two associations that live with the virus, a deliberate action designed to avoid interviewer bias. This is so because the researcher believed that it may be comfortable to respondents to be interviewed by a person who knows how it feels to live with the virus.

A pilot survey was conducted by the researcher and some adjustments, such as including more questions, re-ordering the questions and excluding offensive words were executed. Prior to the main survey both enumerators and supervisors were trained. The fieldwork for the year 2003 started in the second week of February and was completed in the second week of March. The excellent cooperation from workers of the associations, especially DOH facilitated the fieldwork.

4.5 Method of Data Analysis: An econometric Approach

In the simple regression model:

$$Y_i = \beta_1 + \beta_2 x_i + u_i \qquad i = 1,2,\ldots,n$$

We may observe the dependent variable only when $Y_i>0$. However, the observed values of the dependent variable may sometimes have a discrete jump to zero. A dependent variable with the property that has a discrete jump at zero is known as a limited dependent variable. When the dependent variable is limited by some value either from above or below, the data is said to be ***censored*** (Chay and Powell, 2001). Suppose y* has a normal distribution, with

mean μ and variance σ^2. We may consider a sample of size η (y_1^* , y_2^* ,…, y_n^*) and record only those values of y^* greater than a constant c and for those values of $y^* \leq c$, we record the value c.

The data is also said to be censored if the characteristics of respondents are available so that the factors impacting on the decision not to be willing to pay for (for the drugs, in this particular case), can be assessed. Some examples of censored data in empirical literatures forwarded by Greene (2000) are: the number of extramarital affairs; the number of hours worked by a woman in the labour force; the number of arrests after release from prison, etc. Each of these studies analyses a dependent variable that is zero for a significant fraction of the observations.

However, the first applications of the limited dependent variable model was given by Tobin (1958) where he applied it to model household expenditure on automobiles (as cited in Amemiya, 1985). Such models are referred to as **Tobit models** or as **Censored regressions.**

Let's assume a utility maximization problem by defining the following symbols:

y = a household expenditure on a durable good

y_0= the price of the cheapest available durable good

z = all other expenditures

x = income

Then the household maximum utility U(y,z) is subject to the budget constraint $y+z \leq x$ with the boundary constraint $y \geq y_0$ or $y = 0$. Suppose y* is the solution of the maximization subject to $y+z \leq x$ but not the other constraint, and assume that:

$$y^* = \beta_1 + \beta_2 x + u \qquad \text{…(1)}$$

Where u may be interpreted as the collection of all the unobservable variables that affect the utility function. The solution to the original problem, denoted by y is:

$$y = \begin{cases} y^* & \text{if } y^* > y_0 \\ 0 & \text{if } y^* \leq y_0 \end{cases} \qquad \text{…(2)}$$

Tobin (1958) assumed that y* is normally distributed and y_0 to be the same for all households. The ***standard Tobit model (Censored regression model)*** is then***:***

$$y_i^* = X'_i\,\beta + u_i \qquad i = 1,2,\ldots,n, \qquad \text{…(3)}$$

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases}$$

Conventional regression methods fail to account for the qualitative difference between limit (zero) observations and nonlimit (continuous) observations. Particularly, the standard OLS regression using censored data will typically result in coefficient estimates that are biased toward zero, neglecting the upward bias caused by the truncation.

The likelihood function for the Tobit is given by:

$$L = \prod_{y_i / y_i = 0} \left[1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right] \cdot \prod_{y_i / y_i > 0} \frac{1}{\sqrt{2\Pi\sigma^2}} \exp\left[-\frac{1}{2}\frac{(y_i - X_i\beta)^2}{\sigma^2}\right] \qquad \text{…(4)}$$

***Where* Φ = the distribution function of the standard normal**

The first part of the likelihood resembles the probit while the second part resembles the likelihood of conventional OLS on those sample points that are not censored (i.e., greater than zero). The log-likelihood is:

$$l = \sum_{y_i / y_i = 0} \ln\left[1 - \Phi\left(\frac{X_i\beta}{\sigma}\right)\right] + \sum_{y_i / y_i > 0}\left[\ln\frac{1}{\sqrt{2\Pi\sigma^2}} - \frac{1}{2}\frac{(y_i - X_i\beta)^2}{\sigma^2}\right] \text{.....(5)}$$

However, Greene (2000) and Johnston &DiNardo (1997) emphasize that if the underlying disturbances are not normally distributed, then the usual estimator based on (5) is inconsistent.

The coefficients of the Tobit model may not be sensibly interpreted. The expected value of y in Tobit's model is given by (McDonald and Moffitt, 1980):

$$Ey = \mathbf{X\beta}\, F(z) + \sigma\, f(z) \text{ .....(i)}$$

Where $z = X\beta/\sigma$,

$f(z)$ = normal density

$F(z)$ = the cumulative normal distribution function

Furthermore, the expected value of y for observations above the limit, y*, is simply **Xβ** plus the expected value of the truncated normal error term

$$Ey^* = E(y/y>0) \text{ .....(ii)}$$

$$= E(y/u > -\mathbf{X\beta})$$

$$= \mathbf{X\beta} + \sigma\, f(z) / F(z)$$

Consequently, the basic relationship between the expected value of all observations, Ey, and the expected value conditional upon the limit, F(z), is

$$Ey = F(z)Ey^* \quad \text{.....(iii)}$$

The McDonald and Moffitt marginal effect decomposition then is obtained by considering the effect of a change in the i^{th} variable of χ on y:

$$\frac{\partial Ey}{\partial \chi_i} = F(z)\left(\frac{\partial Ey^*}{\partial \chi_i}\right) + Ey^*\left(\frac{\partial F(z)}{\partial \chi_i}\right) \quad \text{.....(iv)}$$

The interpretation is that the change in the mean of y with respect to χ_i has two components. One effect works by changing the conditional mean of y (the change in y of those above the limit, weighted by the probability of being above the limit) and the other by changing the probability that an observation will be positive (the change in the probability of being above the limit, weighted by the expected value of y if above).

Powell's Least Absolute Deviations Estimator

Jim Powell (1984) proposed censored least absolute deviations (CLAD) estimator as an alternative to maximum likelihood estimation of the parameters of the censored regression model. This method does not impose normality and homoscedasticity on the distribution of the disturbance term. In other words, it requires weaker assumptions on the error term than the systematically trimmed estimator (Johansson and DiNardo, 1997).

Considering the standard index model:

$$\mathbf{y^* = X\beta + \varepsilon}$$

Where y* is not observed but rather y, where

$$y_i = \begin{cases} y_i^* & \text{if RHS } >0 \\ 0 & \text{otherwise} \end{cases}$$

which can be written as: $$y_i = \begin{cases} y_i^* & \text{if } \varepsilon_i > - \boldsymbol{X_i\beta} \\ 0 & \text{if } \varepsilon_i \leq - \boldsymbol{X_i\beta} \end{cases}$$

Powell notes that if y* were observed, and if the error term was systematically distributed around 0, then standard OLS would produce consistent estimates of the parameters. Since asymmetry into the distribution is introduced by censoring, for a given observation X_i , y* is not observed and all observations where $\varepsilon_i < - \boldsymbol{X_i\beta}$ are omitted.

If we assume that y* is observed in the basic censored regression model, then

$$E\,[y_i^* | \boldsymbol{X_i}\,] = \boldsymbol{X_i\beta} + E\,[\varepsilon_i \mid \boldsymbol{X_i}\,] = \boldsymbol{X_i\beta} \quad \text{.....(6)}$$

A consistent estimate can be obtained by **OLS** that is the solution to:

$$\min_{\hat{\beta}} \left[\sum_{i=1}^{n} (y_i^* - \chi_i \hat{\beta})^2 \right] \quad \text{.....(7)}$$

That is, $\hat{\beta}$ is the estimator that minimizes the *sum of squared errors*. Instead, however, one may choose to minimize the *sum of the absolute value of the errors*:

$$\min_{\hat{\beta}} \left[\sum_{i=1}^{n} \left| y_i^* - \chi_i \hat{\beta} \right| \right] \quad \text{.....(8)}$$

which is called the **least absolute deviations (LAD) estimator**. This can be rewritten as

$$\min_{\hat{\beta}} \sum_{i=1}^{n} (y_i^* - \chi_i \hat{\beta}) \bullet \psi(y_i^* - \chi_i \hat{\beta}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

where the sign function $\psi(\bullet)$ takes on values of 1, 0, -1 (positive, zero, or negative). The corresponding normal equation is given by:

$$0 = \sum_{i=1}^{n} \chi_i' \bullet \psi(y_i^* - \chi_i \hat{\beta}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(10)$$

implying that it is the sign and not the magnitude of the residuals that matters. Therefore, while OLS corresponds to mean regression, LAD estimator corresponds to median regression that is consistent for $\boldsymbol{\beta}$ because

$$q_{50} \ [y_i^* | \ \boldsymbol{X_i} \ ] = \boldsymbol{X_i\beta} + q_{50} \ [\varepsilon_i \ | \ \boldsymbol{X_i} \ ] = \boldsymbol{X_i\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(11)$$

In (11), q_{50} denotes the median of the fiftieth quantile.

Amemiya (1985) points out that Powell's estimator is attractive because it is the only known estimator that is consistent under general non-normal distributions and that in large samples, this estimator appears to perform much better than the various estimators of the Tobit model.

This paper used both the **Tobit** and Powell's **Censored Limited Absolute Deviation (CLAD)** to estimate the parameters of the data. In the latter case, the **Bootstrap** method is used to estimate the standard errors. The ***Bootstrap*** due to Efron (1979) is a recently constructed general technique for estimating sampling distributions (as cited in Jonston and DiNardo, 1997). The bootstrap is believed to hold a great promise in many applications and is finding its way into more and more applied econometric research. Researchers usually try to determine the *exact* sampling distribution of the estimation procedure to compute confidence intervals and for tests of significance. This, however, is often the hardest part of

the work and the reason for why asymptotic methods are quite often used for interval estimation and hypothesis testing. The bootstrap provides a simple means for obtaining an approximate sampling distribution of the statistic. This, however, is not as exact as the exact distribution and is computationally longer to obtain results than by using the asymptotic distribution. The bootstrap is preferred due to the fact that even if it is computationally tedious, it is not computationally difficult and more importantly, the results are conditional on observed data, not based on large sample approximations.

The formula for the standard error of the median is

$$s_{median} = \sqrt{4f^2}(0)$$

Where $f(0)$ is a consistent estimate of the value of the probability density function at 0. It is possible to generate estimate of the distribution by using the data and then calculate $f^2(0)$.

A second approach to calculating the precision of the median would be to

(i) draw a large number of samples of size n from the distribution $f(x)$

(ii) calculate the median in each of these samples, and

(iii) calculate the square root of the variance of these estimated medians across a large number of replications.

In both approaches it is possible to calculate a consistent estimate of the standard error if one has a precise knowledge of the distribution generating the samples in the first place. Since one does not know this, Efron suggested the use of the sample data to generate an estimate of the distribution. That is, use the empirical distribution to learn about the actual distribution. For a sample X and for $i = 1,\ldots\theta$ the procedure is

1. Generate a random sample X^i with replacement from the original sample X[4].
2. Compute the median $\hat{M}^i$ for this new sample.
3. Store the value of $\hat{M}^i$

Johnston and DiNardo (1997) underline that the number of bootstrap replications, θ, should be set as high as is practical. The bootstrap standard error of the median is

$$\sigma_{boot} = \sqrt{\frac{1}{\theta - 1}\sum_{i=1}^{n}\left[\hat{M}_i - \hat{M}_i(\bullet)\right]^2}$$

where $$\hat{M}(\bullet) = \frac{1}{\theta}\sum_{i=1}^{\theta}\hat{M}^i$$

4.6 Model Specification

The contingent valuation method was used to elicit the willingness to pay of people living with the virus for antiretroviral drugs, which lengthen the lives of the particular individuals. The median willingness to pay (MWTP) is specified as:

$MWTP = \beta_0 + \boldsymbol{\beta_1}SDV + \beta_2 TC + \beta_3 YLV + \beta_4 HS + + \beta_5 I + \beta_6 XY + \beta_7 WP + \beta_8 BP + \beta_9 FR$

Where: SDV = Vector of Socio-demographic variables including age, sex, marital status, religion, educational status, occupational status, family size and family head.

TC = Total cost incurred for treatment of opportunistic diseases for the last two months

YLV = Year(s) of living with the virus

HS = Current health status

[4] We are drawing a sample of size n from the original sample, thus putting the probability 1/n on each

I = Total income of the individual (personal, family, transfer)

XY = Payment for another person living with the virus in the family of the individual

WP = Responsibility of payment of total treatment cost for the last two months

BP = Initial bid price bias

FR= Free riding

Table 4.1. The expected signs and relationships of the variables:

Variable	Expected Sign	Explanation
Sex Dummy variable 1 if male 0 female	(+)	Men usually are economically independent so that they have the decision power to pay for the drugs
Age	?	The older an individual the greater are the family responsibilities so that the higher the WTP for the drugs. But the converse may not be true i.e., the younger the person the less s/he is WTP for the drug because younger people might be eager to live longer and achieve more if they can make it. Hence the hypothesized relationship of WTP and age is ambiguous.
Religion r_0= Protestant/Jehovah r_1=Orthodox/Catholic r_2=Muslim	?	To be tested where r_0 is treated as a control variable
Marital Status m_0= Single m_1=married m_2=divorced	?	To be tested where m_0 is treated as a control variable

observation in the sample.

m_3=widowed		
Educational Status e_0= Illiterate e_1=Primary e_2=secondary e_3=post secondary	(+)	The more educated the individual is the greater the awareness about the drugs' advantages (e_0 is treated as a control variable)
Employment Status Dummy variable 1 if employed 0 Unemployed	(+)	A person's employment status, should be positively correlated with her/his WTP if s/he is employed
Family Size (FS)	?	The greater the family size the higher is the consumption expenditure, other things being equal. Hence the individual is expected to have a lower WTP with increased family size. However, the greater is also the responsibility so that the higher the WTP. . Hence the sign is ambiguous.
Family head (FH) Dummy variable 1 if head 0 otherwise	(+)	The higher will be the WTP when the individual is the family head because s/he has to take care of the rest of the family by lengthening her/his life
Total income (I)	(+)	The higher the income the greater will be the ability to pay for health facilities so that the greater will be the WTP for the drugs
Years of living with the virus (YLV)	?	The longer the individual lives with the virus the higher will be the WTP because the individual is most probably suffering and will be willing to do anything to stop it. On the other hand, those people who didn't live with the virus that long may not want to suffer for the their remaining lives so that they may have a higher WTP for the drugs.

Current Health Status Dummy Variable(HS) 1 if bad 0 good	(+)	If the individual's current health status can be categorized under "good" or "bad" then s/he may have higher WTP for the drugs when the health status deteriorates.
Cost of Treatment (TC)	?	The higher the treatment cost of different OIs for the last two months the higher will be the WTP for the drugs to shift the cost. However, Forsythe (2001) found a negative sign where people who have already spent a lot of money on medications, particularly medications that are ineffective, are unwilling or unable to pay more for ARVS. Therefore, sign is to be tested.
Who paid for treatment cost for the last two months(WP) 1 others 0 self	(-)	If it is already the responsibility of others to pay for the treatment cost of the individual for the last two months then this is an indication that s/he will likely have less willingness and ability to pay for the private good under consideration.
Payment for another person living with the virus in the family (XY) Dummy Variable 1 if yes 0 otherwise	(-)	If there is another person living with the virus and if it is the responsibility of the individual to pay for the drugs to that individual too then the less will be the WTP of the individual for the drugs.
Starting price of the Bidding game (BP)	?	To be tested
Free riding (FR) Dummy Variable 1 if others pay 0 otherwise	?	To be tested

Chapter Five

EMPIRICAL FINDINGS AND ANALYSIS

In this chapter, results of the CV survey are presented and analyzed using both descriptive and multivariate regression analysis. For the descriptive analysis SPSS 11:0 is used while the STATA software (version 7.0) is used to run Tobit and CLAD to estimate the parameters that determine WTP for ARV drugs.

5.1 Descriptive Analysis[4]

In this section, the CV survey results are summarized in six sub-sections. The first part presents the socio-demographic characteristics of respondents followed by questions designed to capture their knowledge, attitude and practice (**KAP**) of the drugs. The third section of the analysis is on the WTP amounts of the respondents. The next two parts

[4] Refer Annex 1 for summary tables

concentrate on the economic characteristics of respondents and health related indicators. Finally, the general attitudes of respondents are summarized. The remaining three sub-sections focus on different tests of the CV method employed in the survey.

5.1.1 Socio-Demographic Characteristics

Data on the gender of the 440 respondents shows that 264(60%) are female out of which 91(72.3%) are family head while 176(40%) are male respondents and 134(76.1%) of them are family heads.

The mean age of the respondents is 33 years. The youngest respondent is 18 years old while the oldest is 65 years old. The total number of respondents in the age range 18-49 years is 426 (97%). This reflects the fact that around 91% of infections in the country occur among economically active age group (15-49 years). The proportion of respondents within the age group 18-25 years old is 80 (18.2%). The majority of the respondents, 167(38%), fall into the age range 26-33 years followed by 134(30.5%) of respondents between 34-41 years. Those between 42-49 years are 45(10.2%). Only 12(2.7%) and 2(0.5%) of the respondents are among the age group 50-57 and 58-65 years, respectively.

The average family size of the respondents is 3.85, ranging from 1 to 12. Out of the 440 interviewees, 205 (46.6%) have 1 to 3 family members, which suggests a somewhat smaller family size among the majority of the respondents. Family size of 4-6 individuals is reported by 191(43.4%) of respondents and 7-9 by 41(9.3%) of respondents. Of the total respondents, only 3(0.7%) individuals reported a family size of 10-12.

Data on marital status reveals that 170(38.6%) respondents are currently married, which is followed by those whose spouses are deceased, 132(32%). The rest of the respondents 84(191%) and 54(12.3%) are either divorced or single, respectively.

Most of the respondents, 282(64.1%), indicated that they are Orthodox Christians. Eighty-two (18.6%) of the respondents are Protestants and 65(14.8%) are Muslims. The rest of the respondents indicated that they are either Catholic (1.4%) or Jehovah (1.1%).

In terms of educational status, most of the respondents, 196(44.55%), have completed high school followed by 102(23.2%) respondents that have completed primary education. Those that have beyond secondary education level are 64(14.5%). Twenty-eight (6.4%) respondents indicated that they have only below 4^{th} grade training. The rest of the respondents, 30(6.8%) and 20(4.5%) are either illiterate or able to read and write, respectively.

The last variable that is considered in this sub-section is the occupational status of respondents. Those who claimed to have their own business account for 17.3% of the total respondents where as those that work as private employees and civil servants are 55 (12.5%) and 33(7.5%), respectively. NGO workers constitute 16.1% of the total respondents. Thirteen respondents (3%) were workers of the respective associations established by PLWHA while 31(7%) indicated that they are daily labourers. However, the majority of the respondents, 161(36.6%) are found to be unemployed during the survey.

5.1.2 KAP

In this section the knowledge, attitude and practice of respondents with regard to ARV drugs are summarized.

Interviewees were asked if they ever heard about ARV drugs before the day of the interview. Even though almost all, 99.5%, confirmed that they have heard about the drugs before, only 28(6.4%) of the respondents are or have been using the drugs purchasing from the parallel market.

Out of the 440 respondents, 177(40.2%) reported that they know people that use the drugs among friends, relatives or those living around.

Respondents were asked if they knew or heard about the current 'underground' price of the drugs in the country and if they thought this was reasonable. Those who think that the current price is not fair compared to the living status of the population are 99.5% while 2(0.5%) of the respondents admitted that they do not know about the on going price in the country.

To evaluate the perception of respondents towards the drugs, they were asked to give their opinion about for how long the drugs extend the life of a person living with the virus. More than half, 243(55.2%), of the respondents either do not have a clue or claim that only God knows. Among those respondents that guessed the years, 11(2.5) believe that the drugs extend life years from 2 to 3 years; 79(18%) think that it extends from 5 to 10 years; 44(10%) conjecture from 10 to 15 years; 34(7.7%) guess from 15 to 20 years. Out of the total respondents, 8(1.8%) and 3(0.7%) respondents speculated that the drugs lengthen life years from 20 to 25 and 25-30 years, respectively. The rest 18(4.1%) respond that once the drugs are started to be taken by an HIV+ person, life is elongated indefinitely.

Respondents' perception about the side effects of these drugs was also used as a means of evaluating their knowledge regarding the drugs. The response to this particular question ranges from 'no toxicity' to 'very high toxicity'. However, 233(53%) let us know that they do not have a clue about the side effects of the drugs. Those who think the side effects to be 'modest' and 'low' are 66(15%) and 64(14.5%), respectively. The two extremes, 'very high toxicity' and 'no toxicity' are chosen by 28(6.4%) and 49(11.1%), interviewees, respectively.

5.1.3 Willingness to Pay

In spite of their ignorance or speculation with regard to for how long the drugs lengthen life years of PLWHA once they start taking the drugs, respondents were made to assume two different scenarios- the drugs lengthen life years indefinitely and ten years.

Out of the total 440 respondents, 242(55%) are either unable or unwilling (protest votes) to pay for the drugs. The majority, 210(47.7%) respondents, indicated that they do not have the ability to pay for the drugs. The other 32 respondents appear to have “protest votes” where their responses generally are recognized not to reflect the true worth of the service, but rather a protest against the idea of consumers having to pay any amount for a certain good or service (Mitchell and Carson, 1993). Out of these 26(5.9%) claimed that there is no chance they would pay for the drugs because only God can extend their life years. The rest 4(0.9%) and 2(0.5%) respondents are unwilling to pay because they believe that the drugs

should be given for free or because of the side effects, respectively. Hence WTP responses in this descriptive analysis are analyzed from 198(45%) of all respondents.

a) Mean Vs Median WTP

The minimum stated price that respondents are willing to pay is Eth. Birr 50 while the maximum is Birr 2000.

The mean WTP of respondents if the drugs lengthen life years indefinitely is Birr 163.64 while it is Birr 148.48 if the drugs are effective only for 10 years. On the other hand, the median WTP of respondents if the triple combinations lengthen life years indefinitely is Birr 100 whereas it is Birr 50 if the drugs are going to extend life years by only 10 years. One of the statistical issues under the analysis of WTP is to consider whether to use the mean or median WTP estimates. In this study the median WTP is used to estimate the WTP of PLWHA for ARV drugs and the determinants of their WTP amounts. This is due to the fact that the mean is very sensitive to assumptions about the valuation function, skewness in the distribution and to outliers in the data, which our data is no exception (refer Annex 2) whereas the median is more robust in these cases.

If the market price of ARV triple combination per month is to be Birr 1-50, 105(53%) and 92(46.5%) of the respondents are willing to pay when the expected life extension is 10 and indefinite years, respectively. When market price ranges from Birr 51-100 per month, it is chosen by 40(20.2%) and 44(22.2%) respondents when the expected life years extension is 10 and indefinite years, respectively. Nine(4.5%) and 16(8.1%) respondents are willing to pay from Birr 101-150 per month for the drugs if life extension is 10 and indefinite years,

respectively. Willingness to pay for the drugs if market price is between Birr 151-350 is observed in 21(10.6%) respondents if the drugs extend life years by 10 years and in 19(9.6%) respondents for a 10 years life extension. The reverse is true when the market price for triple combinations is from Birr 351-550 i.e., 19(9.6%) respondents willing to pay for 10 life years extension and 21(10.6%) respondents if it is indefinitely. In the last category of WTP, Birr 551-2000, only 4(2%) and 6(3%) respondents out of 198 individuals who showed interest to pay are willing to pay the above amount if the drugs lengthen life years by 10 and indefinite years, respectively.

b) WTP and Starting Bid

To obtain the WTP of PLWHA for ARV drugs, five different initial bid prices were given to different respondents randomly. The prices were Eth. Birr 150, 200, 250, 300 and 350 per month and 91, 110, 79, 82, and 78 individuals were randomly given the respective starting prices. Out of the 91 respondents given Eth. Birr 150 as a starting price, 15.7% respond yes and the rest no. Out of the 110 individuals that were given 200, 29.29% are willing to pay for the drugs. Those that were presented with Eth. Birr 250 per month responded yes. For the fourth starting bid price, 26.77% of respondents out of the 82 individuals that were given the same initial bid showed interest in the payment for the drugs. Finally, those 78 respondents provided with an initial price of Birr 350 per month, 16.16% showed willingness to pay for the drugs.

c) Payment responsibility

Out of the total 198 respondents that stated their willingness and ability to pay for the drugs, 73.24% responded that they themselves (60.6%) or their families (12.6%) are going to pay while 26.8% stated that it is the responsibility of others- either their respective associations (21.7%) or the organizations they work in (5.1%).

d) WTP and Some Socio-Demographic Characteristics

In this section an attempt to cross-tabulate some selected socio-demographic characteristics that are thought to strongly influence the decision of WTP is made .

The cross tabulation of WTP with gender of respondents reveals that when the price of triple combinations is very low, the percentage of women who are WTP is greater than men. However, when the figure increases, the percentage of male respondents who are WTP the respective figures, is greater than female respondents.

The minimum WTP amount, Birr 1-50 and the maximum WTP amount, Birr 551-2000 are associated with mean ages 32.29 and 38, respectively. The other WTP amount categories are associated with mean age ranging from 37.31 to 37.95 years.

The relationship between WTP and mean family size reveals that the maximum amount of WTP (1500-2000) is associated with mean family size of 4 while the minimum WTP amount (1-50) is related to mean family size 3.85.

Concerning the occupational status of respondents, for the WTP amount between Birr 1-50, the majority of the respondents are unemployed. The fact that being unemployed does not necessarily mean that the respondents have zero income level because the survey considers total income of an individual: not only income earned per month by the individual but also family and transfer income. Most of the respondents that showed interest in paying the second interval of the WTP amount, work in different NGOs. This is also true for the WTP category Birr 151-350. Those that have their own business are the majority that showed interest to pay from Birr 351 to Birr 2000.

5.1.4 Economic status

To evaluate the total income of respondents per month, three sources were identified- the respondent's earning, family income and transfer income. The latter refers to money income transferred from the respective associations, relatives or friends to the individual. The mean income of the respondents is Eth Birr 367 per month.

Out of the 440 respondents, 144(32.7%) of them have a total income below Eth. Birr 120 per month. Respondents that get total income from Birr 150 to 250 per month are 78(17.7%). This range is almost mated by the next income figure, Birr 300–400, where 77(17.5%) of the respondents get per month. Out of the total interviewees, 50(31.4%) and 33(7.5%) of the respondents fall into income group Birr 450-550 and Birr 600-700 per month, respectively. Only 11(2.5%) of the respondents have total income Eth Birr 750-850 per month. In the last category of income, 47(10.7%) of the respondents get above Birr 900 per month.

The mean income of the 198 respondents that stated different willingness to pay amounts is Birr 583. Comparing this with the mean WTP indicates that these people are prepared to allocate 28% of their income if the drugs are effective indefinitely and 25% if only 10 years.

4.1.5 Health related indicators

In the fourth section of the questionnaire, respondents were asked for how long they knew they were living with the virus. This ranges from 15 days to 13 years. Out of the 440 respondents 99(22.5%) reported that it is less than one year since they knew that they were living with the virus. The majority of the interviewees, 147(33.4%), reported from 1-2 years; 95(21.6%) from 3 to 4 years; 43(9.8%) from 5 to 6 years; 29(6.6%) from 7 to 8 years; 20(4.5%) of the respondents claimed 9 to 10 years. For 5(1.1%) of the respondents, it has been 11-12 years since they knew they were living with the virus. Out of the 440 respondents, 2(0.5%) individuals lived the longest with the virus, that is, 13 years.
To evaluate the health status of respondents three approaches were followed. The first was self-evaluation, that is, by giving the chance to respondents themselves to rank their health status. Then respondents were asked for how many times, for the last two months, did they visit a hospital, clinic or health station. Since some people may prescribe anti-pain for themselves without consulting a doctor, the

third approach was to ask respondents whether they bought medicines from pharmacies without prescription from their doctors. The responses for the above three types of questions were used to categorize the health status of respondents.

The data for health status show that most of the respondents, 139(31.6%) are in a 'good' health condition and 116(26.4%) in 'modest' health status. Some 114(25.9%) respondents think that their health status is very good and they neither visited a doctor nor prescribed medicine for themselves for the last tow months. These are categorized as having 'very good' health status. Out of the total respondents, 59(13.4%) of them have 'bad' health status and only 12(2.7%) show to have 'very bad' health condition.

The cross tabulation of the above two variables in this sub-section reveals that, out of the 99 respondents that knew they were living with the virus for less than a year, the majority, 31respondents, have 'good' health status. The same is true for those who have known that they are HIV+ from 1 to 2 years and 3 to 4 years. However, those individuals who responded that they knew for 5 to 6 years and 7 to 8 years, their health status is categorized under 'modest'. Out of the 20 individuals that have been living with the virus for 9 to 10 years, most of them, 35%, have 'bad' health status. Of the 5 respondents that knew about the virus they are living with for 11-12 years, 4 of them have 'very bad' health condition and both of the respondents that reported to be living with the virus for 13 years also have 'very bad' health status.

From the total respondents in the survey, 294 of them reported to have incurred treatment cost for the last two months. These respondents were asked how much they spent and who paid for the medical expenses. The average total cost is found to be Birr 255, which is 64% of the respective respondents' income.

Respondents that spent from Birr 1-50 are 103, out of which 26(25.2%) paid out of their pocket; for 7(6.8%) respondents their families covered the cost, for another 7(6.8%) respondents the organization they work in paid for the medical cost. However, for the majority, 63.2% of the respondents, the respective associations covered the treatment costs. Those respondents that claimed to incur a medical cost of Eth Birr 100-200 for the last two months are 83 and again for the majority, 52(62.6%) of the respondents, the cost was covered by the associations whereas for 24(30%) respondents either the individuals themselves or their families paid for the treatment cost. For the rest 7(7.4%) individuals that incurred the above figure, the organizations that they work in paid for treatment. Of the 69 respondents that reported to pay from their pocket, 11(16%), of them paid Birr 250-350 for the last two months for medical treatment; 7(10.1%) around Birr 440-550; only two respondents paid Birr 550-650 and another two above Birr 700. Of the total respondents that incurred medical cost for the last two months, 181 respondents' costs were covered by the respective associations. Out of these, the associations paid Birr 250-350 for 30(16.6%) respondents; Birr 400-500 for 19 individuals; and Birr 555-700 for four respondents.

Data related with the issue of another HIV+ person living with the respondents reveal that 156(35.5%) of them actually have a person/s living with the virus at home. Of these 79(50.6%) are the spouses of the respondents; 47(30.1%) constitute the child/children of

the respondent; 10(6.4%) relatives living with the respondents in the same house; 18(11.5%) of the respondents who claimed to be living with other HIV+ persons, the persons are his/her spouse and child/children. The rest 2(1.3%) out of the 156 respondents live with both their HIV+ child/children and relative/s.

However, even if 156 of the respondents responded that they live with another HIV+ person, only 26(16.7%) showed willingness to pay for the other person/s if the drugs become available in the market whereas 130(83.3%) of them refused to have this responsibility.

5.1.6 General Attitude

All of the 440 respondents were asked to give their opinion about the responsibility of distributing the drugs. The majority of respondents, 215(48.9%), believe that government has the responsibility of distributing the drugs for free; 52(11.8%) said it should be left to the NGOs operating in the country to dispense the drugs for free; 155(35%) asserted that both government and NGOs should jointly distribute the drugs for free. Around 5(1.1%) respondents urged their respective associations to take the responsibility of giving out the drugs to their members. Those who suggested that, on the one hand, government should distribute the drugs for free for those unable to pay and, on the other hand, private pharmacies should sell to those that can pay are 11(2.5%). Two individuals out of the 440 respondents said that government, NGOs and the associations must work together for the free distribution of the drugs.

Respondents were inquired if the Ethiopian government has given proper attention till the day of the interview. Of the total 440 interviewed, 396(90%) disagree (most of them strongly) with the suggested idea while the rest 44(10%) respondents believe that it is doing its best concerning ARV drugs.

The last question presented to respondents was if they would be interested to pay more than what they have stated before if their income increases and their economic situation changes for the better. The majority, 408(93.5%), of the respondents confirmed this while 32(7.3%) stated that no matter what their economic situation is, they are not WTP for the drugs. The reason given by the majority, 26(81.3%) of them is only the Lord could extend their life years and not the drugs. The rest four and two respondents are totally unwilling to pay for the drugs because they believe either it should be given for free or it has high toxicity. This question has helped the researcher to check whether there is internal consistency in the responses of interviewees. For instance, it would have been contradictory on the part of the respondent if s/he gave a reason for the protest vote as "only God can help me" in section three but then assert that s/he would pay a positive amount if her/his economic situation changes for the better.

5.1.7 Validity Test

To test the accuracy of the CV survey of this study, **construct** and **scope** validity tests are carried out. Construct test refers to the theoretical validity test, which involves assessing the degree to which the findings of a study are consistent with theoretical expectations (Mitchell and Carson, 1993). The most common test for construct validity of CV studies is the correlation between willingness and ability to pay (Forsythe, 2001). This is so because

if people were overbidding without giving any thought to their economic limitations, one would expect that there would be no correlation between income and WTP.

The data of the survey reveal that there is a significant level of correlation between income of the respondents and their WTP (Table 5.11). The correlation coefficient between total income of respondents and their WTP for the drugs per month life is extended indefinitely is 0.63 whereas the correlation coefficient of total income and WTP if the drugs extend life years by 10 years is 0.64. Both of the Pearson correlation coefficients are significant at 0.01 level of significance.

Another test of the validity of a CV study is to test if respondents can distinguish the intervention according to the scope of the intervention programme (Forsythe, 2001). In order for WTP to provide accurate estimates, respondents should be WTP more for an intervention that has a larger impact. In other words, they should place a higher value on the drugs if these lengthen life years indefinitely than only ten years.

Respondents have apparently passed the scope sensitivity test because their WTP for ARV drugs when life years are extended indefinitely is greater than when the effectiveness is only ten years, which is consistent with economic theory stated in the third chapter i.e., WTP should be sensitive to the magnitude of mortality/risk reduction and should be higher for higher mortality/risk reductions.

5.1.8 Starting Point Bias Test

Studies whose WTP amounts are highly correlated with the starting points are so biased as to be invalid (Mitchell and Carson, 1993). Pearson correlation coefficients of the two WTP

amounts were tested (Table 5.8) and the result shows that the correlation coefficient between the WTP for indefinite years extension and starting point is 0.024. Similarly Pearson correlation coefficient between WTP for ten years extension and starting point is 0.044, which both of the coefficients are insignificant. Therefore, this descriptive analysis suggests that the CV survey may not suffer from starting point bias.

5.1.9 Free Riding Test

Respondents may over pledge their WTP amount if they believe that others are going to pay for the intervention under consideration. To test whether this CV survey suffers from free riding problem, comparison between the population median WTP and the median WTP of those who claimed that it is either their organizations' or associations' responsibility to pay for the drugs is made. If the latter is far higher than the former it is to be concluded that there is in fact free riding on the part of respondents.

As can be seen from Table 5.10, the median WTP is Birr 50 for both indefinite and ten years scenarios, which is not actually far from the median WTP of the population. Hence, it is possible to conclude in this descriptive analysis that the CV survey carried out for this research does not suffer from free riding problem.

5.2 Regression Analysis

This sub-section presents results of both parametric and semiparametric regression techniques and property of the data used in the regression analysis. The determinants of

WTP for ARV drugs by PLWHA were estimated with a sample size of 408 records (after dropping 32 protest values).

5.2.1 Parametric estimation of the censored regression

Table 5.12 presents results of the parametric estimation of the censored regression using the collected data. The model estimates determinant parameters of WTP for ARV drugs assuming that 210 observations are left-censored (at zero) and 198 uncensored observations. The pseudo R^2 is 0.28 indicating that 28% of the variation in WTP is explained by the independent variables identified in the study. The likelihood ratio for the estimation model indicates that the overall model is a good fit.

As stated in the previous chapter, to meaningfully analyze the magnitude of the effects of the regressors on the dependent variable, it is necessary to analyze their marginal effects. This involves decomposing the unconditional mean into the effect on the probability of WTP and the effect on the conditional level of WTP. For continuous variables in the model these marginal effects are used to calculate elasticities at the sample means to allow a quantification of the magnitude of the effects to be made. The effect of the discrete or categorical variables on the dependent variable, however, cannot technically be quantified using elasticities. Instead, marginal effects are used to calculate percentage changes in the dependent variable as a result of the variable moving from zero to one, ceteris paribus (Newman, 2001).

Table 5.12 Results of the Tobit Estimation

Variable	Coefficient	dF/dx (conditional)	dF/dx (probability)	Z
Employed^	1.985436	0.6865141 (0.14)	0.273953 (0.06)	4.83***
FS	-0.4085387	-0.1198156 (0.03)	-0.0542644 (0.01)	-3.83***
I	1.963645	0.5758947 (0.04)	0.2608222 (0.02)	15.53***
TC	0.3157825	0.0926122 (0.04)	0.041944 (0.02)	2.1**
WP^	-1.286819	-0.3768145 (0.13)	-0.1691682 (0.06)	-2.94***
BP	0.353591	0.1037006 (0.04)	0.0469659 (0.02)	2.5**
Cons	-7.577952	-2.22245 (0.38)	-1.006546 (0.17)	-5.78***
No. of observation = 408			Obs. summary: 210 left-censored obs.	
Log likelihood = -517.25203			198 uncensored obs.	
LR χ^2 (21) = 402.99				
Prob > χ^2 = 0.0000				
Pseudo R^2 = 0.2803				

^ dF/dx is for discrete change of dummy variable from 0 to 1
* Significant at 10%, ** significant at 5%, *** significant at 1%

The result in the above table reveals that apart from employment status and family size, all other socio-demographic variables are found to be insignificant in this parametric estimation. When a person living with the virus is categorized as employed, the WTP increases and this variable is found to be statistically significant at 1% level. The marginal coefficients indicate that an employed person increases the expected value of WTP by 68.7%, holding all other variables constant. The probability that an employed person will be willing to pay more is 0.27 than an unemployed one.

The estimated elasticity coefficient for family size is not only negative, as hypothesized, but also is statistically significant at 1% level. The marginal coefficient indicates that an additional member in the family would decrease the WTP of the individual by 12%.

The finding of this parametric estimator shows that income elasticity is highly significant, at 1% level of significance. As hypothesized, the coefficient's sign is positive. This is in line with economic theory that states that income has a direct effect on demand for normal goods and services. Hence, a 1% increase in income will increase WTP of the individual by 58%.

The elasticity coefficient of total treatment cost for the last two months reveals that the higher the cost, the higher would also be the WTP of the individual, which this variable is found to be statistically significant at 5% level. The reason might be that PLWHA would like to shift the cost of treatment to ARV drugs rather than treat opportunistic infections. Thus, a 1% increase in the treatment cost of OIs will result in a 32% increase in the WTP of the individual for antiretroviral drugs, holding all other variables constant.

The fact that other parties (organization or association) pay for the treatment cost for the last two months, instead of him/herself, implies a decrease in the expected value of the WTP by 37.7%, ceteris paribus. Again others cover for treatment cost also means that the probability of the individual to pay more declines by 0.17.

The explanatory variable, initial bid price was used as a test for starting price bias. The result shows that this variable is significant at 5% level of significance. However, free

riding is identified to be not a problem of the study. This is in conformity with the result of the descriptive analysis, unlike starting bid price bias.

5.2.2 Data Property[2]

Before dwelling into the discussion of the result of censored limited absolute deviation, exploration of the CV survey is made to identify the properties of the data.

Mitchell and Carson (1993) underscore that contingent valuation surveys are particularly susceptible to outliers because WTP amounts, unlike ordinary scales, are unbounded at the upper end and this survey is no exception. Even if it is possible to delete outliers on an ad hoc basis, Mitchell and Carson (1993) argue that this procedure suffers from the obvious drawback that it opens the researcher to criticism. Instead the authors suggest to use robust statistical estimators in order to mitigate the effect of outliers.

An attempt was also made to test whether the data of the survey encounters econometric problems i.e., non-normality, heteroskedasticity and multicollinearity.

The two useful parameters, skewness and kurtosis, are used to characterize the normality of the distribution. Skewness coefficient is used to measure the symmetry of a distribution while kurtosis measures the thickness of the tails of the distribution (Greene, 1997).

The test for these coefficients that is carried out for continuous variables in the data shows that WTP, total income, treatment cost and years of living with the virus prove non-

[2] Refer Annex 2 for attached results

normality since the skewness and kurtosis coefficients of these variables are different from zero and three, respectively.

To detect multicollinearity, a simple correlation coefficient matrix of independent variables was used. However, the result shows that multicollinearity is not a serious problem of the data because a correlation coefficient between any of two regressors is not found to be as high as 0.8, which is the rule of thumb for the detection of multicollinearity (Gujarati, 1995).

A Cook-Weisberg test[3] for heteroskedasticity was carried out. Using fitted values, the test result shows that the null hypothesis of constant variance is rejected since the calculated χ^2 at one degree of freedom obtained from the estimated model is 557.65 with prob> χ^2 = 0.0000. This implies that there is heteroskedasticity problem in the model. This, however, is a common problem, which arises in the analysis of cross-section data.

Therefore, non-normality and heteroskedasticity are detected in the data. This fact coupled with the result of the descriptive ananlysis, where 242 observations are censored at zero, necessitate the use of censored quantile regression (CLAD). This is so because, unlike the standard estimators of the censored regression model such as Tobit or other maximum likelihood approaches, the CLAD estimator is robust to heteroskedasticity and is consistent and asymptotically normal for a wide class of error distributions.

5.2.3 Semiparametric estimation of the censored regression

In this section, results of the censored least absolute deviation (CLAD) method of Powell (1984) are presented. The estimation model proceeds by minimizing the (positive) sum of deviations, rather than maximizing the (negative) sum of loglikelihoods.

The estimation procedure followed in this paper is the one outlined by Johnston and DiNardo (1997) i.e.,

1. Run LAD[4] on the entire sample to generate an initial estimate of **β**.
2. Use this estimate of **β** to drop observations for which the predicted value is negative.
3. Run LAD on this new sample, to calculate a new estimate of **β**.
4. Repeat steps 2 and 3 using the $\hat{\beta}$ in step 3 as the new initial estimate.
5. Continue until the estimate stops changing.

As discussed in the methodology part, CLAD estimates the standard errors using the bootstrapping method. Johnston and DiNardo (1997) propose that the bootstrap replications should be set as high as is practical. In this study the replication is set to 1000.

Even if it is not uncommon to find low R^2 results from CV studies, Mitchell and Carson (1993) note that CV studies are open to question if the R^2 fails to show at least 0.15. The pseudo R^2 from the CLAD estimation is 0.339, which makes this particular study to be reliable. This result is an improvement over the parametric estimation, which is 0.28.

[3] This test was carried out using hettest stata command by first estimating the data using OLS
[4] The regression command bsqreg is used

Unlike the parametric estimation result, age of respondents is found to be significant at 10% level. The sign of this explanatory variable is positive indicating that as age increases, the tendency to pay also increases.

With respect to marital status, compared with unmarried people both estimation techniques show that those that are married, divorced or whose spouses deceased have lesser WTP. CLAD estimator particularly indicates that the latter is significant at 5% level of significance. The explanation might be that most probably these people lost their spouses due to the virus and have to support the remaining members of the family, which obviously increases the burden of responsibility. In addition, due to the high treatment cost for the late spouse, the widower/widowed may have exhausted his/her resources. Hence, their WTP is lesser than singles.

Family size, in both parametric and semiparametric estimation techniques, is found to be negative and statistically significant at 1% level. One explanation is the greater the family size the higher is the consumption expenditure in which case the individual is expected to have lower WTP for the drugs.

Income also exhibits consistency in both estimators- positive and highly significant compared with the other explanatory variables at 1% level of significance.

Among the health status indicators, total cost for the last two months is found to be positive and significant, but in this estimation it is at 10% level, instead of 5% as in the case of the Tobit estimation.

WP, the responsibility of treatment cost coverage, also exhibited different level of significance (5% level of significance instead of 1%) with the sign of the coefficient being unchanged.

The initial bid price is found to be positively and weakly affecting (at 10% level of significance) the final response to WTP questions.

Both the parametric and semiparametric estimation methods found free riding as not a problem of the study.

As can be seen in Table 5.13 among the socio-demographic variables that are statistically insignificant, the sign of sex is negative in both the Tobit and CLAD estimators suggesting that female respondents are more WTP than male respondents. A priori the contrary was hypothesized. Another variable, religion, was also found to be insignificant. This is in line with Forsythe's result (2002) that found religion to be an insignificant determinate of the WTP for ARV therapies. With regard to educational status, compared to illiterate individuals,those that have primary and secondary level of education are more WTP for the drugs. Surprisingly, both the parametric and semiparametric methods show that compared with illiterate people, those who have post-secondary education have less WTP. Even though this variable is insignificant, it needs further investigation. Employment status was

found to be significant by the parametric estimation technique but not in the semiparametric method though the sign is preserved.

Table 5.13 Result of CLAD estimation

Variable	Coefficient	Std. Err.	T	P>t
Sex	-0.4241351	0.5119112	-0.83	0.409
Age	0.0727028	0.0367028	1.98**	0.05
Marital status				
Married	-0.4736836	0.5319854	-0.89	0.375
Divorced	-0.9356687	0.5913206	-1.58	0.116
Spouse deceased	-2.312446	0.9379913	-2.47**	0.015
Religion				
Orthodox/Catholic	-0.7729743	0.6022715	-1.28	0.202
Muslim	-0.0853353	0.8674373	-0.1	0.922
Education				
Primary	0.8700452	0.9702863	0.9	0.372
Secondary	0.3779187	0.8472433	0.45	0.656
Post secondary	-0.442761	0.9326168	-0.47	0.636
Employed	0.9709493	0.8453755	1.15	0.253
FS	-0.5571477	0.1306616	-4.26***	0
FH	0.4900646	0.5995701	0.82	0.415
I	1.939576	0.2727556	7.11***	0
YLV	-0.079965	0.1005682	-0.8	0.428
HS	-0.1224018	0.9272038	-0.13	0.895
TC	0.732034	0.4247543	1.72	0.086*
WP	-1.033163	0.5036821	-2.05**	0.042
XY	0.1503784	0.9928933	0.15	0.88
BP	0.3224441	0.177465	1.82*	0.072
FR	-0.4194028	0.4783331	-0.88	0.382
_cons	-7.594917	2.012666	-3.77***	0
			Initial sample size = 408	
Median regression, bootstrap(1000) SEs			Final sample size = 151	
Raw sum of deviations 386 (about 2)				
Min sum of deviations 255.1433			Pseudo R2 = 0.3390	

Among health status indicators that are found to be statistically insignificant, years of living with the virus has a negative sign indicating that as the years of living with the virus increase the WTP for the drugs declines. The same is true for the current health status of the respondents.

Some of the explanatory variables changed their signs when CLAD was run. These are health status, family head, responsibility of payment for the drugs for another person living in the family, and free riding, which all are insignificant in both estimation techniques.

To examine whether the effects of the significant explanatory variables in the above median distribution still hold, the 25^{th} and 75^{th} quantile regression were run, in addition to the 50^{th} quantile regression (Annex 1, Table 5.14). The psuedo R^2s for the 25^{th} and 75^{th} quantile regression are 0.27 and 0.49, respectively.

For the 25^{th} quantile regression, family size, total cost of treatment and initial bid price were found to be statistically significant at 5% level where as income is still significant at 1% level. The responsibility of payment for the treatment cost was found to be significant at 10% level of significance. All of these statistically significant variables have the same signs as the 50^{th} quantile regression.

On the other hand, the 75th quantile regression showed that employment status, like the Tobit result, is significant but this time only at 10% level. Family size and income are also significant in this estimation at 1% level of significance and family head at 10%.
Post secondary education has positive sign across these new quantile estimations implying that compared to illiterate people, respondents having this level of education are more WTP for ARVs. However, all of the educational status variables are still insignificant. In both the 50th and 75th quantile regressions, being a family head implies more WTP whereas the 25th quantile estimation shows the opposite effect. Another variable that changed its sign, from negative to positive, is years of living with the virus. In both the 25th and 50th quantile regressions, the longer the years of living with the virus, the lesser the WTP of individuals whereas the effect of this variable is direct on the dependent variable when the 75th quantile regression is run.

5.2.4 Summary of Estimation Results

The estimations of the data of this paper empirically assessed the determinants of the WTP for ARV drugs by PLWHA.

Apart from standard parametric model used on censored data, notably the Tobit model, a semiparametric estimation technique is also employed, which makes less restrictive assumptions about the functional form of the disturbance term. The results of both techniques are contrasted.

In the Tobit estimation, employment status and family size were found to be determinants of WTP among the stated socio-demographic variables. Treatment cost for the last two months and the responsibility of treatment cost coverage were also found to be statistically significant in affecting the dependent variable with the expected signs.

The censored regression suffers from a number of specification problems. The disturbance term is not normally distributed or homoskedastic. The fact that relaxing these two assumptions of the model can make significant changes on the parameter estimates is highlighted by the literature on the Tobit model. The results of the semiparametric estimation technique shows that apart from family size, two other socio-demographic variables, age and spouse deceased, were found to be statistically significant. However, unlike the result of the parametric estimator, employment status was insignificant in affecting WTP. The findings of this paper support the important role of income in determining the WTP of respondents. Treatment cost and responsibility of coverage for this cost were found to have the expected signs and were statistically significant.

In both estimation techniques, the initial bid price was shown to create bias on the final response of respondents. However, this is one of the disadvantages of using a bidding game as an elicitation method where even if individuals were randomly assigned five different initial bid prices, the starting price had influenced the value respondents place on the drugs. The study was, however, exempt from free riding problem and in general reliable.

Across the 25^{th}, 50^{th} and 75^{th} quantile regressions, both income and family size are found to be determining factors of the WTP of individuals, with expected signs. Comparing the

results of the 25th and 50th quantile regressions reveals that age, family size, income, total treatment cost, responsibility of treatment cost payment and bid price are found to significantly affect WTP for ARVs at a statistically acceptable level of significance. However, when the results of the 75th and median regression are compared, only family size and income are the common explanatory variables that are statistically significant.

Not surprisingly enough, the constant term is negative and found to be significant by all of the estimators (Tobit, median and 75th quantile regression) at 1% level except by the 25th where it is statistically significant at 5% level. This is simply a reflection of those 55% respondents who were unwilling/unable to pay for the reason described earlier.

Since CLAD is an improvement over the Tobit model, only the results of the former estimator are used for conclusion and policy recommendation.

5.4 Demand for ARV drugs

In this sub-section, an attempt is made to estimate the demand function of respondents for ARV drugs.

Table 5.15 Estimated total WTP and demand

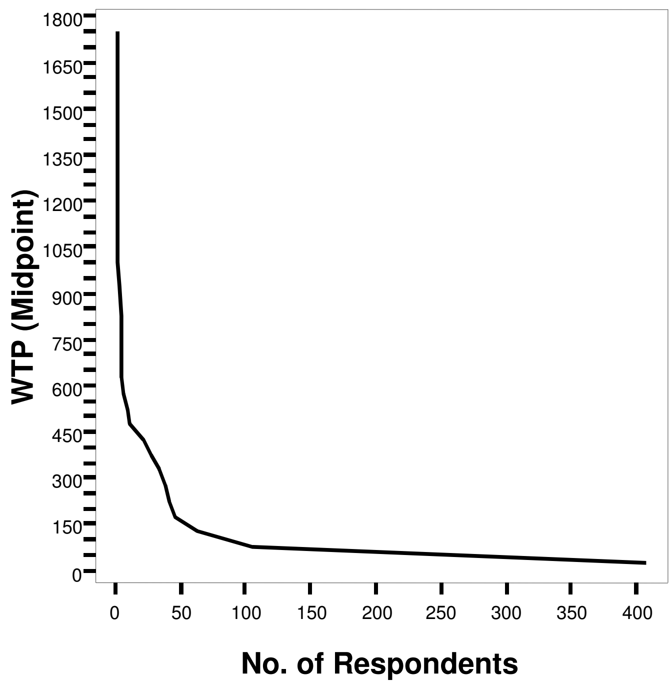
WTP Interval	$\hat{WTP}$	Sample distribution		Total WTP	Respondents WTP at least that amount (cumm.)	
(1)	(2)	(3) No	(4) %	(7)= (2)*(3)	(8) No	(9) %
0-50	25	302	74.0	7,550	408	100
51-100	75.5	42	10.8	3,171	106	25.95
101-150	125.5	16	3.9	2,008	62	15.5

151-200	175.5	5	1.2	878	46	11.25
201-250	225.5	3	0.7	677	41	10.05
251-300	275.5	5	1.2	1,378	38	9.35
301-350	325.5	6	1.5	1,953	33	8.15
351-400	375.5	6	1.5	2,253	27	6.65
401-450	425.5	11	2.7	4,681	21	5.15
451-500	475.5	1	0.25	476	10	2.45
501-550	525.5	3	0.7	1,577	9	2.2
551-600	575.5	1	0.25	576	6	1.5
601-650	625.5	1	0.25	626	5	1.25
801-850	825.5	1	0.25	826	4	1.0
901-950	925.5	1	0.25	926	3	0.75
951-1050	1000.5	1	0.25	1,001	2	0.5
1500-2000	1750	1	0.25	1,750	1	0.25
Total		408	100.0	32,302		

In table 5.15 from the WTP intervals, WTP midpoints are calculated. The grand total WTP (Birr 32,302) indicates that this is the amount all of the respondents living with HIV/AIDS are expected to pay per month if ARV drugs are made available in the market.

In the table, it can be seen that as the monthly payment increases, the number of people willing to pay the increased figures declines. From this relationship the demand curve for ARVs can be derived by plotting WTP midpoints on the vertical axis and the number of respondents willing to pay at least that class mark on the horizontal axis.

Fig. 5.1 Estimated Demand Curve for



The above demand curve has the form of a rectangular hyperbola, being asymptotic to both axes, indicating a ***constant elasticity demand***. This demand is usually associated with the function (Frank, 1994) :

$$N = \alpha / p^{\eta} \quad \text{...(1)}$$

Where: η and α are constant positive numbers.

N= PLWHA

P = Price (WTP midpoints)

α = some constant

η = elasticity coefficient

The implication of this function is, unlike the case of the straight line demand curve, here people spend exactly the *same amount* when price is high as they do when price is low. As one moves along the constant elasticity demand curve, the fall in the ratio of P/N is exactly counterbalanced by the rise in the reciprocal of the slope.

It is useful to note that a demand curve of constant elasticity has its own particular algebraic form. This form involves the logarithms of quantity (N) and price (WTP midpoints) (Hirshleifer, 1980). Hence, (1) can be rewritten as:

$$\text{Log } N = \log \alpha - \eta \log p \quad \text{.....(2)}$$

It is the linear equation (2) that would actually be fitted statistically to the observation reduced to logarithmic form. Therefore, estimating the double log function by fitting the data indicates that $\alpha = 11.2$. The implication of this result is respondents who spend their entire allowance on ARVs each month would have a constant expenditure demand curve for ARVs. The constant, 11.2, is equal to the amount of the allowance.

As mentioned above, η stands for elasticity. It follows that the proportionate change in the number of people is a constant multiple of the proportionate change in price along the demand curve. The estimation result for the elasticity coefficient is $\eta = -1.448$. According to microeconomic theory, a constant elasticity demand curve with $|\eta| > 1$ has the property that a price cut will always increase total expenditure and for one with $|\eta| < 1$, by contrast, a price cut will always reduce total expenditure (Frank, 1994). Hence, the coefficient of P,

1.448, indicates that whenever the price of ARVs declines, total expenditure of people would increase.

Chapter six

CONCLUSION AND POLICY IMPLICATION

6.1 CONCLUSION

Ethiopia is one of the most seriously affected countries in the world by HIV/AIDS. The country, with just 1% of the world's population, contributes 9% of the worldwide cases of HIV/AIDS. The country is also identified, among other four countries, to be hit by the Next Wave of HIV/AIDS.

Clinical trials for vaccine against HIV are underway, which protect against certain viral subtypes of HIV in the test countries. The vaccine probably will not be effective against the most common subtypes of HIV in countries that will be hit by the Next Wave of HIV/AIDS- Nigeria, Ethiopia, Russia, India and China leaving the countries to focus on anti-AIDS education to bring behavioural change to prevent new cases and ARV drugs to prolong the lifetime of people already living with the virus.

This study tried to answer the question: "How much are people living with HIV/AIDS willing to pay for anti-retroviral drugs" and attempted to identify the determinants of willingness to pay for the drugs. The contingent valuation method was employed to assess the above two objectives. CVM can be a very effective preference elicitation tool as long as respondents understand the context and content of survey instrument. The survey results revealed that 99.5% of the sample respondents were aware of ARV drugs, though many had hazy idea for how long the drugs extend life years and/or the side effects of the drugs.

With the exception of 32 individuals, generally, respondents showed interest in the drugs. However, 48% of the respondents that showed interest claimed to have no ability to pay for the drugs if the drugs are available in the market. Among those that stated different amounts of willingness to pay, the mean WTP per month is Birr 163.64 per month if the drugs are effective for indefinite years and Birr 148.48 if only for ten years. The median WTP of the respondents if the triple combination lengthens life years indefinitely is Birr 100 per month and Birr 50 for ten years. The stated figures are far below the current market price of the drugs in other parts of the world, Birr 250 per month (UNAIDS, 2002 and Walgate, 2002).

In relation to income, individuals were found to be willing to spend from 25%-28% of their income to the drugs per month.

To examine the effects of different variables, including socio-economic and demographic characteristics of respondents, censored limited absolute deviation (CLAD) estimator was

used, whose result was compared to the Tobit results. CLAD is preferred because it makes no assumptions about the nature of the WTP data. In other words, it does not impose normality and homoskedasticity restrictions on the distribution of the error term.

The Tobit technique found employment status, income and treatment cost to significantly and positively influence the WTP of individuals, whereas family size and the responsibility of payment to the treatment cost were found to decrease the willingness to pay of respondents significantly.

Results of the CLAD (50^{th} quantile) estimation reveal that apart from family size, two other socio-demographic variables, age and marital status (particularly those with spouse deceased) were found to significantly determine the WTP for the drugs. Specifically, the older the individual and the higher the income, the more would be the willingness to pay. On other hand, those with spouse deceased, with larger family size and with others to pay for their treatment cost have lesser willingness to pay for the drugs.

Finally, a comparison of the regression results for the 25^{th}, 50^{th} and 75^{th} quantile regressions indicated that some of the variables have different effects on the respondents' WTP.

The attempt to derive the demand of respondents for ARVs resulted in a rectangular hyperbolic curve implying a constant elasticity demand curve. The degree of responsiveness of individuals for a 1% cut in price was found to be a 1.4% increase in the demand for the drugs.

In general, the CV survey was found to be free of major biases and is reliable. It passed the scope sensitivity and construct validity tests. Free riding was also not detected from the responses of the individuals. However, even though the descriptive analysis showedd that starting point bias did not exist in the survey, the contrary was found when bid price was treated as an independent variable in the regression analysis. Both estimation techniques found this variable to be highly significant.

6.2 LIMITATIONS OF THE STUDY

- ✓ As stated in third chapter of this paper, respondents were asked to assume two cases: the drugs lengthening lifetime by indefinite and ten years. However, WTP tends to be affected by the order in which the years are presented (Krupnick et al, 2000). This research therefore will not be exempted from this effect.
- ✓ The second limitation of the research is it attempted to derive the value of the drugs by focusing exclusively on those who are in need rather than the general community.
- ✓ The research was conducted in Addis Ababa and did not include people living with the virus in the other parts of the country.

6.3 POLICY IMPLICATION

Among the different explanatory variables, income is found to be the most important determinant of the willingness to pay for anti-retroviral drugs in both estimation techniques. In the descriptive analysis, it was shown that 48% of the interviewed were constrained by low income. This of course is the reflection of the general poverty of the country where it is

ranked 87 out of 88 developing countries in terms of human poverty index (UNDP, 2002). This implies that the willingness to pay of the respondents for the drugs is highly constrained by the low income. The inference from this would be the provision of anti-retrovirals could not completely be left to the market. Different stakeholders- the Ethiopian government, non-governmental organizations and PLWHA associations have to play their role in the provision of the drugs at lower price. The fact that if prices are reduced people would be more willing to pay is substantiated by the findings of the estimated demand elasticity coefficient.

Treating opportunistic infections is costly- the average treatment cost for the two months before the survey is Birr 255. For 63.2% respondents that went to a medical centre to be treated the organizations they work in or the respective associations established by PLWHA covered for the treatment expenses. One of the assumed positive impacts of the availability of ARV drugs is the reduction in the frequent visits to medical centres for the treatment of opportunistic diseases. Hence, it is possible for the associations to divert their resource for the provision of the drugs to their members.

The survey result shows that 90% of those interviewed think the Ethiopian government has not exerted its best effort to bring the drugs to the country. It can change this image by offering special tax incentive or by providing subsidy to local investors to endorse domestic generic production of the drugs. This may be expected to dramatically decrease the price of ARV drugs that are supposed to be imported in the near future.

Almost 47% of the respondents who participated in the survey believe that non-governmental organizations (NGOs) operating in the country should play a role in the distribution of the ARV drugs. It is true that "improvement and advancement of the quality of life of those who are disadvantaged and vulnerable" is included in the mission statement of NGOs (Code of Conduct, 1999). Hence, NGOs operating in the country can play a multifaceted advocacy role. The first is creating awareness among the community of people living with the virus. The survey showed that more than 55% had no idea for how long the drug extends life years or about the toxicity. Since NGOs work at grass-root level, they could sensitize people on the issue.

NGOs could also involve themselves in constructive policy dialogue with the government to undertake active measures towards the drugs.

The third advocacy role could be played with their parent organizations. Though NGOs receive financial or material assistance from donors to operate their programmes, donors' interests are more in favour of prevention and control (UNAIDS, 2002). International organizations functioning in the country, in particular, could convince their

parent organizations and donors to give attention to care and support to people living with HIV/AIDS to raise funds for the importation of the drugs.

For further research, it is possible to include both people living with and without the virus to elicit their willingness to pay for the drugs. This would enable researchers to identify the value attached to the drugs by people falling into the two categories. Furthermore, researchers should be able to avoid the limitations of this particular research to check if results are different from what is indicated in this study.

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Table 5.1 socio demographic Characteristics of respondents

Variable		Frequency	Percent
Sex	Female	264	60.0
	Male	176	40.0
Marital Status	Married	170	38.6
	Divorced	84	19.1
	Single	54	12.3
	Widowed	132	30.0
Religion	Orthodox	282	64.1
	Protestant	82	18.6
	Catholic	6	1.4
	Muslim	65	14.8
	Jehovah	5	1.1
Educational Status	Illiterate	30	6.8
	Able to read & write	20	4.5
	Below 4th grade	28	6.4
	5-8th grade	102	23.2
	9-12th grade	196	44.5
	Above 12th grade	64	14.5

Occupational Status	Civil servant	33	7.5
	Own business	76	17.3
	Private employee	55	12.5
	NGO employee	71	16.1
	Unemployed	161	36.6
	Daily labourer	31	7.0
	Association worker	13	3.0

Table 5.2. Age, Family size and income of respondents

Variable		Frequency	Percent	Min.	Max.	Mean
Age	18-25	80	18.2	18	65	32.79
	26-33	167	38.0			
	34-41	134	30.5			
	42-49	45	10.2			
	50-57	12	2.7			
	58-65	2	.5			
Family size	1-3	205	46.6	1	12	3.85
	4-6	191	43.4			
	7-9	41	9.3			
	10-12	3	0.7			
Income	Below 120	144	32.7	25	5,000	395
	150-250	78	17.7			
	300-400	77	17.5			
	450-550	50	11.4			
	600-700	33	7.5			
	750-800	11	2.5			
	Above 900	47	10.7			

Table 5.3. Knowledge and practice of Respondents

Variable	Yes		No		Do not know	
	No.	%	No.	%	No.	%
Ever Heard	438	99.5	2	0.5	-	-
Ever Used	28	6.4	412	93.6	-	-
Know others who use	177	40.2	263	59.8	-	-
Fair Price	-	-	438	99.5	2	0.5

Table 5.4. Attitude of Respondents towards ARVs

Variable		Frequency	Percent
	Do not Know	243	55.2

Effectiveness	2-3 years	11	2.5
	5-10 years	79	18.0
	10-15 years	44	10.0
	15-20 years	34	7.7
	20-25 years	8	1.8
	25-30 years	3	0.7
	Indefinite years	18	4.1
Toxicity	Very high	28	6.4
	Modest	66	15.0
	Low	64	14.5
	No toxicity	49	11.1
	Do not Know	233	53.0

Table 5.5. Reasons for not paying

Reason		Frequency	Percent
Unable to pay		210	47.7
Unwilling to pay	God	26	5.9
	For free	4	0.9
	Side effect	2	0.5

Table 5.6. Willingness to pay amounts

WTP Interval	Frequency		Percent	
	Ten	Indefinite	Ten	Indefinite
1-50	105	92	53.0	46.5
51-100	40	44	20.2	22.2
101-150	9	16	4.5	8.1
151-350	21	19	10.6	9.6
351-550	19	21	9.6	10.6
551-2000	4	6	2.0	3.0

Table 5.7. Summary statistics of WTP

Years	Mean	Median	Min.	Max.
Ten	148.4848	50	50	2000
Indefinite	163.6364	100	50	2000

Table 5.8. WTP and initial bid price

Starting bid in Birr	Willing to pay		Total
	Yes	No	

150	31	60	91
200	58	52	110
250	24	55	79
300	53	29	82
350	32	46	78
Total	198	242	440
	Indefinite	10 years	
Pearson Correlation	0.0024	0.044	
Sig. (2-tailed)	0.713	0.905	

Table 5.9 WTP and Occupational status of respondents

Occupational Status	1-50	51-100	101-150	151-350	351-2000	Total
Civil	10	6	1	4	3	24
Own Bus.	17	5	4	3	14	43
Private	9	10	4	2	1	26
NGO	17	13	4	10	7	51
Unemployed	27	6	2	0	2	37
Daily Lab.	6	0	0	0	0	6
Association	6	4	1	0	0	11

Table 5.10. Test for Free riding

Years	Mean	Median	Min.	Max.
Ten	75	50	50	350
Indefinite	80.56	50.	50	350

Table 5.11 construct validity test

Variable		WTP indefinite years	WTP 10 years	Income
WTP indefinite years	Pearson correlation	1	0.968**	0.646**
	Sig. (2-tailed)	.	0.000	0.000
WTP 10 years	Pearson correlation	0.968**	1	0.636**
	Sig. (2-tailed	0.000	.	0.000
Income	Pearson correlation	0.646**	0.636**	1
	Sig. (2-tailed	0.000	0.000	.

** Correlation is significant at the 0.01 level (2-tailed)

Fig 5.1 WTP and gender of respondents

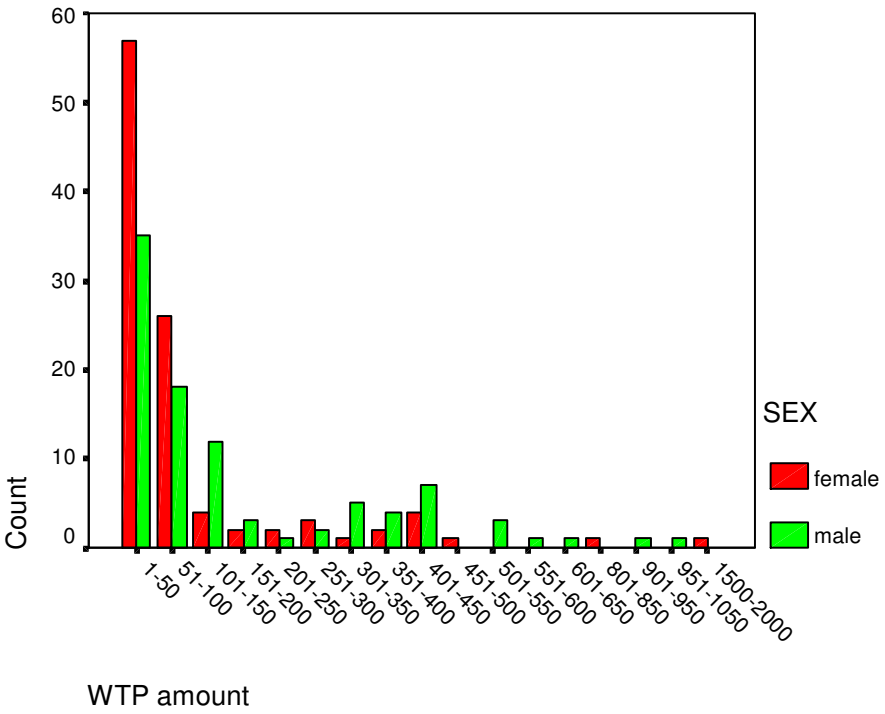


Fig 5.2 WTP and mean age of respondents

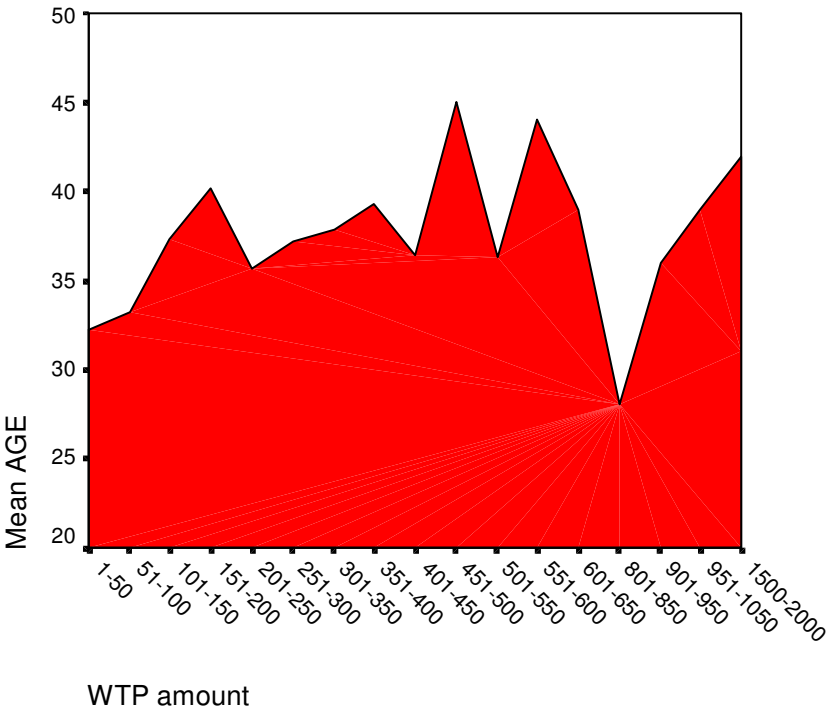


Fig 5.3 WTP and mean Family size

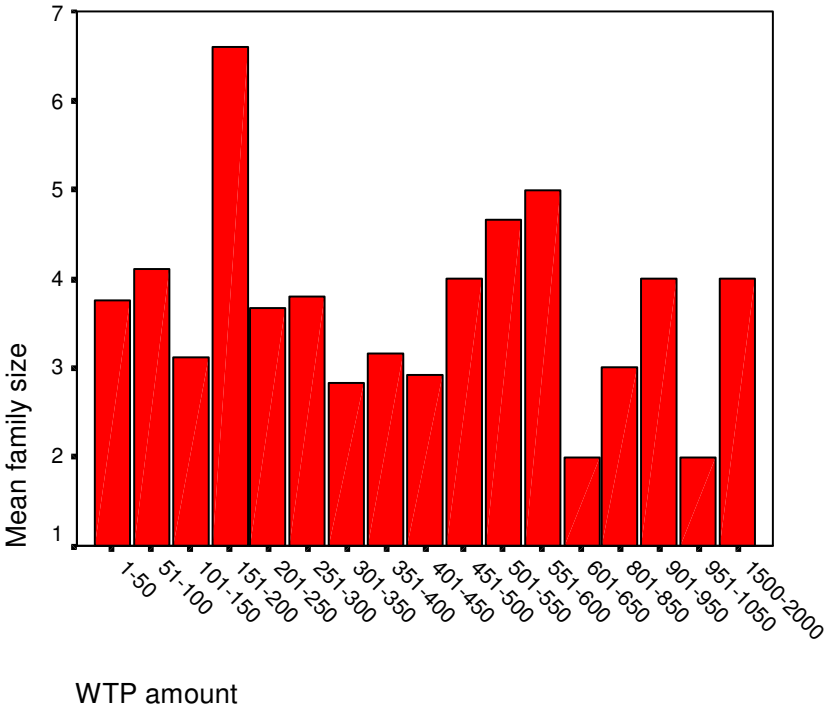
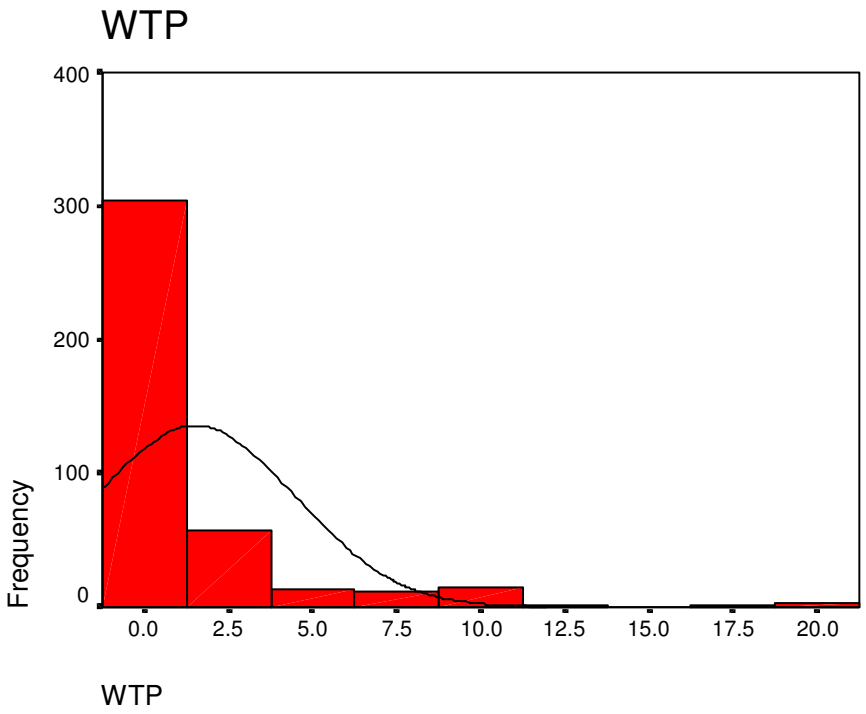


Table 5.14 Results of the 25th and 75th quantile regressions

Variable	25th quantile regression		75th quantile regression	
	Coefficients	t-ratio	Coefficients	t-ratio
Sex	-0.1045171	-0.18	-0.2793702	-0.68
Age	0.0760673	1.97**	0.0369773	1.28
Marital status				
married	-0.9515558	-1.49	-0.5684495	-1.14
divorced	-0.9156075	-1.1	-0.8509377	-1.13
widowed	-0.8966771	-1.2	-0.6040108	-1.15
Religion				
Orthodox/Catholic	0.3917815	0.77	-0.0069478	-0.02
Muslim	-0.7984171	-0.88	-0.4257784	-0.85
Education				
Primary	0.5679173	0.47	0.1384381	0.3
Secondary	0.7367327	0.65	0.129762	0.28
Post secondary	0.2115031	0.17	0.2730608	0.42
Employed	1.268851	0.79	0.6364031	1.73*
FS	-0.3597291	-2.45**	-0.3147552	-3.46***
FH	-0.3764647	-0.74	0.8282734	1.79*
I	1.06995	4.1***	1.830568	12***
YLV	-0.0519969	-0.54	0.062187	0.88
HS	-0.5004839	-0.6	-0.1733955	-0.32
TC	0.3621974	2**	0.1459139	0.88
WP	-1.033206	-1.76*	-0.4958644	-1.24
XY	-1.599744	-1.3	0.1813678	0.21
BP	0.4741712	2.42**	0.1997491	1.63
FR	0.1815428	0.38	0.0982077	0.26
Cons	-6.909576	-2.6**	-4.935946	-4.55***

Normality Test

Statistics	WTP	Income	TC	YLV
Number of Obs.	408	408	408	408
Skewness	3.313	.757	.990	1.280
Std. Error of Skewness	.121	.121	.121	.121
Kurtosis	13.402	-.534	.240	1.185
Std. Error of Kurtosis	.241	.241	.241	.241



Multicollinearity test

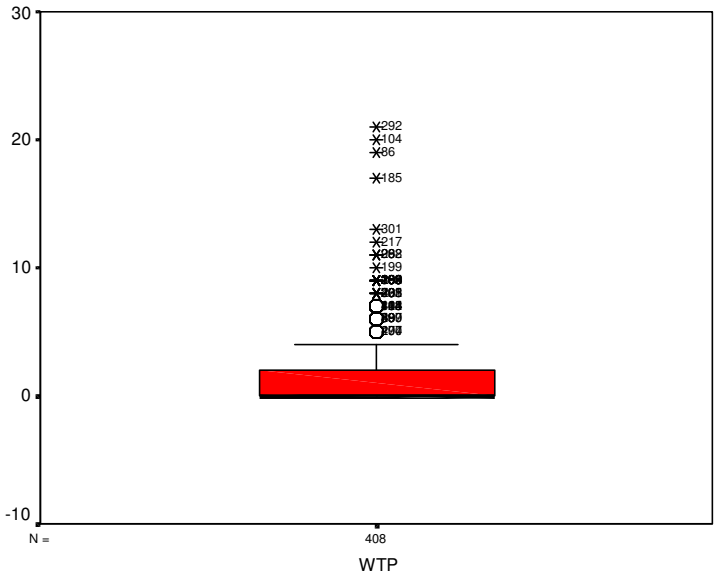
	Sex	age	married	Divorced	widowed	Muslim	Orth/ Cath
Sex	1.000						
Age	0.396	1.000					
married	0.104	-0.053	1.000				
divorced	-0.008	0.094	-0.292	1.000			
widowed	-0.119	0.223	-0.523	-0.244	1.000		
Muslim	0.173	0.164	-0.021	0.078	0.007	1.000	
OrthCath	-0.075	-0.103	-0.034	0.124	-0.047	-0.170	1.000
primary	-0.049	-0.087	-0.127	0.064	0.060	0.172	-0.017

secondary	-0.072	-0.103	0.084	-0.056	-0.037	-0.155	0.059
Bsecondary	0.285	0.241	0.078	-0.007	-0.083	0.017	-0.033
employed	0.290	0.329	0.073	0.045	-0.028	0.100	0.002
FS	0.052	0.257	0.134	-0.057	0.022	0.078	-0.130
BP	-0.002	-0.049	0.023	0.031	-0.027	-0.063	-0.022
YLV	-0.005	0.234	0.014	-0.063	0.098	-0.009	-0.076
TC	0.030	0.168	0.001	0.073	0.080	0.062	-0.050
WP	-0.125	-0.013	0.022	0.050	0.012	0.049	-0.014
FH	0.013	0.282	0.100	0.024	0.237	0.085	-0.089
Income	0.236	0.277	0.103	-0.007	-0.026	0.018	-0.019
XY	0.157	0.150	0.158	0.018	-0.112	0.048	0.010
HS	-0.108	-0.010	-0.038	-0.021	0.081	-0.003	-0.082
FR	-0.077	0.017	0.009	-0.076	0.062	-0.080	0.003

	Primary	Second.	Bsecond.	Employed	FS	BP	YLV
Primary	1.000						
Second.	-0.593	1.000					
Bsecond.	-0.267	-0.390	1.000				
Employed	-0.142	0.050	0.231	1.000			
FS	0.016	-0.006	0.017	0.075	1.000		
BP	-0.015	0.051	-0.063	0.043	-0.002	1.000	
YLV	-0.140	0.046	0.212	0.235	0.109	-0.012	1.000
TC	0.011	-0.053	0.092	0.109	0.061	-0.054	0.233
WP	0.076	-0.012	-0.130	-0.015	0.054	0.012	0.024
FH	-0.077	0.031	0.022	0.222	0.225	0.116	0.137
Income	-0.263	0.077	0.409	0.408	0.065	-0.003	0.319
XY	-0.105	-0.018	0.231	0.150	0.026	0.036	0.045
HS	0.024	-0.027	0.018	-0.014	0.089	-0.042	0.122
FR	-0.086	0.138	-0.039	0.049	0.050	0.097	0.110

	TC	WP	FH	Income	XY	HS	FS
TC	1.000						
WP	0.460	1.000					
FH	0.150	0.065	1.000				
Income	0.110	-0.155	0.138	1.000			
XY	0.042	-0.066	0.131	0.257	1.000		
HS	0.527	0.260	0.044	-0.093	-0.040	1.000	
FS	0.043	0.079	0.107	0.049	0.010	0.006	1.000

Test for outliers



QUESTIONNAIRE

Interviewer's Name_____
Date of the Interview_____
Supervisor's Name_____
Date of Supervision_____

Hello. My name is Martha Getachew. I am doing my Msc thesis on "willingness to pay for antiretroviral drugs", which I believe will help policy makers in their decision. The research will be a successful story only if you help me by answering the questions below.
The interview is totally voluntary and if you feel uncomfortable in any of the questions you are free not to answer.

PART I Socio-Demographic Characteristics

1. Sex_____

2. Age_____

3. Marital Status
   a. Married
   b. Divorced
   c. Single
   d. Spouse deceased

4. Religion
   a. Orthodox
   b. Protestant
   c. Catholic
   d. Muslim
   e. Other_____

5. Educational status
   a. Illiterate
   b. Able to read and write
   c. Below 4th grade
   d. Primary education complete
   e. High school complete
   f. Beyond High school

6. Occupational Status
   a. Civil servant
   b. Own business
   c. Private employee
   d. NOG worker
   e. Daily labourer
   f. Association employee
   g. Unemployed
   h.Other_____

7. How many people live in your house (including yourself)?_____

PART II -Knowledge, attitude and practice

Studies show that using antiretroviral drugs lengthens the life years of people living with the virus. These drugs are being distributed in the other parts of the world.

1. Have you ever heard/read/discussed about anti-retroviral drugs before this survey?
   a) Yes
   b) No
2. Do you use these drugs or have you ever used these before?
   a) Yes
   b) No
3. Do you know any one (family member or friend) who uses these drugs?
   a) Yes
   b) No
4. Do you think the current price in the country is reasonable?
   a) Yes
   b) No
   c) Don't know
5. For how long do you think these drugs lengthen the life of a person living with the virus?_____

6. What do you think about the side effects of the drugs?
   a. Very high toxicity
   b. Modest toxicity
   c. Low toxicity
   d. No toxicity
   e. Don't know

PART III WILLINGNESS TO PAY FOR THE DRUG

Anti-retroviral drugs are assumed to lengthen the lifetime of people living with HIV/AIDS for sometime and reduce the possibility of having opportunistic infections. The Ethiopian government is thinking of providing ARVs for free only to prevent mother-to-child transmission whereas other HIV carriers will be charged user fees. This research will try to assess how much you are willing and able to pay for the triple combinations.

Scenario I. Indefinite years

1. Let's assume that triple combination lengthens the lifetime of people living with the virus for indefinite years. Keeping in mind the limitations of your (family's) income, if the price of triple combination is Birr 200 per month are you willing and able to pay for the drug?

   a) Yes
   b) No

   Note to interviewer: If the response is "Yes" go to the next table; ask the figures till the respondent refuses to pay. However, if the answer to the above question is "No"go to quesion number 2

Birr per month	Yes	Specifically How much?	No
250-300			
351-450			
451-550			
551-650			
651-750			
751-850			
851-950			
951-1050			
1500-2000			
2500-3000			
3500-4000			
4500-5000			
Above 5000			

2. If the answer to question 1 is "No", keeping in mind again the limitations of your (or family's) income, are you willing and able to pay from 150 per month for the triple combination if the drug lengthens your lifetime by indefinite years?
   a) Yes
   b) No

Note to the interviewer: If the response is "Yes" to the above question go to next table. However, if the answer is "No" go to the question number 3.

Birr per month	Yes	Specifically How much?	No
51-100			
1-50			

Note to the interviewer: If the respondents says "Yes" to any of the payment questions go to question 4. However, if the respondent doesn't show any interest in the payment then go to the next question.

3. If you are not willing to pay at all for the drugs, would you tell me the reason? Because:
   a) I believe the drugs do not lengthen life years
   b) I believe the drugs should be given for free
   c) I have no income
   d) I believe it has toxicity/side effects
   e) I believe that only God can cure me
   f) Other_____
4. If the drugs become available in the market and lengthen life years indefinitely whose responsibility is to pay for the drugs for you?
   a. Myself
   b. My family
   c. The organization I work in
   d. The association I am a member in
   e. Other_____

Scenario II Ten years

5. Let's assume that triple combination lengthens the lifetime of people living with the virus for ten years. Keeping in mind the limitations of your (family's) income, if the price of triple combination is Birr 200 per month are you willing and able to pay for the drug?

   a) Yes
   b) No

Note to interviewer: If the response is "Yes" go to the next table; ask the figures till the respondent refuses to pay. However, if the answer to the above question is "No"go to quesion number 2

Birr per month	Yes	Specifically How much?	No
250-300			
351-450			
451-550			
551-650			
651-750			
751-850			
851-950			
951-1050			
1500-2000			
2500-3000			
3500-4000			
4500-5000			
Above 5000			

6. If the answer to question 1 is "No", keeping in mind again the limitations of your (or family's) income, are you willing and able to pay from 150 per month for the triple combination if the drug lengthens your lifetime by ten years?
   a) Yes
   b) No

Note to the interviewer: If the response is "Yes" to the above question go to next table. However, if the answer is "No" go to the question number 3.

Birr per month	Yes	Specifically How much?	No
51-100			
1-50			

Note to the interviewer: If the respondents says "Yes" to any of the payment questions go to question 4. However, if the respondent doesn't show any interest in the payment then go to the next question.

7. If you are not willing to pay at all for the drugs, would you tell me the reason? Because:

   a) I believe the drugs do not lengthen life years
   b) I believe the drugs should be given for free
   c) I have no income
   d) I believe it has toxicity/side effects
   e) I believe that only God can cure me

f) Other_____

8. If the drugs become available in the market and lengthen life years by ten years whose responsibility is to pay for the drugs for you?
    a. Myself
    b. My family
    c. The organization I work in
    d. The association I am a member in
    e. Other_____

PART III- Determinants of Willingness to pay

1. How long has it been since you knew you have the virus in your blood?_____
2. How do you evaluate your health status?
    a. Very good
    b. Good
    c. Modest
    d. Bad
    e. Very bad
3. For the last two months, for how long did you visit a hospital, clinic or health station for treatment?_____
4. For the last two months, without visiting a hospital, clinic or health station, did you prescribe anti-pain for yourself?
    a. Yes
    b. No
5. For the last two months, how much did you spend for treatment cost?_____
6. If you incurred any treatment cost for the last two months, who covered for the expense?
    a. Myself
    b. My family
    c. My organization
    d. My association
    e. Other_____
7. Are a family head?
    a. Yes
    b. No
8. If response to the above question is "Yes" how many persons depend on you?_____
9. Do you work and earn income?
    a. Yes
    b. No

If "Yes" how much do you earn?

Note to the interviewer: if the response is in terms of per month write the answer under "monthly"- do the same for others accordingly.

Daily	Weekly	Monthly	Annually

10. Is there anyone in the house who works and earns income?
    a. Yes
    b. No

If "Yes" how much do they earn?

Number workers	Daily	Weekly	Monthly	Annually
1.				
2.				
3.				
4.				

11. Do you get financial support from relatives, friends, association or others?
    a. Yes
    b. No

If "Yes" how much do you get?

Daily	Weekly	Monthly	Annually

12. Is there anyone else in your family that is also HIV positive
    a. Yes
    b. No

Note to the interviewer: If the response to the above question is "Yes" ask the next question; if "No" go to the next section.

13. What is your relation with this person?
    a. Spouse
    b. Child/children
    c. Relative
    d. Other_____
14. When the drugs become available in the market, are you expected to pay for the person?
    a. Yes
    b. No

Part IV- General Attitude

1. In your opinion how do you think the distribution of the drugs be carried out?
    a. Government should distribute for free
    b. NGOs should distribute for free
    c. Pharmacies should distribute the drugs by charging users
    d. Other_____

2. If your economic status changes for the better are willing to pay for the drugs?
    a. Yes

b. No

3. In your opinion do you think the Ethiopian government has exerted its best effort to import the drugs to the country?
   a. Yes
   b. No