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VALUING THE ECONOMIC LOSS OF DEFORESTATION IN ETHIOPIA: CONTINGENT VALUATION STUDY IN WALMARA WOREDA

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JUNE , 1997

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A thesis submitted to the School of Graduate Studies, Addis Ababa University, Fuculty of Business and Economics, Department of Economics in partial fulfilment of the requirements for the degree of Master of Sciences in economic policy analysis.

June, 1997

Addis Ababa

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ACKNOWLEDGEMENTS

"Yea, let none that wait on thee be ashamed."

Psalm 25 : 3

In writing this thesis I received encouragement and assistance from many people. Special thanks are due to my advisor Dr. André Croppenstedt for his advice, support and enthusiasm. I am indebted to Dr. Christopher Mupimpila of University of Zambia and Ato Alemu Mekonnen of Addis Ababa University and currently doing his PhD dissertation at Göteborgs University, for their help in the early stage of this thesis. My questionnaire benefited from comments by Ato Tekie Alemu and Million Taffese.

I wish to express my gratitude to my employer, Development Bank of Ethiopia and higher officials of the bank who made it possible for me to join and attend the program. My thanks also go to Ato Girma Defar (EFAP Secretariat), Ato Dawit Kidane and Ato Girma Bekele, for providing me essential reading materials on deforestation problems of the country and for the trouble they took in coordinating the survey.

Last, but not least, it is to my pleasure to acknowledge my debt to W/t Hirut Minassie for typing the manuscript and to all my friends who encouraged me all the way to complete this research work.

However, any error of analysis or interpretation which, no doubt, different readers will find in this thesis remain entirely my responsibility.

Abstract

The world's tropical forests are disappearing at alarming rate. With less than 3 percent of total land covered by forests, Ethiopia is one of the least developed countries suffering from the problem of Deforestation. Deforestation impedes agricultural productivity and sustainability, exacerbates rural poverty, and affects the whole ecosystem with serious regional and global implications. As a result, improving management of the existing forest resources has become the subject of considerable attention in many countries.

Proper management of forests requires economic analysis which can be used as a basis for land use decisions. To make such analysis which help guide decision making on a variety of forest land use options, however, improved valuation is needed. This paper has examined the application of contingent valuation method for evaluating the opportunity cost of deforestation in Ethiopia. In doing so, the study also attempted at testing the valuation method employed. The finding of the study suggests that contingent valuation survey can actually measure values that are theoretically consistent and sufficiently reliable and which can be valid for use in benefit-cost analysis.

TABLE OF CONTENTS

PAGE

LIST OF TABLES

I. INTRODUCTION

The world's tropical rainforests are disappearing at an alarming rate. These forests, which once occupied 16 million square kilometres of the earth's surface, today cover only 9 million square kilometres. In many countries the rate of deforestation is accelerating and this has become a major global concern, particularly as only 5 percent of rainforest currently receives legal protection. Perhaps most worrying is that deforestation is occurring with little regard to long-term management of forests (Barbier 1992; Mahar 1989).

At present, 36 percent of the tropics is covered by natural forests, an area amounting to about 1,715 million hectares. Based on an estimate of 1,882 million hectares believed to have been under forest cover in 1980, the average annual rate of tropical deforestation during the 1980's was 0.9 percent. However, the rate of forest loss in countries endowed with small areas of forest cover has been much higher: 6.5 percent in Ivory Coast, 5 percent in Nigeria, 4 percent in Coasta Rica and 4.7 percent in Paraguay, for example. In terms of area, the largest extent of loss is incurred by Brazil (3.2 million hectares annually). By region, tropical America loses 8.3 million hectares per year and Africa loses 5 million hectares per year. If present trends continue unabated, all remaining tropical forest may be lost during the next century. Africa has already lost a little more than half its original forests and could lose existing forests in just 60 years (Mahar 1989; UN-FAO 1992).

It is argued that clearing forest land for agriculture is the major cause of tropical deforestation (about 60 percent of the area cleared each year), with the balance split roughly between logging and other purposes such as roads, urbanization and fuelwood. Economic policies and government-financed investment programs both directly and indirectly encourage frontier agricultural expansion at the expense of tropical forests (Barbier 1992; World Bank 1991; Rowe et al. 1992; Burgess 1992).

With less than 3 percent of the total land area covered by forests, Ethiopia is one of the least developed countries suffering from the problems of deforestation and land degradation (MoNRDEP 1993). It is argued that the long history of sedentary agriculture, combined with recurrent draughts and rugged terrain (especially in the Northern part), have led to a vicious circle of environmental degradation and deteriorating socio-economic condition in the country (MoNRDEP 1993;Wagenigen Agricultural University 1995).

According to historical sources, however, about 42 million hectares or 35 percent of Ethiopia's land area was once covered with high forests of either the coniferous or the broad leaved type. With the inclusion of savanna woodlands, some 66 percent of the country was covered with forest and woodland (MoNRDEP 1993; MoNRDEP 1994). In the 1950's, the forest that remained covered 19 million hectares or 16 percent of the land area. In the early 1980's the coverage was reduced to 3.6 percent, and in 1989 it was estimated to be only 2.7 percent. Some 5 million hectares of savanna woodlands were remaining, giving a total forest and woodland area of about 7 percent (IUCN 1990). The annual loss of closed/natural forest cover has been estimated to be an equivalent of 150,000 to 200,000 hectares. It has been projected that, if the present rate of deforestation continues, the area covered by natural forests in 2010 may be reduced to scattered minor stands of heavily disturbed forests on remote parts of the country (MoNRDEP 1993).

This rapid deforestation is caused by a rapidly growing demand for fuelwood and land for cropping and grazing (MoNRDEP 1993; Newcombe 1989). This leads to an exploitation of the country's forest which is faster than its natural rate of replacement. The depletion and degradation of forests have implications for the whole ecosystem and have a fundamental influence upon the declining standard of living faced by many households, particularly in the rural areas. Arresting deforestation and expanding the forest resource base are, therefore, among the vital elements of a development strategy addressing poverty in Ethiopia.

1.1. STATEMENT OF THE RESEARCH PROBLEM

It is argued that tropical deforestation is an economic problem because important values are lost, some perhaps irreversibly, when closed forest are "opened up", degraded or cleared (Barbier 1992; Pearce 1990). Each choice of land use option for the forest - to leave it standing in its natural state, or to exploit it selectively, e.g. for timber or non-timber products, or to clearcut it entirely so that the land can be converted to another use, such as agriculture - has implications in terms of values gained and lost. The decision as to what land use option to pursue for a given tropical forest area, and ultimately whether current rates of deforestation are "excessive" can only be made if these gains and losses are properly analyzed and evaluated. This requires that all the values that are gained and lost with each land use option are carefully considered.

It is argued that there is now sufficient evidence linking the tropical deforestation problem to economic policies. According to Barbier (1992), the core of the policy problem concerning tropical deforestation is, first, proper economic valuation of the forest losses, second, rigorous analysis of the economic and social causes driving deforestation, and third, design of appropriate incentive structures to correct for the problem.

Many environmentalists as well as some economists believe that the world's forests are not valued properly in economic terms (Kramer et al. 1992). Valuation problems exist for many of the diverse goods and services that forests provide. Some of these forest outputs are traded in commercial markets but are misvalued. For example, government distortions prevent market transactions from reflecting the true scarcity cost of the traded output (e.g below-cost timber sales in temperate countries and insufficient concession agreements for logging in tropical countries). Furthermore, externalities associated with destructive timber extraction practices can prevent timber prices from reflecting the true social returns to timber harvest. Minor-forest products such as medicinal plants, nuts, and rubber may be traded in

informal markets or in little-studied formal markets and hence not counted in data on the contribution of forests to national economies (Peters et al. 1989; Barbier. 1992). Forests produce many non-market services such as soil stabilization, watershed services, climate regulation, waste water treatment, protection of genetic pools, and existence values. These services may have considerable value to society but they are not traded in markets at all and so their economic value is often ignored (Barbier 1992; Pearce 1990; Kramer et al. 1992). Even when environmental values are recognized, they may not be measured or used to promote efficient resource management. As a result, actual choice of land is often biased in favour of land uses that do have marketed outputs, e.g., development options such as timber exploitation, agriculture and mining. The result is too much conversion and over-exploitation of forest and too little natural management of forest land.

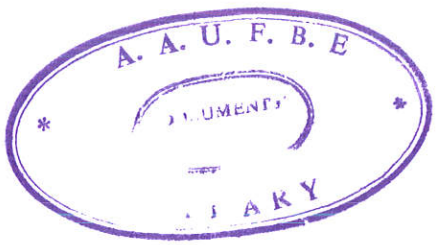
The basic reason for the imbalance is that the non-market values of the natural/managed systems are not automatically reflected in the price of forested land. For example, the market value of land converted to agriculture fails to reflect the lost environmental benefits such as watershed protection. If "owners" (i.e. those with legal title and those who have acquired the land on a first-come basis) had to pay the full social cost of developing forested land, less land would be converted or over-exploited (Barbier 1992). Forested land is clearly underpriced. An important consequence is that once the land occupied has become sufficiently degraded and thus significantly less productive, the "owners" have a strong incentive to abandon the land for new, virgin forested land that is "cheap" to acquire and develop. The process repeats itself until it becomes difficult to get access to new forest lands.

It is argued that undervaluation of forests has caused deforestation to accelerate and has impaired the ability of residual forests to supply useful environmental services. Undervaluation has also caused governments to assign a low priority to the forestry sector because of its apparently low contribution to GDP. This has led governments to subsidise the

direct cost of harvesting and converting tropical forests in many countries which in turn encouraged inefficient and unsustainable exploitation of natural forests. The failure to account more fully for the economic cost of deforestation is, therefore, a major factor behind the design of inappropriate forest policies in many countries.

Thus sustainable management of tropical forests is dependent on accounting correctly for all the economic uses of the forest. Valuing these economic uses help to integrate environmental concerns into the conventional economic decision making process providing policy analysts and policy-makers with better information upon which to base decisions involving alternative land uses and design appropriate forest policy that prevent forest resources from destructive exploitation.

Attempts have hardly been made to evaluate the economic value of forests in Ethiopia. This paper, by applying contingent valuation method to value the economic loss of deforestation in Ethiopia, will try to help to narrow the gap in this regard and hopefully shed light on how to incorporate environmental considerations into economic decision-making through conventional benefit-cost analysis[1].



[1] Contingent valuation is a survey-based methodology that provides survey respondents the opportunity to make an economic decision concerning an environmental good, e.g., a prescribed program affecting a set of natural resources. Values for the affected resources are then inferred from respondents' decisions.

1.2. OBJECTIVES AND SIGNIFICANCE OF THE STUDY

The main objectives of this research project are:

1) To examine the application of contingent valuation method to evaluate the economic value of natural forests and thereby show the possibility of meaningful assignment of economic values to many environmental goods and services which can improve policy and public decision makings; and

2) To test the theoretical validity of the method by examining the statistical dependence of the contingent valuation response on such socio- economic variables as income, education e.t.c.

This study is important for several reasons. First, valuation studies such as this one have relevance for policy-makers, aid agencies and international organizations that are currently seeking policy measures to reduce excessive deforestation. Second, forests produce a number of nontimber outputs that can not be valued with traditional net revenue analysis often used in project analysis. Third, there is tremendous public and political interest in deforestation issues, which in turn has created a demand for improved quantitative information on the benefits and costs of protecting and using natural forests. Valuation studies such as this one thus can shed light on question such as: what is the appropriate level of compensation for local people unable to continue their forest extraction activities because of, say, a reserve.

1.3. SCOPE AND LIMITATIONS OF THE STUDY

The scope of the study is limited to the application of contingent valuation for evaluating the benefits foregone due to destructive deforestation which enables environmental considerations to be explicitly considered in conventional benefit-cost calculus used in economic decision-making.

Although the technique applied here is theoretically well founded, there are limitations to the economic measurement of environmental impacts in general and the various uses of forest resources in particular. Valuation of forest resources poses several difficulties, such as the lack of knowledge regarding value and utility of some forest functions and the difficulties in isolating the benefits of interrelated functions. Other issues such as the value of genetic diversity or cultural significance raise intractable questions of measurement. The hypothetical nature of the questions used in survey analysis may also pose problems since respondents may have little incentive to provide accurate answers concerning willingness to pay. In spite of such limitations, the method is believed to estimate values which are accurate at least within an order of magnitude.

Thus, the remaining parts of the paper is organised as follows. Chapter 2 discusses the deforestation issues in general. Chapter 3 reviews the empirical literature and explain the theoretical framework of CVM. Chapter 4 describes the nature of the data, and the empirical model and analytical techniques employed in the study. Chapter 5 reports the general findings of the survey and the regression results of the model. Finally, Chapter 6 concludes the paper.

II. DEFORESTATION ISSUES

2.1. AN OVERVIEW OF THE FOREST RESOURCE

Data on the forest resources of Ethiopia is highly limited. There is no adequate and reliable information on the types, extent and volume of the standing growth stock, growth rates, or rates at which these resources are being depleted (MoNRDEP 1993).

The two most recent surveys on land use and forest and woody vegetation are those of FAO (1984)[2] and Cesen (1986)[3]. Both surveys used landsat imagery. Because of the extensive deforestation over the last few years, however, their results are now outdated. In 1990, the State Forest Conservation and Development Department (SFCDD) of the Ministry of Agriculture carried out a desk study of the forests resource base. The study classified the country's forest resources and vegetation types as follows:

-natural high forests

-woodlands

-bushlands

-plantations (including industrial plantations, peri-urban plantations, community plantations, and catchment/protection plantations), and

-farm forestry

The study defined natural high forests as land covered by a closed stand of trees with a more or less continuous canopy raising 7m to 30m and a sparse ground cover of few grasses. These remaining natural high forests constitute 8.4% (2.3 million hectares) of the forest resource

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[2] FAO Land Use, Production Regions and Farming Systems. Assistance to Land-Use Planning. Technical Report No. 3, 1984.

[3] Cesen. Biomass Energy Resources. Ministry of Mines and Energy, National Energy Commission, Technical Report No. 1. Addis Ababa, 1986.

base. They are concentrated in the less populated Southern and Western parts of the country. The central and norther parts are found to be almost completely deforested[4].

Woodlands are defined as land covered by an open stand of trees taller than 5m and upto 20m in height and a canopy cover of more than 20 percent. Bushlands are land covered by an open stand of trees and/or taller shrubs 2 to 5 m tall and a canopy cover of more than 20 percent. In Ethiopia woodlands and bushlands represent a variety of wood vegetation types and account for 90.9% (25 million hectares). They are largely restricted to the agro-pastoral and pastoral zones. They occupy large areas in the Awash region, East and South Hararghe, the Rift Valley, South Sidamo, Wellega, Gondar and the slopes of the Eastern and Central highlands.

Plantations include industrial plantations and peri-urban plantations established and operated by the government, as well as community woodlots and catchment protection plantations and constitute only 0.7% (0.2 million hectares) of the forest resource base. The majority of the industrial plantations are found within the boundaries of the National Forest Protection Areas (NFPAs). Peri-urban plantations, created to supply urban centres with poles and fuelwood, are located around Addis Ababa and other major towns. Community woodlots are plantations created and managed by groups of farmers or a community. They can be either protection-oriented or production-oriented (e.g woodlots for fuelwood). Catchment and protection plantations are operations designed to prevent land degradation such as the closure and/or planting of steep slopes, catchments and sub-catchments, and areas of badly degraded land.

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[4] SFCDD. Study on Forest Resource Base. Identification, Conservation, and Rational Use. Ministry of Agriculture, Internal Report. Addis Ababa, 1990.

In parts of Ethiopia, farmers have traditionally used farm forestry practices such as homestead tree planting, field tree planting, and farm boundary planting. Tree growing by private entities, however, has not been officially encouraged or considered an important component of the forest resource base and its development, so information on types of indigenous practice and their extent in the various regions of Ethiopia is almost non-existent. (MoNRDEP 1993).

2.2. FUNCTIONS OF FORESTS

The natural environment provides three main types of services necessary to sustain life: as a source of the raw material vital for all human activity; as a sink for waste residue generated by human activity; and as a means of maintaining essential life support functions (Munasinghe 1992). Natural forests constitute an important part of the natural system that fulfils these services through a multitude of functions and products.

In terms of source functions, the products and services derived from tropical forests are diverse and benefit people at the local, national and global levels. Indigenous peoples and communities that live on the fringes of forests rely on the forest resources for most of their consumption goods, such as food, shelter, and even closing. Their well-being depends extremely upon the forests. At the national level, forest resources are considered as a source of foreign exchange and energy. Forest lands are regarded as "new" land for expansion of food production and settlements. Forests also ensure a regular supply of fresh water, prevent flooding, protect crops from wind damage, and also prevent soil erosion and siltation of river beds downstream. The global community relies on tropical forests to stabilize global climate conditions, protect the diversity of biological species, support natural ecological systems, and provide recreational benefits. People at all levels derive benefits from the amenity value of

forests and the knowledge that forests continue to exist (Pearce 1990; Barbier 1992; Barbier et al. 1991; Kramer et al. 1995; Scharma et al. 1992).

Forest-related exports generate about US$ 100 billion (1989 dollars) worth of foreign exchange, amounting to an average 2.7 percent of GDP in developing countries (Scharma et al. 1992). The forestry sector is a major source of government revenue in some countries - about 70 percent in Malaysia, for example. Nevertheless, the potential rent from the forestry sector is grossly underestimated and goes uncaptured in most developing countries - in Ethiopia, for example (Kramer et al. 1995; MoNRDEP 1993).

By far the most valuable economic product from tropical forests is wood, which accounts for about half of all forest-related revenue. The two main wood products are round wood and fuelwood. Tropical hardwoods, the major industrial timber exports of the tropics, accounts for just over 10 percent of the total international timber trade (Scharma et al. 1992). At present, 33 tropical countries are net exporters of timber. This number, however, is expected to drop to 10 by the end of the century as the domestic demand in many countries catches up with the surplus that was previously exported (Kramer et al. 1995).

Fuelwood is produced primarily to meet national consumption needs. About 83 percent of all wood extracted from tropical forests is consumed as fuelwood. In Africa, as much as 91 percent of all wood supplies is used as a source of energy (Vanclay 1993). An estimated 3 billion people in developing countries rely on fuelwood as the primary source of energy (Scharma et al. 1992). Nevertheless, only about 20 percent of the total energy demand in developing countries is met by fuelwood. Along with increasing scarcity of wood, especially in areas severely denuded of forest cover, the cost of fuelwood had tended to increase significantly. Households, especially poor urban households, may spend up to 20 to 30 percent of their income on fuelwood alone (Rowe et al. 1992).

Forests are the source of many non-wood products as well. These include extractive (such as bark, dyes, fibres, gums, incense, latexes, resins, shellac, tanning compounds and waxes); parts of plants and animals for medicinal, ceremonial or decorative purposes; and good (such as bush, meat, flowers, fruits, honey, nuts, leaves, seeds and spices (Barbier et al. 1991; Kramer et al. 1995; Scharma et al. 1992). Most of these non-wood products are consumed locally (i.e nationally). Nevertheless, they constitute a valuable resource, and their commercial return is much higher than that of wood products and agriculture. Some of these non-wood products have considerable international markets as well. Rattan, latex, palm oil, cocoa, vanilla, nuts, spices, gums and ornamental plants are commodities for which international market exists and are expanding in developed countries. Rattan, resin, essential oil, kapok and quinine exports in 1986 generated US $134 million in foreign exchange (Barbier 1992; Kramer et al. 1995). Also, in Ethiopia minor forest products such as gums and incense; resins and spices; honey and wax; play an important role in the consumption patterns and subsistence of rural communities. Some of these minor forest products are exported, including honey and about half of the officially trade volumes of gums and incense (MoNRDEP 1993).

In terms of other functions, the considerable array of environmental services generated by forests is sufficient justification for protecting natural forests. Tropical forests and forest soils serve as a vast store for carbon due to their high density of biomass. Up to three times the amount of carbon found in the atmosphere is contained by tropical forests (Barbier 1992; Pearce 1990; Scharma et al. 1992). The Intergovernmental Panel on climatic Change (IPCC) estimates that tropical deforestation contributes about one-sixth of the total global emission of carbon into the atmosphere (Kramer et al 1995). And these increasing levels of atmosphere carbon cause the build up of greenhouse gases, which are believed to result in earth's surface temperature.

Tropical forests provide the habitat for extensive fauna and flora (biodiversity[5]) (Pearce 1990). Primary tropical forests support about one-half of all known surviving species. The species and genetic diversity, as well as the diversity of ecosystems found in the tropics, are vital for maintaining the balance of natural ecosystems. Loss of genetic diversity can cause maladaptation of species to changing environmental conditions and increase susceptibility to disease (Kramer et al. 1995; Scharma et al. 1992). The diversity of species also has tremendous medicinal value to humans.

Ethiopia is an important regional center of biological diversity. In large parts of Ethiopia, the climax vegetation are forests. High forests, either coniferous or broad leaved, were the climax vegetation of 35 percent of Ethiopia before human settlement took place. There has been a progressive depletion and degradation of the forest resource base which has accelerated tremendously during the last decades. This severe reduction in forest cover poses a serious threat to the conservation of biodiversity in Ethiopia (MoNRDEP 1993).

Forests serve the important function of protecting watersheds and ensuring perennial supplies of fresh water. They retard soil loss and erosion, especially in the areas of high rainfall, and retain moisture in the soil, ensuring a gradual supply of water to streams and rivers. By mitigating erosion due to winds and surface runoff, forests reduce sedimentation and bed-loading of streams, reservoirs and rivers downstream. Forests also improve air quality and help to maintain regional climates, especially patterns of rainfall (Pearce 1990; Scharma et al. 1992). In Ethiopia, many of the remaining major forests in the National Forest Priority Areas (NFPAs) and National Parks cover critical watersheds and catchments (MoNRDEP 1993).

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[5] Biological diversity (or"biodiversity) encompasses all species of plants, animals, and micro organisms and the ecosystems and ecological processes of which they are parts. Simply stated, biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur (McNeely, J.A. et al concerning the World's Biological Diversity IUCN, WPI, CI, WWF, US and the World Bank, 1990, 17-18).

The recreational value of tropical forests has largely been underestimated thus far. Ecotourism is an emerging economic activity with tremendous potential to generate foreign exchange in tropical countries. Local urban dwellers also derive recreational benefits from visiting tropical forest reserves. The mere existence of tropical forests constitutes a steam of benefits to people, most of who may never intend to visit a forest reserve. In several economic valuation studies that have been conducted to quantify these benefits, the "existence value" of tropical forests constitutes a significant percentage of the total economic value (Kramer et al. 1995; Pearce 1990).

All these functions are economic functions because they contribute to human welfare either directly or indirectly. Evaluation of the above functions of tropical forests is important for assessing the costs and benefits of different land use options. Decisions about the use of tropical forest land, however, are currently made in the context of an imperfect understanding of the total functions of the forest. Even if the functions are broadly understood, only some of them enter into the economic calculus that determines land use. In particular, the direct use values (timber and agricultural land) dominate land use decisions and the wider environmental values are neglected. The resulting asymmetry of values thus explains much deforestation and its analysis indicates some policy instruments for better forest management.

2.3. CAUSES OF DEFORESTATION

It is argued that the real causes of deforestation are often confused with the symptoms of the problem. Misdirected forest management policies that address the symptoms rather than the causes are likely to fail (Vanclay 1993). Distinguishing between the causes and symptoms of deforestation is thus important in designing policies aimed at improving forest management.

2.3.1. DIRECT CAUSES

The principal direct causes of uncontrolled deforestation in the tropics are agricultural expansion, overgrazing, fuelwood gathering, commercial logging, and infrastructure and industrial development. Expansion of agricultural settlement accounts for about 60 percent of the area cleared each year, with the balance split roughly between logging and other activities such as roads, urbanization and fuelwood (Barbier 1992; World Bank 1991; Rowe et al. 1992; Burgess 1992). Also, in Ethiopia, the direct factors that cause rapid deforestation are fuelwood gathering, agricultural expansion and overgrazing (MoNRDEP 1993).

It is argued that Ethiopian farmers are primarily responsible for the destruction of forests by cutting trees, bushes, and shrubs, mainly with the aim of opening up new agricultural land to feed the ever-growing population. Especially in the absence of suitable and accessible technologies aimed at increasing production, the farmers have been forced continuously to encroach upon the forest resources in order to eke out a meagre living for their survival (Stephanos 1995).

Fuelwood is the most important forest product in Ethiopia. The annual demand for fuelwood, for example, is close to twenty times the demand for other forest products combined. Besides, fuelwood is the country's single largest source of energy supply. The national energy balance for Ethiopia for 1990/91 indicates that traditional biomass fuels (i.e. wood, dung, crop residues and charcoal) are the most source for final energy consumption. In 1990/91 modern fuels (i.e., petroleum products and electricity) accounted for a mere 5 percent of overall energy. This shows the extraordinary dependence on biomass fuels and this dependence has persisted over the last twenty years (MoNRDEP 1993).

The recent energy study estimated the total demand for household energy in the country in 1992 to be 63.1[6] million m^3s wood equivalent, with the fuelwood scale being 45 million m^3s. 41.6 m^3s comes from rural households and 3.4 million m^3s comes from urban households. On the other hand, the current annual sustainable incremental yield of woody biomass is estimated to be 14.4 m^3s million (MoNRDEP 1993). The estimated demand for fuelwood of 45 million m^3s is almost three and half times greater than sustainable supply demonstrating the imbalance between the energy required and the capacity of the forest resources to produce. It seems that redressing the energy balance, in the short run, requires excessive mining of the forest resource and the continued loss of natural forests; and thinning of trees on woodlands and bushlands, and illegal cutting on plantations confirm this fact.

It is argued that being a country which depends on its own resources for animal protein, both dairy and meat products, the livestock population, in Ethiopia, is large and varied. According to CSA, the livestock population is estimated to be 3.96 million units and its annual growth rate was 1.66% between 1989/90 and 1991/92. And grazing and browsing account for about 88 percent of the total feed supply[7], the rest being mainly covered by crop residues.

The continuous increase in the livestock population is expected to put pressure on pastures, while their carrying capacity has already been exceeded. At the time there is estimated to be a feed deficit corresponding to 6.6 million tropical livestock units[8]. Thus the increasing pressure on pastures will add to their susceptibility to erosion and will, no doubt, increase the pressure on forest land.

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[6] This estimate is not necessarily indicative of the volumes actually consumed. This is because past sample surveys and estimates of energy consumption, which form the basis for this estimate tends to be based on consumption requirements rather than actual consumption.
[7] CSA, Agricultural sample survey, 1990-1992.
[8] EFAP, Consultant Report on Forest Policy/Legislation, June 1992, Addis Ababa.

2.3.2. UNDERLYING CAUSES

Underlying the major direct causes discussed in the previous section is a dynamic comprising driving forces: growing population and rural poverty; and accelerating forces: market, policy and institutional failures (Pearce et al. 1993; Rowe et al. 1992; Scharma et al. 1994).

In Ethiopia population growth, on average exceeding 3 percent per annum, and poverty have increased the pressure on forest resources mainly through agricultural and pastoral development of natural forests and in terms of increasing demand for woodfuel. The rural population survives by growing their crops, keeping their animal and collecting wood from forest and woodlands to cook their food and build their shelter. Hence fixed land resources have been used to grow trees and forests, cultivate crops and graze animals. As population expands and land productivity falls, these land use options have been increasingly coming in conflict with each other (MoNRDEP 1993; Scharma et al. 1994).

Thus, on the scale now being witnessed, it seems that population growth is the major driving force behind depletion of the forest resource in Ethiopia. As a result, forests essential for watershed protection and biodiversity conservation are likely to be removed in the areas unsuitable for agricultural production, and this undermines sustainable agricultural development.

However, although population pressure plays a major part in the loss of natural resources, population growth alone is not to blame. Many other factors generate resource degradation especially misdirected public policies concerning land tenure and prices. Simple relationships between population growth and the loss of renewable resources therefore tend to conceal the myriad factors contributing to resources degradation.

Market and public policies are important determinants of how forests are used and managed. Mutually reinforcing market and policy failures often precipitate unsustainable forest resource use. Forests generally suffer from their "public good" nature; it is both difficult to market all of the benefits they provide and to exclude public access (Rowe et al. 1992; Scharma et al. 1994).

Various forms of market failures constitute a significant threat to the unsustainability of forest management. Of particular significance is the disparity between the private and social costs of timber harvesting. Timber prices are generally based on the stumpage value; that is, the value of products derived from the timber less the processing cost. However, timber harvesting imposes considerable social costs in terms of opportunity costs, or foregone benefits from other forest related goods and services. The loss to local communities of forest-related consumption goods, loss of services rendered by forest ecosystems (such as flood control, fresh water supply, prevention of erosion, and soil degradation, and carbon sequestering), the loss of biodiversity, and foregone recreational benefits are all factors that must be taken into consideration when determining the social cost of timber harvesting (Kramer et al. 1995; Pearce et al. 1993; Scharma et al. 1994). Other factors that cause market failures are open-access nature of forest resources, incomplete information and uncertainty of forest systems, and imperfect competition.

Market failures are often complemented by policy failures that further aggravate the deforestation problem. Rather than correcting the failure of the market, government intervention has often been aggravating the existing incentives for excessive forest exploitation.

In Ethiopia, there is hardly a past forestry policy with clearly stated aims and means which make it possible to evaluate the effectiveness of the means applied. The absence of forestry policy is also among the major causes of deforestation[9]. It is, however, possible to infer the outstanding issues which should have been addressed in order to avoid the uncontrolled deforestation with economically, socially and environmentally serious consequences.

Like in most other developing and developed countries, the royalty structure, in Ethiopia, does not assign a value, for example, to the tree per se. As a result, the existing royalty/pricing structure does not allow to secure the full economic rent from the forests (MoA 1990). The market for wood and wood products has also been heavily regulated, and state enterprises in the forestry sector remained extensively engaged in commercial activities. Lack of competition, marketing controls, and price regulations have led these enterprises to engage in wasteful and inefficient processing. The underpricing of wood products also distorted the existing pricing structure and incentives frameworks which contributed in a significant way to the over exploitation of forest resources (MoNRDEP 1994).

Policy failures outside the forest sector may be even more important. There are sufficient evidence sharply pointing to the inappropriateness of the past agricultural policies and the attendant disincentives for small farmers which provided incentives for additional land clearing. The first two five year plans (1957-1962 and 1962-1967) deliberately ignored peasant agriculture and favored the development of large-scale commercial farms and exports. The third Five year plan (1968-1973) also encouraged large-scale commercial farming beside small-scale agriculture. To this end, fiscal incentives were provided in the form of duty free imports of tractors and fuels. The Ten-year perspective plan (1983/84-1993/94) also favored large scale farming and mechanized agriculture. The government gave undue importance to

[9] Ethiopia -World Bank Environmental Mission June -July, 1993.

state farms and co-operatives and denied incentives to small farmers. These farms introduced intensive farming and extensive mechanized agriculture and brought unused land (mainly forest land) into cultivation. For example, the expanding state cereal farms, and coffee and tea plantations have cleared thousands of hectares of forest land. The credit policy also gave priority to cooperatives and state farms (Stephanos 1995).

The agricultural policies supported: rigid price control, forced grain delivery, tax incentives to collective farms, fixing farm-gate prices artificially low, preferential prices to state farms and allocation of fertile land to producer cooperatives. The rigid price control, and administratively set price of crops reduced farmers' income and their potential to spend on conservation measures. Subsidies and tax incentives to cooperatives and state farms encouraged the opening up of new forest areas (MoNRDEP 1994; Stephanos 1995).

It is argued that most of the legislative provisions on land use have been rather neutral as forestry policy instruments. Partly because of inadequate land-use planning, considerable misallocation of forest land to different uses has taken place. Furthermore, the land use policy has largely concentrated on security of land tenure and has ever since the revolution in 1975 caused changes in land ownership which also weakened security of land tenure. It is, however, reasonable to bear in mind the possibility that without these provisions deforestation could have been more serious[10].

Inadequate tenurial policy has also accelerated deforestation in Ethiopia. The proclamation of 1975 precipitated nationalization of all land and prohibited transfer of land by sale, lease or inheritance (Proclamation No. 31, 29 April, 1975). Use rights to trees are also ambiguously defined and not believed to be secure for a reasonable time. This rural land

[10] EFAP, Consultant Report on Forest Policy/Legislation, Addis Ababa, 1992.

reform resulted in overcutting of the existing forests and adversely affected the establishment of new plantations (MoNRDEP 1994; Stephanos 1995).

The villagization drive intended to organize better services to the farming communities have conflicted with the aims to grow trees on traditional homesteads. The little information tends to indicate that the impact of villagization on tree growing on homestead was devastating. Security of land tenure was also jeopardised by the integrated resettlement scheme. Peasant associations allocated land to new settlers, thereby reallocating holdings and affecting the security of land tenure (MoNRDEP 1994; Stephanos 1995).

The policy Declaration of 1990 amended the use right to the extent that peasant farmers are given a life-long lease on the land they possess and also a right to pass their use to heirs who earn their livelihood from agriculture. The present government also entitled peasant farmers a life-long, inheritable and transferable rights to the use of land and trees planted thereon (Stephanos 1995). There is, however, hardly a way of knowing whether this is an adequate policy instrument to assure people of their riskless right to work their land to capacity, or whether there is a financial institution which would accept the land possessed by a government tenant as a collateral for a loan.

It seems that the past agricultural, land use, and forestry means would have been far too ineffective had the aim been to retard or halt deforestation. If these policies are likely to continue, the present natural high forests, both those managed for timber production and protection forests, as well as biological conservation and soil and water conservation, will be endangered.

III. LITERATURE REVIEW

3.1. EMPIRICAL WORKS

Several empirical works have been done regarding tropical deforestation in both developed and developing countries. However, only few examples of empirical studies of contingent valuation method are available in developing countries.

Myers (1986) showed the main proximate causes of tropical deforestation worldwide to be small-scale agriculture, commercial logging, fuelwood gathering, and cattle raising. He also indicated the underlying causes of deforestation to include poverty, unequal land distribution, low agricultural productivity, rapid population growth and various public policies. Mahar(1989) analyzed the effects of certain government policies on deforestation on the Brazilian Amazon emphasizing on policies that encourage environmentally unsound economic activities. The principal message of this study is that attempts to reduce or stop tropical deforestation by fiat alone are not likely to succeed if economic incentives encourage people to do the opposite. In other studies, Barbier et al. (1992) examined the extent to which the timber trade and policies, compared to other factors, cause environmental damage and inefficient resource use in the forestry sector and demonstrated that the environmental effects of current timber trade policies can be significant although evidence of these effects is extremely scarce.

Many other authors have investigated the links between deforestation and population growth. Palo et al. (1987) regressed a measure of deforestation in a given year on indicators of sensitivity to soil erosion, climate, accessibility of the forest area, extent of shifting cultivation and grazing, extent of fuelwood collection, various indicators of economic development, land tenure, and population pressure. Forest coverage was found to be very closely correlated with population density and population growth. Allen and Barnes (1985)

used panel data to investigate the link between population growth and deforestation. They found the population change to be more significant, as explanatory variable of changes in forest area in Africa and Asia than Latin America.

On the contrary, Southgate et al. (1989) made a statistical analysis of the causes of agricultural colonization and land clearing in Eastern Ecuador and rejected a simple Malthusian hypothesis linking deforestation with population pressure. In another study, Southgate (1991) also made a regression analysis of the causes of agricultural colonization in twenty-three Latin American Countries and found yield growth, associated with increased supplies of non-land inputs for crop and livestock production to alleviate the pressure for frontier expansion associated with enhanced demand for agricultural commodities. Capistrano and Kiker (1990) found that population was a less important explanatory of deforestation than factors such as income, agricultural self-sufficiency e.t.c.

Amsberg (1994) tried to address the question of how changes in economic parameters, such as the price of timber, influence land use patterns over time, and in particular deforestation rates. His analysis indicated that a lower timber price, ceteris paribus, leads to a larger area of unmanaged forests, and vice versa; and the result suggests that measures to reduce the producer price for timber would be suitable as a second best policy to reduce the pressure on unmanaged forest frontiers. In similar study, Hyde et al. (1996) examined the issues of deforestation problems from the perspective of prices and responses to resource scarcity and his empirical findings from a broad array of industrial and developing countries, temperate and tropical, support that market responses to commercial forest values and subsistence household responses to available forest resources create limits to potential deforestation.

Price (1994) examined the application of economic criteria to an illustrative logging project and found that formal economic criteria for project appraisal frequently reproduce the dubious assumptions of over-optimistic development policies. He argues that, when more realistic criteria are applied the economic case for logging projects tends to diminish. In another study, Pearce (1994) examined how the economic approach can be applied to deforestation problems in the Amazon region of Brazil. The study shows the rates of forest loss, the factors that cause it, the economic value of the forest and the way in which deforestation may be contained through economic policy.

Grut et al. (1991) showed that proper pricing supported by new concession policies can encourage and support sustainable management and conservation of the forests of West and Central Africa, reflect the values of the forest resources, and finance forest management. In their study of the causes of tropical deforestation, Kramer et al. (1995) explored the frontiers of economic analysis by applying nonmarket valuation methods to the environmental services provided by protected forests. The study provides encouraging results from which further work can be done to develop techniques and methodologies to more fully understand the economic consequences of policy, investments and management choices. Their result also shows that by improving economic information on the benefits and costs arising from forest use and misuse, forest valuation can lead to improved decision-making and help policy-makers strike a balance among economic development, biodiversity, recreation, watershed protection, commodity production, and other objectives.

Eutrirak et al. (1986) applied contingent valuation and travel cost approaches to place a value on the benefits of Lumpinee Park in Bangkok. The results from these two approaches provided information about benefits from both park use and the existence of the park. Knetsch and Davis (1966) conducted a contingent valuation study to measure the value of a forest recreation area in Northern Maine and used regression analysis to assess the theoretical validity of their estimate. Each of the variables in an equation, consisting of household

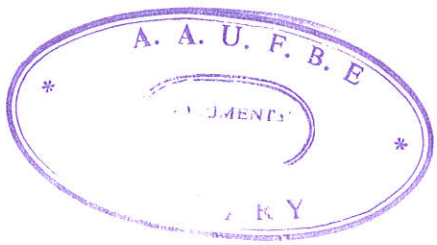
income, years of experience by the household in visiting the area, and the length of stay in the area, were significantly related to the WTP measure. The result of their study showed a very high economic consistency and rationality of the responses.

MacRea and Whittington (1988) conducted a CV study to find the value of supplying water to Haiti and found a reasonable consistent result. Whittington et al. (1990) also used contingent valuation method to estimate consumers' willingness to pay for an improved water system in a village in Southern Haiti. The results of the survey, utilizing an ordered probit model as opposed to a linear model, demonstrated that willingness to pay for a new water system was positively correlated to income, the cost of obtaining water from existing sources and the education of household members. It was negatively correlated with the individual's perception of the quality of water at the traditional source used before the consumption of the improved water supply system. In another study, Whittington et al. (1991) applied contingent valuation survey to estimate household water demand behaviour in Onitsha, Nigeria. In the mean time, they tried to show how the data collected in the survey provides policy-relevant information to water utility managers and can be used to help local water authorities make more informed decisions about how much to charge their customers. The results of these studies also show that it is possible to obtain reasonable consistent answers in a contingent valuation survey conducted among a very poor, illiterate population. Brown and Henry (1989) used CVM for estimating the value of viewing elephants in Kenya and their result showed that it is possible to achieve an estimate which can be used as a useful guide to the order of magnitude of value.

Various studies have been made regarding deforestation and the forestry sector in Ethiopia. Ohlsson (1978) tried to indicate the major problems of Ethiopian forestry which are related to their needs of wood for fuel and building materials and need of protection of their soil and suggested a forestry strategies which should be based upon the fact that the potential to solve these problems are with the peasant and their organization. Yilma (1983) examined

the relation between the rate of deforestation and the energy crisis and assessed the undesirable consequences of deforestation on economic activities and on the ecological balance of the country. Another study by Daba (1984) examined forest utilization and wood consumption pattern of the country and tried to identify the major factors responsible for deforestation and its negative consequences, with particular emphasis on fuel energy crisis and desertification. Newcombe (1989) used three different approaches (production function, replacement cost, and market analysis) to estimate the damage cost of the diversionary use of dung as fuel which arises as a result of deforestation. He estimated that Ethiopian households burned approximately 7.9 tonnes of dung a year and at average grain response value ($79) the dung is worth some $600 million annually. More recently, a comprehensive study of the forestry sector is made by the Ministry of Natural Resources Development and Environmental Protection (EFAP 1993) which focused on forestry and its linkages to economic growth and poverty reduction and, thus, to economic development.

However, none of these studies deal with valuation methods and the empirical literature on these methods is non-existent in Ethiopia. This paper,thus, by applying contingency valuation method to value the economic loss of deforestation in the country attempts to help to narrow the gap in this area.



3.2. A CONCEPTUAL FRAMEWORK

The increasing scale of human activity world wide has prompted the search for approaches for development that are more "sustainable". Nowadays, sustainable development[11] has become a catch-all phrase for forms of economic development which highlights the need to retain an "acceptable" level of environmental quality and to conserve nature's assets (Bateman et al. 1993; Kramer et al. 1995).

As economies grow, so does the strain on the finite natural environmental systems that support life of the planet. The natural environment provides three main types of services necessary to sustain life; i) as a source of the raw material for all human activity; ii) as a sink for waste residue generated by human activity; and iii) as a means of maintaining essential life support function. Natural forests constitute an important part of the natural system that fulfils these services through a multitude of functions and products (see: section 2.2); therefore, the effects of deforestation on sustainable development can be extremely detrimental (Kramer et al. 1995; Munasinghe 1992).

From the conventional economic perspective, it is argued that the sustainability issue has at its core the phenomenon of market failure and its correction via "proper" resource pricing. This requires a strategy that ensures an intertemporally efficient allocation of environmental resources through price corrections. This in turn calls for the need for assessing the environmental impacts of human activity. For example, deforestation of a natural forest may be caused by hydroelectric dams (energy sector policy), roads (transport

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[11] The World Commission on Environment and Development (WCED) defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition highlights both an equity dimension (intragenerational and intergenerational) and a social/ psychological dimension (i.e., the term "need" is used rather than the economic term "want," which is tied into the concept of consumer sovereignty) (WCED 1987).

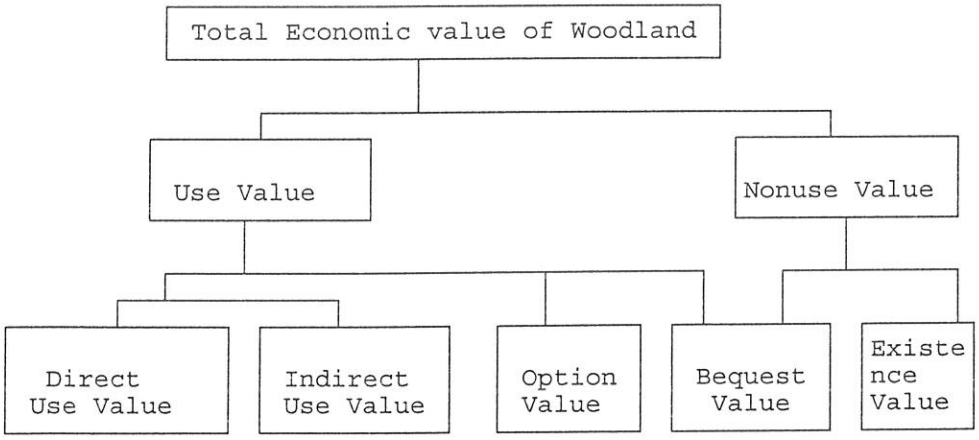
sector policy), slash and burn farming (agriculture sector policy), and mining of minerals (industrial sector policy), and clearing encouraged by land-tax incentives (fiscal policy), and so on. The task of environmental assessment is to distinguish and prioritize among these multiple causes and their impacts (Bateman et al. 1993; Dixon et al. 1994; Kramer et al. 1995).

Once the impact of human activities has been identified by an environmental assessment, economic tools help to map these results into conventional decision making. Among these methods is economic valuation of environmental impacts (at local/project level)[12].

3.2.1. A TOTAL ECONOMIC VALUE FRAMEWORK

The total economic value (TEV) of an environmental resource is made up of use value (UV) and non-use value (NUV). Use value can be further divided into direct use value (DUV), indirect use value (IUV) and option value (OV). Non use value comprises primarily existence value (EV). Bequest value (BV) is sometimes classified as component of NUV as well. The following figure illustrates the use value and non-use values which a multiattribute environmental asset, such as woodland, provides.

[12] The other methods include natural resource management (at the sector/regional level), environmental macroeconomic analysis and environmental accounting measures (at the economy wide or multisectoral level), and global/transnational environmental economic analysis (at the international level). There is, however, considerable overlap in the techniques used at different levels.



By definition, use values derive from the actual use of the environment. Slightly more complex are values expressed through options to use the environment (option values). They are basically premiums that consumers are willing to pay for an unutilized asset, simply to avoid the risk of not having it available in the future. A related form of value is bequest value, a willingness to pay to conserve environmental assets for the benefit of future generations. Existence values are even more problematic. They suggest non-instrumental values which are in the real nature of the thing but unassociated with actual use, or even the option to use the thing (Bateman et al. 1993; Mitchell et al. 1989; Pearce 1990; Randall 1991).

The first step in laying the theoretical foundation for conceptualizing total economic value (TEV) is developing a simple model of TEV in a deterministic framework (Randall 1991). To focus the analysis, consider a single hectare of tropical forest land. The decision problem is either to develop the land, say, by clearing it for agricultural use, or to conserve the land through some combination of sustainable uses. The conservation options capture the two components of TEV: use value and non use value. In between use value and non use

value is option value, which is a premium akin to an insurance premium to conserve the forest for potential use in the future. Therefore, we can state TEV as:

$$TEV = UV + NUV$$

OR

$$TEV = E(CS) + OV + EXV + BV \quad \ldots\ldots(3.1)$$

where E(CS) is the expected value of the consumer surplus from current and planned use, OV is option value, EXV is existence value, and BV is bequest value. Since there is some empirical doubt about the credibility of attempts empirically to differentiate between EXV and BV, and OV and E(CS) (Brown et al. 1994), equation (1) can be shortened to:

$$TEV = E(CS) + EXV \quad \ldots\ldots\ldots\ldots(3.2)$$

Sustainable use of forest land will, therefore, capture E(CS), while the idea of resource transfer to compensate for not burning and clearing land will reflect EXV (Randall 1992; Brown et al. 1994).

Consider also an individual with the utility function:

$$U = U\ (X_e.X_f.Q^0,\ Z) \quad \ldots\ldots\ldots\ldots(3.3)$$

where X_e is services from forest existence, X_f is a vector of minor forest products, Q^0 is the state of environment and Z is a vector of ordinary goods and services.

The solution to the problem :

$$\text{Minimize } (P_e X_e + P_f X_f + PZ)$$

$$\text{S.T} \quad (X_e, X_f, Q^0, Z) \geq U^0 \quad .....(3.4)$$

is the expenditure function:

$$e = e\ (P_e, P_f, Q^0, P, U^0) \quad .....(3.5)$$

If one assumes, purely for notational convenience, prices of ordinary goods and services are exogenous, the expenditure function can be written with P implicit:

$$e = e\ (P_e, P_f, Q^0, U^0)$$

The TEV of the forest is then defined, in terms of Hicksian compensating welfare change measures, as:

$$TEV = e(P^*_e, P^*_f, Q^0, U^0) - e(P^0_e, P^0_f, Q^0, U^0) \quad .....(3.6)$$

where P^* is a choke price (i.e., a price so high that quantity demanded is zero), P^0 is a base line price, and Q^0 is baseline level of resource quantity. Existence services generally are unpriced; thus, P_e is the shadow price of X_e.

Equation (3.6) suggests a one-shot, or holistic, measure of TEV. It is possible to breakdown TEV into its components, and to provide a common sense interpretation of each component. But the breakdown by components often introduces ambiguity and potential for overlap. In many cases, the distinction between individual components is not strongly emphasized since the primary objective is to measure TEV. As a result, most applied benefit-

cost analyses which evaluate proposed policy changes use expression in equation (3.6) to define the appropriate value measures.

3.2.2. CONTINGENT VALUATION METHOD

The total value framework developed in the previous section permits economists to measure total economic value. This can be done via Contingent Valuation Method (CVM). The match between the total value framework and CVM is very close: the total value framework has a sound intuitive appeal; CVM scenarios constructed to implement a total value approach, are as plausible and intuitive as the total value framework (Randall 1991).

The CVM uses survey techniques to establish the value of goods and services that are not exchanged in markets and, therefore, do not have any prices associated with them. Within this framework, demand for non-market goods is established, first, by describing a simulated market to respondents and then asking them directly to reveal their preferences in terms of some common denominator (Bateman et al. 1993; Carson 1991; Mitchell et al. 1989).

The ultimate aim of a CV survey is typically to obtain an accurate estimate of the benefits (and sometimes the costs) of a change in the level of provision of some public good, which can then be used in a benefit-cost analysis. In order to do this, the survey must simultaneously meet the requirements of economic theory and the theoretical imperatives of survey research. To meet the requirements of economic theory, a survey must obtain a correct benefit measures for the good in the context of appropriate hypothetical market setting. To meet the methodological imperatives requires that the scenario be understandable and meaningful to the respondents and free of incentives which might bias the results

(Mitchell et al. 1989). This section reviews the theoretical underpinning of CVM and its methodological issues.

3.2.2.1. A THEORETICAL OVERVIEW OF CVM

CVM enjoys a very strong theoretical foundation. In estimating monetary values for environmental resources, the concern is how changes in the provision of environmental public goods impact upon individuals' utility. Traditionally, the welfare gain or loss from such changes of provision has been approximated by changes in consumer surplus[13]; the area under the ordinary demand curve and above the price level (Bateman et al. 1993; Carson 1991; Varian 1993).

The Marshallian demand curve tracks the "full price effect" which occurs when the provision of a good changes. Typically it has been used to show how much the quantity consumed of a normal good increases when its price falls. A practical problem thus arises in estimating the Marshallian demand curve for an unpriced environmental public good. For these non-market environmental public goods, the price/consumption information required to estimate the Marshallian demand curve will not be directly observable. This problem can be solved by estimating the Marshallian demand curve via a surrogate market, for example, using incurred travel costs as a proxy for recreational value of an open-access leisure site. However, a more fundamental theoretical problem remains in that the presence of income effect means that consumer surplus itself can give an inaccurate measure of the welfare change resulting from a change in good provision (Bateman et al. 1993; Pearce et al. 1993; Varian 1993).

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[13] This refers to Marshallian consumer surplus.

In order to move from the ambiguity of consumer surplus to a theoretically more accurate measure of welfare change we therefore need to compensate for the income effect by holding real income constant, i.e., moving from using the ordinary Marshallian demand curve to the compensated (Hicksian) demand curve.

The Hicksian approach evaluates welfare change as the money income adjustment necessary to maintain a constant level of utility before and after the change of the provision. This Hicksian welfare measure can be expressed in terms of either willingness to pay (WTP) or willingness to accept (WTA) compensation (Carson 1991; Varian 1991). For example, a CVM scenario based on equation (3.6) (see: section 3.2.1) requires the respondent to compare two situations: (P^0_e, P^0_f, Q^0, U^0), in which the particular environment exists, and the site experience and the various activities are available at the current quality levels and prices; and (P^*_e, P^*_f, Q^0, U^0), in which the environment does not exist and hence is unavailable for use. A Hicksian compensating approach to valuation would suggest questions to elicit willingness to accept compensation to permit (P^*_e, P^*_f, Q^0, U^0) given a reference situation of (P^0_e, P^0_f, Q^0, U^0). A Hicksian equivalent approach would suggest eliciting willingness to pay to avoid the less-desired situation.

Thus the CVM approach, in eliciting explicit statements of how much income consumers are WTP to ensure that a welfare gain occurs (or prevent a welfare loss occurring) or how much income they are WTA to endure a welfare loss (or forgo a welfare gain) is, in theory, directly estimating the true Hicksian welfare of these changes. Having a strong theoretical basis, with the unique advantage of estimating income-compensated welfare measure, CVM has the potential for application to a wider range of environmental goods than any of the other non-market valuation techniques[14]. It also has great flexibility, particularly

[14] The other two basic approaches to non-market valuation rely on observed economic behaviour rather than consumer's stated preferences and are known as Hedonic Pricing and Travel Cost analyses.

in valuing environmental commodities or aspects of environmental commodities which are difficult, if not impossible, to value using the other benefit estimation techniques. Although there are some methodological criticisms of the empirical methods, these theoretical ability and flexibility to estimate true welfare measures represent a considerable potential advance over the other approaches and deserves emphasis.

3.2.2.2. METHODOLOGICAL ISSUES IN CVM

The previous section reviewed the theoretical grounds for using CV surveys to measure benefits if truthful revelation of preferences can be obtained. This section looks into the methodological challenge of using sample surveys to accomplish this goal.

Because of its nature as an expressed-preference survey technique, CVM is susceptible to bias, and the task of minimizing such bias to an acceptable level is one which requires considerable skill and methodology. Methodological issues most pertinent to CVM can be roughly divided into validity, reliability and bias categories. Validity refers to the degree to which the CVM evaluation correctly indicates the "true" value of the asset under consideration, bias being a common cause of low validity. Reliability refers to the consistency or repeatability of CVM estimates. Reliability and validity need not thus be synonymous; for example, a particular CVM instrument may, in repeated trials, yield a consistent value estimate for a particular asset. However, if these trials are all subject to a bias then the results will not be valid (Bateman et al. 1993; Mitchell et al. 1989).

A. RELIABILITY

In a CV survey reliability is related to the extent to which the variance of the WTP amounts given by respondents is due to random sources, or "noise", with reliability being inversely related to the degree of non-randomness (Bateman et al. 1993; Mitchell et al. 1989).

The variance in the WTP amounts, in a CV survey is the result of three principal factors: true random error; sampling procedure: and the questionnaire itself (instrument bias). True random error is essential to the statistical process since some people will be willing to pay more than others for a good even if the values for the good were measured by a perfect instrument applied to a perfect sample. The second source of variance is the sampling procedure error which is a problem inherent in any statistical survey and can be usually acceptably minimized by ensuring that a statistically significant sample size is used. The third factor and of most concern here is the instrument: its concepts, its wording, its method of presentation (Bateman et al. 1993; Mitchell et al. 1989).

According to Rowe and Chestnut (1982), a good CVM instrument should be informative; clearly understood; credible; "realistic relying upon established patterns of behaviour and legal institutions"; and "have uniform application to all respondents". The further a particular CVM scenario moves from these forms - for example, the less familiar the respondent is with the environmental good or the construct of its valuation - the more likely it is that such an instrument will increase the variance of responses. Realism and familiarity are therefore at a premium in constructing CVM scenarios.

Several authors (Mitchell et al. 1989; Hanley 1990) advocate the subsequent retesting of a particular CVM scenario as a test of the reliability of estimates from an initial test. One test by Heberlien (1986) did find a substantial correlation between WTP amounts despite a one-year interval between test and retest. Other studies by Loehman et al. (1982) and Loomis (1989) generally support the reliability of CVM instruments. Few such replicability tests, however, have been carried out, mainly due to the high resource cost involved.

In the absence of such test-retest, the burden on the researcher is to demonstrate that the individual WTP amounts are not simply random responses. This can be most easily be done by obtaining a respectable R^2, when regressing WTP on a set of theoretically relevant variables, since the higher the R^2 the lower the random portion of the WTP response variance. Thus the reliability of a CV study which fails to show an R^2 of at least 0.15, using a few key variables, is open to question (Mitchell et al. 1989).

Reliability is closely related to bias. For example, uncertainty induced by a poorly written, unrealistic scenario may lead respondents to make causal and thus unreliable responses, or it may make respondents more vulnerable to various instrument effects which tend to bias WTP amounts.

B. BIAS ISSUES

It is argued that as an expressed-preferce valuation method, CVM is inherently susceptible to various types of bias. In general, this bias can be broadly classified into three: general (strategic and free-riding), instrument (starting point bias) and procedural (aggregation bias)types. The designer of CV study should, therefore, take these possible sources of bias into consideration.

1. **Strategic and Free-Riding Bias:** Strategic bias occurs when respondents deliberately shape their answers to influence the study's outcome in a way that serves their personal interest. That is, if an individual is particularly keen upon a good and calculates that the decision regarding provision depends upon the mean valuation of the sample, then he may behave strategically and overstate his true WTP in an effort to raise that mean and thereby ensure provision. On the contrary, free-riding bias occurs when the respondent pretends to have less interest in a given public good than he really has and understate his WTP for the good on the assumption that others will pay for its provision (Gravelle & Rees 1992).

Probably more than any other arguments, free-riding and strategic behaviour are the problems while economists have focused upon in criticizing CVM. This is because neoclassical theory describes the "rational" individual as essentially selfish (Mitchell et al. 1989).

Different types of field test for strategic behaviour have been reported in the CV literature. None of them are able to definitively measure the presence of strategic behaviour, however, because they can not distinguish it from other possible types of response behaviour. Nonetheless, all types of the test are so constructed that the failure to find strategic behaviour is a good indicator of its absence.

The common type of test for strategic behaviour is a distributional one, first proposed and implemented by Brookshire et al. (1976). They assumed that true WTP bids are theoretically normally distributed, then strategic behaviour should disturb this causing a larger than expected concentration of respondents at the low and high ends of the WTP distribution. Such concentrations would indicate strategic behaviour even if other plausible distributions for WTP, such as the log-normal, were chosen. Using such an approach, Brookshire et al. (1976) test for and reject the presence of strategic bias. The results of other experiments (Brubaker 1982; Rowe et al. 1980; Marwell et al. 1981) also demonstrate that strategic behaviour occurs much less often than standard utility maximization assumptions would predict, except where the person is assured that he will pay. Even under that condition, free-riding bias occurs far less than most economists would predict.

Thus, free-riding and strategic behaviour are generally rare in CV studies and not invalidate CVM exercises. Although such conditions are generally rare in CV studies, and strategic bias is much less of an impediment to CV studies than many economists have assumed, the possibility of strategic bias must be taken seriously.

2. Starting Point Bias: Starting point bias occurs when the respondent's amount is influenced by a value introduced by the scenario. This bias arises from two separate sources. First, the starting point is likely to convey some information about what the value of the good should be and hence the starting point is likely to influence the magnitude of the respondent's final WTP for the good. The second source, which is the process of getting from the starting point to the respondent's final answer, may influence that answer. In bidding game, even if a respondent reject the initial bid, starting points well above the respondent's true WTP will tend to increase the revealed WTP, while starting points well below it will tend to decrease it (Carson 1991; Mitchell et al. 1989).

Several studies (Desvousges et al. 1983; Green et al. 1990) have noted that the suggestion of an initial starting point in a bidding game can significantly influence the final bid - for example, the choice of a low (high) starting point leads to a low (high) mean WTP. While the use of starting points may reduce non-response and variance in open-ended questionnaire, the statistically observable bias this induces indicates that such "bidding hints" lead respondents to take cognitive short-cuts to arrive at a decision rather than thinking seriously about their true WTP (Mitchell et al. 1989).

3. **Aggregation Bias**: In a CV survey, it is a common practice to generalize the sample findings in various ways. The sample data is usually used to estimate benefits for a much larger group of people than those actually interviewed and to value a broader set of policies than those specifically addressed in the original study (Mitchell et al. 1989). The aggregation of CV findings to obtain benefit estimated for different levels of provision of public goods is thus a necessary step in applying these findings to public policy decisions.

However, the aggregation procedure itself can induce bias. The main issue here is to define the relevant population at the pre-survey stage and then conduct standard diagnostics, to validate the sample collected as being representative of the population. In a

CV survey, nonetheless, no matter what sampling plan and survey method are used, some level of non-response to the WTP questions is virtually inevitable[15], with the consequence that the number of those who give valid WTP amounts will be smaller than the number of originally chosen sample elements. This may produce bias because of the propensity of certain people (e.g. less educated) to be disproportionately under-represented in the final data set. This calls for imputing missing values as a way to compensate in part for the bias which would otherwise result (Bateman et al. 1993; Mitchell et al. 1989).

A more fundamental question which arises is the choice of an appropriate welfare measure for aggregation. If the distribution of WTP bias is non-normal then the sample mean will have been biased by the major tail of the distribution. Similarly, reference to the median in such situations will not be valid for aggregation as it can not be said to be representative of the sample (Bateman et al. 1993). Duffield and Patterson (Cited in Bateman et al. 1993) therefore, support the use of a truncated mean as the basic welfare measure for aggregation. Others (Eutriak 1986) used the mid point estimates of the frequency distribution of WTP amounts for aggregation purpose.

Thus, from their very nature, CV surveys are prone to a number of biases. In designing CV surveys, it is imperative therefore to make an effort to reduce bias problems to acceptable level in order to obtain a useful and theoretically consistent valuation information. Otherwise, these biases would impair the validity of the valuation information obtained from such survey results.

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[15] In a CV survey, non-response rates of 20 to 50 percent for the WTP elicitation questions are not uncommon where (i) the sample is random and therefore, includes people of all educational and age levels, (ii) the scenario is complex, and (iii) the object of valuation is an amenity which people are not accustomed to valuing in dollars (Mitchell et al. 1989).

C. VALIDITY

The validity of a measure is the degree to which it measures the theoretical construct under investigation. In the CV context, the theoretical construct is the maximum amount of money the respondents would actually pay for the public good if the appropriate market for that public good existed (Mitchell et al. 1989). Theoretical validity, which mainly focuses upon examination of bid curve functions, examines whether the measures produced by CVM confirms to theoretical expectations. For example, theory predicts a significant positive relationship between income and WTP and failure to find such a relationship raises questions about the validity of one or both of the measures (Bateman et al. 1993).

Basically, the interest in assessing theoretical validity is focused upon the determinants of a WTP amount. Accordingly, theoretical validity is most commonly measured by regressing some form of the WTP amount on a group of independent variables believed to be theoretical determinants of people's WTP for the good being valued. The sign and significance of the estimated coefficients are then examined and judged to be consistent or inconsistent with theory. Studies which do not establish significant relationships where theory indicates they should exist must, therefore, be treated with suspicion (Bateman et al. 1993; Mitchell et al. 1989).

A further variant of this approach is to examine the explanatory power of bid functions. However, the high variance associated with CVM and other social survey techniques tends to produce low R^2 statistics. Hanley (1990) recommends that a minimum R^2 value of 0.2 should be used, while Mitchell and Carson (1989) suggest an R^2 value of 0.15 as a minimum. In testing theoretical validity, however, the outcome of interest should not be the R^2 - which is evidence for reliability rather than validity - but the size and sign of the estimated coefficients and whether they are consistent or inconsistent with theory.

The main problem CV practitioners encounter when considering the estimation of a valuation function is specifying the correct model of the valuation function. The problem here is that theory provides us with no particular expectation regarding the nature of the functional form. As a result, the exact mathematical form of this valuation function is unlikely to be known (Bateman et al. 1993; Carson 1991).

Thus, whenever CV studies are designed with the intent of gathering data to be used for policy proposes, it is highly desirable that they take into account the need to produce theoretically based regression equations or comparable evidence of their theoretical validity.

IV. METHODOLOGY OF THE STUDY

4.1. NATURE AND SOURCE OF DATA

The study uses a cross-sectional data set obtained from a primary source. In order to evaluate the opportunity cost associated with deforestation, a contingent valuation survey was conducted on a sample of 310 households (i.e., 155 households from state forest area and the remaining 155 from community forest area). This sample survey was conducted following a pilot survey undertaken to test the questionnaire. The pilot survey was conducted on 15 households in Woserbi Peasant Association. Based on this pilot survey the questionnaire was modified accordingly.

The questionnaire consists of six parts. The first part is designed to collect information on general characteristics of the sample households. The second part is designed to obtain information on households's income and its sources. The third part is designed to get information on the attitude of the local people towards forest conservation. The fourth part is designed to collect information on the extent to which the local people depend on forest and forest products. The fifth part uses CVM. Given the lack of consensus in the literature about the question format for CV questions (Mitchell et al. 1989), the sample was randomly divided into two groups. Half of the sample was presented with an open-ended style question which ask respondents to provide a direct answer to the question about the most he or she would be willing to pay for the good or service. The other half of the sample was presented with a "bidding game" question format. With this approach, we started with some initial WTP amount and in response to "yes" replies, increased that amount by Birr 5 progressively until the respondents reply "no". Conversely, we decreased the amount by Birr 5 until a "yes" response is obtained if the respondent said "no" to the initial amount.

Three different levels of starting point (i.e., Birr 5, Birr 35, and Birr 100) were used in applying this elicitation method. These three starting points are obtained from the pilot survey conducted prior to the sample survey, i.e., the minimum, mean and maximum WTP amounts obtained in the pilot survey were used as a starting point in the sample survey. Accordingly, the 155 households in this group were divided into three sub-samples. The first 52 households were asked whether they would want to purchase the good or service at Birr 5; the second 52 households were suggested Birr 35 as a starting point; and the remaining 51 were suggested an initial amount of Birr 100.

The final part (section 6) of the questionnaire was designed to know the extent to which the respondent understand the WTP question and the effort he makes to arrive at the best possible WTP amount.

The sample survey was conducted in six Peasant Associations (PAs). These PAs are namely: Kawo, Huletegha Suba, Sadamo, Guntuta, Obersa, and Huletegha Geressu. All these PAs are found within Walmera Woreda, West Shoa Administrative zone of Oromia region. Kawo, Huletegha Suba and Huletegha Geressu are found at the periphery of Menagesha-Suba State Forest Project. Sadomo, Guntuta and Obersa are located within the boundary of and near the former Addis-Bah Forestry Project.

The Menagesha-Suba State Forest Project is located some 45 kms south-west on the Jima road and 53 kms south on the Nekemte road from the capital city Addis Ababa. The area was under protection since 1888. From 1942 up to 1954, the forest land had been administered by the Ministry of Works and Ministry of Finance. These departments of state, later, passed the responsibility to the Ministry of agriculture. In 1980, the Menagesha-suba state forest project was identified as a priority area by the former Forestry and Wildlife Conservation and Development Authority. Since then, 9,248 hectares of land has been designated and 2,328 hectares of artificial forests have been established (MOA 1991).

On the other hand, Addis-Bah Forestry Project was initiated in response to an awareness that the forest cover of Ethiopia was disappearing, with uncontrolled harvesting of wood for fuel and poles being judged to have been a significant contributing factor. The objectives of the project, as stated in the Development Credit Agreement, are to increase the supply of fuelwood and building poles in the project area (i.e., Addis Ababa and Bahir Dar) and to reverse the process of forest and plantation degradation in Ethiopia. By 1991, the plantation coverage of the project reached 20,140 hectares which involved the rehabilitation of some 17,000 hectares of existing plantations and the establishment of 3,140 hectares of new plantations. Of this total plantation coverage, 816 hectares are community plantation activities (MOA 1992).

Two types of PAs are selected for considering the case of community plantation activities. The one in Sadamo is a state supervised plantation with community participation in the establishment and sharing of the benefits. The state provides credit paying for the establishment, maintenance and protection of the community woodlots, and the community repays the state for the costs incurred in establishment and protection when harvesting takes place. The other two PAs, Guntuta and Obersa, are under self-help scheme. These PAs are not provided with any credit or technical assistance by the government.

Thus the selected PAs are found within or at the periphery of forestry projects which have a baseline information. Besides, the residents of these PAs have been benefiting, directly or indirectly, from the natural forest and community plantation in their respective areas. For example, the residents of Sadamo have been benefiting from the electricity power supply installed from the revenue obtained through the sale of harvested plantations. Sometimes, the PAs with community woodlots are found to settle the annual tax obligation of farmers in their boundaries from the sale of these plantations. Therefore, these PAs are believed to serve as an ideal case for the purpose under consideration. Availability of transportation and accessibility of the areas are also considered in selecting these PAs.

In these selected PAs, a fresh list of households prepared which was used as a sampling frame. From this sampling frame, a total of 310 households (i.e, 155 households from state forest area and the remaining 155 households from community plantation area) were selected using a simple random sampling technique. All the selected households were interviewed and the appropriate data were collected. Since the common languages in the study area are Amharic and Oromigna, the interview was conducted in both languages and enumerators and translators were employed to facilitate the interview. The reference date for enumerating was February 1997.

The questionnaires were edited and coded and the edited and coded questionnaires were verified. The verification was done on 100 percent basis. The verified data was entered in personal computer using SPSS software. Then the data entered was checked and cleaned. In the process, 7 questionnaires were found to be incomplete and only the remaining 303 questionnaires were qualified for analysis.

4.2. DATA ANALYSIS

The information obtained from the CV survey is analyzed in two ways. First, descriptive analysis is made to summarize the general findings of the survey. In doing so, we examine the frequency distribution of responses to the willingness to pay questions. This information is used to predict the distribution of WTP responses in the total population and the WTP for the environmental good or service at a specified price level. Secondly, we use a multivariate statistical technique to estimate a function that relates the respondent's answers to their socio-economic characteristics. This analysis can provide a better and greater insight into the factors that affect WTP responses. The decision on what determinants should be included in the valuation function is based on consumer demand theory.

4.2.1. MODEL SPECIFICATION

Consumer theory predicts a positive relationship between households income and their WTP amount (Bateman et al. 1993; Varian 1993). Thus, the WTP model can be specified as follows:

$$WTP_i = f(HI_i), \frac{dWTP}{dHI} > 0 \quad ...(4.1)$$

where WTP_i is the maximum amount of money that household i is willing to pay to protect and manage the forest (plantation), and HI_i is his income level.

Household's WTP is related to other socio-economic variables as well. Studies by Knetsch and Davis (1966) and Whittington et al. (1990) show that such factors as the cost of obtaining the environmental good or service, education, length of stay in the area explain the variations in households's WTP for environmental goods such as forest and water. Other socio-economic variables are also believed to explain household's WTP, especially their WTP to protect and manage forests. These include household size and their knowledge about the various functions of forests. Hence the model in equation (4.1) can be reformulated as follows:

$$WTP_i = f(HI_i, LSA_i, HHS_i, HHE_i, RKFF_i, FWCT_i); \frac{\partial WTP}{\partial LSA} > 0;$$

$$\frac{\partial WTP}{\partial HHS} < 0; \frac{\partial WTP}{\partial HHE} > 0; \frac{\partial WTP}{\partial RKFF} > 0; \frac{\partial WTP}{\partial FWCT} > 0 \quad ...(4.2)$$

It is hypothesized that education of the respondent, his knowledge about the various functions of forest, length of stay in the area, fuelwood collection time (a proxy for the cost of obtaining fuelwood) are positively correlated with household's WTP while household size is negatively correlated to household WTP.

4.2.2. ANALYTICAL TECHNIQUES

It is argued that univariate analyses are the foundation upon which multivarate analysis rests; every feature of the univariate distribution will have multivariate implications (Hamilton 1992). Based on mean-based statistics (such as mean, standard deviation and coefficients of skewness and kurtosis), the study uses univariate techniques to analyze the nature of each variable included in the model and its distribution.

Moreover, in many empirical researches, the interesting questions typically involve relation between variables and regression provides powerful methods to investigate such relations (Gujarati 1988; Hamilton 1992). The specified model is thus fitted to the collected data using ordinary least squares (OLS) technique. OLS encompasses a system of techniques for describing sample data and extending conclusions to a larger population. However, certain statistical problems can undermine the validity of OLS results and care is taken to watch out for and remedy such problems whenever possible.

Like other statistical techniques, regression rests on certain assumptions and may produce unrealistic results if these assumptions are not satisfied. One of the critical assumptions of the classical linear regression model is that the disturbance terms all have the same variance. If this assumption is not satisfied a problem of heteroscedasticity is likely to happen. This problem destroys the minimum variance property of the OLS estimators. In such cases, the t and F tests of significance based on the conventional OLS estimators of

variances will be highly misleading. This makes conventional testing procedure dubious (Gujarati 1988; Maddala 1992).

The problem of heteroscedasticity is more common in cross-sectional than time series data. In cross-sectional data, one usually deals with members of a population at a given point in time, such as individual households. And these members may be of different size, such as low, medium or high income. In view of this fact, the lagrange multiplier test is applied to test for the problem of heteroscedasticity.

The other important assumption of the classical linear regression model is that the error terms entering into the population regression function are random or uncorrelated. If this assumption is violated, we have the problem of autocorrelation. In the presence of this problem, the OLS estimators are no longer efficient. This makes it difficult to legitimately apply the usual t and F tests of significance (Gujarati 1988; Maddala 1992). However, autocorrelation is usually more common in time-series data. Besides, in this case, the ordering of the data does not have any economic logic.

The classical regression model also assumes the absence of multicollinearity among explanatory variables included in the model. If the independent variables are highly correlated, the regression coefficients possess large standard errors and hence insignificant t-ratios. This means that, in the presence of multicollinearity, one can not estimate regression coefficients with great precision or accuracy. Insignificant t values but a high overall R^2 and F test are the main signals of multicollinearity (Gujarati 1988; Maddala 1992).

Furthermore, the classical linear regression model is based on the assumption that the model used in the analysis is "correctly" specified; that is, there is no specification bias or specification error (Gujarati 1988). Hence, the main problem here is that theory provides us with no particular expectation regarding the nature of the functional form. As a result, the

exact mathematical form of the model is unlikely to be known (Bateman et al. 1993, Carson 1991; Mitchell et al. 1989). The R^2 value, the estimated coefficients in relation to their prior expectations, the Durbin-Watson statistics are examined and the Ramsey reset test is applied in determining the adequacy of the model used in the analysis.

The purpose of the above both univariate and multivariate analysis is to determine whether respondents' answers are consistent with theory and common sense (this increases the accuracy and reliability of the information gathered); and to establish statistical relationships or models that can be used to aggregate responses to the overall population under consideration.

V. EMPIRICAL RESULT AND ANALYSIS

5.1. GENERAL CHARACTERISTICS OF THE SURVEYED HOUSEHOLDS AND ESTIMATION OF BENEFITS

A. SOCIO-ECONOMIC CHARACTERISTICS

TABLE 5.1. Age Distribution of the Surveyed Household Heads

Age Group	State Forest Area (%)	Community Forest Area (%)	Total (%)
20≤	2.1	0.6	1.3
21-30	6.8	16.6	11.9
31-40	28.1	15.9	21.8
41-50	24.7	23.3	23.4
50+	38.4	44.6	41.8
Total	100.0	100.0	100.0

As is indicated in Table 5.1, the age of the majority (86.8%) of the head of the surveyed households is greater than 30 years. This percentage is higher in state forest area (91%) than in community forest area (83%). Some 80 percent of these household heads spent more than 30 years as a permanent resident in the village they are now living. It can be said that many of these household heads stayed in the area starting from their childhood. As a result, there is not much difference between their age and the length of years they spent in the village.

Some 80 percent of the sample households are man-headed while the remaining 20 percent are female-headed. The proportion of female-headed households is higher in community forest area (24%) than in state forest area (16%). Ninety four percent of the heads of these households are involved in farming activities and this activity is their main means of livelihood. The remaining 6 percent are engaged in non-farming activities such as teaching and other public office and manual works. The proportion of non-farmer households is higher in community forest area (9%) than in state forest area (2%).

TABLE 5.2. Educational Background of the Surveyed Household Heads

Education	State Forest Area (%)	Community Forest Area (%)	Total (%)
No schooling	33.6	17.2	25.1
Literacy	40.4	40.1	40.3
Traditional	3.4	12.7	8.3
Primary	15.8	10.3	12.9
Junior	1.4	8.9	5.3
High School	5.5	10.8	8.3
Total	100.0	100.0	100.0

As Table 5.2 shows only 27 percent of the sample household heads attended formal education. This percentage is higher in community forest area (30%) than in state forest area (23%). The proportion of those who never did any king of schooling is also lower in community forest area (17%) than in state forest area (34%). But almost equal proportion (around 40%) of the sample household heads in both areas are exposed to literacy program.

In spite of these facts, 56 percent of the sample household heads have at least a good knowledge about the various functions of forests (i.e, the use of forest for fuelwood and timber and non-timber products such as construction poles, various agricultural tools and its medicinal value). This proportion is higher in state forest area (62%) than in community forest area (51%). This is mainly because, unlike the state forest which is natural, the community forest is composed of a single commercial species (i.e, eucalyptus) and as a result, the knowledge of the community is highly influenced by the commercial aspect of the plantation. From the observations made, it seems that those households exposed to formal education do not necessarily have more knowledge about the various functions of forest than those who did little schooling.

TABLE 5.3. Income Category of the Surveyed Households*

Income Bracket	State Forest Area (%)	Community Forest Area (%)	Total (%)
2000≤	74.0	72.6	73.3
2001-4000	17.8	19.7	18.8
4001-6000	4.8	4.5	4.6
6001-8000	0.7	2.5	1.6
8001-10000	2.1	-	1.0
10000+	0.7	0.6	1.0
Total	100.0	100.0	100.0

*This refers to estimated annual income from the sales of crops, livestock and animal products and income from hiring out oxen and off-farm activities.

As Table 5.3 exhibits the annual income of the majority (73%) of the sample households is less than or equal to Birr 2000 and the variation in income between the state

and community forest areas is negligible. Since 94 percent of the heads of these households are engaged in farming activities, their main source of income is crop output. Only 32 and 20 percent of these households get additional income from the sale of livestock and animal products, respectively. Similarly, only 13 percent of the sample households are involved in off-farm activities and more than 75 percent of them are from the community forest area. Income from hiring out oxen is insignificant since only three households are found to be hiring out their oxen to get additional income.

B. LOCAL VILLAGERS ATTITUDE TOWARDS FOREST CONSERVATION

According to the survey, some 70 percent of the sample household heads said a national goal of forest conservation is very important while 27 percent said it is somewhat important to them. Some 65 percent of the households who said a national goal of forest conservation is very important proposed this goal to be accorded very top priority.

TABLE 5.4. Level of Protection Given to Forests by the Government

Level of Protection	State Forest Area (%)	Community Forest Area (%)	Total (%)
Too much	26.0	13.4	19.5
About the right level	47.3	58.0	52.8
Too little	25.3	21.7	23.4
Don't know	1.4	1.3	1.3
Refused	-	5.7	3.0
Total	100.0	100.0	100.0

As is indicated in Table 5.4., more than 50 percent of the sample households said the protection given to forests by the government is about the right level. This percentage is higher in community forest area (58%) than in state forest area. Some 20 percent of the households complained of the excessive government protection. There is also some variation between the two areas in this respect. Those who said government protection is too much are greater in the state forest area (26%) than in community forest area (13%). More than 70 percent of those who complained of the excessive government protection proposed protection to be minimized and involve local participation in both protection and benefits of forests.

On the other hand, 23 percent of the sample households said government protection is too little. There is no noticeable difference between the two areas in this respect. More than 75 percent of the households in this category proposed that the government should give special attention to forests and teach the community the high value of forests so as to increase local participation in forest management. They also proposed that the local people should be beneficiary of the forestry projects in their respective areas.

TABLE 5.5. Level of Protection Given to Forests by the Community

Level of Protection	State Forest Area (%)	Community Forest Area (%)	Total (%)
Too much	15.2	12.3	13.7
About the right level	42.8	64.9	54.2
Too little	37.9	18.8	28.1
Don't know	2.8	0.6	1.7
Refused	1.4	3.2	2.3
Total	100.0	100.0	100.0

As is shown in Table 5.5, more than half the sample households (54%) said the protection given to forests by the community is about the right level. This proportion is significantly higher in community forest area (65%) than in state forest area (43%). Only 14 percent of the households said the protection by the community is too much while 28 percent complained the protection by the community to be too little. There is also a significant difference between the two areas regarding those who said the protection is too little. The percentage is much higher in state forest area (38%) than in the community forest area (19%). More than 90 percent of the households in this category proposed that it is only when the local people directly benefit from forestry projects in their respective areas that it is possible to increase community's participation in the protection and management of forests.

According to the findings of the survey, 66 percent of the sample households claimed small farmers settlement to be the major cause of deforestation followed by fuelwood collection (18%) and local timber production (14%). There is, however, a significant difference between the two areas in this respect. The proportion of households who said small farmers settlement is the major cause is higher in community forest area (74%) than in state forest area (58%). On the contrary, the proportion of those who said fuelwood collection is the major cause is higher in state forest area (23%) than in community forest area (14%). The proportion of those who said local timber production is the major cause is also greater in state forest area (18%) than in community forest area (11%). It seems that the significant pressure on both state and community forests comes from small farmers encroachment. However, state forests are more exposed to fuelwood collectors and local timber producers than community forests while the latter are more vulnerable to small farmers settlements.

C. LOCAL VILLAGERS DEPENDENCE ON FOREST AND FOREST PRODUCTS

The survey found out that 35 percent of the sample households depend on state forest as their main source of energy while some 25 and 24 percents depend on community and open-access forests respectively. The remaining 16 percent of the sample households are found to use their own and other people's holdings as a main source of household energy.

The survey also indicated that 50 percent of these households prefer firewood for household energy consumption while some 27 percent prefer twigs, leaves and branches. The remaining 23 percent preferred cow dung and crop residues. Some 65 percent of the sample households admitted that the fuelwood collection is undertaken by their wives while 25 percent said it is carried out by children. Some 80 percent of these fuelwood collectors spend at least two hours per day in fuelwood gathering and 45 percent spend at least 3 hours per day in the same activity. Some 75 percent of these fuelwood collectors spend at least two days per week on fuelwood gathering while 32 percent spend at least 3 days per week on the same activity.

Thus it can be said that the dependence on forest and forest products is extremely high in the surveyed area and females (especially wives and children) are the most active participants in fuelwood gathering.

D. HOUSEHOLD'S WILLINGNESS TO PAY

TABLE 5.6. Distribution of Household's Willingness to Pay (WTP)

Intervals for WTP Bids (per annum)	State Forest Area (%)	Community Forest Area (%)	Total (%)
0 - 20	36.3	29.9	33.0
20.1 - 40	29.5	35.7	32.7
40.1 - 60	19.9	24.2	22.1
60.1 - 80	4.1	3.8	4.0
80.1 - 100	4.8	1.9	3.3
100.1 - 120	3.4	3.2	3.3
120.1 - 140	0.7	1.3	1.0
140.1 - 160	0.7	-	0.3
160.1 - 180	-	-	-
180.1 - 200	0.7	-	0.3
Total	100.0	100.0	100.0

As is indicated in Table 5.6, some 88 percent of the surveyed households are willing to pay not more than Birr 60 per annum to protect and mange forests in their respective areas. This ratio is a little bit higher in community forest area (90%) than in state forest area (86%). Only 4 percent of the surveyed households are willing to pay more than Birr 100 to protect and manage forests in their respective areas. There is no significant difference between the state and community forest areas with regard to this ratio. In general, however,households in state forest area offer more WTP bids for forest management and protection than those in community forest area. This is partly because the scope (as measured by forest coverage/number of households) is higher in state forest area (3.5 hectares/household) than in community forest area (0.32 hectares/household). It is also

interesting to note that it is only 1% of the households that offered zero WTP bid and it can be said that the free-riding problem is negligible.

According to the findings of the survey, 31 percent of the sample households understood what they were asked to do in the willingness to pay question while 49 percent and 13 percent of them understood the question a great deal and somewhat respectively. It is only 1.3 percent of those households that did not understand the willingness to pay question at all. It can be said that although these households are not familiar with contingent valuation method, they are familiar with the environmental good being valued. Furthermore, around 73 percent of these households valued the forest for its use as household energy consumption, while 16 percent and 10 percent of them valued for its function as watershed protection and its use as timber and non-timber production. It is only 1.4 percent of these households that valued the forest for its bequest value. It seems that forests are the major source of household energy in the study area. Besides, household's willingness to pay in the study capture only the use value component of the total economic value of forests. Non-use value (i.e, bequest value) is negligible.

E. CALCULATION OF FOREST BENEFIT

The frequency distribution of willingness to pay bids in Table 5.6 is used to estimate the total economic benefit of forests (or the opportunity cost of deforestation) in the area which can be used in cost-benefit analysis.

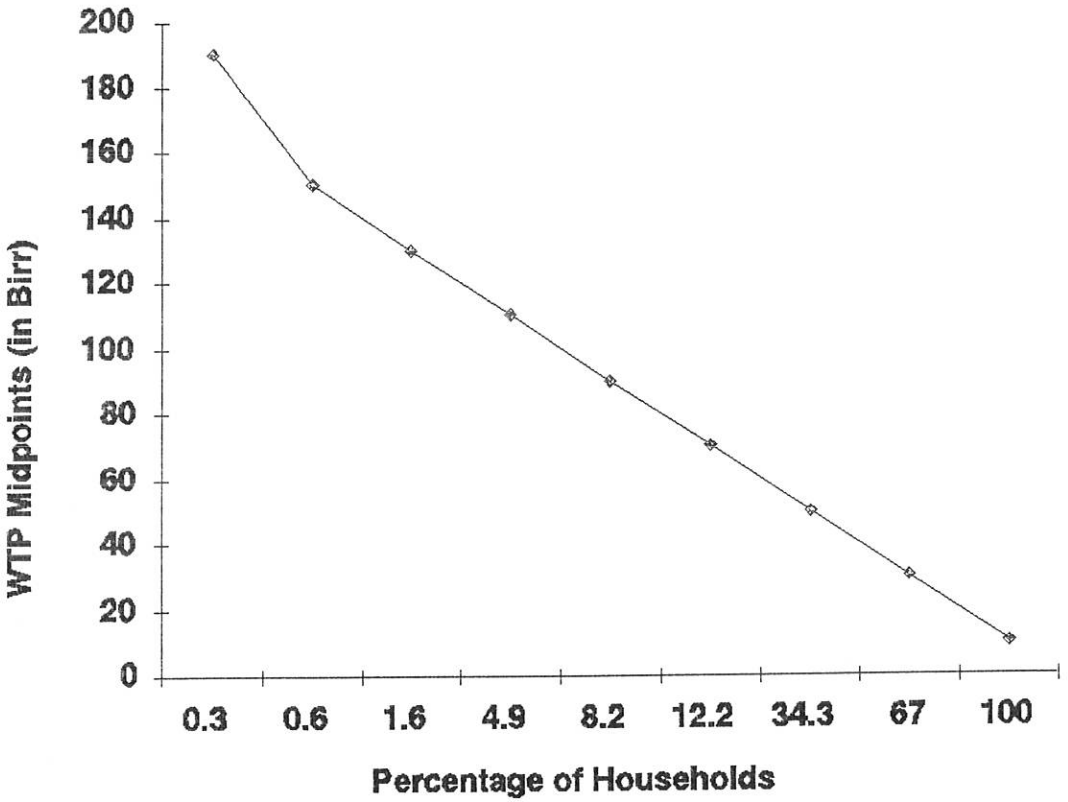
TABLE 5.7. Total Willingness to Pay for Economic Benefit of Forests

Frequency Distribution (from Table 5.6) a	Total Households b	WTP midpoints (from Table 5.6) c	Total WTP for Forest Benefit d
33%	6,537	10	65,370
32.7%	6,477	30	194,310
22.1%	4,378	50	218,900
4%	792	70	55,440
3.3%	654	90	58,860
3.3%	654	110	71,940
1.0%	198	130	25,740
0.3%	59	150	8,850
-	-	170	-
0.3%	59	190	11,210
Total	19,808	-	710,620

As is indicated in Table 5.7, total willingness to pay for forest economic benefit is calculated by multiplying the frequency distribution of the sample by the total households in Walmera woreda (19,808), to get the estimated households in each willingness to pay interval

(column b). Then, by assuming that the mid point of each interval is the mean willingness to pay (column c), the households are multiplied by this mean to estimate total willingness to pay (column d). Thus, the total economic benefit of forests (or the opportunity cost of deforestation) to households in Walmera woreda is estimated to be Birr 710,620 per year. Graphically, this is represented as the area under the curve in the following figure.

Grpahic Representation of Total WTP : Pseudo Demand Curve



As the above graph depicts the percentage of respondents willing to pay a particular prices falls as the price they are asked to pay increases. This is somewhat similar to observing a negative own-price elasticity for marketed good which is consistent with what consumer theory predicts.

F. SUMMARY STATISTICS OF THE SURVEYED HOUSEHOLDS

TABLE 5.8. Summary Statistics of the Surveyed Households

Variable	Mean	Std. Dev	Range	Kurtosis	Skewness
HHA	48	14.89	18 - 91	2.605	0.308
HHLSA	45	15.85	5 - 91	2.762	0.386
HHS	6	2.61	1 - 15	3.010	0.244
HHE	1.6[a/]	1.52	0[b/] - 5[c/]	2.879	0.905
RKFF	2.5[d/]	0.86	1[e/] - 5[f/]	2.823	-0.159
HI	1743	1594	100 - 10136	11.281	2.603
HFWCT	3	1.74	0.5 - 7	3.106	1.062
HWTP	38	28.99	0 - 200	7.409	1.777
RUWTPQ	4[g/]	1.003	0[h/] - 5[i/]	6.127	-1.331

a. The household head attended at least a literacy program.

b. The household head did no schooling.

c. The household head is a high school dropout or a high school complete.

d. The respondent has almost a good knowledge of the various functions of forest.

e. Poor knowledge about the various functions of forest

f. Excellent knowledge of the various functions of forest

g. The respondent understands the willingness to pay question a great deal.

h. The respondent did not understand the willingness to pay question at all.

i. The respondent understand the willingness to pay question completely.

Where HHA=age of household head: HHLSA= household head length of stay in the area; HHS=household size; HHE=household head education attained; RKFF=respondent's knowledge about the various functions of forest; HI=household income; HFWCT=household fuelwood collection time; HWTP=household's maximum willingness to pay; and RUWTPQ is respondent's understanding of the willingness to pay question.

As Table 5.8 exhibits, the average household head is 48 years old and, on average, lived 45 years in the area. The age of these household heads varies between 18 and 91 while the length of stay in the area between 5 and 91 years. The coefficients of Skewness and Kurtosis indicates that both the distribution of age and the number of years the household head lived in the area are slightly skewed to the right (i.e positively skewed) and have thinner tails than a normal distribution.

The education level attained by the household heads ranges between no schooling and high school and the average household head has attended at least a literacy program and has a good knowledge of the various functions of forest. Education is positively skewed while knowledge about the various functions of forests is negatively skewed. But both distributions have thinner tails than a normal distribution.

The average household has six members and spend 3 hours on fuelwood collection. The size of households varies between 1 and 15 while fuelwood collection time between ½ and 7 hours per pay. Household size is positively skewed although the distribution has a tail as thin as that of a normal distribution. Fuelwood collection time is also positively skewed but has heavier tail than that of a normal distribution.

The income of households ranges between Birr 100 and Birr 10,136 and their willingness to pay between 0 and Birr 200. The average household gets an annual income of Birr 1,743 and is willing to pay Birr 38 per annum. And, on the average, household heads understood the willingness question a great deal. Both income and household's willingness to pay are highly skewed to the right and have heavier tails than that of a normal distribution.

TABLE 5.9. List And Definition of Variables Included In The Model

Variable	Description
HI	Household income
FWCT	Household's fuelwood collection time
HHS	Household size
HHE	Education attained by the head of the household: 0 = No schooling; 1 = attended literacy program; 2 = Traditional school; 3 = Primary school; 4 = Junior school; 5 = High school; 6= college
LSA	Household head length of stay in the area
RKFF	Respondents' knowledge about the various functions of forest: 1 = Poor; 2 = Satisfactory; 3 = Good; 4 = Very good; 5 = Excellent
RUWTPQ	Respondents understanding of the WTP question: 0 = Did not understand at all 1 = Did not understand very much 2 = Understand a little; 3 = Understand somewhat 4 = Understand a great deal; 5 = Understand completely
DSHH	Sex of the household head: 1 = male; 0 = female
DSV	Scope variable (proxied by total plantation area/total number of households): 3.5 = state forest area 0.32 = Community forest area
DSB	Dummy for capturing starting point bias: 0 = Open-ended question 5 = Bidding game with Birr 5 starting point 35 = << << << Birr 35 << 100 = << << << Birr 100 <<

All the variables in equation (4.2) are logged and the equation is estimated for both state and community forest areas and the pooled data is also fitted to the same equation to test for the scope difference between the two areas. However, the regression results suffered from heteroscedasticity problem as confirmed by the lagrange multiplier test. As a result, adjusted White's heteroscedasticity-consistent t-statistics are used to determine the significance of the coefficient estimates. The following tables display the ordinary least squares regression results of the model.

Table 5.10. Parameter Estimates of the Model for State Forest Area

Dependent Variable is LNWTP (logarithm of WTP)

Regressors	Coefficient Estimates	Absolute value of T-statistics#	Significance Level
Constant	-0.169@	0.20	85
LNHI	0.413	4.63	0
LNFWCT	0.148	1.68	9.5
LNHHS	-0.392	2.9	0.4
LNHHE	0.177	2.0	5
LNLSA	0.130@	0.86	39
LNRKFF	0.022	1.60	10
LNRUWTPQ	0.274	1.89	6
DSHH	0.126@	0.88	38
DSV*	-	-	-
DSB	$-0.11X10^{-3}$ @	0.83	93
R^2	0.36	-	-
Adjusted R^2	0.32	-	-
F-Statistics	7.99	-	0
DW	2.10	-	-

\# Adjusted White's heteroscedasticity-consistent t values.

@ insignificant at 10%.

* Since forest coverage/number of households (a proxy for scope variable) is assumed to be equal in all peasant associations in state forest area, this variable is not included in the model.

As is shown in Table 5.10, all the explanatory variables are significant except sex (DSHH) ,length of stay in the area (LNLSA) and the dummy for capturing starting point bias (DSB). The adjusted R^2 is reasonable (0.32) implying that more than 30 percent of the variation in household's willingness to pay is explained by the explanatory variables included in the model. This is also confirmed by the F-statistic which shows the overall significance

of the coefficient estimates. A test based on the regression of squared residuals on squared fitted values confirms the absence of functional form problem while the skewness-kurtosis analysis confirms that the normality assumption is satisfied.

Households' income (LNHI) is statistically significant and positively correlated with their willingness to pay. This means that as households' income increases, their willingness to pay for forest protection and management will also increase. It can be said that the poor are less willing to pay for forest conservation and management than the rich. It is also interesting to see that the income elasticity is substantially less than one implying that forest conservation is a "necessary" environmental good in the area.

Education attained by the household head (LNHHE) is significant and has the correct (positive) sign. This implies that the more educated households are also more willing to pay for forest conservation. It is also interesting to see that household's understanding of the willingness to pay question (LNRUWTPQ) is statistically significant and has a positive impact on their willingness to pay. It is implied that those households which properly understand what they are asked to do in the willingness to pay question are more willing to pay for the intended purpose than those which do not understand the question properly.

Similarly, fuelwood collection time (LNFWCT) and households knowledge of the various functions of forest are significant and positively related to, their willingness to pay as expected. This implies that the more households know the various uses of forest, the more will be their concern about forest conservation and management. It can also be said that, in state forest area, the opportunity cost of fuelwood collection time is positive.

On the contrary, household size (LNHHS) is statistically significant and has a negative sign implying that large families are less willing to pay for forest conservation than small families. This is partly because larger families are more likely to spend more on consumption than small families and this will reduce their ability (in terms of residual income) to take conservation measures.

Furthermore, it is interesting to see that the dummy variable capturing the starting point bias of the bidding game question (DSB) is statistically insignificant. This means that households's willingness to pay is not biased by a value introduced by the scenario - for example, a low (high) starting point does not lead to a low (high) mean willingness to pay. The sex variable (DSHH) and length of stay in the area (LNLSA) are also statistically insignificant. This implies that both man-headed and woman-headed households are equally willing to pay for forest conservation and management.

TABLE 5.11. Parameter Estimates of the Model for Community Forest Area

Dependent Variable is LNWTP (logarithm of WTP)

Regressors	Coefficient Estimates	Absolute value of T-statistics#	Significance Level (%)
Constant	-0.987@	1.17	25
LNHI	0.341	3.64	0
LNFWCT	0.330	2.73	0.7
LNHHS	-0.248	2.58	1
LNHHE	0.177	1.59	10
LNLSA	0.095	1.75	8
LNRKFF	0.087@	0.57	57
LNRUWTPQ	0.725	2.12	4
DSHH	0.276	2.09	4
DSV	-0.027@	0.33	74
DSB	$-0.17X10^{-3}$ @	0.12	91
R^2	0.31	-	-
Adjusted R^2	0.27	-	-
F-Statistics	6.68	-	0
DW	2.13	-	-

\# Adjusted White's heteroscedasticity-consistent t values.

@ insignificant at 10%.

Table 5.11 indicates that all the explanatory variables included in the model are statistically significant save the dummies capturing scope test (DSV) and starting point bias (DSB) and household's knowledge of the various functions of forest (LNRKFF). The adjusted R^2 is reasonable (0.27) showing that the model explains around 30 percent of the variation in household's willingness to pay. the F-statistic also confirms the overall significance of the variables included in the model. A test based on the regression of squared

residuals on squared fitted values confirms the absence of functional form problem while Skewness-Kurtosis analysis proves that the normality assumption is met.

Household's income (LNHI) is still statistically significant and positively correlated with households willingness to pay as the theory predicts. It is also still substantially less than one. Education of the household head (LNHHE) and their understanding of the willingness to pay question (LNRUWTPQ) are also significant and have the correct (positive) sign. Households size is also still significant and negatively related to their willingness to pay.

Unlike in the state forest area, however, sex and length of stay in the area are significant and have positive sign. This implies that, in community forest area, man-headed households are more willing to pay for forest conservation than woman-headed households. This may be because of the fact that man-headed households are more beneficiary than woman-headed households from the community plantation. It can also be said that the more the households stay in the village, the more will be their concern about forest conservation and management.

In contrast, household's knowledge about the various uses of forest (LNRKFF) is statistically insignificant although it has the correct (positive) sign. This may imply that the impact of knowing the various functions of forest on household's willingness to pay is insignificant. This may be partly because the community plantation mainly consists of a single species (i.e., eucalyptus) and the benefit of households in this area is limited to its commercial use only. The dummy variables capturing scope difference (DSV) and starting point bias (DSB) are also statistically insignificant. The scope variable is insignificant not because household's willingness to pay is insensitive to scope but the scope variation (as measured by plantation area/number of households) among the three peasant associations is

negligible. It can also be said that the instrumental bias of the values introduced by the market scenario is insignificant in community forest area.

Table 5.12. Parameter Estimates of the Model for Both State and Community Forest Areas Combined

Dependent Variable is LNWTP (logarithm of WTP)

Regressors	Coefficient Estimates	Absolute value of T-statistics#	Significance Level (%)
Constant	-0.763@	1.27	20
LNHI	0.384	6.05	0
LNFWCT	0.225	3.01	0.3
LNHHS	-0.305	4.20	0
LNHHE	0.161	2.31	2
LNLSA	0.116	1.73	9
LNRKFF	0.854@	0.79	43
LNRUWTPQ	0.520	2.23	2.7
DSHH	0.199	2.15	3.3
DSV	0.040	1.59	10
DSB	$0.64X10^{-4}$ @	0.07	95
R^2	0.32	-	-
Adjusted R^2	0.30	-	-
F-Statistics	13.38	-	0
DW	2.00	-	-

\# Adjusted White's heteroscedasticity-consistent t values.

@ Insignificant at 10%.

As Table 5.12. exhibits all the explanatory variables included in the model are significant except household's knowledge about the various uses of forest (LNRKFF) and the dummy capturing for starting point bias. The adjusted R^2 is reasonable (0.30) indicating

that the model explains around 30 percent of the variations in household's willingness to pay. The F-statistic shows the overall significance of the explanatory variables included in the model. A test based on the regression of squared residual on squared fitted values shows the absence of functional form problem while the skewness-kurtosis analysis shows that the normality assumption is met.

Households' income (LNHI) is statistically significant and positively related to households' willingness to pay in all the three cases. This confirms that households' concern for forest conservation is highly related to their income level, i.e, the higher the households' income the more will be their concern for forest conservation. The income elasticity is also substantially less than one in all the three cases implying that forest conservation is a "necessary" environmental good.

Education of the household head (LNHHE) and their understanding of the willing to pay question (LNRUWTPQ) are significant in all the three cases and have the expected (positive) sign. This implies that the relatively more educated and those who more understand the issue under consideration are more concerned about forest conservation and management. Fuelwood collection time (LNFWCT) and household size (LNHHS) are also significant in all the three cases and have the expected (positive and negative, respectively) sign. This implies that large families are less willing to pay for forest conservation than small families. It can also be said that the opportunity cost of fuelwood collection time is positive.

Sex (DSHH) and length of stay in the area (LNLSA) are statistically significant and have the correct (positive) sign in two (community and combined) of the three cases. It can be said that man-headed households are more willing to pay for forest conservation than woman-headed households. Those household heads who stayed longer in the village are also more concerned about forest conservation and management. Households knowledge about the various functions of forest is statistically significant in one case (state forest) only. It is also

interesting to note that the dummy capturing for starting point bias of the bidding game question is insignificant throughout the analysis. This confirms that household's willingness to pay is free of any instrumental bias of the value introduced by the market scenario.

The most important reason for this later regression analysis is to undertake scope test. The scope (as measured by total forest coverage/total number of households) significantly varies between state and community forest areas (i.e, 3.5 hectare per household and 0.32 hectares per household, respectively). The significance of the scope variable (DSV) confirms that household's willingness to pay is sensitive to the scope difference between the two areas. The implication is that households are willing to pay more for environmental good which is larger in scope, either in quality or quantity sense. And this is consistent with economic theory.

In general, it can be said that household's responses to the willingness to pay question is consistent with the underlying theory and common sense and the bias is not so much so that it can invalidate the contingent valuation exercise.

VI. SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

6.1. SUMMARY AND CONCLUSION

The world's tropical forests are disappearing at alarming rate. In many countries the rate of deforestation is accelerating and this is occurring with little regard to long-term management of the forest resource. With less than 3 percent of total land area covered by forests, Ethiopia is one of the least developed countries suffering from the problems of deforestation and land degradation. It has been estimated that the country is losing an equivalent of 150,000 to 200,000 hectares of natural/closed forest annually. This rapid deforestation is caused by a rapidly growing demand for fuelwood and land for cropping and grazing.

The depletion and degradation of these forests have implications for the whole ecosystem, impede agricultural productivity and sustainability, and exacerbate rural poverty. Deforestation has also serious regional and global implications (potential climate change, loss of biodiversity, degradation of watershed). As a result, in many countries, improving management of the existing forest resources has become the subject of considerable attention.

Proper management of forests requires economic analysis which can be used as basis for land use decisions. Without such analysis, it is difficult to determine whether any proposed change in forest land use option is economically justified. In many countries, however, such analyses are rarely conducted while making forest land use decisions.

To make the economic analysis which help guide decision making on a variety of forest land use options available, improved valuation is needed. This paper has examined the application of contingent valuation method for evaluating the opportunity cost of deforestation which enables environmental considerations to be explicitly considered in conventional

benefit-cost analysis. In doing so, the paper looked into factors affecting households willingness to pay for forest conservation and management and thereby tested the theoretical validity of the results obtained from the survey.

Accordingly, based on the contingent valuation survey conducted in six PAs in Walmera Woreda, the annual economic loss of deforestation to rural households in the woreda was estimated at Birr 710,620. This value captured only the use value component of the total economic value of the forests. The free-riding problem was found to be negligible and respondents indicated a strong demand for forest protection save insignificant minorities. The percentage of respondents willing to pay a particular prices has also fallen as the price they are asked to pay increase and this is somewhat similar to observing a negative own-price elasticity for marketed goods.

In order to test the theoretical validity of the valuation method employed and thereby examine the determinants of household's willingness to pay for forest conservation and management, a regression analysis was made for both state and community forest areas and the pooled data is also fitted to the same model to test for the scope difference between the two areas.

According to the regression results of the estimated model, household income, household size, education, fuelwood collection time, and respondent's understanding of the willingness to pay question were found to be statistically significant throughout the analysis. The result indicated that households' willingness to pay for forest conservation is directly related to their income level and the income elasticity of willingness to pay showed forest conservation to be a "necessary" environmental good in the area. The result also implied the educated and those household heads who properly understand the issue under consideration are more concerned about forest conservation and management. Small families are also more willing to pay for forests conservation and management than extended families.

6.2. POLICY IMPLICATIONS

Result from this valuation study has implications for policies, investment decisions, resource mobilization and project design and management. Such information can help governments decide how to (1) allocate scare capital resources among competing land use activities, and (2) choose and implement investment for natural resource conservation and development. Results also can be used in influencing pricing, land, and incentive policies.

Result from this valuation study has also implications for the kind of forestry policy and projects that should be designed and implemented in the country. Forestry policy and projects should involve community participation both in forest conservation and development. Designers of forestry policy and projects should, therefore, find a way to benefit the local people since it is a key to participation. The forestry programs should also target the educated and the elders as a pressure group to promote beneficiary participation since they give more value to forests than any other groups in the community.

Besides, the result implies the need for policies outside the forest sector. The forestry policy should be accompanied by effective agricultural and population policies aimed at improving agricultural productivity and family planning which help reduce rural poverty.

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DECLARATION

I, the undersigned, declared that this thesis is my work and that all sources of materials used are duly acknowledged.

Name Shimelis Gugsa Yae

Signature