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PROCEEDINGS OF THE SEVENTH REGIONAL CONFERENCE OF THE AMHARA REGIONAL STATE ECONOMIC DEVELOPMENT

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FOREWORD

The Ethiopian Economic Association (EEA) and its Bahir Dar Chapter are happy to issue the proceeding of the Seventh Annual Conference on the Amhara Regional State Economic Development which was organized on September 05, 2015 at Homeland Hotel Conference Hall. EEA has been organizing regional conferences every year, as one of its objectives of broadening its activities and coverage at regional level so as to contribute to the economic advancement of regional state through enhancing economic policy formulation capability; the dissemination of economic research findings; promotion of dialogue on critical socio-economic issues; promotion of education in economics in higher learning institutions; enhancing national, continental and global networks of professionals and institutions; and advancement of the professional interests of its members.

The Annual Regional Conferences that the Association has organized in collaboration with its Chapters have created important forums for presenting and discussing development issues that are highly relevant to the Regional Socio-economy. These forums have also provided incentives for researchers to conduct research and present their findings on regular basis. Indeed, the Annual Regional conferences were organized in an interdisciplinary fashion, thereby widening the interactive coverage involving both economists living here in the region and those living outside the region and non- economists who are working and experiences on the region. The 7th Annual Regional Conference on Amhara Regional State Economic Development has contributed towards a deeper understanding of the regional economy and the complex challenges it faces. It attracted about 135 participants including higher officials and expertise from Bahir Dar City Administration, Amhara Regional State, Universities of Bahir Dar, Debre Markos, Debre Tabor, Wollo and Gonder, Adet Agricultural Research Center, Andassa Livestock Research Center /ARARI/, Amhara Agricultural Research Institute, Bahir Dar Agricultural Mechanization and Food Science Research Centre, GAFAT, and Amhara Bureau of Finance and Economic Development, NGOs, private sector representative and EEA members. The participants of the conference expressed their satisfaction on the organization of the

conference and the content of the papers presented. They reflected that the papers largely focused on local issue that can contribute to the development of the region. They also recommended that the issues raised in the discussion are critical that need due attention by policy makers and implementing organs of the regions.

Like the previous conferences, the conference was officially opened by H.E Ato Gedu Andargachew, President of the Amhara National Regional State. In his opening speech, H.E Ato Gedu Andargachew welcomed participants of the conference and thanked the Ethiopian Economics Association and its Bahir Dar Chapter for hosting and organizing this important conference. He underscored that the conference offers best opportunities for policy makers and researchers to understand in depth the complex challenges that the region has faced in the face of fast moving Economic Growth that the country has registered in the past decade and enhances effective networking to synergize the efforts of like-minded individuals and institutions/organizations. H.E Ato Gedu Andargachew also expressed his appreciation of the Ethiopian Economics Association's significant and growing efforts in the spheres of economic policy research and capacity building through which it has been contributing to the sustained advancement of the economics profession and to the policy formulation and implementation process.

In this publication, all papers which were presented at the Seventh Annual Conference were reviewed by external reviewers and comments and suggestions including editorial comments were communicated to authors for improvement. Finally, out of the total ten papers, five which passed all the review and editorial process published in the Proceeding of the Seventh Annual Conference on the Amhara Regional State Economic Development.

At this juncture, on behalf of the Ethiopian Economics Association and on my own behalf I would like to thank many people and organizations that made the conference resounding success. First and foremost, I thank the authors of the papers and the audience whose active participations made the Conference meaningful. The staffs of the Economics Department of the

Bahir Dar University which runs the EEA Bahir Dar Chapter and the staff of EEA Secretariat deserve a special recognition for their enthusiasm and perseverance in managing the conference from inception to completion.

Our special thanks go to our partners who have shared our vision and provided us with generous financial support to materialize the activities of EEA. These include; The Friedrich Ebert Stiftung of Germany, The African Capacity Building Foundation (ACBF) and The Think Tank Initiative of International Development Research Center (IDRC) of Canada.

Finally, I would like to extend my sincere gratitude to H.E. Ato Gedu Andargachew, President of the Amhara National Regional State, for his an insightful opening addresses and for his continued interest on the activities of Bahir Dar Chapter since its establishment. I would like also to thank other officials of the regions and Bahir Dar University who spared their busy schedule and participated in the conference.

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President of the Ethiopian Economics Association

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Does Irrigation Creates Pathway out of Poverty? Evidence from Household Poverty Analysis in North-eastern Ethiopia

Addisu Molla Beyene[1]

Abstract

Irrigation has taken as one of poverty reduction programs designed and implemented by government and non government organizations in Ethiopia. The main aim of this paper is therefore to study the impact of irrigation, as one government intervention program, on household poverty and whether irrigation creates a road out of poverty for the rural households in northeastern Ethiopia. The study used a sample of 400 households drawn from four study weredas using a two stage random sampling method proportionate to size. Household expenditure is considered as a measure of household welfare as it also captures household's consumption capabilities. The propensity score matching (PSM) is used to analyse the impact of the intervention program on poverty. PSM is widely used in impact evaluation as it helps to make inferences about the outcomes that would have been observed for program participants had they not participated. We found that participation in irrigation does have a significant impact on household per capita expenditure and poverty. For matched samples, the per capita expenditure of irrigation users is 10.5 percent higher than the non users. On the other hand, program participants have a total poverty level that is on average 0.123 points (i.e., 45.4 percent) lower than non-participants. Hence it is evident that irrigation is used as a means to get out of poverty for rural households at least in northeastern Ethiopia.

Keywords: Poverty, Irrigation, Rural household, Propensity score matching, Northeastern Ethiopia, Per capita expenditure

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1. Introduction

Ethiopia is undoubtedly among the poorest nations in the World in which poverty persists at debilitating levels and hence becomes longstanding problem over periods. Based on the national poverty line of the year 1999/2000, 44 percent of the population is absolutely poor, while it is 45% for rural population, 37% for urban population (MoFED, 2002). The study conducted by Tassew and Tekie (2002) also indicated that the proportion of people that are absolutely poor in 1999/2000 was 44.2% on the average (37% in urban areas and 45% in rural areas). In addition, based on the Ethiopian government's 2004/05 Household Income and Consumption Expenditure Survey (HICES) the incidence of poverty in rural and urban areas with the poverty head count ratio is found to be 39.3 and 35.1 percent respectively. At national level, 38.7 percent of Ethiopians were poor, implying that there were 27.5 million people living below the poverty line.

Recently, an Interim Report on Poverty Analysis Study entitled "Ethiopia's Progress towards Eradicating Poverty (2010/11), provide key results of the poverty analysis in Ethiopia. Accordingly, the proportion of poor people (poverty head count index) in the country is estimated to be 29.6% with 30.4% in rural areas and 25.7% in urban areas. The poverty gap index is estimated to be 7.8% while it is 8.0% for rural areas and 6.9% for urban areas. Similarly, the national level poverty severity index stood at 0.031 (3.1%) with rural poverty severity index (0.032) being slightly higher than that of urban areas (0.027).

The situation of northeastern Ethiopia, particularly in south and north Wollo zones in Amhara national regional state (ANRS) is found does not be different from the above situations. This area is among the chronically affected areas in Ethiopia, which is currently facing daunting challenges of socioeconomic and demographic variables. The area is characterized by high risk of environmental shocks which in turn causes drought, famine, ill health, loss of assets, or loss of income. So the area is much more vulnerable to poverty (FAO, 2001).

The incidence of poverty in Amhara Region is also extremely high. In 2004/05, head count index in Amhara Region is 40 percent and it was one of the three regions with the highest level of poverty compared to other regions of the country. Urban poverty is worst in this region relative to other regions (at about 38 percent). In the contrary, the rural poverty head count index declined by significant magnitudes from the level of poverty in 1995/96. Translating head count index into numbers of people, numbers of poor people in the region is 7.3 million, accounted for one-fourth of all Ethiopian living in poverty in 2004/05 (MoFED, 2008). According to MoFED, (2012), the head count index in Amhara Region is 30.5 percent. In terms of food poverty for example, the highest food poverty (42.5 percent) is observed in Amhara Region, followed by Tigray (37.1) and Benishangul Gumuz (35.1%) regional states in the country.

In general, despite efforts being made through poverty alleviation programs like irrigation scheme and there are some signs of change in terms of lowering the incidence of poverty to some extent, poverty in Ethiopia is staggeringly high and thus the country is often reported as one of the poorest countries in the world almost by all dimensions of poverty. Thus, The fundamental question that comes in the forefront is not are we really poor, just because we are, but what is the extent of poverty, what makes we still poor, what factors determine we to be poor and how much is the poverty impact of government intervention programs. These questions have been answered through detail analysis of poverty. This, therefore, aims to deal the current poverty situation of the study area and mainly the impact of irrigation on poverty so as to verify whether irrigation can be used as a tool for poverty reduction and if that is so to what extent that irrigation helps the households to get out of poverty. Since thorough research on impacts of intervention programs on poverty is inexistent or little this study has used necessary and sophisticated tool to analyse the poverty impact of irrigation.

2. Irrigation and Poverty: Literature Review

Despite the government of Ethiopia together with its development partners has been pushing with a development with the aim of achieving a broad

based and sustained economic growth and hence has recorded remarkable economic growth since 1990s, Poverty in Ethiopia is still affecting a significant portion of urban and rural communities of the country. Thus, designing and implementing poverty reduction program so as to divert the situation of poverty has been emphasized and is a key objective of the government of Ethiopia. According to GoE *et al (*1998) the government of Ethiopia has, since then, adopted various programmes of poverty reduction that have been considered in the documents of various strategic papers. The Agricultural Development Led Industrialization (ADLI) strategy paper, for instance, indicates that agricultural growth should improve the conditions of food security in the country. There are indications that, excepting conditions of drought, even the present extension program could have sufficed to bring about a satisfactory level of national food security. Irrigation would have to be introduced in a significant way for a sustainable attainment of food security at the national level.

According to FAO (1997) 30-40 percent of world food production comes from an estimated 260 million ha of irrigated land or one–sixth of the world's farmlands. FAO (2001) also reports that the role of irrigation in addressing food insecurity problem and hence poverty reduction goal is well established. Cleary irrigation can play an important role in raising and stabilizing food production especially in the less developed parts of Africa. A study by Hussain *et al.* (2004) confirms that, access to reliable irrigation water can enable farmers to adopt new technologies and intensify cultivation, leading to increased productivity and overall production and contributing to overall improved welfare.

The development of irrigation especially modern irrigation has relatively recent history in Ethiopia, where as traditional irrigation has been in existence for long periods. A study conducted by Woldeab (2003) identified that in Ethiopia irrigated agriculture has benefited some households by providing an opportunity to increase agricultural production through double cropping and by taking advantage of modern technologies and high yielding crops.

3. Data and Methods

The data employed in this study of poverty and inequality analysis are a household survey, which has been conducted in the four districts namely Dessie zuriya and Kalu (South Wollo) and Gubalafto and Harbu (north Wollo) in northeastern Ethiopia, Amhara regional state (ANRS). The survey is based on an expenditure dataset of the sample households in which household expenditure is considered as an adequate measure of household welfare in developing countries as it is better able to capture household's consumption capabilities (Grootaert, 1986).

A survey of 400 rural households in the four districts in the south and north Wollo administrative zones has been undertaken. These zones have been selected to represent the northeastern Ethiopia, which is a populous and famine-prone area of Amhara region and the country as well (FAO, 2001). Out of the woreda administrations in the two zones, two woreda administrations have been selected in each zone purposively to represent different agro-ecological, economic and social diversities within each zone. Sample households are selected using a two stage random sampling method. In the first stage kebelles are selected randomly from each woreda. In the second stage the sample households are randomly drawn from a complete list of each selected kebelles in conformity to proportionate to size random sampling procedure.

Regarding the method of analysis, both descriptive and econometric methods are used. In descriptive analysis, summery statistics of variables related to demographic characteristics and irrigation practices in the study area. In addition, poverty line of the study area is established using the cost of basic needs approach and then the extent of poverty is estimated using the Foster-Greer-Thorbecke (FGT) indices. With regard to econometric analysis, an impact evaluation technique particularly the propensity score matching (PSM) is used to analyse the impact of irrigation on poverty. Such impact evaluation studies whether the changes in well-being, in this case poverty status, is attributed to an intervention, in this case participating in irrigation, or not. Impact evaluation is therefore useful to forecast and evaluate the

impact of irrigation on poverty reduction. The results of an impact evaluation can show how interventions would be effective, and thus inform decisions on whether what should be eliminated, modified, or expanded, as well as what priority they should be accorded. An impact evaluation is essentially a problem of missing data, because one cannot observe the outcomes of program participants had they not been beneficiaries, that is, the counterfactual. Thus, due to the problem of missing data there is no information on the counterfactual.

Without information on the counterfactual, the next best option we have is to estimate the counterfactual from a sample of eligible non-participants and then to compare outcomes of individuals or households participating in the program (treated group) with those of a comparison group that has not been participated (control group). In doing so, one attempts to pick a comparison group that is very similar to the treated group, such that those who received treatment would have had outcomes similar to those in the comparison group in the absence of treatment. (Shahindur, R., *et al*, 2010)

In this study, we are interested to determine whether participation in irrigation initiated in a given time period in the study area improves the poverty status of household i or not. Let Y_{1i} be the outcome of a treated household participating in irrigation and Y_{0i} the outcome of a non treated household. Thus we can put the effect of treatment as (Y_{1i}- Y_{0i}). For a group of households the average of the outcomes will be obtained through the computation of the average Treatment Effect (ATE) as given:

$$ATE = E(Y_{1i} - Y_{0i}) \quad \textbf{(3.1)}$$

ATE has limited significance for policy because it measures the expected effect of treatment on a random sample drawn from the target population including those who may not be eligible for treatment. It may, however, have relevance in interventions with universal applicability so as to estimate the potential gain from treatment. However, the measure of interest in this study is the one that determines the average gain of program participation on the treated as a result of treatment. Hence impact is measured by the difference

in outcome of interest between what is happening with the program and what would happen without the program for those participating in the program. This measure is known as average impact of Treatment effect on the Treated (ATT) and it is the most common evaluation parameter of interest (Jonathan and Shahidur, 2009). Letting D_i be participation dummy equal to1 if the household is irrigation user and 0 otherwise and let Z denote a vector of observed individual characteristics, ATT is given as

$$\begin{aligned} ATT &= E(\Delta Y_i / Z, D_i = 1) = E(Y_{1i} - Y_{0i} / Z, D_i = 1) \\ &= E(Y_{1i} / Z, D_i = 1) - E(Y_{0i} / Z, D_i = 1) \end{aligned} \quad \textbf{(3.2)}$$

While what is happening a program to a participant $(Y_{1i} / Z, D_i = 1)$ is observable, the outcome related to what would have happened without participation to a participant $(Y_{0i} / Z, D_i = 1)$ is however unobservable and it is considered as the counterfactual. This is because in observational studies, it would not be possible to observe the same person in different states at the same time. We estimate the impact of irrigation on poverty using propensity score matching (PSM) as a method of estimating the counterfactual outcome for participants (Rosenbaum and Rubin, 1983).

To undertake matching, one needs survey data for a substantial number of nonparticipants as well as for the participants and then to compare the outcomes between them. The next step is to generate the propensity score, which is the predicted probability of participation, given the observed characteristics *Z*. Once the propensity scores are generated for each person in the treatment group, the member of the comparison group with the closest propensity score would be matched with the member in the treated group.

The validity of PSM depends on assumptions such as conditional independency and common support. Conditional independency describes that if the treated group had not participated into the program, they had the same mean outcomes as that of the control groups. The assumption of common support explains overlapping of propensity scores across among the

participants and nonparticipants. In addition, the balancing condition needs to be satisfied which indicates that for households with the same propensity score assignment to treatment is random.

Once assumptions are satisfied the main impact of the program is given by

$$\begin{aligned} ATT &= E(Y_{1i} - Y_{0i} / D_i = 1) \\ &= E(Y_{1i} / D_i = 1) - E_{P/D_i=1}\{E_Y(Y_{0i} / D_i = 1, P)\} \\ &= E(Y_{1i} / D_i = 1) - E_{P/D_i=1}\{E_Y(Y_{0i} / D_i = 0, P)\} \end{aligned} \quad \textbf{(3.3)}$$

The important question that has to be raised here is how the closeness of propensity score is determined while matching the treated and control groups. In this respect, we used kernel matching to match treatment and comparison observation. In kernel matching all treated observations are matched with a weighted average of all comparison observation. If P_i is the propensity score for participant i and P_j is the propensity score for nonparticipant j, the weights for kernel matching, $\omega(i, j)_{KM}$, are given by:

$$\mu(i, j)_{KM} = \frac{K\left(\frac{P_j - P_i}{a_n}\right)}{\sum_{k \in c} K\left(\frac{P_k - P_i}{a_n}\right)} \quad \textbf{(3.4)}$$

Where K (·) is a kernel function and $a_n$is a bandwidth parameter. Following Heckman et al. (1997) and Smith and Todd (2005), the kernel matching estimator takes the form

$$ATT = \frac{1}{n_1} \sum_{i=I_1} \left\{ Y_{1i} - \frac{\sum_{j \in I_0} Y_{0j} K\left(\frac{P_j - P_i}{a_n}\right)}{\sum_{k \in I_0} K\left(\frac{P_k - P_i}{a_n}\right)} \right\} \quad \textbf{(3.5)}$$

Where n_1 is the sample size,I_1 is the treatment group of program participants, I_0 is the comparison group of non-participants, $K(\cdot)$ is a kernel function and a_n is a bandwidth parameter.

In PSM, each participant is matched to a nonparticipant on the basis of a single propensity score, reflecting the probability of participating conditional on their different observed characteristics *Z* (see Rosenbaum and Rubin 1983).

Now we turn to the specification of the impact and participation equations. Since we are interested in determining whether irrigation program initiated in a given time period improves the poverty status of household *i*. An appealing approach would be to collect data on the outcome or impact indicator (poverty status, given by Y_{1i}), and on household characteristics (X_{1i}), for a sample of individuals that do, and do not, participate in the program. Then we could estimate an impact equation of the form

$$Y_{1i} = \sim + \quad D_i + ¢X_{1i} + £_i \qquad (3.6)$$

Where D_{i1} is a dummy variable that is set equal to 1 if the individual *i* participates in irrigation and to 0 otherwise. ε_i is the error term, the parameters α, β and δ would measure the impact of irrigation on poverty.

4. Results and Discussion

4.1 Descriptive Analysis

In this section, the demographic characteristics of the households are presented. In this regard, as shown in Table 4.1, 81 percent of sample households are headed by men and 19 percent households are females headed. This may be attributed mainly to the cultural norms and societal attitudes, which consider women as inferior and too much family responsibilities they have to bear instead of engaging in agricultural activities. Most literatures also revealed that rural agriculture is highly dominated by men headed households than the women headed ones.

Mean age of household head is 46.71 (with 21 and 90 being the minimum and maximum age respectively) while the mean age of the household is 25.94 (with 11.5 and 62.5 being the minimum and maximum age respectively). Most of the household members are young and hence most of them belong to the working age group. Another demographic variable worth analyzing is education which contributes more in order to enhance the farmer's ability to acquire information, perceive, interpret, and respond to adopt new technologies.

In this study, the average education of household head is almost grade 3 but varies from illiterate to the completion of preparatory secondary school. In case of the mean education of household, the average years of schooling is grade 3 and above, but varies between illiterate and the completion of general secondary school and above. One important fact in this study is that although the northeastern Ethiopian rural agriculture is dominated by illiterate farmers, literate people are engaged in the sector.

Ill-health typically affects the rural people disproportionately because they live in unhealthy environments, they have restricted access to effective and affordable health services, and they depend more than the urban people on their physical strength for their food and income. In connection with this, the link between rural poverty and physical disability was historically very direct in Ethiopia, where the very poor were chiefly the incapacitated (Iliffe, 1987). In the household questionnaire survey for the present study, we asked about each household's health condition whether the household heads were chronically ill defined as inability to work for some time in the past year. Thus, the result showed that almost half of the sample household heads were ill in the past year, implying that the health problem is critical in the rural households.

As far as the marital status of the rural households is concerned, the majority of household heads (87 percent) were found to be married and together unmarried, divorced and widowed constituted the remaining 13 percent. Of the total sample households in the study area the religion for 35 percent is an Orthodox Christian and for 65 percent is Muslim. The survey data of the

present study (as depicted in Table 4.1) revealed that average household size is 5.28 (4.6 adult equivalent unit), though it ranges from 2 to 11 (1.52 and 8.82 adult equivalent units). Based on the 2007 national census of Ethiopia (CSA, 2007), the national average household size of the urban population is 3.9 whereas that of the rural population is 4.9. Thus, the household size of the rural households in northeastern Ethiopia is slightly higher than the national rural average.

Table 4.1: Household location and demographic characteristics (n=382)[2]

Variable	Mean	Std. Deviation	Minimum	Maximum
Sex of household head	0.81	0.39	0	1
Age of household head	46.71	12.65	21	90
Mean age of household	25.94	9.08	11.5	62.50
Education of household head	2.88	3.26	0	12
Mean education of household	3.70	1.99	0	10.50
Marital status of household head	0.87	0.33	0	1
Religion of household head	0.35	0.48	0	1
Illness of household head	0.49	0.51	0	1
Household size	5.28	1.77	2	11
Adult equivalent household size	4.60	1.60	1.52	8.82
Dependency ratio	0.78	0.68	0	4
Female male ratio	1.16	1.00	0	8
District	0.59	0.49	0	1
Climatic condition	0.63	0.60	0	1
Distance from the center (km)	22.88	12.98	1	61

Source: own calculation

[2] The dataset originally consisted of 400 rural households distributed among the four study areas proportion to their size. Eighteen households were discarded in this analysis due to missing values so that the analysis is made for 382 households. In particular, eleven households were failed to report either their full-fledged earnings (agricultural and off farm income) or full-fledged consumption expenditure (food and non-food expenditure). As a result, these observations had to be dropped from the analysis as they were found to be incomplete. The remaining seven observations were also removed from the sample as outliers.

The adult equivalent household size is high even compared to the study conducted by the Ethiopian Economic Association (EEA) in the south and north Wollo Zones in 2003. When compared to the study by EEA (2003), household size per adult equivalent is on average 3.55 in the two zones. The survey result in the present study also showed that the average dependency ratio for the sample households is found to be 0.78 (78 percent). The minimum and maximum dependency ratio stood at 0 and 400 percent respectively.

Empirical studies have shown that direct relationship between dependency ratio and poverty. In this regard, availability of adult labour force plays a crucial role in the welfare of rural households. Bigsten et al., (1999) indicated that dependency ratio is strongly related to the probabilities of falling into poverty (The more the percentage of people below 15 and above 65 years of age in the household, the higher the probability of falling into poverty). The average female male ratio is found to be 1.16 ranging from 0 to 8. This result is confirmed with the 2007 census result in the northeastern Ethiopia specifically, in the south and north Wollo. To this end the sex composition of the population of the two zones is almost equal with little dominance of females over males (CSA, 2007).

With regard to the location of household, 59 percent of the total sample households are from the south Wollo and the remaining 41 percent are located in the north Wollo. In terms of the agro-climatic condition 63 percent of the households are living in Woina Dega and the rest 37 percent are living in either Dega or Kolla climatic condition so that most of the areas in the two zones comprise climatic condition of Woina dega.[3] The average distance to the center of nearby zonal or woreda administration in kilometre for the sample households is found to be 22.88 km with a minimum of 1 km and a maximum of 61 km.

[3] Kolla refers to relatively hot climate (lowland), Woinadega refers to a weather condition which is moderate (temperate) and Dega refers to highland.

4.2 The Poverty Line and Extent of Poverty

In order to set the poverty line using the CBN approach, developed by Ravallion and Bidani (1994), the cost of a food basket[4] enabling households to meet a minimum number of calories required for good health-2200 Kcal per day per adult equivalent - and then an allowance for the consumption of basic non-food items is added. As a result, consumption expenditure reported by the households is used to measure the level of poverty. The adult equivalent consumption expenditure with the help of adult equivalent units calculated by Dercon and Krishnan (1998) using World Health Organisation (WHO) conversion codes has been adopted

Table 4.2: Food and total poverty lines per adult per year

Poverty lines	Food poverty line	Total poverty line	Kcal per adult per day
Absolute poverty line	2866.14	3410.71	2200
Extreme poverty line	2149.39	2557.77	1650

Based on these methodological steps of the CBN approach the food poverty line and the absolute poverty line that corresponds to the food items 8.3 are ETB 2866.14 and 3410.71 respectively.[5] The extreme food and total poverty lines are based on food basket of 1650 Kcal per adult per day are 2149.39.59 and 2557.77 respectively (Table 4.2).[6] Compared to the national level poverty lines in 2010/11, the food poverty line in the present study is higher.

[4]The basic food basket that contains most frequently food items consumed by the poor is presented on appendix table 8.3. In this case, a total of 17 food items are identified and their quantity is determined in such a way that the bundle supplies a predetermined level of minimum calorie requirement (2200 Kcal per day per adult as set by WHO 1985).

[5]At an exchange rate of about 19.60 birr at the time of the date collection, the absolute poverty line for food and for total consumption is about $146.23 and $174.16 per year per adult respectively. Note that this is relatively low poverty line, compared to the standard of 'one dollar per day' suggested by the World Bank.

[6]While the poverty line is used as a threshold point between non poor and poor which basis 2200 Kcal of minimum nutritional requirement, the extreme poverty line is used as a threshold point between poor and extremely poor which basis 1650 Kcal of minimum nutritional requirement.

This is due to the higher price changes between the two periods. The total poverty line is, however, lower. The national level food and total poverty line set by the Ethiopian government are ETB 1985 and 3781 respectively (MOFED, 2012). This reveals that the total poverty line in the study areas has become declined currently compared to the national poverty line in 2010/11 due to relatively lower price changes in the non-food items. Once the poverty lines have been constructed, we can now choose the measures to express the shortfall and deprivation and then analyse the extent of poverty. As has become standard in poverty research, this study follows Foster, Greer and Thorbecke (1984) by using the most common of the so-called Foster-Greer-Thorbecke (FGT) family of poverty indices.

Accordingly, based on total poverty line, absolute head count index indicates that on average, 39 percent of the rural farm households in northeastern Ethiopia are unable to meet the minimum level of calorie intake (2200 kcal per day per adult) adjusted for the requirement of non food items expenditure. In other words, this percentage of households is living below total poverty line. The proportion is 20.4 percent in terms of extreme head count index. The absolute incidence of poverty in rural northeastern Ethiopia in the present study is by far higher compared to the rural national level incidence of poverty (30.4 percent) in 2010/11 (MoFED, 2012). This is because the study areas are much vulnerable to poverty as they are characterized by high risk of environmental shocks which in turn causes drought, famine, ill health, loss of assets, or loss of income.

Table 4.3: Estimated poverty levels in northeastern Ethiopia

Type of poverty	Absolute poverty indices			Extreme poverty indices		
	Head count index (P0)	Poverty gap Index (P1)	Squared poverty gap index (P2)	Head count index (P0)	Poverty gap Index (P1)	Squared poverty gap index (P2)
Food poverty	0.576	0.190	0.093	0.319	0.105	0.050
	(0.025)	(0.012)	(0.008)	(0.024)	(0.010)	(0.006)
Total poverty	0.390	0.106	0.041	0.204	0.043	0.014
	(0.025)	(0.009)	(0.004)	(0.021)	(0.006)	(0.003)

Note: values in brackets are standard errors

The depth of poverty (poverty gap ratio), a measure that captures the mean aggregate consumption shortfall relative to the poverty line across the whole population indicates that the percentage of total consumption needed to bring the entire population to the poverty line is 10.6 percent and 4.3 percent in terms of extreme poverty line. Moreover, the squared poverty gap, a measure that captures the relative deprivation among the poor households, the severity of poverty gives a higher weight to the poorest of the poor and this measure is particularly useful in tracking developments over time and comparing deprivation between regions. In this regard, 4.1 and 1.4 percent of relative deprivation is identified in the study areas in terms of the absolute and extreme poverty lines respectively. This implies that there is sever inequality among the lowest quartile in case of absolute poverty compared to extreme poverty.

Severity of poverty is found to be higher in the study areas compared to the national level of 2010/11 (3.2 percent) even after two years from the national survey. So it can be inferred that, on average people living in the study areas suffer higher levels of deprivation than people living elsewhere in Ethiopia. When considering the food poverty line the absolute and the extreme head count indices in the rural northeastern Ethiopian in the present study are 57.6 percent and 31.9 percent respectively. This indicates that 57.7 percent (in case of absolute poverty) and 31.5 percent (in case of extreme poverty) of the population are food-poor households that are unable to meet even their food requirements and thus fall below the food poverty line. All these are due to the existence of drought and high vulnerability in the study areas even to minor weather related shocks.

The absolute food poverty head count index in the country is estimated to be 33.6% in 2010/11 while it stood at 34.7% in rural areas and 27.9% in urban areas. This indicates that the absolute head count index rural northeastern Ethiopian in the present study is much higher than the national absolute head count index in rural Ethiopia as a whole in 2010/11. Indeed, achievement of food self-sufficiency is one of the key objectives of the government as articulated in its Growth and Transformation Plan (GTP) and rural development policies and strategies, which is also consistent with the MDG

goal of eradicating extreme poverty or hunger. However, this could not be realized specifically in the study areas. The food poverty gap indicates that the households are 19.0 and 10.5 percent far off from the absolute and extreme food poverty lines respectively. The severity of inequality among the poor is also 9.3 and 5 percent in case of absolute and extreme food poverty lines respectively.

Furthermore, as compared to what has been planned in the GTP to reduce the national total and food poverty head count indices to 24.7 and 23.6 percent respectively, as annual targets by 2012/13, both the total and food poverty absolute head count indices in the present study are substantially higher than the national average (MoFED, 2010). Looking at the other dimensions of poverty, the socio-economic status of the sample rural households tells us the extent of poverty in the northeastern Ethiopia. The socio-economic status of the households has been explained by considering the households income and consumption expenditure, ownership of agricultural and household assets by the households, provision of social services to the households and the food security situation of households.

4.3 Irrigation practices

As illustrated in Table 4.4, the survey data revealed that on average 46 percent rural farm households had access to irrigation. Among those 39 percent were poor and 49 percent of them were non poor. The difference between poor and non poor in terms of access to irrigation was found to be statistically significant at 5%.

The implication here is that those households with access to irrigation were less likely to be poor than those who had no access to irrigation. For illustration, irrigation users have absolute advantage than that of the non users because of high production intensity. While the non-users remain idle during some period in a year and their land is ineffective as there is time when the land remains bare, the users produced more than twice per year so that they can irrigate their land during the dry season and produce throughout

the year. The non users are producing at most only twice per year in Meher and Belg seasons.[7]

Table 4.4: Irrigation practice by poverty status

Wereda/Zone	Obs.	Non poor	Poor	Total	t-value
Access to irrigation	382	0.49	0.39	0.46	-1.95**
Source of water	176	0.85	0.85	0.85	0.03
Training	176	0.50	0.46	0.49	-0.53
Years of irrigation use	176	10.67	12.66	11.35	1.38
Type of irrigation	176	0.56	0.65	0.59	1.14**
Purpose of irrigation	176	0.65	0.62	0.64	-0.39

* Significant at 1%; **Significant at 5%

For households with access to irrigation river is the main source of water for the major (85 percent) households while lake, pond and harvested water are used as sources of water by 15 percent households. Among the households with irrigation access, only 49 percent households received training on irrigated agriculture. Of these about 46 percent were poor and 50 percent were non poor. Thus, training in irrigated agriculture plays an important role in creating awareness about irrigated agriculture for the half of the non-poor households. Concerning years of practicing irrigation the mean year of practicing irrigation is 11.35 years. Source of water, training, and years of irrigation use are not found to be significant.

While 59 percent of the irrigation users have used traditional irrigation scheme, 41 percent have used the modern ones. Poor households have a higher tendency of using traditional irrigation in statically significant level as compared to the non-poor; which might have contributed to low level farm productivity and poverty. Households with access to irrigation have various purposes to use irrigation such as income generation, food for household and feed for livestock, among others. It is interesting to note that 64 percent households are involved in irrigation for a purpose of mainly to generate

[7] Meher season refers to agricultural season which extends from August to December whereas Belg season refers to the second agricultural season which extends from March to July.

household income, although the percentage of poor households taking income generation as the main purpose of irrigation is lower than that of the non poor households.

4.4 Impact of Irrigation on Household Poverty: *The Propensity Score Matching*

A lot of procedures were implemented in this impact analysis. Firstly, the summary statistics of the treatment and control groups was discussed in order to see how the treatment and control groups look substantially similar which in turn helps to have balanced data. Secondly, the PSM procedure starts with participation or treatment model which contains the regression estimates from the probit model that we used to calculate the propensity scores. Thirdly, the estimation of programs' impact has been made by outcome or impact model. Finally, it is important to note that various types of tests were made so as to prove whether the assumption and properties under PSM are satisfied or not and thus to ensure that the matching estimators identify and consistently estimate the treatment effects of the programs.

Accordingly now we present the estimation of propensity score using Probit regression. The PSM procedure shows a regression table which contains the regression estimates from the Probit model that we used to calculate the propensity scores. This output also shows us the balancing and common support condition of PSM method. While the former condition tests whether the means of each covariate between treated and control units differ or not in all blocks, the later condition tests the region of common support to see if we have enough overlap between the treatment and control group to make reasonable comparisons. These two conditions have to be satisfied so as to apply the PSM method.

Most importantly, the balancing and common support conditions were further checked using separate tests. The balancing was checked before and after matching implying that the significant mean difference between the treated and control cases, both in the unmatched and matched groups were

tested. Overall, the results found no systematic differences in observed characteristics across the participant and nonparticipant samples. According to the study conducted by Godtland *et al* (2004) the balancing tests also show that the means of the observable variables for each group were significantly different. As a result, the null was not rejected for all but few variables at the 10 percent level. The common support was also checked graphically by producing routines for common support graphing.[8]

Table 4.5 presents the model of participation or treatment in irrigation and the same set of control variables are used to create propensity scores for the matching algorithm. The variables include demographic, socioeconomic, asset and other covariates. In our data set we tried to incorporate set of conditioning variables to control program participation decisions, since irrigation program is intended to serve the very poor. Although it is difficult to identify the poor, one way of judging the welfare level of households is on the basis of assets owned. Hence, we include the basic assets in the rural economy such as availability of own house and farmland, among other variables that help to identify the poor. Lack of these assets is associated not

[8]In the test of balancing property —that is, observations with the same propensity score must have the same distribution of observable characteristics independent of treatment status, the statistical mean comparison the treated and control (non-treated) groups of each variable before and after matching was done using t-test. To assess balance, we should look at both the mean differences between treatment and control and the bias especially in the matched sample. For good balancing, in one hand the means of almost all covariate do not differ and on the other hand the absolute value of standardized bias - %bias – for the non significant covariates before and after matching should be less than 10% (formulae from Rosenbaum and Rubin, 1985). In this study almost for most of the covariates, except for very few, the t-tests for equality of mean in the treated and non-treated both before and after matching are insignificant. Besides, standardized bias for non significant covariates is less than 5% and the absolute value of average percentage of standardized bias for all covariates before and after matching is 7.14% and 7.52% for the irrigation programs. What can be concluded from these results of balancing test is that the balancing property is satisfied and hence the matching was effective in building a good control group. Regarding the test on common support the histograms for the propensity scores of the treatment group vs. the control group were made. The produced propensity score graphs look promising, since almost the treatment cases and control cases have closest propensity scores and thus seem to be balanced frequency. As a result, we have enough overlap between the treatment and control group to make reasonable comparisons in the region of common support.

only with program eligibility but also with the outcome variable – poverty measured by the squared poverty gap. In analyzing the impact evaluation, therefore, we focused on including a set of conditioning variables that are highly associated with the probability of participating in irrigation and with the outcomes of interest based on theoretical grounds and information in the survey.

Therefore, the assumption of unconfoudedness or conditional independence assumptions seems plausible in this analysis, because households are selected on the basis of a few well documented criteria related to demographic, socioeconomic, including some asset and service variables and because the control group also applied to participate in the program. The covariates in this case were the variables in Table 4.5 that were used to select matched control group from the pool of applicants. So, estimators considered here can lead to credible estimates. However, when the selection into treatment depends on unobserved characteristics that are correlated to the outcomes of interest unconfoudedness is not a plausible assumption and thus matching estimators are biased due to the selection bias on unobservables. In other words, an unobserved difference in mean outcomes between treated and untreated households might occur even in the absence of treatment due to unobserved characteristics and then it poses the problem on the ATT estimates.

For example, one may want to account for factors unobserved by the researcher, such as differences in innate ability or personality across treated and control subjects or the effects of non random program placement at the policy-making level. Therefore, in this study Sargan-Wu-Hausman test was conducted so as to test whether there is selection bias on unobservables that arise due to self-selection to participate in the program, purposive program placement at the policy-making level, or both. In order to test whether there is sample selection bias (on unobserved characteristics) or not we need to run OLS regression of expenditure per capita on the propensity score, the residuals from the probit participation equation, as well as a set of additional control variables *Z* that exclude the instruments used to identify exogenous variation in expenditure gains. The coefficient on the residual was not

statistically significant under the null hypothesis of no selection bias, and thus selection bias could not pose a problem in estimating the model for program's impact assessment.

Table 4.5: Probit estimates of the treatment for irrigation scheme

Variables	Irrigation	
	Estimates	**z-values**
Male headed	0.282	4.58***
Household head age	-0.013	-4.20***
Mean age of household	0.013	2.72**
Mean education of household	0.035	2.36**
Adult equivalent household size	0.013	0.66
Dependency ratio	-0.047	-0.91
Dummy for zone	0.022	0.39
Dummy for own farm land	0.264	2.65***
Dummy for access to modern inputs	0.344	4.87***
Dummy for own house	0.144	1.05
Dummy for social capital	-0.474	-5.42***
Dummy for remittance	-0.038	-0.44
Per capita off farm income	-0.000	-0.61
Log likelihood	-233.29	
LR chi2(13)	60.30	
Prob > chi2	0.000	

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Coefficient of the variables considered in the model determining the probability of participating in irrigation are jointly statistically different from zero. Thus, the probit model could be used to predict the probability of participating in irrigation. Coefficients of male headed, mean age of household, mean education of household, access to modern inputs and own farm land are statistically significant and positively associated with irrigation. Coefficients of household head age and social capital are negative and statistically significant.

Average treatment effect on the treated (ATT) is a parameter of interest used to measure impact of programs in most evaluation studies.[9]Kernel matching, a nonparametric matching estimator as proposed by Heckman, Ichimura, and Todd (1998), is used to construct the counterfactual match for each participant by considering a weighted average of all nonparticipants.[10] In this study, the poverty impact of participation in irrigation programs was analyzed. The dependent variables in this impact assessment analysis, takes the value of 1 if a household participates in irrigation and 0 otherwise. The impact is regarded as mean impact of the programs on expenditure as measured by the log of per capita expenditure, and total poverty as measured by squared poverty gap respectively.

Table 4.6 shows a description of participation in irrigation. As can be observed from the table the total sample is divided into two groups: First, the "unmatched" results show the average estimates of expenditure per capita and total poverty for the treated and control cases, before any matching is done; this is just the difference in the raw data before carrying out matching between the two groups. Second, the "matched," results show the average treatment effect for the treated and control cases; this is just average treatment effect for the treated after matching is done. Moreover, there are three columns of interest: "Treated" shows the average estimates of expenditure per capita and total poverty for the treatment group before and after matching, "Controls" shows the average income for the control group

[9] Note that there are two special cases as concerns the computation of the ATT and its analytical standard error. First, if there is no treated and/or no control unit in one (or more) of the blocks, the ATT is computed on the remaining blocks which practically amounts to imposing a (block-based) common support condition. Second, if there is exactly one treated and/or one control in one (or more) of the blocks, the ATT in that block can still be computed but the standard error cannot. In this case, ATT using stratification matching produces missing values for the standard error. However, bootstrapped standard errors can still be computed.

[10] In kernel matching, all treated as well as all controls (in the common support which has been imposed here) are used. The estimate of the ATT is quite close to the one obtained with nearest neighbor matching.

before and after matching, and "Difference" shows the difference between the two as an estimate of the average treatment effect.[11]

In the evaluation of poverty impact of irrigation scheme, the basic idea behind PSM is to match each participant with an identical nonparticipant and then measure the average difference in the outcome variables the per capita expenditure and total poverty between the treated and control groups. As can be portrayed in Table 4.6, for matched sample, the effect of participation in irrigation increases the average per capita expenditure of program participant households by a statistically significant 10.5 percent relative to non participant households. Participating in irrigation scheme has also an increased impact (nearly 13 percent) with high significance on unmatched sample household's per capita expenditure. The per capita expenditure of irrigation users is about 13 percent higher than the non users and this mean difference of welfare between the treated and control groups is statistically significant at 1%. Coming to the poverty impact of irrigation, a similar trend is reflected as the expenditure impact of irrigation, but for matched samples the poverty impact of the program is larger and highly significant compared to the expenditure impact of the program. However the reverse holds true for the unmatched samples.

In this regard, treated households in the matched sample have lower levels of total poverty, as measured by square poverty gap, than non-treated in the same sample. Program participants have a total poverty level that is on average 0.123 points (i.e., 45.4 percent) lower than non-participants and the difference is statistically significant at the 1% level of significance. On the other hand, for the unmatched sample, the impact of irrigation on total poverty level is on average 10.2 (40.6 percent) lower than non-participants at a statistically significant level of 5%.

[11] Statistics on the difference column is used for interpretation to gain a more intuitive measure of the effect of treatment through focusing on the estimate of the average treatment effect as the mean difference between the treated and control groups and thus to aid interpretation. But the statistics on the treated and control columns represent the estimates of the per capita expenditure and total poverty if all and none of the sample households participated in the programs respectively.

Table 4.6: Average outcome of irrigation scheme for the treated and control groups

Outcome	Sample	Treated	Control	Difference (ATT)	t-values
Participation in irrigation scheme					
Per capita expenditure	Unmatched	8.168	8.039	0.129	2.77***
	Matched	8.168	8.063	0.105	1.56**
Total poverty	Unmatched	0.149	0.251	-0.102	-2.49**
	Matched	0.148	0.271	-0.123	-2.00***

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

The results on the poverty impact of irrigation therefore suggest that the irrigation program has a causal influence on total poverty when households are matched on the relevant demographic, socioeconomic, assets and other covariates. Hence, if we had two hypothetical households matched on those covariates in Table 4.5 but were to make one of them participate in irrigation the household would have a poverty level on average 45.4 percent lower than the other households that are not involved in the program. Results in relation to the impact of irrigation are consistently and remarkably similar to earlier findings in this study. Participation in irrigation increases welfare, as measured by the per capita expenditure, but reduces poverty, as measured by squared poverty gap, at a significant amount.

5. Conclusions and Recommendations

5.1 Conclusions

The summary statistics in the descriptive analysis clearly indicated that the majority of rural agricultural activities in northeastern Ethiopia is headed by males, adults, less educated and married group of household heads. Thus, mainly rural agricultural activities in the study areas are facing adverse demographic composition as there is dominance of male headed households and less educated household heads. The average household size is 5.28 (4.6 adult equivalent unit). The average female male ratio is found to be 1.16. This result is confirmed with the 2007 census result in the northeastern Ethiopia specifically, in the south and north Wollo (CSA, 2007).

Based on CBN approach the absolute food poverty line and total poverty line in northeastern Ethiopia are found to be ETB 2866.14 and 3410.71 respectively. The extreme food and total poverty lines based on food basket of 1650 Kcal per adult per day are 2149.39.59 and 2557.77 respectively. Compared to the national level poverty lines in 2010/11, the absolute food poverty line in the present study is higher whereas the total poverty line is lower. The national level food and total poverty line set by the Ethiopian government are ETB 1985 and 3781 respectively (MOFED, 2012). Thereafter, the poverty indices were computed and the resulting poverty estimates for the study area is presented below using FGT indices.

Based on total poverty line, absolute head count index stood at 39 percent indicating that on the average 39 percent of the rural farm households in northeastern Ethiopia are unable to meet the stipulated minimum level of calorie intake, which in turn indicates percentage of households living below total poverty line. The proportion is even lower, 20.4 percent in terms of extreme head count index. Extremely poor households have emerged in one out of two poor households. The absolute incidence of poverty (39 percent) in rural northeastern Ethiopia in the present study is by far higher compared to the rural national level incidence of poverty (30.4 percent) in 2010/11 (MoFED, 2012).

The depth of poverty, i.e. how much people on average fall below the poverty line, is found to be 0.106 which means that the percentage of total consumption needed to bring the entire population to the poverty line is 10.6 percent in terms of absolute poverty line and it is found to be 4.3 percent in terms of extreme poverty line. The levels of the poverty severity index, a measure that captures the relative deprivation among the poor households that gives a higher weight to the poorest of the poor, are 4.1 and 1.4 percent in terms of the absolute and extreme poverty lines respectively.

Indeed, irrigation played an important role to realize a sustainable attainment of food security and hence to alleviate poverty in rural farm households. It helps to enhance agricultural diversification though raising yields, improving grazing land, and reducing harm of famine and drought. The difference

between poor and non poor in terms of access to irrigation was found to be statistically significant, implying that those households with access to irrigation were less likely to be poor than those who had no access to irrigation. For households with access to irrigation river is the main source of water for the major (85 percent) households while lake, pond and harvested water are used as sources of water by 15 percent households. While 59 percent of the irrigation users have used traditional irrigation scheme, 41 percent have used the modern ones. The difference between the poor and the non poor shows statistical significance difference, implying most of the poor households in the study area are relying on traditional irrigation which probably reduces the productivity of farmers. Besides, less than half of the irrigators have trained on irrigation, which is not sufficient to create awareness about irrigated agriculture and hence to bring productivity in irrigation agriculture.

As regards the poverty impact of irrigation, the probit estimates of the treatment for irrigation scheme indicate that it is better to predict irrigation, since most variables have larger significant effect on irrigation. Male headed, mean age of household, mean education of household, access to modern inputs and own farm land were among the strong factors positively associated with irrigation. Only household head age and social capital were negative and significant.

In connection with this, we have analyzed the importance of irrigation scheme in the study areas. The results indicate that the participation in irrigation does have a strong significant impact on household per capita expenditure and poverty. For matched samples, the per capita expenditure of irrigation users is 10.5 percent higher than the non users. On the other hand, program participants have a total poverty level that is on average 0.123 points (i.e., 45.4 percent) lower than non-participants. Therefore, it is evidence that in northeastern Ethiopia irrigation plays a considerable role to get the rural households out of poverty.

5.2 Recommendations

The overall magnitude of poverty in northeastern Ethiopia is quite high and worthy of serious attention. In light of this, concrete action oriented programmes and plans are needed to improve the poverty condition of the households in the study areas. To this end, firstly there should be a clear and common understanding on the extent, causes and consequences of poverty and inequality and then shared responsibilities and commitments in the implementation of key ingredients of a poverty reduction strategy from the government, NGOs, professionals, the poor themselves, and from any interested stakeholders.

The finding of evaluating the poverty alleviation programs confirms that gender of the household head is significant in explaining irrigation, as poverty alleviation program. Male headed household is positively correlated to irrigation. Therefore, gender-sensitive poverty alleviation policies that enhance endowments of female headed households in terms of building their own assets, providing education, among others have paramount significance in poverty alleviation strategies of the country. Importantly, since mean education of the household plays an important role for poverty reduction in vesting in education should be given a prime attention in the poverty alleviation strategy.

The results of evaluating of irrigation program corroborate that the irrigation scheme does have a strong significant impact on both household per capita expenditure and poverty. This implies that irrigation plays a considerable role to resolve both the food security and poverty problems of the rural households. Therefore, spreading out of irrigation and enhancing its productivity should be given proper attention and it becomes an area that deserves prime attention in the rural areas of northeastern Ethiopia to fight poverty. Expanding and improving irrigation scheme in turn would help to raise yields, reduce drought-induced crop losses, and improve grazing land.
Since irrigation played an important role to realize a sustainable attainment of food security and hence to alleviate poverty in rural farm households, giving much emphasis to irrigation is the first step towards improving

household food security. In addition to promoting the formal education, households in the study area should be given training and introduced the advantage of new technologies such as the use of small scale irrigation and better water management to produce more than once a year and increase yield by reducing the households' dependency on rain-fed agriculture.

Moreover, the practice of irrigation scheme in the study areas is not being modernized and would not bring the desired results. Thus, for the successful development of irrigation and then food security a concerted effort on investments in agricultural water management, such as small-scale irrigation schemes should be made by the government, NGOs and farmers to reduce food insecurity and incidence of rural poverty.

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Smallholder Farmer's Access to Credit for Livestock Production

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Abstract

Access to credit is a key to increase livestock production and productivity. This study aims to analyze the suitability of the rural credit systems for livestock production. Microfinance institutions (MFIs) product characteristics, small loan size and short repayment duration, are not suitable for livestock production, particularly dairy production, due to the relative huge investment cost and long gestation period. Almost all respondents (98%) in this study were credit constrained for livestock production and fattening enterprises. Particularly, youth and women suffer from lack of credit due to the systematically marginalizing effect of MFIs' group lending system. Government and non-government organizations working on livestock should recognize that livestock sector is credit constrained and should act accordingly. They should also adopt household asset building programs, which had been implemented in unproductive areas, to marginalized people in productive areas. The country's central bank should also design strategies that help local MFIs to exercise untouched important characteristics of MFIs products to livestock production and fattening enterprises.

Key words: Access to credit; Group lending system; Negative binomial regression; Livestock production.

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1. Introduction

Access to credit is an important tool to promote production (Robinson, 2001; Armendariz and Morduch, 2005). Credit can contribute to livestock productivity by increasing ownership and adoption of improved breeds, use of crop residues, and adoption of stall feeding and use of health services (Benin et al., 2003). Poor rural households in developing countries lack adequate access to credit, which is believed to have significant negative consequences on various aggregate and household-level activities which include technology adoption, agricultural productivity, food security, nutrition, health, and overall household welfare (Diagne et al., 2006).

Access to credit to smallholder farmers can facilitate growth of the agrarian economy and is used as a way of lifting rural people out of poverty. However, as Benin et al (2003) reported, smallholder farmers lack adequate credit to agricultural activities in general and to livestock production in particular. The problem is often faced in areas where the production system is mixed crop-livestock production. In such production system, crop and livestock production are interdependent and have no distinct credit service for them. From the study conducted on Ethiopian agricultural extension by Kassa (2003), we understand that livestock production has less priority regarding input supply and service delivery. In addition to the focus of the agricultural extension which contradict with the large potential of the country on livestock production and marketing, shortage of capital and huge financial requirement are constraints of livestock production. In this regard, the potential solution to alleviate the problem and help exploit the existing livestock production and marketing is access to credit.

Most studies conducted on smallholder farmers' access to credit is not business specific although the nature of the business varies in terms of capital requirement and duration. The objective of the study is to assess smallholder farmers' access to credit specific to livestock production. The main research question of the study is ‘do smallholder farmers have access credit for livestock production?’ The other two related research question are:

(1) Do women and youths have access to credit? (2) What factors influence frequency of getting loans?

2. Conceptual Framework

The fact that smallholder farmer have the possibility of borrowing money from MFIs but may not mean that they have access to credit. Since the principle of access to credit, i.e., the ability to borrow as much they want (Diagne and Zeller, 2001), may not be in place. The finding of Stigliz and Weiss (1981) reinforce this as no competitive force leads demand equal to supply in the credit market. Lack of access to credit to some smallholder farmers is an expected rural financial market phenomena. The question is rather for whom and for what type of business do MFIs supply loans is crucial issue in rural financial markets.

Brown and Taylor (2008), in their empirical study, point out that household characteristics have a significant impact on household financial circumstances. The level of household characteristics on financial circumstance varies with the lending system of financial institutions. The effect of asset ownership in group lending systems seems loose but it is used as implicit collateral. Furthermore, disaggregating the borrower as men, women and youths has a direct implication regarding asset ownership in rural areas.

Regarding rural business, smallholder farmers are engaged on crop and livestock production, which implies that they have two potential loan allocation options. The initial capital requirement for those businesses and its term of investment are quite different. Livestock production needs huge capital and long term investment as compared to crop production. The decision of smallholder farmers on which business the loan should be allocated depends on loan size and repayment duration. The characteristics of microfinance institutions that are working in the study areas give an insight on whether or not the coexisting rural financial market allows smallholder farmers to allocate loans for livestock production.

3. Methods

Description of study area and microfinance institutions

The study was conducted in four districts (Dera-Hamusite, Dangela, Yilmana Densa, and Debay Telate) of Western Amhara region, Ethiopia. Agricultural production system, livestock production potential and rural financial institution outreach are the major criteria used to select the study districts. The Agricultural production system in the study districts is mixed crop-livestock production. The total population of cattle (goat and sheep) at Yilmana Densa, Dera, and Dangila is 124836 (126740), 182829 (197218), and 152032 (58798), respectively (Amhara National Regional State Livestock development and promotion Agency).

The most well organized microfinance institutions that reach those study areas is Amhara Saving and Credit Institution (ACSI). ACSI was initiated in 1995 and has 710,576 clients in 13 branches and 185 sub-braches. The Poverty Eradication and Community Empowerment (PEACE) MFI is the other rural financial institution, which has been working in East Gojjam with limited outreach and performance. Both MFIs follow group lending system and couple lending systems (issuing of loans for husband and wife together). MFIs employ two screening steps. First, MFIs use peers evaluation, which is conducted between group members themselves, to minimize the effects of information asymmetry (adverse selection and enforcement cost).The second evaluation is conducted by locally organized screening committees to refine the evaluation further. The amount of loans had an increasing trend and reached a maximum level in 2009 and then after seemed constant. The average loan size per borrower was ETB 2232 with a standard deviation of ETB 714 from 2004 up to 2011.

Sampling methods and data collection

A two-stage sampling procedure was used to select sample respondents. At the first stage, study districts were selected purposely based on livestock production potential and rural financial institution outreach. At the second stage, eight Kebeles (the smallest administrative units) and sample respondents were selected randomly from the list of credit users' profile at

MFIs. From 36 up to 40 respondents at each district were drawn and a total of 151 respondents were interviewed using a structured questionnaire. The contents of the questionnaire included demographic characteristics, socioeconomic characteristics, access to credit and credit institutions. The questionnaire was pre-tested and amended accordingly before it is collected by enumerators who were continuously supervised by the researcher. In addition, we held focused group discussion (FGD) to assess access to credit for male headed versus female headed households, elders versus youths and poor versus rich. Each FGD consisted of a manageable number (10 to 16) of men, women, youths and elders, smallholder farmers at poor, medium and better-off income levels.

Data analysis and model specification

The data was analyzed using descriptive statistical methods and an econometric model. Frequency and percentage of nominal variables and measures of the central tendency of scalar variables were used to describe small-scale farmers' socio-economic, demographic, and client related household and farm characteristics. An econometric model was applied to examine factors affecting frequency of getting loans. Poisson model has been widely used to estimate the parameter in claim count or frequency model in recent years. Negative binomial model has also been used to estimate count data. Model choice between Poisson and negative binomial models should depend on the nature of the distribution of the data which can be measured using Pearson goodness-of-fit test (Piza 2012). Poisson distribution assumes the conditional mean and the variance of the distribution to be equal while negative binomial distribution relaxes the assumption of conditional mean which equals variance of the distribution. Our result indicates the distribution of the dependent variables significantly differs for a Poisson distribution[2]. The data set displays over dispersion[3]. In this case, Poisson regression is inappropriate and gives erroneous results (Ismail and Jemain 2007). A negative binomial regression is more

[2] Pearson goodness-of-fit is 160.7319 (prob > chi2 (120) = 0.0077). The null hypothesis - variance equal mean is rejected and the alternative hypothesis - variance exceeds mean, is accepted.

[3] A situation where the variance of the response variable exceeds the mean.

appropriate to accommodate over dispersed count data (Greene 2008). The primary equation of negative binomial model is basically the same as that of the Poisson regression (Greene 2008). The Poisson regression is as follows:

$$\Pr[Y = y_i \,|X_i] = \frac{\exp(-\mathrm{a}_i)\mathrm{a}_i^{\,y_i}}{\Gamma(1+y_i)},$$

$$\mathrm{a}_i = \exp(\sim + X_i^{'}),\ y_i = 0, 1, \ldots,\ i = 1, \ldots, N$$

where X_i is a vector of covariates and i= 1,...,N, indexes the N observations in a random sample, the signature features of the Poisson model are its log linear conditional mean function

$$E[y_i \,|X_i] = \mathrm{a}_i,$$

and its equi-dispersion,

$$Var[y_i \,|x_i] = \mathrm{a}_i.$$

The negative binomial model is employed as a functional form that relaxes the equi-dispersion restriction of the Poisson model (Greene 2008). A simple way to motivate the model is through the introduction of latent heterogeneity in the conditional mean of the Poisson model (Greene 2008). Thus, we write

$$E[y_i \,|X_i, £_i] = \exp(\sim + X_i^{'} + £_i) = h_i\,\mathrm{a}_i,$$

where $h_i = \exp(£_i)$ is assumed to have a parameter gamma distribution, $G(\theta, \theta)$ with mean 1 and variance $1/\overline{\ } = ©$;

$$f(h_i) = \frac{\overline{\ }^{\overline{\ }}\exp(-\overline{\ }h_i)\,h_i^{\overline{\ }-1}}{\Gamma(\overline{\ })}, h_i \geq 0, \overline{\ } > 0$$

After integrating h_i out of the joint distribution, the marginal negative binomial distribution can be obtained as follows:

$$\Pr[Y = y_i | X_i] = \frac{\Gamma(\overline{} + y_i)\, r_i^{\overline{}})(1 - r_i)^{y_i}}{\Gamma(1 + y_i)\Gamma(\overline{})},$$

$$y_i = 0, 1, ..., \overline{} > 0, r_i = \overline{} / (\overline{} + \mathtt{a}_i).$$

The latent heterogeneity induces over-dispersion while preserving the conditional mean;

$E[y_i | X_i] = \mathtt{a}_i$,

$$Var[y_i | x_i] = \mathtt{a}_i[1 + (1/\overline{})\mathtt{a}_i = \mathtt{a}_i[1 + \mathtt{©}\mathtt{a}_i]$$

where $\mathtt{©} = Var[h_i]$.The model is estimated using Maximum likelihood and the result is presented in Table 8.

4. Results

Demographic and socioeconomic characteristics of household survey respondents are presented in Table 1. Eighty eight percent of the respondents were male headed households while the remaining 12% were female headed. The mean age of a household head was 43 years and household size 6 persons. Respondents had relatively low level of literacy; about 40% did not attend school. About 88% of respondents' livelihood relied on mixed crop-livestock production, while the others were additionally engaged in off-farm activities (petty trading) and local agricultural equipments manufacturing. The mean land holding size was 1.3 ha. As expected, youths and female headed households had low land holding. Land holding of female headed households was lower than male headed household by 0.3 ha. Land holding of youths was also lower than that of adults by 0.6 ha. Smallholder farmers mainly rear cattle and sheep and they, on average, owned 2.5 livestock in

tropical livestock unit (TLU). Male headed households and youth owned to some extent a higher number of livestock as compared to female headed households and adults.

Majority of male headed households (86%) withdraw credit consulting their spouses. This is an implication of spouses' access to loans to control but not in place for household leading women. About 89% of women and 95% of youths suffer from lack of opportunities to be a member of credit applicant groups or to form borrower groups. Moreover, for about 39% better-off, 59% middle and 80% poor households, group borrowing is an obstacle to access credit (Table 2). The study also gives emphasis on where the loan was allocated and the rationale for the allocation. Two-thirds of borrowers allocated the loans for crop production to purchase draft power and agricultural inputs (chemical fertilizer and improved seed), while 25% of borrowers used the loan to supplement livestock investment particularly on beef and mutton production (Table 3).

As Table 4 shown MFIs' clients (98%) claimed that the existing formal credit system is not suitable for livestock production and fattening enterprises. The amount of loan, the loan term, the time of loan issuing and repayment period are the main challenges to access credit for livestock production and fattening enterprises. For 38% and 42% of respondents repayment period is short and amount of loan is small, respectively. Table 5 shows, moreover, that the frequency of access to credit was determined by household heads' age, education level, the number of household members and total livestock owned. Loan frequency is a concave function of age. Education has a positive and significant effect on access to credit. Similarly, the number of livestock owed has positive and significant effects on access to credit. In contrast, the number of members in a household is found to have negative and significant influence on access to credit.

5. Discussions

MFIs have adapted Grameen group lending model and they share the characteristics of microfinance products - small loan size and very short

repayment duration (Murray and Boros, 2002). Moreover, MFIs set a threshold and ladder on loan size which they revised annually. Loan size, within the domain of the threshold, is restricted by loan size ladder. Clients can pass from one loan size ladder to the next based on membership duration if they do not default. Time spent as member of a microfinance institution therefore, determines the amount of loan that an individual borrower should withdraw; and he/she does not simply borrow up to the upper limit of loan.

Borrowers have to repay their loans on a one year basis and all the members of the group should payback their loans at the same time; otherwise, they face obligation of group responsibility. According to group responsibility contracts are cancelled for all group members if any one of them defaults. In order to escape sanction, all members have to repay the defaulted amount. Thus, MFIs had been implementing joint liability relaxing strategies such as compulsory saving up to ten percent of the loan in three months and life insurance for death of a household head.

A group lending system has profound importance to secure a high repayment rate. However, a group lending system may not ensure high repayment rate at any time (Sharma and Zeller, 1997). ACSI has been using government bureaucracy to enforce defaulters (Getenah *et al.*, 2005). Strong credit enforcement mechanisms are therefore a means of securing a high repayment rate. But it does not make borrowers are non-defaulters. Some borrowers are invincible defaulters and lie under default vicious circle. When borrowers face default, they search for a temporary credit source to pay back the loan to the former lender. Borrowers again withdraw loans from the former lender to pay back the loan which is drawn from the temporary credit source. Under such situation, credit does not alleviate poverty, rather it may lead to severe poverty.

A Couple lending system creates a conducive environment for married women to have access to control the loan. In contrast, a group lending system does not favor women (female headed households) and youths particularly poor households. Women and youths suffer from lack of opportunities to be a member of a credit applicant group or to form borrower

groups. This contradicts with the principles of rural finance - credit should be offered and used in rural areas by people of all income levels (CGAP, 2009). In the case female headed households, men hesitate to make them members of a loan applicant group because they are jointly liable to pay members' default and the screening committee does not accept a group if it is composed of only women. People who are below 30 years are landless, because during the time of land re-distribution in 1996, were below 18 years old and at that age level the country's constitution prohibits them to be land owners. As a result, currently, youths are landless. According to Mahmood (2000), youths suffer more than small landowners or tenants. As a whole, women (female headed household) and youths are systematically marginalized from rural credit market because of the group lending system.

Livestock production particularly dairy requires capital - above the average loan size, and long gestation period (above three years) - beyond the credit repayment duration (1year). The average loan size (ETB 2232) was lower than the average market price of ox (ETB 3549[4]) and a local breed cow (ETB 2765) in 2011. Sheep and goat production needs small capital, which is relatively consistent with the loan size characteristics of MFIs; but the loan repayment period is not relaxed. Similarly, it does not encourage beef fattening practice due to huge capital and untimely credit issuing. This leads rural financial markets to have low outreach to livestock production.

In the study areas, agriculture is subsistent and farmers follow diversification of agriculture. Crop production has short gestation period as compared to livestock production. As a result, the amount of loan and loan term are more suitable for crop than for livestock production. Inconvenient credit issuing season and repayment period are other limitations in the case of crop production. If smallholder farmers are urged to repay the loan during peak crop production season (where the price of crop falls), they lose the benefit that they can obtain from crop selling during a slack period (where the price of crop rises).

[4] The average price of ox for draft power and breeding cow, sheep and goat are ETB 3549, 2765,555 and 469, respectively (Amhara National Regional State bureau of trade).

The negative binomial model result shows that at middle-age smallholder farmers have higher access to credit than that of young one. Such empirical result corroborates the finding of Chen and Chivakul (2008) and the authors concluded that middle-aged household heads generally have more stable income streams and higher net wealth, which leads to lower credit risk. The quadratic effect of age implies that youths and retired people benefited less from rural credit markets. This is the effect of application of similar lending systems by MFIs to all clients regardless of their socioeconomic characteristics. Larger family size implies higher credit need, however, the loan may not be enough to engage all the people of a large family. Literate rural people could face low default risk due to business plan preparation and financial management like allocating credit for targeted business and they have better access to credit. Livestock is considered as collateral but it is so implicitly. It is implied that livestock can be easily sold and the money can be used to reimburse those members who cover the loan of bankrupt member(s).

6. Conclusion and Recommendation

Although there is no need of collateral in group lending system, this system does not favor women and youths. The negative binomial model result shows that at middle-age smallholder farmers have higher access to credit than that of young ones. Education and livestock ownership have a positive effect on access to credit. In general, rural financial markets outreach to livestock production is limited because of (1) small amount of loan size - capital requirement is above the average loan size, (2) short loan term – gestation period is longer than credit repayment duration and (3) inconvenient loan issuing time for fattening business.

This study recommends that organizations should recognize that the livestock sector is credit constrained and they should act to alleviate this constraint. Government should adopt household asset building programs, which have been implemented in unproductive areas, to marginalized people from rural markets in productive areas. The central bank should also design strategies that help local MFIs to exercise still untouched important characteristics of their products.

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Table 1: Demographic and socioeconomic characteristics of MFIs' clients

Variables	Mean	Variables	%
Age of household heads (year)	43.0	Male headed households	88.0
Family size	6.0	Education status of household heads	
Livestock holding (TLU)	2.5	Illiterate	39.2
Land holding (ha)	1.3	Basic education	38.5
Livestock holding X Sex		Elementary	18.2
Female	2.0	Secondary	4.1
Male	2.6	Source of income	
Livestock holding X Age	2.5	Only agriculture	87.8
≤ 30 years old	2.7	Agriculture plus off-farm activities	12.2
≥ 31 years old	2.3		
Land holding X Sex			
Female	1.1		
Male	1.4		
Landholding X Age			
≤ 30 years old	0.8		
≥ 31 years old	1.4		

N = Number of respondents. % = Percentage. Source: Survey data

Table 2: Access to credit to women, youths and poor

	Responses			
	Yes		No	
	N	%	N	%
Do you have problem to access credit?				
Gender				
Male headed household	22	57.9	16	42.1
Female headed household	137	88.9	17	11.0
Age				
Youth (≤ 30 years old)	40	95.2	2	4.8
Elders (≥ 31 years old)	81	54.0	69	46.0
Wealth status				
Rich	7	38.9	11	61.1
Medium	61	58.7	43	41.4
Poor	56	80.0	14	20.0
Do you consult your spouse about credit application?	119	85.6	10	14.4

N = Number of respondents; % = Percentage. Source : Survey data and FGD

Table 3: The type of investment where the loan allocated

	N	%
Crop production		
Farm animal (ox)	59	47.2
Fertilizer and improved seed	28	22.4
Animal fattening		
Ox	11	8.8
Sheep	8	6.4
Animal production		
Dairy cow	4	3.2
Sheep	8	6.4
Petty trading	7	5.6

N = Number of respondents. % = Percentage. Source : Survey data

Table 4: Credit constraints for livestock production

	N	%
MFIs product characteristics in livestock production perspective		
Small amount of loan	59	41.55
Short repayment period	54	38.03
Inconvenient repayment period	19	13.38
Credit issued not on right time	10	7.04
Clients perception to rural financial market		
Suitable to livestock production	3	2.0
Not suitable to livestock production	148	98.0

N = Number of respondents. % = Percentage. Source: Survey data

Table 5: Factors affecting frequency of credit access

Variables	IRR	Robust Std. Err.	Z-value
Gender	.9698877	.0466896	-0.64
Age	1.095515	.0135098	7.40***
Age square	.9990954	.0001263	-7.16***
Elementary school	1.147369	.0402003	3.92***
Secondary school	1.098269	.059049	1.74*
Family size	.9742728	.0091549	-2.77***
Dependency ratio	1.001594	.0010292	1.55
Land size	1.039525	.0250055	1.61
TLU	1.047746	.0115578	4.22***
Constant	.6070917	.1627043	-1.86*
Log pseudo likelihood	-1921.0656		
Wald chi2 (9)	129.90		
Prob > chi2	0.0000		

*** and * means significant at 1% and 10% probability levels

Estimating the Recreational Use Value of Lake Tana through Travel Cost Method

Atalel Wubalem[1], and Teshale W/Amanuel[2]

Abstract

Lake Tana is a famous destination in Ethiopia for both domestic and foreign visitors. Although the recreation and tourism potential of the site is regarded as enormous, the value of the Lake through proper economic valuation systems has not been estimated and has not been used to maximize the benefit out of this resource. Thus, the main objective of this study is to estimate the recreational use value of Lake Tana and investigate the determinants of demand for recreation. The study employed Individual Travel Cost Method with Poisson regression model for count data generated from 174 samples of on-site survey. The result of socioeconomic characteristics shows that the site is well visited by males and those who have jobs, own business income source, higher education, leisure time and low family size. The Truncated Poisson regression result indicated that visitors' sex, education level, marital status, occupation, monthly income, leisure time, being in group and alternative sites are variables that significantly and positively determine the decision to visit the lake. However, visitors' recreation decision to the site is significantly and negatively determined by their total cost of visits. The measure of responsiveness for recreation demand for a change in travel cost shows that price elastic demand while the income elasticity indicates that Lake Tana is a normal good and in particular a necessity good. The estimation result shows that Lake Tana has a huge annual recreational value of 17,579,345.52 USD and consumer surplus of 1,915,397.69 USD. The value attachment suggests that estimation of recreational value for Lake Tana is a central component in the sustainable use and management of the resource. However, well controlled waste disposals and EIA, controlling a widely spreading invasive weed, effective revenue collection, strong regulatory practices on prices and tariffs are important considerations which need immediate interventions for better use of the Lake's recreational services.

Key words: Non-market valuation, Poisson model, Trip frequency, Truncated form, Total benefit, Consumer surplus

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1. Introduction

1.1 Background and Justification

Desirable social welfare could be achieved when resources are managed and utilized in an economically optimal and sustainable way. This needs proper valuation of environmental resources. In recent years, economic analysis has expanded its scope from its traditional market orientation to more inclusive form of resource use valuation through non-market based resource valuation techniques. Environmental resources (clean water, clean air, nice views, and forests for hiking) are not exchanged on the conventional market, and therefore do not have market prices (Sommer and Sohngen, 2002; Morrison, 2009). Recreational services from forests, national parks, waterfalls and lakes, wildlife, natural heritages are some areas in which people prefer to spend their working or leisure time. Although recreation is one attribute from numerous use and non-use values of environmental resources, unfortunately, nature based recreational sites are mostly regarded as public goods which show non-excludable and non-rival characteristics and in some cases as a common property when there is no entry fee to a site. (Ward and Beal, 2000). This means figures from traditional quantity-priced based market demand models cannot reflect their exact values. The issue is particularly important for Lake Tana. Though the Lake has multidimensional benefits, a recreational value is an old aged and major component of its use values. More importantly, the service associated with recreation is non-rivalry hence it does not diminish the water's service to alternative uses. However the country is unable to consider a win-win strategy over resource use due to its reliance on the traditional market resource valuation approach that only tends to focus on market prices. Therefore, valuation of services for recreational use can be of real importance for better understanding of the total value the resource provides (Thierry et al., 2011). From this point of view, valuing the use values of the Lake for recreation among its multiple arrays of economic activities has its own significant role for efficient and sustainable use and management of the resource.

1.2 Objective of the study

The general objective of the study is to estimate the economic value of Lake Tana and its major determinants from revealed behavior of visitors.

Specific Objectives

The specific objectives of the study are to:

- to estimate the recreational use value of Lake Tana, and
- to identify determinants of recreation and recreational value of Lake Tana

2. Literature Review

2.1. Theoretical Literature Review of Economic Valuation

Economists usually classify methodologies for cost benefit analysis in to two categories; market based and non-market based approaches. Non-market valuation techniques are increasingly gaining acceptance nowadays in most economic research works where it is all about looking for ways to assign values to such goods and services which are either not traded in the market or whose prices are not appropriate reflections of their values (Boardman et al., 2006).

The conventional market based approaches are used where market data is available. But, a major problem confronting environmental economists is the difficulty of valuing environmental resources and other public goods such as recreational sites since there are no markets or markets are imperfect in situations where they exist (Twerefou and Ababio, 2012). This means that while marketable goods and services are valued in terms of their prices, non-market goods and services either do not have a market price or the market prices do not reflect the values of the goods or services (Nde, 2011). However, even in situations where no price is available for non-market goods, now days it is possible to use the prices of related market goods, or the prices obtained from hypothetical markets to estimate their value (Longo, 2007). Thus, incorporating non-market values into a decision-making

process requires the implementation of a suitable valuation framework that captures all values of an environmental resource (Philcox, 2007).
In various resources and environmental economics literature we find different valuation methods of environmental benefits. These valuation techniques generally fall in two broad categories, Direct and Indirect methods (Hanley et al., 1993).

The direct method relies on market prices of goods and services in a market and assumes the price formed in this market is equal to the economic value of the good (Groot *et al.*, 2002). However, this approach will be constrained by imperfect information. The indirect method is based on the assumption in cases where prices of goods and services under consideration are not available in a perfectly competitive market. In this case, the market price is only a piece of financial information and is not equal to the economic value of the good (Groot et al., 2002; Freeman, 2003).These valuation methods are also divided as stated preference methods and revealed preference methods to refer to direct and indirect approaches, respectively (Hanley et al., 1993).

Stated preference methods seek to infer individuals' preferences for environmental quality directly by asking them to states their preferences for the environment. These methods are widely employed to value a particular public good when it has very poor or no market proxies to value it. This techniques use surveys through questionnaires to elicit information since respondents are not actually required to pay for their valuations of goods and services (Boardman et al., 2006). It includes contingent valuation, stated choice modeling and conjoint analysis techniques.

Revealed preference methods seek to recover estimates of individuals' WTP for environmental quality by observing their behavior in related markets. A revealed preference method includes travel cost, hedonic pricing and market pricing methods (Yacob and Radam, 2010).

Travel cost method (TCM)
Travel Cost Method (TCM) is originated from the economist Harold Hotelling's letter to the director of the US park service in 1947, It become a

popular technique after famous economists Clawson and Knetsch applied the method during 1966 (Habb and McConnell, 2002). It is a technique of measuring the use value of an environmental amenity by using the costs that individuals pay to travel and all sorts of expenditure to the site as a proxy for the price of the amenity (Mitchell et al., 2003).

TCM is predominantly used in recreation modelling. It involves using travel costs which individuals incur in travelling to an outdoor area; both direct monetary and time costs, and on-site costs, such as entry fees as a proxy for the price of visiting recreational sites and look at how the visit frequency of users responds to changes in the price of a visit (Hanley and Spash, 1993; Tisdell, 2005). The primary strength of the TCM for estimating recreational use benefits is that it relies on observed data reflecting the actual behaviour of recreationists (Styles, 2005). In the travel cost model, individuals are actually observed spending money and time, and their economic values are deduced from their behaviour. Economists generally tend to prefer techniques of this sort because they are based on actual behaviour rather than unreal responses to hypothetical scenarios. In appropriate circumstances, this model can often be applied without an enormous expense (Moons, 2003). Besides its prime role in estimating the value of a given environmental good for recreation, the technique can even provide a significant input for environmental quality as a means of valuation by observing how visitation rates to a site change as the environmental quality of the site varies. The greatest disadvantage of travel cost is that it cannot be employed unless there is some easily observable behaviour that can be used to reveal values. Thus, in the case of measurement of non-use values this method is inappropriate. Hence a method which relies on surrogate markets as a proxy, assumes weak complementarities between the environmental asset and consumption expenditure. Despite the fact that TCM cannot estimate non-use values, TCM is technically and statistically complicated and hence results obtained from the valuation of use value are sensitive to model specification, handling of substitutes, multi-propose trips and cost of time measurement (Styles, 2005). Additionally, attempting to relate the recreational value of a place with travel costs incurred to the site could be an oversimplification of reality.

This is because people who live near the site may incur zero or minimal travel costs but may nevertheless have high values for the site.

2.2. Empirical Literature Review on Recreation Valuation Using TCM

Evidence in Ethiopia, unlike that existing globally, shows that very few research activities have been done on non-market resource valuation particularly using TCM and no study was done on Lake Tana in an attempt to know its recreational value as far as the author of this paper knows.
In the nearby location of Lake Tana, Terefe (2000) studied the value of outdoor recreation of Tis-Abay Water Falls using TCM. In his study, 140 visitors were used as sample size using zonal travel cost method. Using gathered data on the percentage of sampled visitors from each of the zones, the visit rate per 1000 population in each zone was determined. The model assumes a zero admission fee. Then, the economic value of the park was estimated at 2,181,998,095 ETB per year. The study also indicated the optimal entrance fee as 40 ETB and the maximum expected revenue for the site as 85,812,000 (= 40*21,378) ETB where 21,378 was the number of total visits per year.

In addition, Ali (2011) examined the economic benefit of Ecotourism of Semien Mountain National Park using a combination of both travel cost and choice experiment valuation methods. In his finding, the expected aggregate annual recreational economic benefit gained by visitors of the site was estimated at 48,562,086.4 ETB (approximately 2,943,156.7 USD). While the choice experiment method (CE) was employed to measure visitors' valuation of different attributes of the site, and to examine their general perception towards the park's services and resources, three attributes (namely, the number of Walia Ibex and Ethiopian Wolf population, afforestation and additional service to visitors) were found as elements that explain the park's quality.

Sitotaw (2003) also used Individual travel cost method (ITCM) to estimate the benefits of out-door recreation of Wabi-Shebele Langano recreation site.

In his study, travel costs, visitors' income, age, level of education, family size, acquaintance with the site, substitute sites and family head were found to be major determinants of visits to the site. Using truncated Poisson model, the annual recreational benefit of the site was estimated to be around8, 685,774 ETB (1,009,974 USD).

Mohammed (2007) estimated the recreation use value of Wondo Genet Wetland Ecosystem in Ethiopia. In his estimation of the recreation use value of the site, single site travel cost model was applied. A truncated count data model for consumer surplus (CS) estimation per single recreation visits to the site on average resulted in 184 ETB and 271 ETB for daily and overnight visitors, respectively. Accordingly, the aggregate CS is estimated as 18 million ETB and 1.5 million ETB for daily and overnight domestic visitors, respectively; which amounts in total to around 20 Million ETB per year (equivalent to 2.2 million USD per year).

Twerefou and Ababio (2012) examined the economic value of Kakum National Park in Ghana through individual travel cost approach. The results indicate that the annual per person value of the site is about (46.40 USD) which translates into an annual aggregate value of (5,849,416 USD). Regression analysis using the zero-truncated negative binomial method indicates that travel cost, gender, knowledge of composite sites is the most important factors that influence visitation to the Park.

Nde (2011) conducted a research work in Cameroon titled 'Non-market Valuation of Beach Recreation using the TCM in the Context of the Developing World: An Application to Visitors of the Ngoe Beach'. The count data of 242 sample size was modeled with the left truncated Poisson and negative binomial models as well as the zero-inflated negative binomial model. The results show that CS estimates are equivalent to the recreational value of the beach per trip per visitor per day and ranged from 2.56 USD to 41.51 USD. Different CS estimates per trip per visitor per day were obtained for the different categories of visitors ranging from 9.86 USD to 37.11 USD. Also, a possible access fee to the beach of 2.0 USD was suggested based on the stated WTP of visitors and hence the Ngoe beach is an open access beach. Another important finding is that tourists had the highest spending

propensity than any other category of visitors. Also, a visitor's income was found to have a very small impact on the CS estimates of visitors whereas the stated WTP of visitors was found to largely correlate with their CS estimates.

3. Methodology

The study is carried out in Lake Tana which is situated in the north-western highlands at an altitude of 1786m and location of $12^{0}00$'N, $37^{0}15$'E with a surface area of 3200 km^2(Wasie *et al.*, 2012). The study mainly uses both quantitative and qualitative primary data. In addition to the primary data gathered on site from the visitors, some secondary data from government offices and churches was also used to support results and findings of the study.

The most prevalent sampling scheme in individual demand estimation for a specific recreational site is either a random sample of the population of individuals or on-site sample of intercepted users. Considering time and cost constraints, data surveying was designed based on on-site sampling procedure. The main problem of sampling in on-site survey is inability to know the target population prior and hence different people may have different objectives around and inside the Lake besides recreation. A typical on-site survey is an intercept survey where a sample of recreation users at a site is chosen in purposive sampling. Interview was done by screening out single aim visitors to Lake Tana recreation site from those who come for multiple aims. Particularly for visitors of double aim the interview was carried out allowing them to show the place than where they started to make a trip to the site separately from their alternative duty. Those visitors whose aim is visit to nearby sites were requested to put the proportion of the cost and time allotted to Lake Tana recreation site. But those visitors who were found travelling by boat for different purposes (such as religious purpose, business activities, and dwellers in and around of the site) rather than for recreation were completely excluded from the interview.

The data was collected between the first week of December and the first week of January 2013 from 174 purposively selected visitors on Lake Tana

Recreation site on-site basis. Visitors were intercepted at various entrances to the Lake, during boat travelling and at the visitors' destination in the entire body of the Lake. Surveys were made on five sites where these sites are almost all visitors' entry to the site, destinations for recreation and exiting from the Lake, Bahir-Dar in the South (Tana Hotel, Shum Abo, Mango and Kuriftu) and Gorgora in the North during entrance and exit time of visitors. Debre-Mariam, Intons-Eyesus, Kibran-Gebriel and Zegae Peninsula (Ura-Kidane-Mihiret) in the middle and during boat travelling were the other sites in the entire part of the Lake.

In order to have a representative sample to the research work and legitimacy of results, an appropriate sample size was specified. Referring to Green (1991), rule of Thumb for a minimum sample requirement determination for regression analysis, sample size was determined by the formula; $N \geq 8m + 50$; where m = number of explanatory variables included in the model and 174 sample size is taken. The data analysis employed both descriptive and econometric analysis.

Empirical model specification

The principal characteristic of the recreational service is that individuals should travel to a natural or man-made site to consume the service instead of the commodity that will be transported to the individuals'. For the individual, the scarce resources such as time, income for both transportation and accommodation costs etc. are central to the decision process of whether and how much to use a particular resource (McConnell, 1992). Here cost is central for access to recreation services and TCM is considered the most widely used technique for determining the demand for recreation site and thereby to estimate its values.

A TCM relies on the assumption that people make repeated trips to recreational sites until the marginal utility derived from a trip equals the marginal costs of a trip assuming the demand for trips to a specific site is dependent on travel costs, income, characteristics of the site, prices of substitutes, etc. The marginal costs are travel costs in terms of time cost (both travelling to the site and visiting the site) and transportation cost.

These travel costs can be regarded as directly revealed preference for recreation and indirectly revealed preference for nature. The travel cost to reach the site is considered as the implicit or the surrogate price of the visit, and changes in the travel cost will cause a variation in the quantity of visits. Observation of these visitations among individuals will permit the estimation of demand functions and the derivation of the welfare measure. The measure of the use value of a recreational site implies that a microeconomic model explaining the behavior which leads an individual to decide to visit a site must be identified.

As Freeman (1993) summarizes the basic theory that a given individual will have a utility function which comprises a vector of the quantities of market goods (X) and a vector of environmental goods (Q) whose quantities or qualities are fixed and it can be stated as:

$$U_i = f(X_i, Q_i) \quad \textbf{(1)}$$

Remind that, the aim of the TCM is to provide a measure of the use value of a recreation site by establishing a demand curve based on users' utility maximization. Then if we assume individual (i) made a visit/trip (V) to site (j) and spent time (T) travelling a distance (D), individuals utility maximization function will be:

$$U_i = f(X_i, Q_{ij}, V_{ij}, T_{ij}, D_{ij}) \quad \textbf{(2)}$$

All terms from equation (2) above except (X) are variables which attribute to visitors to the recreation site. And if we compiled all of them as visit (V), a model can be specified as:

$$U_i = f(X, V) \quad \textbf{(3)}$$

However, each trip to the site is constrained by income (Y) hence it has a cost (Tc_i). If an individual has an income (where Y_0 =non-labor income, w = wage rate, t_w = work hours):

$$Y = Y_0 + wt_w \quad \textbf{(4)}$$

Likewise, an individual has a certain amount of time; where t_v is the time spent on visit:

$$T = t_w + Vt_v \quad \textbf{(5)}$$

Therefore, visitors are also constrained by time to maximize recreation utility, which means that visitors have to maximize the utility subject to time and income restrictions.

Let's assume that individuals are in trade-off between time for work and leisure for recreation and are free to choose between work and recreation. In this case, the wage rate will be the opportunity cost of time.

However, there are costs to consume market goods and to use the services of environmental goods (for our case recreation with a visit cost) and let's denote these costs by 'P_x' and 'P_v' respectively. In this manner, the utility function $U = f(X, V)$ may be maximized subject to the following restrictions:

$$Y = P_xX + P_vV \quad \textbf{(6)}$$

$$T = tw + Vtv \quad \textbf{(7)}$$

Rearranging and simplifying, it is possible to rewrite as:

$$Y = Y_0 + wt_w = P_xX + P_vV$$
$$Y_0 + w(T - Vt_v) = P_xX + P_vV$$
$$Y_0 + wT - V(wt_v + P_v) - P_xX = 0 \quad \textbf{(8)}$$

Then formulating the Lagrange equation (L) we can have a form which enables to calculate partial effects of each attribute in visitors utility maximization function as given below.

$$L = u(X, V) \pm \lambda (Y_0 + wT - V(wt_v + P_v) - P_xX) \quad \textbf{(9)}$$

The first order conditions will tell us the marginal effects of each attribute.

$$\frac{\partial L}{\partial x} = \frac{\partial [u(X,V) - \lambda Px]}{\partial x} \partial X = 0$$
$$\frac{\partial L}{\partial V} = \frac{\partial [u(X,V) - \lambda (wtv + Pv)]}{\partial V} \partial V = 0$$

$\frac{\partial L}{\partial \lambda} = Y_0 + wT - V(wt_v + P_v) - P_xX = 0$ and so forth.

Now, solving all the above equations from the fist-order conditions we can obtain the Marshallian demand function which is a number of visits of individuals as a function of basic variables like income, travel cost, etc. Then, once a demand function is derived, we can estimate the recreational benefit of the Lake and hence the total area under this demand curve is the total recreational benefit associated with a given trip.

There are essentially two types of travel cost models, the individual demand approach and zonal[3] approach. In the case of Individual Travel Cost Model (ITCM), the dependent variable is the number of trips per year (or per season) by individual users of a recreation site while in zonal approach the dependent variable is the number of trips taken by the population of a particular region or zone. It requires aggregate visitation data, often not available and assumes identical behavior of individuals within a zone (Haab and McConnell, 2002).

Although Zonal is more appropriate for sites visited infrequently and seldom by travellers in groups from afar, ITCM is more appropriate for local and frequently visited sites and can handle visitors' behavioral differences unlike the zonal travel cost (Fleming and Cook, 2007). With this in mind, the individual demand travel cost model is the appropriate approach to Lake Tana as it exhibits the features of this approach.

Recalling utility equation (1) above: $U_i = f(X_i, Q_j)$, if we split the environmental good (Q) in to two components as visit (v) component and other remaining environmental services (q), the utility function will be:

$$U_i = f(X_i, V_{i,} q_j) \qquad \textbf{(10)}$$

[3]Zonal travel cost approach derives recreation demand and recreational value of the site collecting information from visitors of once defined zones by concentric circles around the recreation site and differences in visits by zone distance are therefore caused by differences in travel costs (Haab and McConnell, 2002).

Then applying Lagrange expression and maximizing equation (10) subject to equations (6) and (7), or using the aggregate equation (8), Marshialian demand functions for market goods and recreation services are obtained:

$$X_i = g\ (P_x, P_v, Y, q_j) \quad \textbf{(11)}$$

$$V_{ij} = f\ (P_x, P_v, Y, q_j) \quad \textbf{(12)}$$

Equations (11) and (12) represent the Marshialian demand functions of market goods and recreational goods, respectively. However, for the purpose of the work, equation (12) is the main focus and relevant Marshialian demand function. In a more summarized form this equation may be simply a function of cost of trip, demographic characteristics of respondent and nature and attributes of the site along with its substitute sites. Then we can rewrite it as:

$$V_{ij} = f\ (T_c, R, S) \quad \textbf{(13)}$$

Where T_c is trip cost, R is respondent socio-economic characteristics and S is a site characteristics.

Equation (12) and (13) are more general forms of individual demand model. However, since a quantity demanded is the number of trips a person takes to the site, it will be affected by different variables like all attributes of costs of visit, characteristics of the site, and demographic characteristics of the sample and substitute sites. Taking all these in consideration a demand for trip function will take a more relaxed and detailed form which looks like:

$$V_{ij} = f\ (Tc, Sx, A, Fs, Y, Ed, Oc, Ms, Aq, G, Lt, Al) \quad \textbf{(14)}$$

Where: V = frequency of visit
Tc = travel cost of visitors
A = age of visitors
Sx = sex of visitors
Fs = family size
Y = monthly income of visitors
Ed = education level of visitors
Oc = visitors' occupation situation
Ms = marital status of visitors

Aq = visitors' acquaintance to Lake Tana
G = being in group during visitation
Lt = Available of leisure time of visitors per year
Al= alternative visit sites
ε_i = error term

$$V = \beta_0 + \beta_1 Tc + \beta_2 Sx + \beta_3 A + \beta_4 Fs + \beta_5 Y + \beta_6 Ed + \beta_7 Oc + \beta_8 MS + \beta_9 Aq + \beta_{10} G + \beta_{11} Lt + \beta_{12} Al + \varepsilon_i \quad \textbf{(15)}$$

Then feeding data for all variables in equation (15) above enables to estimate the individual demand equation to the recreation or trip to the site. Finally, to derive estimates of the total use value of the site the consumer surplus (CS) estimate from this demand curve is aggregated with either visitation or population totals (Fujiwara and Campbell, 2011). CS for access to the site (Lake Tana) for a season for individual (i) is:

$$CS_i = \int_{Tci}^{Tcn} f(Tc, Sx, A, Fs, Y, Ed, Oc, Ms, Aq, G, Lt, Al)\, \partial Tc \quad \textbf{(16)}$$

Where; Tc_i is current trip cost to the site and Tcnis a 'choke price' (the trip cost at which demand for trips goes to zero for individual (i)). If the site were lost, CS_i is the loss in welfare to individuals; sometimes called 'access value' (Parsons, 2003). And mean access value will be an access value per trip of visit with a form CS_i/V_i.

Variable definitions and their expected signs

Total cost (Tc): Total cost is costs or prices of all expenditures related to recreation from the start of the trip back to home after visitation. It constitutes various expenditure components; transportation, accommodation and opportunity costs of time. Transportation cost is costs for both round trips to and from Lake Tana and boat travelling during the entire body of the Lake. However accommodation cost include costs related to hotel room, food, entrance fees to Monastery visits, rental payments of hotel rooms and related services. Opportunity cost is a time cost where a receivable income from wage or business earning is given up as a result of being in the recreation. Recent articles dealing with time in recreation demand advocate the use of the wage rate or some fraction of the wage rate as the cost of time

(Feather and Shaw, 1999). Hence while wage only works for laborers and employed visitors, visitors were asked to put what they could receive if they were in their job or normal business activity. This helps to capture all round opportunity cost of time for employed and business running visitors, in some cases from both. Thus, Total cost is the aggregate of all costs. Poor and Smith (2004), found that the price or travel cost coefficient estimate are inversely related demand for recreation. Thus, its sign is expected to be negative and significant (Nam and Son, 2001; Ortacesme *et al.*, 2001; Poor and Smith, 2004; Sitotaw, 2003; Blayac *et al.*, 2011).

Sex (Sx): Visitors' sex is entered in to the regression analysis in dummy; where 1= male and 0 = female. It is difficult to guess the relationship between gender and number of visits a priori. However, there is a finding about a negative influence of recreationist gender on the number of visits showing that the probability of visiting decreases when the person is a woman (Blayac *et al.*, 2011).

Age (A): Age has been found to influence the demand for various types of recreation activity (Taylor, 2000). However, there are opposing results in the existing literature. One shows a significant but negative sign (Sitotaw, 2003) arguing that as people get old they are less willing to travel long distances for recreation while Ortacesme et al. (2001) and Blayac et al. (2011) found a significant but a positive relationship to trip demand suggesting that as age increases the demand for recreation increases. Thus, it is not possible to determine to hypothesize its sign a prior.

Education (E): Visitors' educational level is measured by a continuous number of years of schooling and it is expected to have a positive relationship with the number of visits, hence it would lead to a better understanding of the importance and benefits of visits to recreation site (Ortacesme et al., 2001).

Family size (Fs): A visitor's family size is measured by the number of persons in the visitor's household. As the number of people in a visitor's family increases, out of pocket money allotted for recreation purpose

relatively decreases and it in turn affects negatively the number of visits that a visitor could take. Therefore, a visitor's family size is expected to have a negative relationship with the number of visits (Sitotaw, 2003).

Income (Y): Income is the monthly gross earning of visitors. Hence income reveals the ability of individuals to afford a recreation; it is expected to be significant. It is used in its continuous form. Number of trips to Lake Tana recreation site and income are expected to have a positive relationship (Ortacesme et al., 2001).

Marital Status (Ms): Recreationists marital status is measured in two categories as single and married where 1 = single and 0 = married. It is expected to influence the number of visits. However, the relationship between visitor's marital status and number of visits is also indeterminate a priori. A newly married couple might increase frequency of visits to a recreation site but later they are more likely to be engaged in social activities and they are less likely to make visits to recreation sites (Sitotaw, 2003).

Leisure time (Lt): Leisure time is a free time of visitors per year to make a trip and it is measured in number of days. It is expected that leisure time availability could affect visitation demand positively (Grogger and Carson, 2008). A positive relationship of leisure time and annual trip frequency was found in Khan (2011) in India and Okojie and Amujo (2011) in Nigeria.

Acquaintance (Aq): Visitor's acquaintance is a measure of a visitor's experience and familiarity with the site that is measured by the number/frequency of visits throughout life to the site. The extent to which visitors can have a preference for the site is directly related to the degree of their experience for the area. Hence, a visitor's acquaintance with the site is expected to have a positive relationship with the number of visits (Twerefou and Ababio, 2012).

Being in group during trip and visitation (G): Visitation in-group or alone is also included in as a dummy variable, where 1 is assigned for group visits

and 0 for lone visits. Hence, the relationship between this variable and the number of visits to the site is indeterminate a priori.

Alternative sites (Al): Alternative sites are sites which are found in the proximity of Lake Tana and are potentially alternative destinations of recreationists such as the Tis-Abay waterfall, Gondar-Fasiledes Castle, Semien Mountain National Parks and Sainte Lalibela. Trip costs allotted to these sites partly from the total trip undergone was considered. Thus, the existence of an alternative site as mentioned above affects the number of the annual visits to Lake Tana negatively. Therefore it is expected that these sites are substitute sites and the costs of these sites took a negative sign (Ortacesme et al., 2001). Nam and Son (2001) assures that the demand for a site will rise when prices of substitute sites increases.

Table 1: Summary of variables description and their expected effect

Variable	Description	Measure	Expected effect
Tc	Travel cost of visitors	Total cost in ETB	Negative
A	Age of visitors	Age in years	Indeterminate
Sx	Visitors' sex as a dummy variable	1 = Male, 0 = Female	Indeterminate
Fs	Visitors' family size	Family size in number	Negative
Y	Visitors' monthly income	Income in ETB	Positive
Ed	Visitors level of education	Education in years of schooling	Positive
Oc	Visitors' Occupation situation	1 = Employed, 0 = Unemployed	Positive
Ms	Visitors' marital status	1 = Single, 0 = Married	Indeterminate
Aq	Visitors' acquaintance to Lake Tana	In number of trips	Positive
G	Visitors' being in group for the recreation	1 = Yes, 0 = No	Positive
Lt	Leisure time of visitors per year	Leisure time in number of days	Positive
Al	Alternative sites	1 = Yes, 0 = No	Negative

Demand for Recreation (V): Demand for Recreation is the want or desire to enjoy a recreation service with the necessary financial requirements (Habb and McConnell, 2002). The amount of recreation demanded at specific price level is referred as quantity demanded and it is synonymously used as trip or visit frequency to the site.

Estimation Procedure

In most modern single site applications, the model is estimated as a count[4] data model where the dependent variable (number of visit) is a nonnegative integer and zero trip and small numbers of trips make up a sizable fraction of the data set (Parsons, 2003, 2012).

Since the data was collected on-site basis from visitors who made at least one trip to the site, the range of values of the dependent variable need to be truncated at one. For this reason truncated[5] count data model is preferable to handle the data analysis process (Haab and McConnell, 2002; Parsons, 2003).

Given the count nature of the visit as a dependent variable, Poisson regression model is a better and well fitted model to establish recreation demand function. Trip frequency taken by a person to a site in a given season is assumed to be generated by a Poisson[6] process. This is what we call a Poisson regression count data travel cost model. The probability of observing an individual take *V* visits/trips in a season is:

$$\Pr(V_i/X_i) = \frac{\exp(-\mu)*\mu^{V}}{V!}, \ \mu > 0; \qquad \textbf{(17)}$$

[4]Count data is a type of data only with non-negative integer values of observations where these integers arise from counting rather than ranking. It is also called rare event data (Gujarati, 2004).

[5] A truncated data is the part of data distribution above or below some specified value (Greene, 2003).

[6] A Poisson process is type of discrete probability distribution of events for modeling the times at which arrivals enter a system per unit of time when the events are independent (Salvatore and Reagle, 2002).

Where i = 1, 2 … N visitors and X_i is the i^{th} set of explanatory variables.
The notation μ is a parameter to denote expected number of visits made (mean trip) and is assumed to be a function of the variables specified in the demand model of equation (15). The model can be extended to ensure non-negative probabilities and to make ease of regression by setting $\mu = \exp(X_i\beta)$, where X_i is the set of explanatory variables and β is the Poisson parameters to be estimated. The exponential specification is used to restrict μ to be positive as is required for a proper distribution. Thus, Expected trip (μ) usually takes a semi-log form:

$$E(V_i) = \mu = \exp(\beta_0 + \beta_1 Tc + \beta_2 Sx + \beta_3 A + \beta_4 Fs + \beta_5 Y + \beta_6 Ed + \beta_7 Oc + \beta_8 MS + \beta_9 Aq + \beta_{10} G + \beta_{11} Lt + \beta_{12} Al + \varepsilon_i) \quad \textbf{(18)}$$

$$Ln(\mu) = \beta_0 + \beta_1 Tc + \beta_2 Sx + \beta_3 A + \beta_4 Fs + \beta_5 Y + \beta_6 Ed + \beta_7 Oc + \beta_8 MS + \beta_9 Aq + \beta_{10} G + \beta_{11} Lt + \beta_{12} Al + \varepsilon_i \quad \textbf{(19)}$$

Equation (19) is Poisson form of the recreation demand specified previously in equation (15).

The parameters in equation (19) are estimated by maximum likelihood. For each person in the sample we know Tc, Sx, A, Fs, Y, Ed, Oc, Ms, Aq, G, Lt and Al. Making use of these data and equations (17) and (19), the probability of observing the number of visits actually taken is constructed for individuals in the sample. Parsons (2012) state that the parameters in equation 19 are estimated by maximum likelihood where each person's probability of taking the number of trips actually taken is used as an entry in the likelihood function.

$$L = \prod_{i=1}^{N} \frac{\exp(-\mu i) * \mu i^{Vi}}{Vi!} \quad \textbf{(20)}$$

Annual CS for individuals in the Poisson form is: $CS = \mu / -\beta T_C$ or $\hat{CS} = \hat{V}_i / - \hat{Tc}$; where 'hated' values denote estimates and a per-trip CS is: $\hat{CS}/\hat{V}_i = 1/ - \hat{Tc}$. Here 'Tc' is to denote costs associated to all

expenditures made to the visit or trip. Therefore it is the sum of travel cost, opportunity costs and accommodation expenditures.

An undesirable feature of the Poisson Model is an implicit constraint that the mean and variance of V_i are equal (Parsons, 2012). The test for the data shows equality between mean and variance of annual trip. Thus, truncated Poisson Regression Model is a more fitted model than the Negative Binomial Model where it is appropriate to over-dispersed data.

Elasticity of Demand for Recreation Service

The responsiveness of recreation demand for parameters change is predominantly measured by three well known elasticity measures; price elasticity of demand, income elasticity of demand and cross-price elasticity of demand. This is an in-depth examination on the effect of change on trip cost, income and substitution site costs on recreation demand. Theoretically, when the independent variables are log transforms the estimated slope coefficients directly reveal the elasticity whereas when the independent variables are linear the elasticity is found by multiplying the coefficient with the mean of the independent variable (McKean and Taylor, 2000). Thus, the elasticity of demand is; $e = \beta i\ \overline{Xi}$ where e is the elasticity of demand and $\overline{Xi}$ is the mean value of each independent variables with their corresponding coefficients of i.

4. Results and Discussion

4.1 Descriptive Analysis

In this section the results of the descriptive analysis are presented and discussed.

Table 2: Socio-economic Characteristics of the respondents (frequency, percentage, χ2 values)

Variables	Category/ Dummy	Frequency	Percent	χ2 (P-value)
Sex	Male	93	53.45	1.827(0.401)
	Female	81	46.55	
Occupation	Employed	145	83.3	5.294(0.071)*
	Unemployed	29	16.7	
Marital Status	Unmarried	97	55.75	3.663(0.453)
	Married	75	43.1	
	Divorced/widow	2	1.15	
Group	No	7	4	4.773(0.092)*
	Yes	167	95.43	
Transport mode	Public transport	153	87.43	27.534(0.001)***
	Own/rental car	9	5.14	
	Airplane	12	6.86	
Trip aim	Single	100	57.5	2.260(0.323)
	Multiple	74	42.5	
Total		174	100	

Note: ** (= 0.05 levels of significance) is to denote for categorical variables of respondents which have statistically significant differences on frequency of recreation

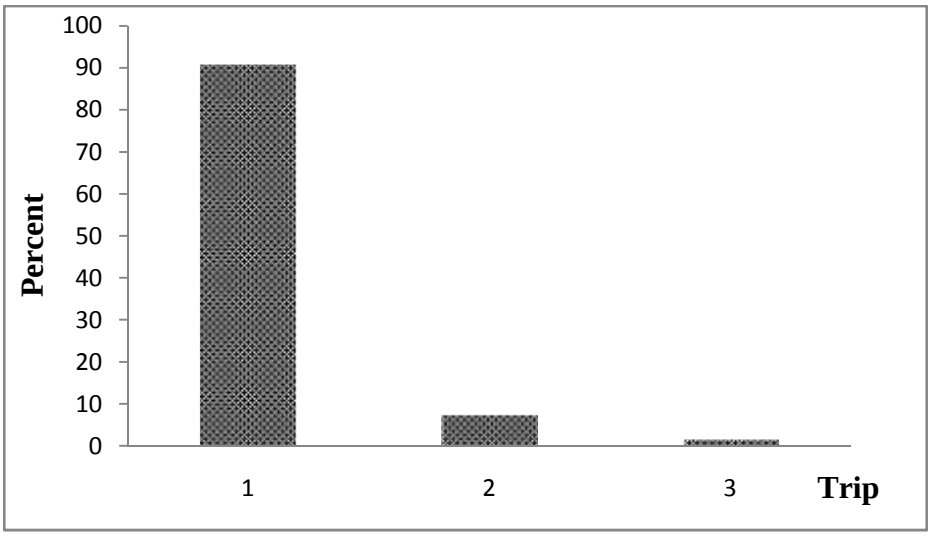
The gender composition of respondents shows that male respondents were slightly higher than female respondents (Table 2) and the mean age of respondent was 29.15 years (Table 3). More than half were unmarried and dominant visitors (83.33%) were employed. The effect of being employed and unemployed on respondents' trip is statistically significant ($p<0.1$) (Table 2). Average household size of visitors was nearly 2 and it shows respondents with lower family size made frequent trips than visitors of large family size (Table 2). The majority of the respondents (83.3%) attended college/university education and made better trip frequency comparatively. The mean monthly income of visitors of the site was 3557 ETB (Table 3).

Table 3: Socio-Economic Characteristics of the respondents (min, max, mean and standard deviation, n=174)

Variables	Minimum	Maximum	Mean	Std. Deviation
Age	17	73	29.15	8.36940
Family size	1	7	1.89	1.26062
Education Level	10	24	14.74	0.91925
Monthly income	400	15330	3557	2729.47781
Leisure Time	10	120	40.53	29.96862
Knowhow	1	30	9.09	6.545
Acquaintance	1	25	3.75	3.87102
Actual trip	1	3	1.11	0.40815
Time stayed	1	5	1.98	0.93706
Total cost	96	15213	2721.59	2702.53141

The respondents' mean trip frequency to the site was nearly 1.12 times (Table 2) with the dominant (90.8%) of visitors making single trips per annum (Figure 1).

Figure 1: The proportion of respondents as per the frequency of trip



Mean trip was relatively smaller as compared to other studies (Alvarez and Larkin, 2010). From the field survey it was obtained that visitors who travelled a mean distance of 365.33 km to the site (Table 3). The respondents' mean acquaintance to the site throughout life was 3.75 times (Table 3). Most of the respondents (95.43%) had visited Lake Tana in groups (Table 2).Dominant visitors (87.9%) used public transportation followed by air transport (6.9%).The reason for better annual trip frequency for public transport users could be related to its cheapness and accessibility. During recreation, visitors stayed in the site nearly for two days on average (Table 3). As compared to transportation cost and opportunity costs of time, accommodation cost took more than three-fourth of total cost. In aggregate, the mean cost of undertaking a trip and recreation was 2721.59 ETB per person (Table 3).

Respondents' choice about the site's attributes showed that monasteries and heritages (27%) and islands and forest (24.1%) were mainly preferred attributes (Table 4). This preference could be linked to the relative uniqueness of the attributes of the Lake.

Table 4: Attribute of Lake Tana by visitors' preference

Attribute	Frequency	Percent	Cumulative percent
Monasteries & its heritages	47	27.01	27.01
Forest of the islands	42	24.14	51.15
Scenery view	36	20.69	52.87
Bird watching	4	2.3	73.56
Boat travelling	41	23.56	75.86
Swimming	3	1.72	99.43
Photographing	1	0.58	100
Total	174	100	

More than half of the visitors (57.5%) go to the site having a single purpose while the remaining go to relax in nearby recreation sites in conjunction with visiting Lake Tana (Table 2). As the result suggested, due to many investment activities and residential buildings around the Lake, waste

disposal is threatening the quality and natural beauty of the Lake along with the reckless expansion of an invasive weed over the Lake. Most visitors complained that they were asked arbitrary prices for boat traveling and were mistreated by some brokers.

4.2 Econometric Analysis

In this section the results of the econometric analysis will be presented and discussed. The first section is about tests and model validations. The second section deals with determinant factors of individual recreation demand. Individual demand function and benefits estimation are discussed in the third section.

Data Diagnosis, Cleaning and Tests

Regression analysis is helpful to analyze determinants of the decision of an individual to travel or not to a certain recreation site. However, the relevance of the estimation is subject to internal consistency and theoretical validity. Thus, before the regression process is carried out, data examination, cleaning and appropriate tests were conducted.

The data was checked for problems of outliers, violation of Poisson regression model assumption, problem of correlation which is referred to as multicorrelation and problem of homoscedasticity where it is termed as heteroskedasticity.

The main assumption of the Poisson regression model is that variance and expected trips are equal. The inequality of these values will lead to over dispersion and then appropriateness of Poisson regression model for such type of data and its result will be suspicious. Moreover, failure to account for over dispersion leads to substantial changes in parameter estimates and their standard errors (Nakatani and Sato, 2010). For this reason tests for equality of variance and mean trip were checked and found to be equal to one another. This satisfies the assumption of Poisson regression model proving that it is an appropriate for regression analysis where sampling is based on truncated individuals from the whole population.

To test the credibility and fitness of the model, likelihood ratio (LR) test was used where it is applied to measure the relevance of the model (Green, 2003). LR tests are used to see whether the coefficient of determination is different from zero or not to examine the relevance of the variable in determining the model (Mukherjee *et al*., 1998; Loomis, 1987).

Determinants of individual recreation demand

The econometric model is estimated using 'annual trip' as a dependent variable and other determinant variables as explanatory variables. The robust regression result shows that except age, family size and acquaintance, the remaining explanatory variables are statistically significant in explaining an individual's recreation demand.

Table 5: Regression result of the determinants of Individuals' recreation demand

Variable	Coefficient	Z	P>|z|	Elasticity Coefficient
Constant	-13.68556	-7.28	0.000***	-
Sex	11.53286	2.34	0.019**	0.26643265
Age	0.007855	0.19	0.847	0.22899366
Education	0.277914	4.29	0.000***	4.09646120
Marital status	3.779681	3.46	0.001***	1.8898405
Family size	-0.276734	-1.03	0.303	-0.52302726
Occupation	3.369747	5.36	0.000***	1.6848735
Income	0.000237	2.46	0.014**	0.8437204
Total cost	-0.001608	-4.83	0.000***	-4.37658888
Leisure time	0.002116	3.58	0.000***	0.08577364
Acquaintance	0.024623	0.63	0.526	0.09233475
Group	2.036776	3.35	0.001 **	1.018388
Alternative	2.000993	1.13	0.0260**	2.0004965

Log pseudo-likelihood = -30.97 Wald $\chi 2$ (12) = 264.28 *** 1% level of significance
Number of observation = 174 Prob>$\chi 2$ = 0.0000 ** 5% level of significance
LR Chi2 ($\chi 2$) = 312.82 Pseudo R^2 = 0.7370 * 10% level of significance

Respondents' sex was positively and significantly related to recreation demand ($p<0.05$). The parameter coefficient indicates that recreation demand for males was greater by 53.29 % than for females. Hence those females face more constraining factors than men for outdoor recreation. The dominant reasons could be low economic status, social or cultural norms and values such as child care and responsibility at home and male domination at decision making (Khan, 2011; Nde, 2011).

Marital status was positively and significantly related with recreation demand ($p<0.01$). The probability of expected visits for single visitors was greater than married by 77.97%. One reason that may account for more visits of single visitors could be less family responsibility and independence in decision making (Twerefou and Ababio, 2012).

Respondents' level of education is also positively and significantly related to recreation demand ($p<0.01$). The coefficient of education shows that a change in visitors' level of education by one year increases demand for recreation by 27.79%. The reason could be that as individuals acquire better educational level, income from employment and knowledge about the site and importance of recreation increases (Khan, 2011; Okojie and Amujo, 2011).Visitors' occupational status was significant ($p<0.01$) and positive showing a probability of employed individuals' visit being higher than those of unemployed individuals by 36.97%. Respondents' monthly income was found to be significant ($p<0.01$) and positively related with demand for recreation despite the fact that its coefficient (0.0002372) was too small suggesting that an influence of a unit in respondents' monthly income on recreation demand is slight which in this case is only 0.024%. Following Jones et al., 2010; Vicente et al., 2010, the result in this study indicates that, a one percent recreation increment is attained if and only if respondents' monthly income increases by 42.15% ().

The effect of total cost of visits to Lake Tana recreation site was negative and it validates a theoretical inverse relationship between recreation demand and travel cost. It was significant at 1% level of significance. The estimation coefficient result shows that recreation demand to Lake Tana recreation site

would decrease by one unit if a visitor's travel cost increased by 621.85 ETB (Okojie and Amujo, 2011; Twerefou and Ababio, 2012). Cost of alternative sites has a positive effect and was significantly related with recreation demand ($p<0.05$). A parameter coefficient infers that a unit cost reduction in the recreation service of alternative sites in the region (Tis-Abay Waterfall, Gondar[7] Fasiledes Castle, Semien[8] Mountain National Park and Sainte Lalibela[9] Churches) decreases demand for recreation to Lake Tana on average by 0.1%. The positive sign of the parameter implies the higher the costs of substitution sites the higher is the demand for recreation to Lake Tana (Mohammed, 2007; Jones et al., 2010).

Leisure time per year was positively and significantly related with recreation demand ($p<0.01$). The number of visits would increase by 0.21% for a day's leisure time available (Khan, 2011). Being in groups visits is also a positive and significant explanatory variable ($p<0.01$). It shows that recreation in groups is preferable to undertaking lone trips. This finding is related to costs and motive forces. Hence group formation could minimize individual costs by cost sharing and it creates also motivation for group trips and hence group recreation can be more entertaining (Alvarez and Larkin, 2010; Sitotaw, 2003).

As it is reported in Table 5, an elasticity of estimated visit with respect to travel cost is the price elasticity of demand for a visit. Its value was 4.38 and negative and following Poor and Smith (2004), the demand for recreation is elastic. Elasticity of demand for recreation costs to alternate recreation site was 2.001and positive following McKean and Taylor (2000) this indicates that the alternate site is a substitute recreation site for Lake Tana recreation site. The income elasticity of demand for the expected visit was inelastic (0.843) and this positive result, in accordance with Poor and Smith (2004), implies that recreation service obtained from Lake Tana is a normal good.

[7]Gondar Fasiledes Castle is a compounded complex of castles, palaces and heritages in Gondar city, Ethiopia.
[8]Semien Mountains National Park is one of the National Parks of Ethiopia found in Amhara region.
[9]Sainte Lalibela Churche is a religious place found in Amhara region, Ethiopia comprising eleven churches hewn from solid rock.

Benefit estimation

Based on Cook (2000), individual visitors demand function to Lake Tana was developed by considering visitors' frequency of visits to Lake Tana recreation site (V) with their travel costs (TC). Thus, the estimated demand is stated as:

$$\text{Ln}(V_i) = 9.3131623 - 0.0016081Tc$$
$$V_i = 11082.941e^{-0.0004207Tc}.$$

After integrating the inverse demand function between one and mean trip of 1.12, recreational value of Lake Tana was estimated to be 5,791.41 ETB for the average number of visits whereas per visit per person value was estimated to be 5,221.25 ETB and the annual total recreation value of Lake is 301,996,940.3 ETB (17,579,345.52 USD[10]). According to visitors' response about their utility proportion to the on-site value of Lake Tana relative to the off-site, about 83.7% of enjoyment is obtained from the on-site recreation. Given this information, on-site recreational benefit per visit per person was estimated by multiplying the estimated benefit of the recreational value of Lake Tana per visit per person with the percentage enjoyment which is equal to 4,370.18 ETB. Recreational value of the Lake per visit per person was translated into annual on-site recreational value of 252,771,211.2 ETB (13,460,814.41 USD) (Sitotaw, 2003; Ali, 2011). However as compared to the total annual recreational value estimation, the revenue collected from recreation in Lake Tana which is approximately 127,334,066 ETB (ATCO, 2013) was only around 50.38% while the remaining was efficiency loss of resource use and management. Following a similar procedure and using the exponential demand function, CS for the average number of visits was approximated. Based on Blackwell, 2007; Fleming and Cook, 2007; Muhammad et al., 2010, individual CS per visit was approximated to 621.85 ETB (33.12 USD) and the CS per person per visit was translated into aggregate CS of 35,967,912.44 ETB (1,915,397.69 USD).

[10] 1USD = 18.7783 ETB; taking the July 2013 exchange rate

5. Conclusion and Recommendations

5.1 Conclusion

The objective of the study was to estimate the economic value of Lake Tana and its major determinants from revealed behavior of visitors based on a sample of 174 using travel cost method.

The recreational value estimation for Lake Tana shows that the Lake is the most important recreation site. Both the estimated total value and CS results revealed that visitors have attached very high value to the Lake. Taking annual visits to the site in to consideration, the annual total recreation value of Lake Tana site and CS were approximated to be 301,996,940.3 ETB and 35,967,912.44 ETB, respectively. However, as compared to the total estimated recreational value of the Lake, the revenue generated from the site has not been remarkable. The result shows that the site is dominantly visited by more males than females, employed individuals than unemployed, those having higher education than less educated ones and working age groups than youths and elders. The regression result also indicates that visitors' sex, educational level, marital status, occupation, monthly income, leisure time, being in group and alternative sites were variables that significantly and positively determine decision to visit. However, visitors' recreation decisions to the site are significantly and negatively determined by total cost of visits. Price elasticity of demand for recreation is elastic and income elasticity of demand for recreation in Lake Tana showed the recreation service is a necessity normal good. Despite the Lake's immense recreational value, expansion of urbanization around the Lake and weak regulatory measures are threatening the Lake's natural beauty and its recreational value due to uncontrolled waste disposal and an invasive weed, arbitrary price for boat traveling and entrance fees by some private boat owners and brokers.

5.2 Recommendations

Based on the results of the study, the following recommendations are drawn.

- Visitors' value attachment to the recreational service of the Lake has important information for different sectors that may have interests on

the Lake for different developmental activities. These include such agricultural activities, electricity generation, hotels, restaurants, cafes and other tourism related work alongside cultural and religious roles that the society attaches to the site. The findings of this study provide information on the annual recreational value that visitors put on the Lake and planners and decision makers may consider using this information to plan and reconcile competing uses of the Lake without compromising one another.

- The Majority of visitors are found to make only a single trip per year. This reflects that the site is not frequently visited even by those people who have somehow demonstrated to have a visiting culture. Thus, the of Culture and Tourism Bureau has to take measures on ways of increasing the frequency of trip by visitors, such as, smooth service delivery, better facilities provision like swimming another sporting activities.
- As compared to the total estimated recreational value of the Lake, the revenue generated was not adequate. The culture and Tourism Bureau needs to increase its effort in order to maximize the benefit through revision and introduction of appropriate pricing (service price, entrance fee, etc.) and taxation on hotels, transport unions, different business activities on the site and churches. The intervention of the Amhara Region Revenue Office is also important. Lake Tana Transport Agency has to control and monitor implementation of tariffs and take actions on illegal actors.
- As a result of expansion of urbanization around the Lake, most of the respondents stressed that pollution should be controlled and environmental friendly activities be promoted. At the same time, the effort of controlling an invasive weed by different stakeholders has not yet succeeded. As a result more intense involvement by all stakeholders including the government is required. Therefore, the issue requires carrying out EIA and strong regulatory activities for sustainable use of the resource.

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Livelihood Strategies of the Inhabitants of the Sacred Forest of Zege Peninsula, Amhara Region

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Abstract

Diversification of household level economic activities is a principal strategy to improve the livelihood of the rural population of Ethiopia. Depending on one livelihood source is one of the main causes of vulnerability of rural households in case of natural hazards. A household's engagement in a particular economic activity and in turn livelihood strategy depends on socio economic, environmental and market factors. This study was conducted to explore the determinants of choice of livelihood strategies in the inhabitants of Zege. For the analysis, the sustainable livelihood approach was used as a framework of analysis. A structured questionnaire was used to collect data from 120 households. Data was analyzed using descriptive statistics and the Multinomial logit model. Four major distinct livelihood strategies are identified; forest products, fish and livestock, Non Timber Forest Products and non forest activities and remittances. Sale of fuel wood is practiced by 84.17% of the population either as a dominant livelihood source or as a gap filling strategy. The non timber forest products sector serves as a major livelihood source for 60% of the population. Rainfall variability, productivity, diseases and pests, low adoption of technologies have affected choice of livelihood strategies. The study confirms the hypothesis that significant population depends on sale of fuel wood as a livelihood source at 1% level of significance. The econometric model indicates that credit, extension and practice of apiculture have significant effect on choice of livelihoods. The findings imply taking policy actions to improve the livelihoods of the community through better market linkage, consolidating extension services, apiculture expansion and provision of well designed supplemental irrigation.

Key words: Coffee forest, Livelihoods, NTFPs, Zege, Multinomial logit

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1. Introduction

Forests provide livelihoods to millions of rural people. They serve principally as a subsistence source of cash income, capital asset and a source of employment (Scherr *et al.,* (2003). Forests are also recognized as a safety net (Coad *et al.,* 2008; Clark, 2001).By and large, the universally acknowledged use of forests is their services as sources of Non Timber forest products (NTFPs). NTFPs refers to the huge variety of materials derived from forests excluding timber and fuel wood used for food, medicine and source of income. Roots, tubers, seeds, fruits, honey, meat, skins and other belong to NTFPs. An estimated 1.6 billion people and 90% of the world's poor depend on forests for at least a portion of their income (Scherr *et al.*, 2003;World Bank, 2004;Inoni, 2009;Simon, 2009; FAO, 2010).Forest resources had been key components of the natural resource base of every community playing a fundamental role in the socio-economic well-being (Inoni, 2009).The tropical forests have much more economic significance (Simon, 2009) as millions of Africans earn their cash income from forest related enterprises (Scherr *et al.,* 2003*;* Coad *et al.,* 2008*;*Olufunso, 2010*).*

Zege peninsula (hereafter referred as Zege) contains one of the remnant dry Afromontaneforests of the country (Alemnew *et al.,* 2011). This is a typical forest area where religious, economic, ecological and biodiversity interests, all together, are one of the highest. The peninsula borders Lake Tana that requires its management for ecological and economic importance, old aged Ethiopian Orthodox Monasteries' that are of spiritual and economic importance, source of unique coffee and other flora species which are of economic and biodiversity importance. The inhabitants of Zege mainly draw their livelihoods from the forest either indirectly through favouring the production of other crops mainly coffee and fruits or directly for subsistence and cash source to acquire other needs. To this end, there had been a variety of economic activities that had been undertaken by the people of Zege ranging from production of NTFPs to fuel wood extraction for home consumption and source of income. However, for the inhabitants of Zege, there are different recent evidences that the people had been more engaged in wood production and their livelihood is more of fuel wood based. This is resulting in degradation of the forest and overall disturbance of the

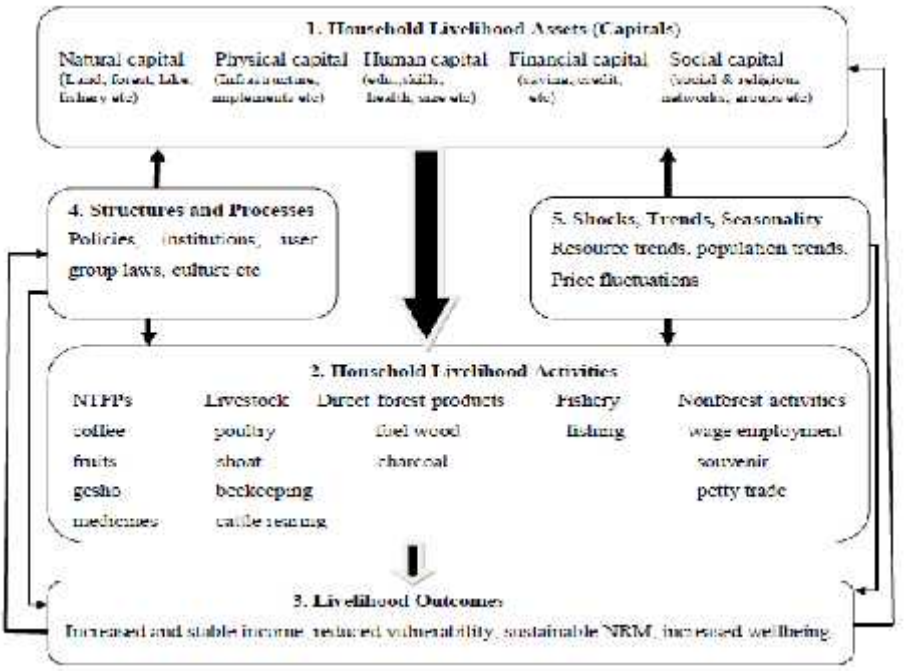
surrounding ecosystem. The degradation of the forest has serious consequences on the degradation of the livelihood of the community, the churches and ultimately Lake Tana. The activity, sale of fuel wood was intensified due to recurring failurity of NTFPs and rising need of forest products. This could also be the differing access of people to different levels and combinations of assets (DFID, 2001).Besides, regional and national market and research had not recognized the main livelihood source, Zege coffee, specifically in terms of its uniqueness, aroma and specialty origin (St. George, 2009) that markets and productivity had not been encouraging (Tihut,2009; Alemnew *et al*.,2011).Therefore on the basis of subjective evidence (observation of daily arrival of fuel wood by pack animals and boats and peoples witnesses), this paper tested the hypothesis that there was a large population that depends on sale of wood and hence higher tendency for wood extraction. Therefore, it confirmed the idea that the livelihood of part of the population depends on sale of fuel wood, away from NTFPs. Overall, the objectives of this study were to assess the livelihood strategies of the society of Zege and to analyze the factors that affected choice of livelihood strategies.

Theoretical framework

There are different conceptual models that can be used for the analysis of forest resources utilization and management. However, in here it was assumed rather than the pure institutional or economic goal models of frameworks that it was better to glimpse the management from economic benefits point of view for the local people and institutional point of view from ecological perspectives of the coffee forest ecosystem for promoting sustainable livelihoods and natural resources management (Shaanker *et al.*, 2004). Hence, the IAD frame work was not directly adopted in this study rather conceived as incorporated under the sustainable livelihood frameworks as part of the five arenas of the sustainable livelihoods. The assumption gone with the findings of Chhatre and Agrawal (2008) that increased demands for livelihood needs were the major factors that were responsible for deforestation. Moreover, it agreed with the finding that forest degradation was dependent on how forests were associated with multiple products (Gibson *et al*, 1998). Hence, as Shaanker *et al.*, (2004)

recommended that studies should identify potential interventions of maintaining or enhancing livelihoods from forest and reducing the direct dependence. Besides, it was inappropriate to use frameworks and models developed for common pool resources for this forest system where conservation of the forest is directly related to benefits drawn from either the dominant livelihood strategies or direct use for subsistence and cash source. The assumption was also used by Iqbal (2011) that employed the sustainable livelihoods framework for livelihoods analysis in the perspectives of institutional changes in forestry sector of NTFPs. The conceptual framework used for this study is presented below that resembles to the bio-economic conceptual framework.

Figure 1: Conceptual framework



Source: Adapted from Bedru *et al*., 2008)

The sustainable livelihood framework is primarily a conceptual framework for analyzing causes of poverty, people's access to resources and their diverse livelihoods activities and relationship between relevant factors at

micro, intermediate and macro levels and for assessing and prioritizing interventions (Iqbal, 2011). Hence, this study used an adapted sustainable livelihoods framework as a basic strategy of investigation of population-coffee forest ecosystem interaction. Over all, the basic assumption was the population characteristics‟ influenced by existing institutions guided by needs and resources present livelihood options. This livelihood options mediated by market affected the resource base for certain livelihood outcomes. Hence, the sustainable use of the resource (forest) was a function of incomes derived from indirect forest benefits and other activities. Therefore, this indicated that the degree of dependence on the forest had different degrees of association on deforestation (Chhatre and Agrawal, 2008).

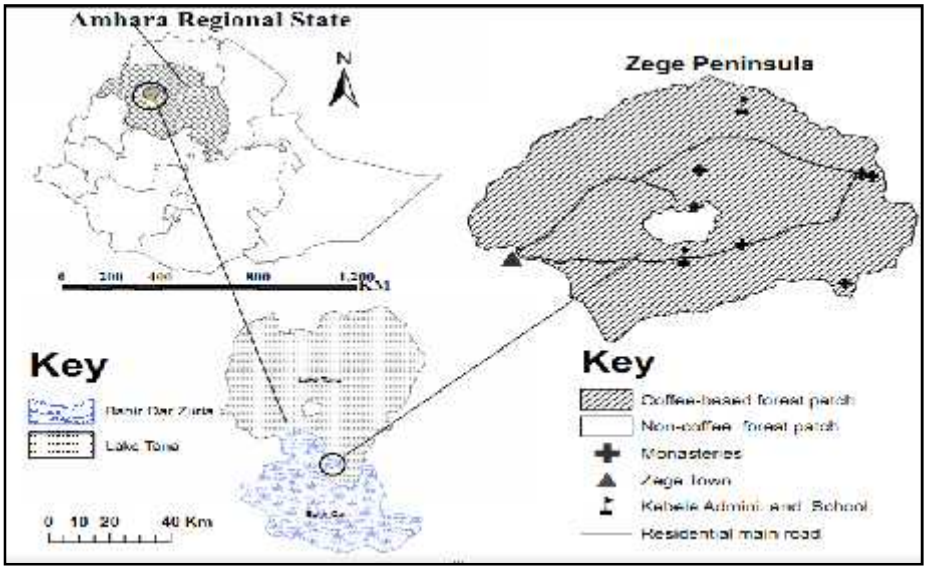
2. Methodology

2.1 Location of the study

The study was conducted in Zege peninsula of Amhara regional state (Dagninet et al., 2012). The peninsula was named after either the Amharic names "zeg bilo adere'[4] or "zegeie"[5] (source: key informants interview) or the name of place in Jerusalem "zigag'' (St. Kidanemihret, 2010). It is locally called ''Gedame Zege", literally means Zege monastery. It covers 1060 ha of coffee forest land with average temperatures ranging from 11 ^{0}C to 27 ^{0}C. Zegehas a bimodal mean annual rainfall of 1658.6 mm (EMA, 2011). It has an estimated population of 5143 individuals under 1285 households. Zege is under the Bahir Dar city Administration and formerly was in Bahir Dar Zuria woreda. The local people prefer being in the administration of the Zuria woreda due to the mobilization of agricultural and other rural oriented technologies (source: FGD participants).

[4] In Amharic means densely grown [2]In Amharic means being late.

Figure 2: Study area



Source: Own mapping

2.2. Data collection and Sampling Technique: multi-stage sampling procedure was used to select sample households. Zege was purposively selected due to the coffee forest environment condition, interaction of the society with the environment and the anecdotal high wood harvest information and risky, continuous failure, livelihood strategy pursued. Then, two of the three kebeles of Zege were selected due to the dependence on the forest. Ultimately, simple random sample method was employed to select 120 respondents. Data was collected using household interview, focused group discussions, key informants interviews and observation. Structured closed ended and unstructured open ended questions were used.

2.3. Data analysis: data was analyzed using descriptive statistics and econometric models. In descriptive statics, central tendency (mean) and dispersion (standard deviation) were used for analysis. Bivariate analysis particularly paired t-test and Pearson $\chi 2$-square test were used to show the mean difference between continuous and dependent variables and the association of categorical and dependent variables respectively on wood sale participation basis.

Econometric model: Analysis of the relationship between livelihood strategies and determinants involves a mixed set of qualitative and quantitative data. In this study, the response (dependent) variables are categorical (unordered qualitative variables) taking arbitrary numbers; in this case 0, 1, 2 and 3. Hence, the multinomial logit model was preferred for analysis of the determinants of livelihood strategies as it has a superior ability to predict livelihood diversification and pick up the differences between the livelihoods strategies of rural households (Adugna, 2008) and is commonly used by researchers (Adugna, 2008; Bedru *et al.*, 2008). The study recognized the IIA (independence of irrelevant alternatives) principle (Cameron and Trivedi, 2005), that is considered as a failure in several other studies. The analysis was made using Stata v11.0 statistical software.

Model Specification: Based on utility theory, rural households maximize their utility under the subject of many constraints. Livelihood choice occurs because of households' decision to engage in one economic activity more than other strategies that results in more survival or income portfolio. An individual or a household chooses the outcome or portfolio of activities that maximizes the utility gained from that choice (long, 1977). Accordingly, a household *i* faced with choices of *0* and *1* where u_o is utility derived from choosing item 0 and u_1 utility derived from choosing item *1*, chooses the item that has maximum benefits relative to the other from those particular choices presented. Hence, following Cameron and Trivedi (2005) suppose for the *i*th household faced with j choices, we specify the utility choice j as:

$$u_{ij} = z_{ij} + \varepsilon_{ij} \qquad (1)$$

If the respondent makes choice *j* in particular, then we assume that u_{ij} is the maximum among the *j* utilities. Hence, the statistical model is derived by the probability that choice *j* is made, which is:

$$\text{Prob}\,(u_{ij} > u_{ik}) \text{ for all other } K \neq j \qquad (2)$$

Where, u_{ij} is the utility to the *i*th respondent form livelihood strategy *j*, u_{ik} the utility to the *i*th respondent from livelihood strategy k.

If the household maximizes its utility defined over income realizations, then the household's choice is simply an optimal allocation of its asset endowment to choose livelihood that maximizes its utility (Brown *et al*., 2006). Thus, the ith household's decision can, therefore, be modeled as maximizing the expected utility by choosing the jth livelihood strategy among J discrete livelihood strategies, i.e.,

$$\text{Max}_j = \mathcal{E}(u_{ij}) = f_j(xi) + \varepsilon_{ij}; j=0,1,2,3 \qquad (3)$$

Following Cameron and Trivedi (2005:500), for an outcome variable with J categories, let the j_{th} livelihood strategy that the i_{th} household chooses to maximize its utility could take the value 1 if the i_{th} household choose j_{th} livelihood strategy and 0 otherwise. The probability that a household with characteristics x_i chooses livelihood strategy j, p_{ij} is specified as:

$$p_{ij} = \frac{e^{(x_i'\beta_j)}}{\sum_{j=0}^{3} e^{(x_i'\beta_j)}}, j=0, 1, 2, 3.. \quad (4)$$, where P is the probability

attached to choice of a livelihood j by individual i from the categories set above, e is base of natural logarithm, βj are coefficients of variables of the respective livelihood strategies and x_i' is vector of variables

Estimation of the logit model and the value of the independent variables was done by the maximum likelihood method. The maximum likelihood estimation of multinomial logit sets that the individual selects either of the alternatives (Hill *et al*., 2008). Therefore,the interpretation follows that if the regression coefficient is positive then an increase in the corresponding component of the regressor value for the k^{th} alternative increases the probability of the *k*th alternative and decreases the probability of the other alternatives. Hence, the model considers the effect on the *j* th probability of changing by one unit a regressor that takes the same value across all alternatives in comparison to a base category that is, the alternative, normalized to have coefficients equal to zero (Cameron and Trivedi, 2005).

As a result, a distinguishable feature of multinomial logit is that there is a single explanatory variable that describes the individual not the alternatives facing the individual that seeks values of the parameters that maximize the likelihood or the log likelihood function (Hill *et al*., 2008). The impact of each significant explanatory variable on the probability of household's decision to pursue certain livelihood activities was computed by keeping the continuous variables at their mean values and the dummy variables at their most frequent values (0/1) (Paulos *et al.* ,2004). The multicollinearity tests conducted for both continuous and discrete variables, included in the model, showed absence of associations.

2.4. Livelihood strategies classification: as the rural population is dependent on risky agricultural business, they pursue various livelihood strategies to improve their life situations. To avoid confounding outputs, where respondents may state one livelihood as their main strategy while their income portfolio may indicate another strategy, identification of the determinants choice of livelihood strategies was employed by first assigning a household to a specific livelihood strategy. This was accomplished by using two methods. The first was direct probing of the respondents' to identify the most essential livelihood activities that without which the household could not survive or that enables at least minimum living conditions without involvement of other activities. Secondly, income portfolio analysis was undertaken to identify annual household income. Households, based on their annual income portfolio, that derive more than 70% of their annual income from a specific activity are grouped to a category of a specific livelihood strategy regardless of the strategy they stated.

3. Results and Discussion

3.1 Socio economic characteristics of the households

Households own land individually (18.3%), in groups (41.7%) and both individually and in groups (40%). The average land size owned privately is 0.325ha, in groups 0.391ha and both 0.717ha. Group ownership existed because of inability to partition the land due to shortage of time during the

land redistribution during Dergue and inability to provide the land size approved for an individual household due to land shortage and confiscation (source: key informants interview and FGD).

The livestock ownership in the peninsula was one of the lowest due to the protection for safety of the coffee forest and absence of conventional farming. The main livestock unit owned was chicken followed by sheep that had been promoted as a resilience strategy. The average TLU was 0.44. Apiculture is practiced by 24.17% of the households. Traditional and transitional bee colonies were possessed by 11.67% and 2.5%, respectively while the rest had combination of bee colonies with insignificant proportion of modern bee colonies. Other major asset owned is canoe (owned by 20%), used for fuel wood transportation in cases of fuel wood sale and fishing.
Extension is the basic component for the development of agricultural and forest area people (Adugna, 2008). The study found that 53.3% of the households had extension contact in the previous year. The extension contact provided technology only to 5% of the households while the rest of the contact households had only information exchanges. Hence, the technology transfer rate was negligible and is highly recognized by the society and the administration that their enclosure in the city administration had not helped while neighbouring kebeles under the Zuria woreda received several agricultural technologies and development activities (source: FGDs, Key informants and informal discussions).

Credit enables diversification of livelihoods and creates access to basic needs in times of income shortage from major livelihood activities (Destaw, 2003).Credit was accessed by 15.8% of the households. The households borrowed an average cash of Birr 218.90 with maximum cash of Birr 4000. Non-wood selling and wood selling households borrowed ETB 320 and ETB 199.85 averagely and the amount was significantly different (t =3.84) at 1% level of significance between these groups. The purposes for borrowing were temporary relief (10.5%), to diversify livelihood (63.2%) and micro-economic activities (26. 3%). Farmers' cooperatives and ACSI provided credit for 84.2% and 15.8% of the borrowers, respectively. Further, 24.17% of Zege population received cash remittance that was helpful to undertake

more remunerable livelihood activities (Brown *et al.*, 2006). Statistically significant difference is observed in the distribution(x^2=14.01) and amount (t = 3.94) of remittance received between wood selling and non-wood selling households at 1% level of significance, respectively. However, there was no remittance in kind.

3.2 Livelihood activities

The main livelihood activities of Zege include NTFPs production (coffee, fruits, and *Rhamunus prinoides*), fishing and sheep fattening, non forest activities[6] (casual labour, petty trading, employed works like guards and priest, tourist guide) and forest product (sale of fuel wood and timber) based activities. Failure of coffee production and low market price for the available produce resulted in insufficiency of income to sustain livelihoods (Dagninet et al., 2012). Hence, the population pursued other strategies like fruits and *Rhamunus prinoides* production, fishing and other non forest activities and to some extent fuel wood sale as a relief strategy. However, with great ape population, low market demand and diseases resulting in complete loss of fruits production and absence of crop production, the community is under food insecurity. Food shortage was reported by 96.67% of the households and was acute for 59.17% of them. In consequence, mired by these interwoven problems, the livelihood of the population had been shifting to fuel wood sale based strategy with the only *Rhamunus prinoides* maintained. Besides, natural forest trees were being replaced by cash crops like 'kat' and eucalyptus. This is creating degradation and inevitably will occur unless livelihood situations are dealt (Shaanker *et al.*, 2004; Coad *et al*., 2008).Such production activities weakens local livelihoods (Coad *et al.*, 2008) and contributes to the loss of biological diversity (Assefa, 2005), aggravates deforestation (Shaanker *et al.*, 2004), disturbs the social and ecological condition of the area and had disturbed social capital (Adhikari, 2008) and lead to conflicts (Zenebe, 2001; Von, 2006).

[6]Non forest activities refer in this study as those activities that are usually called off farm and nonfarm activities.

3.3 Income portfolio analysis

Highest average income from nonforest activities and remittances and NTFPs for wood sellers and non wood sellers (Table 1) shows that people pursue livelihood strategies from which high income is derived (Shaanker *et al.*, 2004).There is significant (t= 2.23) difference in the average income from NTFPs (Table 1) for the wood sellers and non wood sellers at 5% level of significance. Wood sale (Table 1) indicates that poorer people who cannot meet subsistence needs from NTFPs income depend on forest resources for food and fuel (Assan and Kumar, 2009). On the other hand, abstinence of selling fuel wood (wood non sellers) may be due to availability of sufficient income from NTFPs (Zerihun,2001; Shaanker *et al.*,2004).Presence of off farm employment showed reduction of dependence on wood production (Adhikari *et al.*, 2004) and positive relationship with conservation (Lepetu and Oladele, 2009). The sheep fattening activity that was being promoted as a resilience strategy had ruined the social capital by trespassing earlier excommunications and hence broken down social trust, cooperation and cooperative actions.

Table 1: Cash income structure of the households by participation in wood sale

Cash source	Mean annual income (ETB)			Rank of income source		
	Non-wood sellers (19)	Wood sellers (101)	Overall (120)	Non-wood sellers	Wood sellers	Overall
Coffee	2255.26	427.35	716.77			
Fruit	124.21	82.43	89.04			
Gesho	286.84	270.94	273.46			
NTFPs	2719.21	892.14	1173.99	1	3	2
Fish	789.47	191.24	285.96			
Sheep fattening	136.84	46.04	60.42			
Honey	47.63	102.40	93.73			
FSHLVSTCK	926.32	226.39	337.21	3	4	4
Wood sale	-	1134.16	954.58			
FP	-	1134.16	954.58		2	3
Non forest act.	1322.11	1443.36	1424.5			
Remittance	1447.37	308.91	489.17			
NONFREMITT	2611.58	1742.77	1880.33	2	1	1
Mean HH income	**6257.11**	**3980.19**	**4332.37**			

Source: own survey result

3.4 Livelihood strategies

Four different types of livelihood strategies are identified among the community. These are the NTFPs, fish and livestock, forest product (fuel wood sale) and non forest activities and remittances (off farm, nonfarm and remittances) livelihood strategies. The livelihood analysis indicated that 60% of the population pursues the NTFPswhilst 20% use FPs as a dominant livelihood strategy. Non forest activities and fish and livestock are pursued by 15% and 5% of the population. Sale of fuel wood was practiced by 84.17% of the households either as a gap filling or a dominant strategy. Hence, this confirmed the hypothesis that significant population depends on sale of fuel wood as a livelihood source at 1% level of significance.

3.5 Determinants of livelihood strategies

The choice of non forest activities is negatively correlated with presence of employment in other activities, fruit income, practice of apiculture and extension service while positively correlated with access to credit (Table 2). This indicates that households pursue the NTFPs based livelihood activities if they have employment or engage in honey production or when their income from fruits increases. For example, the presence of employed household members increased the choice of NTFPs livelihood strategy relative to nonforest activities strategy by a margin of 51.82%. This might be linked to the presence of permanent salaries like priesthood and guards that income from these activities might have been invested in increasing production efficiency of the NTFPs, like using pumps. The result was in line with Falcao *et al.* (2011) that increased capital accumulation lead people to pursue the NTFPs strategy. The finding illustrated that increase in one ETB in income from fruits increased the preference of households to pursue NTFPs based strategy by a margin of 0.44% than the non forest activities and remittances strategy. It is incongruence with the findings of Falcao *et al.* (2011) that stated increased income from NTFPs leads to increased capital benefits in turn enables them focus on the NTFPs strategy and Shaanker *et al.* (2004) that households follow strategies from which higher incomes are derived. Further, the practice of apiculture showed that households the preference of the NTFPs based strategies than the non forest activities based livelihood strategies by a margin of 36.5%. The result was in incongruence with the findings of Shaanker *et al.* (2004) that indicated increased income from NTFPs decreased the likelihood of households' engagement in other activities as dominant livelihood strategies. More interestingly, the delivery extension services showed that households would engage in NTFPs activities than the non forest and remittances based livelihood activities. This may be due to the better knowledge acquired for handling the NTFPs based activities.

The choice of the fish and livestock based livelihood strategy is positively correlated with fish income and remittance while negatively correlated with presence of employment (Table 2). For example, The ME indicated that

increase in one ETB in income from fish decreased the preference of households from pursuing NTFPs and lead to fish and livestock based livelihood strategy by a margin of 0.18%. It was in agreement with Lepetu and Oladele (2009) that increased income from other sources reduces people's dependence on forests. Similarly, a household that received a remittance pursued a fish and livestock based livelihood by a margin of 1.471. This might be due to the increased investment capacity acquired for the efficient production of fish and livestock productions (Falcao *et al.*, 2009).

Table 2: Multinomial outputs for livelihood strategies

livelihood strategies	**Fish and Livestock**		**Fuel wood sale**		**Non-forest activities**	
Variables	**Coeff.**	**ME**	**Coeff.**	**ME**	**Coeff.**	**ME**
Age	-0.156	0.0204	0.012	0.0010	0.025	-0.0009
Employment	-7.84	-1.057**	0.28	0.0586	-4.78	-0.5182***
Formal education level	0.163	0.020	-0.027	0.0052	-0.205	0.0177
Dependency ratio	-2.12	0.294	-0.353	0.0625	0.842	-0.0454
Fruit income	-0.0041	0.0005	0.0065	0.0005	-0.05	-0.0044**
Bee colony	-0.291	0.077	-0.6412	0.1409	-3.77	-0.3650*
Fish income	0.0018	0.0018**	0.0001	0.0055*	-.576	0.0528
Credit use	1.905	0.1681	-2.51	-0.3582*	2.6	0.1978**
Remittance	11.75	1.471**	-2.59	-0.3374**	-1.06	0.0321
Extension	-1.066	0.1414	0.2014	0.0067	-1.8	-0.1710*
Fuel wood price	0.0051	0.00085	0.0037	0.0007	0.0085	0.0009
Coffee price	-1.12	0.1488	0.0276	0.0031	0.043	0.0077
Price of sheep	0.0115	0.0028	-0.112	0.0177	-0.0017	0.0028
Constant	3.83		-2.37*		0.0943	

Dependent variable=Livelihood Strategies where the base strategy was Non-timber forest products based livelihood strategy, Number of observations=120, Log likelihood function= -69.57, PseudoR^2 =0.4545, Chi-square=115.91, degrees of freedom=39, significance level=0.0000. ***, ** and * Significant at 1%, 5% and 10% level of significance. Source: own survey

As hypothesized the increase in market price of coffee was found to positively but insignificantly affect choice of the NTFPs strategy. Moreover, it positive relation with the choice of the non forest activities based

livelihood strategy due to creation of capital for handling these activities. In general, it indicated that increase in income from NTFPs could be an important intervention in conserving the coffee forest by increasing the proportion of population with the NTFPs strategy. In the forest product strategy age showed a positive relationship with the choice of the fuel wood sale based livelihood strategy indicating older headed households' dependence on this sale of fuel wood. In the fuel wood sale strategy, market price of fuel wood was found insignificant. This confirmed the idea grasped during FGDs that people engage in sale of fuel wood strategy due to poverty not mere appeal of price of wood.

Community action plans

The community of Zege provided various interventions, during FGDs and household interviews, which aimed at improving their livelihood and reducing the ongoing deforestation. This included increasing the productivity of Zege coffee through research, creation of efficient coffee marketing system, immediate solution for fruit diseases and pests, provision of supplementary irrigation (39.2% of the population),creation of job opportunities to the young and jobless (suggested by 64.1% of the population), improving market efficiency of fish, accessing low interest rate and long term credit, modernization and expansion of apiculture, consolidating technology provision based extension service that can increase efficiency in production of NTFPs. They farther added that inclusion of the peninsula under Bahir Dar Zaria administration may be an option to facilitate delivery of agricultural technologies.

4. Conclusions

The results of this study indicated that the residents of Zege engage in several other activities than the conventional NTFPs. This was due to the interwoven problems of low coffee productivity, pests and diseases, drought and low market prices for major produces. This has resulted in the issues of food insecurity in the peninsula. Overall the non forest activities and remittances, NTFPs, FPs and the fish and livestock livelihood strategies

provide incomes for the population in descending order. As a result, the FPs based livelihood activity was found vital for supporting the livelihood of majority of the households. Presence of remittance, increase in price of NTFPs, delivery of extension service and presence of employment in other activities are found to have a consolidating effect on continuing to engage in NTFPs based livelihood strategies.

5. Policy Implications

The findings imply taking policy actions to improve the livelihoods of the community and thereby reduce the deforestation in the peninsula. Interventions forwarded by the community are in congruence with our figurative results both from the income portfolio and the model. Hence, interventions aimed at consolidating extension services, strengthening the productivity of the NTFPs based activities (like apiculture, coffee productivity), creation of efficient and more remunerable markets for the NTFPs including fish, creating job opportunities, solutions aimed at relieving fruit pest and disease are very mandatory, if the forest is desired to continue with minimal disturbance. Remittance was found vital as it keeps away engagement of people from FPs based livelihood strategy. Hence, community level remittance like the REDD+ could be valuable projects as the forest has numerous ecological and environmental benefits in addition to the apparent economic benefits. Accessing credit to the community in the most desirable and affordable ways is another indispensable intervention.

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Socioeconomic Impacts of Smallholder Plantation in Amhara Region of Ethiopia: The Case of Lay Gayint and Fagta Locuma Woredas

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Abstract

This study analyzes the impacts of smallholder plantation on the households' cash income, modern agricultural input use, education and health care spending of 300 sampled households (of which 153 are planters and the remaining 147 were non planters) in Fagta Locuma and Lay Gayint woreda's of Amhara National Regional State of Ethiopia. A multistage sampling technique was used to select respondents. Both descriptive statistics and econometric model have been used to analyze the data. The propensity score matching analysis results revealed that, participation in to plantation has a significant impact on farm households' total cash income, education and health spending, but it doesn't have statistically significant impact on the use of modern agricultural inputs. The findings of this study calls for the scale up of best smallholder plantation practices at least in Amhara region. In addition, concern have to be given in improving the land productivity, educational level of farm households, creating and increasing market access and linkages, value addition of plantation products, expansion of infrastructures especially road and telecommunication networks in the rural parts of the sampled woreda's to raise the plantation participation.

Key words: plantation, propensity score matching, households, planter, non planter, impact analysis.

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1. Introduction

Forests provide numerous benefits to mankind including improvement of the quality of environment. Forests provide goods and services and maintain life support systems like timber, fuel wood, fodder, and a wide range of non-timber products. Further, forests are a source of natural habitat for biodiversity and repository of genetic wealth. In addition, forests help in watershed development, regulate water regime, conserve soil, and control floods. They contribute to process of carbon sequestration and act as carbon sink, which is important for reduction of greenhouse gases and global warming (Mathur and Sachdeva, 2003).

In additions to the economic and environmental roles, trees provide lots of social benefits to human being. The social benefits of trees include health benefits, crime reduction eg. Forests i.e. green place, helps people to relax and renew, reducing aggression and green spaces also bring people together outdoors, increasing surveillance and discouraging criminals (*Kuo & Sullivan, 2001)* and educational (Eg. woodlands host a variety of plants and animals and supply the ideal setting to develop flora and fauna identification skills) and recreational opportunities. People have strong emotional ties to trees. It improves physical and mental health, social cohesion; benefit the population from an aesthetic, symbolic and sensory perspective (Community Dimensions Pty Ltd, 2010).

Ethiopia has a long history of tree planting activities. According to historical records, afforestation started in the early 1 400s by the order of King Zera-Yakob (1434-1468). Modern tree planting by introducing tree species (mainly Australian *Eucalyptus*) started in 1895 when Emperor Menelik II (1888-1892) looked into solutions for alleviating shortage of firewood and construction wood in the capital, Addis Ababa. Starting around 1910, private plantations around Addis Ababa provided the capital with energy and construction material (Nawir *et al.*, 2007). However, the historic rapid expansion of large scale and community plantations occurred during the Dergue regime, which resulted in the establishment of large scale plantations (Yitebitu, Zewdu & Sisay, 2010).

Amhara region has wide biodiversity composition of flora and fauna species. However, high population and livestock pressure, long use agriculture, etc are causing significant depletion of forest resources, which results in high rate of soil erosion, loss of soil fertility, degradation of water resources. These factors, in turn, adversely affect agricultural production and productivity (BoA, 2012).

A study conducted by BoA (2012) of Amhara region indicates that, total forest cover is1 288 383.3 hectares or about 8.2 percent of the total land area of the region. Including bush lands, the coverage becomes around 2 178 295.21 hectare or about 13 percent of the total land area. The percentage coverage of woodlands, natural dense forest, riverian forest, bush lands and plantation forestry from the land area of the region is about 4.71 percent; 2.95 percent; 0.13 percent; 5.66 percent and 0.40 percent respectively.
Eucalyptus species, Acacia decurrence and Cupressus lusitanica are the most common tree species widely planted in community woodlots and private tree investments in Amhara region. *Eucalyptus* woodlots used to be extensively planted on farmland and increasing numbers of farmers are being encouraged to plant small on-farm woodlots in peri -urban areas where the returns from the sale of firewood and poles are attractive. *Eucalyptus species, Cuprssus lustnia, Acacia species* and mixed plantation species are accounts 66 percent, 23.2 percent, 2.3 percent, and 8.5 percent of the total plantation forests recourses in the region respectively (Gebrekidan, 2003, cited in BoARD, 2008).

Many commercial forest plantations have been developed on a large scale by governments and corporations worldwide. Smallholder forestry plantation has been seen as an anomaly which requires special assistance schemes and subsidies (Byron, 2001). Farmers are commonly believed to be uninterested in, or even hostile to, trees and are widely blamed for deforestation and land clearing, especially in tropical developing countries. Yet farmers all over the world can and do plant and manage trees whenever they perceive that to be more useful and beneficial than alternative activities with the land, capital and labor recourses they have available (Ibid).

Forests play a significant role in supporting the poor, in reducing their vulnerability to economic and environmental shocks, and in reducing poverty. However, the contribution that forests actually make to poverty reduction and increasing the livelihood resilience of the poor is often obscure for policy-makers in key ministries, including finance, planning and local government, and the supra-ministerial bodies where poverty reduction strategy processes are often located (FRA, 2010).

Small-scale forestry is an important component of many forested ecosystems around the world. However, the number of surveys of small-scale forest owners is staggering (Butler, n.d). Little research has been done on smallholder timber plantations particularly in tropical developing countries (Byron, 2001). There has been also a consistent bias against smallholder forestry in most developing countries with regard to technical support, market structure and government policies (Ibid).

In Ethiopia, forest resources play a vital role in income generation especially for the poorest population (EPA, 2007). But the economic contribution of forest resources to the national development as well as to household livelihood is not adequately documented. A variety of forest products and services that constitute a major source of livelihood for rural households are not formally traded or not monetary valued and hence forestry's contribution is underestimated to the national economy. The contribution of forests to GDP is not yet fully accounted but the officially reported figures estimated that the sector comprised 2.75 percent of GDP in 1986, 3.3 percent in 1991/92 and 6.3 percent in 2001 (EPA, 2007). One reason for this underestimation is market failure. Markets only exist for some of the production functions of forest and nature, such as for timber, fuel wood and certain non-timber forest products. Other services provided by forests such as carbon storage, biodiversity protection, recreation are not traded in markets; their economic values are often ignored. Even if markets exist, market prices for these goods may not reflect their real value, since markets can be distorted by different policies. Furthermore, the market price of a particular good may not reflect all the costs involved in producing that good (Gardei, 2006).

Many studies have been done on smallholder plantation in Ethiopia and Amhara region especially on *eucalyptus* plantation. Such studies are mainly focused more on the environmental and hydrological effects and impacts of *eucalyptus* and on value chain analysis (Example Tilashwork, Collick, Enyew, Lehmann, & Steenhuis, 2013; Sirawdink, Zerihun, Amsalu, Nardos & Seife, 2011). However, there is no empirical evidence on whether or not participation in plantation improves the livelihoods of the participant households or has socio economic impacts on the community at large.
The overall objective of this study is to assess and document the socio-economic impacts of smallholder plantation forest in the study area.
The specific objectives of the study are:

- To assess the impacts of smallholder plantation on cash income and use of improved agricultural input of the participant household.
- To assess the impacts smallholder plantation on the education of the participant households in the study area.
- To evaluate the impacts smallholder plantation on health care services.

2. Literature Review

Forest is defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use (FAO, 2010).This definition includes both natural forests and forest plantations. However, it excludes stands of trees established primarily for agricultural production (e.g. fruit tree plantations) (August, 2003).

A clear definition of plantation forests is difficult to provide. Most definitions identify the degree of management as the determining factor between a plantation and a natural forest (ABARE, 1999).Plantation means forest/other wooded land of introduced species and in some cases native species, established through planting or seedling, mainly for production of wood or non-wood goods (FAO, 2006 cited in Thompson, Mackey, McNulty & Mosseler, 2009). Establishment is either through afforestation on land

that until then was not classified as forest, or by reforestation of land classified as forest, for instance after a fire or a storm or following clear felling (FAO, 2010).

2.1 Significance of Plantation Forest

Forest provide a wide variety of social and economic benefits, ranging from easily quantified economic values associated with forest products, to less tangible services and contributions to society (FRA, 2010). Forests have an important role to play in alleviating poverty worldwide in two senses. First, they serve a vital safety net function, helping rural people avoid poverty, or helping those who are poor to mitigate their plight. Second, forests have untapped potential to actually lift some rural people out of poverty (Sunderlin, Angelsen, Arild & Wunder, 2004).) However, these characteristics and the safety net functions of forests are, in some respects, poorly understood and recognized. The contribution of forests to poor households is largely unrecorded in national statistics, most of it being for subsistence or for trade in local markets.

Wood is almost as important to humanity as food, and the natural forests from which most of it is harvested from are of enormous environmental value. However, these slow-growing forests are unable to meet current demand, resulting in the loss and degradation of forest. Plantation forests have the potential to supply the bulk of humanity's wood needs on a long-term basis, and so reduce to acceptable limits the harvest pressures on natural forests (Fenning *et al.,* 2002). They provide as much as 35 percent of global round wood production. It is estimated that by 2020 plantation wood production will increase by 50 percent (Siry, Cubbage & Abt, n.d). Planted forests are much more important than their share of the forest area indicates, and their importance will increase with time (Varmola, Gautier, Lee, Montagnini & Saramäki, n.d). It has playing an increasingly important role in meeting the world's growing requirements for wood and non-wood forest products. They represent less than 3 percent of the world's forest resources, yet are estimated to supply around a third of industrial round wood and 10 percent of fuel wood (ABARE, 1999).

Plantation forest has provided a multi dimensional economical, social and environmental role for the survival of human beings. Some of these benefits are:

Source of Energy: Wood is expected to remain the main source of fuel in rural and urban communities in the developing world, reflecting a lack of options that results from their low income (ABARE, 1999). Developing countries in Asia, Africa and South America consume almost 90 percent of fuel-wood. Plantation wood from these regions is estimated to supply around 10 percent of the total fuel-wood demand. Many countries also use plantation grown wood as energy for industrial uses, through conversion to ethanol, gasification, charcoal production and the direct use of solid wood as a fuel.

The fuel wood requirement of the Ethiopians is estimated 0.8 m^3 per person per annum. This is impossible with the current deforestation rate of 0.34 percent per annum. Fast growing tree species like *Eucalyptus* and *Acacia* contributed a lot in averting fuel wood crisis in the country, in addition to the harvest from the natural forests and woodlands (Abayneh, Negash, Kaleb, Woldeyohanes & Yitebitu, 2012).

Food Security/Poverty Alleviation Role: Forest resources contribute significantly to poverty reduction by providing useful products and additional income for rural people (Kabubo - Mariara, 2009). According to DWAF (2005) forest resources provide three types of benefits for the poor. The first benefit is that, the supply of basic needs: firewood, building poles, medicinal plants, and edible fruits in which are all critical to the livelihood of the rural poor. Second, Cash saving– the saving of scarce cash resources, which may then be used for other household needs. Third, the safety-net function of forest goods refers to the role they play in assisting households cope in times of adversity. However, the actual and potential contribution of forests and trees to food security and sustainable livelihoods tends to be overlooked by decision and policy makers. This situation is due to a predominance of information on crops and livestock in the agriculture sector and/or a narrow vision on the role of forestry sector (FAO, n.d).

Employment Generation: Forests can contribute directly to income generation by providing formal and informal employment (FAO, 2009). Forestry has considerable potential to create green jobs, particularly through activities such as reforestation, afforestation, agro forestry and sustainable forest management (ILO, 2011).

The forestry sector in Ethiopia, offers employment opportunities both for urban and rural communities. According to CSA, 2005, the forestry sector absorbs 0.29 percent of the nation's total employed persons (Sisay, Menale & Eric, n.d). From the total employment in forestry about 50 percent of the labor force is employed in fuel wood and charcoal production and collection, 34 percent in forest plantation work, and 2 percent of the work force is employed in forest industries (Million, 2011). However, this figure does not include the employment opportunities for households in the collection and sales of biomass fuel and exudates.

Source of Medicine: Roots, shoots, leaves and bark of many plants are used for healing and protective purposes. Plant-derived medicines are used in self-treatment of common ailments, such as coughs, headaches and stomach problems (Jumbe, Bwalya & Husselman, 2005). There are about 1 000 plant species are documented as being used in traditional medicines in Ethiopia (Million, 2011).

Environmental Protection: Trees are the longest lived organism on the planet and therefore planting trees is an investment that creates a global ecological heritage for many hundreds of years (Tree appeal, n.d). Plantations offer environmental benefits when established on degraded land, by contributing to site rehabilitation. Plantations of native species, in particular, can help achieve conservation goals and protect core conservation areas (ABARE, 1999). They can be used to provide corridors between protected areas, control water runoff, provide shelter from wind, heat and sand storms, and lower water tables in saline areas. Forest plantation advocates argue that plantations reduce pressure on the remaining natural forests. Environmental advocates on the other hand express their concerns that plantations replace natural forests (Siry *et al*, n.d).

Carbon Sequestration: Sequestration is the uptake and storage of carbon by trees and other vegetation. Planting trees to absorb carbon is recognized as a way of enhancing the carbon sink to compensate for carbon dioxide emissions from fossil fuels (Tree appeal, n.d). Trees are the longest lived organism on the planet and over a hundred year period one tree will lock up approximately 200kg of carbon. By planting trees it can be make a very real contribution to the environment and take a positive step toward offsetting carbon footprint.

2.2 Impact Evaluation Approaches

2.2.1 Impact Evaluation

Impact evaluation is an assessment of how the intervention being evaluated affects outcomes, whether these effects are intended or unintended (Khandker, Koolwal & Samad, 2010). Impact assessment is done for several practical reasons: (1) Accountability – to evaluate how well we have done in the past, to report to stakeholders on the return to their investment, and to underpin political support for continued investment; (2) Improving program design and implementation - to learn lessons from past that can be applied in improving efficiency of research programs; and (3) Planning and prioritizing - to assess likely future impacts of institutional actions and investment of resources, with results being used in resource allocation and prioritizing future programs and activities, and designing policies, programs and projects **(**Gregersen, Leeuw & David, 2000).

Impact evaluation can be ex ante and ex post. The ex ante design determines the possible benefits or pitfalls of an intervention through simulation or economic models. This approach attempts to predict the outcomes of intended policy changes, given assumptions on individual behavior and markets. Ex ante analysis can help in refining programs before they are implemented, as well as in forecasting the potential effects of programs in different economic environments (Khandker *et al.*, 2010).

Ex post impact evaluation, in contrast, is based on actual data gathered either after program intervention or before and after program implementation. Ex

post evaluations measure actual impacts accrued by the beneficiaries because of the program. These mechanisms can be very important in understanding program effectiveness (particularly in future settings). Ex post evaluations have immediate benefits and reflect reality (Ibid).

2.2.2 Impact Evaluation Approaches

The main challenge of an impact evaluation is to determine what would have happened to the beneficiaries if the program had not existed (Khandker *et al.*, 2010). A beneficiary's outcome in the absence of the intervention would be its *counterfactual*. However, the counterfactual is not observed. So the challenge is to create a convincing and reasonable comparison group for beneficiaries in light of this missing data. Ideally, one would like to compare how the same household or individual would have fared with and without an intervention or "treatment." But one cannot do so because at a given point in time a household or an individual cannot have two simultaneous existences. Therefore, finding an appropriate counterfactual is the main concerns of an impact evaluation. There are two methods to solve this problem: experimental and non-experimental approaches (Diaz & Handa, 2004).

2.2.2.1 The Experimental Approach

Experimental designs, also known as randomization, are generally considered the most robust of the evaluation methodologies. By randomly allocating the intervention among eligible beneficiaries, the assignment process itself creates comparable treatment and control groups that are statistically equivalent to one another, given appropriate sample sizes (Baker, 2000). In this approach, each member of the population being studied has the same probability of being selected (Germanov, Meijer-Irons & Carver, n.d). If the assignment is properly carried out, random assignment creates a control group comprising individuals with identical distributions of observable and unobservable characteristics to those in the treatment group (within sampling variation). Hence, the selection problem is overcome because participation is randomly determined (Bryson, Dorsett, & Purdon, 2002).

This approach has both advantages and disadvantages. The main advantages of this approach are: first, it ensures that the two groups of subjects are matched equally on all factors even before determining what these factors may be. Second, it is ideal for making casual inferences. Third, it does not depend on conditioning on the observed covariates and can balance for both observed and unobserved covariates. Its disadvantages are: First, randomization may be unethical owing to the denial of benefits or services to otherwise eligible members of the population for the purposes of the study (Baker, 2000). Second, carrying out randomized design is often politically unfeasible because justifying such a design to people who might benefit from it is hard (Khandker *et al.*, 2010; Bryson *et al*., 2002; Diaz & Handa, 2004). Third, individuals in control groups may change certain identifying characteristics during the experiment that could invalidate or contaminate the results (Baker, 2000). Fourth, it is too expensive in terms of both monetary and time cost, particularly in the collection of new data. Fourth, subjects may not be representative of the general population (Domingue & Briggs, 2009; Baker, 2000).

2.2.2.2 Non experimental (Quasi-experimental) Approach

Quasi-experimental (nonrandom) methods can be used to carry out an evaluation when it is not possible to construct treatment and comparison groups through experimental design. These techniques generate comparison groups that resemble the treatment group, at least in observed characteristics, through econometric methodologies, which include matching methods (propensity score matching), double difference methods, instrumental variables methods, and reflexive comparisons (Baker, 2000). These techniques require imposing assumptions which are non-testable, although many of their implications might be, and may or may not be tenable in actual data (Diaz & Handa, 2004). The choice of best approach is determined in large part by practicalities. Specifically, the characteristics of the program and the nature and quality of available data are key factors (Bryson *et al.*, 2002).

Propensity score matching analysis, which is preferred in this study, is a relatively recent statistical innovation that is useful in the analysis of data from quasi-experiments (Luellen, Shadish & Clark, 2005).The notion in propensity score matching is to develop a counterfactual that is as similar to the treatment group as possible in terms of *observed* characteristics. Each participant is matched with an observationally similar nonparticipant, and then the average difference in outcomes across the two groups is compared to get the program treatment effect (Khandker *et al.,* 2010). A good comparison group comes from the same economic environment and was administered the same questionnaire by similarly trained interviewers as the treatment group (Baker, 2000). This method is very appealing to evaluators with time constraints and working without the benefit of baseline data given that it can be used with a single cross section of data (Khandker *et al.*, 2010).

2.3 Empirical Evidences on the Impacts of Plantation

Generally, there is a lack of empirical studies on the application of propensity score matching approach to evaluate (assess) the socio economic impacts of smallholder plantation. Therefore, in this study some empirical works based on descriptive statistics were reviewed.

Proponents believe that plantations can reduce pressure on natural forests, produce a sustainable timber resource, help address poverty and social inequality and perhaps in the long term also supply an important contribution to global energy needs through bio-fuels. Opponents believe conversely that plantations can increase the rate of natural forest loss, creating a new range of social and environmental problems in the process, reducing local peoples' control over land in favor of large corporations and encouraging further wasteful consumption (Schirmer, Parsons, Charalambous & Gavran, 2005).

According to a study conducted in Ghana reforestation program, by Manu, Tollenaar & Ogoe (2012) employment generation, reduce dependency on farm produce, increase chances on labor market, provide forest services to local people, improved yield of farm land because of improved micro climate, increase humidity, shading etc, infrastructural development (

improved road network, improved connectivity town services) are the positive socio economic impacts while loss of farm land, increased risk of poaching, crop damage of fringing farmers due to new pests introduced by forest environment, increase pressure on road network (increase risk of road accident, increase air and noise pollutions) are among the negative socio economic impact of plantation.

A study finding by Obidzinski, Andriani, Komarudin & Andrianto (2012) on the environmental and socioeconomic impacts of oil palm plantation in the three selected districts of Indonesia also indicates that, development of oil palm plantation caused deforestation, resulting in significant secondary external impacts such as water pollution, soil erosion, and air pollution. It also results in increasing land scarcity, rising land prices, and conflicts over land in all sites. In terms of social impacts, many stakeholder groups, i.e., employees, out-growers, and investing households, report significant gains. However, from his finding the benefits were not evenly distributed among different participants.

Another study by Landry (2009)analyzes potential socio-economic impacts of introducing forest plantations in Sanga District of Niassa province, Mozambique. His finding concluded that the most commonly perceived positive socio-economic benefits of forest plantations were creation of employment and better infrastructure (e.g. schools, health care services, and roads) while the adverse socio-economic impacts were land use change and land availability, water and natural resource availability change, less household labor for agriculture and livelihood activities, increase in traffic on roads, and social and cultural changes.

3. Research Methodology

3.1 Study Area

3.1.1. Lay Gayint Woreda

Layi Gayint woreda is found in South Gondar zone of Amhara regional state. It is found 75 km away from the zonal capital city, Debre Tabor, and about 175 km from regional capital city Bahir Dar, along the main road from Bahir

Dar to Woldia (Lay Gayint Woreda Agricultural Bureau, 2013). The livelihood of 95 percent of the total population in the woreda depends on agriculture. The woreda has a total land area of 151, 182 hectares. From this about 37.16 percent is arable, 19.3 percent is grazing land, 5.4 percent is forests and bushes land; and the remaining 38.14 percent is allocated for other land use purposes. Crop production, livestock and forest products mainly from plantation are the principal sources of livelihood for farmers. The woreda has a great potential for forest plantation. Especially *Eucalyptus globules* and *Cupresses lustanica* tree species are widely planted in this woreda (Lay Gayint Woreda Agricultural Bureau , 2013). Altitude of Lay Gayint ranges from 1 500 to 4 231 meters above sea level. The agro ecological zones of the Lay Gayint worda covers *Dega (45.39* percent*), weina Dega* (39.4percent), *kolla* (12.5percent) and *wurchi* (2.71percent).

3.1.2 Fagta Locuma Woreda

Fagta locuma woreda having a total land cover of 67 733.32 hectares is one of the eighth woreda s and three town administrations of Awi zone; Amhara region. Agriculture and plantation are the basis of the livelihood of the woreda. Recently the woreda has become known in its *Acacia diccurence* plantation. The latitude of the woreda ranges from 1 800 to 2 950 metres above sea level while the average rain fall and temperature of the area is 2 371 mm and 20 ℃ respectively. *Dega* and *weina Dega* agro ecological zones share about 55 percent and 45 percent of the woreda respectively (Fagta Locuma Woreda BoFED, 2014).

3.2 Sampling Techniques and Data Type

For this study purpose, multistage sampling technique was used to select sample households. Plantation experiences in Lay Gayint woreda and Fagta Locuma woreda have been selected as a representative study area. These study sites were selected based on their best smallholder plantation experience and plantation species differences. *Eucalyptus globules* and *Acacia decurrence* plantation experience is widely found in Lay Gayint and Fagta Locuma woredas respectively. From the two woredas a total sample of

300 households of which 153 participants (planters) and 147 non-participants (non planters) were randomly selected.

This study was relying on both primary and secondary data. Primary data's were collected using a pre tested structured questionnaire through household survey. Secondary data were collected from different institutions; Trade and Transport Bureau of Amhara Regional State, and Finance and Economic Development Bureau and Agricultural Bureau of each Woredas.

3.3 Methods of Data Analysis

For this study purpose descriptive statistics, inferential statistics and propensity score matching econometric analysis were use to analyses the data.

3.3.1 Propensity Score Matching Model

The method of matching has achieved popularity more recently as a tool of evaluation. It assumes that selection can be explained purely in terms of observable characteristics. For every individual in the treatment group a matching individual is found from among the non-treatment group. The choice of match is dictated by observable characteristics. What is required is to match each treatment group individual with individual sharing similar characteristics. The mean effect of treatment can then be calculated as the average difference in outcomes between the treated and non-treated (Bryson *et al.*, 2002). Among quasi-experimental design techniques, propensity score matching is generally considered as a second-best alternative to experimental design (Baker, 2000).

Propensity score matching (PSM) identifies a group of individuals, households or firms with the same observable characteristics as those participating in the project. It does this by estimating a statistical model of the probability of participating (propensity to participate) using a regression model with participation as the zero-one dependent variable, and a set of observable characteristics, which must be unaffected by the intervention, as

the explanatory variables. The coefficients are used to calculate a propensity score, and participants matched with non-participants based on having similar propensity scores (IEG, n.d).

In this study, propensity score matching method is preferred as compared to the other methodologies. Because, propensity score matching have the following advantages over the other. Some of these are; first, it does not necessarily require a baseline or panel survey (Khandker *et al.,* 2010). Second, it allows matching subjects on a single number, no matter how many covariates are existed (Luellen *et al.,* 2005). Third, it avoids the ethical considerations which arise when a potentially beneficial treatment is denied to those randomly assigned out. Fourth, data generation may be less costly than in the case of an experiment since the latter involves substantial monitoring to secure the random allocation (Bryson *et al.,* 2002).

3.3.2 The Logit Model

To calculate the program treatment effect (impacts of plantation), one must first calculate the propensity score $P(X)$ on the basis of all observed covariates X that jointly affect participation (participation in plantation) and the outcome of interest (Khandker *et al.,* 2010).

A propensity score is the conditional probability of being selected into the treatment group (in our case the participation in plantation) given a set of covariates or observed characteristics for group members (explanatory variables which affect plantation):

$$P(X) = Pr\{D = 1 \mid X\} = E\{D \mid X\},$$

where D is an indicator variable for treatment group selection. If D = 1, households who have participated in plantation and D=0, households who have not participated in plantation and X is a multidimensional vector of covariates (Stone & Tang, 2013). The values of propensity score ranges from 0 to 1. If all information relevant to participation and outcomes is

observable to the researcher, the propensity score will produce valid matches for estimating the impact of an intervention (Baum, 2013).

Propensity score typically computed using logistic regression (Domingue & Briggs, 2009; Luellen *et al.*, 2005; Caliendo and Kopeinig, 2005). Binary logistic regression is appropriate when the observed outcome for a dependent variable can have only two possible values (Gugrati, 2004). For this study purpose it is assumed that participation in plantation is program intervention (treatment) and households who have planted trees are assumed to be a treated group and households who don't have planted trees are assumed to be a controlled. Hence, the dependent variable is participation in plantation and takes value 1 if the household is participated in plantation and 0 if the household doesn't participate in plantation. Therefore, PSM were used to compare the level of economic and social (cash income, health, education, and improved agricultural use) impacts of plantation program users (planters) to that of non- program (non-planters) users.

The form of binary logit model can be derived from a logistic function (Gugrati, 2004). The probability of a household being planting tree is given by:

$$Pr(planating) = \frac{e^{X_i'\beta+\varepsilon}}{1+e^{X_i'\beta+\varepsilon}} \text{ ---------- } \mathbf{3.1}$$

where $_i$ = are vector of coefficients to be estimated and

X_i = are vector of explanatory variables

From equation one the probability of not planting can be written as

$$Pr(notplanting) = 1 - \Pr(planting) = 1 - \frac{e^{X_i'\beta+\varepsilon}}{1+e^{X_i'\beta+\varepsilon}} \quad \mathbf{3.2}$$

It is usual to rewrite the above probability function in the form of odds in favor of the households being planting trees as shown below.

$$L = \frac{Pr(planting)}{Pr(notplanting)} = \frac{\frac{e^{X_i'\beta+\varepsilon}}{1+e^{X_i'\beta+\varepsilon}}}{1-\frac{e^{X_i'\beta+\varepsilon}}{1+e^{X_i'\beta+\varepsilon}}} = e^{X_i'\beta+\varepsilon-} \quad \mathbf{3.3}$$

Taking the natural logarithm of equation (3) the log-odds or logit model which is estimated by maximum likelihood method is:

$$lnL = X'\beta + \varepsilon = \beta_0 + \beta_1 X_{1i} + \beta_{2i} X_{2i} + - - - + \beta_k X_{ki} + \varepsilon - - - - \mathbf{3.4}$$

$ln(L)$, is log of odds ratio. However, in propensity score matching analysis the assumption is that estimation is based on observed covariates, models are properly specified and all variables which affects participation in to plantations are included in the estimation model and hence no unmeasured covariates (Luellen *et al.*, 2005).

Based on this assumption the logit model becomes;

$$lnL = \beta_0 + \beta_1 X_{1i} + \beta_{2i} X_{2i} + - - - + \beta_k X_{ki} - - - - - - - - - - \mathbf{3.5}$$

Therefore, Equation 3.5 is the logit model which is used to estimate the propensity score.

3.3.3 Variables and Descriptions

Since propensity scores are derived from observed covariates, identifying potentially relevant covariates is a necessary task in designing a quasi-experiment. Omitting relevant covariates results in hidden bias that propensity scores cannot adjust (Luellen *et al.*, 2005). Therefore, one has expected to take the economic theory; previous empirical findings, consultation with experts and a pilot study to identify potentially relevant covariates for estimating propensity score.

Variables	Description	Variable type
Dependent variables		
Plant	Household's participation in plantation forest. It takes a value of 1 if the household participated in plantation, 0= otherwise. A household having planted trees with area cover of ≥ 0.125 hector (0.5kada/timad[4]) is considered as a planter and otherwise non-planter.	Dummy
Covariate variables		
Head_sex	Household head Sex (1 = male, 0= otherwise)	Dummy
Head_age	Household head Age (number of years)	Continuous
Fmly_size	Family size (number of hh members in a given household)	Continuous
Head_educ	Household head Education (1= literate, 0 =otherwise). Household heads who able to write and read either from formal or informal education is considered as a literate.	Dummy
Land_size	Land size (land holding in hectares)	Continuous
Land_prod	Land productivity (productivity of agricultural land measured in monetary value per hectare per year).	Continuous
Livestock	Livestock holding (total number of livestock holding in TLU)	Continuous
Ex_service	Extension services (number of days per year in which agricultural extension workers visiting a given household farming practice for the provision of extension service.	Continuous
Mkt_distc	Market access (distance in Km from household's village to the nearest market center)	Continuous
nursery	Nurseries site ownership (1=own nursery site and 0 otherwise.	Dummy
Impact (Outcome) Indicator Variables		
Income	Households' cash income in Birr which is generated from different sources or income generating activities (from crop sale, livestock and livestock product sale, forest and plantation tress sale, and income from other off farm activities etc).	Continuous
Input	Household's spending in Birr for the purchase of improved agricultural input (expenditure for fertilizer, improved seeds, pesticides, insecticides, adoption of improve animal species etc).	Continuous
Educ_ Spending	Households' spending in birr for educating household members who are currently enrolled in education.	Continuous
Health_ Spending	Health care spending of household for their family member measured in terms of birr.	Continuous

[4] 0.5kada/timad is a local measure of land. 1 hectare = 4 kada/ timad

4. Results and Discussion

4.1 Descriptive Statistics Results

4.1.1 Mean Difference Results

Descriptive statistics results of covariate variables are summarized and presented in Table 4.1. The result shows that there is statistically a significant difference between planters and non planters in terms of family size, land holding in hectare, livestock holdings, extension service provision (number of days visited by DAs) and distance to the nearest market center measured in kilometers. Family size and extension services are significant at 5% and 10% probability levels respectively while land holding in hectare, market distance and livestock holding in tropical livestock unit are significant at 1% probability level. In contrast to the non planter sampled households, planter households have large family size, large land holding, livestock holding, visited more frequently by development agents and short distance to the nearest market center. Planter households on average have 52.14 percent and 31.27 percent higher land holding and livestock holding than those of non planters respectively. Distance to the nearest market center for planter is shorter than their counter parts by 0.96 km. Furthermore, planters visited by DAs more than 4.5 days per year than comparison households. In experimental design, by randomly allocating the intervention among eligible beneficiaries, the assignment process itself creates comparable treatment and control groups that are statistically equivalent to one another (Baker, 2000). In this approach, each member of the population being studied has the same probability of being selected (Germanov *et al*, n.d). If the assignment is properly carried out, random assignment creates a control group comprising individuals with identical distributions of observable and unobservable characteristics to those in the treatment group (within sampling variation) (Bryson *et al*, 2002). However, here in this study, the treatment is not randomly allocated between planters and non planters and hence that is why we have taken non planters are taken as counterfactual. This is the reason for a statistically significant difference between the two groups before matching with regards to covariate variables. These differences are considerably reduced after selecting the appropriate

matching algorism which is kernel matching with 0.1 band width for this study.

Table 4.1: Summary Statistics and Mean Difference Test of Covariate Variables

Variables		Planters (N=153)		Non planters (N=147)		Total (N=300)		Mean Difference		T Value
	Unit	Mean	(SD)	Mean	(SD)	Mean	(SD)	Mean	(SD)	
Head_age	Year	50.85	13.753	49.67	14.588	50.27	14.157	1.176	1.636	0.719
Fmly_size	No	5.74	1.999	5.27	2.089	5.51	2.054	0.446	0.237	1.976**
Land_size	ha	1.527	0.76	1.004	0.6879	1.271	0.77	0.5235	0.838	6.245*
Livestock	TLU	5.164	3.37	3 .934	2.608	4.56	3.078	1.23	0.349	3.53*
Ex_servic	Day	28.07	23.87	23.46	23.65	25.81	23.83	4.62	2.744	1.68***
Mkt_distc	Km	3.94	2.602	4.903	3.385	4.41	3.045	-0.968	0.347	-2.783*
Land_prod	Birr	8013.2	10869.4	6590.3	6597.5	7316	9045.5	1423	1043.9	1.364

Remark: *, ** and *** significant at 1%, 5% and 10% significance levels respectively.
Source: Survey result

4.1.2 Major Planted Tree Species in the Study Area

Several kinds of trees species; *Eucalyptus globules, Acacia decurrens, Eucalyptus camaldulensis, and Cupresses lustanica,* are grown in both sampled woredas (Table 4.2). In the sampled woredas, more than 80 percent of planter households are planting E*ucalyptus globules* and A*cacia decurrens* species. Besides to productivity loss of land, high market demand for fire wood (charcoal) and construction boom around the cities are the motivating factors for farmers to invest in *Acacia decurrens and Eucalyptus globules* tree species. A*cacia decurrens* trees are mainly used for charcoal preparation while *eucalyptus globules* mainly serve for construction pole, charcoal preparation, and the like. As compared to their Fagta Locuma counterparts, Lay Gayint households are mainly planted e*ucalyptus globules* trees. In contrast to this, more than one third of Fagta Locuma woreda farmers are planted A*cacia decurrens* tree species.

Table 4.2: Major Tree Species Planted by Sampled Households

Tree species	Layi Gayint Woreda (N=76)		Fagta Locuma Woreda (N=77)		Total (N=153)	
	Number	Percent	Number	Percent	N	Percent
Eucalyptus globules	74	48.36	5	3.26	79	51.63
Acacia decurrens	0	0	52	33.99	52	33.99
Eucalyptus camaldulensis	0	0	1	0.65	1	0.65
Eucalyptus globules and Acacia decurrens	0	0	7	4.57	7	4.57
Acacia decurrensand Eucalyptus camaldulensis	0	0	9	5.88	9	5.88
Eucalyptus globules and Cupresses lustanica	2	1.307	0	0	2	1.307
Acacia decurrens and Cupresses lustanica	0	0	3	1.96	1	1.96

Source: Survey result

4.1.3 Reasons for Planting and Not-Planting Trees

Sampled farmers typically indicated several reasons for planting and/ or not planting trees. As presented in Table 4.3, degradation of land (productivity loss) (67.3 percent) and high market demand for plantation products (29.42 percent) are the most often cited reasons for participating in plantation. Farmers reported that the land they possessed had been cultivated for a long period of time and its productivity were declined from time to time and such a problem motivates most of them to invest in tree planting. Therefore, planting trees becoming the best coping mechanisms for productivity loses by most farm households and it enables them to sustain their livelihood.

Table 4.3: The Main Reasons for Planting

Reasons for planting	Layi Gayint Woreda (N=76)		Fagta Locuma Woreda (N=77)		Total (N=153)	
	Number	Percent	Number	Percent	Percent	Number
Degradation of land	44	28.75	59	38.56	103	67.3
High market demand	31	20.26	14	9.15	45	29.42
Existence of ample labor	1	0.653	0	0	1	0.653
Other reasons	0	0	4	2.614	4	2.614

Source: Survey result

Table 4.4 presents the reasons for not planting trees. Accordingly, out of the total non planter farm households, 81.62 percent, 7.48 percent, and 6.8 percent of them reported that shortage of land, fears of negative side effects associated with tree planting (e.g shade effect, conflict with the neighbors due to shade effect), lack of labor force within the household were the most often cited reasons for not participating in planting trees respectively. Plantation is a long term investment; requests substantial amount of resources. Especially, land resources have a paramount importance for plantation investment decisions. However, most of the non planter households posses a small plots of land and hence they doesn't want to allocate it for such investment.

Table 4.4: The Main Reasons for Not Planting

Reasons for not planting	Lay Gayint Woreda (N=74)		Fagta Locuma Woreda (N=73)		Total (N=147)	
	Number	Percent	Number	Percent	Percent	Number
Shortage of land	57	38.77	63	42.85	120	81.62
Fear of negative side effects	7	4.76	4	2.72	11	7.48
Lack of labor	6	4.08	4	2.72	10	6.8
Seedling problem	3	2.04	1	0.68	4	2.72
In appropriate slop	1	0.68	0	0	1	0.68
In appropriate soil	0	0	1	0.68	1	0.68

Source: Survey result

4.2 Econometric Estimation Results

In this section the results of econometric estimation were presented and discussed. As explained earlier to account for the impacts of smallholder plantation, propensity score matching estimation technique was applied.

4.2.1 Estimation of Propensity Scores

Binary logistic regression model were used to estimate propensity scores for matching treated households with control households. For estimating

propensity scores only those variables which affect both the likelihood of plantation and the outcomes of interest were included.

Table 4.5: Logistic Regression Results for Plantation Participation

Variables	Coefficients	dy/dx (Marginal effects)[a]	Z_value
_cons	-1.548329	-	-2.00
Head_sex	-0.6684975	-0.1614597	-1.17
Ex_service	0 .0012673	0.0003145	0.22
Livestock	.022425	0.0054347	0.38
Head_age	-0.0028951	-0.0007261	-0.28
Fmly_size	0.0090542	0.0031121	0.12
Nursery	1.378593	0.3311875	4.96*
Land_size	1.167162	0.2912196	4.26*
Mkt_distc	-0.1521814	-0.0380481	-2.99*
Land_prod	0.0000474	0.0000119	2.34**
Head_educ	0.58596	0.1454752	1.98**
Number of obs =	300		
LR $chi^2(10)$ =	91.02		
Prob > $chi^{2..}$ =	0.0000		
Log likelihood =	-162.37663		
Pseudo R^2 =	0.2189		
% correctly predicted =	80%		

Remark: *, and ** indicates significant at 1% and 5% significance levels, respectively.

a dy/dx is for discrete change of dummy variable from 0 to 1

Source: Estimation result

Table 4.5 shows the logistic regression estimation results of plantation participation. The estimated regression results shows that the probability of participation in plantation is significantly and positively affected by nursery ownership, land holding size, land productivity measured in terms of monetary unit per hectare, and household head education and these results are significant at 1%, 1% 5 % and 5% probability level respectively. Likewise, it is negatively affected by distance to the nearest market center which is significant at 1% probability level.

4.2.2 The Impacts of Smallholder Plantation

The main goals of propensity score analysis is to balance two non-equivalent groups; treated and control groups, on observed covariates to get more accurate estimates of the effects of a treatment (average treatment effect on the treated) on which the two groups differ (Luellen *et al.,* 2005). In line with this, here in this section, the treatment effects of participation in plantation were presented. Table 4.6 shows the econometric estimation results of the effects of plantation on the outcome variables of interest.

The result from the propensity score matching estimation (Table 4.6) shows that there is significant difference in total cash income between planter and non planter households and this result is significant at 1% probability level. It has been found that, on average, planter households have an income of birr 27566.31, which is by 141.45 percent higher than the total cash incomes of non planter households. This might because mainly households participated in plantation is for the sought of generating cash income.

In this study, educational spending is also another impact indicator variable. The estimation result signifies that there is a statistically a significant difference between planters and non planters on education spending for household members who are currently enrolled in education (Table 4.6). Planter households spend 69.85 percent more birr for educating their household member than their counter parts.

With regard to health care spending, the estimation result also shows that there is a significant difference between planter and non planter households and this difference is significant at 10% probability level. Looking into the health care spending, on average non planter households spend about 918 Birr more than the planter households.

Modern agricultural input use which is measured in terms of monetary spending on the purchase of such inputs (e.g. fertilizer, improved seeds, insecticides, insecticides etc) is the last outcome indicator variables of plantation participation in this study. In line with this variable, Table 4.6

shows that, statistically there is insignificant difference between planters and non planters.

Table 4.6: Impacts of Plantation Forest on Households

Outcome Variables	Treated	Controls	Difference	S.E[B]	T value
Total cash income	27566.31	11416.631	16149.679	4304.084	3.752*
Educational spending	2434.112	1433.02	1001.092	383.806	2.608**
Health care spending	816.901	1734.929	-918.028	504.633	-1.819***
Agricultural input spending	2050.88	1663.311	387.569	399.968	0.969

Remark: *, ** and *** implies significant at 1%, 5% and 10% significance levels, respectively.

[B] Stands for bootstrapped standard error which is obtained after100 replication.

Source: Estimation result

5. Conclusion and Recommendation

5.1 Conclusion

The propensity score matching estimation result shows that, there is a significant difference between planters and non planters in terms of the outcome variables; total households cash income, education spending and health care spending. The effect of plantation on households total cash income revealed that, on average planter households generated a cash income of Birr 27 566.31, which is by 141.45 percent higher than the total cash incomes of non-planter households. Moreover, for education purpose, on average planter households spend 69.85 percent more of Birr than the non-planter households. In addition, non planter households spend more of 918 birr over the planter households for the purpose of health care service. However, smallholder plantation had not brought significant effect on the planters in terms of modern agricultural input use in the study area.

5.2 Recommendations

Based on the empirical results obtained from the study, the following possible recommendations can be drown for better development of

smallholder plantation in Amhara region particularly in Fagta Locuma and Lay Gayint woredas.

It is better to improve land productivity by applying certain sustainable land management practice. Education produces changes in attitudes, beliefs, and behavior of farmers and therefore it is advisable to educate farmers. Poor seedlings are likely to have slower growth, to be less able to compete with weeds, and to be more liable to damage by insects and pests. Thus, owning nursery (nurseries) helps in matching demand with production of planting materials and controlling its quality, to reduce the financial money spend for purchasing seedlings.

Moreover, long distance to the market increases uncertainty and reduces choice: it results in more limited marketing opportunities, reduced farm-gate prices and increased input costs. It also increases the transportation and transaction costs. Therefore, focus has to given for expanding market centers on the nearby area, infrastructure like road, telecommunication, and market information system near to residence of smallholder is required.

In the last, smallholder plantation had brought a positive impact on the livelihoods' of planter households in the study woredas. Therefore, due attention should be given to expand plantation practices and the plantation experiences these woredas in other parts of the region. Government and other concerned body must have to establish and rearrange marketing chain to maximize the benefits planter households generated from plantation. Concerns also have to be given to organize farmers in to cooperatives so as to increase the bargaining power of farmers in the market place to obtained good prices for their plantation products, developing new market channels for the products, enable cost-effective delivery of extension services and to access timely information for the member households.

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