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Demirew Getachew

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FOREWORD

The Ethiopian Economic Association (EEA) and its Bahir Dar Chapter are happy to issue the proceeding of the Fifth Annual Conference on the Amhara Regional State Economic Development which was organized on August 31, 2013 at the BoFED Conference Hall. EEA organized this important regional conference 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 5th 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 130 participants including the X-President of the Amhara National Regional State and higher officials of the Regional Bureaus and expertise from Regional Bureaus, Universities, NGOs, private sector representative and EEA members in the region. 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.

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

I would like to take this opportunity to express my heartfelt gratitude, on my own behalf and on behalf of the Ethiopian Economic Association, to the 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 passion 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), The Think Tank Initiative of International Development Research Center (IDRC) of Canada; Civil Society Support Program (CSSP), The Norwegian Church Aid, The Royal Netherlands Embassy, The Swedish Embassy through SIDA, The Development Cooperation of Ireland (DCI) the Ireland Embassy, and the British Embassy through DFID.

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; and Dr. Tesfaye Shiferaw Bahir Dar University Vice President for his welcoming address. I would like also to thank other officials of the regions and Bahir Dar University for their encouragement for the successful conclusion of the conference and for their continued support for the activities of EEA Bahir Dar Chapter.

Alemayehu Seyoum Taffesse (DPhil)
President of the Ethiopian Economics Association

TABLE OF CONTENTS

ENROLMENT IN ETHIOPIA'S COMMUNITY BASED HEALTH INSURANCE SCHEME 1

ANAGAW DERSEH, ROBERT SPARROW, ZELALEM YILMA, GETNET ALEMU, ARJUN S. BEDI

MANUFACTURING INDUSTRY COMPETITIVENESS PLATFORM OF AMHARA RGION 37

KASSIE DESSIE

DETERMINANTS OF FARMERS' PREFERENCE FOR ADAPTATION STRATEGIES TO CLIMATE CHANGE: EVIDENCE FROM SHOA ROBIT AREA, NORTH SHOA ZONE OF AMHARA REGION, ETHIOPIA 81

NEGASH MULATU DEBALKE

THE IMPACTS OF BROKERAGE INSTITUTIONS IN THE MARKETING OF HORTICULTURAL CROPS IN FOGERA DISTRICT, SOUTH GONDAR, AMHARA REGION OF ETHIOPIA 113

SIMEGNEW TAMIR, KINDE GETNET AND JEMA HAJI

PROSPECTS OF TRANSFORMING SUBSISTENCE AGRICULTURE INTO SUSTAINABLE LIVELIHOODS: A CASE-STUDY OF THE RIBB SUB-CATCHMENT ETHIOPIA 135

YODIT BALCHA

DETERMINANTS OF LOAN REPAYMENT PERFORMANCE OF SMALLHOLDER FARMERS: THE CASE OF KALU DISTRICT, SOUTH WOLLO ZONE, AMHARA NATIONAL REGIONAL STATE..... 189

ZELALEM GEBEYEHU, JEMA HAJI HASSEN BESHIRE

Enrolment in Ethiopia's Community Based Health Insurance Scheme[1]

Anagaw Derseh[2], Robert Sparrow[3], Zelalem Yilma[4], Getnet Alemu[5], and Arjun S. Bedi[6]

Abstract

In June 2011, the Government of Ethiopia rolled out a pilot Community Based Health Insurance scheme (CBHI). This paper assesses scheme uptake. We examine whether the scheme is inclusive, the role of health status in inducing enrolment and the effect of the quality of health care on uptake. By December 2012, scheme uptake had reached an impressive 45.5 percent of target households. We find that a household's socioeconomic status does not inhibit uptake and the most food-insecure households are substantially more likely to enrol. Recent illnesses, incidence of chronic diseases and self-assessed health status do not induce enrolment; there is a positive link between past expenditure on outpatient care and enrolment. A relative novelty is the identification of the quality of health care on enrolment. We find that the availability of medical equipment and waiting time to see a medical professional play a substantial role in determining enrolment. Focus group discussions raised concerns about the behaviour of health care providers who tend to provide preferential treatment to uninsured households. Nevertheless, the start of the pilot scheme has been impressive and despite some concerns, almost all insured households indicate their intention to renew membership and more than half of uninsured households indicate a desire to enrol. While this augurs well, the estimates suggest that expanding uptake will require continued investments in the quality of health care.

Keywords: Community based health insurance, adverse selection, social exclusion, Ethiopia

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[1] The authors acknowledge the financial support of the Netherlands Organisation for Scientific Research (NWO-WOTRO), grant number W07.45.103.00. [e] International Institute of Social Studies, Erasmus University Rotterdam & School of Foreign Service-Qatar, Georgetown University, em: bedi@iss.nl.

[2] **Corresponding author**, International Institute of Social Studies, Erasmus University Rotterdam, em: mebratie@iss.nl;

[3] Australian National University, em: robert.sparrow@anu.edu;

[4] International Institute of Social Studies, Erasmus University Rotterdam, em: debebe@iss.nl;

[5] Addis Ababa University, em: galemu2001@yahoo.com;

[6] International Institute of Social Studies, Erasmus University Rotterdam & School of Foreign Service-Qatar, Georgetown University, em: bedi@iss.nl.

1. Introduction

Over the past decade, Ethiopia has recorded notable progress in a number of population health outcomes. For instance child mortality per 1000 live births has fallen from 166 in 2000 to 88 in 2011 and maternal mortality rates have declined from 871 to 676 per 100,000 live births. These changes have been accompanied by a rapid expansion of health-care infrastructure at all levels. According to Ethiopia's Federal Ministry of Health (FMoH, 2011), there has been an 18-fold increase in the number of health posts from 833 in 2000 to 15,095 in 2011 and a 7-fold increase (356 to 2,660) in the number of health centers over the same period. Consequently it is estimated that primary health care coverage, defined as village-level access to a health post, has increased from 51 percent in 2000 to 92 percent in 2011.

Despite these increases in the supply of health care and increases in the utilization of some specific services, overall utilization rates remain low. For example, according to the Ethiopian Demographic and Health Surveys, outpatient health care utilization per capita per year has increased only marginally from 0.27 visits in 2000 to 0.3 visits in 2011. The low utilization rates are accompanied by a high reliance on out-of-pocket (OOP) spending to finance health care. According to the FMoH (2010) the three main sources of health-care financing in Ethiopia are local and international donors (40 percent), out-of-pocket (OOP) spending by health-care users (37 percent), and central and local governments (21 percent). The remainder (about 2 percent) is covered by employer and other private insurance schemes.

Since the late 1990s, as an alternative to informal risk-pooling approaches, community-based health insurance schemes (CBHI) which involve potential clients in determining scheme benefits and scheme management have been implemented in several developing countries. Matching the roll-out of these schemes, theoretical and especially empirical studies which examine their impact on outcomes such as utilization of healthcare, financial protection, resource mobilization and social exclusion have proliferated. Early reviews of this body of work are provided by Jakab and Krishnan (2001) and Preker et al. (2002). Based on 45 published and unpublished works, Jakab and Krishnan (2001) conclude that there is convincing evidence that community health

financing schemes are able to mobilize resources to finance healthcare needs, and that such schemes are effective in terms of reaching low-income groups although the lowest-income groups are often excluded. As opposed to these two narrative reviews, Ekman (2004) provides a systematic review of the literature based on 36 studies conducted between 1980 and 2002. Echoing previous findings, Ekman (2004) concludes that while such schemes do provide financial protection for low income groups, the magnitude of the effect is small and the lowest income groups are excluded from enrolment. More recently, based on a systematic review of 46 papers published between 1995 and 2012, among other aspects, Mebratie et al. (2013) examine the extent of social exclusion and adverse selection in CBHI schemes. They conclude that a majority of papers (61 percent, 11 out of 18) find statistically significant evidence of exclusion of the lowest income groups from CBHI schemes. Even when such households become members, they tend to use healthcare services less intensively as compared to higher income groups potentially due to their inability to afford co-payments and other related costs (transportation and forgone income). They also report that about 67 percent (6 out of 9) of the studies find evidence that individuals suffering from chronic health conditions, a proxy for adverse selection, are more likely to join CBHI schemes as compared to those in good health.

In July 2011, with the aim of enhancing access to health care and reducing the burden of OOP expenditure, the Government of Ethiopia launched a pilot Community Based Health Insurance (CBHI). The scheme which caters to rural households and urban informal sector workers was rolled out in 13 districts located in four main regions (Tigray, Amhara, Oromiya, and SNNPR) of the country. The aim of this paper is to examine and identify factors that drive scheme enrolment. While straightforward this issue is pertinent from a policy perspective as the government plans a nation-wide roll-out of the scheme and hence it is important to examine what factors drive or deter enrolment.

In addition to the policy relevance, the paper offers several innovative elements. First, unlike the bulk of the literature which relies on examining the effect of current traits (such as individual health conditions) on current enrolment and relies on a single post-intervention cross-section of data, we are able to draw on two household surveys canvassed before and after the launch

of the CBHI scheme to examine enrolment in 2012 as a function of individual, household and community traits in 2011.[7] This enables us to provide estimates that are less likely to be influenced by the endogenous nature of some of the explanatory variables. For instance, in the case of papers relying on post-intervention data, health status and enrolment in CBHI may be endogenous. Second, the paper draws on both survey data and qualitative information gathered through a series of key informant interviews (KII) and focus group discussions (FGD) to identify factors that drive or deter enrolment. A final novelty is that we are able to combine data from a health facility survey conducted prior to the launch of the CBHI scheme with the household survey data to examine the role played by the quality of health care in determining enrolment. While some studies (Nketiah-Amponsah, 2009; Chankova et al., 2008, Shimeles, 2010) do control for access to health care by including variables such as distance to the nearest health facility we are able to push further by directly examining the role of health care quality (for example, educational level of health professionals, availability of medical equipment).

The article unfolds by providing in the next section a description of the key design features of the pilot scheme. Section three describes the data, section four discusses the research methods, section five contains empirical results and the final section concludes.

2. Key features of the Ethiopian CBHI scheme

In June 2011 the Ethiopian CBHI scheme was rolled out in 13 pilot districts in four main regions (*Tigray, Amhara, Oromiya,* and *SNNPR*) of the country.[8] The pilot districts were selected by regional administrative bodies based on directives provided by the Federal Ministry of Health (FMoH). While the chosen districts were expected to fulfill five selection criteria, in practice,

[7] Mebratie et al. (2013) report that of the fourteen papers which examine social exclusion in CBHI uptake using regression methods, only two studies are based on longitudinal data sets canvassed before and after the intervention. The remainder are cross-section studies based on post-intervention data. Similarly, only three out of nine that papers that have examined adverse selection rely on longitudinal data.

[8] The initial plan was to roll out the pilot scheme in 3 districts in each of the four regions. However, an additional district in Oromiya region volunteered to join the pilot scheme and was included. Together, these four main regions account for about 86 percent of the country's population (Population Census Commission, 2008).

selection was based on two conditions. Namely, the district should have undertaken health care financing reforms designed to increase cost recovery and retention of locally raised revenues and that health centres in these districts should be geographically accessible (located close to a main road).[9]

The scheme was introduced by Ethiopia's, Federal Ministry of Health (FMoH) in collaboration with USAID, Abt Associates Inc. an international consultancy company and CARE Ethiopia an international non-governmental organization. The scheme is part of the government's broader health care financing reform strategy which aims to improve quality and coverage of health services by identifying alternative healthcare resources (USAID, 2011). Feasibility studies, scheme design and scheme promotion were outsourced to Abt Associates and CARE Ethiopia. The basic design of the scheme in terms of benefit packages, registration fees and premium payments, co-payments were determined on the basis of feasibility studies and in collaboration with regional governments and are the same within each of the pilot regions but differ slightly across regions. Scheme implementation and monitoring is conducted by Abt Associates in collaboration with relevant government authorities at the central, regional, district, and village levels.

While the scheme has been introduced by the government, it is 'community based' in the sense that the community at the village (*kebele*) level determines whether or not to join the scheme and is subsequently involved in scheme management and supervision.[10] After being exposed to a range of awareness creation activities a general assembly at the village level decided whether or not to join the scheme (a simple majority had to support the decision) and then households decide whether to enroll in the scheme.[11] In order to reduce the

[9] The complete set of selection criteria included (1) Willingness of district authorities to implement the schemes (2) Commitment of districts to support schemes, (3) Geographical accessibility of health centers (4) Quality of health centers, (5) The implementation of cost recovery, local revenue retention, and public pharmacy policies in health centers.

[10] In their review of the CBHI literature, Mebratie et al. (2013) classify the 48 schemes covered in the studies they review into three distinct scheme types. Sixteen are community prepayment health organizations, 7 are health care provider initiated insurance schemes, and 25 are classified as government run community involved health insurance schemes. The Ethiopian CBHI scheme falls in the last category

[11] According to information obtained from a key informant at Abt Associates, no village voted against the scheme and the programme rolled out in all villages in the pilot districts.

possibility of adverse selection the unit of membership is the household rather than the individual (FMoH, 2008).

Household level monthly premiums for core household members range between ETB 10.50 in SNNPR to ETB 15 in Oromiya (see Table 1).[12] For each non-core household member the monthly premium lies between ETB 2.10 and ETB 3.00. Premiums in Amhara region are set at ETB 3.00 per individual per month. The premiums amount to about 3 percent of household monthly income.[13] To enhance affordability the central government subsidizes a quarter of the premium and district and regional governments are expected to cover the costs of providing a fee waiver to the poorest 10 percent of the population or so called "indigent groups".[14]

Premium collection intervals differ across pilot districts and are sensitive to local conditions. While local level officials and community representatives are able to adjust the interval of premium collection they cannot change the premium. In order to enable community engagement every village is expected to select 3 delegates/CBHI members who will be part of the village CBHI administrative bodies and participate in the general assembly organized at district level.[15] According to information obtained from key informant interviews and focus group discussions, village level government officials and the community at large are involved in identifying the poorest households and implementing the fee waiver arrangement.

[12] Core household members include a mother, father, and their children below age 18.

[13] This figure is based on an annual per capita income of USD 370 in 2011, an exchange rate of ETB 18 to USD 1 and a household of 6 core members.

[14] Indigent groups are defined as those households who do not have land, a house, or any valuable assets. According to information obtained from Abt Associates, the coverage of the indigent groups depends on the budget allocated by district and regional governments. In December 2012, the share of indigent groups as a proportion of the total eligible households (300,605 households) ranged from a low of 0.9 percent in Deder District in Oromiya to 21.1 percent in South Achefer district in Amhara region. Nation-wide, by December 2012, 8.9 percent of total eligible households had received a fee-waiver.

[15] The qualitative survey shows that the participation of the community in the decision making process of the scheme is limited. Only two CBHI members were actually selected as part of the village management and there were no regular meetings with the community to update members about the activities of the scheme and collect feedback.

The scheme covers both outpatient and inpatient health care services in public facilities. Transportation costs to access health facilities are not covered. Utilization of care from private providers is usually not permitted unless a particular service or drug is unavailable at a public facility. Treatment outside the country is not covered. Scheme participants are expected to access health providers who have signed a contractual agreement with district level CBHI administrators. The selection of the facilities takes into account a number of factors such as quality of the care (in terms of human resource and equipment), geographical proximity between the providers and the location of the target households, implementation of the healthcare financing reform, and service charges. There is no upfront payment at the time of service utilization if treatment is obtained from those facilities which have contractual agreements with the scheme. In Tigray, Amhara, and Oromiya regions, CBHI members are allowed to use care from public facilities that do not have formal contractual agreements with the scheme and then claim reimbursement. There is no reimbursement for service utilization outside CBHI linked facilities in SNNPR.

Medical treatments which have largely cosmetic value (for example, artificial teeth and plastic surgery) are excluded. There are no copayments as long as members follow the scheme's referral procedure. When they seek care, scheme members are first expected to visit a health center and can subsequently access higher level care at district or regional hospitals as long as they have referral letters from the health center. Members who visit hospitals without referral letters need to cover 50 percent of their costs. Access to tertiary level care differs across regions. In Amhara and Tigray, CBHI enrollees may visit any public hospital within the region but not outside the region. In SNNPR, care is covered only in the nearest public hospital while in Oromiya coverage includes hospitals located outside the region.

According to our survey data, scheme uptake was 41 percent in April 2012 (see Table 1) and according to Abt Associates uptake reached 45.5 percent in December 2012 (see Table 2). As compared to the experience of several other African countries the speed of uptake is remarkable. For instance, uptake in Mali was 11.4% after six years (Diop et al., 2006), 4.8% after two years in Senegal (Smith and Sulzbach, 2008), 2.8% in Tanzania after six years (Chee et

al., 2002), 35% in Rwanda after seven years and 85% percent after nine years (Shimeles, 2010).

3. Data

This paper draws on three different types of data – two rounds of a longitudinal household survey, a health facility survey, and qualitative information from key informant interviews and focus group discussions.

Prior to the launch of the CBHI scheme in July 2011, a baseline household survey was conducted between March and April 2011 and a follow up survey was undertaken between March and April 2012. The household surveys cover 12 of the 13 CBHI pilot districts and 4 non-intervention districts located in four regions (*Tigray, Amhara, Oromiya, and SNNPR*).[16] From each of the 16 sampled districts, 6 villages (*Kebeles*) were randomly chosen and within each village 17 households were randomly chosen to yield a total of 1,632 households. This paper is based on the surveys conducted in the CBHI pilot districts which include a total of 1,224 households in 2011, of which 1,203 were interviewed again in 2012.[17]

In addition to an extensive module on household and individual health conditions, the surveys contain information on a variety of individual and household socio-economic attributes (consumption expenditure, assets, household demographics, and employment), access to formal and informal sources of credit, and involvement in social networks. The health module includes questions regarding self-rated health status and outpatient and inpatient health care utilization for each household member. The recall period for outpatient health care is two months preceding the survey while it is 12 months in the case of inpatient health care. Medical health expenditure including transport costs, consultation and diagnosis costs, drug costs and other health care related expenses for each episode of health care consumption are recorded. The second round of the survey enquired whether households had enrolled in the CBHI, and their reasons for doing so.

[16] In each of the four regions there are three CBHI districts and one control district.
[17] In total, the second round of the survey covered 1,599 (2% attrition) households that had been canvassed in the first round.

While the household surveys contain information on access to health facilities (travel time to reach the nearest health facilities), in order to assess and potentially control for the quality of health care services in determining enrolment, we combine the surveys with information gathered from 48 health care centers (3 randomly selected health centers from each of the 16 districts). We focused on health centers as these are usually the main source of curative health care in rural Ethiopia. The health facility survey was canvassed between April and May 2011, that is, before the introduction of the CBHI scheme. The health facility survey contains information on the educational qualifications and work experience of the head of the facility, availability of medical equipment, and the head's (self-) assessment of the quality of care provided by the facility. In addition, the survey obtained information from five randomly chosen patients who were exiting from the health center, on the time taken to obtain a patient card and time taken between obtaining the patient card and consulting with a health care professional. Based on information provided by the district health offices, households from the 96 sampled villages were matched to the 48 health centres on the basis of household proximity to the health centers.[18]

In order to understand the overall vision of the scheme and to gain a clearer understanding of design, operation and implementation issues at different levels of government, between December 2012 and January 2013, 15 key informant interviews were conducted. These interviews include FMoH, Abt Associates, Care Ethiopia, four regional level CBHI coordinators, four district level CBHI officials and four village level CBHI managers from each of the pilot region. Eight focus group discussions, two in each of four villages randomly selected per region, were conducted with groups of 7 to 12 individuals. Each FGD had at least three and at most six female participants. One of the FGDs was conducted with scheme members and focused on their motivation for joining the scheme and their views on scheme operation while the other was conducted with non-members and focused on why they had chosen not to join the scheme.

[18] On average about 41 households were matched to one health center.

4. Estimating enrolment

We treat the probability that a household enrols in the *CBHI* scheme as a function of a range of factors that are likely to influence both the demand for health insurance and for health care. In particular, we focus on the role of three main sets of variables, that is, household socio-economic status, health status and past use of health care services, and access to and quality of health care, in determining enrolment. The enrolment status of household *h* in time period *t* (2012) is expressed as a function of various sets of variables in period *t-1* (2011) and written as,

$$CBHI_{ht} = \alpha' SES_{ht-1} + \theta' DE_{ht-1} + \beta' HS_{ht-1} + \gamma' FISC_{ht-1} + \delta' SSA_{ht-1} + \eta' SSQ_{ht-1} + \varepsilon_{ht}, \quad (1)$$

where, $CBHI_{ht}$ is a binary variable with a value of 1 if a household is enrolled in the scheme and zero; otherwise. Socio-economic status (*SES*) is a set of variables that includes the educational status of the head of the household, whether a household participates in a social security programme called the productive safety net programme (*PSNP*) which targets chronically food insecure households and the consumption quintile in which a household falls.[19] [20] *DE* is a set of variables that captures the demographic profile of the households and includes the gender of the household head, household size, and proportion of male and female household members in different age groups and religion of household head. To account for the role of past illnesses, health care use and health care expenditure as well as potential illnesses in determining enrolment status we include a set of variables (*HS*) indicating past illness events, incidence of chronic disease, use of outpatient and inpatient care, outpatient and impatient health care expenditure, and household self-reported health status (good, fair, poor). *FISC* includes variables that control for access to formal and informal sources of credit and the strength of a household's social network. These include variables such as whether a household has savings in a bank account, outstanding loans, is a member of a

[19] The productive safety net programme (PSNP) is a government social security programme designed to support chronically food insecure households. Participants engage in public works (road and school construction, soil and water conservation) and receive payments in cash or food.

[20] Since we are interested in identifying the separate effect of health care expenditure the consumption measure used here is net of health care expenditure.

credit and savings association, and member of an *Iqqub*.[21] The strength of a household's social network is proxied, amongst other variables, by membership in a *Wonfel* or a *Debo*, membership in church/mosque based religious groups, and whether any household member has ever held or holds an official government position.[22]

We include two sets of supply side characteristics. One set, access to health care facilities (*SSA)* includes travel time to health centers and hospitals while a second set includes a range of variables to capture the quality of health care on offer. This includes information on the education and training of the head of the facility, availability of medical equipment, waiting time to obtain a patient card and to see a medical care provider and the perception of the quality of care provided by the facility as reported by its head.[23] In addition, we also include a set of regional controls and control for community level access to infrastructure (roads, access to water and electricity).

A description of the variables and summary statistics are provided in Table A1 and Table 3, respectively.

5. Results

We estimate several variants of (1) using a logit model. Marginal effect estimates, with standard errors clustered at the level of the primary sampling unit (the village), are provided in Table 4.

Unlike the bulk of the existing papers on enrolment in CBHI which find that the lowest-income groups are often excluded from the scheme, the estimates reported here reveal the opposite. While the educational status of the household head and the consumption quintile in which a household falls have no statistically significant bearing on enrolment, participation in the productive

[21] Iqqub is a rotating credit and savings association.
[22] Wonfel & Debo are traditional associations where members help each other in agricultural activities.
[23] 'Perceived quality of health care services' is based on eliciting the view of the head of the health facility survey on the overall quality of health care services provided by the facility. The specific question was, in general, do you think that this health center is providing the expected standard of health care services, yes or no.

safety net programme (PSNP) which targets chronically food insecure households is associated with a 33 to 34 percentage point increase in enrolment.[24] Equitable, and perhaps even the pro-poor character of the scheme if one considers the PSNP effect, may in part be attributed to the targeted subsidy provided to indigent households. As shown in Table 2, about 20 percent (8.9/45.5) of enrolled households in December 2012 were receiving a fee waiver. The large effect of PSNP participation on enrolment is remarkable. The qualitative information gathered through the key informant interviews and via observations in the field suggests several reasons for this pattern. First, government officials have been taking measures to integrate different development interventions such as agricultural extension, education and health programmes. Households covered by the PSNP are provided information on the health insurance scheme and encouraged to enrol. This is illustrated by a statement made by a key informant in Tigray region,

> *"*Continuous education on health issues including about the recently introduced community based health insurance scheme is provided to those people who are covered under PSNP. Moreover, during the distribution of PSNP payments, the participants are asked if they would like to register for CBHI and those who volunteer pay immediately and join" [Interviewed on December 07, 2012]."

Second, while the pro-poor tilt of the scheme is a positive aspect it is possible that the enrolment of PSNP beneficiaries may not be entirely voluntary. Village level CBHI officials may exert pressure and force households to enrol. Our data show that about 10 percent (50 out of 489) of insured households indicate that they joined the scheme due to pressure from CBHI officials (Table A3). In relation to this, an uninsured FGD participant in Oromiya region said,

> "A *kebele* (village) official reduced my monthly income from PSNP and informed me that the reduced money was for CBHI membership contribution. I said I did not want to enroll in the scheme and asked him to give me my full PSNP benefit. However, he did not pay me. So, I

[24] A majority (55 percent) of the PSNP beneficiaries fall in the bottom two quintiles of the consumption distribution.

accused him to a higher *kebele* official and I got my money back" [Discussed on December 23, 2013]."

The gender and age distribution of household members may affect CBHI uptake. For instance, households with more children, a greater proportion of elderly household members or adult females in the reproductive age group may be more likely to demand health insurance and health care. Some evidence of this is available in Table A3 which elicits information on the reason for purchasing insurance. However, apart from household size, which is associated with a 2 percentage point increase in the probability of enrolment there is no statistically significant relationship between household composition and scheme enrolment. In three of the four regions (Tigray, Oromiya and SNNPR) the insurance contribution is fixed per household and hence the scheme may be especially attractive for households with a large family size. Orthodox Christians are about 14 percentage points more likely to join the scheme as compared to other religions. The reasons for this are not entirely clear.

There is no evidence that poor self-assessed health status has a bearing on enrolment. Similarly, illnesses, incidence of chronic diseases, duration of hospitalization and utilization of care (outpatient and inpatient) are not positively linked to CBHI uptake. In fact, there is a negative link between enrolment and chronic disease. While pre-existing medical conditions and utilization may not induce uptake it does seem that recent episodes of health care spending on outpatient care prompt enrolment – a half a standard deviation increase, about 100 Birr, in outpatient expenditure is associated with a 2.5 percentage point increase in enrolment. Nevertheless, only about 8 percent of insured households reported that they joined the scheme because of frequent illnesses in their households (see Table A3). The existing papers, of which six out of nine find evidence of adverse selection, tend to use the incidence of illness as their selection measure. If we were to use a similar measure then we would conclude that adverse selection is unlikely to be major concern in the current scheme. While it is hard to make a definitive claim, perhaps a key reason for the lack of selection effects is that, in order to

discourage enrolment on the basis of pre-existing medical conditions, enrolment is permitted only at the household and not at the individual level.[25] Access to formal and informal sources of credit and membership in social networks may have a positive or a negative effect on demand for health insurance. On the one hand, belonging to a network may reduce the incentive to participate in the CBHI scheme while at the same time such networks may be sources of finance to purchase insurance and may also help enhance understanding of health insurance. The key informant interviews and the focus group discussions revealed that various social networks such as *Iddir* (funeral association), *Iqqub* and religious groups were used to raise understanding of CBHI and to persuade households to join the scheme. However, except for the variable which indicates that a household member holds or held an official position government position, none of the other variables have a bearing on enrolment. Holding or ever having held an administrative or community leadership position enhances CBHI enrolment by about 11-12 percentage points. This is perhaps not surprising. The qualitative data collection efforts show that in all regions, *kebele* officials and community leaders were provided information and understanding of the scheme and were expected to inform their constituencies and help generate interest in the scheme.

Turning to supply side factors, contrary to expectations, there is a positive association between travel time to health centers and CBHI membership. A one standard deviation increase (about 45 minutes) in travel time increases enrolment by 3.6 percentage points. Travel time to public hospitals does not have a bearing on CBHI uptake. There is a clear and discernible link between the quality of care on offer and CBHI uptake. For instance, availability of blood testing equipment in the closest health facility increases the probability of CBHI enrolment by 31 percentage points. Average waiting time to see a health care professional, a measure of quality in its own right and a proxy for facility staffing levels, exerts a negative effect on enrolment. A one standard deviation reduction in waiting time (28 minutes) is associated with a 12 percentage point increase in enrolment.

[25] All six of the papers/schemes which find evidence of adverse selection permit enrolment at an individual level.

The importance of the quality of care in determining insurance uptake and use of services also emerged from the focus group discussions. Both insured and uninsured FGD participants from all regions criticized the quality of available services and indicated that even if public health facilities were relatively accessible in terms of distance as compared to private facilities, a number of them did not have the necessary laboratory equipment and medicines. In relation to this, an insured FGD participant in Amhara region shared her experience,

> "I went to private providers and incurred OOP health care expenditure even if I am a CBHI member. The health center in our village did not have laboratory equipment and the health workers could not examine my real health problem." [Discussed on January 11, 2013]."

An additional issue which we cannot control for in our estimates but was revealed by the qualitative information is the reported behavior and attitude of medical providers to those who have insurance. For instance, an insured FGD participant in SNNPR explained,

> "The health professionals do not provide equal services and respect for both insured and uninsured patients. They give medicine only for non-members of the scheme and they tell members of the scheme to buy from private stores and we are forced to buy drugs from our pockets even if we have health insurance cards" [Discussed on January 24, 2013]."

Similarly, uninsured FGD participants in Oromiya region believed,

> "The doctors give priority to those patients who pay in cash during services provision and insured people do not get quick services. Moreover, they do not want to properly treat insured patients and think that most insured people come to health facility just for check up for minor medical cases since CBHI members do not pay cash during services utilization" [Discussed on December 25, 2013]."

Based on the FGD the two reasons for the preferential treatment meted out to uninsured patients is their immediate contribution to the revenues of the health facilities and their apparent overuse of health care facilities. Doctors/facilities may also prefer to treat the uninsured due to the paper work required to receive payments for insured patients and the payment lag.[26]

Households in Amhara and Oromiya regions are about 20 to 25 percentage points more likely to enrol as compared to households living in Tigray and SNNPR. A possible reason behind the lower CBHI participation preference in SNNPR regions could be the relative difference in the design characteristics of the schemes. Unlike the three pilot sites, CBHI members in SNNPR have limited access to tertiary health care services. Insured households in this region may only use tertiary services at the nearest public hospital (while those in Amhara may visit any public hospital within the region and those in Oromiya may use care from public hospitals within and outside the region). Similarly, unlike the other three regions, insured households in SNNPR cannot claim reimbursements if they use health care services from private providers in the event that medical equipment or drugs are not available in CBHI linked facilities. In addition, SNNPR is a relatively poorer province (see Table A2, consumption quintiles) and the lower uptake may also reflect a lower capacity to pay for health insurance. In the case of Tigray, while the features of the insurance package do not differ as compared to other regions it lacks behind in terms of the quality of care and records the longest waiting times across regions and is also not particularly well-resourced in terms of equipment (see Table A2).

6. Conclusion

This paper used data from longitudinal household surveys, a health facility survey and qualitative information obtained through focus group discussions

[26] Health facilities are expected to submit claims on a quarterly basis. To be reimbursed, health facilities need to submit a claim based on a specific format and submit it to the district CBHI offices. Photocopies of the signatures of CBHI members who used health care services also need to be attached. The district CBHI offices are supposed to pay 75 percent of the claims within three days of receipt of the forms by checks/bank transfer without any investigation. Prior to paying out the remainder, a medical audit is expected to be conducted. Once approved, the rest of the claims are paid out.

and key informant interviews to analyse the factors that determine insurance uptake in a pilot CBHI scheme introduced by the Ethiopian government in June 2011. The paper focused on three issues – whether the scheme is socially inclusive, whether uptake is more likely amongst households with specific health care status and health needs and the role of the quality of health care in influencing uptake.

We found that by December 2012, a year and a half since being introduced, scheme uptake had reached an impressive 45.5 percent of target households. This is remarkable as compared to the experiences of other Sub-Saharan African countries which have introduced similar schemes. With regard to social inclusion, unlike the bulk of the literature which finds that the lowest income groups are often excluded from such schemes we found that the CBHI scheme may be characterised as pro-poor. There was no evidence that socioeconomic status as measured by consumption quintiles and education of the household head influences enrolment and we found that food insecure households who have participated or still participate in the productive safety net programme (PSNP) are far more likely (33 percentage points) to join the pilot scheme. The inclusive nature of the scheme may be attributed to the government's targeted subsidy program while the PSNP effect may be attributed to two reasons. On a positive note the KII and the FGD revealed that the government is making efforts to integrate various development interventions and recipients of one government program are far more likely to be informed about other government programs which in turn encourages uptake. On a relatively negative note we also found evidence of officials coercing PSNP beneficiaries to join the scheme. About 10 percent of insured households indicated that they had been pressurized into joining the scheme. Self-assessed health status and past illnesses and symptoms are not positively correlated with uptake and about 8 percent of insured households indicated that the main reason for enrolling in the scheme is that household members are frequently ill. Given these figures it is unlikely that adverse selection will seriously afflict the scheme. An explanation for this may be the scheme design which was explicitly designed to mitigate adverse selection by permitting enrolment only at the household level.

A relatively novel contribution of the paper is our examination of the role of the quality of care on uptake. The availability of medical equipment and waiting time to see a medical professional played a large role in determining enrolment. For instance, the availability of blood testing equipment at the nearest health center was associated with a 30 percentage point increase in enrolment while a one standard deviation reduction in waiting time was associated with a 12 percentage point increase in uptake. During the FGD both insured and non-insured groups criticised the shortage of medical equipment, lack of drugs and also pointed out that health providers favoured uninsured patients versus the insured. The proximate reasons for this appear to be the immediate payments provided by the uninsured and the administrative burden associated with obtaining payments for providing services to the insured.

The start of the pilot scheme has been impressive and despite coercion in some cases and criticisms about the quality of care, a clear signal of the benefits emanating from the scheme is that almost all insured households (96 percent) indicate that they will renew their membership (see Table A3). At the same time about 57 percent of uninsured households' state that they plan to enrol in the future. While this augurs well as the government plans to spread the scheme to an additional 161 districts which fulfil the same selection criteria as the 12 pilot districts, the results presented here suggest that expanding uptake will need continued investments in the quality of care and attempts to alter the differential treatment received by the insured.

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Table 1: CBHI in Ethiopia – Premiums, payment intervals and enrolment

Region	Unit of contribution	Premium per month		Payment interval	CBHI uptake in April 2012 (%)
		Core household members*	Per extended family member		
Tigray	Household	ETB 11.00	ETB 2.50	Annual	34
Amhara	Individual	ETB 3.00	ETB 3.00	Biannual	49
Oromiya	Household	ETB 15.00	ETB 3.00	Gimbichu district - annual Kuyu, Deder, and L. Kossa districts – annual or biannual	44
SNNPR	Household	ETB 10.50	ETB 2.10	Yirgalem and D. Woyde – quarterly Damboya - three times a year	35
Total					41

Notes: In addition to the premiums there is a one-time registration fee of ETB 5.00 per household.

Source: Abt Associates and key informant interviews at the federal, district and regional levels.

Table 2: CBHI uptake and fee waiver beneficiaries up to December 31, 2012

Region	No of Eligible HHs	Registered HHs					
		Paying		Non-paying		Total	
		%	N	%	N	%	N
Tigray	75,190	33.4	25,101	11.5	8,651	44.9	33,752
Amhara	86,628	42.0	36,412	16.0	13,865	58.0	50,277
Oromiya	106,674	29.3	31,301	2.6	2,750	31.9	34,051
SNNPR	32,113	53.6	17,228	4.2	1,342	57.8	18,570
Total	**300,605**	**36.6**	**110,042**	**8.9**	**26,608**	**45.5**	**136,650**

Source: Abt Associates, Addis Ababa

Table 3: Descriptive statistics by insurance status, 2011

Variable	Enrolled		Non-Enrolled		Mean differences p-value	Total	
	Mean	SD	Mean	SD		Mean	SD
Socioeconomic status							
Poorest consumption quintile	0.23	0.42	0.18	0.39	0.0462	0.20	0.40
2nd consumption quintile	0.20	0.40	0.20	0.40	0.9255	0.20	0.40
3rd consumption quintile	0.19	0.39	0.21	0.41	0.3832	0.20	0.40
4th consumption quintile	0.18	0.38	0.21	0.41	0.1301	0.20	0.40
Richest consumption quintile	0.20	0.40	0.20	0.40	0.7655	0.20	0.40
HH head education- No education at all	0.42	0.49	0.48	0.50	0.0387	0.46	0.50
HH head education- Informal	0.16	0.37	0.11	0.32	0.0214	0.13	0.34
HH head education- Primary or above	0.42	0.49	0.40	0.49	0.6313	0.41	0.49
Participates in PSNP	0.28	0.45	0.17	0.38	0.0000	0.21	0.41
Demographic traits							
Male headed HH	0.90	0.31	0.84	0.36	0.0108	0.87	0.34
Age of HH head	46.91	12.68	46.79	14.75	0.8860	46.84	13.96
Household size	6.25	2.21	5.61	2.26	0.0000	5.87	2.26
Prop. of children aged under 6	0.13	0.14	0.15	0.16	0.0669	0.14	0.15
Prop. of male aged 6 to 15	0.17	0.15	0.15	0.15	0.0766	0.16	0.15
Prop. of female aged 6 to 15	0.16	0.14	0.14	0.15	0.0108	0.15	0.15
Prop. of male aged 16 to 64	0.26	0.15	0.25	0.17	0.4008	0.25	0.16
Prop. of female aged 16 to 64	0.25	0.14	0.26	0.16	0.7691	0.25	0.15
Prop. of elderly aged above 64	0.03	0.11	0.06	0.18	0.0029	0.05	0.15

Variable	Enrolled		Non-Enrolled		Mean differences p-value	Total	
	Mean	SD	Mean	SD		Mean	SD
HH head religion - Orthodox Christian	0.62	0.49	0.59	0.49	0.3421	0.61	0.49
HH head religion – Protestant	0.18	0.38	0.21	0.41	0.1920	0.20	0.40
HH head religion – Muslim	0.19	0.39	0.17	0.38	0.4022	0.18	0.38
HH head religion - Other religion or no religion	0.01	0.10	0.03	0.16	0.0535	0.02	0.14
Health status and health care use							
Prop. of household members with good SAH	0.81	0.32	0.74	0.38	0.0015	0.77	0.35
Prop. of household members with fair SAH	0.15	0.29	0.21	0.35	0.0016	0.18	0.33
Prop. of household members with low SAH	0.05	0.13	0.05	0.16	0.4860	0.05	0.15
Past illness event	8.75	16.06	9.13	16.61	0.6881	8.98	16.39
Chronic illness	0.24	0.65	0.35	0.31	0.0216	0.31	0.82
Outpatient care use	0.39	0.49	0.38	0.48	0.6288	0.38	0.49
Inpatient care use	0.03	0.17	0.03	0.18	0.6913	0.03	0.17
Duration of hospitalization	0.37	2.61	0.59	8.04	0.5678	0.50	6.44
Outpatient healthcare expenditure	80.21	307.81	42.33	129.87	0.0031	57.47	219.71
Inpatient healthcare expenditure	44.40	415.49	40.81	451.0	0.8883	8.98	16.39
Trust in modern care – Disagree	0.06	0.23	0.06	0.23	0.8683	0.06	0.23
Trust in modern care - Neither agree nor disagree	0.04	0.20	0.06	0.23	0.2621	0.05	0.22
Trust in modern care – Agree	0.90	0.30	0.89	0.32	0.3564	0.89	0.31
Formal and informal access to credit and networks							
Member of *Iqqub*	0.08	0.27	0.06	0.24	0.1140	0.07	0.25
Member of credit & saving association	0.17	0.38	0.09	0.29	0.0000	0.12	0.33

Variable	Enrolled		Non-Enrolled		Mean differences p-value	Total	
	Mean	SD	Mean	SD		Mean	SD
Member of religious group	0.59	0.49	0.60	0.49	0.8083	0.59	0.49
Participate in *Wonfel* or *Debo*	0.46	0.50	0.43	0.50	0.3777	0.44	0.50
Savings in bank account	0.16	0.37	0.12	0.33	0.0311	0.14	0.35
Outstanding loan	0.38	0.49	0.28	0.45	0.0006	0.32	0.47
Someone to rely on	0.40	0.49	0.37	0.48	0.2846	0.38	0.49
Official position held	0.29	0.46	0.19	0.39	0.0000	0.23	0.42
Supply side characteristics							
Travel time to health center	70.00	46.94	64.07	43.37	0.0235	66.44	44.90
Travel time to public hospital	113.58	65.83	114.44	75.51	0.8373	114.10	71.77
Completed first degree (12+3)	0.45	0.50	0.46	0.50	0.6293	0.46	0.50
Received on the job training	0.81	0.39	0.83	0.38	0.4754	0.82	0.38
Availability of blood testing equipment	0.92	0.26	0.77	0.42	0.0000	0.83	0.37
Availability of urine testing equipment	0.94	0.24	0.88	0.33	0.0005	0.90	0.30
Waiting time to get patient card	10.56	10.06	14.60	12.59	0.0000	12.99	11.81
Waiting time to see a medical professional	28.33	23.97	38.48	29.42	0.0000	34.43	27.81
Perceived quality of care	0.65	0.48	0.40	0.49	0.0000	0.50	0.50
Community characteristics							
Region – Tigray	0.21	0.41	0.28	0.45	0.0042	0.25	0.43
Region – Amhara	0.30	0.46	0.21	0.41	0.0005	0.25	0.43
Region – Oromiya	0.27	0.45	0.24	0.42	0.1476	0.25	0.43
Region – SNNPR	0.22	0.41	0.27	0.44	0.0399	0.25	0.43

Variable	Enrolled		Non-Enrolled		Mean differences p-value	Total	
	Mean	SD	Mean	SD		Mean	SD
Travel time to all weather road	38.45	35.75	36.46	39.42	0.3718	37.25	37.99
Travel time to asphalt road	80.31	53.09	78.58	63.20	0.6193	79.27	59.35
Access to improved water	0.78	0.41	0.73	0.44	0.0369	0.75	0.43
Access to modern light	0.05	0.21	0.04	0.20	0.6892	0.04	0.21
Radio use	0.74	0.44	0.70	0.46	0.0696	0.72	0.45
Mobile phone use	0.42	0.49	0.39	0.49	0.3391	0.40	0.49
Observations	489		735			1224	

Table 4: Probability of enrolment - marginal effects (std. error)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Socioeconomic status				
2nd consumption quintile (ref: poorest consumption quintile)	0.0185	0.0232	0.0208	0.0230
	(0.0518)	(0.0527)	(0.0519)	(0.0528)
3rd consumption quintile	0.0240	0.0332	0.0291	0.0324
	(0.0508)	(0.0522)	(0.0517)	(0.0525)
4th consumption quintile	0.0424	0.0420	0.0408	0.0397
	(0.0535)	(0.0533)	(0.0531)	(0.0537)
Richest consumption quintile	0.0748	0.0792	0.0774	0.0793
	(0.0681)	(0.0701)	(0.0692)	(0.0696)
HH head education- Informal (ref: no education at all)	0.0168	0.0136	0.0141	0.00984
	(0.0521)	(0.0516)	(0.0515)	(0.0515)
HH head education- Primary or above	0.0390	0.0412	0.0418	0.0365
	(0.0472)	(0.0474)	(0.0473)	(0.0475)
Participated in PSNP	0.328***	0.331***	0.331***	0.337***
	(0.0649)	(0.0654)	(0.0654)	(0.0647)
Demographic traits				
Male headed HH	0.0264	0.0311	0.0306	0.0316
	(0.0525)	(0.0500)	(0.0508)	(0.0501)
Age of HH head	0.000548	0.000430	0.000318	0.000538
	(0.00184)	(0.00184)	(0.00183)	(0.00186)
Household size	0.0223**	0.0214**	0.0217**	0.0199*
	(0.0107)	(0.0107)	(0.0106)	(0.0108)
Prop. of children aged under 6 (ref: Prop. of male aged 16 to 64)	-0.0940	-0.104	-0.102	-0.0694
	(0.177)	(0.176)	(0.176)	(0.178)
Prop. of male aged 6 to 15	-0.0192	-0.0168	-0.0158	0.00198
	(0.171)	(0.171)	(0.171)	(0.170)
Prop. of female aged 6 to 15	0.128	0.125	0.124	0.141
	(0.173)	(0.170)	(0.172)	(0.171)

VARIABLES	Model 1	Model 2	Model 3	Model 4
Prop. of female aged 16 to 64	0.0511	0.0541	0.0590	0.0734
	(0.204)	(0.206)	(0.205)	(0.205)
Prop. of elderly aged above 64	-0.200	-0.173	-0.172	-0.163
	(0.177)	(0.170)	(0.171)	(0.176)
HH head religion - Orthodox Christian (ref: Muslim)	0.144*	0.136*	0.136*	0.143*
	(0.0757)	(0.0761)	(0.0769)	(0.0768)
HH head religion – Protestant	0.106	0.0976	0.0935	0.100
	(0.104)	(0.105)	(0.105)	(0.106)
HH head religion - Other religion or no religion	-0.0686	-0.0781	-0.0825	-0.0577
	(0.135)	(0.131)	(0.132)	(0.136)
Health status and health care use				
Prop. of household members with fair SAH (ref: Prop. of household members with high SAH)	-0.0872	-0.0959	-0.0940	-0.106*
	(0.0602)	(0.0596)	(0.0601)	(0.0591)
Prop. of household members with low SAH	0.210	0.123	0.112	0.0927
	(0.138)	(0.136)	(0.130)	(0.131)
Past illness event	0.00143		0.000816	
	(0.00109)		(0.00103)	
Chronic illness	-0.0513**			
	(0.0222)			
Outpatient care use		0.0239		
		(0.0330)		
Inpatient care use		-0.0773	-0.0875	
		(0.0850)	(0.0818)	
Duration of hospitalization	-0.00166			
	(0.00458)			
Outpatient healthcare expenditure				0.000246**
				(9.59e-05)
Inpatient healthcare expenditure				-2.26e-05

VARIABLES	Model 1	Model 2	Model 3	Model 4
				(2.36e-05)
Trust in modern care - Neither agree nor disagree (ref: Disagree)	-0.0267	-0.0337	-0.0304	-0.0261
	(0.0836)	(0.0822)	(0.0832)	(0.0821)
Trust in modern care - Agree	0.0867	0.0820	0.0827	0.0837
	(0.0717)	(0.0729)	(0.0735)	(0.0728)
Formal and informal access to credit and social networks				
Member of *Iqqub*	0.0532	0.0614	0.0620	0.0689
	(0.0777)	(0.0764)	(0.0767)	(0.0760)
Member of credit & savings association	-0.00685	-0.0108	-0.0112	-0.00981
	(0.0690)	(0.0688)	(0.0686)	(0.0703)
Member of religious group	0.0277	0.0315	0.0336	0.0305
	(0.0404)	(0.0394)	(0.0392)	(0.0395)
Participate in *Wonfel* or *Debo*	0.0339	0.0335	0.0352	0.0370
	(0.0428)	(0.0427)	(0.0423)	(0.0434)
Savings in bank account	0.0503	0.0443	0.0464	0.0414
	(0.0621)	(0.0620)	(0.0624)	(0.0630)
Outstanding loan	0.0761	0.0794	0.0805	0.0811
	(0.0497)	(0.0492)	(0.0493)	(0.0498)
Someone to rely on	-0.0291	-0.0345	-0.0334	-0.0343
	(0.0287)	(0.0285)	(0.0286)	(0.0285)
Official position held	0.119***	0.117***	0.117***	0.110***
	(0.0432)	(0.0435)	(0.0433)	(0.0421)
Supply side characteristics				
Travel time to health center	0.000807*	0.000857**	0.000847**	0.000834*
	(0.000418)	(0.000421)	(0.000422)	(0.000428)
Travel time to public hospital	0.000167	0.000164	0.000165	0.000207
	(0.000421)	(0.000426)	(0.000423)	(0.000423)
Completed first degree (12+3)	-0.105	-0.105	-0.104	-0.110

VARIABLES	Model 1	Model 2	Model 3	Model 4
	(0.0749)	(0.0743)	(0.0752)	(0.0749)
Received on the job training	-0.0374	-0.0485	-0.0474	-0.0470
	(0.0925)	(0.0948)	(0.0944)	(0.0949)
Availability of blood testing equipment	0.304***	0.304***	0.307***	0.310***
	(0.0604)	(0.0608)	(0.0604)	(0.0607)
Availability of urine testing equipment	-0.120	-0.126	-0.128	-0.115
	(0.114)	(0.116)	(0.116)	(0.116)
Waiting time to get patient card	-0.00212	-0.00238	-0.00236	-0.00252
	(0.00468)	(0.00465)	(0.00467)	(0.00466)
Waiting time to see a medical professional	-0.00449**	-0.00462**	-0.00463**	-0.00445**
	(0.00214)	(0.00215)	(0.00215)	(0.00215)
Perceived quality of care	0.214***	0.212***	0.211***	0.209***
	(0.0633)	(0.0632)	(0.0636)	(0.0638)
Community characteristics				
Region – Tigray (ref: SNNPR)	0.00736	0.00647	0.00245	0.00716
	(0.126)	(0.125)	(0.126)	(0.126)
Region – Amhara	0.215*	0.211*	0.206*	0.213*
	(0.118)	(0.117)	(0.118)	(0.119)
Region – Oromiya	0.237**	0.238**	0.236*	0.246**
	(0.119)	(0.119)	(0.121)	(0.121)
Observations	1,180	1,182	1,182	1,182
Pseudo R-squared	0.1900	0.1884	0.1885	0.1925
Log pseudo likelihood	-643.878	-646.332	-646.297	-643.083

Notes: Outcome variable is CBHI enrolment status in 2012 and all explanatory variables are at their baseline (2011) values; clustered standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A1

Description of explanatory variables

Variable	Description
Socioeconomic status	
Consumption quintiles	Classification of households based on monthly household consumption expenditure (in Birr) excluding health care spending (poorest quintile, 2nd quintile, 3rd quintile, 4th quintile, richest quintile)
HH head education	Education level of the household head (no education at all, informal education, primary or above)
Participated in PSNP	Household participated or still participates in productive safety net programme, PSNP (1=yes)
Demographic traits	
Male headed hhd.	Made headed household (1= yes)
Age of hhd. Head	Age of the household head (in completed years)
Household size	Number of household members
Prop. of children aged under 6	Proportion of children in the household aged under 6 years old
Prop. of male aged 6 to 15	Proportion of males in the household aged between 6 to 15 years old
Prop. of female aged 6 to 15	Proportion of females in the household aged between 6 to 15 years old
Prop. of male aged 16 to 64	Proportion of males in the household aged between 16 to 64 years old
Prop. of female aged 16 to 64	Proportion of females in the household aged between 16 to 64 years old
Prop. of elderly aged above 64	Proportion of elderly in the household aged above 64 years old
HH head religion	The religion of the household head (Orthodox Christian, Protestant, Muslim, other religion or no religion)
Health status and health care use	
Prop. of hhd members with good SAH	Proportion of household members aged 6 years and above with good self-assessed health status (based on the perception of the respondent to the household survey)
Prop. of hhd members with fair SAH	Proportion of household members aged 6 years and above with fair self-assessed health status (based on the perception of the respondent to the household survey)
Prop. of hhd members with low SAH	Proportion of household members aged 6 years and above with low self-assessed health status (based on

Variable	Description
	the perception of the respondent to the household survey)
Past illness event	Household, total number of days ill past two months
Chronic disease	Number of household members aged 6 and above years who suffered from a chronic disease (symptoms have been going on for more than 30 days)
Outpatient care use	At least one household member used outpatient care in the past two months (1= yes)
Inpatient care use	At least one household member used inpatient care in the past twelve months (1= yes)
Duration of hospitalization cases	Household, number of days spent in health facility in the past twelve months
Outpatient healthcare expenditure	Household's health care spending (in Birr) for outpatient care in the past two months
Inpatient healthcare expenditure	Household's health care spending (in Birr) for inpatient care in the past twelve months
Trust in modern heath care	Modern health care providers can be trusted more than traditional healers (perception of the respondent to the household survey) (agree, neither agree nor disagree, disagree)
Formal and informal access to credit and networks	
Member of *Iqqub*	At least one household member participates in an *Iqqub* association (1=yes)
Member of credit & savings ass.	At least one household member participates in credit & savings association (1=yes)
Member of religious group	At least one household member participates in a religious group (1=yes)
Participates in *Wonfel* or *Debo*	At least one household member participates in *Wonfel* or *Debo* (1=yes)
Savings in bank account	At least one household member has savings in a bank account (1=yes)
Outstanding loan	The household has an outstanding loan (1=yes)
Someone to rely on	The household has someone to rely on at times of shock (1=yes)
Official position held	At least one household member held or still holds official, kebele, or traditional position (1=yes)
Supply side characteristics	
Travel time to health center	Travel time to the nearest health center (in minutes)
Travel time to public hospital	Travel time to the nearest public hospital (in minutes)
Completed first degree (12+3)	Head of the facility has at least completed a first medical degree (12+3) (1=yes)

Variable	Description
Received on the job training	Head of the facility received on the job training (1=yes)
Availability of blood testing equipment	The health facility has blood testing equipment (1=yes)
Availability of urine testing equipment	The health facility has urine testing equipment (1=yes)
Waiting time to get patient card	Average waiting time (in minutes) before getting patient card (based on the response of five patients interviewed after getting medical treatment from the health facility)
Waiting time to see a medical professional	Average waiting time (in minutes) to see a medical professional (Doctor, nurse) (based on the response of five patients interviewed after getting medical treatment from the health facility)
Perceived quality of care	Perception of the respondent (typically the head of the facility) about the overall quality of health care services provided by the facility (1=yes, the facility provides quality services)
Community characteristics	
Region	The region where the household is located (Tigray Region, Amhara Region, Oromiya Region, Southern Nations Nationalities and People's Region /SNNPR)
Travel time to all weather road	Travel time to the nearest all weather road (in minutes)
Travel time to asphalt road	Travel time to the nearest asphalt road (in minutes)
Access to improved water	The household has access to improved water from pipe to home, public tap, borehole in residence, public borehole or protected spring (1=yes)
Access to modern light	The household has access to light from electricity, generator or solar (1=yes)
Radio use	The household members use radio at least sometimes in a year (1=yes)
Mobile phone use	The household members use mobile at least sometimes in a year (1=yes)

Table A2

Characteristics of target households per pilot region, 2011

Variable	Tigray		Amhara		Oromiya		SNNPR	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Socioeconomic status								
Poorest consumption quintile	0.18	0.38	0.20	0.40	0.04	0.20	0.38	0.49
2nd consumption quintile	0.24	0.43	0.24	0.42	0.11	0.31	0.22	0.41
3rd consumption quintile	0.23	0.42	0.22	0.41	0.22	0.41	0.13	0.34
4th consumption quintile	0.17	0.37	0.22	0.42	0.28	0.45	0.13	0.34
Richest consumption quintile	0.19	0.39	0.13	0.33	0.35	0.48	0.13	0.34
HH head education- No education at all	0.56	0.50	0.46	0.50	0.45	0.50	0.38	0.49
HH head education - Informal	0.09	0.29	0.23	0.42	0.17	0.37	0.04	0.19
HH head education - Primary or above	0.35	0.48	0.31	0.46	0.39	0.49	0.58	0.49
Participates in PSNP	0.58	0.49	0.06	0.24	0.05	0.22	0.16	0.37
Demographic traits								
Male headed HH	0.77	0.42	0.92	0.28	0.90	0.30	0.88	0.33
Age of HH head	47.89	14.81	47.00	13.59	45.38	13.31	47.07	14.02
Household size	5.32	2.47	5.67	2.08	5.97	2.08	6.51	2.25
Prop. of children aged under 6	0.15	0.16	0.14	0.14	0.15	0.16	0.12	0.14
Prop. of male aged 6 to 15	0.14	0.15	0.14	0.14	0.18	0.15	0.16	0.15
Prop. of female aged 6 to 15	0.14	0.15	0.15	0.15	0.15	0.14	0.16	0.15
Prop. of male aged 16 to 64	0.23	0.19	0.26	0.14	0.24	0.14	0.27	0.15
Prop. of female aged 16 to 64	0.26	0.18	0.26	0.14	0.24	0.13	0.26	0.14
Prop. of elderly aged above 64	0.08	0.21	0.05	0.14	0.04	0.13	0.04	0.11
HH head religion - Orthodox Christian	0.98	0.13	0.66	0.47	0.65	0.48	0.13	0.33
HH head religion – Protestant	0.00	0.00	0.00	0.00	0.02	0.15	0.76	0.43

Variable	Tigray		Amhara		Oromiya		SNNPR	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
HH head religion – Muslim	0.02	0.13	0.34	0.47	0.33	0.47	0.03	0.18
HH head religion - Other religion or no religion	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.27
Health status and health care use								
Prop. of household members with good SAH	0.66	0.43	0.67	0.42	0.94	0.13	0.79	0.28
Prop. of household members with fair SAH	0.28	0.41	0.27	0.39	0.05	0.12	0.13	0.25
Prop. of household members with low SAH	0.06	0.19	0.05	0.16	0.01	0.06	0.07	0.14
Past illness event	6.59	13.49	8.43	13.89	5.40	10.92	15.51	22.82
Chronic illness	0.25	0.57	0.34	0.89	0.09	0.36	0.55	1.14
Outpatient care use	0.29	0.45	0.38	0.49	0.28	0.45	0.58	0.50
Inpatient care use	0.03	0.17	0.03	0.16	0.03	0.17	0.04	0.19
Duration of hospitalization cases	1.08	2.28	0.18	1.34	0.33	2.47	0.41	2.70
Outpatient healthcare expenditure	27.51	147.23	71.36	352.08	47.10	139.07	83.88	163.37
Inpatient healthcare expenditure	21.81	172.22	25.51	205.63	70.81	731.16	50.86	396.92
Trust in modern care – Disagree	0.11	0.31	0.04	0.19	0.04	0.20	0.04	0.19
Trust in modern care - Neither agree nor disagree	0.07	0.26	0.03	0.16	0.04	0.20	0.07	0.25
Trust in modern care – Agree	0.82	0.38	0.93	0.25	0.92	0.28	0.90	0.31
Formal and informal access to credit and networks								
Member of *Iqqub*	0.04	0.20	0.08	0.26	0.09	0.29	0.06	0.24
Member of credit & savings ass.	0.02	0.15	0.26	0.44	0.10	0.31	0.10	0.31
Member of religious group	0.75	0.43	0.58	0.50	0.42	0.49	0.63	0.48
Participate in *Wonfel* or *Debo*	0.39	0.49	0.79	0.41	0.49	0.50	0.10	0.29
Savings in bank account	0.14	0.35	0.26	0.44	0.08	0.28	0.06	0.24

Variable	Tigray		Amhara		Oromiya		SNNPR	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Outstanding loan	0.39	0.49	0.32	0.47	0.17	0.38	0.40	0.49
Someone to rely on	0.36	0.48	0.51	0.50	0.47	0.50	0.20	0.40
Official position held	0.19	0.39	0.37	0.48	0.21	0.41	0.16	0.36
Supply side characteristics								
Travel time to health center	74.57	54.90	74.09	50.42	67.62	35.32	49.48	29.45
Travel time to public hospital	151.94	94.98	123.68	60.99	98.38	50.15	82.50	51.34
Completed first degree (12+3)	0.72	0.45	0.39	0.49	0.56	0.50	0.17	0.37
Received on the job training	0.56	0.50	0.72	0.45	1.00	0.00	1.00	0.00
Availability of blood testing equipment	0.78	0.42	1.00	0.00	0.67	0.47	0.89	0.31
Availability of urine testing equipment	0.78	0.42	0.83	0.37	1.00	0.00	1.00	0.00
Waiting time to get patient card	19.58	13.83	13.19	13.38	7.03	3.82	12.16	9.72
Waiting time to see a medical professional	57.78	35.38	38.83	25.22	15.37	8.56	25.74	11.57
Perceived quality of care	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Community characteristics								
Travel time to all weather road	26.84	28.11	48.69	46.77	43.31	34.34	30.68	36.62
Travel time to asphalt road	79.22	66.02	72.57	54.19	90.54	50.11	74.75	64.29
Access to improved water	0.84	0.37	0.80	0.40	0.62	0.49	0.75	0.43
Access to modern light	0.07	0.25	0.03	0.17	0.04	0.19	0.05	0.21
Radio use	0.47	0.50	0.86	0.35	0.72	0.45	0.82	0.39
Mobile phone use	0.33	0.47	0.52	0.50	0.38	0.49	0.37	0.48
Observations	306		306		306		306	

Table A3: Single most important reason for (not) enrolling and intention to alter insurance status

Insured households (N = 489)	N (%)	Uninsured households (N = 735)	N (%)
Reasons for enrolment (percent of insured households)		Reasons for not enrolling in CBHI (percent of those non-insured but eligible households)	
Illness and/or injury occurs frequently in the household	39 (8.1)	Illness and injury does not occur frequently in the household	31 (5.2)
Pregnant women in the household need health care services	34 (7.0)	The registration fee and premiums are not affordable	203 (34.2)
Child/children in the households need health care services	37 (7.7)	Want to wait in order to confirm the benefit	117 (19.7)
To finance health care expenses	152 (31.5)	Lack of awareness about the scheme	133 (22.4)
The household is exempt from registration fee and premium	22 (4.6)	Shortage of money	32 (5.4)
Premium is low compared to user fee	120 (24.8)	Limited availability of health services	13 (2.2)
Pressure from CBHI officials	50 (10.4)	Quality of health care services is low	17 (2.9)
Other reasons	29 (6.0)	Other reasons	47 (7.9)
Insured households who plan to renew their CBHI membership	466 (96.1)	Uninsured households who plan to enroll in the future	404 (57.1)

Manufacturing Industry Competitiveness Platform of Amhara Rgion

Kassie Dessie

Acronyms

ADLI	Agriculture Development led Industrialization
ADSWE	Amhara Design, supervision works enterprise
FDI	Foreign Direct investment
GTP	Gross Transformation Plan
IMP	Industry Master Plan
IZ	Industry Zone
RGDP	Regional gross Domestic Product
R&D	Research and Development
MSE	Micro and small enterprise

Executive Summary

The Amhara National Regional state, despite endowed with an immense natural resources especially water, fertile land, flora and fauna and huge human resources. Though there are no industrial development observed that support the agriculture development, the establishment of dams, irrigation networks and ongoing projects and the establishment of Industrial Zones (IZs) in the region could be considered as well functioning practices of the industrialization policy of the country. The huge investments on infrastructural development and the establishment of irrigation networks envisaged to enhance agricultural output has not yet contributed to socio-economic dynamics to large

The development agenda of the region is then giving proper attention to and frame the manufacturing. The main objective of this study is to assess the existing industries based on the firm/ industry level characteristics which eventually show competitiveness platform of the manufacturing industry of the region

The study used quite an extensive questionnaire, yielding detailed information on a wide range of variables including company background, firm performance, labour force structure, input and market structures, sales, production and constraints. Moreover, primary data at the regional level were collected by check lists and discussion with key stakeholders for industrial sectors. The result was reported based on descriptive statistics and use Porter model to analyze and show competitive platform.

The existing Industrial Structure concentrates on simple agro-processing activities (flour mill, edible oil production, leather tanning) and production of basic consumer goods (beer, soft drinks, textiles and garment). Currently Manufacturing sector is at its infant stage and are at lower levels of the value chain. The region lacks basic capital goods industries. According to BOFED, the share of Manufacturing in the RGDP is only 5.8% in 1993 EC but the share of medium and large in only 0.84% in the same year.

Industries like Textiles industries, Leather and tanning, are prioritized partly based on their labor intensiveness. However, Employment per establishment is high in manufacturing of wearing and apparel and Manufacturing of food. The Input structure of these industries signifies that about 67% of firms' input values are imported. Manufacturing of soft drink is the dominant importing industry accounting 25% from the total imported input.

As number of people argue that number of employee, size of the firm and the existence of foreign ownership, and efficiency of the firm determines the probability to export or on exporting behavior.

one firm in Manufacture of food NEC, two firms Malt liquors and two firms in manufacture of wearing apparel, two firms in Tanning and dressing of leather are major exporting industries in the region most industries are uncompetitive even in the domestic market. Most of the firm, about 52% of the firm, does not vertically integrate in the distribution of their product in which most of them relay on the market for the distribution resulting high transaction cost and limit the competitiveness. Most firms do not have a clear strategy to take the advantage of opportunities revealed. 27% of the firm distributes the product through contractual arrangements with vertical restriction of sale territory and retailing price. While 73% relay on the market for the distribution of their product. None of the firm undertake vertical merger since its establishment.

The competitive platform of the region depends on negative factors that can affect the competitiveness of industrial sector adversely which lies on the lacks specific technical knowledge and consequently lead to low labour productivity. There are also negative factors in the infrastructure side which pervasive constraint for the sub-sector's competitiveness. Infrastructure includes power supply, telecommunication service, roads, domestic quality of packaging and air transport (ITC, 2009). As a landlocked country manufacturing industries need to uses the port of another country for export and import which leads rise in the cost of production. This in turn limits the firms' competitiveness in both domestic and international market. Low purchasing power and domestic firms face stiff competition with imported product than domestic competitors

On the contrary, existence of large domestic potential market, the government role provision of basic infrastructure such as power, railways, roads, telecommunications, etc. influence the factor conditions of the sector while the regulatory environment and other industrial and economic policies reflect in the sophistication of domestic demand as well as in the strategies adopted by various firms. African growth and opportunity act (AGOA) is "one of the preferential market accesses which opens the opportunity for industrial product export to the United States duty and quota free

The industrial sector can be considered as one of the main driving forces for economic growth, and the essential source for future employment opportunities. Establish a strong foundation for a well-advanced and developed industrial sector to absorb local demand, attract investments and allow local products for export. The Bureau of Industry and urban development is seeking to draw a plan of action for the development of a well-organized and highly competitive industrial sector, through providing the appropriate environment and framework (legal, infrastructure, technology). The proper implementation and successful accomplishment of such plan will only be realized through the full cooperation of both private and public sectors. The following managerial and technical institutions/including their branches/ has been tapped in implementing the industrial master plan:- Bahir Dar University Engineering College, Amhara Research Institution, Technique Education and Vocational Training Schools, Construction College, Medium and Large enterprises, Regional government Bureau of urban and Industry, Bureau of Agriculture, Municipality, Trade and transport Bureau, Quality and Standards Authority, Banks, Sectoral and Chamber of Commerce are main stockholders to industrial sector.

1. Introduction

The Amhara National Regional state is one of the largest regions in Ethiopia in terms geographical area and population size. It is endowed with an immense natural resources especially water, fertile land, flora and fauna and huge human resources.

The vast majority of its people depend on agriculture for their livelihood and employment. The living standards of these people are extremely low even as compared with other region of the country. To change this, the regional government has been designed and implemented various policy and legal framework. Among these identifying, integrating and implementing the region's available resources (Labour and Land) to improve the economy has been given prior attention. In line with this, equally importance is given to the contribution of private investment in the process of economic development. Mainly the intended goal is possible through investment and economic growth and transformation of the economy. The vision of the government is well established as it is stated in ADLI and reflected in Industrial Development Strategy which later adopted in the region. The policy principles is ADLI, private initiative, export-led, labor-intensive, FDI role, whole-society mobilization which eventually reflects targeted sectors like textile & garment; meat, leather & leather products; agro-processing; construction, MSEs.

There are no comprehensive industrial and urban policies in the Amhara region. The industrial policy and strategy of the region is taken directly from the country. The region is one of the least developed regions in terms of industry development as evidenced by many indicators but it is believed that its present economic performance is far from reflecting its actual potential. The establishment of dams, irrigation networks and ongoing project and the establishment of Industrial Zones (IZs) of the region could be considered as well functioning practices of the industrialization policy of the country. Though there are infrastructural investments and the established irrigation networks have increased the agricultural output of the region, has not yet contributed to socio-economic dynamics to larger population.

The strategic location of the region in terms of access to Sudan and Djibouti ports could give it comparative advantage to exploit East Asian and South Asian countries. The international cargo airport, which is new of its kind in the region, is yet another facility that provides logistical advantages to the companies operating in Amhara. In terms of conventional factor endowments (i.e. land and labour), the region is quite rich. However the qualified labour force endowment is rather poor. The water resource potential of the region both in terms of irrigation (700,000 hectares) and power generation is very enormous.

Lake Tana and others which happens to be the largest fresh water lake in the country provide as significant fishing potential.

Although no detail geological study in the region, but available literature reveals that there exists metallic minerals such as gold, associated minerals such as Sulphides, non-metallic minerals such as Kaolin, Silica, Limestone, Gypsum, Coal, Opal and Bentonite. There are also signs that suggest the possible existence of oil gas.

If we use strategically, these resources might serve as a sound socio-economic development for the region. The Industrialization agenda in the region might exclusively combine these resource endowments that could benefit the region in particular the nation in general. Hence, the development agenda of the region relay on the role of the manufacturing sector in the realizing its vision of becoming middle income countries. Hence this paper tries to address the competitive platform of the region.

2. Objective

The basis of the study is region's wishes to its industrialization in order to generate industrial employment, incomes, and raise general living standards through linkages with other sectors, particularly agriculture and services. Therefore, the main objective of this paper is to assess the existing industries at firm/ industry level, and show the competitiveness platform of the manufacturing sector.

3. Methodology

3.1 Data collection instruments and methods

The survey used quite an extensive questionnaire, yielding detailed information on a wide range of variables including company background, firm performance, labour force structure, input structures, market structures, sales, constraints and production. A significant attempt to rectify all sector of medium and large manufacturing activities are included in the survey. Based on "Federal micro and small enterprise development agency establishment council of ministers regulation No 201/201" definition, all medium and large manufacturing industry whose capital excluding building capital exceeds 1.5million Birr and

able to employee more than 30 people including the owner and family were covered in the study. However, data specific to manufacturing firms are scarce.

Structured questionnaires were developed and used to collect relevant data all over the region. Moreover, check lists were used to discuss with key stakeholders. The primary data were supplement by data from secondary sources.

3.2 Data Entry and cleaning

Collected data were entered into computer by experienced data entry clerk. Following data entry operation, the data has further reviewed for data consistency, missing data. The final stage of data processing was producing statistical data that are presented in the report.

3.3 Data Analysis

The result was reported based on descriptive statistics. The study uses Porter model to analyze how national / regional conditions influence competitiveness. Hence firms/industry (sector)/cluster using industrial standard international classification are the domains of estimation and statistical inference. The model has been utilized on the following issues

3.4 Problem faced during field data collection and entry

A number of problems were faced during the actual work of this study. First, most firm owner does not live outside the region to give relevant information. Moreover the some owners were reluctant to give information even the willing firms does not fill quantitative data. Secondly it was difficult to find the respondents in operations terminating firms.

4. Assessment of Existing Manufacturing Industries

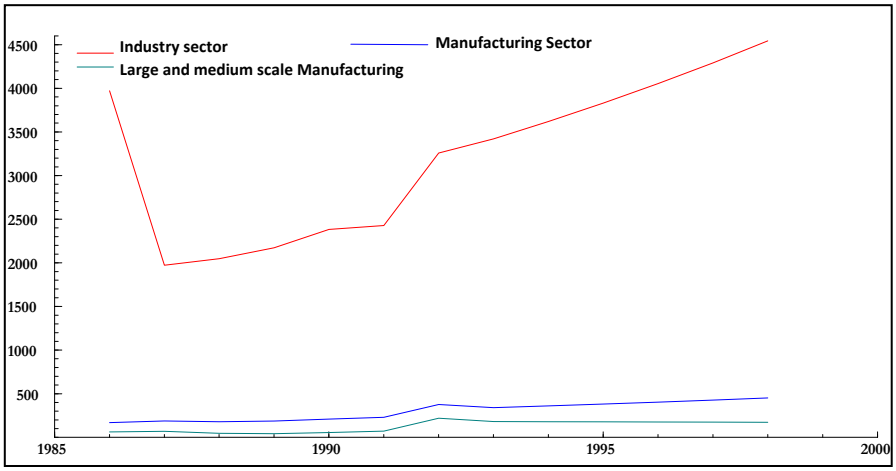
4.1 Sectoral Share in Regional Economy

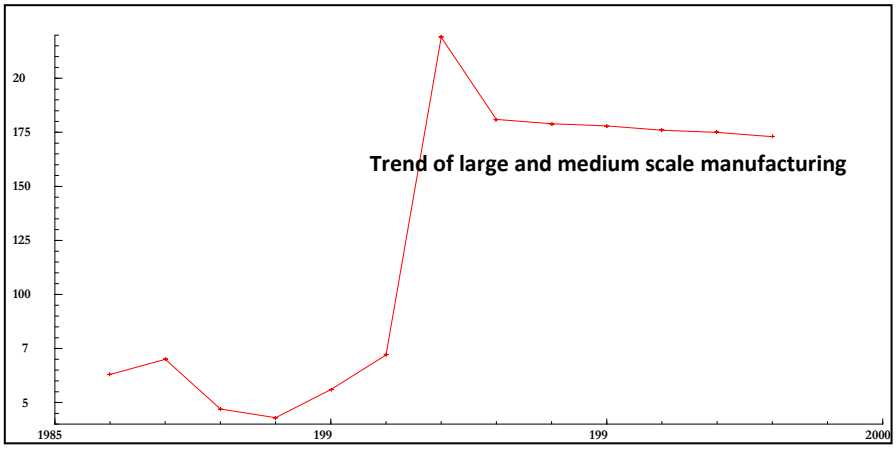
Major contribution of the industrial section as source of employeement, technology transfer, support the agriculture sector, foreign exchange, create favarable condition for urban developnment is recognized in the GTP. The share of Manuacturing in the RGDP is only 5.8% in 1993 E.C but the share of

medium and large manufacturing is very low and is about 0.84% in the same year. As it is clearly indicated in the firgure below, medium and Large scale manufacturing have low value in the RGDP over the specified three years period. (BOPED, 2005)

The trend of the value medium and large scale manufacturing

Figure 1: Value of RGDP estimated and forcased by BOFED





Similarly, the share of value of agriculture in the regional Gross Domestic Product is more than 80 percent**.**

4.2 Industrial Structure

As early 1987 EC including small and microenterprise about 4293 private industries were established in the region. Among them 96% were in food industries. 88% of the total industries are grid mills which are categorized under service sector than manufacturing. Later the industry was kickoff to single processing industries i.e. 2 leather and tannery, 77 small scale metal industries were available. But industries that could create massive linkage are still missing in the region. (Trade and industry sector 1988-92 evaluation, 1992).

Table 1: The relative share of industries

Industrial Group	Surveyed	Amhara region, CSA	National	%
Manufacturing of food and Beverages	28	38	381	9.97
Manufacturing of textile	4	5	41	12.2
Tanning and dressing of leather	3	7	78	9.78
Manufacturing of wood and products of wood except furniture	0	2	41	4.88
Manufacturing of paper and paper products and printing	2	2	117	1.71
Other non metallic mineral products	4	33	287	11.02
Manufacturing of plastic products	3			
Manufacturing of fabrication metals products, machineries and equipment	6	4	57	7.02
Manufacturing of motor vehicles and travellers and semi travellers	0	2	42	4.75
Manufacturing of furniture	2	48	229	18.79
Total	52	141	1273	

Source: BoFED, 2011 and survey data

As it is indicated in the table below regional industry is largely limited to simple agro-processing activities (flour mill, edible oil production, and leather tanning) and production of basic consumer goods (beer, footwear, textiles and garments). Currently Manufacturing sector is at its infant stage. These agro-based industries at the lower levels of the value chain in the region, which impedes socio-economic growth. In terms of numbers only 9.7% of the

manufacturing industries are Located in the region this figure could higher if we include non-functional industries. Hence, this level of analysis includes only functional industries during the data collection and those industries that could proved data collection process.

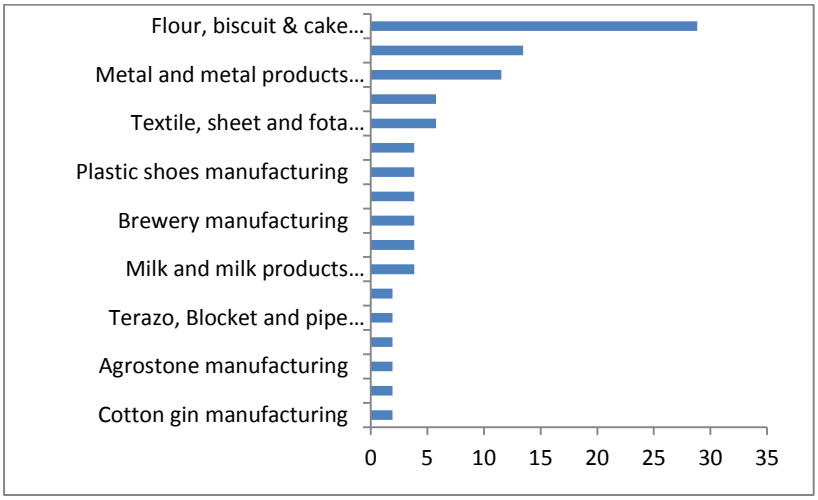
Table 2: List of Capital goods industry in the country but does not exist in the region

Industrial group	Surveyed	Amhara region, CSA	National levels
Manufacturing of Tobacco products	0	0	1
Manufacturing of wearing apparel except fur apparel	0	0	32
Manufacturing of chemical and chemical products	0	0	64
Manufacturing of Rubber products	0	0	64
Manufacturing of Basic iron and steel	0	0	13
Manufacturing of machineries and equipments	0	0	5
Total	0	0	179

Source: BoFED, 2011

As it is obviously indicated in the graph below Manufacturing of flour mill is the dominating industry accounting 28 percent of the total industry followed by manufacturing of battled water and soft drinks and manufacturing of Metal and Metal products accounting 12 and 9 percent respectively.

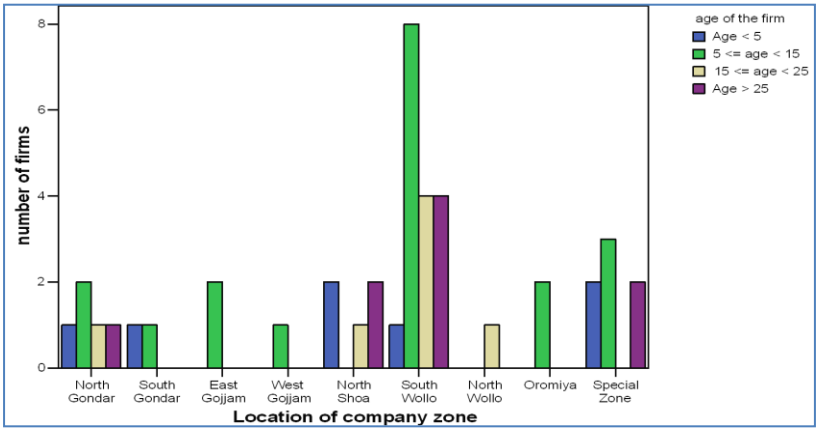
Figure 2: Percentage distribution of existing manufacturing industries



Source: Survey result

As one can observe from the graph below, in East Gojjam, West Gojjam and Oromyia Zones firms are established within fifteen years age. There are no new investments in North Wollo with fifteen years. So the Pattern of investment may depend on the private investor's interest. Promotional strategy and infrastructural development shall focus on Zonal distribution of firms.

Figure 3: Geographical distribution of firms in the region by age



With regards to the ownership of firms about 48 percent of firms are owned by individually but 35 percent of them are in the form of Share Company. 86 percent of firms are experienced for more than 5 years. See Table 3 below

Table 3: Firms characteristics

Form of ownership	Total	
	Count	%
Sole proprietorship	25	48.1
Partnership	7	13.5
Share Company	18	34.6
Cooperative	2	3.8
	N=52	
Age < 5	5	14
5 <= age < 15	16	46
15 <= age < 25	5	14
Age > 25	9	26
	N=35	
Semi processed goods (intermediate)	8	14
Finished Goods	43	78
Both semi processed and finished goods	4	9
	N=51	

Source: Survey result

4.3 Labor Productivity and Capital Intensity

Textiles, Leather tanning, Wearing apparel, and Footwear is prioritized partly for their labor intensiveness. However, employment per establishment is high in manufacturing of wearing apparel and Manufacturing of food (Table 7). Highly capital intensive industries are more likely evidence to be competitive given the markets play the central role of economic management, and also given that the government is aspiring to be a member of the WTO, the future trend would inevitably be shifting from labor- to capital-intensive manufacturing industries.

The survey result shows that the average wage of labor per year is estimated as 48 percent of total value of production which is quite high reflecting under estimating production and overestimating the expense due to fear of taxation.

4.4 Input and Market Structure

The proportion of inputs (RM and intermediate inputs) can also show as the degree of dependence of domestic firms on the international market. As indicated in Table 6, about 68 percent of firms in the region use imported input. Manufacturing of soft drink is the dominant importing industry accounting 17% from the total imported input. And see Table 6 and Annex 3 below.

Table 4: Percentage distribution of input importing firms

Industry	Imported inputs (%)
Bottled water, soft drinks and candy manufacturing	17.6
Flour, biscuit & cake manufacturing	14.7
Milk and milk products manufacturing	2.9
Meat and meat products manufacturing	5.9
Brewery manufacturing	5.9
Cotton gin manufacturing	
Textile, sheet and fota manufacturing	8.8
Finished leather manufacturing	8.8
Publishing and printing enterprise	5.9
Plastic shoes manufacturing	2.9
Metal and metal products manufacturing	11.8
Agro stone manufacturing	2.9
Concrete pole manufacturing	2.9
Terazo, Bricks and pipe manufacturing	
Manufacture of furniture	5.9
Manufacture of cement, lime and plaster	2.9

Source: Survey result

As it is indicated in Table 5 below, malt industry does not use imported input while soft drink, wood, paper, basic chemical and Metallurgy industries are import dependent industries.

Table 5: Import and export structure of firms

No	Type of industry	The share of imported input to the total input	The share of export to the total output
1	Meat and vegetable proc.	8.1	0.0
2	Animal oil & fats	0.05	10.2
3	Grain Mill	10.3	0
4	Malt	0	0
5	Brewery	9.4	0.1
6	Textiles	11.3	7.0
7	Wearing apparel (leather)	6.8	3.5
8	Tannery	14.2	79.4
9	Footwear	30.6	0.4
10	Wearing apparel (cloths)	6.2	0
11	Glass & G. products	0.7	0
12	Structural clay	0.3	0
13	Cement & lime	0.9	0
14	Furniture	19.8	0
15	Fiber products	39.5	0
16	Soft Drinks & mineral	2.1	0.02
17	Wood	20.2	0
18	Paper	53.8	0
19	Basic chemicals	6.3	0
20	Pharmaceuticals	5.9	0
21	Soap, cosmetics & detergents	52.7	0
22	Basic iron & steel	6.7	0
23	Structural metal	38.9	0
24	Other fabric. Metal	48.4	0
25	Food & beverage Machinery	22.1	0

Source; own computation from Kibrom and Alem linkage analysis of 2001

A number of people argue that exporting behavior of firms can be determined by number of employee, size of the firm and the existence of foreign ownership, and efficiency of the firm. As it is indicated in Table

6, Regardless of these factors, *Brewery manufacturing*, *Textile, sheet and fota manufacturing* and *finished leather manufacturing* industries were the major exporting firms in the region.

Leather and leather product manufacturing industries export 79 percent of the total volume of products but brewery industries were not competitive in the international market.

In the analysis of competitiveness a value greater than one without considering investment cost indicates that the particular sectors are financially unprofitable at domestic market implying that these sectors sell their products below their unit costs of production. These sectors are not financially profitable even with the current tariff barriers impose on imported products. As per computations made, most of the major industrial groups of Manufacturing of Cotton gin and textile activities were unable to cover all costs of production during the last five year on average, including depreciation cost of capital. Surprisingly, the majority of these belong to sub-sectors in which one would expect the region to have a clear competitive advantage in the global market. However, Manufacturing of Bottled water, soft drinks industries are competitive as the product is a global brand and the product use semi processed intermediate imported inputs.

All except Manufacturing of Bottled water, soft drinks and Manufacturing of Metals, machinery and equipment were not domestically competitive without considering the cost of capital. The significance of capacity underutilization, contraband and under-invoicing, and backward technology could be the reason behind such a situation. The main reason are summarized in Table 8.

Table 6: Competitiveness Indicators by Industrial Classifications

no	Industrial Group	No of establishment	Total employment per estab.	Permanent employment per estab.	Average sales per year per estab. in birr	avg_wage per year estab. in birr	avg_cost_RM per year per estab. in birr	WOOC	WOCC
1	Manufacturing of food and beverage	28	175	134	56,331,602	1,909,406	49,904,241	1.1	0.6
1.1	Manufacturing of bottled water, soft drinks and candy	7	153	114	797,652	1,369,995	11,404,676	0.1	0.03
1.2	Manufacturing of flour, biscuit & cake	15	27	20	4,354,563	43,996	2,207,656	1.9	0.33
1.3	Manufacturing of milk and milk products	2	20	12	70,720				
1.4	Manufacturing of meat and meat products	2	173	70	19,635,406	2,564,370	15,907,383	1.1	1.06
1.5	Manufacturing of brewery	2	505	458	256,799,671	5,568,670	220,001,487	1.1	0.62
2	Manufacturing of cotton gin and textile	4	573	510	19,058,349	338,865	5,714,996	44.9	1.46
2.1	Manufacturing of cotton ginning	1	83	58	3,284,715	677,730	170,336	3.9	
2.2	Manufacturing of textile, sheet and towels	3	1,062	962	34,831,983		11,259,655		1.46
3	Manufacturing of leather and leather products	3	97	63	18,983,495	6,057,588	35,789,819	0.6	0.18
4	Manufacturing of paper, paper and printing products	2	72	15	4,839,200	609,030	25,906,302		0.74
5	Manufacturing of plastic and plastic products	3	66	19	1,760,000	108,600	1,397,000	1.2	0.58
6	Manufacturing of metals, machinery and equipment	6	63	60	8,070,077	371,227	9,893,775	0.8	0.75
7	Manufacturing of others metallic and non-metallic products	4	230	106	102,000		5,761,947		
8	Manufacturing of furniture	2	112	52	6,642,832	925,405	5,090,008		

Source: survey result

Note: Wooc: competitiveness without considering all costs of capital.

Wocc: competitiveness considering depreciation but without taking into consideration the opportunity cost of capital

estab.=establishment

About 42.9, and 14.3 percent of the firm indicate that capacity underutilization and dependency on import were the main reason respectively. However out-dated technology, contrabanding and lack of standardized product were also the critical problem of the manufacturing industries in the region to participate and compete in the international markets accounting 28.6 percent each.

4.4 Firms Level Strategy

The survey result shows that 48% of the firm does vertically integrate in the distribution of their product in which most of them relay on the market for the distribution resulting high transaction cost and limit the competitiveness. Firm's do not have strategy weak to take the advantage the opportunities.

Table 7: Upward and Downward Firm Integration

Industrial Group	produce and supply input by the firm				Firm participate in distributing the product by themselves to the final consumer?			
	Yes(N=16)		No(N=29)		Yes(N=23)		No(N=22)	
	#	%	#	%	#	%	#	%
Bottled water, soft drinks and candy manufacturing	2	12.5	4	13.8	4	17.4	2	9.1
Flour, biscuit & cake manufacturing	3	18.8	9	31.0	7	30.4	5	22.7
Milk and milk products manufacturing	2	12.5			2	8.7		
Meat and meat products manufacturing	1	6.3	1	3.4	1	4.3	1	4.5
Brewery manufacturing			2	6.9	1	4.3	1	4.5
Cotton gin manufacturing			1	3.4	1	4.3		
Textile, sheet and towels manufacturing	1	6.3	2	6.9			2	9.1
Finished leather manufacturing	1	6.3	2	6.9	1	4.3	2	9.1
Publishing and printing enterprise	1	6.3	1	3.4			2	9.1
Plastic shoes manufacturing			2	6.9			2	9.1
Plastic and plastic pipe manufacturing			1	3.4			1	4.5
Metal and metal products manufacturing	3	18.8	1	3.4	4	17.4	1	4.5
Agro stone manufacturing	1	6.3					1	4.5
Concrete pole manufacturing			1	3.4			1	4.5
Terazo, Bricks and pipe manufacturing			1	3.4	1	4.3		
Manufacture of furniture	1	6.3			1	4.3		
Manufacture of cement ,lime and plaster			1	3.4			1	4.5

Source: survey result

As it is indicated in the table, 36 percent of firm is vertically integrated to produce its input while 51 percent of the firms distribute its own output for final users.

As it is noted in the Table 8 below, 27% Non- integrated firm distribute its product through contractual arrangements with vertical restriction of sale territory and retailing price while 73% relay on the market for the distribution of their product.

Table 8: Non downward integrated firm ways of distribution of its product

Industrial group	Through anonymous distributors/ buyers N=14	Through contract arrangement with vertical restriction N=7
Bottled water, soft drinks and candy manufacturing	14.3	
Flour, biscuit & cake manufacturing	14.3	42.9
Meat and meat products manufacturing		14.3
Brewery manufacturing		14.3
Textile, sheet and fota manufacturing	7.1	
Finished leather manufacturing	14.3	
Publishing and printing enterprise	7.1	14.3
Plastic shoes manufacturing	14.3	
Plastic and plastic pipe manufacturing	7.1	
Metal and metal products manufacturing	7.1	
Agro stone manufacturing		14.3
Concrete pole manufacturing	7.1	
Manufacture of cement ,lime and plaster	7.1	

4.6 Problems and challenges of firms in the region

85% of the firm could not consider policy as the basic problem but still 15% perceive policy as a problem. The most significant problems mentioned by the respondent were management, access to finance, infrastructure, competition and market related problems most.

Table 9: Lists of identified problems

Problems	#	%
1=Management problem	8	36.4
2=Access to finance/	10	45.5
3=Infrastructural pr	9	40.9
4=Government policy	5	22.7
5=Environmental fact	3	13.6
6=Multiple taxes and	6	27.3
7=Access to modern t	6	27.3
8=Unfair competition	7	31.8
9=Marketing related	9	40.9
10=Non-availability	9	40.9

5. Competitiveness Platform of the Regions Manufacturing Industries

5.1 Defining and Measuring Competitiveness

Competitiveness is a multidimensional concept. It can be looked at from three different levels: country/regional, industry, and firm level (Murths, 1998). Hence, the measure of Competitiveness can be analyzed from three aggregation levels with different indicators of competitiveness for each aggregation level (i.e .the firm, the industry or one sector of it, and the region/nation). Firm level analysis of competitiveness is there for focus on profitability, costs, productivity and market share. Similarly, value chain analysis which is narrower than a sector traces business strategy, industrial development, and globalization (Humphrey & Schmitz, 2000; Porter, 1998).

A sophisticated consumer in local markets is one of the best indicators for predicting whether developing- country firms—are likely to participate in the value-added functions of production. ‘‘If you can sell shoes to an Italian woman, you can sell shoes anywhere in the world.

(a) Vertical linkages: Individual firms form vertical linkages with their buyers and suppliers. In this respect vertical linkages can facilitate MSE growth and other input supplier of agriculture and foster firm growth through expanded business opportunities and provide opportunities for learning and

innovation (Berry, Rodriguez, & Sandee, 2002)—or when input suppliers offer training or information related to the use of improved technologies.

(b) Horizontal linkages help the firm to have better negotiation position with buyers or suppliers, access market information or services, or lobby for political or regulatory changes (Goldmark & Barber, 2005; Steen, Magnani, & Goldmark, 2005).

5.2 Drivers of Competitiveness

5.2.1 Supranational and macro level drivers

These set of drivers are usually beyond the scope or control of a particular region and are influenced by multilateral organizations, multilateral cooperation, foreign governments (donor countries), international finance flows and trade blocs as well as government policy instruments, policy environment and policy institutions in the country. A very good example in this context is that the existence or non-existence of an industrial policy with clearly defined strategy and an action plan; the availability of foreign exchange; interest rates; inflation rate and the exchange rates of the country's currency. In addition, the existence of macro institutions especially educational, training and research and development institutions could also impact positively or negatively on competitiveness. Hence, assessing whether the region is favorably or unfavorably position in relation to the above drivers.

5.2.2 Micro/industry – level drivers

These drivers are sector specific factors (industry level) industry policies, industry level strategic cooperation or competition and institution of relevance to the development of the industry. If there is competition among firms of a particular industry, there is always a desire to improve production process, the quality of the product and marketing. Such competition could be disastrous or healthy, depending on the environment. However, it is likely that in such situations, inefficiencies could be eliminated and firms that are efficient could be encouraged to develop, thereby allowing stronger firms to compete with other similar firms at the regional, national or international levels.

5.2.3 Meso/cluster – level drivers

These drivers are relevant to a related set of industries. They are industries operating within the same vertical production chain or closely related to ensure significant spill over or economies of scale. They include various inputs that are available to local industries, the nature of demand, the level of competition, cooperation among institutions, the ability to share resources and activities, as well as policies and institutions at the, meso or cluster levels. In any economy, where there is superior access to land, capital, infrastructure, technologies, including knowledge resources and support services, there is a definite source of advantage to industrial enterprises and they will become competitive.

Cluster development also encourages firms to become competitive. Cluster development involves a high level of interaction among industrial enterprises. Resources are shared among the same or related industries in a cluster; industries tend to join forces to develop human resources, procure raw materials, conduct market research, etc.

5.2.4 Firm level drivers

Firms should “be able to exploit locational advantage and overcome locational disadvantages. The region/Countries can create a favorable environment for industries to thrive. The existence of macro-economic stability and favorable factor conditions are meaningless if industries are unable to take advantage of such favorable conditions to improve production in terms of quality and quantity and compete at the regional and country, as well as at the international level where appropriate. Enright indicates that, “the strategies and organisation of firms can be heavily influenced by the corporate governance system present in the economy. Such system creates numerous influences on the behaviour of firms and managers. Governance systems that reward innovations and improvements rather than special relationships and non-transparency are those most likely to send signals to firms, consistent with fostering competitive industries and high development potential”.

5.3 Competitiveness Platform of Regional Manufacturing Industries

As indicated earlier, a survey of about 52 industrial enterprises, representing various industrial sub-sectors was conducted to determine Amhara's platform for industrial competitiveness that is addressed in how Porter's framework and the various drivers mentioned above are applied to Amhara region?

Given manufacturing industries are core industrial sub-sectors that produce for both regional and national markets and, in a few cases, the international markets, industry could be the main driving force for economic growth, development and poverty eradication. How could we expand and make them globally competitive as global market is a highly competitive, therefore, regional industries' competitiveness depend on whether such industries have a competitive advantage in production, in productivity growth, especially in terms of the cost of production, the quality of the products, prices and efficiency, in particular, the timely delivery of quality goods at competitive prices. Industries, per se, would not be able to achieve competitive success. The national/regional environment in which they operate has a major role in ensuring competitive success. Hence, as stated earlier part of this chapter, the regional competitiveness determinants which individually or collectively create a platform for the country's industries to compete locally and externally, could be discussed below.

5.3.1 Factor conditions

It is argued that a region's endowment with factor conditions is one of the most significant indicators of the region's ability to compete. However, the existence of these factors does not necessarily result in competitive advantage. The important determinant is the nature of the factors. In his analysis, Porter makes a distinction between basic and advanced factors and generalised and specialized factors. Basic factors require relatively modest investments. These include human resources, both skilled and semi-skilled and natural resources. Advanced factors enable the region to produce distinctive products and involve high investments in production technology, for example. The very existence of such factors would enable requisite capabilities in an industry or industries to be creative and innovative rather than continue with the usual routine of the production functions. They help to improve on design, production technologies

and production processes to achieve competitiveness. Therefore, a sustained investment in human resource could contribute enormously to strengthening industry's capacity to innovate. On the other hand, the specialised factors are considered to be highly specific skills and knowledge resources. The generalised factors refer to those factors that can be employed in a wide range of industries, for example the existence of a core of well-motivated engineers in information technology or engineering design.

5.3.1.1 Human resources

It is now generally acknowledged that the availability of qualified and skilled human resources is a prerequisite for development, industrialisation, technology acquisition and use, as well as industrial competitiveness. Recognises that a healthy and well-educated population is a necessary condition for development and it is also a central objective of development. In recent years, the Government of has invested heavily education. As it is common with other African countries, human resource for the transformation of the economy is a major constraint. There are shortages of professionals, skilled and semi-skilled human resource including entrepreneurial skills. The argument here is that the shortage of skilled human resources should be addressed by all sectors providing goods and services to the nation - "All sectors should ensure that the skills provided by the sectors match national economic needs". The question remains whether the educational system is functional and geared towards production of goods and services.

The Government is the country's biggest employer and the most important provider of jobs at a regular basis. The formal sector of economy provides jobs for about 13 percent of the labour force at the professional, managerial, vocational and technical levels. Although, there are many educated employees in the industry, they lack the requisite technical and vocational skills, simply because the training offered by the education and skills development institutes are not in direct response to the demands of industry.

Consequently, many employers in industry provide on the job-training to ensure adequate skilled labour. However, there is still the problem of inadequacy of skilled labour. Poor technical skills have been attributed to inadequate capacity of the training institutes.

The inadequacy of technical and professional capabilities in industry is a direct result of the education system, which is based on set curricula and the absence of a policy framework for industrial skills development. Ironically, given the level of development in the country and the structure and status of industrial development, not all qualified university graduates or skilled labour could find employment.

Productivity is a function of skill, infrastructure, work structure, equipment machinery, etc. As indicated earlier, it is the value added produced by each unit of labour. The unit labour cost is fair.

Industrial enterprises, in particular, the large and medium enterprises should be encouraged to integrate comprehensive on the job training as an integral element of their human resource development programmes. Sustainable industrial development and competitiveness presupposes the availability of a critical mass of a highly skilled labour force with adequate supply of professional, technological and managerial competencies to further nurture innovation and creativity. The qualification base of the labour force should be improved and the country should be in a position to provide at all times a higher level of skills for industry.

5.3.1.2 Knowledge resources

Knowledge is regarded as a major engine for growth and development and it is considered a major factor of production. Knowledge resources are mainly in the universities, research institutions, in market research, technological processes, the availability of knowledge intensive services such as business services, consulting services, financial services, Internet services, etc. The global economy is, therefore, a knowledge driven economy in which knowledge is important for improved economic performance of countries in their industrialisation process or in the transformation of their economies.

The information revolution has created a borderless global economy. The increasing and continuing change in information and communication technology has facilitated the dissemination of knowledge, and R&D results. The increasing stock of scientific and technological research has widened the stock of knowledge, including scientific and technological knowledge. The flow

of information, creativity, R&D, the increasing use of computer aided design and computer aided manufacturing (CAD/CAM) techniques, as well as knowledge embodied in an experienced work force are all critical elements for competitiveness. However, the impact of knowledge resources on competitiveness depends on a number of factors. Knowledge resources also include, a country's, or more specifically, a firm's ability to source, master, absorb and utilize knowledge to drive industrialisation, transform production processes, as well as to improve the quality and quantity of products. Porter and others believe and, it is becoming quite apparent, that countries that create a business climate that promotes research and development (R&D) and countries that invest heavily on information technology, offer tremendous opportunities for industrial development and competitiveness. Whereas, countries that stifle investments in research and development and information technology tend to perform poorly.

As opposed developed countries and other developing countries, knowledge is limited in Ethiopia. The cost of identifying and utilising technologies including developing new technologies could frustrate industrial development. The Government must, therefore, support institutions that are involved in R&D, in particular, those involved in product and process technologies.

5.3.1.3 Capital resources

A major constraint to industrial development is limited access to capital resources. Although it is possible to attracted increasing amounts of foreign direct investments in recent years, access to capital is a serious problem. The region is highly dependent on donor funds and foreign capital and federal transfer for its development programme it is highly limited to finance from own source. The experience of recent resource mobilization for Abay Renaissance dam could be replicated for major projects.

Of course there are innovative changes in the financial and banking system and by structural reforms to improve the enabling environment. As a result, the private sector has responded positively and, in recent years, both domestic capitals have increased quite substantially. The government banks are expected to play a key role in financing domestic investments and in supporting private sector led development.

Physical resources

Physical resources cover not only the availability of land, agricultural and mineral resource but also the quality of such resources, ownership, proximity to industrial sites and markets and the cost of such resources. All these elements could have a positive or negative impact on competitiveness.

Most of the enterprises surveyed consider physical resources as a determinant for competitiveness with water, land and the availability of semi processed materials. Resource based industries such as the food processing industries, the wood and wood products industries and non-metallic minerals industries are positive about physical resources and the implications for production, sustainability and competitiveness.

i. Land

In the earlier times, land was commonly cited as a major constraint to economic development. For industrial purpose, land is still an issue as the controversy between industrial land and the protection of land right. Access to land for industrial purpose may be prohibited to ensure tenure security. Amhara is well endowed with arable land for agricultural products, which are raw materials for industry. The effective use of land is constrained by the absence of other types of infrastructure and services such as water, road transport and electricity/energy.

ii. Mineral resources

Amhara is endowed with metallic and non-metallic mineral resources. Production of minerals such as gold, iron, ore, copper, cobalt, columbium, tin, tantalum and tungsten, Other industrial minerals such as gypsum, clay, talc, lime, salt and vermiculite were used as raw materials for a number of non-metallic industries in the region.

iii. Water

Water is essential for industrial production, however, our region more concerned about water for irrigation than for industry. The infrastructure for water for industry is poorly developed, especially in the woreda and kebele areas. There are also problems of maintenance and supply in the urban areas. It

is proposed to integrate the needs of industry in the region's overall water supply plans.

iv. Raw materials

Raw materials availability, in particular, access to such raw materials is important for industrial competitiveness. Agricultural raw materials are the main ingredients for an agricultural led industrialization. The region is rich in agricultural resources such as sesame, cotton, maize, fisheries and livestock.

v. Tourism resources

There are a number of sites that are attractive to tourists. Lake Tana is the largest lake in Ethiopia and the source of the blue Nile.

Infrastructure

A major factor for industrial competitiveness is infrastructure. For industry to succeed, infrastructure should be adequate and reliable. In common with other African countries, the quality and access to infrastructure should be improved.

i. Transport and communication

Ethiopia recognises the significance of road transport and has adopted a policy that puts emphasis on development and sustainability of road networks throughout the country. Amhara region is served by approximately 1542 km Asphalt roads that connect region with other regions of the countries,6075 km gravel roads. It is essential for bulk transportation of agriculture and industrial products. No rain transport in the region. Water transport is only in Bahir Dar to Gonder/Gorgora and Zege/ a priority area of concentration.

Air transport, on the other hand, is much more efficient. The region has on international cargo airport. Cargo handling and cold storage facilities provide refrigerating services for exports and imports.

ii. Electricity and energy

It is estimated that some 89 percent of urban households have access to electricity and only 3 percent of rural households have access to grid electricity. The supply and cost of energy is critical to industrialisation and

competitiveness. Electric energy supply is inadequate and unreliable for industry.

iii. Water infrastructure

Water for industry is limited. The country is endowed with fresh water resources but at the same time there are areas prone to drought or floods with devastating effects on production. The Government and other authorities are effectively implementing water resource protection strategies and watershed management measures. The main challenge however, is how to integrate water resource management with other economic activities, in particular, with industry. The urban areas have higher water coverage than the rural areas 90 percent of the total population compared to 60 percent in the rural areas.

5.3.2 Demand conditions

5.3.2.1 Size of domestic demand

The population of Amhara is estimated at around 18.2 million with approximately 42.6 percent between the ages of 0 – 14 years. The number of people between the ages of 15 – 64 years is estimated at about 9.7 million representing approximately 53.4 percent of the population. With an annual population growth rate of nearly2.6 percent, Ethiopia has one of the fastest growing populations in the world. In terms of numbers therefore, there is a potential market for industrial products.

Demand is mainly influenced by private consumption expenditure. A substantial part of consumer spending is for basic items such as food, water, fuel, electrical energy and clothing. It should be noted that about 87 of the population live in the rural areas and mostly engaged in agriculture.

The domestic market is penetrated with all sorts of imported industrial products including processed food, textiles and clothing, leather goods and footwear, wood and wood products, paper and paper products, engineering goods, basic metals etc. Some domestic firms produce for both the domestic market and for exports. They are being encouraged by the Government to improve both the quantity and quality of their products.

5.3.2.2 Nature of demand

The food processing industrial sub-sector is one of the most promising sub-sectors in Ethiopia. Growth of import of processed food has increased quite substantially. There has been a corresponding increase in processed food. The demand for fresh food is, however, very high. Consumers also utilise large quantities of imported food (oil). However, they are not particularly worried about the quality or packaging of processed foods of domestic origin. It should be noted that if consumers demonstrate unsophisticated preferences, industries would not be under pressure to improve the quality of products. This could suppress the growth of the food processing industry and its ability to compete. The packaging industry will also be in a similar situation. The textiles, clothing and footwear industrial is also growing. The domestic market for textiles, clothing and footwear is not sophisticated. However, as the economy expands, it is likely that there will be a strong growth in the domestic demand for textiles, clothing and footwear. Producers will continue to produce the same quality of products for an unsophisticated market unless they are under pressure to improve the quality of the products being exported.

Government demand and consumption patterns can also contribute to the expansion of production or the growth of a particular enterprise. A very high proportion of Government expenditure is channeled into social services such as education and health, as well as public administration and defense.

5.3.3 Related and supporting industries

In either early or late industrialized countries Europe, the United States of America and in the newly industrialized countries of Asia, industrial enterprises tend to share and coordinate activities. There is a strong presence of related industries and other support services all of which influence industrial growth and the way goods are produced. The existence of such industries in a particular country or region encourages competition among industries and there is always a desire to innovate, improve production technology and production methods, as well as the quality of the products. It is also very likely that inefficiencies could be eliminated and the growth of lead firms within an industrial sub-sector could emerge. These related and supporting industries, includes supporting institutions such as those providing financial services,

market information, etc. could have a positive impact on the growth and performance of industries. Supporting industries coordinate and share activities in the value chain, thereby, strengthening a country's industrial enterprises to compete in certain lines of production and actually achieve national, as well as global competitiveness.

On the demand side, manufacturing industries have large local potential market measured by the size of the people. In the growing demand a smaller portion supplied by local production while a significant part of local demand is met through imported items. The major problem in this respect is people purchasing power is low and demand is not sophisticated to force the firms to upgrade their product,

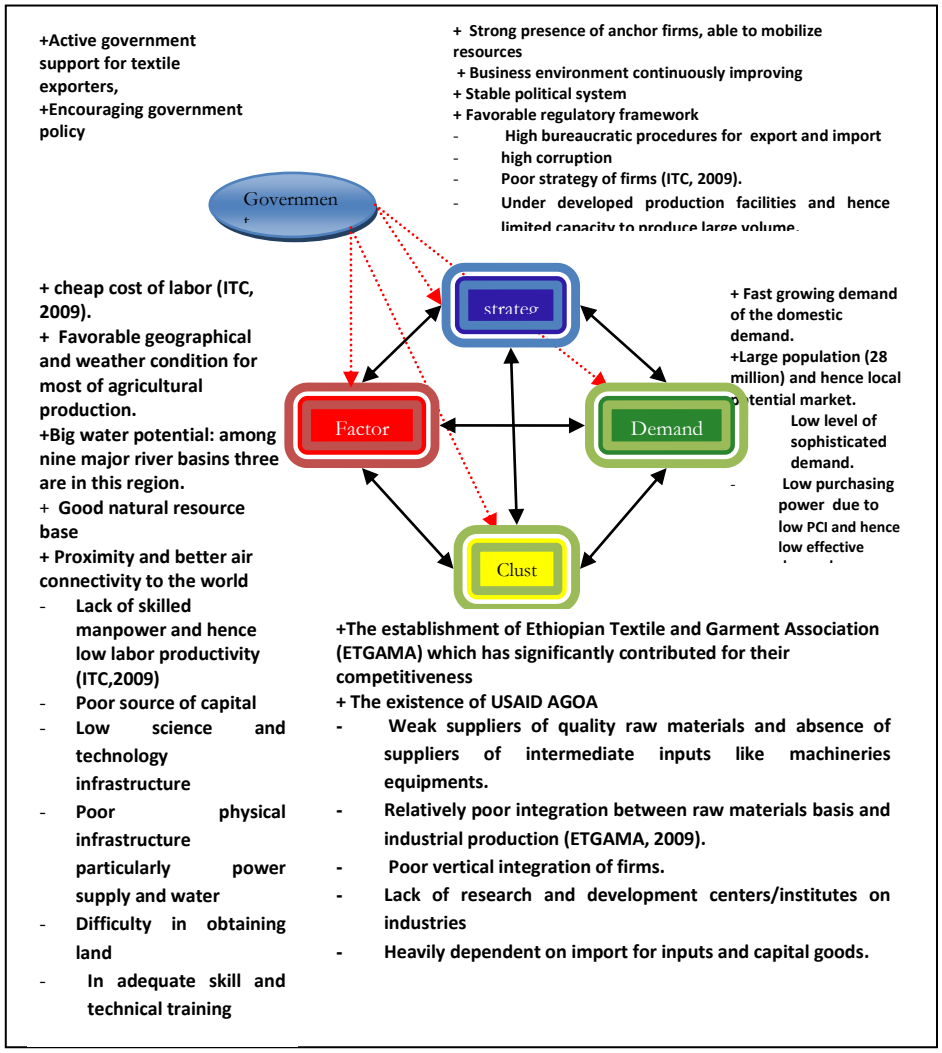
Most firms do not have a well established strategy that shows their future directions. Even those firms that have strategy lack customer orientation and are not effectively operational. Most of the industries do not have input and product marketing strategy, selling their goods to anonymous buyers and buying input from anonymous supplier which increase transportation cost. The existence of Firm rivalry in each industry is an indicator of the nature and intensity of competition (Porter, 2009). Such competition compelled firms to upgrade their products and to innovate. However, domestic firms face stiff competition from imported product than domestic competitors.

Government plays a key role in determining the competitiveness. The government's educational effort policies and the provision of basic infrastructure such as power, railways, roads, telecommunications, etc. influence positively the factor conditions of the sector while the regulatory environment and other industrial and economic policies reflect in the sophistication of domestic demand as well as in the strategies adopted by various firms.

African growth and opportunity act (AGOA) is "one of the preferential market accesses which opens the opportunity for industrial product export to the United States duty and quota free until 2015" (GAO, 2009, p.25)..This opportunity creates cost competitive advantage for textile sub-sector by offering free tariff and quota market access. Moreover, the other external

opportunity for industrial sector particularly textile sub-sector is "change in production trend globally" (Dicken, 2008) which creates a competitive advantage for Ethiopia as producers in the industrialized countries face a fierce competition from labor intensive technologies of LDCs.

Figure 4: Amhara Region's Industry Competitive Diamond



On the contrary, there are negative factors that can affect the competitiveness of industrial sector adversely. The existing cheap labor force lacks specific technical knowledge. This consequently would bring the low labour productivity. According to MEASURE: Ethiopia (2009), the region's productivity

per employee per year is birr 9646 which is very low compared with Ethiopia's annual productivity per employee which is birr 81,626. Furthermore, electricity and water interruption is another pervasive constraint for the sub-sector's competitiveness. Ethiopia is landlocked country in which the industrial sector are forced to uses the port of another country for export and import that leads a rise in the cost of production. This in turn limits the firms' competitiveness in both domestic and international market. Here, the recent effort of the government on investing intensively for construction of roads, telecommunications and Hydro Electric Power reduces the extent of the problem.

6. Supporting Institutions

The industrial sector can be considered as one of the main driving forces for economic growth, and the essential source for future employment opportunities. A strong foundation, a well-advanced and developed industrial sector can absorb local demand, attract investments and allow local products for export. The Bureau of Industry and urban development is seeking to draw a plan of action for the development of a well-organized and highly competitive industrial sector, through providing the appropriate environment and framework (legal, infrastructure, technology). The proper implementation and successful accomplishment of such plan will only be realized through the full cooperation of both private and public sectors. The public will be responsible for providing and ensuring a safe business environment through the creation of proper institutions, while the role of the private sector (including chamber of commerce) will be to initiate private investment and to mobilize resources into the economy.

The industrial development on the other hand involves many government institutions. Hence, stakeholders meeting were held widely in the region at each office. The following managerial and technical institutions/including their branches/ will be tapped in implementing the industrial development in the region; Universities in the region (eg. Bahir Dar University Engineering College), Amhara Research Institution, Technique Education and Vocational Training Schools, Regional government, Bureau of Industry and urban Development, Bureau of Agriculture, Bureau of Trade and transport, Quality and Standards

Authority, Banks, insurances Medium and Large enterprises, Chamber of Commerce are main once.

Table 10: Supporting Institution to the Development of Industrial Sector

No.	Stakeholder	Expectations in the perspective of industries	problems if not implemented the expectations
1	Regional Government	Conducive political, economic and social governance	Barrier to investors Reduce purchasing power
2	Trade and Transport	Cheap transport facilities and competitive environment	Industries could not be competitive in both locally and internationally
3	Micro and small scale enterprise Agency	Strengthen and promote micro and small scale to medium size firms, Industrial extension	Lack of industrial linkage and base of expansion
4	Agriculture Bureau	• Cheap and quality raw material supply for agro processing industries • Marketing of industrial produce • Cheap food supply to industrial and urban residence	• Agro processing industries stop due to lack of inputs • Rising unemployment
5	Research Institute	Production and productivity increase Increased technologies of production	Backward techniques of production and less productivity which later has an negative impact input supply
6	Infrastructure service provision (public utility)	Cheap and uninterrupted supply of energy, water and telecommunication service	Barrier to investment as well as reduce industrialization
7	Education Sector	Technical and skilled supply of manpower	High cost of production and poor quality production
8	Mining	Cheap and adequate supply of mining alternative energy source as well as minerals	Weak capacity and high cost of production
9	Trade and Sectoral association	Support to participate in fairs and exhibitions supported by various institutions, value Chain approach.	Weak linkage and less competitiveness
10	Financial Institutions	Credit at low and no interest rate Sufficient foreign exchange	Less access to finance for long term that hinders the capacity expansion.
11	Universities	Industry specific Knowledge creation through university-Industry R & D support	Weak linkage

6.1 Views of Stakeholder

6.1.1 Bureau of Industry and Urban Development

Given the wide-ranging efforts currently underway, study focuses on three key areas where the Bureau of Industry can play a catalytic and facilitating role for the private sector. These roles are concentrated in establishing Policy and competition framework, support and control, industry and urban development strategy.

There has been frequent structural change in this sector that leads a loss of its institutional memory and less attention has been given until GTP periods in both organizational and finance. Beside instability in structure, the industrial sector is under narrow work process together with very big task of the region (Urban development). Moreover, the organization support is not decentralized to woreda and kebele level which limit itself to main zonal town. Lack of clear organizational structure obviously leads to an ineffective speeding up industrialization in the region. There is investment advisory board which creates a forum for the private sectors. More importantly the Bureau is not organized in required skill and limited budget to support the industrial sectors. Service sector are not well organized to support the industrial sectors. Given these limitation, the private sector are benefited from support of training and working capitals.

The Bureau of industry and urban development should provide policy direction and guidance for industrial development. In this respect, BIUD should be in a position to provide industrial and technological information to the private sector. The Bureau's capacity for industrial and technological information is extremely weak. It relies on other institutions, e.g. the CSA for most of its information.

6.1.2 Research Institutes

In the region there are no industrial research institutions. Agricultural research is undertaken by the ARARI with the focus of immediate consumption for food security, export based crops and industrial inputs for agro-processing industries particularly cotton, sesame and selit. For pulp industries forestry research and

small scale medicinal plants, ARARI, is a government organization to undertake 90 percent of its focus in adoption than invention. The Institute's main function is to conduct research for product development and process technology for agriculture industry. It conducts raw materials research and provides support in identifying and developing appropriate technologies for agricultural operators. There is no new technological invention that has been branded by ARARI. On the other hand there is no patent protection in agricultural research outputs. For improved varieties the researchers send to national variety release committee for recognition. The major problem of the institute is not supporting agro-processing industries.

The Ethiopian Economic associations (EEA), also conducts research and critical analysis on economic issues including industry related issues that could impact on policy formulation, policy implementation, monitoring and evaluation.

Manufacturers Association and trade-sectoral association are the main source of research and market information as well as industrial and technological information. More importantly firm level research are also very important which currently non existence. CSA is responsible for statistical system and its coordination. It conducts a wide variety of surveys to collect process and disseminate industrial and related statistics. In recent years, it has been providing information and data on medium and large manufacturing industries but the statistical capacity is not adequate which needs to be integrated with the regions. Moreover the Authority has to be strengthened for more advanced statistical research of relevance to industrial competitiveness.
The potential scope for industrial and technological information has increased with the widespread use of information and communication technology. It is now easier to source R&D information from around the world than it was in the 1980s. Industrial enterprises could source the Internet and access global markets for knowledge assets. However, the institutional infrastructures and arrangements for industrial and technological information are weak.

6.1.3 Financial Institutions

There are seventeen banks in Ethiopia. In terms of ownership, three are public; fourteen are private and one is cooperative bank. Among these banks more than twelve banks operates in Amhara region.

Public Banks

Export based companies, manufacturing industries; agriculture sectors (agro processing) are given priority by the financial sector to access finance. Expansion of branches to many part of the region is to deliver services at door of the customer which creates excess capacity providing services with high technologies that enable them core banking(one line access) an smart banking (one customer at one shop). However, deposit and lending rate are lower or higher as these are instruments to stabilize the macroeconomic. The major strategy of the sector for competition could be considered as a right direction for the private sectors access to finance. Telecommunication and speed of internet are the major problem in the banking industry so to say but the private sector is not coming as visionary to access finance.

Private Banks

Similarly private banks, like Wogagen Bank, have 5 years strategy at corporate level. Providing credit to government prioritized industries such as manufacturing, export and agriculture. Private Banks like government banks renders quality and standard service using latest technology like mobile banking, computer and ATM and core banking. Each bank in the country is linked with its branch.

Private Banks are not active in medium /long-term loans mainly limited capital and limited information on the project and the borrower is not substantial enough to enable them to make a clear judgment on the feasibility/profitability/risk to finance them so that they have to minimize the lending risk by avoiding long-term commitments. Mid/long term loans are, however, crucial for manufacturing industries growth. Therefore, the public banks (Commercial Bank of Ethiopia, Development Bank of Ethiopia and Construction and Business Bank) are engaged in mid/long term loans. Banking Association was established in 2001 and all banks are member of the association.

The critical problem in the financial sector is lack of huge financial credit scheme for manufacturing sectors request high finance which needs government support especially for those that graduate from Small and micro scale to medium scale should be supported by government.

6.1.4 Higher Institutions

Bahir Dar University, Gondar University, Markos University, Debre Brihan University, Debretabor University and Dessie-Combolcha University are considered as the institutional infrastructure for knowledge in Amhara. The Universities aims to become a centre of academic excellence and provides teaching and academic research and other services of relevance to the development of the country's economy. Universities are supposed to conduct research studies in the past. Some of the research conducted could be regarded as supply driven. However, Universities - Industry linkage is extremely limited. The University has a pool of specialized talents, which could be effectively engaged in R&D, specifically for industry. There is a start in practicing this talent as it could be reflected by the school of computing and electrical engineering of Bahir Dar University in working with Ashraf for design and installation and cable test, with Tana Mobile and proved training and other consultancy service in the area. Moreover, IOTEX also working with Bahir Dar and Combolch textile industries.

6.1.5 Agriculture Bureau

Fertilizer, pesticides and improved techniques are some of the input that the sector required as an input from industries. Agriculture is still use backward Technology – oxen power, every steps and stages of agricultural activities uses manpower driven. So the agricultural practice has to be improved to increase productivity and production of the sector. The region is suitable for rain fed agriculture and Irrigation is the highest in Ethiopia about 900, 000ha and is expected to reach 1.2ml of ha in 10 years time. The region has three basins out of seven.

Farmer's behavior in product selection depends on the price of the product. A good example could be seen cotton and sesame products. Even if cotton has high demand the price is relatively very cheap compared with Sesame. As a result farmers shift from cotton to sesame in those products produced area. Agriculture is showing a good technological adoption in livestock though the sector is at low level and not utilizing well. Bureau of agriculture is implement cattle hormone synchronization and sex fixer techniques to improve the productivity of livestock. Fish industry, leather industry, fruit industries etc are

resource based industries mainly relied by the sector. Our region can be center of Excellency in agro processing industries. Starting from Gondar sesame and cotton are the major inputs for the industries.

Hence, in our region, we can produce every months of a year. A number of country produce few months of the year which enable as a window to inter in the international market in that period. Land consolidation is very important to solve the problem of input supply problem.

6.1.6 Construction Enterprise (construction sectors)

Manufacturing sector should outsmart to support the construction sectors as Construction sector use imported intermediate inputs like mixer, dam truck, agro stone table, welding machines, excavators. Welding and material testing centers which are very important in the construction sectors. Construction management is weak and also skilled labor is low. Competition in the construction sector is based on price. Recently, agro stone technology is new technology in the sector.

6.1.7 Ethiopian Conformity Assessment Enterprise (ECAE)

There are two branch of ECAE in Amhara region with the major responsibility of inspecting manufacturing products quality and services inspection. Of course there are forced and voluntary certification of which there are 102 compulsory inspections. This enterprise currently working with agro stone, Amhara pipe, Nile food oil factory, Guna spring water, Bahir Dar tannery, Bahir Dar Textile, Ashraf group, Ethio California food complex, Agunta honey products, Tana communications, and Elilta Flour factory. The Ethiopian National Standard Authority and the Ethiopian Science and Technology commission are also knowledge resource institutions of relevance to industry.

7. Conclusion and Policy Implication

The findings help to shed light on what the government and other supporting institutions (stakeholders) should do to industrial master plan.

First and foremost, manufacturing industries has a huge comparative advantage in basic factor endowments however it lacks advanced factors (for example, trade infrastructure, and capital resource and research and development institutions) which are indispensable to become competitive. Therefore, it is important for the regional government to push further the economic reforms for example, establishing industry specific training institutions in order to increase skilled labor and thereby to increase labor productivity.

Since the competitiveness of industries is highly constrained by lack of related and supporting industries, the government should attempt to boost industrial competitiveness by creating industry clusters toward the goals of value chain alignment. This in turn may ease the flow of raw materials and knowledge throughout the value chain.

There is lack of updated and unified industrial information in the region. The information developed by CSA and BOFED conflict each other in terms of number and other important issues of the industry. By creating the information database online with CSA data will help in policies' formulation and direction, as well as investment attraction. Industrial sector need simplified administrative procedures for registration, follow up and import licensing

Providing appropriate, effective, and geographically well-distributed industrial infrastructure would increase capacity of the region for competition. Infrastructure will include: Industrial zones, Industrial services, Strong human resource base, Supply industrial power, Supply good communication network
The industry suffers from the high cost of fixed assets and labor, leading to high prices of manufactured products. Nowadays, the challenge lies in reducing the costs of raw material, acquiring fixed assets (machinery, lands)

and cost of the labor force. In addition, reducing taxes by increasing exemptions

The industries faces financial obstacle for medium and long-term finance at lower costs. It is very important to increase the quality of manufactured products, which will help in the increase of our competitiveness in the world market. The application of international norms and standards will increase consumers' assurance and trust in the products. As a result, increasing the level of standards and issuing accredited certificates will be very important initiative for quality improvement. Human Resource Development will also be of high importance for the increase in productivity. A strong coordination should happen between the educational system and the sector's needs. Finally, Research and Development (R&D) is very important for the continuity of development and increase in production, hence a clear policy should be set to help developing such departments. The Technological structure is very weak, proven by the lack of R&D specifically private firms and the absence of national technological support. It is very important to establish a technological base in order to increase the competitive edge of manufactured products.

Due to the small size of the markets, it is important to take necessary measures for the protection and marketability of regional products, mainly through the implementation of anti-dumping measures.

The BOUID lacks human, financial and physical resources. Hence, it is very important to restructure the Bureau through providing essential human and physical resources as well as give a structure does not shed in.

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Determinants of Farmers' Preference for Adaptation Strategies to Climate Change: Evidence from Shoa Robit Area, North Shoa Zone of Amhara Region, Ethiopia

Negash Mulatu Debalke[1]

Abstract

Studies on climate change adaptation emphasize the importance of agro-ecology level researches for designing contextual policies and programs to climate change. This case-study, therefore, examined farmers' preference for climate change adaptation strategies and the factors deriving their preference. Thus, households' preference for five types of climate change adaptation strategies is identified and the determinants of the preference are analyzed using Rank-Ordered Logit Model. The result shows that multiple cropping is the most preferred adaptation strategy to climate change, while livestock production is the least. It also indicates that farmers' preference for the climate change adaptation strategies is influenced by different household and farm level characteristics, institutional factors and their perceptions to climate change. Thus, policies and programs with the aim of reducing climate change impacts through adaptation need to consider important roles of these factors. Although adaptation is one mechanism for reducing the negative impacts of climate change, barriers such as lack of information or knowledge, shortage of money, shortage of land, and unsuitability of land and poor potential for irrigation are challenging farmers to apply it. Therefore, strengthening efforts on these constraints is suggested to enhance farmers' adaptation capacity and thus adaptation to climate change.

Keywords: Climate change; Adaptation strategy; Preference; Rank-Ordered Logit Model

[1] Department of Economics, Ambo University; P.O.Box 19; Email: negash2011@yahoo.com;
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1. Background

The Ethiopian economy is dominated by subsistence agriculture which is characterized by small-scale farming and livestock husbandry. The sector employs 85 percent of the country's labor force and accounts for 60 percent of all exports. Approximately 80 percent of households live in rural areas and are dependent on local agriculture to meet their food needs (WFP, 2009). Recent report of MoFED showed that contribution of the sector to the overall economy is estimated to be 41.6 percent of the GDP (MoFED, 2010).

Agriculture plays a significant and decisive role in the social and economic development of the country. However, owing to natural and man-made causes the country has not properly benefited from its abundant natural resources conducive to agricultural development, and consequently failed to register the desired economic development that would enable its people pull out of the quagmires of poverty. The major impediments to agricultural development are lack of more business/market-oriented agriculture; adverse climatic changes; failure to use agricultural land according to appropriate land use management plan and resource base; limitation in information base; lack of supply and dissemination of appropriate technology; failure to integrate relevant activities; and lack of adequate implementation capacity (MoFED, 2006).

Ethiopia provides a good example of the influence of climate change on a developing country's economy. The country's economy is sensitive to climate variability, particularly variations in rainfall (USAID, 2007). In addition to the nature-dependent agricultural sector of the economy, the country's geographical location and topography in combination with low adaptive capacity can cause a high vulnerability to adverse impacts of climate change. Historically, Ethiopia has been suffering from natural catastrophes and is prone to extreme weather events. Rainfall in Ethiopia is highly erratic, and most rain falls intensively, often as convective storms, with very high rainfall intensity and extreme spatial and temporal variability.

2. Statement of the Problem

Some literatures indicated that Ethiopian farmers have already perceived the change in the climate and started taking different adaptation measures. It is also shown that the most preferred adaptation strategy by farmers is mostly applied in combination with other strategies and not alone (Hassan & Nhemachena, 2008). There are also farmers who are not taking adaptation measures (Deressa et al, 2009). Better understanding of farmers' preferences for adaptation strategies and the factors deriving their choices is important to inform policy for future adaptation of the agricultural sector to climate change (Nhemachena & Hassan, 2007). It is, therefore, vital to identify both the generic and climate-specific elements of farmers' adaptation behavior in order to help responses not only to the current but also to the future changes in climate and the possible impacts.

Furthermore, climate change adaptation policy and program design needs to consider the specific characteristics of every places and community. Deressa et al (2009) indicated that policies focusing on adaptation to climate change have to aim at providing adaptation technologies through agro-ecology based research. That means one-size-fits-all approaches are inappropriate given the differences in agro-ecologies and other factors among farmers in different parts or areas of the country. Beside this, the performance and application of different adaptation technologies or methods is location specific. Therefore, programs aimed at promoting adaptation technologies as part of a climate change adaptation strategy should take such important differences into account (Kato et al, 2009). As cited by Seo & Mendelsohn (2007), understanding farmers' adaptation behavior is an important goal in itself to assist planning by policymakers and private individuals (Smith, 1997; Smit et al., 2000; Smit and Pilifosova, 2001). Understanding adaptation is also highly important if one is interested in quantifying the impacts of climate change (Mendelsohn et al, 1994).

Additionally, farmers in different areas or agricultural zones would possibly have unequal propensity and capacity to climate change impacts and adaptation processes. IPPC (2007) showed that the capacity to adapt to climate change is unequal across and within societies. There are individuals and groups

within all societies that have insufficient capacity to adapt to climate change. Fussel (2007) also indicated that tailoring adaptation practices to specific societies or communities according to their context may make it possible to offset the adverse impacts of climate change. It is, therefore, argued that measures at local or micro level are important and feasible in the reduction of climate change impact on farmers in a certain area.

However, enough studies specific to each agro-ecological zones of Ethiopia have not been made though there are some efforts to do so. A notable study is the one carried out by Deressa et al (2009) in the Nile Basin of Ethiopia. Hence, there is a need for researches at household and/or farm level which are very essential to know micro level farm and farmers' characteristics and thus help design appropriate policies and strategies in that local context. Policies and strategies at micro and household level regarding climate change adaptation are equally important with the macroeconomic development policies and strategies.

Shoa Robit and the surrounding area in the North Shoa zone of the Amhara region is one of those areas which needs similar studies specifically to the area. Because the area has its own specific characteristics interms of exposition to climate change. Its agro ecology is kola, characterized by hot temperature and erratic rainfall. The area (especially the agriculture) is seriously and successively affected by changing climatic condition and its extremes. Besides, there are two rivers (Shoa Robit and Kobo River) in the area which were used for inappropriate purpose such as waste depository, and to feed animals, wash clothes and bodies for longer periods of times. As time goes on, the people started to use the rivers as recreation sites, to irrigate their crops and vegetables. Nowadays, the rivers are decreasing from time to time in amount and losing their capacity of serving the people which sometimes resulted in societal conflict and challenges.

3. Objectives of the Study

The main objective of this study is to identify and analyze factors that influence farmers' preference for a particular adaptation strategy to the impacts of climate change. It also aims to examine farmers' preferences for adaptation

strategies, barriers to adaptation and forward micro-level policy recommendations and intervention areas.

4. Materials and Methods

4.1 Sampling, Data Collection Method and Data

The study area is located in the North Shoa Zone of the Amhara National Regional State, around 230 KMs away from the capital city Addis Ababa. The data analyzed in this research is primary and collected in the production year 2009/2010. Among the 9 Kebeles[2] in the study area, seven of them (5 rural and 2 urban Kebeles) are selected by considering the different environmental and socioeconomic characteristics of the areas. Next, a total of 238 households were selected randomly from the selected Kebeles. However, the final dataset includes only responses of 225 households because 13 households did not give full and reliable responses and thus omitted. Data on farmers' preferences for climate change adaptation strategies, different attributes of the households, their farms, institutional factors and climate perception variables is collected using questionnaire and face-to-face interview with the household head.

4.2 Analytical Method

The analytical model used in this study is the Rank-Ordered Logit Model (ROL model hereafter). The ROL model takes advantage of the added information if respondents are asked to rank each alternative instead of the most preferred one. Beggs et al (1981) as cited by Fok et al (2010), and Padilla et al (2003) noted that more information per respondent and thus efficiency can be obtained in estimating parameters if we ask the farmers for a ranking of the whole set of alternatives available to them instead of listing their preferred choices. Therefore, the ROL model is used by taking only case-specific explanatory variables when all alternatives are fully ranked without ties[3].

It is assumed that based on their detail knowledge of their farming environment, agricultural problems and past experiences, farmers can state their preferences for the alternative adaptation strategies to climate change in

[2] "Kebele" is the smallest administrational unit of the government of Ethiopia.
[3] "Ties" are situations when the same ranks are given for different alternatives.

line with their benefit maximization objective under different constraints and resource endowments. Hence, the farmers are presented with five randomly permutated list of possible adaptation strategies to climate change and asked systematically to capture the order of their preferences for the whole set of alternative adaptation strategies (from the most preferred to the least preferred). This is done by treating the assignment of each rank for each alternative as a choice process itself and then separating rank orderings into series of choices.

The functional relationship is, therefore, as follows

$$ASP = f(H, F, I, C)$$

where, ASP refers to adaptation strategy preferences of farmers; H household characteristics; F farm characteristics; I institutional factors and C to climate perception variables.

The empirical literature review and the researcher's observation in the study area are used in selecting adaptation options. Therefore, the following five adaptation strategies are included in the analysis: multiple cropping, using different and new crop varieties or types; livestock production; soil conservation; irrigation development; and changing planting dates, early and late planting. The adaptation measures that farmers used may be profit-driven, rather than climate change driven. Despite such missing link, it is assumed that farmers' actions are driven by climatic factors.

Random utility framework is used to represent the preferences of the households. It is a widely applied framework to situations where individuals are asked to state and rank their preferences for alternative choice set where the utility of each alternative is a function of observed characteristics plus an additive error term (McFadden, 1974; Verbeek, 2008). The utilities for each farmer are given by U_{i1}. … U_{ij} where i represents the individual farmers and j refers to the adaptation method selected by them. It is assumed that the respondent makes a systematic choice and knows the benefits that could be derived from the adaptation strategies. The random utilities for individual i are, thus, expressed as

$$U_{ij} = V_{ij} + \varepsilon_{ij}$$

where V_{ij} is the systematic component and ε_{ij} is the random component of the utility. The systematic part of the utility is going to be determined by the observed individual characteristics, and is given as

$$V_{ij} = X_i' \beta_j$$

where, X_i is an m-dimensional vector of characteristics of individual i (that is case-specific explanatory variables) and β_j is an m-dimensional parameter vector specific to adaptation strategy j.

From the ranking of the farmers, the response of respondent i is denoted by the vector

$$y_i = (y_{i1} \ldots\ldots y_{ij})'$$

where y_{ij} now denotes the rank that individual i assigns to adaptation strategy j. An observed ranking by a respondent is an implication of the complete ordering of the underlying utilities that could be derived from the respective methods. A farmer prefers an adaptation method with a higher benefit over an option with a lower benefit. If we observe a full ranking r_i of the given alternatives, it implies that $U_{iri1} > U_{iri2} > \cdots > U_{iriJ}$. Assuming that all ε_{ij}'s are independent and follow type I extreme value distribution, we get the ROL model. Hence, the probability of observing a particular ranking r_i will be

$$\begin{aligned} Prob[r_i;\, \beta] &= Pr[\, U_{iri1} > U_{iri2} > \ldots > U_{iriJ}] \\ &= \prod_{j=1}^{J-1} \frac{exp(V_{irij})}{\sum_{l=j}^{J} exp(V_{iri1})} \end{aligned}$$

By extending the above logic to the ranking of the adaptation strategies by farmers, the probability of the rank-ordering is expressed as:

$$\begin{aligned} Prob\,(Y_1 = MC, Y_2 = LI, Y_3 = SC, Y_4 = IR|X\,) = Prob\,(Y_1 = MC|X) \times \\ Prob\,(Y_2 = LI|X, Y_1 = MC) \times \;\; Prob\,(Y_3 = SC|X, Y_1 = MC, Y_2 = LI) \times \\ Prob\,(Y_4 = IR|X, Y_1 = MC, Y_2 = LI, Y_3 = SC) \end{aligned}$$

where MC, LI, SC, IR represent Multiple Cropping, Livestock, Soil Conservation and Irrigation Development respectively and Y_1, Y_2, Y_3 and Y_4 refer to the first, second, third and fourth choices, respectively. The equation above states that the probability of a specific rank ordering is the product of:

I. The probability of multiple cropping being selected from a choice set that includes all five alternatives;
II. The probability of livestock being selected from a choice set that excludes multiple cropping;
III. The probability of soil conservation being selected from a choice set that excludes multiple cropping and livestock;
IV. The probability of irrigation being selected, given a choice set that excludes multiple cropping, livestock and soil conservation. Here, the last choice is not taken in to account because if the first 4 choices are known, the last choice is implied.

The probability of multiple cropping (MC) being selected from a set of five alternative adaptation strategies is

$$Prob(Y_1 = MC|X) = \frac{exp\ (X\beta_{MC|b})}{\sum_{j=1}^{J} exp\ (X\beta_{j|b})}$$

where X contains case-specific variables, b is the base category (in this case the selection of base category is arbitrary), $\beta_{MC|b}$ is the effect of the X on the log odds of choosing alternative MC over the base category b, and $\beta_{b|b}$ =0 for all explanatory variables.

The probability of livestock production (LI) being selected given a choice set that excludes multiple cropping requires that we subtract $\exp\ (X\beta_{MC|b})$ from the denominator, and then it will be:

$$Prob(Y_2 = LI|X, Y_1 = MC\ ) = \frac{exp\ (X\beta_{LI|b})}{\left\{\sum_{j=1}^{J} exp\ (X\beta_{j|b})\right\} - exp\ (X\beta_{MC|b})}$$

Similarly, the probability of soil conservation (SC) being selected from a choice set that excludes MC and LI requires that we subtract $\exp(X\beta_{MC|b})$ and $\exp(X\beta_{LI|b})$ from the denominator

$$Prob(Y_3 = SC|X, Y_1 = MC, Y_2 = LI) = \frac{exp(X\beta_{SC|b})}{\left\{\sum_{j=1}^{J} exp(X\beta_{j|b})\right\} - exp(X\beta_{MC|b}) - exp(X\beta_{LI|b})}$$

In a similar way, the probability of irrigation development (IR) being selected from a choice set that excludes MC, LI and SC again requires that we subtract $\exp(X\beta_{MC|b})$, $\exp(X\beta_{LI|b})$ and $\exp(X\beta_{SC|b})$ from the denominator:

$$Prob(Y_4 = IR|X, Y_1 = MC, Y_2 = LI, Y_3 = SC) = \frac{exp(X\beta_{IR|b})}{\left\{\sum_{j=1}^{J} exp(X\beta_{j|b})\right\} - exp(X\beta_{MC|b}) - exp(X\beta_{LI|b}) - exp(X\beta_{SC|b})}$$

Also, unbiased and consistent parameter estimates of the ROL model require the independence of irrelevant alternatives. Therefore, Independence of Irrelevant Alternatives (IIA) is assumed.

Since the parameter estimates of the ROL model provide only the direction of the effect of the independent variables on the dependent one, the discrete change in the probabilities is used to examine the effects of the independent variables on the farmers' preference for a particular adaptation strategy. The estimation of predicted probabilities based on discrete changes in the independent variables is more convenient and straightforward in the case of dummy independent variables, since they change from 0 to 1. The change from 0 to 1 is the only appropriate quantity for interpretation for binary variables (Long and Freese, 2006). For the continuous independent variables, predicted probabilities are estimated for a unit change and also for a standard deviation change in the variables centered on their mean (except nonfarm income). For simplicity, the values of the remaining independent variables are held constant during interpretation. In the ROL model, the predicted probabilities are for an alternative being ranked first. The discrete change in the predicted probability of a certain outcome for a change in X_K from the start value say, X_S, to the end value say to, X_E,

$$\frac{\Delta Pr(y=m|X)}{\Delta X_K} = Pr(y = m|X, X_K = X_E) - Pr(y = m|X, X_K = X_S)$$

where $Pr(y = m|\mathrm{X}, \mathrm{X_K})$ is the probability that y=m given X, by assigning specific value to X_K. The change in the probability is interpreted as when X_K changes from X_S to X_E, the predicted probability of outcome m changes by$\Delta \Pr(y = m|\mathrm{X})/\Delta X_K$, other variables constant. Also, the odds values are used to know the nature of the overall preference of the households for the five adaptation strategies.

The dependent variable for the ROL model is the rankings of farmers for the five alternative adaptation strategies. The identification of the model's explanatory variables is based on literature and availability of data. Thus, the explanatory variables identified are household characteristics such as age, education level and gender of the household head, household size, farming experience, farm and non-farm income, television and/or radio ownership, and living area of the farmers; farm characteristics such as farm size, distance to input market, distance to output market, and farm distance to homestead; institutional factors such as provision of extension services by experts, farmer-to-farmer extension services, credit services, access to climate forecast information, knowing others who perceived and adapted to climate change, and training on agriculture; climate perception variables such as farmers' perception of long-term[4] temperature and rainfall.

The rank-ordered data is fitted using the rank-ordered logistic regression in such a way that the probability of observing the rank orders is maximized. The working data set for the analysis is consisted of a separate record for each adaptation strategy for each respondent, for a total of 1125 observations (225 respondents $\times$ 5 alternatives). The estimation is conducted by normalizing multiple cropping, as the base category using STATA 11.

5. Results and Discussions

5.1. Model specification and tests

Hendry approach is followed to arrive at the final model. Different statistical tests and fitness measures have been conducted such as Overall LR^2, the Bayesian Information Criteria (BIC), Variance Inflation Factor (VIF) and the Wald Test methods. In the initial run, all of the variables identified were included to

[4] Long-term in this research is for 20 years and above.

the model. Then, by excluding those highly insignificant variables and those expected to bring multicollinearity problem one-by-one, different models were estimated and each has been checked for fitness. Hence, variables such as living area of the farmers, input market distance, output market distance, ownership of television and/or radio, knowing others who perceived and adapted to climate change and training on agriculture are dropped. Moreover, a variable "market distance" (average of both input and output market distances) is included and the final model is fitted. Summary statistics of the explanatory variables included in the model is given in Table 1.

The final model was also tested for multicollinearity using the VIF and all VIF values for all explanatory variables are less than 7 and the mean VIF is 2.08 where for most of the variables, the VIF is between 1 and 2. This indicates that multicollinearity is not a serious problem in the model. Parameterization of the model by excluding one category also helps to avoid exact multicollinearity. Furthermore, the model was tested for Independence of Irrelevant Alternatives (IIA) using the Hausman-McFadden test and no evidence is found to reject the IIA assumption at 5% significance level. This suggests that the specified ROL model is appropriate to modeling the farmers' preferences for climate change adaptation strategies.

Table 1: Summary statistics of the explanatory variables

No	Variables	Description	Min	Max	Mean	S.D.
1	Gender of household head	Dummy, 1 if male and 0 otherwise	0.00	1.00	0.88	0.32
2	Age of the household head in years	Continuous	22.00	68.00	41.12	10.42
3	Education level of the head in years	Continuous	0.00	12.00	3.31	3.60
4	Farming experience of the head in years	Continuous	5.00	54.00	24.78	10.70
5	Household size in numbers	Continuous	2.00	10.00	5.20	1.92
6	Farm size in hectares	Continuous	0.25	2.75	1.21	0.51
7	Farm distance to home in kilometres	Continuous	0.25	17.00	5.05	3.88
8	Market distance to home in kilometres	Continuous	0.48	12.75	4.72	2.72
9	Farm income in birr 1000	Continuous	0.50	52.78	14.85	10.33
10	Nonfarm income in birr 1000	Continuous	0.00	40.00	1.69	4.01
11	Extension by experts	Dummy, 1 if received and 0 otherwise	0.00	1.00	0.75	0.43
12	Farmer-to-farmer extension	Dummy, 1 if there is and 0 otherwise	0.00	1.00	0.89	0.31
13	Credit access	Dummy, 1if there is and 0 otherwise	0.00	1.00	0.39	0.49
14	Climate forecast information	Dummy, 1 if received and 0 otherwise	0.00	1.00	0.32	0.47
15	Perceived temperature	Dummy, 1if perceived and 0 otherwise	0.00	1.00	0.68	0.47
16	Perceived rainfall	Dummy,1if perceived and 0 otherwise	0.00	1.00	0.92	0.26

The Wald test results for each explanatory variable included in the final model are given in Table 2. Testing that a variable has no effect on the dependent variable (i.e. farmers' preference for adaptation strategies) requires a test that four coefficients are simultaneously equal to zero. This is because each explanatory variable included in the estimation has 4 different estimates corresponding to the four adaptation strategies, excluding the base category.

Among the 16 explanatory variables included in the final model, only three of them are found statistically insignificant to influence the dependent variable. They are market distance to home, farmer-to-farmer extension and credit access. The remaining 13 variables have statistically significant effect on the farmers' preferences for adaptation strategies to climate change at 5% level of significance.

Table 2: Wald test results for each explanatory variable at 5%

No	Variables	Chi2 (4)	Prob> chi2	Evidence
1	Gender of household head	19.14	0.0007	Against Ho
2	Age of the household head	21.12	0.0003	Against Ho
3	Education level of the head	33.24	0.0000	Against Ho
4	Farming experience of the head	28.66	0.0000	Against Ho
5	Household size	24.76	0.0001	Against Ho
6	Farm size in hectares	17.54	0.0015	Against Ho
7	Farm distance to home	42.88	0.0000	Against Ho
8	Market distance	4.050	0.3987	For Ho
9	Farm income	14.42	0.0061	Against Ho
10	Nonfarm income	15.58	0.0036	Against Ho
11	Extension by experts	19.78	0.0006	Against Ho
12	Farmer-to-farmer extension	6.590	0.1591	For Ho
13	Credit access	3.880	0.4226	For Ho
14	Climate forecast	12.76	0.0125	Against Ho
15	Perceived temperature	41.11	0.0000	Against Ho
16	Perceived rainfall	12.02	0.0172	Against Ho

Finally, to check the efficiency gain from ranking data, two models are estimated: the first is based on the full ranked data and the second is using only the most preferred alternative. Then, Hausman-McFadden specification test is conducted. It fails to reject the null hypothesis which states that estimates do not change systematically (because P > chi2 = 1.0000). Therefore, exclusion of the four rankings is inefficient even if it doesn't lead to inconsistency. As a result, the ROL model with full ranking is more appropriate since its estimates are both consistent and efficient.

Barriers to adaptation

The constraints/barriers to adapt to climate change faced by the farmers in the study area are lack of information or knowledge (34.55%), shortage of money (23.95%), shortage of land (20.4%), unsuitability of land and poor potential for irrigation (11.5%), shortage of labor (5.6%) and others (4%): (Figure 1).

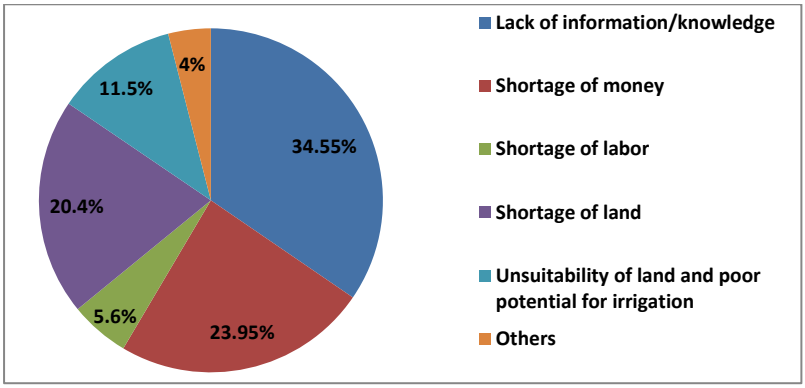
Lack of information/knowledge is the main constraint to adaptation. This could be a manifestation of poor information system of the concerned bodies, poor training or extension services for the farmers. It can also imply weak research and development efforts on new and suitable agricultural practices.

Since money is the medium households commonly use to make purchase of the necessary inputs and other transactions, it is expected that their adaptive capacity to climate change is limited by shortage of money. Getting credit is not an easy task for the farmers. One reason is farmers could not produce collateral to get credit. Some mentioned that they don't want to borrow money for the simple reason that they fear borrowing and servicing of their debt.

Additionally, shortage of land is the third constraint that challenges the farmers. This constraint includes not only shortage in terms of size of land but also the fertility of the land, as mentioned by the farmers. They explained that their currently owned land is poor in its fertility and is losing its capacity from time to time. Increasing in the number of population in general and households' size in particular would force households to fragment and overexploit their limited farm land. This situation could limit their capacity to exercise diverse adaptation measures to climate change. Moreover, the nature of some lands is not suitable to undertake adaptation measures such as soil and water conservation, and tree planting. Farmers cannot also grow any kind of crop they want as it is limited by the nature of their land. Lack of land suitable for irrigation is a big constraint to undertake irrigation activities. However, even those farmers who have their own irrigable land are facing difficulty to undertake irrigation due to lack of water. As mentioned previously, there are two rivers in the study area. Few years ago, large number of farmers started using the rivers for different purposes particularly for irrigation. This in combination with the changing climatic conditions made the rivers unable to serve the needs of the farmers.

Shortage of labor is also a constraint for 5.6% of the households. Others constraints include lack of fodder, animals' death, unavailability of technologies, unwillingness to take measures and unable to adapt, due to for instance age.

Figure 1: Adaptation Constraints



5.3 Overall Preference for the Adaptation Strategies

The ROL model with constant only ($V_{ij} = \beta_j$) is estimated to see the overall preferences of the households for the adaptation strategies. Table 3 presents estimates of the β_j (constants), the exponent of the coefficients and predicted probabilities for each adaptation strategy at the means of the explanatory variables. The odds are interpreted with reference to the base category. As we see, the constant parameter for multiple cropping is zero because multiple cropping is used as a base category in our estimation and its coefficient necessarily equals to zero. The Wald chi-square statistic for the model with a constant term only is 303.48 with a p-value of 0.0000, which means that the farmers in the area, in general, have statistically significant different preferences for the five adaptation strategies.

The result in Table 3 indicates that on average multiple cropping is the most preferred adaptation strategy to climate change. On the other hand, livestock is the least preferred adaptation strategy since it has the smallest odds value, which is 0.1412. The second most preferred adaptation strategy is soil conservation measure followed by irrigation and then changing planting dates.

An average household in the sample has a probability of around 0.36 of ranking multiple cropping as the most preferred adaptation strategy while it has a probability of 0.30 of ranking soil conservation first. Similarly, the probabilities of ranking irrigation development, changing planting dates and livestock production first are 0.18, 0.14 and 0.02, respectively.

Table 3: Odds of overall ranking and predicted probabilities

No	Adaptation Strategy	Coefficient	Exp(b)	Probability
1	Livestock production	-1.95734	0.1412	0.02275157
2	Soil conservation	-0.06895	0.9334	0.29519317
3	Irrigation development	-0.47168	0.6240	0.18354297
4	Changing planting dates	-0.63836	0.5282	0.1397042
5	Multiple cropping	0	1	0.3588081
	LR chi2(4) = 303.48	Prob > chi2 = 0.0000		

5.4 Effects of the independent variables on the farmers' preference for adaptation strategies

The estimated coefficients of the ROL model, along with significance levels, are presented in Table 4. The model's likelihood ratio statistics (LR $chi^2(68)$ = 604.38 and $P>chi^2=0.0000$) suggests that the model has a strong explanatory power. Since the parameter estimates of the ROL model provide only the direction of the effect of the independent variables on the dependent variable, the discrete changes in the probabilities is used to investigate the effects of the independent variables on the farmers' preference for a particular adaptation strategy to climate change, and these predicted probabilities are presented in Table 5.

Table 4: Parameter estimates of the ROL model of climate change adaptation

Explanatory Variables	Livestock Production		Soil Conservation		Irrigation Development		Changing Planting Dates	
	Coeff.	P level	Coeff.	P level	Coeff.	P level	Coeff.	P level
Gender of HH head	-0.701	0.1740	0.946	0.0353	0.628	0.1719	-0.485	0.2848
Age of HH head	0.023	0.5900	0.089	0.0071	-0.058	0.1063	-0.018	0.5919
Education level	-0.191	0.0002	-0.205	0.0000	-0.215	0.0000	-0.188	0.0000
Farming experience	-0.105	0.0107	-0.105	0.0008	0.041	0.2326	-0.007	0.8374
Household size	0.453	0.0001	-0.104	0.1937	-0.050	0.5659	0.069	0.4424
Farm size	-1.289	0.0044	-0.281	0.4177	-0.839	0.0176	-1.330	0.0003
Farm distance	0.115	0.0200	0.041	0.3054	0.252	0.0000	0.028	0.5027
Average market distance	0.005	0.9453	0.073	0.1672	0.036	0.5243	0.101	0.0841
Farm income	0.069	0.0004	0.032	0.0498	0.024	0.1588	0.013	0.4114
Nonfarm income	-0.064	0.2721	0.116	0.0078	-0.036	0.4464	0.094	0.0280
Experts extension	0.629	0.1566	-0.756	0.0257	0.494	0.1568	-0.481	0.1631
Farmer-farmer extension	-0.752	0.2547	0.729	0.1474	-0.070	0.8953	-0.128	0.8030
Access to credit	-0.037	0.9180	-0.394	0.1625	0.024	0.9346	-0.336	0.2619
Information on climate	0.126	0.7543	-0.749	0.0307	-0.172	0.6209	0.378	0.2886
Perceived temperature	-1.237	0.0009	-1.538	0.0000	-1.739	0.0000	-1.598	0.0000
Perceived rain	0.943	0.2107	0.949	0.0874	2.142	0.0006	1.142	0.0464
Constant	-2.019	0.1435	-1.271	0.2388	-0.685	0.5554	1.803	0.1042

Base category	Multiple cropping
Number of observations	1125
Number of groups	225
LR chi-square, degree of freedom, p- value	LR chi2(68) = 604.38 Prob > chi2 = 0.0000
Log-Likelihood	-773.6117

I. Gender of the household head

Gender of the household head is one of the significant variables that affect the overall preference of farmers for the adaptation strategies. As it can be seen from Table 5, male-headed households have probability of preferring soil conservation as the most preferred adaptation strategy 16.6% higher than female-headed households and for irrigation 6.6% higher. On the other hand, the probability of ranking changing planting dates as their most preferred adaptation strategy is 12.6% lower for male headed households than female-headed ones. Similarly, the predicted probabilities of ranking multiple cropping and livestock first are 7.7% and 3.0% lower for male-headed households.

Overall, male-headed households have greater preferences for soil conservation and irrigation adaptation measures to climate change than female-headed households. Since soil conservation and irrigation development relative to the other adaptation strategies require better skills and information on technologies to undertake them to adapt to climate change, it is more likely that male-headed households have more preference for these measures than the female counterparts. This is in line with the argument that male-headed households are more likely to get information about new technologies than female-headed households (Asfaw & Admassie, 2004). Moreover, female-headed households are more likely than male-headed households to exercise adaptation methods which are common and known by almost all farmers, such as changing planting dates and crop production.

II. Age of the household head

Adaptation strategy preference to climate change is also affected by age of the household head. For instance, a one year (or a standard deviation) increase in the age of the household head results in a 2.2% (or 22.7%) increase in the probability of ranking soil conservation first, 0.02% (or 0.2%) increase in the probability of ranking livestock first and 0.5% (or 5.5%) increase in the probability of changing planting dates, respectively. Also, an increase in the age of the household by one year (or by a standard deviation) decreases the probabilities of ranking multiple cropping and irrigation first by 0.5% (or by 5%) and 1.3% (or by 13.5%), respectively.

As indicated by Hassan & Nhemachena (2008) the influence of age on adaptation choices has been mixed in the literature. Some studies found that age had no influence on a farmer's decision to participate in forest and soil and water management activities while others found that age is significantly and negatively related to farmers' decisions to adopt. However, Bayard et al (2007) found that age is positively related to the adoption of conservation measures.
Even if the effects of age on the probabilities of two of the measures are negative and do not suggest important information, this could be an indication of the different implications of age and farming experience on adaptation preference. Given these situations, the result is justified with the possibility that old-aged farmers usually prefer adaptation measures which can be practiced with the limited resources at their disposal so as to smooth the household's consumption.

As a result, it is likely that old-aged farmers prefer to practice soil conservation on their limited land and grow their common crops by changing planting dates. They also prefer to tend livestock with small efforts than the younger farmers. In contrast to this, younger farmers are better to adopt improved technologies or methods than older ones without fear of risks and future uncertainties. Younger farmers also have better energy to devote, better access to new information, and thus more likely to grow different types of crops and develop irrigation. This is inline with the result that young farmers are more likely to face the risks associated with innovations (uncertainty in yield and unfamiliarity in technology) and to adopt them than their old counterparts (Asfaw & Admassie, 2004).

III. Education level of the household head

The effect of education is largest on the probability of multiple cropping where its probability to be selected first increases by 4.7% for a one year increase in education and by 16.7% for a standard deviation increase in years of education. It was expected that farmers with higher levels of education are more likely to adapt better to climate change using various methods because a farmer who has more years of education is more likely to adopt improved methods and expected to be more efficient to understand and obtain new technologies than less-educated people.

Even though unexpected result is found, this possibility can be explained from various angles in the context of the study area. The result points out that education plays a great role in farmers' decision to specialize or work more intensively on specific activities. Additionally, it is common to see when an educated farmer is working for jobs outside agriculture in combination with the commonly practiced farming system, crop production. On the other hand, more educated farmers are more likely to get information on new crop type that would make them profitable within the changing climatic conditions. They are, therefore, more likely to specialize on producing such crops and utilize their limited farm land effectively instead of moving and looking for other alternatives.

In addition to this, crop production is highly practiced in the area in both dryland and irrigable land. Nowadays, many farmers started growing a recently introduced crop to the area called "*green mung bean*[5]". It is heat-tolerant crop and can grow with little rain. Since farmers fear future uncertainties or risks and are less confident to this new crop type, education could play great role here. From the result, education has positive and significant impact on multiple cropping. This is possibly due to educated farmers who have better information about that crop and nature of the climate prefer to grow that crop intensively with less hesitation than the less-educated farmers. More educated farmers are more likely to have additional off-farm job to sustain consumption in case the crop fails. Moreover, they could have better information on market conditions and how the crop is growing, in which environment it can grow, what the future climate likely to be than the less educated farmer.

IV. Farming experience

Farming experience increases the likelihoods of preferring irrigation, multiple cropping, soil conservation and changing planting dates as the most preferred adaptation strategies to climate change. For instance, an increase in farming experience by one year increases the probabilities of selecting multiple cropping, irrigation, soil conservation and changing planting dates first by 1%, 1.2%, 3.0% and 0.3%, respectively, while the probability of livestock decreases by 0.2%. Increase in farming experience has the largest positive effect on the probability of preferring soil conservation followed by irrigation and the

[5] "Masho" is the "Amharic" name of the crop.

smallest effect on livestock. That means more experienced farmers are more likely to use soil conservation, irrigation, changing planting dates and multiple cropping to adapt to climate change because the more experienced farmers are, the more likely they have better information on changes in climatic conditions and knowledge of crop practices.

The result shows that farming experience has opposite effect with age of the household head for three of the adaptation strategies. Even if age of farmers is a significant factor, the directions of some of its effects do not suggest relevant particular pattern. Hassan & Nhemachena (2008) found that it is experience rather than age that matters for adapting to climate change. They also found that farming experience increases the probability of uptake of all adaptation options while age of the farmer did not seem to be of significant in influencing adaptation.

V. Household size

Household size is another determinant where an increase in the household size by one person results in increase in the probabilities of preferring multiple cropping, livestock and changing planting dates by 0.7%, 1.1% and 1.2%, respectively.

Therefore, increase in household size increases the probability of adapting to climate change using multiple cropping, livestock and changing planting dates. This result suggests that these strategies are labor-intensive which is more likely to happen in Ethiopia's agriculture. Assuming that households with large family size have a higher labour endowment, families with more household size can rely on their own labor for the most important activities of multiple cropping that is the field operation. Families with larger household size are also more likely to rear livestock because of availability of labor to tend the animals. This result is also in line with the argument that multiple cropping and mixed farming systems are more labor intensive (Hassan & Nhemachena, 2008).

VI. Farm size of the household

Households' farm size is also a significant factor that affects farmers' preferences for the adaptation strategies to climate change. In a similar way, an increase in farm size by 1 hectare (or 1 standard deviation) increases the

likelihood of selecting multiple cropping as the most preferred adaptation strategy by 16% (or 8.2%) and the likelihood of soil conservation by 5% (or 2.5%), respectively. Similarly, a hectare increase in farm size decreases the probabilities of choosing livestock, irrigation and changing planting dates by 1.9%, 6.9% and 12.2%, respectively. Its least effect is on the preference for livestock.

In general, an increase in farm size increases the likelihood of adapting to climate change using multiple cropping and soil conservation. This result is expected in the sense that the more households have larger farms, the more likely they tend to work intensively on their land instead of going for another alternative to adapt to climate change. They can do this by growing many types and new variety of crops and by applying soil conservation measures. Households with larger farm sizes, therefore, are more probably to diversify their crops especially under dryland conditions and help spread the negative impacts of changes in climatic conditions.

VII. Farm distance from homestead

An increase in farm distance by one kilometer (or 1 standard deviation, around 3.88 kilometers) results in increase in the probabilities of selecting irrigation as the most preferred adaptation strategy by 3.4% (or 13.4%) and livestock by 0.1% (or 0.4%) respectively while, it decreases the probabilities of multiple cropping by 2.3% (or 9%), soil conservation by 0.7% (or 2.8%) and changing planting dates by 0.5% (or 2%), respectively.

Overall, an increase in farm distance increases the likelihood of preferring irrigation highly, and secondly it affects the preference for multiple cropping negatively, while the preference for livestock is the least affected by the change in farm distance. This result suggests that as farm distance from their homes increases, farmers are less likely to go for field operation continuously which could have its own impact on their production and productivity. They, therefore, prefer to rent irrigable lands near to their homes and rear livestock.

Table 5: Changes in predicted probabilities for a ROL model of climate change adaptation

Explanatory Variables	Multiple cropping	Livestock production	Soil conservation	Irrigation development	Changing planting dates
Gender of the household head	-0.077	-0.030	0.166	0.066	-0.126
Age of the household head	-0.005 (-0.05)	0.0002 (0.002)	0.022 (0.227)	-0.013 (-0.135)	0.005 (0.055)
Education level of the household head	0.047 (0.167)	-0.001 (-0.005)	-0.022 (-0.078)	-0.016 (-0.055)	-0.008 (-0.029)
Farming experience of the household head	0.010 (0.100)	-0.002 (-0.019)	0.030 (0.252)	0.012 (0.130)	0.003 (0.029)
Household size	0.007 (0.013)	0.011 (0.021)	-0.025 (-0.048)	-0.006 (-0.011)	0.012 (0.024)
Farm size	0.160 (0.082)	-0.019 (-0.010)	0.050 (0.025)	-0.069 (-0.036)	-0.122 (-0.062)
Farm distance	-0.023 (-0.090)	0.001 (0.004)	-0.007 (-0.028)	0.034 (0.134)	-0.005 (-0.020)
Market distance	-0.015 (-0.041)	-0.001 (-0.002)	0.009 (0.024)	-0.001 (-0.003)	0.008 (0.022)
Farm income	-0.006 (-0.063)	0.001 (0.122)	0.004 (0.044)	0.00 1(0.013)	-0.001 (-0.006)
Nonfarm income	-0.015 (-0.059)	-0.002 (-0.009)	0.023 (0.092)	-0.014 (-0.054)	0.007 (0.030)
Expert extension	0.079	0.016	-0.172	0.112	-0.035
Farmer-farmer extension	-0.042	-0.028	0.144	-0.036	-0.037
Access to credit	0.057	0.003	-0.068	0.034	-0.025
Climate forecast information	0.062	0.007	-0.154	-0.0001	0.084
Perceived temperature	0.325	-0.003	-0.129	-0.123	-0.070
Perceived rain	-0.299	0.006	0.080	0.157	0.056

Note: values given in brackets are for a standard deviation change in the values of the continuous variable.

VIII. Farm income of households

An increase in farm income of the households increases the likelihood of adapting to climate change using soil conservation, irrigation and livestock. For instance, an increase in farm income by 1 unit (that is birr[6] 1000) increases the

[6] "Birr" is the Ethiopian currency

probabilities of selecting livestock, soil conservation and irrigation as the most preferred adaptation strategies to climate change by 0.1%, 0.4% and 0.1%, respectively, while the probabilities of multiple cropping and changing planting dates decrease.

It is believed that compared with the other adaptation strategies livestock, irrigation and soil conservation require more financial resources than the others. If farmers have more income, they can afford to produce livestock, develop irrigation and conserve their soil with the latest technologies. This result is reflection of the actual behavior of households; that is, when their income increases, they tend to shift to activities which require more income. This, therefore, supports the argument that subsistence farmers are more likely to vary planting dates and diversify crops as their adaptation options instead of using those expensive methods such as irrigation, livestock and soil conservation.

IX. Nonfarm income of households

Nonfarm income of households is also found significant factor that affects their preferences for the adaptation strategies. An increase in nonfarm income enhances the likelihood of adapting to climate change using soil conservation and changing planting dates. Since nonfarm income has highly extreme values in the data, a centered change on the median is found more appropriate than the mean. Therefore, a unit increase in nonfarm income (that is birr 1000) of households centered on the median increases the probabilities of soil conservation and changing planting dates by 2.3% and 0.7%, respectively. On the other hand, it decreases the probabilities of multiple cropping, irrigation and livestock by 1.5%, 1.4% and 0.2%, respectively.

Farmers who have sources of nonfarm income are expected to have nonfarm job which could possibly be a measure they took to climate change. If that is so, it is clear that it will affect negatively the probability of taking some other adaptation measures while it could affect positively the probability of adaptation strategies that can be undertaken in combination with nonfarm jobs, such as varying planting dates. Also, they can exercise soil conservation on their limited land since they have additional nonfarm income.

X. Extension services from experts

It can be seen from Table 5 that experts' extension services increase the probabilities of using irrigation, multiple cropping and livestock by 11.2%, 7.9% and 1.6%, respectively, to adapt to climate change. However, the probabilities of ranking soil conservation and changing planting dates first are about 17.2% and 3.5% lower for households who received extension services from experts than those who didn't, respectively.

This result implies the importance of increasing institutional support so as to encourage the use of strategies such as irrigation, livestock and multiple cropping to acclimatize to the impacts of climate change. This is because farmers who have better access to extension services have better opportunities to get information on changing climatic conditions and the various farming practices that they can use to adapt to changes in climatic conditions. This is also in line with the result of Nhemachena & Hassan (2007) that access to free extension services significantly increases the probability of taking up adaptation options since extension services provide an important source of information on climate change as well as agricultural production and management practices.

XI. Access to climate forecast information

Access to climate forecast information also increases the likelihoods of preferring multiple cropping as the most preferred strategy by 6.2% and changing planting dates by 8.4%. Similarly, access to this information increases the probability of ranking livestock first by 0.7%, while it decreases that of soil conservation by 15.4% and irrigation by 0.001%, almost negligible effect on irrigation.

Generally, the likelihood of adapting to climate change using multiple cropping, changing planting dates and livestock is higher for those households who received climate forecast information than those who did not. This result, therefore, indicates the importance of information on climate forecast to enhance climate change adaptation. Farmers who received climate forecast information are more likely to grow different crop types and vary their planting dates to suit the prevailing and forecasted climate conditions.

XII. Long-term temperature perception

Farmers were also requested to indicate whether they perceived changes in the long-term average temperature and rainfall. It is found that most of the farmers have perceived changes in the long-term average temperature and rainfall, though there are some farmers who perceived only recent period variations.

Perceiving the change in long-term average temperature increases the probability of preferring multiple cropping to adapt to climate change by 32.5%; whereas, the probabilities of selecting soil conservation, irrigation and changing planting dates are around 12.9%, 12.3% and 7% lower for those farmers who perceived the change in the long-term average temperature than those who did not perceive it, respectively. The farmers know that increasing temperature is damaging to their production and need to respond to it through the use of different adaptation methods. However, perceiving the change in long-term average temperature enhances adaptation using only multiple cropping, but of course with the largest change in the probability. This possibility is due to the fact that farmers who perceive the warmer change in the long-term temperature are likely to grow different heat-tolerant crop types, the most affordable practice next to changing planting dates by subsistence smallholder farmers. Since the farmers are located in the same agro-ecological zone and the area is already hotter, a warmer change in the temperature would not highly affect their farming practices except the usually practiced systems of multiple cropping. This is in line with the result of Kurukulasuriya & Mendelsohn (2007) where crop choice is very climate sensitive and as temperatures warm, farmers will shift towards more heat tolerant crops.

XIII. Long-term rainfall perception

As the result indicates, perceiving change in the average rainfall has a positive effect on the likelihood of adaptation to climate change using all the strategies except multiple cropping. That is, it increases the probability of preferring irrigation by 15.7%, soil conservation by 8%, changing planting dates by 5.6% and livestock by 0.6%. In contrast to this, perceiving the change in long-term average rainfall decreases the probability of selecting multiple cropping to adapt to climate change by around 29.9%.

More clearly, the likelihoods of preferring soil conservation, irrigation and changing planting dates to adapt to climate are higher for those who noticed the long-term change in the rainfall pattern than those who did not. This is expected result because farmers who perceive shortage or decrease in the rainfall are more likely to take adaptation measures to acclimatize to it. For example, during rainfall shortage, using irrigation is very convincing. The same is to soil conservation measures to maintain or keep moisture of their soil. Changing the planting dates according to their perception on the pattern of the rainfall is also important and expected measure.

Generally, noticing the change in the long-term average climatic conditions has its own significant influence on the farmers' decisions about the choice of adaptation strategies to climate change. Farmers who are aware of changes in climatic conditions have higher chances of taking adaptive measures in response to the observed changes.

6. Conclusions and Policy Implications

This study analyzed the determinants of farmers' preference for climate change adaptation strategies and also identified barriers to climate change adaptation using a cross-sectional data. The study reveals that lack of information/knowledge and shortage of money are the main constraints to adaptation followed by shortage of land, and unsuitability of their land and poor potential for irrigation. Rank-Ordered Logit (ROL) Model is applied to examine the factors that derive households' observed preference for climate change adaptation strategies. The result indicates that multiple cropping is the most preferred adaptation strategy to climate change. The next most preferred adaptation strategy is soil conservation followed by irrigation and changing planting dates, consecutively, while livestock is the least preferred. The nature of the farmers' preference for the five adaptation strategies provides directions for intervention and policy measures that aim to promote adaptation and reduce the negative impacts of climate change.

The result also shows that all variables included in the model, except market distance, farmer-to-farmer extension and credit access, are significant determinants of farmers' preference for the climate change adaptation

strategies. All variables representing the households' characteristics (gender, age, farming experience and education level of the household head, household size, and farm and nonfarm income) are found significant factors that affect adaptation strategy preference of farmers. Among these variables education level, farm and nonfarm income can be influenced by policy and program interventions to enhance the farmers' adaptation to climate change. Moreover, the result showed that farmers' preference for climate change adaptation strategies is sensitive to farm characteristics such as farm size and farm distance to homestead. These issues could be addressed in combination with efforts to raise income of the households. Experts' extension services on crop and livestock production and climate forecast information are also significant institutional factors influencing households' preference for the adaptation strategies. Moreover, long-term climate change perception of the farmers' (perception on long-term average temperature and rainfall) are significant factors affecting their decision regarding the choice of climate change adaptation strategies. Noticing the changes in the long-term temperature and rainfall enhances the probability of taking various adaptation measures.

Based on the findings, the researcher has arrived at the following policy implications specifically to the study area. Strengthening efforts on enhancing the farmers' adaptive capacity to climate change is an important policy measure to be considered. Encouraging investment at local level on the barriers to adaptation is a good policy option. For instance, developing good information system among farmers, fostering research and development on agriculture specific to the area, and promoting water conservation and irrigation schemes in the area among farmers are suggested intervention measures. The finding confirms the important roles of research and developments in changing crop types suitable to the area and the changing climatic conditions rather than sticking on common crops that frequently fail to meet the farmers' needs. For instance, the recently introduced new crop, *green mung bean*, to the area is highly preferred and being produced by the local farmers since it suits the prevailing condition and also generates better income for them. This practice gives an important lesson for research and development efforts on new crop types. Overall, policies or programs aimed to reduce climate change impacts need to encourage investments on soil conservation, irrigation development, and researches on livestock and crop types. Supporting

and training farmers on soil conservation measures, irrigation development and changing planting dates can improve adaptation practices to climate change.
On the other hand, designing programs to increase the farmers' education level is an important policy measure in enhancing adaptation to climate change and thus reduce its impact on the farmers. In addition to its role of delivering knowledge, education can create opportunities for the households to gather information on new technologies or methods of production, better information on climate change and farming practices that suit to it. Furthermore, programs that can increase farm income of households such as better supply of inputs at fair price, and creating better access to markets and transportation facilities are suggested policy measures to help farmers adapt to climate change. Promoting investments that create job opportunities and raise farmers' nonfarm income is also recommended to enhance farmers' capacity.

It is also believed that better access to agricultural extension services for farmers has the potential to increase farmers' awareness of changing climatic conditions and suitable adaptation responses to it. Therefore, a policy with the objective of enhancing farmers' adaptation to climate change should take in to account the significant roles of agricultural extension services and climate forecast information on the farmers' practices of climate change adaptation.

The researcher, therefore, argues that information on the prevailing and forecasted climate is very helpful especially for subsistence farmers who focus on growing crops and cannot afford to exercise irrigation development or soil conservation, because subsistence farmers are more likely to vary planting dates and diversify crops than changing to different crops or using expensive adaptation technologies such as irrigation development and soil conservation. Hence, working on and promoting less-costly adaptation options (such as multiple cropping, changing crop type, changing planting dates etc) among smallholder farmers could have the potential to positively enhance adaptation to climate change by subsistence farmers.

Generally, it is suggested that government bodies at different level, meteorological departments, and agricultural offices should play important roles in raising farmers' awareness of the prevailing and expected changes in the climate through proper mechanisms that are easily accessible to the

farmers such as extension services, local medias, social groups such as eddir, farmers gatherings, and input and output traders. This awareness creation effort should be combined with the different types of crop and livestock production and management practices that farmers could take up as adaptation measures to the change in the climate. Finally, the researcher suggests further research and developments specific to each agro-ecology and adaptation strategy with respect to the behavioral nature of farmers' preferences for the adaptation strategies. All the efforts need to move towards making farmers more resilient to damaging changes in the climate.

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The Impacts of Brokerage Institutions in the Marketing of Horticultural Crops in Fogera District, South Gondar, Amhara Region of Ethiopia

Simegnew Tamir[1], Kinde Getnet[2] and Jema Haji[3]

Abstract

The main objective of this study was to analyze the economic roles played by the brokerage institutions in smallholder market linkages to market outlets in horticultural marketing and determinants of decisions on whether to use brokerage institutions or not under imperfect market condition in Fogera District, North Western Amhara Region particularly focusing on onion and tomato. Both secondary and primary data were collected for the study. Primary data were collected from a very wide number of respondents at all stages of the market channel where brokers are expected to play role. Two stage sampling techniques were used to select the sampled farmers. Descriptive and econometric

[1] MSc., Socioeconomics Researcher at ARARI, simegnew.2004@gmail.com

[2] PhD, International Water Management Institute

[3] PhD, Haramaya University

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statistical models were employed for data analysis using STATA software. The study implemented the Propensity Score Matching (PSM) model. The result of the study showed that the brokerage institutions are characterized as urban, peri-urban and farmer brokers. There was significant brokerage activity only for onion marketing and in the case of tomato marketing the brokers act as rural assemblers. Most of the horticultural trading in the area is undertaken by credit and thrust based and in this arena brokerage institutions are playing most important role by linking smallholder farmers to market outlets. Logistic regression estimation of Propensity Score Matching model revealed that Age, education level, distance of residence from development agent office, distance of residence from Woreta market, distance of residence from main asphalt road, access to cell phone (mobile phone) and number of regular wholesaler customers significantly affected the participation decisions of the smallholders in the brokerage institutions services. The result of the study also revealed that, smallholder farmers using brokerage institutions have got 4393.62 ETB higher net income and 13.55% of greater marketed surplus than those smallholders who do not use. Generally, the brokerage institutions are playing significant and important role in forming market linkages between smallholders and wholesalers under imperfect market conditions with their limitations. Therefore, the study highly recommends the formalization of the brokerage institutions through licensing, training and continuous follow up in the District considering the experience of ECX.

Key words: Fogera, Brokerage institutions, STATA, PSM, ECX

1. Introduction

Ethiopia has highly-diversified agro-ecological conditions which are suitable for the production of various types of fruit and vegetables. Amhara Region is one of the potential areas in the Country. Fogera District is endowed with diverse natural resource, with the capacity to grow different annual and perennial crops. Two major rivers are of great importance to the Woreda, Gumara and Rib. They are used for irrigation during the dry season for the production of

horticultural crops mainly vegetables (Abay, 2007) . Efficient coordination in traditional markets is a prerequisite for a successful smallholder commercialization towards rural transformation, poverty reduction and agrarian change in the developing countries. However, it is often staggered by the problem of market imperfection and institutional underdevelopment that increase transaction cost and risk faced by smallholders. There are no producer organizations, such as cooperatives to coordinate horticultural marketing purpose in Fogera on behalf of farmers, against a growing demand for the products in different parts of the country. Because of this, success in horticulture crop production as high value crops is not necessarily translated into a market success in the area. Such institutional bottlenecks against an emerging horticultural market have created a fertile ground for a strong presence of brokers in the horticultural market of Fogera.

Though road infrastructure and use of mobile telephones among farmers for market access and information exchange is reasonable, direct linkage of farmers to the wholesale market (the major market for the horticulture crops produced) is very limited. As a result, the majority of smallholders opt to use brokers to sell their products to wholesalers, who distribute products to different consumer and seasonally deficit producer markets in the country. Given the large volume of horticulture products in the area, combined with seasonal glut and high perishability, efficient market coordination and logistics are necessary to link Fogera horticulture farmers with the wholesale markets and to enable them generate sufficient economic incentives. In rural areas where producer organizations are absent and market institutions are underdeveloped, posing a challenge for smallholder market linkage, brokers could fill the coordination gaps and logistical constraints to facilitate exchange. Fogera provides a useful case in this regard where the brokerage institution, which dominantly exists informally, plays an important role in coordinating the horticultural marketing activities, starting from the farm. According to Amhara Regional Agricultural Research Institute and Amhara Regional Bureau of Agriculture (2008) participatory rural appraisal report, one of the priority research problems in horticultural marketing in the Woreda was the role and functions of informal brokerage activity in the area.

However, the brokers at Fogera horticulture market (who play a market coordination role by constituting an important element of the "invisible hand"), are not closely studied, known, and described in terms of their impacts, limitations and constraints to improve their efficiency and impact as an important intermediary in the horticultural supply chain of the area. Perhaps, this is a result of the less recognition the brokerage institution receives. This paper is intended to contribute to filling this knowledge gap in the area by addressing the following objectives.

The general objective of the study was:

- To assess the economic roles played by the brokerage institution and identify determinants of decisions on whether to use brokers or not under imperfect market condition in the study area;,
- The specific objectives of the study were;
- To identify the determinants of farmers decision whether to use brokerage institutions or not as a means of market linkage to wholesalers; and
- To measure the impact of brokerage institutions on smallholder horticulture producers.

2. Research Methodology

2.1. Description of the Study Area

Fogera District is one of the 106 Woreda's of the Amhara Regional State and found in South Gondar Zone. It is situated at 110 58 N latitude and 370 41 E longitude. Woreta is the capital of the Woreda and is found 625 km from Addis Ababa and 55 km from the Regional capital, Bahir Dar. The District is divided into 27 rural Peasant Associations and 3 urban kebeles.

2.2. Methods of Data Collection and Sampling Procedures

Both primary and secondary data were used for this study. The primary data for the study were collected from market actors starting from production to the end retailers which were conducted through interview and discussion. A semi-structured questionnaire and check-list were used for data collection. Field trips were made to undertake Rapid Market Appraisal (RMA). The

questionnaires were pre-tested and its contents were refined. The researcher has made personal observations and informal discussions with farmers, development agents, district agricultural experts of Ministry of Agriculture and Rural Development using checklists. Multi-stage random sampling techniques were employed. The sample has covered farmers, brokers, rural assemblers, wholesalers and retailers on proportionate to size basis and research objectives using sample size determination formula.

2.3. Methods of Data Analysis

2.3.1. Descriptive statistics

For this study descriptive statistics such as percentages, frequencies, standard deviation, independent sample t-test and chi squared test were used.

2.3.2. Propensity score matching model

To measure the impacts of brokerage institutions this study used with and without approach which best suits the purpose of this particular study i.e. brokerage institution participants and non participants comparison using Propensity Score Matching (PSM) model. The first step in estimating the treatment effect is to estimate the propensity score. To get this propensity scores any standard probability model can be used (for example, logit, probit or multi-nominal logit) (Rajeev *et al*., 2007). Since the propensity to participate in use of brokerage institution is unknown, the first task in matching is to estimate this propensity. Any resulting estimates of brokerage institution effect rest on the quality of the participation estimate. This can be routinely carried out using a choice model. Which choice model is appropriate depends on the nature of the brokerage institution being evaluated. If it offers a single treatment, the propensity score can be estimated in a standard way using, for example, a probit or logit model, where the dependent variable is 'participation whether to use brokers or not' and the independent variables are the factors thought to influence participation and outcome.

Following Pindyck and Rubinfeld (1981), the cumulative logistic probability function is specified as:

$$P_i = F(Z_i) = F\left[\alpha + \sum_{i=1}^{m} \beta_i X_i\right] = \left[\frac{1}{1 + e^{-\left[\alpha + \sum \beta_i X_i\right]}}\right] \quad \textbf{(1)}$$

Where; e: represents the base of natural logarithms (2.718…)

X_i: represents the ith explanatory variable

P_i: the probability that a farmer participates in the brokerage institution services

α and β_i: are parameters to be estimated.

Interpretation of coefficients will be easier if the logistic model can be written in terms of the odds and log of odds (Gujarati, 2004). The odds ratio implies the ratio of the probability that an individual will be a participant (P_i) to the probability that he/she will not be a participant ($1-P_i$). The probability that he/she will not be a participant is defined by:

$$\left[1 - P_i\right] = \left[\frac{1}{1 + e^{Z_i}}\right] \quad \textbf{(2)}$$

Using equations (1) and (2), the odds ratio becomes

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{Z_i} \quad \textbf{(3)}$$

Alternatively,

$$\left[\frac{P_i}{1 - P_i}\right] = \left[\frac{1 + e^{Z_i}}{1 + e^{-Z_i}}\right] = e^{\left[\alpha + \sum_{t=1}^{m} \beta_i X_{ii}\right]} \quad \textbf{(4)}$$

Taking the natural logarithms of equation (4) will give the logit model as indicated below.

$$Zi = \ln\left[\frac{P_i}{1 - P_i}\right] = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots\ldots\ldots\ldots + \beta_m X_{mi} \quad \textbf{(5)}$$

If we consider a disturbance term, u_i, the Logit model becomes

$$Z_i = \alpha + \sum_{t=1}^{m} \beta_i X_{ti} + U_i \quad \textbf{(6)}$$

So the binary Logit will become:

$$\Pr(PBS) = f(X) \quad \textbf{(7)}$$

Where *PBS* is participation in broker service, *f(X)* is the dependent variable project participation and *X* is a vector of observable covariates of the households;

$$X = [FS, AG, ED, PI, SC, TC, DMM, DMR, AFC, CP, WC, MC, EV, VHP, THP] \quad \textbf{(8)}$$

After obtaining the predicted probability values conditional on the observable covariates (the propensity scores) from the binary estimation, matching was done using a matching algorithm that is selected based on the data at hand. Then the impact of farmer's participation in the services provided by brokerage institution on a given outcome (outcome in this study is market participation, household's gross income from horticultural crop production, percentage of brokered transaction and marketed surplus) (Y_i) is specified as:

$$\tau_i = Y_i(D_i = 1) - Y_i(D_i = 0) \quad \textbf{(9)}$$

Where; τ_i: is treatment effect (effect due to participation in the service of brokers), Y_i: is the outcome on household i, D_i: is whether household i has got the treatment or not (i.e., whether a household participated in the brokers service or not). However, one should note that Y_i (D_i = 1) and Y_i (D_i = 0) cannot be observed for the same household at the same time. Depending on the position of the household in the treatment (market participation), either Y_i (D_i = 1) or Y_i (D_i = 0) is unobserved outcome (called counterfactual outcome) (Yemisrach, 2010). Due to this fact, estimating individual treatment effect τ_i is not possible and one has to shift to estimating the average treatment effects of the population than the individual one. Most commonly used average treatment effect estimation is the 'average treatment effect on the treated (τ_{ATT}), and specified as:

$$\tau_{ATT} = E(\tau | D = 1) = E[Y(1) | D = 1] - E[Y(0) | D = 1] \quad \textbf{(10)}$$

As the counterfactual mean for those being treated, E[Y(0) D = 1] is not observed, one has to choose a proper substitute for it in order to estimate the average treatment effect (ATT). One may think to use the mean outcome of the untreated individuals, E[Y(0) D = 0] as a substitute to the counterfactual mean for those being treated, E[Y(0) D = 1] . However, this is not a good idea especially in non-experimental studies. Because, it is most likely that components which determine the treatment decision also determine the outcome variable of interest. In this particular case, variables that determine household's decision to participate in the services developed by the brokers could also affect household's market participation, gross income from horticultural crop production and percentage of brokered transaction and marketed surplus etc. Therefore, the outcomes of individuals from treatment and comparison group would differ even in the absence of treatment leading to a self-selection bias. By rearranging, and subtracting $E[Y(0)\ D = 0]$ from both sides, one can get the following specification for ATT.

$$E[Y(1)|D=1]-E[Y(0)|D=0]=\tau_{ATT}+E[Y(0)|D=1]-E[Y(0)|D=0] \quad \textbf{(11)}$$

Both terms in the left hand side are observables and ATT can be identified, if and only if $E[Y(0)\ D = 1] - E[Y(0)\ D = 0] = 0$. i.e., when there is no self-selection bias. This condition can be ensured only in social experiments where treatments are assigned to units randomly (i.e., when there is no self-selection bias). In non-experimental studies one has to introduce some identifying assumptions to solve the selection problem. The following are two strong assumptions to solve the selection problem.

Conditional independence assumption: Given a set of observable covariates (X) which are not affected by treatment (in our case, participation in brokerage service), potential outcomes (market participation, household's gross income from horticultural crop production and percentage of brokered transaction and marketed surplus etc) are independent of treatment assignment (independent of how the brokerage service participation decision is made by the household). This assumption implies that the selection is solely based on observable characteristics, and variables that influence treatment assignment (participation in broker service decision is made by the household) and potential outcomes (market participation, household's gross income from

horticultural crop production, percentage of brokered transaction and marketed surplus) are simultaneously observed.

Common support: This assumption rules out perfect predictability of D given X. That is: 0 < P (D = 1| X) < 1. This assumption ensures that persons with the same X values have a positive probability of being both participants and non-participants in broker's service. Given the above two assumptions, the PSM estimator of ATT can be written as:

$$\tau_{ATT}^{PSM} = E_{P(X/D=1)}\{E[Y(1)|D=1,P(X)] - E[Y(0)|D=0,P(X)] \quad \textbf{(12)}$$

Where; P(X) is the propensity score computed on the covariates X. Equation (12) is explained as; the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

3. Results and Discussions

3.1. Demographic and Socio-economic characteristics of sampled households

This study is based on the information collected from 143 sampled farm households in Fogera District. Family size ranges from 2 to 14. The sample is composed of 63 male headed and 4 female headed non participant households and 67 male headed and 9 female headed participant households. As indicated in Table 1 below, there is significant difference between participant and non participant farmers with respect to sex. This indicates female headed households tend to participate in the brokerage institutions to sell the horticulture product. Because, direct linkage to the wholesalers needs high communication ability, networked interaction, labor intensive and mobility from place to place but females in the area cannot undertake this because they are very busy undertaking house works and also social taboos hinder them.

Table 1. Descriptive statistics of sample households on pre-intervention characteristics

Pre-intervention Variables	Sampled Households (143)		Participant (N=76)		Non participant (N=67)		Difference in means		T-Value
	Mean	Std.Er	Mean	Std.Er	Mean	Std.Er	Mean	Std.Er	
Age	39.60	0.99	42.54	1. 64	37.01	1.09	-5.52	1.93	-2.86***
Sex	1.91	0.02	1.87	0.04	1.95	0.03	0.08	0.05	1.70**
Marital Status	0.96	0.02	0.95	0.03	0.96	0.02	0.01	0.03	0.16
Education Level	2.53	0.29	1.52	0.36	3.42	0.41	1.9	0.56	3.42***
Family Size[1]	3.31	0.11	3.36	0.15	3.26	0.15	-0.10	0.22	-0.47
Family Size	6.13	0.21	5.94	0.29	6.29	0.30	0.35	0.42	0.83
TLU	5.67	0.25	5.97	0.38	5.40	0.34	-0.57	0.51	-1.11
Land Size	1.57	0.09	1.43	0.08	1.69	0.16	0.27	0.19	1.43
Irrigable Land	0.97	0.09	0.77	0.06	1.16	0.15	0.39	0.18	2.2**
Experience in production	8.97	0.32	9.18	0.48	8.79	0.42	-0.39	0.64	-0.61
Distance to Extension	3.49	0.30	4.41	0.55	2.69	0.26	-1.71	0.59	-2.92***
Cell phone	0.43	0.04	0.18	0.05	0.64	0.06	0.47	0.07	6.32***
Distance to District (Woreta)	12.43	0.63	14.64	1.1	10.49	0.63	-4.15	1.22	-3.40***
Distance to Asphalt road	2.49	0.22	3.76	0.36	1.37	0.18	-2.39	0.39	-6.16***
Number of customers	1.52	0.20	0.85	0.19	2.12	0.32	1.27	0.38	3.29***
Number of Trading contacts	8.07	0.59	7.95	0.74	8.17	0.92	0.22	1.20	0.18

Source: Author's Survey, 2012

*** and **means significant at the 1 and 5% probability levels, respectively.

1. Labor supply conversion factor (person day equivalent)

There is a significant difference in age. This is because aged people are weak in communication and interaction which needs moving from place to place and labor intensive. Thus, they tend to participate in the brokerage institutions. The level of education of the household heads is statistically different for the two groups and non participants were better-off in their level of education.

Educated people have greater communication and negotiation ability in addition they have no problem of calculating the transaction and profit. Thus, educated households tend to do not participate in the brokerage institutions in order to remove the *commission payment* and maximize their profit. There was significant difference on irrigable land holding between the non-participant and participant households. This might be due to the reason that households who have higher irrigable land size have the opportunity to produce more which in turn gives an incentive for them to attract wholesalers because wholesalers think of the reduced transaction cost in which they can have full of the car at a time from one producer. The livestock ownership was not significantly different between participant and non-participant households. The minimum amount owned by a household is 0 while the maximum was 17.68 TLU which indicates that there is a high degree of disparity in the ownership of livestock between the sample households.

3.2. Institutional and social capital aspects

All of the households have access to formal credit sources such as Amhara Credit and Saving Institutions (ACSI). Only 13.2% of households are member of cooperatives. In all of the kebeles of the District there are development agents. However, there is significant difference in distance from residence to development agents between participant and non participant households. Telecommunication facility is the most important service in marketing of horticultural products by providing recent information and reducing the transaction cost of trading. There was significant difference between the participant and non participant households with respect to cell phone ownership. Higher percentage of mobile phone ownership helps the non participant households to easily call and find the wholesalers for selling their horticulture product. There are two main asphalt roads from Bahir Dar to Gondar and from Woreta to Debre Tabour. There is significant difference between participant and nonparticipant households with respect to distance of residence to Woreta (District) market and main asphalt road. The reason is that when the households are far away from the main asphalt road and Woreta town, the transaction cost of finding market information and wholesalers is very high. Thus, the households tend to use brokerage institutions in order to reduce the transaction cost.

Table 2: Descriptive statistics of sample households (for dummy variables)

Pre-intervention Variables	Category	Participant (N=76)		Non participant (N=67)		Total		χ2
		N	%	N	%	N	%	
Sex	Female	10	13.16	3	4.48	13	9.09	2.88*
	Male	56	86.84	64	95.52	130	90.91	
Cell phone	No	62	81.58	43	64.18	105	73.43	31.56***
	Yes	14	18.42	24	35.52	38	26.57	

Source: Author's Survey, 2012

*** and *means significant at the 1 and 10% probability levels, respectively.

Social capital plays very significant role in transaction. There is significant difference between the participant and non participant households with respect to the number of regular wholesaler customers and number of trading contacts to main (Woreta) market in marketing of horticultural products. Social capital reduces the transaction cost by reducing the negotiation and information searching costs. High social capital means less probability of participation in the brokerage institutions. Since, non participant households have higher social capital which reduces the transaction cost they tend to directly contact to wholesalers to sell their product than using brokerage institutions.

3.3. Characteristics of Brokers and their Economic Role

Brokers in the study area are characterized as farmer, peri-urban and urban brokers including farmers, youth brokers (school dropout and high school complete youngsters) and traders of cereals like rice. The brokerage institutions have strong chain in the Woreda and most of the transactions are undertaken by them and are playing role by searching different market outlets to almost all parts of Ethiopia. Since brokerage institutions are well informed by buyers and producers, are residents of the Woreda, educated and youngsters, they have easy information access and play significant role by providing market information, linking smallholders to wholesalers, creating economies of scale from many smallholders, easily bargain both smallholders and wholesalers and act as a collateral for both of actors which helps the smallholders and wholesalers to reduce transaction cost under market imperfections and trust based transaction.

3.4. Propensity score matching model

As indicated in Table 3 below, only six of the fifteen explanatory variables which are theoretically supported to influence the decision to participate in the brokerage institutions for linkage in the logit model have significant effect on the participation decision of the household.

Table 3. Logit results of households' brokerage institution participation

Variables	Coefficients	Std.Er	Z value
Age	.056**	.028	2.03
Sex	-.157	.996	-0.16
Marital Status	-.308	1.410	-0.22
Education Level	-.163*	.086	-1.90
Family Size[1]	-.052	.282	-0.19
TLU	.109	.098	1.11
Land Size	.183	.586	0.31
Irrigable Land	-.022	.574	-0.04
Experience in production	-.021	.065	-0.33
Distance to Extension	.156*	.087	1.81
Cell Phone	-1.710***	.554	-3.09
Distance to District	.006	.038	0.16
Distance to Asphalt	.631***	.172	3.67
Regular Customer	-.331**	.164	-2.02
Trading Contacts	-.027	.042	-0.65
Constant	-2.479	2.458	-1.01
Sample size (N)	143		
LR chi2(15)	84.88		
Prob > chi2	0.00		
Pseudo R^2	0.42		
Log likelihood	-56.394		

Source: Own estimation result

***, ** and *means significant at the 1%, 5% and 10% probability levels, respectively.

1. Labor supply conversion factor (person day equivalent)

The interest of the matching procedure is to get a household from non-participants in brokerage institutions service with similar probability of participation or using brokerage institutions given the explanatory variables.

Age of the household head significantly and positively affected the probability of participation in using brokerage institutions service of the household. It coincides with the hypothesis that as the age of the household head increases, the household decides better to participate in brokerage institutions. This is due to the fact that aged people have weak communication and information searching ability in order to directly contact to traders/wholesalers to sale the onion. In other words, the younger the household head is, and the more likely will be the probability of not participating in the brokerage institutions for linkage in the marketing of onion.

Education level of the household has a negative significant effect on the participation decision of the household in brokerage institutions. People with higher education level are good at communication, information searching, negotiation and undertaking transaction which leads to direct contact to traders to sell their product. This indicates that educated people have less probability of using brokerage institutions for linkage to wholesalers than uneducated people (illiterate and adult education). In Fogera Woreda the most determining factor for direct linkage of farmers to wholesalers is the thrust between them during transaction. The transaction can be undertaken if there is strong thrust between them in weighing and payment. If the household head is uneducated he has no knowledge about weighing and preferred to use brokerage institutions for market linkage than direct linkage to wholesalers as he is more familiar with the broker who lives in the residence and trustful on the broker. Payment place is also the most important issue for farmers and wholesalers. Farmers prefer to receive their payment at the farm while wholesalers prefer to pay at Woreta town this disagreement made uneducated farmers to sale their product using brokerage institutions while educated farmers have no problem of payment place rather the price itself. Thus, there will be easy agreement between farmers and wholesalers and they tend to directly contact to wholesalers to sell their product without using brokerage institutions.

Distance of residence of the household to development agent's office has a positive significant effect on the participation decision of the household in the brokerage institutions. Households which are far from the development agent office have higher probability to use brokerage institutions for linkage to the

market outlet than households which are near to development agents. The reason for this fact is that when distance of the household's residence to the development agents increase, the household cannot have easy access for extension services related with product marketing techniques, market information and market linkages which lead the household to participate in brokerage institutions service for linkage than direct contact to the wholesalers. The two most important factors which affects households decisions whether to use brokerage institutions or not in Fogera Woreda are transaction costs and the issue of obtaining secure market outlet for the product. Having Cell phone (Mobile phone) or not has a negative significant effect on the participation decision of the households whether to use brokerage institutions or not for linkage to the traders/wholesalers. Households who have mobile phone have a higher probability of not using brokerage institutions for market linkage than those who do not have. Mobile phone makes communication and information searching very easy as a result it reduces the transaction cost of finding wholesalers. Therefore, it facilitates the direct contact of households to the traders.

Distance of residence of the household to the main asphalt road has a positive and significant effect on the participation decision of the households in the brokerage institutions. Households which are far from the main asphalt road have higher probability to use brokerage institutions for linkage to the market outlet than households which are near to the main asphalt road. The reason for this fact is that when distance of the household's residence to the main asphalt road increases, the household cannot access information about the wholesalers and there will not be thrust between the wholesalers and the farmers in the transaction processes (payment become very difficult for the wholesalers at the farm which is distant from the asphalt road, the wholesaler do not thrust the farmer whether he has quality onion or not in the area and if there is no quality onion there will be high transaction cost for wholesaler to come out of the farm to the main road. On the other side, the farmer also do not have thrust on the wholesaler in order to receive the payment for his product from the wholesaler in the Woreta town) which leads to higher probability of using brokerage institutions for market linkages in which the brokerage institutions are known and the transaction is safe from any default.

Number of regular customers (wholesalers) of the households has a negative and significant effect on the participation decision of the household in brokerage institutions service. Households having large number of regular wholesalers have lower probability of participating in the brokerage institutions for market linkage than those who have lesser number of regular customers this is due to the fact that households prefer direct market contact to the wholesalers as they have larger number of regular customers who can purchase the product. Thus, there is no information problem and higher transaction cost to access them. In addition direct contact removes the *FERQ* which is advantageous for both producers and wholesalers. However, if the household have less number of regular wholesaler customers, this wholesalers cannot purchase all of his product because they are few which needs searching another market outlet or wholesaler this in turn leads to higher transaction cost of searching information and wholesalers. As a result the household prefer to use brokerage institutions for market linkage under this condition.

3.5. Common support condition and matching using matching algorithms

The next step in propensity score matching technique is the common support condition. Only observations in the common support region matched with the other group considered and others should be out of further consideration. The predicted probability for those who are participating in the brokerage service ranges from 0.060 to 0.999 with the mean probability of participation being 0.725. On the other hand, the probability of not participating of the non participant households in the brokerage institutions service ranges from 0.003to 0.895 with mean of 0.242. From the result, observations with the predicted probability between 0.060 and 0.895 are in the common support region with the possibility of getting good match from the other group. Observations with predicted probability less than 0.060 and greater than 0.895 have been disregarded out from further analysis.

In an impact assessment study, households should have their good match from the control group. This will be maintained through balancing the covariates of the participant group to the covariates of the non-participant group. Against the unmatched sample, matched samples using kernel with band width of 0.25

satisfy the property of balanced matching for all of the covariates. The three criteria were implemented to each matching algorism to identify the best matching technique. Kernel matching algorism with a band width of 0.25 was found to be the best estimator by balancing all the observable covariates, ends with low pseudo-R^2 and large number of observations in the common support. Accordingly, the research used it for measuring the impact.

3.6. Impacts of the Brokerage Institutions

The study describes the impacts of brokerage institutions in linking smallholder horticultural crop (onion) producers with market outlets (wholesalers) in terms of net return, percentage of marketed surplus, land allocated to onion production, amount of onion produced and sensitivity of the impacts.

Table 4: Impact of Brokerage institutions

Outcomes	ATT	Std.Err[1]	T-value
NRO	4393.62	1781.51	2.53**
PMS	13.55	13.84	2.86**
AOP	-5.084	36.72	-0.25
LAOP	-0.053	0.22	-0.24

Source: Own estimation result

**, significant at 5% probability levels

1. The bootstrapped SE is obtained after 100 replications

3.6.1. Impact on net return from onion production (NRO)

Brokerage institutions in Fogera Woreda create linkage between farmers and the market outlet (wholesalers). Thus, farmers using brokerage institutions have easy access to wholesalers which reduces the transaction cost of searching traders, market information, loss due to perishablity and transportation cost which in turn reduces the overall marketing cost. As net return is revenue reduced the total cost, a reduction in marketing cost means a reduction in total cost which leads to high net return. Smallholder farmers using brokerage institutions have got 4393.62 ETB higher net incomes from onion production than those farmers who do not use brokerage institutions for linkage to the market outlet. This indicates that brokerage institutions are

playing a significant and positive role in linking smallholder farmers to the market outlets.

3.6.2. Impact on percentage of marketed surplus (PMS)

Smallholder's use of brokerage institutions is highly associated with the issue of obtaining secure market for their product in all the production years. According to Woreda Experts and Development Agents there is significant fluctuation either increasing or decreasing in horticultural production every year following the increase or decrease in price of the previous year respectively. In 2011 production year, It was very good year for horticultural production and onion production was high in the area following the high price incentive in 2010. Thus, in 2011 the price of onion has reached to 0.25 ETB for Kg of onion because the supply was much more than the demand and even most of the farmers specially farmers who do not use brokerage institutions do not sell much of their product, following this the farmers reduced allocation of more land to onion production and the supply in 2012 become very low relative to demand. Based on the monitoring of the study area for about four months (January, February, March and April) the price score for a Kg of onion was between 4.00-7.00 ETB.

In 2011, due to the high supply of onion, lower demand compared to production and perishable nature of the product brokerage institutions played great role in linking their smallholder customer farmers (broker users) to the market outlets and the percentage of non marketed onion from total production was lower than 27.27% while farmers who do not have the experience of using brokerage institutions specially those their residence is far from the main asphalt road were unable to sell their product and the non marketed onion from total production has reached to up to 79%. This is due to the fact that brokers have much higher regular wholesaler customers than farmers who do not use brokers, more information and very high communication capacity which leads them to control most of the wholesalers coming to the area. In addition, in the time of much supply brokerage institutions provide service first for their very experienced farmer customers that is based on experience in transaction. The result of the study revealed that smallholder farmers who participated in brokerage institutions for linkage have

13.55% of greater marketed surplus than those smallholders who do not participate. This implies that brokerage institutions have significant and positive impact on marketed surplus in Fogera District.

3.6.3. Impact on Amount of Onion Produced (AOP) and Land Allocated to Onion Production (LOAP)

The result of the study indicated that brokers have no significant and positive impact on the amount of onion produced and land allocated to onion production. The reason is that higher land allocation and high production is affected by other factors like previous year price.

3.7. Sensitivity Analysis

Rosenbaum (2002) proposes using Rosenbaum bounding approach in order to check the sensitivity of the estimated ATT with respect to deviation from the CIA (Conditional Independence Assumption). The basic question to be answered here is whether inference about treatment effects may be altered by unobserved factors or not.

Table 5: Result of sensitivity analysis using Rosenbaum bounding approach.

Outcomes	e^{γ}=1	e^{γ}=1.25	e^{γ}=1.5	e^{γ}=1.75	e^{γ}=2	e^{γ}=2.25	e^{γ}=2.5	e^{γ}=2.75	e^{γ}=3
NIO	5.0e-12	6.4e-09	6.9e-07	.000018	.000192	.001141	.004497	.013149	.030763
PMSU	P<0.000	P<0.000	P<0.000	1.1e-16	8.0e-15	2.3e-13	3.3e-12	2.9e-11	1.8e-10
AOP	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000
LAOP	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000	P<0.000

Source: Own estimation

e^{γ}(Gamma)=log odds of differential due to unobserved factors where Wilcoxon significance level for each significant outcome variable is calculated

The first column of Table 5 showed those outcome variables which bears statistical difference between treated and control households in our impact estimate above. The rest of the values which corresponds to each row of the significant outcome variables are p-critical at different critical value of e^{γ}. Result showed that the inference for the effect of the brokerage institutions is not changing though the participants and non participant households in the brokerage institutions has been allowed to differ in their odds of being treated

up to 200% (e^{γ}=3**)** in terms of unobserved covariates**.** That means for all outcome variables estimated, at various level of critical value of e^{γ}, the p-critical values are significant which further indicate that the study have considered important covariates that affected both participation and outcome variables. The study couldn't get the critical value e^{γ} where the estimated ATT is questioned even if the research have set largely up to 3, which is larger value compared to the value set in different literatures which is usually e^{γ}=2 (100%).Thus, it is possible to conclude that the research impact estimates (ATT) are insensitive to unobserved selection bias and are a pure effect of brokerage institutions in the area.

4. Conclusion and Recommendations

The overall analysis of the study can be concluded that brokerage institutions are characterized as farmer, peri-urban and urban brokers including farmers, youth brokers (school dropout and high school complete youngsters) and traders of cereals like rice. The brokerage institutions have strong chain in the Woreda and most of the transactions are undertaken by them and are playing role by searching different market outlets to almost all parts of Ethiopia. Since brokerage institutions are well informed by buyers and producers, are residents of the Woreda, educated and youngsters, they have easy information access and play significant role by providing market information, linking smallholders to wholesalers, creating economies of scale from many smallholders, easily bargain both smallholders and wholesalers and act as a collateral for both of actors which helps the smallholders and wholesalers to reduce transaction cost under market imperfections. If brokerage institutions were not there, it was very difficult for wholesalers coming from the area to find smallholder producers. Therefore, empirically the idea that brokerage institutions are not important along the value chain is highly challenged here and brokerage institutions are the most important actors in the marketing of perishable products like onion which implies that greater attention should be given for them in order to sustain production and market linkages.

Brokerage institutions are source of secure market for smallholder producers because they have many regular wholesaler customers coming from the different areas of the country. Thus, if a farmer have regular customer of

broker and plan to produce onion he is secured for the market because of brokers. This in turn implies that brokerage institutions form market outlets for the smallholders. Finally, the study recommends that a formalized and upgraded brokerage institution is commendable only as a *third pillar* for a better market coordination in the area. That is to say, in the best circumstances, even a formalized and upgraded brokerage institution should be considered only as a complement to, rather than as a substitute for, improved market institutions and effective producer organizations. The formalization activity can be adopted from the Ethiopian Commodity Exchange (ECX) experience. The study also recommends the ECX to include the horticultural crops such as onion in its commodity crop services. In addition, the study recommends training to farmers on marketing and weighing, standardization of weighing and provision of market information for the farmers in order to increase the benefit and income of farmers which helps them to come out of poverty.

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Prospects of Transforming Subsistence Agriculture into Sustainable Livelihoods: A Case-Study of the Ribb Sub-Catchment Ethiopia

Yodit Balcha[1]

Abstract

This study assesses the importance of agricultural transformation in achieving sustainable livelihood in rural Ethiopia. By focusing on the different agricultural transformation components, the study analyse different farming typologies at household level. Through the process of smallholder commercialization, households can transform into more desired farm typology which can assist them to achieve food security and reduce poverty. Based on households production objective, the result suggests that households in the study area belong to four major farm typology i.e., below-subsistence, subsistence, constant improving and commercial level farm typologies. By applying an ordered logit regression model, the variables having high significance level and determine households to transform from lower farm typology (below-subsistence level) to higher (commercial level) are topography, livestock holdings and irrigation. Farm land size, land fragmentation and non-farm income are also determining factors in smallholder agricultural transformation. In addition, the result show that weak institutions, poor access to markets and credit, inadequate infrastructure, poor soil fertility and land degradation have constrained households to transform to smallholder commercialization.

Keyword: Sustainable development; sustainable rural livelihood; farm typology; subsistence agriculture; smallholder commercialization; agricultural transformation; ordered logit regression

[1] Yodit Balcha, Sustainable Development (MSc.) is the Founder of (B) Energy Ethiopia (www.be-nrg.com). It is a company that provides mobile, simple and affordable biogas technologies. E-mail: yodit@be-nrg.com, Mobile: +251911880141

Abbreviation

ADLI	Agricultural Development-Led Industrialization
ARARI	Amhara Region Agricultural Research Institute
BoARD	Bureau of Agriculture and Rural Development
BoWRD	Bureau of Water Resources Development
CSA	Central Statistical Agency of Ethiopia
DA	Development Agent
DID	Department of International Development
EIA	Ethiopian Investment Authority
EMIS	Education Management Information System
FAO	Food and Agricultural Organization
GDP	Gross Domestic Product
GTP	Growth and Transformation Plan
IDS	Institute for Development Studies
IFAD	International Fund for Agricultural Development
ILCA	International Livestock Center for Africa
MDGs	Millennium Development Goals
MoA	Ministry of Agriculture
MoFED	Ministry of Finance and Economic Development
MoWE	Ministry of Water and Energy
NGO	Non-Governmental Organization
PA	Peasant Association
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PRS	Poverty Reduction Strategy
SAPRP	Sustainable Development and Poverty Reduction Programme
SARD	Sustainable Agriculture and Rural Development
SSA	Sub-Saharan Africa
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
WCED	World Commission on Environment and Development

1. Introduction

1.1 Background

Sub-Saharan Africa (SSA) is categorised as an agrarian economy where 32% and 65% of the region's total gross domestic product (GDP) and total labour respectively depends on (World Bank, 2007; Bach & Per, 2008). The region's agricultural production depends on diverse agro-ecological and farming systems where farmers grow a wide range of crops and keep different types of livestock for their livelihood strategies. SSA is highly challenged in terms of poverty and hunger as well as ensuring environmental sustainability (Reynolds et al., 2007; Rockstrom et al., 2007). The major challenges the agricultural sector in SSA faces include high population growth (which results in livelihood resources competition), increasing climate variability, declining levels of agricultural productivity, natural resource degradation and food insecurity (Biggs et al., 2004; Beintema & Stads, 2006). In order to enhance the agricultural productivity of the region, a special attention needs to be given to the smallholder[2] farmers. Most of SSA smallholder farmers use small-scale rain-fed agricultural system categorizing them as; "the poorest, least educated, poorly linked to markets, most vulnerable to non-conducive policies and surrender more severely to unfavourable environmental conditions such as draught" (World Bank, 2007).

Like many of sub-Saharan African countries, the major driving vehicle for the economic growth and in fighting poverty and hunger in Ethiopia is agriculture. As the main source of livelihood and backbone of the country's economy; for the year 2008/2009 agriculture sector contributed 43% for GDP, 86% for foreign currency earnings (EIA, 2010) and 85% for rural employment (MoA, 2011). Through institutional and policy reforms, Ethiopia has achieved strong and promising economic growth in the past decade (MoFED, 2007). The witnessed economic growth is believed to be the result of the Poverty Reduction Strategy (PRS) [3] designed by the Ethiopian government with subsequent policy eras of Sustainable Development and Poverty Reduction

[2]Smallholder farmers are often characterized as farmers with limited land and capital, high exposure to risk, low input technologies, and low market orientation (World Bank, 2003).

[3] Poverty reduction strategy is a strategy that describes and evaluates the country's macroeconomic, structural, and social policies and programmes that will promote growth and reduce poverty (MoFED, 2003).

Programme (SDPRP) for year 2002/03-2004/05; Plan for Accelerated and Sustained Development to End Poverty (PASDEP) for year 2005/06-2009/10 and Growth and Transformation Plan (GTP) for 2010/11-2014/15. To date SDPRP and PASDEP have been formulated with major emphasis given to Agricultural Development-Led Industrialization (ADLI)since agriculture sector is the source of the country's livelihood (MoFED, 2003). Even if Ethiopia recorded highest performing economies in sub-Saharan Africa, 29% of the population still lives below the national poverty line (IFAD, 2009). In 2011, World Bank reported that 83% of Ethiopian population resides in the rural part of the country where poverty is significantly severe and livelihood strategy is dependent on small scale farming or livestock herding. With 1.8% annual rural population growth in Ethiopia (World Bank, 2011), promoting Sustainable Agriculture and Rural Development (SARD) in order to satisfy the demands of the increasing population for food and other agricultural commodities is important.

> *"The major objective of SARD is to increase food production in a sustainable way and enhance food security ..." (UNCED, 1992). There is growing realisation that there is no single solution to achieving SARD and that income generation off the farm importantly contributes to enhancing the quality of rural life." (FAO, 2001).*

The primary focus of ADLI (the agricultural policy and strategy designed by the Ethiopian government)is on the expansion of large scale commercial farms and smallholder productivity improvement in order to accelerate agricultural production and development at all level (MoFED, 2003). Although ensuring agricultural productivity and food security is the primary objective, there should be a parallel goal that maintains and/or enhances the agro-ecosystem[4] services to achieve sustainable development and rural livelihood (see Folke et al., 2002; Sayer & Cambell, 2004; Swinton et al., 2007). Evidence from Ghana shows that strong agricultural performance by strongly emphasising on smallholder and subsistence farmer's investment can be a key tool in poverty

[4] In order to sustain agro-ecosystem services, this study included the different social endeavors shaped by human values such as market development and policy decisions (see Robertson & Swinton 2005).Through this, we can specifically study the social-ecological linkage of the agricultural system that can help us to meet the challenges of sustainable development (see Folke et al., 2002; Sayer & Cambell, 2004).

eradication (Beintema & Stads, 2006). Ethiopia's development and poverty reduction strategy also recognizes the need in "market oriented" agricultural system in order to promote "sustainable development". The five year plan PASDEP that was put in action for the years 2005/06-2009/10 gave particular emphasis on commercialization of agriculture, private sector development and the scaling up of resources for a faster development (MoFED, 2007). With this strategy, Ethiopia is heading in the right path in eradicating extreme poverty and hunger and ensuring environmental sustainability (MDGs 1 and 7) by giving priority to the development of rural livelihood where vast number of the country's population resides.

Different agricultural policies have been adopted by many agrarian countries in SSA, where implementation of those policies with special focus in smallholder agricultural transformation. The study made by Salami et al., (2010) in four East African countries including Ethiopia commented on the significant agricultural potential the countries possess: though achieving food security seems to be a challenge. By giving special attention in smallholder agricultural infrastructural development (through access to water and irrigation), enhancing access to markets, access to finance (by providing credits to facilitate investments and inputs purchase), adaptation of technology which increases crop varieties and policy re-orientation that secure land tenure system food security and rural development can be achieved (FAO, 2008; IFAD, 2009; Moti et al., 2009; Salami et al., 2010). Therefore, this study fully investigates the multiple components the Ribb sub-Catchment has in smallholder agricultural transformation. The scope of this study will give us a clear image on how linking smallholder agriculture commercialization will be a driving vehicle to achieve sustainable livelihood. Since the region is "endowed and blessed with a high potential of irrigable land area, sizeable surface water diversion for small-scale agricultural system from four major river basins and underground water" (BoWRD, 2005), a focused study of households using irrigation in smallholder agricultural transformation is included.

1.2 Gap analysis

This study tries to address the different aspects smallholder farmers apply that helps them to transform their agricultural system. Currently, intensive

development intervention is underway through irrigation and infrastructure in Amhara region (BoWRD, 2005). Modern irrigation schemes to successfully transform smallholder agriculture require investment in improved technologies (improved seeds, high value crops, constant supply of inputs and agronomic packages) and knowledge that integrate production and marketing (Salami et al., 2010). Agricultural transformation mainly is seen as the linkage farm households have with market at a given point of time. Different characteristics and parameters are used by different authors and researchers to describe what agricultural transformation is(see Moti et al.,2009). This study uses a combination of change in production objective (from subsistence to marketing where changes in the proportion of marketed agricultural outputs is the key aspect) and change in harvested crops (from traditional to commercial crops) as indicators of transformation. The parameter "change in harvested crops" is used due to the recent witnessed change where farmers in the study area started producing marketable/ cash crops (mainly rice).Even though the region has great potential in transforming small-scale farmers to achieve food security through irrigation and other agricultural water management technologies. Lack of investment capital, limited access to credit and market infrastructure (roads, physical market structures, market information and contacts) is reported to be an obstacle in smallholder transformation in the region. Due to the lack of these factors result small-scale farmers to stay trapped within subsistence agriculture system with minimal orientation towards commercializing and increasing agricultural productivity. By addressing these factors in a proper and contextual manner, households in the region can achieve sustainable rural livelihood strategy and food security.

The Amhara region is the second most populous region[5] in Ethiopia with a total population of 18,529,000 (CSA, 2012). The region have a long history of famine and drought where an estimated 18-20% of the population is chronically food insecure (BoARD, 2003). The Bureau of Agriculture and Rural Development (BoARD) listed "erratic and unreliable rainfall, degraded natural resource base, high population density and low productivity caused by poor agricultural

[5] Ethiopia is divided in to 11 regions (which replaced the older system of provinces). From those 11 regions, 9 are ethnically based administrative regions (named: Afar, Amhara, Benishangul-Gumuz, Gambela, Harari, Oromiya, Somali, Southern Nations and Nationalities People (SNNP) and Tigray) and Two city Administrative regions (Addis Ababa and Dire Dawa) are autonomous cities (CSA, 2012).

management practices" as major factors for the witnessed famine and food insecurity in the region. As reported by MoFED (2010), one of the major challenge encountered while implementing PASDEP in the past five years were the delayed on-set of rain which has made increasing agricultural productivity very difficult. In some areas of the country mal-distribution of rain were the major challenge mentioned with regards to smallholder commercialization which is helpful way in increasing agricultural productivity and reducing the level of household's[6] food insecurity. It is therefore very important to study how food security can be achieved through agricultural commercialization for sustainable rural livelihood.

1.3 Objective

This study assesses the importance of smallholder agricultural transformation to achieve sustainable livelihood in the Ribbsub-Catchment of the Amhara region in Ethiopia. With specific objectives of answering the following research questions:

- What are the different agriculture typologies and rural livelihood strategies conducted in the area?
- What are the socio-economic and bio-physical factors which determine the transformation of subsistence smallholder farming systems to a level of better welfare status?
- Is there significant difference in farm income across farm typologies?

2. Literature Review

In this section, different literatures which are done on the topic of sustainable rural livelihood and smallholder commercialization will be reviewed. Definitions of the different terms that are important in giving a clear image of the linkage smallholder agricultural commercialization have in achieving sustainable livelihood. .

[6] The household is taken as the unit of reference because it is the primary level of aggregation through which people organizes production, share income and consumption (Guido et al., 2012).

2.1 Sustainable rural livelihood

With 83% of Ethiopia's population residing in rural areas, the government adopted a focused intervention through strengthening rural development for accelerated and sustained economic growth (MOFED, 2003). In order to eradicate poverty and achieve economic development, the 1987 Brundtland report[7] proposes a development path that is sustainable which involves a progressive transformation of economy and society for both developing and developed countries. As per the Brundtland report:

> "*Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (WCED, 1987).

In order to achieve sustainable development by a nation, the development strategy should focus on the available resource and assets. For Ethiopia, agriculture and rural livelihood development can be a great way to eradicate poverty and achieve sustainable development. A livelihood may be defined as "the sum of ways in which households obtain the things necessary[8] for life, both in good and bad years" (FAO, 2008). Scoones (1998) in his paper discussed about the different livelihood approaches rural people uses and which strategy would yield a sustainable livelihood outcome. It is very important to define what sustainable livelihood means and how realistic it is. Krantz (2001) has made a detailed analysis about the different definition and terminologies used by different scholars and research organizations by referring the early definition of sustainable livelihood found in Brundtland report of 1987. In her paper, Krantz believes the definition the Institute for Development Studies (IDS) team used is more realistic and appropriate in cases of studying specific

[7] 1987 Brundtland report was organized by the World Commission on Environment and Development (WCED) following the first conference on the Human and Environment held in Stockholm in 1972. The WCED's aim while publishing the report is in "creating a united international community with shared sustainability goals by identifying sustainability problems worldwide, raising awareness about them, and suggesting the implementation of solutions" (WCED, 1987).

[8] These necessities include food, water, shelter, clothing and health care (with education often included too) (FAO,2008)

livelihood strategies[9]. Thus, the definition of sustainable livelihood in this paper uses the IDS teams' definition of:

> "*A livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, while not undermining the natural resource base" (Chambers & Conway, 1992).*

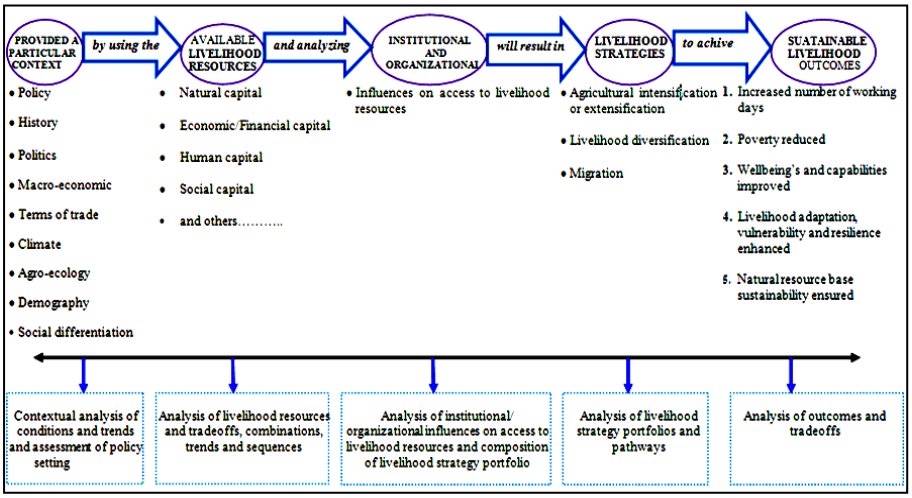
In order to investigate and provide a solution (way forward) to achieve sustainable rural livelihood, the IDS team has developed a Sustainable Rural Livelihoods framework (*Figure 1*). Derived from a combination of different livelihood strategies a community or an individual can reach sustainable livelihood based on their access to different livelihood resources[10] and the way they pertain those resources. The framework provides a more logical and integrated approach in realizing how to lessen poverty by addressing policy, institutional, development and resource management factors. Department of International Development (DFID) in 1999 has acknowledged the framework's attractiveness since it provides "a simple but well-developed way of thinking about a complex issue and can be applied as a broad conceptual framework or as a practical tool for designing programmes and evaluation strategies". The framework is also a holistic approach in understanding poverty and how to alleviate it (DFID, 1999).

The livelihood effects generated could take both positive and negative depending on the available resources people have and the pressure exerted on those resources. The different components[11] of the sustainable livelihood outcomes (Figure *1*) have a linkage between one another where; the employment generated through a specific livelihood strategy adopted by household will lead to poverty reduction and improving household's well-being and capability. By achieving those outcomes a resilient livelihood adaptation and natural resource sustainability can be enhanced. This in turn will be a starting point in any policy and development project in achieving sustainable development by the rural community and the country in general. Since the

[9] Livelihood strategies imply agricultural intensification or extensification, livelihood diversification and migration.
[10] Livelihood resource includes natural, economic, human and social capitals.
[11] Scoones (1998) by referring various literatures, have an elaborated discussion about each component in his paper.

framework helps in identifying the necessary linkages in rural people's living strategy in an economically, ecologically, and socially sustainable manner (Krantz, 2001; Timmer, 2003; Bryceson, 2005; Guido et al., 2012) a country can incorporate a policy to achieve sustainable development.

Figure 1: The Sustainable Livelihood Framework (Scoones 1998)



2.2 Rural livelihood development

SSA is home to more than 690 million people (UNDP, 2006) from which 62% of the population resides in the rural area (FAO, 2008). Since the rural part of the SSA population's livelihood depends on agriculture, decreases in rural household's farm size and resource competition has become a common phenomenon for the region. With more than half of SSA population residing in the rural part, it is very important to increases the levels of productivity per unit area of land in order to reduce rural poverty and generate employment for their growing population. Referring back to the sustainable livelihood framework (*Figure 1*), agricultural intensification will be a key way to improve rural livelihood. Why agricultural intensification? Since many rural households in SSA have land holding of less than 1 ha (FAO, 2008), a livelihood strategy of agricultural intensification which is characterized by "more output per unit area through capital investment or increases in labour inputs" (Scoones, 1998) will be suitable.

It is necessary to use different livelihood strategies in order for the households to be able to resist shock or to avert risk. From past experience applying a specific type of livelihood strategy of agricultural investments (such as investments in natural and physical assets) in challenging conditions (land degradation, soil fertility and rainfall variability) has limited smallholder farmer's livelihood development (World Bank, 2003; Brown and Lall, 2006). Even though the livelihoods of rural household especially in SSA is predominantly characterized as subsistence farming, households supplement their livelihood strategy with several other activities (non-[12] and off-farm[13] income, migration income, remittance, food transfer) for food and income earning (FAO, 2008). Since different livelihood options are available to people depending on where they live (the agro-ecological context) and the resources to which they have access (land, infrastructure, assets, financial resources, labour, social network, etc.), it is necessary to map out and identify homogenous conditions where households share similar livelihood patterns and have relatively similar entitlements (Guido et al., 2012). By considering the biophysical and socio-economic determinants of rural households, rural livelihood development resolutions can be sketched.

2.3 Subsistence agriculture in transition

Subsistence agricultural system is widely practiced by smallholder farmers in developing economies usually characterised by 'low production and economic return' which may not be a viable activity in ensuring sustainable livelihood and food security (Pingali et al., 2005). In order to sustain smallholder farmer's production, there is a need to transform the process they practice to more desirable and economically viable solution. Moti et al. (2009) talked about the importance of agricultural commercialization for a country's economic growth and development through smallholder commercialization. In order to lay concrete foundation in attaining MDGs by 2015, strategy documents in many SSA countries tend to highlight in transforming smallholder agriculture to high growth path shift through diversification and commercialization (MOFED, 2006; World Bank, 2007). In Ethiopia in 2010, for example, the average annual per

[12] Non-farm income includes income generated from employment, petty trading, handicraft, sales of wood, renting out land, etc

[13] Income gained from working on others farm either through cash or food (share of production)

capita income growth rate was 8.4% due to the emphasis given by PASDEP to commercialization and diversification of smallholder agriculture (MOFED, 2010).

Several researches including Pingali et al. (2005), FAO (2008) and Moti et al. (2009) has shown the impacts of the transition from subsistence to commercialized agricultural system in income generation, nutritional change, other social and economic dimension development, and production specialization both at regional and household level as well as production diversification at national level. Though subsistence farmers usually transform to commercial farming due to surplus crop production while producing staple foods; smallholder commercialization will lead to increased diversity of market oriented commodities at national level (Thorpe et al. 2000;Pingali et al., 2005).For example; experiences from Kenya in 2000 suggested that agricultural products from rural smallholder farmers contributed export items (60% of horticultural export, 62% of black tea and 80% of dairy output) that generated income and employment opportunity (Thorpe et al., 2000).

2.4 Progression in agricultural commercialization

The agricultural strategy the Ethiopian government aims, as in the PASDEP report outlined is to pursue a parallel shift in commercialization (MOFED, 2006). This shift has improved people's livelihood; infrastructure development and expansion of social services; involvement of private investors and a remarkable real GDP growth of 8.4% (MOFED, 2010). Box 1 describes the public investment and services the PASDEP strategy outlined to facilitate and help jump-start the process of agricultural commercialization.

Box 1. Accelerating market based agricultural development under PASDEP

In order to encourage smallholder farmers to transform in to market based agricultural system which will lead to economic growth and food security, the instruments used under PASDEP by the Ethiopian government includes:

- Constructing farm to market roads,
- Development of agricultural credit markets,
- Specialized extension services for differentiated agricultural zones and types of commercial agriculture,
- The development of national business plans and tailored packages for specialized export crops (such as spices, cut flowers, fruits and vegetables),
- Supporting small-scale irrigation and area irrigation through multi-purpose dams,
- Measures to improve land tenure security, and to make land available where feasible for large-scale commercial farming,
- Reforms to improve the availability of fertilizer and seeds and,
- Better-functioning agricultural markets for both inputs and outputs, and institutions, including improved value chains, information flows, quality and standards support, and cooperatives that strengthen the position of farmers in the market.

Source: MoFED, 2006

Although such national level progress has been witnessed by implementing the market based agricultural development initiative, most smallholder farmers still exercise subsistence agriculture (MOFED, 2010). An agricultural transformation process in which individual farms shift from a subsistence-oriented production towards more specialized with marketable surplus production can be characterized as agricultural commercialization (Moti et al., 2009). Depending up on the different resources available to the households, agricultural transformation from subsistence to commercial production takes a longer process (Pingali and Rosegrant, 1995). This transformation process through which farmer's pass is explained in different categories of farming typologies. The identification and categorization of rural population's typology is a crucial aspect in the sustainable rural livelihood analysis. These typologies have

different characteristics, constraints, priorities and attitudes for which different individual's practice (in this case transforming to smallholder agricultural commercialization) which can impact differently on their livelihoods (Guido et al., 2012). In different literatures different definitions of farm typologies existed based on the specific characteristics each author used. Box 2 shows some examples of farm typology definitions.

Box 2: Defining farm typology

Pingali and Rosegrant (1995) and Moti et al., (2009) defined farm typology based on the comparative advantage the produced product have in the market as well as the major production objective and decision the household used. Based on those characteristics three levels of farm typologies were formed named subsistence, semi-commercial and commercial farming system. The specific characteristics the authors used in order to classify farming households in different farm typologies includes input and output markets, degree of specialization in production and dependence on markets for income and/or consumption the household uses.

Defining Farm Typology

Farm typology	Farmers objective	Source of input	Product mix	Household income source	Human nutrition	Soil fertility
Subsistence system	Food self-sufficiency	Household generated (non-traded)	Wide range	Pre-dominantly agriculture	Predominantly home produced	Farm yard manure (FYM)
Semi-commercial system	Surplus generation	Mix of traded and non-traded inputs	Moderately specialized	Agricultural and non-agricultural	Home produced and purchased	FYM and chemical fertilizer
Commercial system	Profit maximization	Predominantly traded inputs	Highly specialized	Pre-dominantly non-agricultural	Predominantly purchased	Chemical fertilizer

Source Moti et al., (2009) adopted from Pingali (2001)

On the other hand Guido et al. (2012) identified five main farming typologies based on livelihood analysis context as:

Highly vulnerable people:
This category consists of people having no or very limited access to livelihood assets and resources. They are often widows, families affected by HIV/AIDS or other diseases, etc.

Landless:
These are farmers who do not possess any land, depends on other's land for cultivation by providing their labor

Traditional smallholder farmers:
These farmers produce mainly staple food (both crop and livestock) for household consumption and have relatively marginal connections to markets. The aim at stabilizing production and reduce risks of production failures.

Emerging market-oriented smallholder farmers:
These farmers may partially subsist from their own production but whose principal objective is to produce a marketable surplus.

Commercial farmers:
These are large or small-scale commercial farmers and enterprises that are fully oriented towards internal and export markets.

3. Methods

This study constitutes part of a large research project on Blue Nile/ Lake Tana Nexus project in Ethiopia undertaken under the auspices of Stockholm Environment Institute (SEI), aimed at studying the food, energy and water nexus issues in the region. This study is based on a survey conducted during April and May 2012, in the Ribb Sub-Catchment area of the Fogera woreda[14], which is part of the South Gonder Zone of the Amhara Regional State. This section is organized to include the descriptions of the study area, data sampling and collection procedure and the theoretical and empirical methodology of data analysis.

[14]Woreda (which is an equivalent to a district) in Ethiopia is the third-level administrative division that is managed by a local government.

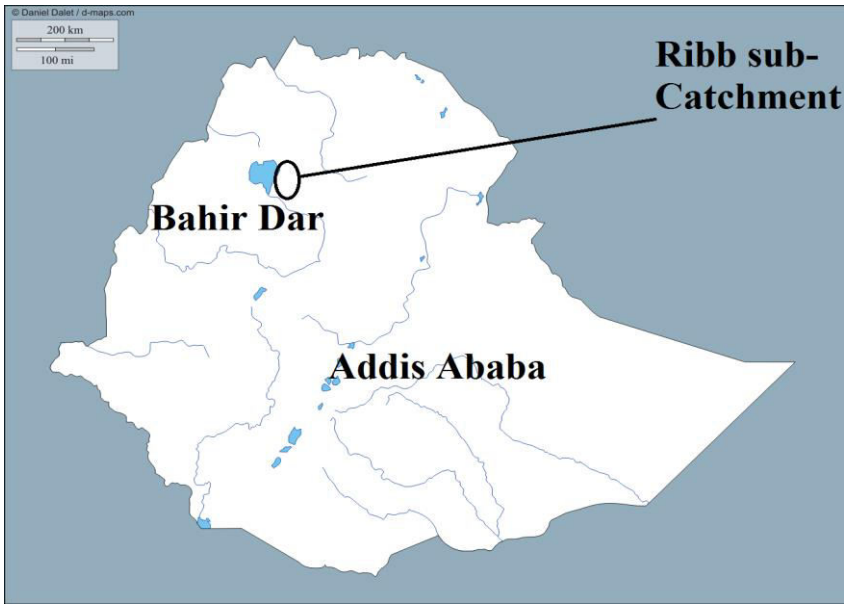
3.1 Description of the study area

Ribb River is found in LiboKemkem and Fogera woredas and is one of the contributing Rivers of Lake Tana[15]. The specific study area of the Ribb River sub-Catchment is located in the Fogera woreda of South Gondar zone. The Fogera woreda is bordered by LiboKemkem woreda in the north, Dera woreda in the south, Lake Tana in the west and Farta woreda in the east (*Figure 2*). Woreta is the capital of Fogera woreda and is located 625 km from Addis Ababa and 55 km north of the regional capital, Bahir Dar city. It is located at 11044'-12003'N latitude and 37025'-37058'E longitude (BoWRD, 2005).

Fogera woreda consists of plain or flat lands that account for 76% mountains, 11% hills and 13% valley bottoms classified locally as highland, midland and lowland topography levels. The total land area of the woreda is 117,405 ha with land holding ranging from 0.5 to 3.0 ha (BoARD, 2003). According to the Central Statistical Authority (CSA) the total population size of Fogera woreda in 2008 was 251,714 from which 129,093 are male and 122,621 are female. High population density of 233 people per km^2 was recorded for the woreda exerting severe pressure on natural resources of the area. The agro-ecology of Fogera plain is classified as Woina Dega (sub-humid), with average annual rainfall of about 1296 mm during the main rainy season (June to September).Agriculture in the area is characterized by small-scale subsistence mixed farming-system, with livestock production as an integral part. Hot-pepper appears to be the major crop cultivated during the rainy season where as Maize, Teff, Sorghum and Chickpea are also grown in smaller amount. Traditionally finger millet and fenugreek are cultivated as cash crops and since 1999 rice has also become one of the best cash crop grown in the lower catchment through flood based farming mechanism (ARARI, 2009), transforming the livelihood strategy of households in the lower catchment to market oriented strategy.

[15] Lake Tana is Ethiopia's largest lake and it is the gateway to the Blue Nile Falls, river and the Zeghe Peninsula. It measures 68 km by 73 km and is famous for the churches and monasteries on 20 of the lake's 37 islands (BoARD, 2003).

Figure 2: Map of Ethiopia and location of the study area



Source: http://d-maps.com/index.php?lang=en

Generally the Amhara region has been under intensive economic and infrastructural development over the past 20 years. The region has an estimated density of 121.9 persons per km^2 making the region the second most densely populated region in Ethiopia. The economy of the Amhara region is highly dependent on irrigated agriculture, agro-industry, hydropower generation, tourism and other rural-urban development schemes. Some 18-20% of the region's population is critically food insecure. The region is greatly endowed with a potential of irrigable land area of 0.6 million hectare, from which only about 76 thousand hectare is currently being irrigated (BoWRD, 2005). In order to maximize the total number of hectare being irrigated and to increase agricultural productivity, the Federal Government of Ethiopia is currently implementing irrigation and drainage projects funded by the World Bank. The region has also undergone through an intensive development interventions in large scale hydropower plants and infrastructure construction. Infrastructural development includes construction of asphalt roads from and to the major cities of the region. There are also all weathered roads with in the woredas of the region. The availability of road has provided easily access to transportation where farmers could benefit from easily accessing of market.

Other interventions by the Government include the establishment of health posts and primary schools in rural villages.

3.2 Sampling technique and Data collection

3.2.1 Sampling technique

The Fogera woreda was selected purposely to include the new irrigation development scheme in the Ribb River. This study used both qualitative and quantitative methods of data collection from both natural and social characteristics of the rural livelihoods system. A combination of primary and secondary data collection is used to identify the different variables that are considered to be key thresholds for farmer's livelihood strategy. This approach has been chosen specifically for this study in order to capture the necessary interactions between the socio-economic and bio-physical components of the rural livelihood typologies.

3.2.1. Data collection

a) Primary data collection

The procedure of collecting household level data from selected participants was done in two phases. *The first phase* includes qualitative studies that involved key informant interviews and individual farmer's interviews. This process has helped in identifying the key farm typologies definition used by the woreda Agriculture Office and was helpful in guiding the development of the formal questioners. Based on this informal survey, a representative seven Peasant Associations (PA), which is the smallest administrative unit, were purposely selected since those areas are part of an irrigation project conducted by the woreda Agricultural Office funded by the World Bank. From the chosen seven peasant associations (i.e., Weji, Alember, Addis Betekrstian, Wetenb, AvuaKokit, Zenge and Nabega), 15 farmers were randomly selected, making a total number of 102 households interviewed. The randomly selected households are categorized as those that use irrigation and those with out in order to evaluate the impact of irrigation access in agricultural system transformation.

The second phase of data collection included the individual interview conducted with the selected 102 households from the seven PA's. These randomly selected households were individually interviewed using a semi-structured questionnaire (e.g Brenner et al., 1985; Bernard, 1994; Weiss, 1994) and ranking questions (e.gMikkelsen 1995). An estimated 1.30 – 2.00 hours were spent in interviewing the informants. The interviews and discussions were held in Amharic, which is the main language spoken in the area. Both female headed and male headed households were selected and interviewed. In order to generate an honest answer and data from the respondents, the questioner is designed to include consistent information. The questions included in the final survey has covered household and farm characteristics of physical, socio-cultural,/economic and institutional aspects (see Appendix 1).

b) Secondary data collection

Secondary data was collected through different litterateur studies. Those include investment and policy briefs, laws, reports, articles, atlases etc; that are relevant to the study area and in addressing rural livelihood strategies have been included and analysed.

3.3. Data analysis

The methods of data analysis used in the study include a descriptive statistics and econometric regression modelling. The data analysing methods described briefly in this section are selected because it provides the quantifiable results in explaining to which farm typology each household belongs and the impact of smallholder agricultural transformation. Based on the sustainable rural livelihood framework (*Figure 1*), linkage between livelihood resources available for farmers and the outcome generated were analysed.

3.3.1 Descriptive analysis approach

This part mainly focuses in analysing the descriptive statistics of the data collected from the field survey. The analysis approach summarizes the data on household demographic and socio-economic characteristics, livelihood assets, strategies and outcomes, access to market, agricultural extension programme,

soil quality, gender related issues and similar quantitative data generated by the survey.

3.3.2 Econometric analysis approach

I used an ordered logit regression to identify the enabling socio-economic and bio-physical factors for household to transform from below-subsistence farm typology to commercial farm typology. Ordered logit model creates successive iterations in order to fit the full model at sufficiently small log likelihood. The econometric model used to examine the factors that condition smallholder farming system to belong in different farm typologies of the study area is the ordered logit model[16]. The advantage of ordered logit is its ability to analyse a dependent variable that has more than two categories where the value between each category has meaningful unobserved sequential order (Green, 2008; Wooldridge, 2002).This regression assumes the relationship between each pair of outcome group is the same, that in the case the coefficients that describe the relationship between the lowest (below-subsistence level farm typology) versus all the other categories of farm typology are the same as those that describe the relationship between the next lowest category (subsistence farm typology) and all higher category.

To describe the ordered logit model, let *Y* denote a random variable (farm typology in this case) taking on a positive integer values of 1, 2...*j*. And let *x* denote a set of conditioning variables (household attributes, farm income, institutional framework, access to irrigation, soil fertility, topography and so forth). In order to answer how all other things held constant, changes in the elements of *x* affect the response probabilities *P* (y= *j* / *x*), *j* =1, 2 ...n (where the probabilities will be summed to unity, *P*(y= *j* / *x*) after determining the probabilities for *j* = 2,...*n)* (Green et al., 2008).

In case of ordered logit we introduce a latent variable (y_i^*) which is not observed variable; however the properties of the variable are useful and intuitive.

[16]The ordered logit model compared to the ordered probit model which is also used in ordered choice model is widely used based on mathematical convenience and because of its ready revelation of "odds ratios" (see Berkson, 1951).

- The latent variable takes a low value if household's farm typology is below subsistence (y=1)
- Intermediate1 value if household's farm typology is subsistence (y=2)
- Intermediate2 value if household's farm typology is constant improving (y=3)
- High value if household's farm typology is commercial (y=4)

Thus, the latent continuous variable model specification (including the logistic error term) is described as:

$$y_i^* = \beta_\circ + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \ldots\ldots\ldots\ldots \beta_n x_{ni} + \varepsilon_i$$

Whereas the observed ordered categorical variable (y_i) model specification is described as:

$$\frac{Pr(y_i > j)}{Pr(y_i \leq j)} = exp\{-\gamma_j + \beta_\circ + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \ldots\ldots\ldots\ldots \beta_n x_{ni}\}$$

Where: y_i is farm typology

$x_{ni}$is the vector of other socio economic variables

β_1------β_n is the slopes of the equation in the model (the coefficients to be estimated)

$\beta_\circ$is the intercept

$\varepsilon_i$is the disturbance (error) term

However, the difference between the categories is unknown though the variables are inherently ordered resulting in low, intermediate 1, intermediate 2 and high values. By introducing threshold variables of $\gamma_1, \gamma_2 and \gamma_3$ we will be able to formulate the formal relationship between the latent (y_i^*) and observed (y_i) model specification is:

$$y_i = \begin{cases} 1\ if\ y_i^* \leq 0 \\ 2\ if\ 0 \leq y_i^* \leq \gamma_2 \\ 3\ if\ \gamma_2 \leq y_i^* \leq \gamma_3 \\ 4\ if\ \gamma_3 \leq y_i^* \end{cases}$$

The implied probabilities are obtained as:

$$P(y_i = 1) = P(y_i^* \le \gamma_1) = P(X_i\beta + \varepsilon_i \le \gamma_1) = \Phi(\gamma_1 - X_i\beta)$$
$$P(y_i = 2) = P(\gamma_1 < y_i^* \le \gamma_2) = P(X_i\beta + \varepsilon_i > \gamma_2) = \Phi(\gamma_2 - X_i\beta) - \Phi(\gamma_1 - X_i\beta)$$
$$P(y_i = 3) = P(\gamma_2 < y_i^* \le \gamma_3) = P(X_i\beta + \varepsilon_i > \gamma_3) = \Phi(\gamma_3 - X_i\beta) - \Phi(\gamma_2 - X_i\beta)$$
$$P(y_i = 4) = P(y_i^* > \gamma_3) = P(X_i\beta + \varepsilon_i > \gamma_3) = 1 - \Phi(\gamma_3 - X_i\beta)$$

Where γ is an unknown parameter that is estimated jointly with β. We enter the above probabilities in a likelihood function and estimate them based on maximum likelihood method.

3.4 Definition of variables

Below is the definition of the variables used in the ordered logit econometric model. The model is useful in generating linkage between factors that determine smallholder farming system and smallholder agricultural transformation (commercialization). The variables are entered in to Stata statistical package which performs most general statistical analyses (such as: regression, logistic regression, ANOVA, factor analysis, and some multivariate analysis).

3.4.1 Dependent variable

Farm typology: is the dependent variable and four major types of farm typology were identified for the Ribb sub-catchment based on the local context of farmer's production objective, consumption behaviour, input use and agricultural diversification and the market share of the produced farm output (Table 1). The variable takes a continuous positive integer value of:

1: if the household is in the farm typology of below-subsistence;
2: if the household is in the farm typology of subsistence;
3: if the household farm typology of constant improving and
4: if the household farm typology is commercial

Table 1: Major Farm typologies in Ribb sub-catchment

Farm Typology	Consumption behaviour	Production objective	Input use	Market share	Overall characteristics
Below-subsistence	They under consume	They require production loan for consumption	Homemade fertilizers and require seed loan	No market share	Households production isn't sufficient enough to feed their family year long
Subsistence	They struggle to feed their family from self-production	Self-sufficiency production objective	Uses seed and fertilizer from their home	No/minimal market share, if they sell product from their production it is in order to gain cash to buy other non-staple items for household consumption	Could barely feed their households all year along and they use traditional farming technique and they have to sell what they have in order to purchase other necessities through what they have produced
Constant improving	They consume from their production and maintain to have surplus production	produce surplus or marketable goods to get loan to improve their farming system	Agricultural diversification is to minimal Uses fair amount of improved seed and fertilizer for production	Through surplus production sale	They will try to use some degree of technological innovations in their farming; where there will be surplus production after consumed by the household and will be marketed to generate additional income
Commercial	They consume both from self and purchased production	Market targeted production objective	Apply improved seeds and fertilizer for better production High agricultural diversification	Through sales of profit maximizing products	The cultivated products mostly are aimed for market and they also apply different technological innovations to improve their production

Source: Authors interview with the Fogera woreda agricultural expert, 2012

3.4.2 Explanatory variables

Taking the measures and incentives made available by the government under the PASDEP strategy (refer Box 1), transformation of agricultural production in to different farm typologies relies on a set of basic livelihood resources (natural, human, social, economic/financial capital (*Figure 1*). In order for a households farming system to go through agricultural transformation the following explanatory variables were hypothesized to affect the dependent variable.

A) <u>Natural Capital</u>

Topography: this variable is helpful in identifying the agricultural land use for farming and its characteristics for development. As per the definition given in MoWE (2010), the variable in the analysis is classified as:

0: Highland (characterized by very steep slopes in an intensively used, eroded and degraded landscape where production yield from these farms are minimal).
1: Middle section Ribb (characterized as the River is often incised and receives water flow from different tributes; have a relative resistance to land degradation and with a proper land and water management, sufficient production can be achieved).
2: Lowland (characterized by flooded plain, sediment deposition and river channel change where farmers practice flood based farming for high production output).

Land holding: the average size of agricultural land a household holds is hypothesized to benefit the households economically through production of agricultural products. In the analysis farm land size takes a numeric value to indicate the total land the household constitutes.

*Soil fertility:*this variable is important in understanding farmer's farm land capability for agricultural development. By identifying the fertility status of soil, farmers apply different soil management that would enhance the fertility and yield higher output. In the Ribb sub-catchment soil fertility is identified based on soil color and texture since those criteria's are helpful in identifying the soils

water holding capacity, workability and fertilizer requirement (the level of soil nutrient). Therefore the values the variable use are categorized as:

0: Severely eroded (poor fertility)
1: Moderately fertile
2: Productive

*Irrigation:*to see the impact of access to irrigation in agricultural transformation, this variable uses a dummy value of 0 for households that do not have access to irrigation and therefore do not use and 1 for those that have access and are irrigation users.

Farm land holding fragmentation[17]*:* this variable indicates the ratio of number of parcels owned by the household and the average parcel in the community.. High farm land holding fragmentation occurs in the Eastern Amhara region (CSA, 2012), it is important to see the effect of fragmented land holding have in agricultural commercialization since the more fragmented the land holding is the more time it takes for the farmers to manage each land and with potential consequence in productivity.

B) Social and human capital

Labourholding: this variable is continues numeric variable. It is the number of adults in the household that can be used as labour holding for the agricultural system.

Gender of the household head: this variable takes a dummy value 0 if the household head sex is female and 1 if it is male.

*Household Head Age:*this variable takes an integer value in order to describe the association of age and agricultural transformation.

Education level of Household head: this variable takes a value of continues integer value based on the structure of Ethiopian education system (EMIS, 2010).

[17]Farm land holding ffragmentation is when household's farm land constitutes with a number of separate farm plot that are located in different places.

0: Illiterate
1: Adult education (this is implies the household head can read and write)
2: 1st cycle education level (if the heads educational status ranges from 1-4)
3: 2nd cycle education level (if the heads educational status ranges from 5-8)
4: General secondary education level (if the heads educational status is 9 &10)
5: Preparatory level (if the heads educational status ranges between grade 11&12)
6: Technical and vocational education and training (TVET) the educational status for the household head is certificate.

C) Economic/financial capital

Livestock holding (TLU): livestock in Ethiopia is a major source of income, draught power for farming, asset, and nutritional source and as a means for transportation (ILCA, 1980). Different livestock species in the household have different value to the household depending up on the livestock work for their livelihood. In order to quantify household's livestock asset as a single figure we use the tropical livestock unit (TLU) conversion factor. The specific value for most common livestock species that are commonly owned by the Ethiopian rural households for their livelihoods is described in Appendix 2. The TLU conversion factor uses "exchange ratio" where different species with different size can be compared and described to a common one unit (FAO, 1986),

Non-farm income: this variable describes the total amount of cash gained by the household from other nonfarm activities. This variable will help us identify if external income is a determining factor in transforming households farming system from one farm typology to the other (to most favorable one).

D) Institutional composition

Market infrastructure: having a good rural-urban market linkage is important in smallholder agricultural transformation in order for households to sell their marketable product in a good price. The variable takes a numeric value which

describes the total time a household have to travel to get to the nearest market in minute. The total time travelled to the market indicates if the household have good access to market infrastructure (the availability of road and transportation)

Agricultural extension services: this variable takes a Yes or No value to identify if farmers get agricultural extension services or not. The agricultural extension service plays a vital role in creating awareness and educating people through promoting their participation in the supply of services, improving resource allocation and by making sure public services provided for the farmers are delivered effectively.

Cooperative membership: if the household is a member of any cooperative the variable takes a value of 1(Yes) or 0 (No) if otherwise. Cooperatives play a great role for households since they provide different kinds of services (sales of output, supplying improved seeds and fertilizer, etc...).

4. Results

This chapter presents the descriptive and econometrics results of the study based on the different agricultural typologies and rural livelihood strategies conducted by the sampled households. The results also identify the difference in farm income across farm typology. The enabling socio-economic and bio-physical conditions intransforming subsistence smallholder farming systems to a level of higher farm income status (smallholder commercialization) are analyzed and interpreted.

4.1 Descriptive results

This section discusses the descriptive statistics of the socio-economic and demographic characteristics of the sampled households. The result generated in this section answers the specific objectives by identifying the differentfarming typologies and rural livelihood strategies exercised by the sampled households in the study area. By applying descriptive statistics such as mean, frequency and percentage, the results compare sampled households with the available livelihood resources to draw important implications.

4.1.1 Natural capital

Based on data obtained from 102 households, I generated 12 different groups paired by farm typologies and topography as shown in Table 2. Most of the households (31.4%) are found to be at the subsistence level followed by those who are in constant improvement (28.4%), while the remaining 20.6% and 19.6% are below-subsistence level and commercial households respectively. Looking at the different farm typologies of the different farm land topography, in highlands 37.9% out of the total 29 households are below-subsistence level, whilst the majority (41.4%) are subsistence farmers, 17.2% are constant improving farm households and only 3.4% are found to be in the commercial farm typology

Table 2. Percentage of interviewed household's farm typology by farm land topography

Farm typology	Farm land topography			
	Highland (N=29)	Midland (N=33)	Lowland (N=40)	All cases (N=102)
Below- Subsistence	37.9	21.2	7.5	20.6
Subsistence	41.4	30.3	25.0	31.4
Constant improving	17.2	30.3	35.0	28.4
Commercial	3.4	18.2	32.5	19.6

NB: N= the number of sampled households interviewed

For the midland of the study area, subsistence and constant improving farming households account for 30.3 percent of the households level identifying the households in this topography to have better chance in feeding their family members from their farm production and as well market their production in case of surplus. The value of 18.2% for commercial level farmers in the midland also indicates that when the farm land topography changes from upper (which is characterised by high degradation and poor soil fertility) to middle catchment, the number of farm households that are categorised in commercial farm typology increased. However, around 21.2% of the households from the midland are found to be below-subsistence farm typology.

Higher percentage value was recorded for commercial farm typology in the lowland of 32.5% compared to the other farm typologies. About 35% of the

sampled households in the lowland are in a constantly improving farm typology and only 7.5% are below-subsistence level (Table 2). This indicates that farm land topography plays a great role in transforming agricultural households from below-subsistence level to commercial level. The result was consistent with the secondary data obtained from ARARI (2009), which indicates that households located at the lowland have been practicing flood based farming which transferred their livelihood to market oriented and targeted crop production (rice being the predominantly grown cash crop and then pepper).

The total area of land owned by the sample farmers was about 146.2 ha with the average of 1.4ha per household. The average land holding for below-subsistence level farm typology is 0.5ha, 1.2ha for subsistence level, 1.7ha for constant improving farm typology and 2.5ha per person for commercial level agricultural households. This figure was consistent with secondary data obtained from BoARD (2003) which indicated that the average land holding for the total population of the local district ranges from 0.5 to 3.0 ha. The result indicates that landholdings of below-subsistence level households are smaller by about 80% than that of commercial level households. Moreover, it was found that the fertility of land in Ribb sub-catchment varies from productive plots to severely eroded plots. Only 25.5% of the total farm land is productive where as 36.3% and 38.2% are severely and moderately eroded respectively according to farmer's judgment (Table 3). To avoid soil fertility losses, the farmers practice various soil and water conservation techniques like terracing, cut off drain and tree planting.

Table 3: Land fertility in plot erosion (%)

	Degree of soil fertility		
	Severely eroded	Moderately eroded	Productive
Below-Subsistence (N=21)	61.9	38.1	0.0
Subsistence (N=32)	62.5	21.9	15.6
Constant improving (N=29)	10.3	55.2	34.5
Commercial (N=20)	5.0	40.0	55.0
All cases (N=102)	36.3	38.2	25.5

Another important farm characteristic in smallholder agricultural system is the distribution of farm land fragmentation. The ratio between the total plots owned by the household to the average parcel owned by the community is

used to describe land fragmentation.A larger proportion of the households (28.57%) in below-subsistence farm typology have land fragmentation ratio of 0.24, this implies the number of plot owned by the household is less for this farm typology. In contrast commercial farm households have higher (25%) land fragmentation of 1.44 and 0.96 indicating that more plots is owned in this farm typology. Most people responded to having a fragmented farm holding by renting it out rather than farming it themselves since it requires too much labour time as well as energy to manage each plot properly. From the result it was found that constant improving and commercial farm typology have larger farm land fragmentation which implies those farm households have large land holding either from renting in or owning. Having a larger land fragmentation and be able to stay in a higher welfare status of commercial or constant improving farm typology implies that, land fragmentation plays a great role in agricultural transformation. The main reason for this is since the parcels owned by the household are located in different agro-ecological conditions, it has helped households to produce different types of crops (diversify) and minimize disasters (such as crop failure, disease, pests and other environmental disaster).

Table 4: Percentage of farm land fragmentation for the sampled households

Land fragmentation	Below-Subsistence (N=21)	Subsistence (N=32)	Constant Improving (N=29)	Commercial (N=20)	All (N=102)
0.24	28.57	0	0	0	5.88
0.48	23.81	6.25	7.41	5	9.80
0.72	19.05	21.88	25.93	10	19.61
0.96	23.81	37.50	18.52	25	26.47
1.2	4.76	18.75	14.81	20	14.71
1.44	0	6.25	22.22	25	12.75
1.67	0	9.38	3.70	10	7.84
1.91	0	0	7.41	5	2.94

In line with the natural capital a farm household possesses for agricultural production; Land tenure right is one of the constraint households in the study area mention to why transforming to commercial farming is not boldly seen. Although from the discussion with sampled households, weak land tenure governance has both positive and negative effect in smallholder agricultural transformation. In the 1991 constitution land is owned by state and the state can take any land for “better development”. Even though better development

was not clearly stated by the constitution, smallholder farmers are becoming more motivated to move up to commercial farming system in hope that their land will not be taken for "better development" since their farming system will also be considered as one. In some cases farmers have also lost their motivation to invest in their farm land do you to the land right uncertainty that they tend to shift to other livelihood strategy abandoning their farm land. It is therefore important to develop clear land-use and agricultural policies in order for agricultural transformation which is important in sketching for sustainable rural livelihood path.

Water is a perquisite in smallholder agricultural transformation. In the Ribb sub-Catchment, water supply is generally adequate in the rainy season though over the past several years erratic and uneven rainfall distribution has been witnessed. The Ethiopian government has launched irrigation and drainage projects in the region to increases agricultural productivity during dry seasons. According to the result from the survey 47.1% of the sampled households are irrigation users from which 37.5% of the households reside in the midland catchment, 33.3% are in the lowland catchment and the remaining 29.2% are in the highland catchment. From the data collected the majority of below-subsistence level (61.9%) and subsistence level households (53.1%) are non-users of irrigation (Table 5); whereas, for constant improving and commercial level households the majority are irrigation users with 51.7% and 50% respectively. The result clearly shows the importance of water availability in transformation and commercialization of smallholder agricultural system. For households in the highland of the catchment, irrigation from rivers and springs act as a source of water for agricultural production. Whereas for the low land catchment flooding during rainy season as well as irrigating rivers and ponds are used as a source of water which contributed for households agriculture to transform to constant improving and commercial agricultural typologies.

Table 5: Respondents access to irrigation (%)

	Irrigation users	Non-users
Below-Subsistence (N=21)	38.1	61.9
Subsistence (N=32)	46.9	53.1
Constant improving (N=29)	51.7	48.3
Commercial (N=20)	50.0	50.0
All cases (N=102)	47.1	52.9

From the data, households in the study area also perform water harvesting techniques in addition to irrigating their farm land. In order to store and stabilize water availability for their agricultural and day to day life activity, the most common water harvesting technique used are constructing traditional ditches, raised boundary buds and small wells constructed from stone/soil. In the highlands of the study area, 48.3% practices rain fed agricultural harvesting; whereas the remaining 51.7% uses irrigation through cut-off drains or artificial water ways.In the midland and lowland catchment areas, 27.3% and 27.5% respectively practice flood based agricultural harvesting. In the midland 54.5% irrigate their lands while 18.2% still practices rain fed agricultural harvesting system.

4.1.2 Social and human capital

Table 6 shows the demographic composition of sampled households. The majority (85.3%) of the interviewed households are male headed (MHH), whereas female headed households (FHH) account for 14.7%. One of the major reasons for higher number of MHHs in the study area is because FHHs tend to shift their livelihood strategy from agriculture to small business due to social factors. Men inherent farm land from their family, whilst women only get farm land if married to a person who owns land or in cases where there is no male sibling to inherent the land. About 66.7% of FHHs that practice agriculture as their major livelihood strategy in the study area are below-subsistence farmers and 6.7% lies in the commercial farm typology. In the case of MHH, the majority (33.3%) of the households are constant improving farmers, while only a few of the MHHs (12.6%) are below-subsistence level. Since the number of MHHs and FHHs are not relative it is hard to conclude if household head's sex has impact in smallholder agricultural transformation.

The age structure for the total households shows an average of 42.25 years with the minimum and maximum age of 20 and 76 years respectively. The average age for commercial farm households(47.8 years) is found to be greater than for those below-subsistence farm households (37.2). The average household size in the study area is 5.63 people, with a range of 1 to 10 people residing per household. Comparing the average household size for each typology, Table 6 shows average family size increases as the farm typology

improves. I calculated family size in adult equivalent (AE) and the standard conversion factors used is given in Appendix 3. The major source of agricultural labour is family labour which consists of the labour force of all adult people residing within the household. The result shows that the average family size for below-subsistence farmers is 4.1 whereas it is 7.0 for commercial farming household. This implies that increases in average family size have a high impact in transforming household's agriculture.

Table 6: Demographic characteristics of the interviewed respondent in each farm typology

	Sex of household head (%)		Average age of household head	Average family size
	Male	Female		
Below-Subsistence (N=21)	12.6	66.7	37.2	4.1
Subsistence (N=32)	32.2	26.7	42.8	5.3
Constant improving (N=29)	33.3	0.0	41.7	6.2
Commercial (N=20)	21.8	6.7	47.8	7.0
All cases (N=102)	85.3	14.7	42.25	5.63

As shown in Table 7, the education status indicates that about 35.3% of the households were illiterate, 31.4% attended adult education classes while around 17.6% have 1st cycle education; 10.8% had second cycle education level and only 4.9% have general secondary school level. Furthermore, 69.1% of below-subsistence level households are illiterate; 23.8% can read and write and the remaining 14.3% have 1st cycle education level. In contrast, about 25% of commercial level households were illiterate; 30% can read and write; 25% have first cycle educational level; 15% have second cycle educational level and about 5% have a general secondary educational level. The results indicate that percentage of illiterate household head decreases as the farm typology improves. Looking at the structure of the Ethiopian educational system listed by EMIS (2010), head of the sampled households have a maximum educational level of general secondary level (grade 9&10). The reason to why there are no household heads in the study area that have educational level greater than secondary schooling is mainly because their livelihood strategy changes from agriculture to other source of livelihood.

Table 7: Education status of household head (%)

	Education level				
	Illiterate	Adult Education (Read and write)	1st cycle (grade 1-4)	2nd cycle (grade 5-8)	General secondary (grade 9 & 10)
Below-Subsistence (N=21)	61.9	23.8	14.3	0	0
Subsistence (N=32)	31.3	40.6	12.5	12.5	3.1
Constant improving (N=29)	27.6	27.6	20.7	13.8	10.3
Commercial (N=20)	25.0	30	25.0	15.0	5
All cases (N=102)	35.3	31.4	17.6	10.8	4.9

4.1.3 Economic characteristics and financial capital

In general, the major livelihood strategy practiced in the study area is mixed-farming system where as extracting and selling sand along the river banks are also practiced by youth, landless and the poor. Off-farm employment is also another major livelihood strategy practiced in the study area. From the sampled households 60% of commercial farmers practice mixed crop production as their major livelihood strategy where as 25% of the households have livestock fattening incorporated (Table 8). Also 10% of the commercial farm typology households earn income through vegetable farming as their second most important activity for income generation where as 5% of the commercial farmers practice bee keeping as their second most important livelihood strategy. For below-subsistence level farmers, 52.4% practice mixed crop production as their primary income generator or livelihood strategy where as 38.1% integrates poultry farming with their crop production. The mean livestock size owned by the sample farmers is 4.5 TLU. Where comparison of the livestock ownership between each farm typology shows that below-subsistence farmers on average own 2.1 TLU, subsistence farmers on average own 3.8 TLU, constant improving farmers on average own 5.7 TLU, and commercial farmers on average own 6.6 TLU per household. This implies that livestock holding increases when households farming system improves and indicates the wealth status a household holds since livestock holding is considered as a measure of farm households wealth in the study area.

Some of the Bio-physical constraints households are facing are: draught, insects and pests, weeds, diseases and floods are the major problems the study area faces. Households have strongly pointed out the unpredictable rainfall patter the area received in recent years have resulted in excessive irrigation water discharge, drainage impediment and moisture stress caused by flooding from rivers that swell and overflow the farm land during the main rainy season. This has hindered crop growth at its critical stage as the common problem their community face. Moreover, the water logging condition and high humidity have also accelerated pest and disease infestation which has made horticultural crops to be damaged.

Table 8: Major livelihood strategy used by the respondents (%)

	Below-Subsistence (N=21)	Subsistence (N=32)	Constant Improving (N=29)	Commercial (N=20)	All cases (N=102)
Mixed crop production	52.4	56.3	51.7	60.0	54.9
Crop production and Poultry farming	38.1	25.0	10.3	0.0	18.6
Crop production and Livestock fattening	4.8	6.3	20.7	25.0	13.7
Crop production and Vegetable farming	4.8	6.3	17.2	10.0	9.8
Crop production and Bee keeping	0.0	6.3	0.0	5.0	2.9

4.1.4 Institutional characteristics

Having access to different kinds of agricultural services is important in transforming smallholder agriculture. From the field research, households are part of existing institutions in the study area which have been helpful in promoting people's participation in adopting new and improved agricultural production. Extension services, cooperatives, credit and market organizations, microfinance institutions and irrigation associations are some of the major institutions the sampled households are actively participating.

Market infrastructure, for households to transform to commercial agricultural system it is necessary to have a working market infrastructure through which households could easily deliver their products. Having good access to road, transportation and a working market linkage between urban and rural have a great influence in agricultural commercialization. On average households residing in the highlands of the catchment travel 2.3hrs to get to the nearest market, in the midland area the average time spent in travelling to the nearest market is 3.7 where as for the lowland catchment travel 2.1hr on average (Table 9). This indicates that households residing in the lowland and highland area are closer to the nearby market compared to the households residing in the midland area.

Table 9: Market infrastructure in the study area

Market distance	Highland	2.3hrs
	Midland	3.7hrs
	Lowland	2.1hrs
Market information	Neighbors	85%
	Radio	8%
	Traders	7%

Households in the study area receive market information from neighbours, radio and traders (Table 9). The majority of households (85%) take their agricultural production to the market based on the price and other information they get from their neighbours. Farmers trust the information generated from their neighbours and act accordingly than they get from the radio and traders. This is mainly because in the Ribb sub-Catchment agricultural products are sold in the market through the involvement of brokers who act as price setters for that product. Brokers are not legal price makers but since they transport most of the received products to larger markets and cities they manipulate the pricing system.

Cooperatives: the major cooperatives households are member too in the study area is farmers' cooperative with large number of households from each farm typology are a member too (Table 10). Due to the variety of service farmers' cooperative provide to farming households it is common for households to be a member there. It was only 2 households from constant improving farm

typology that uses microfinance institution to get credit to improve their agricultural system. Households from commercial (2) and constant improving (3) farm typology are also the ones that are a member in the fishery cooperative that existed in the area.

Table 10: Major cooperatives sampled households are a member to (in number)

	Below-Subsistence (N=21)	Subsistence (N=32)	Constant Improving (N=29)	Commercial (N=20)	All cases (N=102)
Irrigation cooperative	2	5	6	8	21
Farmers' cooperative	13	22	14	8	57
Fishing cooperative	0	0	3	2	5
Extension service	6	5	4	2	17
Micro Finance	0	0	2	0	2

Based on the field study, the socio-economic constraints that hinder households in the Ribb sub-Catchment to transform to commercial farm typology are: high price of improved inputs (seed and fertilizer), un-reasonable price estimation of agricultural products by traders, timely un-availability of improved seeds and fertilizers, poor quality of seeds in the market, un-availability of credit to buy seed and fertilizers, lack of storage facility where households could store in case of surplus production, labour intensive and time consuming traditional ploughing system using animal power and lack/ poor access to markets and information.

4.2 Econometric results

Based on the basic livelihood resources available to the households and general agricultural characteristics, theordered logit regression analysis helped to identify the factors that determine household's transformation between farming typology. Out of the thirteen variables included in the analysis, six variables were found to have significant effect in transforming households farming system from below-subsistence level to commercial farming system

(Table 11). Those variables are topography, land fragmentation; land size, livestock holding in terms of TLU, irrigation and non-farm income.

Table 11: Results from Ordered Logit Regression (dependent variable: Farming typology)

Variables	Coefficient	Standard Error	z	P>|z|
Topography	-.0674246	.02837	-2.38	0.017**
Land holding	-.0397656	.02385	-1.57	0.095*
Soil fertility	.0198884	.01694	1.17	0.240
Irrigation	-.0728411	.03522	-2.07	0.039**
Farm land holding fragmentation	-.0000263	.00001	-1.85	0.064*
Labour holding	-.0067546	.00874	-0.77	0.439
Gender of household head	.0594559	.04861	1.22	0.221
Household Head Age	-.0003881	.00117	-0.33	0.740
Education level of Household head	.0000194	.00033	0.06	0.953
Livestock holding	-.0203527	.00755	-2.69	0.007**
Non-farm income	-2.10e-06	.00000	-1.68	0.092*
Agricultural extension services	-.0029519	.00282	-1.05	0.295
Cooperative membership	.0039352	.00341	1.16	0.248

Ordered logistic regression Number of obs = 102
LR chi2(15) = 65.34
Prob> chi2 = 0.0000
Pseudo R2 = 0.2949
Log likelihood = -78.099167

Marginal effects after ologit
y = Pr(farmtypo== Below-subsistence level) (predict)
= .06699499

*statistical significant at 10% and ** statistical significant at 5%

The p-value 0.017 for topography indicates that the coefficient for topography is significant. Farming land size is also a determining factor in agricultural transformation where a one unit increases in the size of household's farm land increases the likelihood of household's farm typology to shift from lower to high by a factor of 1.57. The estimated coefficient for irrigation 0.039 indicates that a unit increases in irrigation use by the household is more likely to change their farm typology from lower level to higher farm typology at a factor of 2.07. Increase in land fragmentation also increases the likelihood of smallholder agriculturaltransformation from lower farm typology to higher by 1.85 given all

other variables in the model is held constant. As the livestock holding increases, the likelihood of farming system to transform from lowers farm typology to commercial increases by a factor of 2.59. Having non-farm income to supplement agricultural transformation have also a positive implication in transforming household's farm typology from lower level to higher and more desired one by a factor of 1.68.

As it is further seen in Table 11, the coefficient estimates for the rest of the variables in the model such as soil fertility, market infrastructure, household labour holding and sex of the head are not statistically significant. Even though those variables had a positive impact and has been found to be the characteristics of commercial farm typology compared to the others in the descriptive analysis, the econometric analysis found them to be insignificant. This is mainly because those variables alone cannot have an impact in transforming households to better farm typology. For example, having market infrastructure alone cannot transform households to be commercial farmers since they would require having land to grow their crops on and be able to sale it in the market that is provided to them. The same goes with labour holding, sex of household head and soil fertility. Those variables will only have a positive impact in transforming households from below-subsistence level farm typology to subsistence and to constant improving and finally to commercial farm typology only if other variables such as land, irrigation, livestock and other variables is available to them.

4.3 Difference in farm income across farm typologies

Farm income in this analysis only includes the income gained by the household from sales of agricultural products produced by the household. This is helpful in identifying the farm income level a farm typology possesses only by performing agriculture as their primary livelihood strategy since there are alternative livelihood (off-farm and non-farm) activities applied by households to generate income. As it can be seen in Figure 3, the income difference between each farm typology is indicated with the corresponding grid line. The income difference i.e. the difference between farm incomes gained from 32 subsistence level farm households and 21 below-subsistence level farm households in the study

area is 780,517 ETB[18]. The result indicates a 265.7%increases in income gained from sales of agricultural products by subsistence farm typology than below-subsistence farm typology from the sampled households. In the case ofconstant improving farm households and subsistence level, the difference in farm income is642,473 ETB.From subsistence level farm typology to constant improving the farm income gained increases is 59.8%. Since households are classified based on their production objective and their market share, farm income gained by commercial farm typology households shows a 124.5% increases from farm income gained by constant improving households. The difference between farm income gained from 20 commercial level farm households and 29 constant improving level farm households is 2,137,410 ETB (Figure 3).

Figure 3: Difference in farm income acrossfarm typology (ETB/yr)

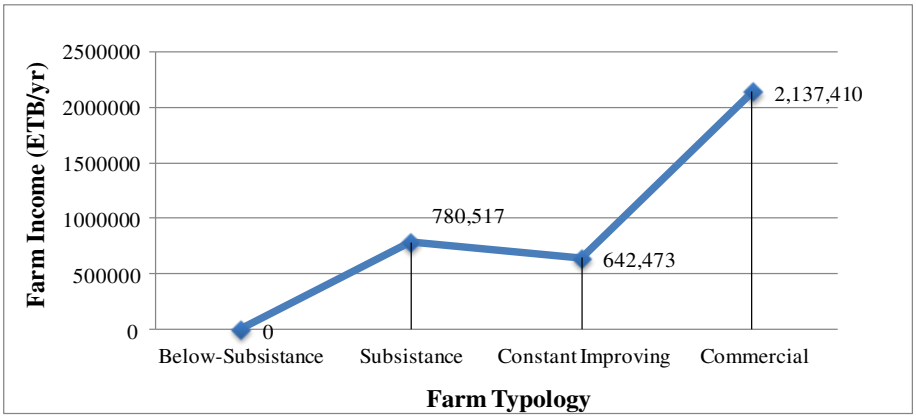
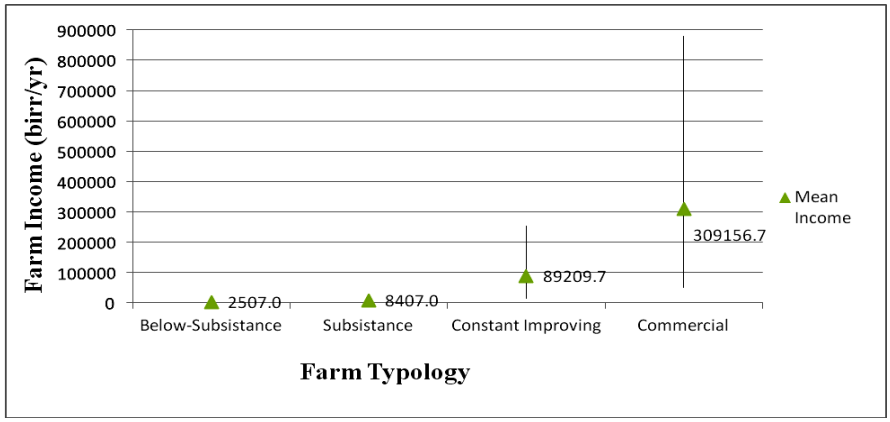


Figure 4 shows the overall income range gained from the sales of agricultural product across each farm typology. The mean income gained from sales of agricultural products by below-subsistence level farm typology is 2,507ETB. Even though the below-subsistence level farm households are defined as those with no market share, the result indicates that some of the households had a market share earning farm income ranging from 0 to 7,500ETB for the last year. The reason behind the income gain from farm products sale for some households in the below subsistence level is the occurrence of good production season that resulted for households to put some of their product to market and

[18]1 ETB (Ethiopian Birr) = 0.37 Swedish Crowns

be able to pay back some of the loans they took. With self-sufficiency as the production objective and very minimal market share; households belonging to subsistence level farm typology from the sampled household have a mean farm income of 8,407ETB. The income gained from the sales of farm outputs by subsistence level households ranges from 7,500 to 17,689ETB. In the case of constant improving farm typology, the farm income gain ranges from 14,500 to 253,100ETB. For commercial level farm typology the income gained from sales of farm product produced by a household ranges from 50,000 to 877,450 ETB. With mean farm income of309,156ETB, households in commercial level farm typology have high market share from the produced farm outputs. Even though the mean farm income gained by constant improving farm typology is greater than the minimum farm income gained by commercial level farm typology, based on the production objective households with income of 50,000ETB remain to be classified as commercial level farm typology.

Figure 4: Farm income range in each farm typology (ETB)



The income gained from farm production mainly goes to household consumption since the main target of the households is ensuring food sufficiency and security. From the analysis it was found that the majority of the households (24.2%) allocate their surplus income to improving their household through purchase of assets such as livestock, radio, TV, stoves and improving the house they live in. About 18.3% of the responded allocate the surplus income gained from sales of agricultural production to sending out their kids to school. This shows that through investing in human development households aspire to change their kid's quality of life. About 15.9% allocate the income

surplus for medication. The remaining households allocate their income surplus to improve their agricultural system by purchasing production inputs (fertilizer, pesticides and chemicals) (13.5%), to purchase improved seeds (10.2%), to rent in land (11.9%) and to purchase water pumps (5.9%).

5. Discussion

This section discusses the result found from the field survey which is helpful in answering the research question of what are the enabling socio-economic and bio-physical conditions for the transformation of subsistence smallholder farming systems to a level of better welfare statusfor a sustainable rural livelihood.

5.1 Enabling factors for agricultural transformation

Farm land topography has a positive association in transforming farm households from below-subsistence level to subsistence to constant improving and then to commercial level. Since the study looks at small-scale farm households; agricultural transformation takes a long process of transforming from one farm typology to another. Both econometric and descriptive analysis result indicates that topography have positive impact in agricultural transformation. Households in the lowland and midland compared to highland benefits largely by growing cash crops such as rice and pepper because the land receives sediments and other soil nutrient components since the area is prone to flooding. This has resulted in a positive impact in farmer's income where their living standards have changed through time. Due to the flooding of the lowland catchment farmers also benefit from rice production, which has a high market value. Flooding may have benefited the farmers in planting cash crops by providing fertile soil, but farmers residing in those areas have also listed flooding to be as one of the major bio-physical constraints they face in agricultural transformation where un-timely flooding have destroyed the grown crops. Interventions by the government and the households have been seen in order to control the damage flooding may have by applying water harvesting methods which in return have resulted in a positive impact to the community and the households from which they were able to harvest multiple time.

From both statistical and qualitative finding, using irrigation is important in transforming households to better farm typology. Greater intervention by the government has been done in recent years through the development of small-scale irrigation schemes to encourage smallholder agricultural commercialization. The evidence shows that farmers have started to grow crops which were not previously grown in the area which has impacted their income in a positive way and transform to a better farm typology. Households have started to incorporate vegetable farming as an integral livelihood strategy. The farmers themselves witnessed that it has a positive impact on their income as well as on the living standard of their families. Access to agricultural water supply plays critical role in the sustainable livelihoods of rural people since households will be able to harvest more than once a year through their irrigated fields. Furthermore, irrigation is one of the options which increase yield and output by facilitating diversification of products being grown and reducing vulnerability of rainfall season. Meanwhile; effort still needs to be made on provision of technical assistance to farmers in supplying variety of seeds, herbicides, pesticides and training provision in order to motivate farmers to reach to a commercial level farming typology. It is necessary to provide good market access in order to increase the magnitude of beneficiaries that produces perishable products such as vegetable through market and infrastructure accessibility. In addition, the finding also revealed that the un-timely availability of inputs and credit have affected farmers agricultural transformation. Therefore, intervention is needed on the availability of institutional support services such as input supply and credit extension.

Household asset such as farm land and livestock plays vital role in transforming smallholder agriculture to economically viable one. Both statistical and descriptive evidence indicated that, households which have larger size of land for agriculture and with higher TLU have positive association in household belonging to a higher farm typology.Since livestock is important for ploughing owning livestock can make farmers to transform to a better farm income and is therefore plays a great role in smallholder agriculture transformation. Moreover, livestock rearing is highly practiced by smallholder farmers as income generation activity transforming the households to favourable farm typology and earn better income. Households also earn extra income by selling livestock by-productswhich provide extra cash for the household's basic

necessity. When households have larger amount of farm land it is possible for them to diversify their crop production which is important in planting staple foods for home consumption and in turn to produce cash crops. This statistical result is found to be consistent with the descriptive result found in the study area where a large number of households having an average farm land of 2.5ha per person in commercial farming typology.

From the descriptive analysis, it was found that land fragmentation can hinder farm households from transforming to higher farm typology due to the distance they have to travel between each plot which makes it hard to properly and equally manage it. But in the econometric result it is found to be an enabling condition for farmers to transform to more desired farm typology. This is due to the fragmented land holding result in a landscape of agro-ecological diversity which is helpful in reducing the risk of total crop failure for smallholder farmers.The analysis also indicated land fragmentation has both positive and negative relationship in transforming subsistence households to commercial level. Difference in the topography of each fragmented farm land, soil fertility, water availability and input requirement will benefit farmers to be shock resistance. Whereas managing each plot with few labour and livestock holding is a negative impact land fragmentation have. It was found from the result that households take the initiative to invest more in commercialization their agricultural system when they have supporting income from other livelihood strategy. The finding supports the sustainable livelihood framework (Scoones, 1998) which indicated that “sustainable rural livelihood can be achieved through integrating different livelihood strategies”. This is because households will be motivated to invest in improving their agricultural system if they have disposable income for their livelihood needs and helps them to be risk takers in adopting new technology and production.

The research evidence shows that access to markets have a positive impact in agricultural transformation. Since commercial farming system has a market oriented production objective it is necessary for households to reside closer to a market where they would sell their products. Major constraints listed by the sampled households with regards to market infrastructure are the poor pricing system that is set by brokers. Such system has made most households to be reserved in investing in agricultural development works in fear of having fewer

prices for their product. Since the middlemen's are profit making business people the price they estimate for agricultural product usually are very low and do not account the production price farmers exert in the first place. There are cooperatives that help in providing market linkages between rural and urban areas where member farmers benefit from that. Farmers have also indicated lack of storage has prevented them in getting the right price for their production. Commonly smallholder farmers use their own storage system where surplus production needs to be sold with fewer prices due to shortage of storage space. Combinations of the wide range of informal and formal institutions and organizations operating at different levels influence different people's abilities to pursue combinations of different livelihood strategies, with what results for sustainable livelihood outcomes.

Farmers cooperatives provides basic advice and knowledge which have been effective in the lowland catchment of the study area where farmers have transformed their farming system to market oriented by producing rice and paper solely for sale. Farmer's cooperative also provides major agricultural inputs such as improved seeds, fertilizers and farm implements. The cooperative also serves as a credit and saving institution which is usually used by the farmers due to its easiness to get loan at lower interest rate compared to the microfinance institutions that functions largely in the country. Microfinance institutions provide credit and loans for agricultural development through different payment procedures. Even though the service is provided in the service area, respondents have indicated that in fear of high interest rate and requirement of collateral to get loan, farmers did not utilize the provided service properly. Though cooperatives provide credit for the farmers, it is not a sufficient system to rely on the cooperatives for loan and amending the procedure in the microfinance is needed for better agricultural development and commercialization. Cooperatives also play a big role in providing market information and distribution of major products for their members. *Irrigation cooperatives* play a vital role by providing water pumps for households who cultivate using irrigation. *Fishery cooperatives* provide market opportunity in which harvested fish are sold to the nearby city and town. Local communities also rely in informal cooperatives (*iqub, edir, debo and mahiber*) where they maximize their agricultural production through saving, credit, sharing and renting out of land, drought animal and labour in order to share risk or in time of need.

Extension services provide support, training and advice for better agricultural production through skilled development agents (DA's). The major services provided through extension workers are providing technical assistance, capacity building, demonstration and supply of training materials, providing market information, advocating adaptation of water harvesting methods, providing education in health and family planning. Agricultural extension services have played a great role in introducing rice plantation in the lowland catchment which has improved households livelihood through agricultural commercialization. In the highland catchment of the river, vegetable farming has been integrated in their farming system in order to get extra income to improve their livelihood.

5.2 Implications for policy

From the field data it was found that households who are in commercial farm typology tend to diversify in crop production whereas definition for commercial farm typology by Moti et al., (2009) indicated that household specialize. Since smallholder commercialization occurs through staple crop production, it is necessary to control farms becoming very specialized. In the Ribb sub-Catchment, flooding have resulted in rice production which have high commercial value and if households shift in producing only rice because of its economic return then securing food may be a problem. It is also necessary to look at the environmental implication smallholder transformation may have. Households have become very dependent in using fertilizer for higher agricultural yield due to poor soil fertility. This in return have a bad consequence in the water bodies of the region as well as in the downstream of the catchment. Under the implementation phase of the PASDEP, change has been witnessed in smallholder commercialization, though the measures to improve land tenure security have not been clearly defined. The report doesn't indicate what kind of land would be available to large-scale farming system and who those stakeholders are. Clearly stating the aim of accelerating market based agricultural development under PASDEP and while implementing GTP is necessary if the country wants to continue in smallholder agricultural commercialization and improve rural livelihoods.

6. Conclusion

The study was undertaken in view of examining the importance of agricultural transformation to achieve sustainable livelihood in rural Ethiopia. Furthermore attempts have been made to classify sampled households in to different farm typology based on household's farm production objective.

By assessing the importance of smallholder agricultural transformation to achieve sustainable livelihood, this study specifically looks at the different agricultural typology; livelihood strategies; the enabling socio-economic and bio-physical conditions; and the difference in farm income across farm typology. The analysis is based on household level data collected from 102 randomly selected farm households from 7 Peasant Associations of the Ribb sub-Catchment in FogeraWoreda of the Amhara region in Ethiopia. An ordered logit model was applied to analysis the enabling socio-economic and bio-physical variables in smallholder agricultural transformation.

The result indicated the existence of four types of farm typology named below-subsistence, subsistence, constant improving and commercial level farm typologies. The generated results have looked at the different agricultural transformation components provided by PASDEP and their impact in transforming smallholder households acrossthe identified farm typologies. From the components provided by PASDEP for smallholder agricultural transformation, irrigation has a significant effect in transforming subsistence smallholder farming system to the level of better welfare status in the study area. Out of the total sampled households, 42% are irrigation users from which 50% are commercial farmers and 38.1% are below-subsistence level farm households. Water availability for irrigation enabled the farmers to have an additional crop per season, which resulted in higher farm incomes. Supporting small-scale irrigation and introducing area irrigation through multipurpose dam has proved to be an enabling factor in smallholder agricultural commercialization.

Based on households production objective, 31.4% of the households from the sampled cases belongs to below-subsistence level farm typology whereas only

19.6% are commercial farmers. In the Ribb sub-catchment, difference in the topography of farm land has a significant effect in smallholder agricultural transformation. Households belonging to better welfare status are mainly located in the lowlands of the catchment where the soil is fertile and less prone to degradation. In the highland topography, households have to exert extra effort in order to transform from subsistence agricultural system to improved and commercial level. Land fertility also plays a crucial role in agricultural transformation, where 61.9% of below-subsistence level farm households are located on severely eroded farm land, while 55% of commercial households are located on productive lands. Specialized extension services such as providingaccess to adequate agricultural input service, irrigation, water harvesting and land management is important in achievingsmall-scale farm efficiency.

Agricultural transformation has resulted in farm income increases where households allocate the surplus income to invest in household's member wellbeing improvement (health, education, assets building, etc.) and provide a gateway to achieve sustainable livelihood. Livestock ownership has a significant effect in smallholder commercialization. Households belonging to commercial farm typology possess large number of livestock. Since farm households allocate their surplus income generated from smallholder commercialization to purchase of assets such as livestock, the number of livestock holding increases across farm typology. Pre-ownership of livestock have also a significant effect in smallholder commercialization, where farmers livelihood strategy also includes sales of livestock and their by-products. In addition agricultural transformation play vital role in improving the quality of smallholder farmer's life through income generation, poverty and hunger reduction where households aspire to invest more in their social and environmental capital which will in return result in a sustainable rural development.

In general the study concludes that to ensure food security and reduce poverty; the ongoing smallholder farm transformation is both sustainable and feasible, in terms of long term yields and environmental impacts. Further research and study must be done in designing strategies to strengthen integration among farmers and brokers for better agricultural output pricing in order for

smallholder households to continue and contribute in production of staple food crops to achieve food security. It is also important to make an assessment on smallholder agricultural transformation and its consequences on downstream water resources.

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Determinants of Loan Repayment Performance of Smallholder Farmers: The Case of Kalu District, South Wollo Zone, Amhara National Regional State

Zelalem Gebeyehu, Jema Haji and Hassen Beshire

Abstract

Smallholder farmers require improved agricultural technologies, knowledge and inputs such as fertilizer, improved seeds, pesticides and others that help to increase production and productivity thereby transforming their farm structure and capacity. Large investment cannot be made by the farmers out of their own funds because of their low level of incomes. Even though there are attempts to solve these rural financial difficulties by the government through extending rural financial institutions, because of social, economic and institutional factors, a number of farmers turned out to be defaulters. When such difficulty arises, the lending institution faces a problem. This study focused on the analysis of determinants of loan repayment performance of smallholder farmers in Kalu district, Amhara National Regional State. In this study, primary data were collect from 130 randomly selected borrowers using semi-structured questionnaire. In addition, secondary data were collected from different organizations and pertinent publications. A two-limit tobit regression model was employed to identify factors influencing loan repayment and intensity of loan recovery among smallholder farmers. A total of 14 explanatory variables were included in the empirical model and out of these, six variables were found to be statistically significant. These are total land holding size of the family (hectare), total livestock holding (TLU), expenditure on social festivals, number of years of experience in agricultural extension services, purpose of borrowing and source of credit. Regarding the sign of the significant variables, expenditure on social festivals has a negative and significant effect on loan recovery rate while the remaining five variables have a significant and positive effect. Variance inflation factor were calculated to detect multicollinearity and association among all explanatory variables. Therefore, consideration of factors affecting loan repayment performance is vital because it provides information that would enable to undertake effective measures with the aim

of improving loan repayment performance and hence helped lenders such as microfinance institution, NGOs and policy makers to have knowledge as to where and how to channel efforts to minimize loan defaults.

Key Words: Kalu, Loan repayment, Defaulters, Non-defaulters, two-limit tobit.

1. Introduction

1.1. Background

Agriculture is the main stay of the Ethiopian economy. The role that it plays in economic development is monumental. Agriculture meets the most essential needs of both human beings and small-scale industries. It accounts about 43 percent of the GDP, contributes over 80 percent of the country's export earnings and 85 percent of the population earns living from it (Seleshi, 2010). The country and its people have historically relied on rain-fed agriculture to meet their needs. This strategy has faced many challenges over the years, with the obvious short fall of food often arising from natural and economic disasters (MoFED, 2008).

Poverty is pervasive and persistent in most developing countries. The root causes of economic suffrage are many but it is well understood that the most vulnerable population, those in a persistent poverty trap, are those who lack physical and financial resources. Physical resources imply the economic resources, land, buildings, and inputs, from which livelihoods are derived and financial capital implies the capital with which to acquire the physical resources. To many, the root cause of the poverty trap is not the constraint on physical resources but the financial constraints or credit constraints that prohibit the acquisition of those resources to poverty-escaping scale (Calum, 2007).

The circular relationship between food insecurity, hunger, poverty and low productivity in food and crop production is increasingly understood that hunger leads to low productivity which in turn contributes to food insecurity. Reducing the incidence of hunger is essential to increase agricultural productivity and achieve higher rate of economic growth. People suffering from hunger are

marginalized within the economy, contributing little to output and still less to demand. Investing in reducing hunger is a moral and economic imperative. So the goal of reducing food insecurity and rising agricultural productivity are interrelated (FAO, 2006).

History shows that no region in world achieved food security and substantial productivity increases without significantly expanding agricultural input use. The goal of 6% annual agricultural growth by NEPAD's comprehensive African Agricultural Development Programme (CAADP) supports attainment of the millennium development goals. Yield gains through expanded use of fertilizer and other complementary inputs can enhance household food security and increase rural incomes, which in turn will allow for investment in human capital and technologies to maintain the long-term quality of the soil (Camara and Heinemann, 2006).

In Ethiopia, agricultural sector has been unable to produce sufficient quantities to feed the rapidly growing population. The reasons for low productivity of the agricultural sector and the growing gap between the demand and the supply of agricultural products are many in numbers and different in character. These include: poor and backward technology; limited use of modern inputs; lack of transportation and storage facilities; inadequate extension and credit facilities; natural calamities such as drought and ecological degradation (EEA, 2007).

Various empirical studies have concluded that without the development and adoption of new agricultural technologies and the use of credit facilities, it is impossible to expect rapid growth of agricultural productivity. However, with the introduction of new production technologies, the financial needs of farmers increase manifold. Steady agricultural development depends up on the continuous increase in farm investment. Most of the time, large investment cannot be made by the farmers out of their own funds because of their low level of incomes. Thus, here comes the importance and significance of the availability of rural credits to bridge the gap between owned and required capital (Gebrehiwot, 2007).

Agricultural lending involves giving out of credit (in cash and kind) to small scale farmers for the purpose of farming. There is no doubt about the crucial roles of

credit in economic development. But the increasing default rate is one of the major problems of the lending institutions (Mohammad, 2009).

Increasing defaults in the repayment of loans may lead to very serious implications. For instance, it discourages the financial institutions to refinance the defaulting members, which put the defaulters once again into vicious circle of low productivity. Therefore, a thorough investigation of the various aspects of loan defaults, source of credit, purpose of the loan, form of the loan, and condition of loan provision are of utmost importance both for policy makers and the lending institutions (Kelly, 2005).

In Ethiopia, the current agricultural loan repayment performance is not promising. Therefore, this study analyzed the extent to which agricultural credit functions and how non-default and default rates are associated with different demographic, institutional and socio-economic characteristics of farm households in South Wollo at Kalu district.

1.2. Statement of the Problem

In Ethiopia, there is a wide gap between owned and required capital to finance the agricultural activities of small holder farmers since the income from subsistence agriculture does not provide much surplus beyond family consumption and other social obligations. The lack of access to capital in rural areas is one of the major factors which hinder the development of agriculture. The price of inputs is going up every year. Consequently, the dependence of the subsistence farmers on financial institutions for credit has become substantially higher now a day (Tefera, 2004).

In Ethiopia, the importance of agricultural credit in the development of the sector has been underlined strongly by various authors (Sisay, 2008; Gebrehiwot, 2006; Tsegaye, 2006; Wolday, 2003). All these authors had concluded that credit helps to bring about the required productivity and food self sufficiency through the adoption of new technologies.

However, increasing default rate is one of the major problems of the lending institutions. Farmers who had not settled their last loan could not apply for

credit in the following year. Therefore, they could not acquire seasonal inputs that are beyond their reach. In Kalu district, financial institutions extend credit facilities to farming households to narrow the gap between the required and the owned capital to use new agricultural technologies that would increase production and productivity.

The past empirical studies that were conducted on the factors contributing to loan default in different regions are not similar and the issues that were identified as problems in the previous studies may not issue today. This is because changes are in a continuous process that are bringing new challenges in terms of the conditions of credit supply, production technology, costs of production, the relative prices of the associated inputs and outputs, which could have impact on the general profitability of enterprises.

In addition to these, factors affecting loan repayment performance of smallholder farmers even in the good harvesting years are not yet studied in the study area. Therefore, this study initiated with the main objective of analyzing determinants of loan repayment performance of smallholder farmers in Kalu district.

1.3. Research Questions

This particular study attempted to address at least the following questions:
What is the extent of loan repayment default in the area?
What are the important factors affecting loan repayment performance of small holder farmers in the study area?

1.4. Objectives of the Study

The general objective of this study is to investigate the loan repayment rate of smallholder farmers in Kalu district.
The specific objectives are:

- To compare defaulters and non-defaulters in terms of different explanatory variables.
- To determine the extent of default in the repayment of loan offered to smallholder farmers in the study area.

1.5. Significance of the Study

The study on the determinants of rural credit repayment performance is vital as it enables governmental and non-governmental financial institutions, policy makers as well as lending institutions to know as to where and how to channel efforts in order to minimize loan defaults. The identification of factors encumbering rural loan repayment performance also helps to formulate successful credit policies and rural development programs. Moreover, it may enable policy makers to formulate successful strategies and improve the living standard of poor by providing effective loans. Moreover, the study magnifies the importance that fund extended for this purpose should be used for the intended goals and finally repaid to the credit institutions to have visible, strong, and sustainable business credit schemes and efficient operation mechanisms. In addition to these, the study might provide micro level information for those who would like to conduct detailed and comprehensive studies on the performance of rural micro finance.

1.6. Scope and Limitations of the Study

This study was conducted in South Wollo Zone particularly in Kalu district. As stated in the objectives, the main aim of this study is to investigate the loan repayment rate of smallholder farmers are associated with different personal, socio-economic and institutional characteristic of smallholder farmers in Kalu district that borrowed from formal credit sources

Other limitations of the study are it does not include informal moneylenders and lack of proper documentation on the required information. This ultimately reduces the number of valid data case in the analysis. Moreover, the efforts of getting reliable data might be affected by doubtful respondents and their idiosyncratic behaviours. However, greater efforts were exerted to convince the borrowers and the institutions about the objectives of the study and confidentiality of the given information

It also focused on the case of a limited number of households and limited to the situation of one year as it was constrained by time, budget and logistics. Thus, the study may not warrant complete information to generalize the issue

for the entire zones. In spite the fact that the study may provide benchmark information to launch similar studies in other districts which have similar conditions to the study area.

2. Research Methodology

2.1. Description of the Study Area

The Federal Democratic Republic of Ethiopia (FDRE) is administratively divided into nine national regional states and two administrative councils. The Amhara National Regional State (ANRS) is one of the nine National Regional States. The ANRS is again divided into eleven administrative zones, one of which is South Wollo (CSA, 2005).

Kalu is one of the 105 districts in the Amhara National Regional State of Ethiopia and it is one of the 22 districts of South Wollo administrative zone. Kalu is bordered by Werebabo to the North, Dessie district to the West, Albiko to the South and Argoba to the East. The administrative centre for this district is Harbu; other towns in Kalu include Ancharo, and Degaga. The study district, Kalu is divided into 31 rural and 4 urban *kebeles.*

As estimated by the District Office of Agriculture (DOA), the district has an area of land of 851.54 square kilometres. About 34% of the district's area is under crop production, and 1% is serving as a grazing land. About 56% of Kalu land area is covered with bushes and shrubs, and 4% is covered with forest. About 2% of Kalu's area is regarded as wasteland and another 3% is taken by physical constructions (DOA, 2010).

The climate of Kalu varies from dry sub-humid to semi-arid. The annual average rainfall of the district ranges from 750 to 900 mm. The annual temperature also ranges in between 25–35 ^{o}C. The altitude of the district ranges from 1400 to 2467 meters above sea level (Kalu DOA, 2010).

The district has a total population of 186,181, which increased by 9.18% over the 1994 census, of whom 91,994 (49.41%) were women; 19,810 (10.64%) were urban inhabitants (CSA, 2008). With an area of 851.54 square kilometres, Kalu has a population density of 218.64, which is greater than the zone average

of 147.58 persons per square kilometre. A total of 41,648 households were counted in this district. The largest ethnic group reported in Kalu was the Amhara (99.24%) and spokes Amharic. Muslims accounts 96.76% of the population and the rest 3.14% are Christians (CSA, 2008).

Ten percent of the rural population of Kalu is engaged in crop production while the rest depends on mixed farming (crop with livestock). Crop production is dependent on rainfall and the major crops produced in the area are sorghum, *teff*, fruits and sugarcane. Livestock are also reared by most families. Oxen provide traction power for the cultivation of the agricultural lands. On the other hand, livestock are kept as a source of income through milk, butter, meat and egg production (Kalu DOA, 2010).

3.2. Sampling Technique and Sample Size

Multi-stage sampling method was used to obtain the necessary information from formal credit users. At the first stage, four *kebeles* of the district was purposively selected because they are the leading user of credit with long years of experience and adequate information for the research at hand. In the second stage, a cluster sampling technique was employed for each selected *kebeles* since some farmers take loan from ACSI and others from Cooperatives. Finally, the list of the names of farmers who have obtained loans from these credit sources were recorded from each *kebeles* and a total of 130 farm households (62 from ACSI and 68 from cooperatives) were selected randomly using probability proportional to size sampling technique.

Table 11: Sampled households

Name of *kebeles*	No. of borrowers from ACSI (in the year 2010/11)	No. of borrowers from cooperatives (in the year 2010/11)	No. of sampled borrowers from ACSI	No. of sampled borrowers from cooperatives
Kurfa	333	250	20	15
Tekake	283	350	17	21
Abicho	183	316	11	19
Kedida	233	216	14	13
Total	**1032**	**1132**	**62**	**68**

3.3. Data Sources and Collection Methods

Both primary and secondary data were used for the study. Primary data was used to study the whole situation of loan repayment performances in Kalu district. The primary data was collected from the small holder farmers benefiting from the formal credit service directly through interview. The questionnaire was developed and pre-tested to evaluate for consistency, clarity and to avoid duplication and to estimate the time requirement during data collection. Appropriate training, including field practice, was given to the enumerators to develop their understanding regarding the objectives of the study, the content of the questionnaire, how to approach the respondents and conduct the interview. Secondary data were collected from MoA, BoAD, CPA, DOA, ACSI, Kalu sub-branch, and other relevant institutions.

3.4. Method of Data Analysis

3.4.1. Descriptive statistics

Descriptive statistics, one of the techniques, which was used to summarize information (data) collected from the respondents. By applying descriptive statistics such as, percentages, mean, standard deviation, maximum and minimum, one can compare and contrast different categories of sample households with respect to the desired characters to draw some important conclusions. In addition, t-test and Chi-square test statistics were employed to compare defaulter and non-defaulter groups with respect to some explanatory variables.

3.4.2. Econometric model

In this study the value of the dependent variable is the percentage of loan paid by the borrowers from the total borrowed from formal sources of credit. Thus, the value of the dependent variable ranges between 0 and 1 and a two-limit tobit model has been chosen as a more appropriate econometric model.

The two-limit tobit was originally presented by Rossett and Nelson (1975) and discussed in detail by Maddala (1992) and Long (1997). The model derives from an underlying classical normal linear regression and can be represented as:

$$y^* = \beta' x_i + \varepsilon_i , \quad \textbf{(1)}$$

$\varepsilon \sim N [0,\sigma^2]$.

Denoting Yi as the observed dependent (censored) variable

$$Yi = \begin{cases} L & \text{if } Y^* \leq L \\ Y^* = X\beta + \varepsilon_I & \text{if } L < Y^* < U \\ U & \text{if } Y^* \geq U \end{cases} \quad \textbf{(2)}$$

Where, Y_i= the observed dependent variable, in our case the percentage of loan paid by the borrowers from total borrowed; Y_i^* = the latent variable (unobserved for values smaller than 0 and greater than 1); X_i= a vector of independent variables (factors affecting loan repayment an intensity of loan recovery); β_i =Vector of unknown parameters; ε_i=Residuals that are independently and normally distributed with mean zero and a common variance σ^2 ,and i= 1,2,…n (n is the number of observations) , L and U are threshold values (L =0 and U =1).

Before estimating the two-limit tobit model, it is necessary to check if multicollinearity exists among the continuous variables and verify the associations among discrete variables. The reason for this is that the existence of multicollinearity will affect seriously the parameter estimates. If multicollinearity turns out to be significant, the simultaneous presence of the two variables will attenuate or reinforce the individual effects of these variables. Needless to say, omitting significant interaction terms incorrectly will lead to a specification bias. In short, the coefficients of the interaction of the variables indicate whether or not the two associated variables should be further investigated for inclusion in model analysis (Kothari, 1990).

Accordingly, variance inflation factor (VIF) technique was employed for identifying whether the problems of multicollinearity among explanatory variables exist or not (Gujarati, 2006).

3.5. Definition of Variables and Working Hypothesis

3.5.1. Dependent variable

The dependent variable for the econometric model for this study is define as the percentage of loan paid by borrowers during the specified repayment period, which is a continuous variable, calculated from the total amount of loan that a person's took. Its value ranges between zero and one. The borrowers that did not repay the amount of money they borrowed as per credit schedules are considered as complete defaulters (i.e. the value of repayment ratio in this case is zero). Likewise, borrowers that repaid some proportion of the money they borrowed are considered as non-complete defaulters (takes values between zero and one). On the other hand, borrowers who fully repaid the amount they borrowed are considered as non-defaulters and assume a value of one.

3.5.2. Explanatory variables of the study

The main explanatory variables of this study are:Age of the borrower (AGE), Sex of respondent (SEX) ,Family size (FS) ,Education level (EDUC) , Land size (LAND) ,Number of livestock owned (LIVSTOCKO) ,Non-farm income (NOFINK) ,Expenditure on social festivals (EXPSC) ,Experience in extension package (EXPEXETN) ,Distance from main road (RAODDIST) ,Amount of loan (LNAMNT) and (LNAMNT) 2 , Purpose of borrowing (BORWPURP) and Source of credit (CRDTSRCE):

4. Results and Discussion

This chapter discusses the analytical results of the study. The first section of this chapter presents the descriptive statistics results of the study. This is followed by the discussion of the econometric model results.

4.1 Descriptive Results

4.1.1. Demographic characteristics

Age of the respondents: The average age of the whole sampled household heads was 42.82 years with the minimum and maximum ages of 23 and 70

years, respectively (Table 2). The average age of non-defaulters was 44.58 years while that of defaulters was 41.35 years with mean difference significant at 10% probability level. This implies that non-defaulters are aged than defaulters, which helped them to accumulate better wealth and able to repay their debt in time than defaulters.

Table 12: Descriptive statistics of age of the head by repayment status of sample households

Age	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	44.58	41.35	42.82	1.782*
SD	10.65	11.70	11.31	
Minimum	24.00	23.00	23.00	
Maximum	70.00	70.00	70.00	

*Significant at 10% probability level.

Source: Own survey result, 2011

Sex of household head: The sample was composed of both male and female-headed households. Of the total sample household heads, 78.5 percent were male household heads and 21.5 percent were female household heads. About 50.00 and 55.88 percent of the defaulters were female and male-headed households, respectively, while 50.00 and 44.12 percent of non-defaulters were female and male-headed households, respectively. The proportion difference tests in terms of sex between the two groups were not statistically significant (Table 13).

Table 13: Distribution of household head sex by repayment status

Sex	Non defaulters (59)		Defaulters (71)		Total (130)		χ2-value
	№	%	№	%	№	%	
Female	14	23.73	14	19.72	28	21.5	3.968
Male	45	76.27	57	80.28	102	78.5	

Source: Own survey result, 2011

Family size: The average family size of the sample households was 5.05. The largest family size was 9 and the smallest was 3. The average family size of non-

defaulters was 5.15 while that of defaulters was 4.97 with no significant difference between means of the two groups (Table 14).

Table 14: Descriptive statistics of family size by repayment status

Family size	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	5.15	4.97	5.05	0.718
SD	1.25	1.55	1.43	
Minimum	3.00	3.00	3.00	
Maximum	8.00	9.00	9.00	

Source: Own survey result, 2011

Household head educational level: Descriptive results showed that the average educational level of household heads was 2.17 grades with the minimum and maximum grade of 0 and 10, respectively (Table 15). The average level of year of schooling of non-defaulters was 3.14, while that of defaulters was 1.37 with mean difference significant at 1% level of probability. The implication of the result is that non-defaulters are educated than defaulters, this enable them to acquainted with agricultural technologies, get written agricultural materials and more aware of the importance of loan and hence these reduced default.

Table 15. Distribution of educational level of the head by repayment status

educational level (Grades)	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	3.14	1.37	2.17	4.140***
SD	2.93	1.91	2.57	
Minimum	0.00	0.00	0.00	
Maximum	10.00	9.00	10.00	

***Significant at 1% probability level.

Source: Own survey result, 2011

4.1.2. Socio-economic characteristics

Land ownership: Land is the basic asset of farmers. The average size of own cultivated land was nearly 0.85 ha, the minimum and maximum being 0.32 and 1.50 ha, respectively. Non-defaulters cultivated on average larger area of land

(1.01 ha) than defaulters (0.65 ha). The mean difference between the land holding by non-defaulters and defaulters was statistically significant at 1% level of probability level. This indicates that non-defaulters have large farm size as compared to defaulter, and that enable to produce more farm output which helped them repaid their loan, being other factors *ceteris paribus*.

Table 16: Descriptive statistics of farm size (in hectare) by repayment status

Farm size(ha)	Non-defaulters (59)	Defaulters(71)	Total(130)	t-value
Mean	1.01	0.65	0.85	7.669***
SD	0.16	0.20	0.25	
Minimum	0.48	0.32	0.32	
Maximum	1.50	1.50	1.50	

***Significant at 1% probability level.

Source: Own survey result, 2011

Livestock holding: Sample households in the study area on average owned 3.460 TLU, with a minimum of 0.026 and a maximum of 9.360 TLU. The mean TLU of non defaulters and defaulters households are 5.11 and 2.09, respectively. The survey result demonstrated that the mean differences between livestock holding by non-defaulters and defaulters were statistically significant at 1% level of probability (Table 7). The implication is that livestock is an important asset for farmers not only to perform farm activities such as draught power, to generate income, to secure food and to cover different social, economical and legal expense, but also contribute to secure cash to pay debts.

Table 17: Descriptive statistics of livestock holding (in TLU) by repayment status

Livestock(TLU)	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	5.11	2.090	3.460	8.934***
SD	1.88	1.950	2.440	
Minimum	2.80	0.260	0.026	
Maximum	9.36	4.745	9.360	

***Significant at 1% probability level.

Source: Own survey result, 2011

Non-farm income: The income generated from non-farm activity ranges from no income to a maximum of Birr 15,000.00. The mean annual non-farm income of sample households was found to be Birr 3,673.07. About 60 percent of the sample household heads reported that at least one of their family members was engaged in non-farm activities, which helped them to earn additional income. On average, defaulters earned 1239.40 Birr/year from non-farm income sources while the non-defaulter earned 6,957.60 Birr. There was a significant difference in mean annual non-farm income between defaulters and non-defaulters at 1% probability level (Table 8). The implication is that non-defaulters have better opportunities to generate income from non-farm activities which resulted in reducing default.

Table 18: Descriptive statistics of non-farm income by repayment status

Non-farm income	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	6957.60	1239.40	3673.07	6.999***
SD	6077.44	2954.20	5270.55	
Minimum	600.00	0.00	0.00	
Maximum	15000.00	5000.00	15,000.00	

***Significant at 1% probability level.

Source: Own survey result, 2011

Expenditure on social festivals: Expenditure on social festivals includes expenditure for social ceremonies such as wedding, circumcision, funeral of a family member or close relative and engagement. All of the respondents were celebrated one or more of the above occasional ceremonies during the study period. The minimum and maximum expenditures for such ceremonies were Birr 100.00 and Birr 3000.00, respectively. Average amount of money spent for social ceremonies, was Birr 1660.70 for the defaulters' which was higher than the non-defaulters' Birr 414.36 with mean difference significant at 1% probability level (Table 9). This indicates that defaulters had spent more on occasional ceremonies than non–defaulters, and that expenditure on social festivals is negatively related to loan repayment performance.

Table 19: Descriptive statistics of expenditure on social festivals by repayment status

Expenditure on social festivals	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	414.36	1660.70	1082.75	-10.509***
SD	199.04	892.12	905.57	
Minimum	100.00	200.00	100.00	
Maximum	900.00	3000.00	3000.00	

***Significant at 1% probability level.

Source: Own survey result, 2011

Purpose of borrowing: Rural households usually borrow money for a wide range of purposes. About 98.30 and 5.63 percent of non-defaulters and defaulters respectively used the borrowed money for purchase of agricultural inputs (Table 10). The survey result demonstrated that the proportion difference between the purpose of borrowing by non-defaulters and defaulters was statistically significant at 1% level of probability. The implication is that non-defaulter households used the loan for productive purpose instead of consuming it and generated more income which helped to repay their loan.

Table 20: Distribution of purpose of borrowing by repayment status

Purpose	Non defaulters (59)		Defaulters (71)		Total (130)		χ2-value
	№	%	№	%	№	%	
productive	58	98.3	4	5.63	62	47.7	111.1***
Non-productive	1	1.7	54	94.36	68	52.3	

***Significant at 1% probability level.

Source: Own survey result, 2011

4.1.3. Institutional factors

Source of credit: Farmers in the study area get credit mainly from two institutions (ACSI and FMSC). Out of the total 130 interviewed households 59 (45.38%) were non-defaulters, and the remaining 71 (54.62%) were defaulters. Among defaulters, 13 (18.31 %) were non-complete defaulters (Table 11).

With regard to the sources of credit (CRDTSRCE), out of the total respondents 52.31 percent, borrowed from cooperatives and the rest 47.69 percent borrowed from ACSI. The performance of credit repayment varied with respect to sources of credit. Larger proportion of defaulters (76.06 percent) borrowed from cooperatives as compared to ACSI (23.94 percent). Chi-square analysis showed that the difference between defaulters and non- defaulters in terms of source of credit was significant at 1% probability level (Table 11). This indicates that those households who borrowed from ACSI were relatively non-defaulters than who had borrowed from cooperatives. Since the formation of borrowers group, the use of group responsibility and peer monitoring in ACSI helped to reduced asymmetric information and increased group pressure to repay the loan.

Table 21: Distribution of source of credit by repayment status

	Non defaulters (59)		Defaulters (71)		Total (130)		χ2-value
Source	№	%	№	%	№	%	
ACSI	45	76.27	17	23.94	62	47.69	36.893***
Cooperative	14	23.73	54	76.06	68	52.31	

***Significant at 1% probability level.

Source: Own survey result, 2011

Distance from main road: The distance in kilometers that the borrowers travelled to get main road for accessing different services. In line with this, the average distance traveled by the respondents to the main road was about 6.92 kilometers. On average, non-defaulters traveled about 6.24 kilometers while defaulters traveled on average about 7.49 kilometers to reach the main road. The mean difference between the distances traveled by non-defaulters and defaulters was not statistically significant (Table 12).

Table 22: Descriptive statistics of distance from main road (in km) by repayment status

Distance from main road	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	6.24	7.49	6.92	-1.069
SD	6.39	6.91	6.69	
Minimum	1.00	1.00	1.00	
Maximum	18.00	18.00	18.50	

Source: Own survey result, 2011

Experience in agricultural extension package: Experience in agricultural extension package varied among the sample borrowers from minimum of 3 years experience to a maximum of 18 years experience. Non-defaulters participated on average for higher number of years 12.10 as compared to the defaulters who participated on average for 7.82 years (Table 13). The mean difference between the two groups was significant at 1% level of significance. That is, farmers experience in agricultural extension services has significant role in loan repayment performance.

Table 23: Descriptive statistics of experience in agricultural extension package by repayment Status

Experience on extension package	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	12.10	7.82	9.76	5.875***
SD	4.40	3.90	4.65	
Minimum	3.00	3.00	3.00	
Maximum	18.00	18.00	18.00	

***Significant at 1% probability level.

Source: Own survey result, 2011

Amount of loan: The sample households on average borrowed Birr 1876.84. However, the loan size varied in accordance with the type of financial institution. The survey result also revealed that on average Birr 1885.60 was borrowed by non-defaulters and defaulters borrowed Birr 1869.60 with no significant mean difference among the groups (Table 14).

Table 24: Descriptive statistics of amount of loan by repayment status

Amount of loan	Non-defaulters (59)	Defaulters (71)	Total (130)	t-value
Mean	1885.60	1869.60	1876.84	0.119
SD	816.69	714.78	759.73	
Minimum	650.00	352.00	352.00	
Maximum	3000.00	3000.00	3000.00	

Source: Own survey result, 2011

4.2. Results of the Econometric Model

4.2.1. Testing of multicollinearity and hetroscedasticity problem

Prior to running the two-limit tobit model, the hypothesized explanatory variables were checked for the existence of multicolinearity. Multicolinearity problem arises when at least one of the independent variables is a linear combination of the others. The existence of multicolinearity might cause the estimated regression coefficients to have the wrong signs and smaller t-ratios that might lead to wrong conclusions.

Variance inflation factor technique was used for identifying whether the problems of multicollinearity among explanatory variables exist or not. For the absence of serious multicollinearity, the values of VIF for explanatory variables were less than 10. The result showed that there were no multicollinearity problems among the variables considered (Appendix Table 2).

Hetroscedasticity is a situation where the disturbance terms do not have constant variance. Since the presence of hetroscedasticity would result in inconsistent estimators, the model was then estimated with STATA version 11 software and I have used robust standard error to eliminate hetroscedasticity problem.

4.2.2. Determinants of probability of being non-defaulter and degree of loan recovery

The estimated results of the two-limit tobit model of the maximum likelihood and the marginal effects are shown in Tables 15 and 16, respectively. A total of

14 explanatory variables were considered in the econometric model out of which six variables were found to significantly influence the probability of being non-defaulter and intensity of loan recovery among the farm households. These were total land holding size of the family (hectare), total livestock holding (TLU), expenditure on social festivals, number of years of experience in agricultural extension services, purpose of borrowing and source of credit. The remaining variables were found to have no significant effect on the loan recovery of smallholder farmers.

Table 25: Maximum likelihood estimates of the two-limit tobit model and the effects of explanatory variables on probability of being non-defaulter

Variable	Coefficient	Robust standard. error	t-ratio	Probability of being non-defaulter
AGE	0.00190	0.0014	1.34	0.00090
EDUC	0.00470	0.0052	0.91	0.00220
SEX	0.01630	0.0263	0.62	0.00770
FS	-0.00170	0.0085	-0.20	-0.00080
LANDH	0.12870	0.0492	2.62*	0.06060
LIVSTOCKO	0.03180	0.0076	4.17***	0.01500
NOFINC	2.37e-6	2.36e-6	1.01	1.12e-6
EXPSC	-0.00030	0.0001	-5.86***	-0.00020
EXPEXETN	0.00550	0.0029	1.88*	0.01260
RAODDIST	-0.00004	0.0023	1.18	0.00120
LNAMNT	-0.00003	0.0001	-0.99	-0.00001
PURBOR	0.62470	0.0431	14.50***	0.29420
CRDTSRCE	0.05000	0.0284	1.76*	0.02360
LNAMNT2	5.42e-9	7.84e-9	0.69	2.55e-9
_cons	0.11025	0.1598	0.69	

***, * Represent level of significance at 1% and 10 %, respectively

Source: Own result, 2011

Table 26: Marginal effects of significant explanatory variables on rate of repayment

Variable	Change among non-complete defaulters $\frac{\partial E(Y/U>Y>L,X)}{\partial X_i}$	Total change $\frac{\partial E(Y_i)}{\partial X_i}$
AGE	0.00120	0.00110
EDUC	0.00300	0.00290
SEX	0.01020	0.00990
FS	-0.00110	-0.00100
LANDH	0.08050	0.07870
LIVSTOCKO	0.01990	0.01840
NOFINC	$1.48e^{-6}$	$1.45e^{-6}$
EXPSC	-0.01030	-0.00220
EXPEXETN	0.01350	0.00340
RAODDIST	0.00160	0.00150
LNAMNT	-0.00002	-0.00001
PURBOR	0.39040	0.38190
CRDTSRCE	0.13130	0.03060
LNAMNT2	$3.39e^{-9}$	$3.31e^{-9}$

Source: Own result, 2011

The size of land holding in hectare (LANDH): It was one of economic factors, which positively affected loan recovery of smallholder farmers (significant at 10% probability level). Each additional hectare of land holding increases the probability of being non-defaulter by 6.06 percent (Table 15). On average, each additional hectare of land holding of smallholder farmers increases the rate of loan repayment by 0.0787for the entire sample and by 0.0805 among non-complete defaulters ceteris paribus (Table 16). As more and more land is brought under cultivation, farm-income is expected to increase due to the increased output. Therefore, having larger size of land enhances a borrower's capacity to repay his/her loan timely. This is consistent with the study result of Bekele (2001), Belay (2002), Daniel (2006) and Worku (2008).

Total livestock ownership (LIVSTOCKO): It has positively related to the dependent variable and significant at 1% probability level. Each additional TLU increases the probability being non-defaulter by 1.5 percent (Table 15). Also, for each additional unit of TLU the rate of loan repayment increases by 0.0184

for the whole borrowers and by 0.0199 among non-complete defaulters (Table 16). The implication is that livestock are sources of cash in rural Ethiopia and serve as security against crop failure. Farmers who owned more livestock are able to repay their loans even when their crops fail due to natural disaster. In addition, as a proxy to oxen ownership the result suggests that farmers who have larger number of livestock have sufficient number of oxen to plough their field timely and as a result obtain high yield and income to repay loans. This result is consistent with the study result of Belay (1998), Jemal (2003), Worku (2008), Mohammad (2009) and Kebede (2010) which states that having larger number of livestock is positively related to loan repayment performance.

Expenditure on social festivals (EXPSC): This is another important social factor, which was found to negatively affect the probability of being non-defaulter at 1% level of significance. Each additional birr of expenditure on social festivals decrease the probability of being non-defaulter by 0.02 percent (Table 15). Each additional birr of expenditure on social festivals decrease the rate of repayment by 0.0022 for the entire sample and by 0.0103 among non-complete defaulters, ceteris paribus (Table 16). This implies that farmers with more Expenditure on social festivals were unable to repay their loan than those who had less or no expenses at all. The reason for this is that such expenses are more than the normal economic stand of the borrower. As this variable can be alternative for use of income for non-productive purposes, it was a negative impact on loan repayment performance of the farmers. Miller (1977), Singh *et al*., (1985), Mwinijilo (1987), Zeller and Sharma (1996), Belay (1998) Belay (2002) and Kebede (2010) also reported the negative effect of this variable on loan repayment.

Experience in agricultural extension services (EXPEXETN): This variable have strongly influenced smallholder farmer's loan recovery. This was positively related to the dependent variable at 10% level of significance. Each additional year of agriculture extension package experience increases the probability of being non-defaulter by 1.26 percent (Table 15). On average, one year additional experience in the extension package increases rate of loan repayment by 0.0034 for the whole respondents and by 0.0135 among non-complete defaulters, ceteris paribus (Table 16). This implies that experienced farmers in extension programs have developed their credit utilization and management

skills that helped them to pay loans timely. In addition, as a result of their participation in extension for a number of years, these farmers are the beneficiary of the use of improved agricultural technologies that would increase their income generating capacity and this repay loans timely. This is consistent with the study result of Oladeebo (2008).

Purpose of borrowing (BORWPURP): It is another economic factor that was positively and significantly affected loan repayment performance of smallholder farmers at 1% probability level. This might be due to the fact that; households who used the loan for productive purpose such as purchased chemical fertilizers, livestock and improved seeds which produce enterprises that would give maximum benefits to the farmer. These farmers are the beneficiary of the use loan that would increase their income generating capacity and repay their loans timely. Each additional unit of available loan for productive purpose, increases probability of being non-defaulter by 29.42 percent (Table 15) and on average increases the rate of loan repayment by 0.3819 for the entire respondents and by 0.3904 among non-complete defaulters (Table 16). Mohammad (2009) also came up with similar results in his study on factors affecting on loan repayment performance of farmers.

Source of credit (CRDTSRCE): The probability of being non-defaulter and the degree of loan recovery were also positively and significantly influenced by the source of credit. The formation of borrowers group, the use of group responsibility and peer monitoring are the core principles guiding financial transactions of ACSI. In group lending programs, the functions of screening, monitoring, and enforcement of repayment are largely transferred from the lender to the borrowers' group members. Therefore, group lending might be the reason for better repayment performance of borrowers from ACSI than cooperatives. It is consistent with the study result of Amare (2005). Being a borrower from ACSI increases the probability of being non-defaulter by 2.36 percent (Table 15). Similarly, it increases loan repayment rate by 0.0306 for the entire sample and by 0.1313 among non-complete defaulters (Table 16).

5. Summary, Conclusions And Recommendations

a. Summary and Conclusion

Ethiopia is an agrarian country employing about 85 percent of the total population in the sector. Smallholder farmers are numerically dominant, contributing over 80 percent of the export earning and it accounts 43 percents of the country GDP. Yet, this output cannot meet the food requirements of the country's population, even for the farmer himself. There exist a variety of reasons for this problem, but low productivity, which results from lack of adequate capital, is the main one.

Smallholder farmers required improved agricultural technologies, knowledge and inputs such as fertilizer, improved seeds, pesticides and others that help to increase production and productivity thereby to transform their farm structure and capacity. However, the majority of Ethiopian population comprises small farmers, who cannot implement a technology without external funding. Even though, there are attempts to solve these rural financial difficulties by government through extending microfinance institution, associated to different factors, a number of farmers are becoming defaulters and the lending institution faces a problem. A key challenge is determining what types of policies and strategies to adopt to solve the problem.

The objectives of the study were to identify socio-economic and institutional factors affecting loan repayment performance and to determine the extent of default in the repayments of loan offered to smallholder farmers in Kalu district. Both primary and secondary sources were used to carry out the study. A multi-stage sampling procedure was used and a total of 130 household heads were selected by a simple random sampling method from four *kebeles* of the district. The descriptive statistics results showed that about 54.62 and 45.38 percent of sample households were defaulters and non-defaulters respectively.

The t- test showed that there is a significant difference between the defaulter and non defaulter group in terms of age of the head, education level, non-farm income, land size, livestock owner ship, expenditure on social festivals and experience on extension package at various levels of probability. The chi-square tests also revealed that purpose of borrowing and source of credit have

significant relationship with loan repayment performance at 1 percent probability level.

The result of two-limit tobit econometric model showed that, from a total of 14 explanatory variables used in the regression model, six variables (land holding size, livestock ownership, experience agricultural extension package, expenditure on social festivals, source of credit used and purpose of borrowing) had statistically significant influence on the loan repayment performance of the sample households.

The result of the econometric model showed that, farmers who had taken loan from ACSI were relatively non-defaulters than who had borrowed from cooperatives. The formation of borrowers group, the use of group responsibility and peer monitoring are the principles guiding financial transaction of ACSI. Loan extended to groups rather than individuals have high repayment rates due to many reasons. First, loans extended to groups reduce the information asymmetry between the lender and the borrower. Thus, adverse selection and moral hazard problems reduced in such cases. Secondly, the joint liability mechanism in-group lending means group pressure on members to repay loans timely would increase the repayment rate.

Land size affected loan repayment performance positively and significantly. This is due to the fact that those borrowers with larger land size earn more income from agricultural activities, which in turn helps them in loan repayment.

Number of years of experience in agricultural extension services is a factor, which positively related to the dependent variable. This might because of the fact that those farmers that have participated in the extension package have developed the skills of using new agricultural technologies that would increase their income. This ultimately improves the loan repayment performance of the farmers. In addition, those farmers that are regular participants in the extension package are aware of the consequences of loan default on the availability of credit for the next production season and are likely to make conscious decision to repay loan timely.

Celebration of social ceremonies had a significant negative impact on loan repayment performance. The reason is that celebration of one or more of social ceremonies need much material and financial resources, which are beyond what the borrowers could afford and aggravated them being defaulters.

The finding of this study also revealed that livestock are important farm assets that improve the farmers' repayment performance. Higher total household wealth in form of livestock would increase significantly the repayment performance of farmers since livestock can be easily liquidated into money. The higher the number of livestock owned, the more the probability of being non-defaulter and vice versa.

It is important, however, that the borrowed funds are invested for productive purposes and this would enable farmers to generated income and the loan would be repaid to the lending institutions than those who used for consumption purposes.

b. Recommendations

Based on the findings of the study the following recommendations are made:
Occasionally celebrated social ceremonies needed a great deal of investment which was beyond what farmers could afford and are found to be one of the major causes of being defaulters. Therefore, elders, community leaders, local associations (*Iddirs*), religious organizations and concerned government bodies should strive to minimize these traditional ceremonies and alleviate the associated expenditure through time.

Livestock production is a very important source of livelihood and cash in the rural areas. Therefore, due attention should be given for scientific livestock management system which is salient to improve the welfare of rural household. Hence, effort should be made to improve livestock's genetics, provide appropriate nutrition, and monitor their health.

Loan providing institutions need to make detail assessments on why really, farmers are taking the credit and they need to check on what purpose the money has spent after the distribution of the credit.

The provision of credit schemes in the area should focus on group lending as it would increase the likelihood of loan repayment by group members. Particularly, cooperatives should shared experience on the formation of borrowers group, the use of group responsibility and peer monitoring principles guiding financial transaction from ACSI.

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