Ethiopian Economics Association (EEA)

PROCEEDINGS OF THE SIXTH REGIONAL CONFERENCE ON THE SOUTHERN NATIONS NATIONALITIES AND PEOPLES REGIONAL STATE ECONOMIC DEVELOPMENT

Edited by

Gashaw Desalegn
Samuel Gebreselassie
Demirew Getachew

i

Published: March 2017

Paper presented at the 6th Annual Conference on South Nations Nationalities and Peoples Region Economic Development, March 26, 2016, Lewi Resort Conference Hall, Hawassa, Ethiopia

The Ethiopian Economic Association (EEA) and its Hawassa Chapter are happy to issue the proceeding of the sixth Annual Conference on the Southern Nations and Nationalities People Regional State Economic Development which was organized on March 26, 2016 at Lewi Resort 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 Hawassa Chapter has 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 Sixth Annual Regional Conference on Southern Nation and Nationalities People Regional State Economic Development has contributed towards a deeper understanding of the regional economy and the complex challenges it faces. It attracted about 165 participants including members of Regional Parliament, higher officials and expertise from Hawassa City Administration, Universities of Hawassa, Wolita Sodo, Arba Minch and Dilla, NGOs, private sector representative and EEA members in the Southern Region of Ethiopia. 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 region.

In this publication, nine papers which were presented at the Sixth Annual Conference reviewed by external reviewers and comments and suggestions including editorial comments were communicated to authors for improvement. Finally, four papers which passed all the review and editorial process published in the Proceeding of the Sixth Annual Conference on the Southern Nation and Nationalities People 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 Hawassa University which runs the EEA Hawassa Chapter, participants from Wolaita Sodo, Arba Minch and Dilla Universities and the staff of EEA Secretariat deserve a special recognition for their passion and perseverance in managing the conference from inception to completion. Hawassa University also deserves appreciation for hosting EEA Chapter by providing office and BoFED for its endless support to the organization of the conference.

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

Alemayehu Seyoum Taffesse (D Phil)
President of the Ethiopian Economics Association

TABLE OF CONTENTS

Application of Two Stage Switching Regression on Impact Assessment: The Case of Wheat Producers in Southern Ethiopia

Debela Geleta Dibaba[1]

Abstract

Agricultural intensification can be achieved through better farm management practices and increased use of improved technologies like chemical fertilizers, high yielding varieties, pesticides and organic mineral. Improved crop varieties are crucial to increase agricultural productivity. This study was conducted in order to examine the extent and the impact of agricultural technology on farm productivity based on data obtained from 200 farming households. The two stage switching regression estimates revealed that improved seed significantly enhances farm productivity.

Key words: Improved seed, two stage switching regression, Impact

1.   Background and Statement of the Problem

Agriculture in Ethiopia, like other sub Saharan countries, is the foundation of the country's economy which accounts for over 40 percent of GDP, 80 percent of exports, and 80 percent of the labor force employment (MoFED, 2010). Agriculture also remains to be the economy's most important sector. Ethiopia has great agricultural potential because of its vast areas of fertile land, diverse climate, generally adequate rainfall, and large labor force. Despite this potential, however, the Ethiopian agriculture has remained quite a lot of reasons. Mentions can be said of drought, which has persistently affected the country since the early 1970s, poor economic base (low productivity, weak

---

[1] Ph.D., Scholar, School of Economics, Andhra University, Visakhapatnam, India
Email: debelag@gmail.com

infrastructure, and low level of technology) lack of consistency in technology adoption. Yet agriculture is the country's most promising economic sector. Although potential exists for self-sufficiency in grains and for export development in livestock, grains, vegetables, a large part of commodity exports are provided by the small agricultural cash-crop sector. [P. Thomas et al, 1991; Demeke and Ferede, 2005].

Agricultural intensification has a lot to do with the Millennium Development Goal of the United Nations in general and Ethiopia in particular. Poverty reduction, hunger eradication, and technology transfer are among the issues high on the global agenda on sustainable development after the approval of the Millennium Declaration by the General Assembly of the United Nations (UN, 2000). This declaration resulted in the formulation of eight Millennium Development Goals (MDGs): a set of goals and targets to guide international policies. Some of the most important issues of MDGs are poverty, hunger and technologies transfer. These, in developing countries, are strongly linked to agricultural sustainable development at national, regional or local levels. (Javier, 2008; Paulos, 2005)

The success of any policy intervention to bring about a technological change in agriculture depends on the extent of adoption and diffusion of new technologies and the degree to which it has impacted the wellbeing of technology adopters. It is, therefore, imperative to investigate the general welfare and social well-being of technology adopting farmers as evidenced by their status relative to other farmers who do not adopt technologies. It is also necessary to evaluate technological and socioeconomic policy related problems facing the farmers that may hinder the sustainability of the positive impacts of the adoption of high yielding varieties.

2.   Objective of the study

The study generally aimed at assessing the impact of improved seed on farm productivity using a two stage switching regression analysis.

3.   Methodology
3.1   The Model

The research employed a Cobb-Douglas production function. It proposes that farm productivity varies between farmers using improved seed and those using the traditional seed. Thus, it is very intuitive that effective use of modern inputs, Citrus paribus, shifts the production function upward. To measure and compare the marginal products of different farm inputs, microeconomic analysis seems to be worthwhile. To appraise the magnitude of improvement in productivity that may be attributable to technological change from the traditional practices, a production function specification is found to be appropriate. The typical specification is

$$Y = F\ (X_{i,}\ Z) \tag{1}$$

Where Y refers to yield response of technologies of wheat

X_i is a vector of variable inputs (such as labor, fertilizer, oxen hour, and seed)

Z a fixed input such as land

Thus a Cobb-Douglas production function is used to estimate the coefficients of the explanatory variables. The transcendental logarithmic *(translog) production function* is generalization of the *Cobb–Douglas* production function. The translog is a flexible functional form imposing fewer restrictions on the properties of the underlying technology and has been widely used in many econometric models. (Beyene, 1998; Mulat, 2003).

The Cobb-Douglas production model commonly employed to evaluate the benefit from such type of program (participation in adoption decision) is as follows:

$$Y = A_i \prod_{i=1}^{k} x_i^{Bi} \exp\left(\delta I + e_i\right) \tag{2}$$

Where the ß and δ are the parameters to be estimated X is for inputs that has already been explained above and I is a dummy variable (1 for technology adopters and 0 otherwise). Thus in this model I measures the effect of improved

wheat technology. Finally e is the random disturbance term, which is assumed to be independently distributed with zero mean and constant variance.

Using equation (2) as a model of estimation leads to some basic problems. The first source of the estimation problem is the problem of indirect or secondary information flow where knowledge that originates from adaptors is passed on to other farmers who are not adopters. Information may be diffused instantaneously to other non participating farmers from participating farmers. In such cases there may be no difference in the performance of participating and non participating farmers as far as adoption is concerned. For this reason, the usual recommended procedure is to analyze technology adoption first, and then the adoption levels predicted from this stage are included in the second stage productivity regression which will be an indicator of selectivity bias (Beyene, 1998).

The statistical endogenity in the adoption decision is the second problem. It is likely that one of the characteristics of a more productive farmer is the desire to acquire information about changing farm conditions or new technologies. Such a farmer may be inclined to attend more demonstration days, seek out extension contact and the like. Analogously, improved seed distributors (or development agents and the government) themselves may also seek out contacts with better farmers who would be good performers even in the absence of extension contacts. That is, they may be biased in favor of particular types of farmers. In such cases, the distribution process of improved seed is endogenous, and the estimation of impact of adoption on farmers performances are likely to be biased up ward, as some of the better performing farmers are credited to the superior attributes of extension participation and adoption decision in particular.

As a result, the I (in equation 2) is not exogenous in our case as the decision of an individual to participate or not to participate in the adoption decision is based on an individual self-selection.

This problem can be handled econometrically using the **Two-Stage Switching Regression Model** (models with self-selectivity) (Verbeek, 2004; Woldrige, 2009; Madala, 1994). Therefore, we have a two step method of estimating the

production function. First, the adoption decision function is estimated using the probit model. This function (equation 3) enables us to use endogenous switching in the equation (4) and (5).

Adoption decision function is defined as:

$$I^* = YZ_i + \ i \qquad\qquad (3)$$

The observed I_i is defined as

$I_i = 1$ if $I^* > 1$, if a farmer participated in adoption
$I_i = 0$ if $I^* \ 0$, other wise

Where Z_i are exogenous variables and Y is a vector of unknown coefficients and is a disturbance term.

The ability and willingness of a farmer to participate in the adoption decision depends on his/her household characteristics, resource endowment and on the socio-economic environment he or she is faced with.

In the second step, the predicted Adoption participation was included in the estimation on the production function for the two groups. That is, since the standard normal density faction and the corresponding distribution function are a function of Z, they were estimated and used to construct the **Inverse Mill's ratio** which is then included in the estimation of the production function to eliminate the influence of the selectivity bias associated with adoption decision. Hence, a more generalized model to estimate productivity is as follows:

For Adoptors:
$$Y_{1i} = A_{1i} \prod_{1i=1}^{k} x_{1i}^{Bi} \exp\left(B_1 sq + \lambda_1 Mr + e_{1i}\right) \qquad\qquad (4)$$

For Non Adoptors:
$$Y_{2i} = A_{2i} \prod_{1i=1}^{k} x_{2i}^{Bi} \exp\left(B_2 sq + \lambda_2 Mr + e_{2i}\right) \qquad\qquad (5)$$

Where Y is physical output measured in quintal per household (OUTPUT) and Xi are:

AREA: Haricot bean area operated by farm households measured in hectare

FERT: Chemical fertilizer (DAP and/or UREA) applied to the crop per farm measured in Kg

LBRMD: Human labor per household measured in man days

SEED: Amount of seed in Kg per farm

Sq: Soil quality in terms of its suitability for growing crops as ranked by the farmers

Mr: The inverse Mills Ratio computed from the extension participation function (equation 3)

A, B and λ are parameters to be estimated and K is the number of repressors.

To evaluate whether or not the program has benefited participants; we need to consider the expected mean output of the two groups. For each participant with characteristics and Z_i, the expected output, y_{1i}, in the adoptors and the expected output of non adoptors, y_{2i}, were compared. The expected output for the adoptors is given by:

$$E\left(\frac{Y_{1i}}{I_i} = 1\right) - E\left(\frac{Y_{2i}}{I_i} = 1\right) = X_i(B_1 - B_2) + (\,_{1\varepsilon} - \delta_{2\varepsilon})\frac{\Phi\,(Z_iY)}{N\,(Z_iY)}) \quad (6)$$

The adoption decision will produce greater benefit under self selection if the above equation is greater than zero. The study has employed ordinary least square (OLS) to estimate the two separated Cobb-Douglas production functions (i.e. equation 4 and 5) and STATA as a statistical package to fit the models is used.

3.2 Data Type, Data source and Sampling Design

Both primary and secondary data are used in conducting the study. The main source of the data for this study, however, is survey conducted on a sample of farmers from southern Ethiopia. Secondary data on yield, use of improved seed, situational environment and several other relevant issues is obtained from agricultural development offices in the study areas. This is in order to fill the gap and substantiate the findings from the primary data as deemed appropriate.

The study employed a multistage sampling technique to select a sample of 200 farmers.

4.   Econometric analysis

Two stage regression estimates of Cobb-Douglas production function

Table 1 displays the estimated parameters of the production function for both adaptors and non-adaptors using two step switching regression approaches. Adoption decision function is, first, estimated using the probit model. This will help us to predict the inverse Mills ratio, which is going to be used as a regresser in the second function of Cobb-Douglas production function. This variable will help us eliminate the influence of selectivity bias associated with extension participation. The result of two stage switching regression of the production function shows that there are differences in input utilization between adopters and non-adaptors as can be understood from elasticity coefficients of the variables in the above table. The coefficients of **LLBRMD** and **LFERT** for adaptors are greater than that of the non-adoptors. This implies that output is more responsive to fertilizer and labor under improved practice than under the traditional one. In turn output elasticity of **LAREA** is greater for non-adaptors than that of adopters implying that higher output in the traditional practice is to be obtained by increasing more of the areas under cultivation. The result is consistent with the general notion that higher output is obtained by increasing area under cultivation in the traditional practices than is under the improved practice.

The Inverse Mills ratio, which measures the non-linear effect of selectivity of farmers, is not significant. Thus there is no selectivity bias between adopters and non-adopters. The farmers who decided to adopt did not self-select themselves nor did the development agents thus adoption decision or improved seed supply and/or distribution is random. The program that is the distribution of improved seed is rather administered randomly. We can thus run an OLS using, the whole sample, without considering the inverse mills ratio variable and conduct impact assessment without any doubt of selectivity bias. This is presented in the Table 2 below.

Table 1: Two stage switching regression Estimates of a Cobb-Douglas production function

Non Adopters		$R = 0.9689$ $Adj\ R^2 = 0.9643$ $F(8,54) = 210$ $Prob > F = 0.000$		

Dependent variable lnoutput

	Coefficient	Standard Error	t-value	P-value
lnArea	1.0465	0.0487	12.88	0.000
lnlabor	0.1771	0.1168	0.89	0.378
lnseed	0.2304	0.0853	1.75	0.085
lnfert	0.3164	0.0911	2.74	0.008
lnoxen	-0.160	0.1602	-0.60	0.551
Soilql	-0.031	0.0449	-0.47	0.644
Millsratio	0.0589	0.0477	0.29	0.776

Adopters		$R = 0.9693$ $Adj\ R^2 = 0.9673$ $F(8,121) = 809.72$ $Prob > F = 0.000$		

Dependent variable lnoutput

	Coefficient	Standard Error	t-value	P-value
lnArea	0.8899	0.0942	9.45	0.000
Lnlabor	0.1978	0.1711	1.16	0.249
Lnseed	-0.071	-0.139	-0.51	0.613
Lnfert	0.4874	0.1946	2.50	0.014
Lnoxen	-0.019	-0.255	-0.07	0.940
Soilql	-0.072	-0.063	-1.14	0.263
Millsratio	0.2187	0.2111	1.04	0.302

Since we proved that there is no selectivity bias in the sampled households, we can easily see the impact of technology adoption on productivity by running an OLS.

The result of table 2 showed that four out of seven explanatory variables are significant. Output is more responsive to area cultivated and fertilizer used followed by labor utilization and seed rate. Adoption, a dummy variable, is positively related with the log of output. Besides it is significant at one percent.

Holding all other factors constant output will increase by 31% for farmers who used an improved seed than those who are sticking to the local Varity. This suggests the significant impact of using improved technology for increasing farm productivity.

Table 2: An OLS estimate of the Cobb-Douglas Production function

Dependent variable lnoutput				
	Coefficient	**Standard Error**	**t-value**	**P-value**
lnArea	**0.9739**	**0.0487**	20.00	**0.000**
Lnlabor	**0.1576**	**0.1168**	1.35	**0.179**
Lnseed	**0.0549**	**0.0853**	0.64	**0.521**
Lnfert	**0.4435**	**0.0911**	4.87	**0.000**
Lnoxen	**-0.096**	**0.1602**	-0.60	**0.550**
Soilql	**-0.077**	**0.0449**	-1.71	**0.090**
Adopt	**0.3063**	**0.0477**	6.42	**0.000**

$$Adj\ R^2 = 0.96$$
$$F_{(7,18\ 4)} = 80 \quad .72$$
$$Prob > F = 0. \quad 000$$

5.   Implication

The switching model was used to give consistent estimates for the coefficients of Cobb-Douglas production function. In the model, the Inverse Mills ratio which measures the non linear effect of selectivity of farmers is found to be insignificant. Thus there is no selectivity bias in the sampled households. The farmers who received improved seed did not self-select themselves nor did the development agents. The program is rather administered randomly. Consequently an OLS, using, the whole sample without considering the inverse mills ratio variable or selectivity bias, can provide consistent and efficient estimates of the coefficients.

The OLS estimates of the Cobb-Douglas production function uncovered that the impact of improved seed in farm productivity is large and statistically significant. Holding all other factors constant output will increase by 31% for farmers who used improved seed than those who are sticking to the local Varity.

This suggests the positive impact of using improved technology for increasing farm productivity. It is very emphatically recommended to enhance the widespread distribution of improved seeds to farmers. This is highly recommended because, as was revealed in the study, adoption has a large and statistically significant impact on farm productivity. Thus, in developing countries like Ethiopia, widespread adoption of yield-enhancing agricultural technologies is one way to alleviate poverty and to ensure food security.

References

Beyene, T. (1998). Impact of Agricultural Extension on maize production; AAU, Addis Ababa.

Demeke, M and Ferede, T. (2005). The performance of grain marketing in Ethiopian; the case of Addis Ababa Central Marketing in south west Oromia, Southern Bale and Adami Tulu editions. The future of small holder farming in Eastern African: The Roles of states, markets, and Civil Society; IFPRI Eastern Africa Food Policy Project.

Javier Becerril. (2008). *Maize adoption and poverty in Mexico*. Mexico

Maddala, G. S. (1997). *Limited Dependent and Quantitative Variables in Econometrics.* Cambridge University Press.

Mulugeta Arega. (2009). Determinants of intensity of adoption of old coffee stumping technology in Dale Woreda, SNNPRS, Ethiopia. MSc Thesis .Haramaya University

Ministry of Finance and Economic Development. (2010). Summary of Agriculture and Food Security strategy and Post compact policy and investment frame work.

Paulos, G. (2005). *Factor Price and Agricultural Production in Sub Saharan Africa*. McMaster University, Canada.

Thomas P. Ofcansky and Laverne Berry, editors. (1991). Ethiopia: A Country Study. Washington: GPO for the Library of Congress.

United Nations. (2000). United Nations Millennium Declaration, The General Assembly. 55/2

Maroon Verbeek. (2004). *A Guide to modern econometrics*, 2nd Edition: John Wisely and sons

Wooldridge M. J. (2009). *Introductory Econometrics*: A Modern approach, 2nd Edition; engage learning

Evaluation of Internal Revenue Retention and Utilization in Ethiopian Health Care Financing: The Case of Health Centers in SNNPR

Fekade Asmamaw[1]

Abstract

As a result of Ethiopia's health policy that substantiate healthcare resource self-reliance from domestic sources, health facilities were allowed to collect, retain and utilize revenue obtained from health service rendition and the sale of other non-clinical goods and services as an additional domestic source besides tax revenue. The purposes of this paper were to describe revenue retention and budget utilization capacity of HCs; explain the contribution of sources of retained revenue to facility's revenue and the role of retained revenue in financing operational expenses of HCs in SNNPR. Data used are earmarked survey and routine supportive supervision records all collected in 2007 EFY from HCs being selected via multistage sampling techniques. On average, HCs retained revenue has been growing at 31.06% each year with monetary values ranging from 88,850 ETB in 1999 EFY to 220,003.2 ETB in 2007 EFY. At $\alpha = 0.05$ level of significance, a robust log-linear model analysis showed that 93% of the change in total retained revenue of HCs was explained by explanatory variables and the contribution of SDMS and the value of lagged dependent variable on facilities retained revenue were significant with respective $p-values$ of 0.012 and 0.000. On average, about 83.7% of operational budget was covered by retained revenue during 2005, 2006 and 2007 EFYs and about 67.7% of it was utilized for purchasing drug and medical supplies during the same period. The findings showed that maximizing the scale of utilizing sources of retained revenue in harmony with users of healthcare inputs can continuously generate consistently increasing funds.

---
[1] fekadea@gmail.com,

Acronym

BOFED	Bureau of Finance and Economic Development
CBE	Commercial Bank of Ethiopia
CBHI	Community Health Insurance
CMH	Commission for Macroeconomics and Health
DNG	Debub Negarith Gazeta
EFY	Ethiopian Fiscal Year
ETB	Ethiopian Birr
FMOH	Federal Ministry of Health
FWBs	Fee Waiver Beneficiaries
GR	Gross Revenue
GDP	Gross Domestic Product
GGHE	General Government Health Expenditure
GGE	General Government Expenditure
GHE	Government Health Expenditure
HC	Health Centers
HSDA	Health Service Delivery and Administration
HSDP	Health Sector Development Programme
HSFR	Health Sector Financing Reform
HFs	Health Facilities
HCFS	Healthcare Financing Specialists
MDG	Millennium Development Goals
MFIs	Microfinance Institutions
MoFED	Ministry of Finance and Economic Development
NHA	National Health Accounts
OLS	Ordinary Least Square
OOPs	Out of Pocket Payments
PFPA	Procurement, Finance and Property Administration
PFL	Property, Finance and Logistics
R(S)DMS	Revenue from(Sale) Drug and Medical Supplies
RCM(E)S	Revenue from Consultation and Medical (Examination) services
RONC(G)S	Revenue from Other Non-Clinical (Goods) and Services
SNNPR	Southern Nations, Nationalities and Peoples Region
SPSS	Statistical Packages for Social Sciences

THE	Total Health Expenditure
TGE	Transitional Government of Ethiopia
WoFED	Woreda Finance and Economic Development
WHO	World Health Organization
USD	United States Dollar

1.   Introduction

1.1   Background

Modern healthcare service in Ethiopia had been introduced during the reign of Emperor Libne Dingel (1508 – 1540), when the Portuguese mission to his court brought a physician named Bermudes. Other antiquity carriers of modern healthcare to Ethiopia included European travelers, missionaries and members of the diplomatic community; (Health Research in Ethiopia – Country Overview). Besides, the same literature recalled that modern healthcare system was organized in the country during the reign of Emperor Menilik II (1889 – 1913). Healthcare provision and health research were also carried out during Italian invasion in the northern part of Ethiopia, now the sovereign Eritrea. Later, during the reign of Emperor Haile Selassie, expansion of health facilities continued.

Since the introduction of formal health care in Ethiopia some 70 years back (FMoH 1998), the sole ownership of healthcare delivery had been taken by the public sector until late 1990s. TGE (1993b) pinpointed that the first health policy of Ethiopia, initiated by World Health Organization (WHO), was adopted in early 1960s. Another health policy with emphasis on disease prevention and control particularly focusing on rural areas and advocacy of community involvement was formulated in the mid-1970s. During these imperial and Derg regimes, the sole responsibility of providing health services almost entirely rested on the government sector. The health system had been highly resource constrained and was able to reach only 48.5% of the population with much lower per capita health expenditure of (1.2 USD in 1996) as compared to the same period Sub-Saharan average (6.7 USD per capita); FMoH (1998).

The third health policy of the country was published in 1993 with its major aspects being fiscal and political decentralization, expansion of primary healthcare system, encouragement of partnership and participation of non-governmental actors and promotion of national self-reliance in health development by mobilizing and maximally utilizing internal and external revenue sources; Richard G. WAMAI (2009). To implement this third policy, four successive five year Health Sector Development Programs (HSDP I – IV) were developed and executed since 1996/97 to the end of 2015.Besides, the third health policy of the country has been lucky to have a healthcare and financing strategy developed by Federal Ministry of Health (FMoH) and endorsed by council of ministers in 1998.

Healthcare and financing strategy was formulated with objective of reversing the facts that the health sector was highly resource constrained; government spending on health was very low; allocation of the minimally available health resources was highly skewed in favor of big urban centers and curative healthcare and that access to and quality of healthcare services were highly deteriorated; (FMoH 1998).

The sources of healthcare resources spent directly by health facilities (hospitals and health centers) are obtained from block grant by the government, retained revenue and donation either in cash or in kind from rest of the world. During the last fifteen years, public health facilities have had discretion to collect, retain and utilize revenue generated from health service rendition and the sale of other facility's owned non-clinical goods and services. The revenue collected, retained and utilized by Health Facilities (HFs) is commonly known as retained revenue or internal revenue. This study is intended to identify sources of retained revenue and their contribution to facility's internal revenue. Besides, the study unravels the share of retained revenue in operational budgets of health facilities. Finally, the contribution of retained revenue in covering operational expenses of HCs is discussed.

1.2   Statement of the Problem

In SNNPR, retained revenue has been one of the approaches of financing health care. HCs have been implementing revenue collection, retention and utilization during the past fifteen years following the endorsement of health care and financing strategy and successive legal documents. The practice of revenue retention and utilization by health facilities has jointly been supported by all levels of MoH, MoFED and a nation-wide project called Health Sector Financing Reform (HSFR).

Implementation of the HSFR project has been materialized via the framework of Health Service Delivery and Administration (HSDA) proclamations, regulations and directives both at federal and regional levels. SNNP regional counsel approved HSDA proclamation in August 2004 and regulation in December 2005 followed by an HSDA directive and operational guideline endorsed and distributed to HFs in November 2006.These legal frameworks have allowed HFs to collect, retain and utilize revenue generated from health service rendition and the sale of other non-clinical goods and services; DNG (2004). Earlier to HSFR, financing bylaws required that revenues collected by HFs be transferred to central treasury as a result the health sector didn't receive any direct benefit from any of the service fees collected by them.

HCs in SNNPR vary in revenue generation and budget utilization. It is clear that revenue generation and budget utilization capacity of health centers is affected by availability of qualified procurement, finance and property administration staffs, the vigilance of governance bodies and HC's skillful administration as a whole. HCs with vigilant governance bodies, qualified PFPA officers and committed facility directors are able to properly collect internal revenue from its sources namely sale of drug and medical equipment, rendition of health care services and the sale of other non-clinical good and services. The sale of non-clinical goods and services include all goods and services that don't have direct connection with health service rendition. Revenue generated from health service rendition may be either from direct out of pocket payments or from credit health service seekers like the Fee Waiver Beneficiaries (FWBs), Community Based Health Insurance (CBHI) beneficiaries or other credit customers. The cost of

credit health service seekers is usually covered by third parties who sign memorandum of understanding with HCs. HCs are also allowed to utilize their planned and appropriated budget effectively with greater sense of ownership and efficiency. The focus of this study is therefore to determine the contribution of HC's revenue sources to total revenue of the health center.

The price of healthcare services are required to be set and revised with the sense that the HC should get some extra revolving fund intended to improve the quality of health care. Though HCs particularly of the public sector have no profit motive, there is a need to intermittently revise service fees considering both the ability and willingness to pay of the population and generation of some profit margin intended to improve access to and the quality of healthcare services at facility level.

However, the contribution of revenue sources to facility's revenue and the contribution of retained revenue to cover operational expenses haven't yet been studied. Hence, this paper intends to unravel the contribution of the three major internal revenue sources to retained revenue of health centers. It also intends to answer the question how much retained revenue contributed to operational budget of health centers.

Therefore, the full blown paper need to answer the following questions:
1. How does one compare health financing status of Ethiopia in relation to low income and Sub-Saharan African countries?
2. What are internal revenue sources of health centers?
3. How much is the contribution of each source of internal revenue to retained revenue of health centers?
4. What is the share of retained revenue in operational budgets of health centers during 2005, 2006 and 2007 Ethiopian Fiscal Years (EFYs)?

1.3   Objective of the assessment

The objectives of this study are to:
- Review health financing performance of Ethiopia in comparison to its neighbor countries and African low income counterparts;

- Discuss retained revenue sources of health centers ;
- Analyze the contribution of retained revenue sources of health centers to gross revenue of health centers;
- Unravel the share of retained revenue to operational budget of health centers;
- Explain whether lagged dependent variable has contribution to the increment of gross retained revenue.

2.   Research Methods

This survey study was conducted on 72 HCs located in different zones and a special woreda of the region. Zones were selected by systematic random sampling technique; 53.3% of zones and 25% of special woredas of the region were included as a sample in this study. After arranging zones in alphabetical order of their name initial and selecting the first zone, the other zones are obtained by drawing every second zone. The special woredas are considered separately so as to let them included in the study. Woredas and HCs from each zone have been selected via simple random sampling technique after allocating the proportional share of HCs for sampled zone.

The sources of data for this survey were HC heads and Procurement, Finance and Property Administration (PFPA) officers of selected HCs. HC heads and PFPA officers were preferred to respond for the structured interview purposively as they are believed to have direct intervention in revenue generation and budget utilization activities. The survey was supplemented by secondary data from different published sources and data records. Data collection tool of the survey was a pretested and structured questionnaire developed by a team of Health Care Financing Specialists (HCFS) and the method of data collection was structured interview conducted by two teams of HCFSs. The data were supplemented by supportive supervision data collected from 124 randomly selected HCs of the region in 2006 EFY. Collected and cleaned data were encoded to SPSS 17 statistical package and descriptive and regressive outputs were generated using STATA 11 and Microsoft excels statistical software. Since the data have both quantitative and qualitative nature,

discussion of results involved various approaches. Descriptive and regressive results were discussed and interpreted according to the nature of the result.

Model: A Cobb Douglas production function of a dependent variable was regressed against three independent variables and one lagged dependent variable.

$$f(x_i) = \alpha \mid \prod_{i=1}^{n} x_i^{\beta_i} + \mu_i$$

$\ln f(x_i) = \ln\left(\alpha \prod_{i=1}^{t} x_i^{\beta_i} + \mu_i\right)$, x_i= sources of retained revenue of a HC, β_i= coefficients of the sources of revenue of a HC and μ *is the error term*. The actual model therefore, is:

$$GR_t = \alpha RDME_t^{\beta_1}. RCMS_t^{\beta_2}. RONCS_t^{\beta_3}. GR_{t-1}^{\beta_4} + \mu$$

$\ln \_GR_t = \ln(\alpha RDME_t^{\beta_1}. RCMS_t^{\beta_2}. RONCS_t^{\beta_3}. GR_{2005}^{\beta_4}) + \varepsilon,$

$\ln \_GR_t = \ln \_\alpha + \beta_1 \ln \_RDMS_t + \beta_2 \ln \_RCMS_t + \beta_3 \ln \_RONCS_t + \beta_4 \ln \_GR_{t-1} + \varepsilon,$ where:

GR_t = Gross revenue of a health facility generated in year t;

$RDMS_t$ = Revenue of a facility generated from the sale of drug and medical supplies in year t;

$RCMS_t$ = Revenue of a facility generated from consultation and medical services in year t;

$RONCS_t$ = Revenue of a facility generated from other non-clinical sources like the sale of hey in the facilities compound, the sale of worn-out equipment, the sale of trees in the facilities compound, the sale of crops and any other type of valuable goods and services owned by the health facility in year t;

GR_{t-1} = Gross revenue of a health facility in year t-1;

$$\mu = error\ term\ and\ \varepsilon = \ln(\mu)$$

$\beta_1, \beta_2, \beta_3$ *and* β_4 *are parameters* (coefficients of corresponding variables).

Hypothesis: $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$, i.e., independent variables don't have any effect on the dependent variable.

H$_A$: $\beta_1 \neq 0, \beta_2 \neq 0, \beta_3 \neq 0,$ or $\beta_4 \neq 0$, this means that the independent variables has significant effect on the value of the dependent variable.

3.   Results and Discussion

### 3.1   Health Financing Scenario in Ethiopia

Ethiopia has shown successive improvements in financing the health sector since the late 1990s as compared to previous trends. Total health expenditure per capita was more than quadrupled in the last fifteen years. It has grown from $4.5 in 1995/96 to $20.77 in 2010/11.

Figure 1: Growth of Total Health Expenditure Per Capita at Current USD Exchange Rate
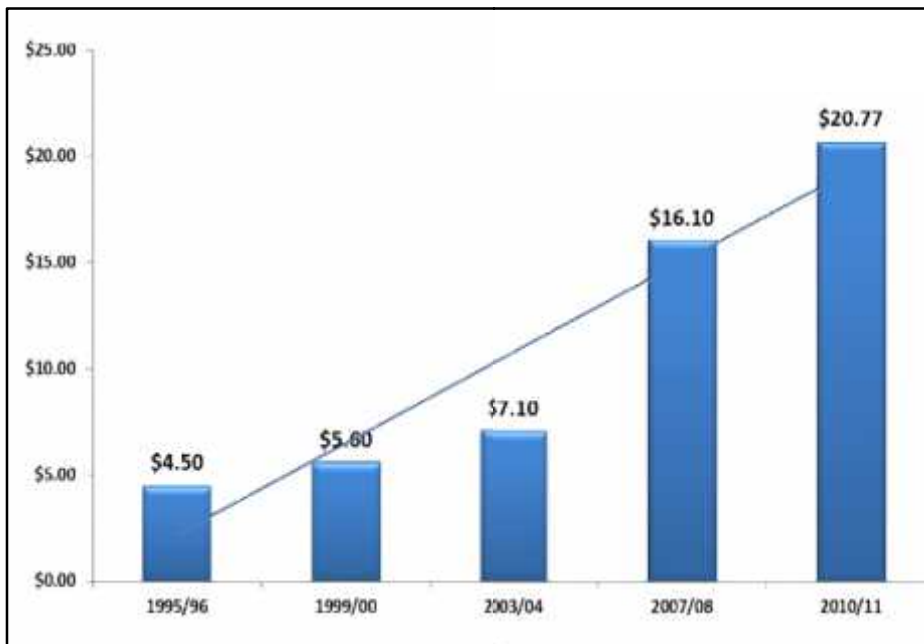
Source:5th NHA survey of 2010/11.

Nominal health spending growth from the third to the fourth and then to the fifth rounds of NHA in ETB and US$ were 146.7% and 138% and 130.8% and 33.3% respectively; (Computed from EFMoH 2014 – NHA V).

Fig. 2 a. Overall healthcare spending trend in US$

b. Overall healthcare spending in ETB
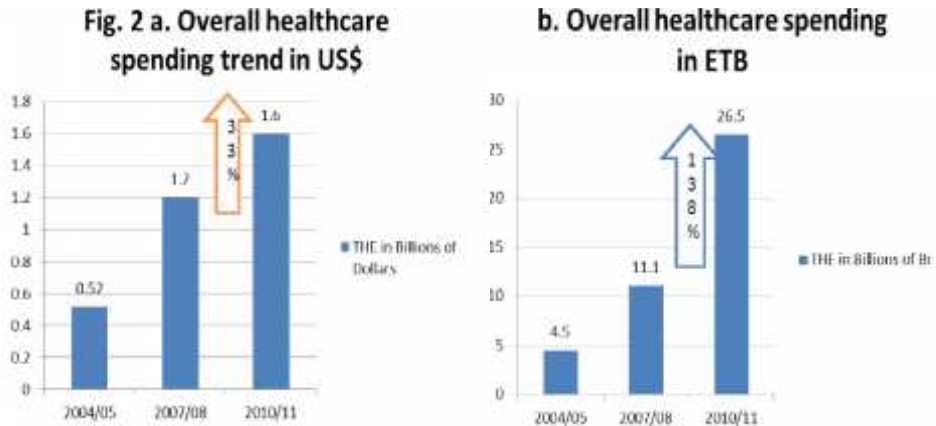
However, healthcare in Ethiopia is still underfinanced. The benchmarks for saying that Ethiopia's health sector has been underfinanced are those internationally agreed health financing indicators and national targets. The first indicator to mention is the WHO recommended threshold which substantiates the fact that governments should expend at least five percent of their Gross Domestic Product (GDP) in order for mitigating financial hardship of their citizens to pay for essential packages of health services. This indicator is usually referred to as General Government Health Expenditure (GGHE) as a share of GDP; WHO (2013). The second indicator is Total Health Expenditure (THE) per capita at average exchange rate of US$. According to WHO (2010), low income countries should have a per capita THE of US$34 (CMH target set in 2001) which was revised to US$44 by (High level Taskforce on Innovative International Financing recommendation to be achieved before 2009) or US$60 by 2015 by (WHO recommendation) for providing essential packages of health services for their citizens; KeXu *et al* (2010).

The third important indicator is the level of GGHE as a percentage of General Government Expenditure (GGE). According to this indicator, if countries spend 15% of their national expenditure for the health sector, it can enable their citizens to obtain essential packages of health services; WHO (2014). The last indicator to mention here is the level of Out of Pocket Payments (OOPs) for health as a percentage of THE. World Health Organization (WHO) recommends that catastrophic OOPs should be less than 20% of total health expenditure for

countries to be going out of impoverishment due to health spending. World Health Organization (WHO) added the fact that over 100 million people are pushed to impoverishment every year due to catastrophic OOPs health expenditure; WHO (2013).

Ethiopia has shown successive improvements in financing the health sector since the late 1990s as compared to previous trends. However, all except one of the global benchmarks are very far to meet. The following table shows Ethiopia's status in health financing as compared to the aforementioned global indicators. Only GGHE as a share of GDP is acceptable. The fact that GGHE as a share of GDP is acceptable but GGHE as a share of GHE is not acceptable implies that the country's health care is highly donor dependent; NHA (2014).

Table 1. Global health financing indicators, targets and Ethiopia's status

| Indicator /recommendations/	Global targets	Gov't target	NHA IV 2007/08	NHA V 2010/11	Year to meet target	Status of meeting targets
GGHE as share of GDP	>5%	>5%	4.5%	5.2%	Before 2015	Met
GGHE as share of GGE	15%	15%	5%	5.6%	Before 2015	Far to Meet
THE per capita (US$)	US$60	32.2%	16.1	20.77	Before 2015	far to meet
OOPs as share of THE	<20%		37%	34%	Before 2015	far to meet
GHE as a share of THE	NA	increase	21%	16%	NA	Against growth promoting sector
Rest of the world as a share of THE	NA	increase	40%	50%	NA	
Insured population		50%	1%	0.7%	Before 2015	Far to meet

Source: NHA (2014), Ethiopia's fifth national health account 2010/11; WHO 2014 Global Health Expenditure Atlas, September 2014,

Most of healthcare financing indicators are very much far to get met. Almost one-third of the target of total health expenditure per capita is met with only four to five years of implementation left to the final year of Millennium Development Goals (MDGs). NHA (2014) has indicated that Ethiopia is unlikely to meet the US$44 High Level Taskforce target and off course Health

Sector Development Program (HSDP IV) target of US$32.2 per capita by the year 2014/15.

WHO (2014) has published African region data for years 2002, 2007 and 2012. The following figure shows the performance of Ethiopia in common global health financing indicators. Data for 2012 had shown that GGHE as a share of GGE in Ethiopia was about 11% and was a bit less than the Abuja target of 15%. The government has shown improvement in this indicator though there has been a slight decline from 13% in 2007 to 11% in 2012.

**Figure 3: Trend of Ethiopia's Health Financing Performance using common global indicators**
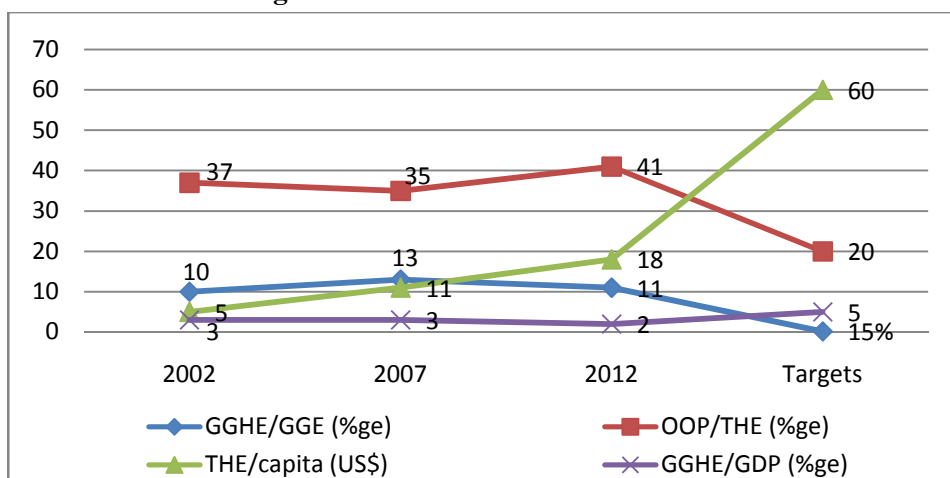
Source: WHO African Region Expenditure Atlas, November 2014

This datum is by far distinct from GGHE datum given in NHA (2014) (which is about 5.6%) as the former comprises government managed donations. The trend for total health expenditure per capita at current average exchange rate of US$ was increasing. It was $5 in 2002, $11 in 2007 and $18 in 2012. When we compare it with 2010/11 data in NHA V, per capita health spending showed a declining trend from $20.77 in 2010/11 to $18 in 2012; the latter being WHO African region health expenditure atlas, November 2014.

Catastrophic OOPs for health as a percentage of GGHE had grown to 41% in 2012 as compared to its average (35%) in 2007. This indicator should have shown decrement towards the threshold target of 20% of total health spending. NHA V (2014), however, stated that OOPs has declined to 34% of total health expenditure using 2010/11 data.

Comparison of Ethiopia's health financing performance with some sub-Saharan African countries showed that the country still has minimal per capita total health expenditure and need to leverage extra effort to meet financing requirements thereby create access to and quality of essential packages of health services for her citizens. Ethiopia's per capita total health expenditure is below a quarter of sub-Saharan African countries' average per capita total health expenditure.

Figure 4: Per Capita total health Spending of Some SSA countries (Current US Dollars): 2011
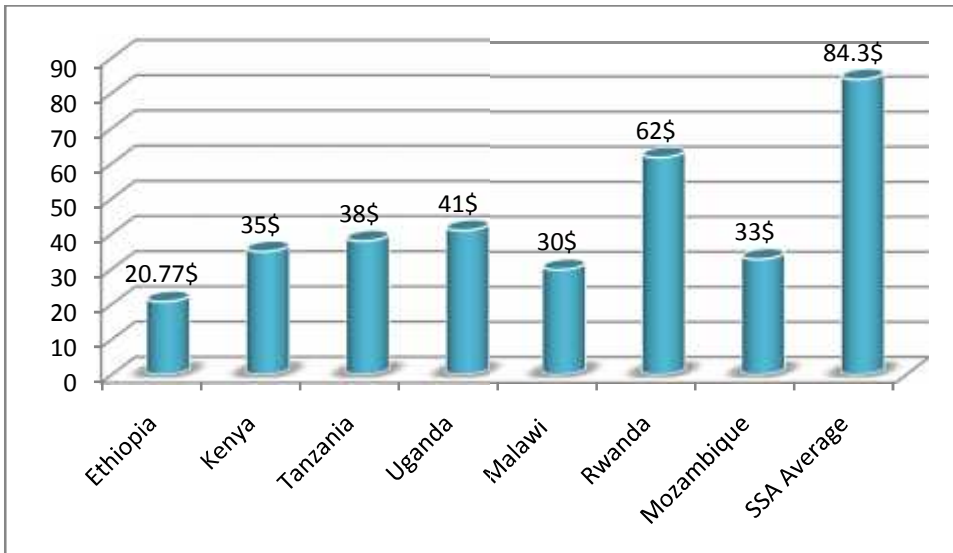
Source: The World Health Organization (2011); The source of data for Ethiopia is the 5th NHA survey of 2010/11.

All the aforementioned explanations ensure the fact that the health sector of Ethiopia has been highly resource constrained and the government should

leverage extra effort and create innovative health financing approach to improve health sector resources from both internal and external sources. Major sources of health finance in Ethiopia are government tax revenue, households out of pocket payments and rest of the world. 50% of GHE in 2010/11 was covered by rest of the world; a 10 percentage point increase from its share in 2007/2008. Rest of the world includes donations from multilateral and bilateral organizations. Government and households out of pocket payments covered 16% and 34% of GHE in 2010/11; NHA (2014).

3.2   Legal frameworks of Revenue Retention and Utilization

SNNPR HSDA proclamation No. 84/2004, regulation No. 46/2005 and the corresponding directive distributed in 2006 have allowed HFs to collect, retain and utilize money obtained from health service provision and the sale of other non-clinical good and services. The legal documents have also substantiated the fact that the collection, retention and utilization of such revenue are solely using the regulations and directives dispatched via the Bureau of Finance and Economic Development (BoFED); (ፋኢልማ ጥቅምት 2005, ፋኢልማ ጥር 2004, ፋኢልማ ታህሳስ 2005).

All HCs have been expected to collect revenue using BoFED's printed receiving voucher and deposited it in a special account "A" opened at commercial bank of Ethiopia in addition to the regular budgetary account "B". Account "A" is distinguished solely to retain and administer retained revenue during deposition, retention and utilization; while the budgetary account (B-account) is distinguished to let HFs administer their budget from treasury.

Given the aforementioned facts, 71 (98.6%) of visited HCs have been using commercial bank of Ethiopia to deposit their collected revenue. While the number of HCs which have both "A" and "B" accounts are 20, i.e. 28.2% of those which possess bank account, the number of HCs which have only account "A" and only account "B" respectively are 37 (52.1%) and 13 (18.3%). The responsibility and power to permit opening both A and B bank accounts for HCs at commercial bank of Ethiopia is owned by BoFED. Some of the HCs have explained that BoFED has refused account opening against the regional HSDA

proclamation. HCs faced difficulty in revenue retention and financial administration due to unavailability of bank account.

Table 2: Retained revenue collection, deposition and the where of deposition

Place to deposit RR	Frequency of cases		Type of bank account	frequency of cases	
	yes	%		yes	%
CBE	71	98.6	Only A account	37	51.4
WoFED	1	1.4	Only B account	13	18.1
MFIs	0	0.0	Both A&B account	20	27.8
Other HC's account	0	0.0	C account	1	1.4

Source: Own compilation from data collected during October 2014

Those HCs with only "B" account are either retaining their collected revenue in their safe box if any or depositing it in "B" account along with their treasury budgets. This has its own financial administration problems as the nature of "B" account is subject to closing at the end of every budget year contrary to its counterpart the "A" account. On the other hand, while all the 72 HCs should have "B" account at CBE, only 33 (45.8%) of the HCs have possessed it. This implies that majority 39(54.2%) of the HCs' treasury budget has been administered by WoFED officers centrally or budget transfer is being taking place towards their "A" account. These issues need to be solved as they can have their own influence on the quality of HCs' financial administration. Off course, zero-ness of number of HCs which deposit their retained revenue in MFIs was a celebration as MFIs are lender institutions and may not provide money immediately to HCs upon request.

3.2.1 Sources of Retained Revenue and their Share to HCs' Total Revenue

The sources of finance for HFs are block grant planned and allocated to HFs from government treasury and retained revenue collected by HFs from various sources. The source of block grant planned and allocated for HCs comes from either tax revenue or government managed cash based and in-kind donations.

On the other hand, retained revenue is the one collected, retained and utilized by HCs.

There are three most commonly known sources of retained revenue for HCs in SNNPR. Two of the sources of retained revenue are directly related to that obtained from health service rendition and the third one is obtained from the sale of non-clinical goods and services.

1. **Revenue from the Sale of Drug and Medical Supplies (RDMSs):** RDMS is collected from the sale of drug medical supplies prescribed to patients and bought from HC's service providing units. HCs can increase the level of revenue collected from sale of drug and medical equipment by setting evidence based and legitimate drug prices in such a way that they can obtain some revolving fund as a profit intended to improve the quality of healthcare services. Every time HCs purchased new drug and medical equipment, there is a practice of setting and/or revising new drug prices list and the new price list is usually posted in the compound of HCs for transparency purpose. HCs have the autonomy of setting and/or revising drug prices putting all their purchasing related costs and a pre-set profit margin given by their governance committees as a benchmark. Thus, the profit (revolving drug fund) from the sale of drug and medical equipment can be boosted by supplying all essential drug lists and minimizing drug stock-out from their pharmacy. The second way to increase their revenue from this source is evidence based and scientific setting and/or revision of drug prices.

2. **Revenue from Sale of Consultation and Medical Examination Services (RSCMES):** The second important source of retained revenue is SCMES. This source of revenue included but not limited to one collected from clients when they are advised to take laboratory examinations to diagnose the specific cause of their disease. Here, patients are let pay for laboratory reagent prices and partial estimate of the service they obtained in the laboratory. Just the same as RDMSs, some revolving fund of a certain profit margin is collected from RSCMES. The difference here is that the approval of price of services (not reagents only) should be done by HC governance

committees. HCs can boost the revolving profit fund from SCMES if they have access to essential medical examination machines, qualified man power who handles the laboratory operation, water and electricity infrastructure and basic reagents. There is also a need to set and/or revise legitimate and evidence based service prices which consider willingness and ability to pay of clients (patients).

a) **Revenue from the Sale of Other Non-clinical Goods and Services (RONCGSs):** Retained revenue can also be generated from the sale of facility owned non-clinical goods and services. If a HC found the sale of goods and services feasible and legitimate, they can generate, retain and utilize revenue collected from it. Although the kinds of non-clinical goods and services that are used as source of retained revenue in HCs vary from zone to zone and from facility to facility, the most common and observed sources consists of but not limited to the sale of worn-out equipment of HCs, provision of cafeteria and restaurant services for patients, provision of consultation services (least used source), the sale of any harvest in HC's compound like hey, cash crops (such as coffee, fruits, ginger, crops etc.) and the sale of trees, any other revenue source of a HC innovated by HC's management committee and endorsed by HCs' governance committee. Here, the role of the HCs' management committee and that of the governance committee is fundamental.

Figure 5: % Share of RR Sources from gross revenue of a HC
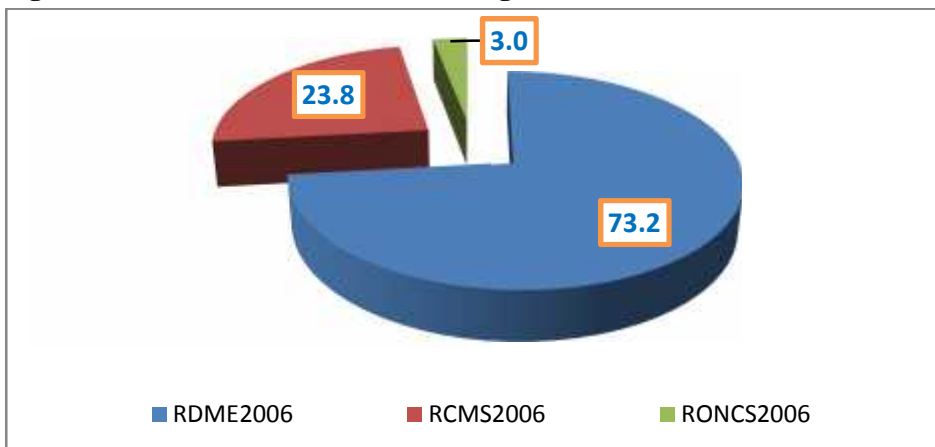
3.2.2   Level of Generated Revenue of HCs in SNNPR by Source

In 2006 EFY, the highest share of revenue of a HC was obtained from the SDMSs. The second largest share was obtained from the SCMES. 73.2% of retained revenue of a HC is generated from the sale of drug and medical supplies. The sale of consultation and medical examination services took about 23.8% part of total retained revenue of HCs.

As a result of Health care and financing strategy and successive legal documents, Health Facilities all over the country has been collecting, retaining and utilizing internal revenue obtained from service rendition and the sale of other non-clinical sources. In a similar fashion, HCs in SNNPR has been collected and retained revenue from the sale of health care services and other non-clinical services. The level of revenue generated from HCs has been increasing in successive years. Particularly, revenues generated from the sale of drug and medical supplies and that from the sale of consultation and medical examination services have been increasing since the start of the reform.

Table 3: Level of collected revenues of HCs in SNNPR during 2005, 2006 and 2007 EFYs

Major Revenue Sources	Budget year, Number of HCs and Average amount of revenue generated per HC					
	2005 EFY		2006 EFY		2007 EFY	
	# of HCs	Value	# of HCs	Value	# of HCs	Value
Average generated revenue from SDMS	30	150933.4	49	162121.1	54	177367.3
Average generated revenue from SCMES	30	42155.9	49	52660.8	54	39392.4
Average generated revenue from SONCGS	26	4261.3	44	6678.5	38	3243.5
Average total generated revenue	51	199186.4	51	214655.5	49	220003.2

Source: Own computation from data collected during October 2014

The Growth Rate of revenue of a HC generated from the Sale of Drug and Medical Supplies (SDMS or 1436) between 2005 and 2006 EFYs is:

$$GRSDMS = \frac{SDMS\ 2006 - SDMS\ 2005}{SDMS\ 2005} \times 100\% = \frac{162121.1 - 150933.4}{150933.4} \times 100\%$$

$$GRSDMS = 7.4\%$$

Similarly, Growth Rate of Revenue from Sale of Consultation and Medical Examination Services (GRRSCMES) between 2005 and 2006 EFYs are given as:

$$GRRCMES = \frac{SCMES\ 2006 - SCMES\ 2005}{SCMES\ 2005} = \frac{52660.8 - 42155.9}{42155.9} \times 100\% = 24.92\%$$

The growth rate of revenue collection accomplishments in 2006 and 2007 EFY is given as follows.

$$GRATAR\ in\ 2006 = \frac{Av.\ Amount\ collected\ in\ 2006 - Av.\ amount\ collected\ in\ 2005}{Av.\ Amount\ collected\ in\ 2005} * 100\%$$

$$GRATAR\ in\ 2006 = \frac{214655.5 - 199186.4}{199186.4} * 100\% = 7.77\%\ and,$$

$$GRATAR\ in\ 2007 = \frac{Av.\ Amount\ collected\ in\ 2007 - Av.\ amount\ collected\ in\ 2006}{Av.\ Amount\ collected\ in\ 2006} * 100\%$$

$$GRATPR\ in\ 2007 = \frac{220003.2 - 214655.5}{214655.5}\ 100\% = 2.49\%$$

The average growth rate of collected revenue of HCs during 2005 through 2007 EFYs is about 5.13%. One can further the computation of the growth rate of collected revenues of a HC for revenue sources vis-à-vis sales of drug and medical supplies, rendition of consultation and medical examination services and other non-clinical revenue sources of different fiscal years. Besides, the attribution of each revenue sources to gross generated revenues can be estimated descriptively.

Data showed that there is consistent growth of generated revenue of HCs since 2001 EFY to 2007 EFY. The average annual growth rate of collected revenue of

HCs during the aforementioned period has been 26.1%. There was tremendous annual revenue growth in the period between 2001 to 2005 EFYs with growth rate amounting up to 47.23%. Data collected as of Sene 30, 2005 EFY showed that the number of public HCs in SNNPR were 660.

Thus, on average only public HCs (excluding hospitals) in SNNPR contributed about 141,672,630 ETB. This money is the one collected by HCs from the sale of drug and medical supplies, sale of consultation and medical examination services and the sale of other non-clinical goods and services. This showed that retained revenue has huge contribution in financing healthcare services in Ethiopia. Assuming that the number of HCs in the region was constant at 660, the average annual revenue generated from them in 2005 and 2007 EFYs was 131,463,024 ETB and 145,202,112 ETB respectively. Figure 6 below showed the level of internal revenue generated per HC since 1999 EFY in SNNPR.

Figure 6: Trend of retained revenue since 1999 EFY
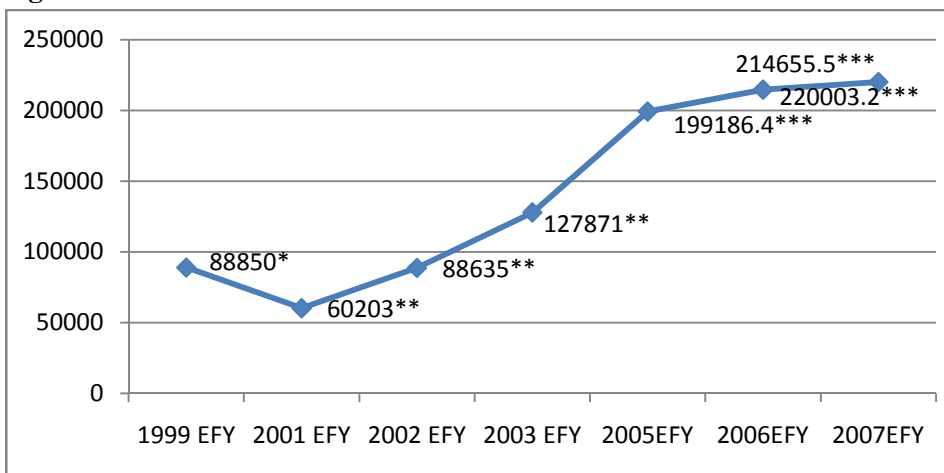
Source: *National average data obtained from project end- survey by ESHE September 2008; **Routine supportive supervision data of each year; ***Own summary from data collected from HCs in October 2014;

3.2.3   Empirical Analysis of contribution of Revenue Sources to Gross Revenue

In this section, simple Cobb Douglas production function is employed to analyze the contribution of different sources of retained revenue to HCs' gross

revenue. After linearizing the Cobb Douglas production function using logarithm operation, a robust result that remedies the violation of classical linear regression assumptions has been obtained. Data were analyzed using stata 11 software as the result is shown in table 4 below.

The Model:

$$\ln \_GR_{2006} = \ln(\alpha RDMS_{2006}{}^{\beta_1}.RCMS_{2006}{}^{\beta_2}.RONCS_{2006}{}^{\beta_3}.GR_{2005}{}^{\beta_4}) + \mu,$$
$$\ln \_GR_t = \ln \_\alpha + \beta_1 \ln \_RDMS_t + \beta_2 \ln \_RCMS_t + \beta_3 \ln \_RONCS_t$$
$$+ \beta_4 \ln \_GR_{t-1} + \mu_t$$
$$GR_{2006} = 1.14 + 0.2\ln \_RDMS_{2006} + 0.08\ln \_RCMS_{2006}$$
$$+ 0.005\ln \_RONCS_{2006} + 0.65\ln \_GR_{2005} + \mu$$

Robust OLS regression on the log-linear Cobb Douglas production function has shown that 93% of the change in gross revenue of a health center is explained by the change in the explanatory variables RDMS2006, RCMS2006, ROSNCS and GR2005 of HCs. Two of the independent variables, i.e. RDME and GR of lagged dependent variable are found to have significant contribution to the change of the value of the dependent variable. The p-values for the independent variables RDME2006 and GR2005 are well below the critical value 0.05. Thus, we reject the null hypotheses that $\beta_1 = \beta_4 = 0$. Revenue from the sale of drug and medical supplies and amount of HC's previous year revenue significantly contributed to the gross revenue of a HC in the current year. 10% increase in the effort to sale drug and medical supplies at a given HC will raise gross revenue of the health center by 2 percentage points. We can also observe from the result in the table below that if gross revenue of a health center last year is higher than gross revenue of another health center in the same year by 10 percentage points, then current year's gross revenue of the former HC is expected to increase by about 6.5 percentage points more than the latter HC.

However, the sale of consultation and medical examination services and the sale of other non-clinical goods and services were found not to have significant effect on the value of gross revenue of a health center at 95% confidence. The p-values of RCMS2006 and RONCS2006 were well above the critical value 0.05. We fail to reject the null hypotheses that $\beta_2 = \beta_3 = 0$. Thus, the variables RCMS2006 and RONCS2006 don't significantly contribute to retained revenue

of HCs. The justification for the fact that RCMS2006 doesn't have noticeable effect on facilities retained revenue may be due to the fact that majority of health centers don't have either laboratory equipment or the required health professional to operate the equipment. Besides, there is limited access to electricity and water infrastructure at HCs. This means, majority of the medication services at health centers is provided by patient information and physical examination due to which revenue from medical examination services is limited to that collected from consultation services, usually called payment for card.

Table 4: Linear regression result of gross revenue of HCs contributed by its sources

```
. reg ln_GR ln_DME ln_CMES ln_ONGS ln_PR, vce(robust)

Linear regression                              Number of obs =      48
                                               F( 4,   43) =  284.91
                                               Prob > F      =  0.0000
                                               R-squared     =  0.9290
                                               Root MSE      =  .20442

                          Robust
     ln_GR  |   Coef.   Std. Err.     t    P>|t|    [95% Conf. Interval]

    ln_DME  | .1968188  .0751338    2.62   0.012   .0452971    .3483404
   ln_CMES  | .0771779  .0456716    1.69   0.098  -.0149277    .1692834
   ln_ONGS  | .0049608  .0029647    1.67   0.102  -.0010181    .0109397
     ln_PR  | .6534465  .1064449    6.14   0.000   .4387799    .8681131
     _cons  | 1.144049  .4567177    2.50   0.016   .2229901    2.065108
```

Source: Own computation from data collected from HCs during October 2014

On the other hand, the pettiness of the contribution of revenue from ONCGS2006 is because it is much more dependent on the vigilance of HC directors and facility governance committees. Generating revenue from ONCGS2006 requires some innovative approaches in creating sources of finance for HCs, provision of consultancy services for those who require and other mechanisms. Thus, its insignificance can unravel that there were not such innovative activities in HCs.

Hypothesis testing: The P-values for variables RDME2006 and GR2005 are very small, i.e. they are well below 0.05. Hence, the decision in this case is to reject the

null hypothesis which states that the parameters $\beta_1 = \beta_4 = 0$. This implies RDME2006 and GR2005 are significant and the coefficients are non-zero. On the other hand, the P-value of the variable RCMS2006 and RONCS2006 are not small, i.e. they are well above 0.05. Hence, we fail to reject the null hypothesis $\beta_2 = \beta_3 = 0$. That is, the elasticity of retained revenue of a HC as a result of the variables RCMS2006 and RONCS2006 were not significant.

3.3   Utilization of Budget from Treasury and Internal Revenue Sources

HCs have got budget from treasury and internal revenue sources. Payroll budget for HCs' staff is solely covered from treasury source. Other operational and capital budgets are covered by both internal revenue and treasury sources. Internal revenue is a supplementary budget for HFs to be used for purchasing goods and services that are particularly deemed to improve the quality of healthcare services. In addition to government allocated budget, internal revenue can primarily be used to enhance the supply of drug and medical supplies, purchase of medical equipment like examination machines of different type and for building service expansionary rooms. Having the aforementioned fact as a bench mark, figure 6 below compares the amount of budget utilized for operational expenditure items of HCs from internal revenue and treasury budget sources in 2006 EFY.

Figure 7: Utilized amount of money from retained revenue and treasury sources for operational expenses in 2006 EFY in ETB for HCs in SNNPR
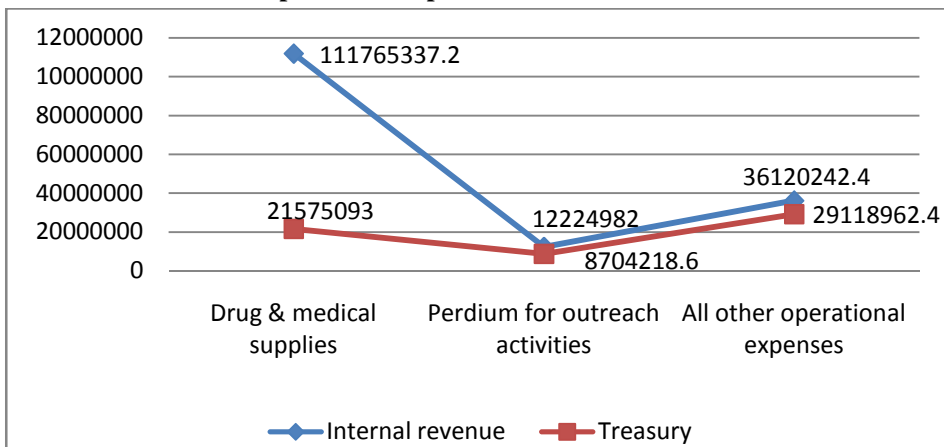
Source: Own computation from data collected from HCs during October 2014

In 2006 EFY, utilized budget for drug and medical supplies (6214), per diem for outreach services (6231) and all other operational expenses from internal revenue and treasury sources respectively were (111.77 million ETB, 12.22 million ETB, 36.12 million ETB) and (21.58 million ETB, 8.70 million ETB, 29.12 million ETB). On average 69.8% of total utilized budget of HCs from retained revenue was employed to drug and medical supplies in 2006 EFY. In 2006 EFY, utilized budget from retained revenue for drug and medical supplies outweighs the amount utilized for the same expenditure item from treasury source. Figuratively, about 83.8% of total expenditure of HCs in SNNPR for drug and medical supplies in 2006 EFY was covered by internal revenue. Similarly, internal revenue contributed about 58.4% of total expenditure for perdiem. Overall, expenditure from internal revenue outweighs that from treasury source in covering operational costs of HCs in SNNPR. As shown in figure 7 below, about 73% of total operational expenditure of HCs in SNNPR is covered by internal revenue.

Figure 8: Percentage share of internal revenue in covering operational expenses of HCs in SNNP in 2006 EFY
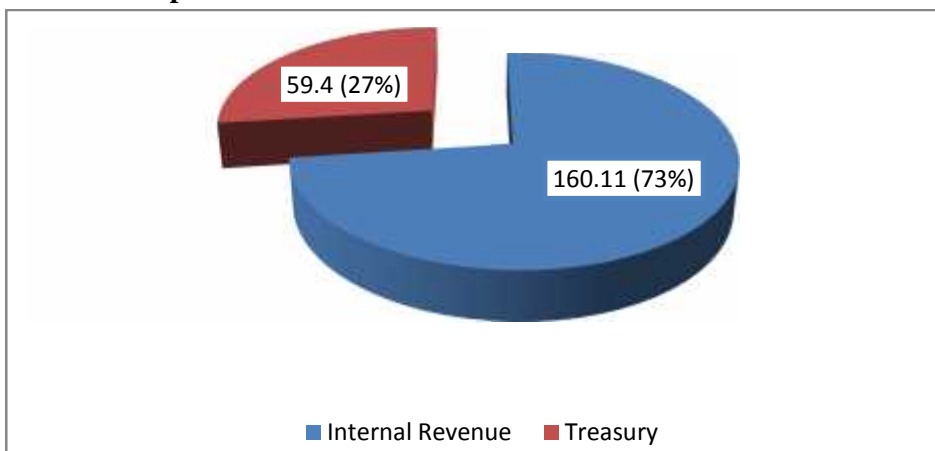
The purpose of revenue retention and utilization as part of health care financing reform was and has been to increase absolute health resource to mitigate resource constrains in improving the quality of health care services. This paper tried to address whether revenue retention and utilization has improved health care resource availability or not. Surely, as all the above explanations clearly

show, retained revenue has duly contributed in mitigating health care resource shortage particularly of drug and medical supplies at HCs. However, the level of contribution of health care inputs generated using internal revenue is beyond the scope of this paper and can be a project for next intervention.

4.   Challenges of implementing revenue retention and utilization

HCs have mentioned different challenges that they confront during collection, retention and utilization of internal revenue. Some of these challenges have been:

1. Difficulty of collecting revenue during off working hour services as there is no payment scheme for holiday, weekend and night shift daily cash collectors;
2. Capacity constraint of PFPA staffs in financial management and lack of gap filling support from WoFED professionals;
3. Shortage of qualified human resource for PFPA, auditor and daily cash collector positions in the labor market particularly for remote areas;
4. Minimal or nil allocation of operational budget from treasury sources such as for purchasing drug and medical supplies, paying perdiem and fuel expenses among others due to which HCs face critical budget shortage;
5. Farness of Commercial Banks of Ethiopia to deposit retained revenue on daily basis and
6. Unavailability of electricity and water infrastructure in most HCs to expand and render laboratory services thereby improve retained revenue to boost revenue obtained from sale of consultation and medical examination services.

5.   Conclusion and Recommendation

Health financing in Ethiopia has showed tremendous improvements. Per capita health expenditure more than quadrupled within fifteen years with added advantage obtained from implementation of health sector financing reform. However, health care is still underfinanced as compared to global financing indicators and the need to improve access to and quality of health care services.

Thus, health financing schemes should involve innovative strategies that can increase competition among health facilities in both revenue generation and utilization for quality healthcare service provision.

Identifying the level of contribution of sources of retained revenue can help the health sector to continue maximizing the attribution of better sources and design strategies to increase the gain from current poor contributors. The highest share (73.2%) of retained revenue of HCs is taken by the sale of drug and medical supplies. Its contribution is found significant at 95% confidence. However, it is only at 10% level of significance that the sale of consultation and medical examination services had significant contribution to HCs' retained revenue. This is because majority of HCs don't provide medical examination services due to lack of required medical equipment, qualified lab technicians, water and electricity infrastructure. Thus, regional health bureau need to address such infrastructural and capital set-ups that can help improve generation of revolving fund from health service rendition to intensify the quality of healthcare.

Generation of revenue from sale of non-clinical goods and services requires the vigilance and creativity of the management committee and facility governance bodies of HCs. The support of facility governance bodies to HCs to generate retained revenue from the sale of ONCGS includes but not limited to the provision of arable land near to the compound of a HC so that they can harvest cash crops to raise revenue to HCs, creation of enabling and conducive environment for HCs to collect revenue from consultancy and research activities and any other feasible way of capacitating HCs.

HCs should have a very organized record of provided healthcare services along with corresponding cost of each service. Otherwise, difficulty will arise in collecting revenue from postpaid clients such as credit based service users, community based health insurance users and fee waiver beneficiaries.

The capacity of revenue generation of HCs has been highly dependent not only on availability of drug and medical supplies and amount of previous year deposit of HCs but also on unreserved support and oversight of governance committees and management committees of HCs. The higher the deposit a

health center had in the previous year, the more inputs the HC could purchase for this year and as a result expanded service can bring more revenue in the current year.

As the when of a health problem is unpredictable, HCs are providing healthcare services 24 hours a day and 7 days a week. Thus, daily cash collectors are required in all these periods. Hence, concerned stakeholders should stretch a scheme which accommodate and enable HCs to collect revenue during night shifts, weekends and holidays.

Financing the health system via social security tax like (tobacco taxation, emission taxation, alcohol taxation, etc.) has multiple advantages. On one hand, it can discourage such practices thereby remedy the security of the society. Second, it can generate compensatory finance to improve the health system to let it cop up risks arising from the alleged practices. A specified percentage share of tax revenue from the aforementioned and related social wellbeing challenges should be earmarked to the health sector.

References

Central Statistics Authority (Ethiopia) and ICF international. 2012. Ethiopia Demographic and health survey 2011. Addis Ababa, Ethiopia and Calverton, Maryland, USA: Central Statistical Agency and ICF International.

DNG (2004), Debub Negarit Gazeta of SNNPRS. Health Service Delivery and Administration Proclamation Number 84/2004. August 19th, 2004. Hawassa, Ethiopia

Ethiopia Federal Ministry of Health (EFMoH). April 2014. Ethiopia's Fifth National Health Accounts 2010/2011. Addis Ababa, Ethiopia.

_____. May 2010. Ethiopia's Fourth National Health Accounts 2007/2008. Addis Ababa, Ethiopia

_____. (1998), Health Care and Financing Strategy. Federal Democratic Republic of Ethiopia, Ministry of Health, 1998, Addis Ababa, Ethiopia.

Health Research in Ethiopia – a Country Overview, downloaded from internet on March 21, 2016.

John Snow Inc (2008) Essential Health Services in Ethiopia; Health Care Financing End-line Survey Synthesis Report published in September 2008 by the support of USAID.

KeXu *et al* (2010), Exploring thresholds of health expenditure for protection against financial risk, World health report 2010 background paper 19

Transitional Government of Ethiopia (TGE).September 1993b.Health policy of Transitional Government of Ethiopia. Addis Ababa, Ethiopia: Transitional Government of Ethiopia.

World Health statistics 2014 ISBN 978 92 4 0692 67 1 (PDF) (NLM classification 900.1)

WHO Regional office for Africa, 2013.State of Health Financing in the African Region: WHO Regional Office for Africa. ISBN: 978-929023213-1

WHO African Region Expenditure Atlas; November 2014. ISBN: 978929 023 273-5(NLM classification:W74).

WHO Global Health Expenditure Atlas; September 2014. ISBN: 97892 4 150 4447 (NLM Classification: W74).

(ፋኢልጣ ጥቅምት 2005) የደ/ብ/ብ/ሕ/ከ/ መንግስት የጥሬ ገንዘብ አስተዳደር መመሪያ ቁጥር 8/2005

(ፋኢልጣ ጥር 2004) የደ/ብ/ብ/ሕ/ከ/ መንግስት የጥሬ ገንዘብ አስተዳደር መመሪያ ቁጥር 6/2004

(ፋኢልጣ ታህሳስ 2005) የደ/ብ/ብ/ሕ/ከ/ መንግስት የጥሬ ገንዘብ አስተዳደር መመሪያቁጥር12/2005

Women's Access to Microfinance Services in Southern Ethiopia: Assessing the promises, Impacts, Challenges and Gaps

Mitiku Kebede [1] and Nigatu Regassa[2]

Abstract

This study has primarily focused on examining the participation of women in micro finance institutions and major determinants of membership in MFIs based on data collected from 11,162 households selected from 43 districts. Data were also collected through Focus Group Discussions (FGDs) and Key Informant Interviews (KIIs) with village elders and microfinance staffs. The result indicated that women's participation in MFIs is fairly low (only 17%). Among the clients, 75% of them use the borrowed money for income generating activities. The logistic regression analysis indicated that some household and individual variables such as educational status, size of land holding, age, religion, job status, husband's education level, family size, type of crop they grow and the use of informal credit sources are the main determinants of women's participation in MFIs. The main institutional challenges reported includes high loan requirements, poor mobilization by the service providers and media , high withdrawal rate of the saved money, huge gender gap in the disbursement of loan, insufficient provision of entrepreneurial trainings on skill development and financial outlay and frequent dropouts.

Key Words: Compulsory saving, Microfinance, Voluntary saving, Withdrawal

[1] Lecturer and Researcher, School of Economics, Addis Ababa University, Ethiopia Email: mitekeni@gmail.com

[2] Visiting Researcher, University of Saskatchewan, Saskatoon, S7N 5A2. Canada. Email: negyon@yahoo.com

Conflict of interest

The authors declare no conflict of interest.

1.   Introduction

Microfinance is a small scale financial services-primarily credit and savings-provided to individual entrepreneurs and small businesses lacking access to banking and related services. After the establishment of modern banking system, even though credit and other services were available, they were exclusively used by the capable part of the society who can afford the heavy collateral. In order to overcome this challenge, particularly during the 1960s and 1970s, the governments of some developing countries adopted specialized subsidized credit institutions and programs with the principal intention of helping the poor. However, in 1980s, the subsidized program came under heavy criticism because their performance was below expectations in several ways, including the failure to reach poor farmers and provide financial services in a sustainable manner; that is why microfinance service has come to existence as a remedy (Robinson, 2001).

Increasing women's access to microfinance services promises greater contribution to household income which in turn, will translate into improved standards of living. Moreover, because women have fewer resources available, they tend to be more vulnerable when economic challenges or unforeseen circumstances arise. By providing access to loans for income-generating activities, microfinance institutions can significantly increase a woman's resources, thereby reducing her overall vulnerability. Furthermore, it is well-documented that women are more likely than men to spend their income on household and family needs (Getaneh, 2005; Linda, 2009).

The modern finance history of Ethiopia dates back to the beginning of 20th century, 1906, by the establishment of Bank of Abyssinia (NBE, 2001). For long period of time, the major source of credit for the rural and urban poor has been the informal sector which includes friends and relatives, local money lenders, eqquib[3] and, iddir[4] and other similar social networks.

---

[3] Associations where friends, relatives or some community members summon and contribute a fixed amount of money per month or week and the collected money circles around every term.

[4] Communal associations where the people mainly gather to help each other in time.

However the slow movement of the finance sector made a paradigm shift after the fall of the socialist government in 1991. Consequently, the Ethiopian financial system has passed through significant reform process since 1992 as a part of transition from a planned to a market economy: liberalizing and reforming the financial sector, relaxing foreign exchange controls, dismantling the administered interest rate regime, establishing a new framework for banks, insurance companies, microfinance institutions and cooperatives are some of them.

Following the issuance of Proclamation No. 40/1996 in July 1996, the first group of few Micro Finance Institutions (MFIs) was established in early 1997 among which Omo Microfinance Institution (OMFI) was one of them. Since then many MFIs flourished in different parts of the country (Getaneh, 2005) with different purposes among which empowering the poor women has been their principal intention. The proclamation has brought about a remarkable growth in terms of outreach and sustainability of the microfinance industry of Ethiopia (Dereje et al, 2013).In 2005, the government of Ethiopia National Action Plan has given due attention for the empowerment of women. Similarly, the revised Development and Transformation Package of Bureau of Women, Children and Youth Affairs (BoWCYA) also states enhancing the economic capacity of women and encouraging the saving their habit as the very important mission to undertake. Recently, women's access and control of microfinance services has been one of the priority agenda in almost all regions of Ethiopia.

Despite several efforts being made, women's access to and control over microfinance services in Ethiopia is still low. A study undertaken at industry level indicates that only 38.4 percent of women use microfinance services and at individual MFIs level, the share of women participation to credit access was below 50 percent except for very few of them (Befkadu, 2007). *On the other hand,* Emana et al. (2005) have documented that only 1% of the households in the study accessed credit from commercial banks. In the Southern Regional State of Ethiopia, out of the total beneficiaries of Omo

---

of need (joy or sadness) and contribute in cash or kind for it as part of the service.

MFI in 2010 only 28% were female (OMFI Annual Report, 2011). On top of this, about 72% of loans disbursed goes to the male clients. *This is mainly due to the need for heavy collateral* and partly because commercial banks are mostly located in the urban centers, where less than 20% of the population resides. Therefore, the need for microfinance- financial services to low-income individuals or to those who do not have access to typical banking services became indispensable.

With regards to the impacts of MFIs, previous studies had controversial conclusions ranging from enormous positive impacts to none. For example, a study conducted in Amhara and Oromiya regions of Ethiopia (Tarozzi *et al,* 2015) concluded that the program led to a substantial increase in both the probability of borrowing and the loan size, but there is limited evidence that it increased household income, improved school attendance or empowered women in household decision-making. A study conducted on OMFI beneficiaries in Southern Ethiopia (Tesfaye, 2012) reported that microcredit and micro saving services of OMFI has brought a positive impact on improving its client's income at household level. 77.4 percent of the total respondents indicated an increase in their annual income due to their access to microcredit programs, which enabled them either to expand the existing business or to start up new productive enterprising.

To the best of our knowledge, no comprehensive regional level study was conducted on MFIs since their establishment in the Region (late 1990's), and our knowledge has solely been based on the scantly available beneficiary specific case studies conducted by graduate students. Also, the findings of these available studies have based on small sample of households taken from a district or sub-districts who are beneficiaries of one particular MFI. This study, on the other hand, is a large scale/region level analysis based on data collected from all zones and all categories of beneficiaries and non-beneficiaries, and is aimed at examining women's participation in MFIs, impacts, opportunities, challenges and gaps in the sector. This study, thus, posed and addressed the following three questions: (1) what is the overall status of MFIs in terms of participation of women, and what are the barriers for membership? (2) What are the main impacts of MFIs on women and/or

their households? 3) What are the prevailing opportunities, challenges and gaps in MFIs in the region?

2.   Data Sources and Methodology

The study area

The Southern Nations, Nationalities and Peoples Region (SNNPR) is one of the nine states making the federal government of Ethiopia. Administratively, the region is divided in to 14 zones, one city administration and 4 special woredas/districts. These include Hadiya, Sidama, Gedio, Silte, Gurage, Kambata Tembaro, Gamogoffa, South Omo, Bench Maji, Kafa, Sheka, Dawro, Wolyta and Segen people's zones and Basketo, Yem, Konta, and Halaba special woredas. The region is multi ethnic with 56 nations and nationalities. The population of SNNPR for the year 2012/13 is 17,855,710 of which 8,885,204 are male and 8,970,506 are female. Region started to use the microfinance services in 1997. There are about seven micro financing institutions operating in the region; namely, Omo (OMFI), Sidama, Wisdom, Agar, Leta, Metemamen and Meklit. Sidama micro finance is operating in almost all urban and rural areas of Sidama zone. Wisdom is operating mainly in urban areas of Sidama, Gedeo, Wolayita, Hadiya, KambataTembaro, and Gamo Gofa zones. Metemamen is operating in Gurage Zone while Agar and Meklit are operating in some urban areas of same zone. Of these the MFIs, OMFI has a wider geographical coverage, huge capital and largest number of clients (BoFED, 2013).

Data source

The main data for this study were generated through both primary and secondary sources. Larger proportion of the data were collected from households and key informants at four different levels (kebele, woreda, zones and Region), women entrepreneurs in urban and semi urban areas. The secondary data were collected from relevant authorities in the region which supplemented the household survey. Basically, the study is a cross sectional survey design with qualitative and quantitative methods. The quantitative aspect of the study has mainly focused on description of key demographic profiles, measurement of selected socio economic variables, description of

current scenarios and econometrics. The qualitative dimension of the study has mainly dealt with narration of contexts and further examination of attitudinal as well as perceptual issues on women and development packages.

Sampling design

To determine the sample size of the current study, it is imperative to consider a wide range of women empowerment indicators in SNNPR taken from very recent studies, which includes but not limited to, women education/ participation rate (64.3 %, CSA 2011), autonomy and decision making index (69.1%), headship rate (26%, CSA, 2011), ownership of land/house (61%, CSA, 2011) and employment status (40.7 %, CSA, 2011). Once the key women empowerment indicators were known, it was assumed that these indicators did not vary much across all zones/ districts of the region. Then, the sample size for the study was determined by using the formula for a cross sectional household based survey (see Cochrane 1977).

The estimated sample size for each zone (i.14 zones, one city administration and 4 special woredas/districts) was 383 and was weighted by 1.5 (Cochrane 1977) to get a size of 575, then a 5 % contingency was added to get the final sample size of 604 households from each zone, giving a total sample size of 11,476 from the region. Then the individual households were selected using multistage sampling technique and the process of sampling for the household level survey was started with purposeful selection of two representative districts/woredas from each zone of the region, giving a total of 43 study woredas. At the third stage of sampling, 5-10 % kebeles (Sub-districts) from the total list of kebeles of each selected woreda (proportionally representing urban and rural kebeles) were considered. Based on the information from Central Statistics Authority, it was assumed that the kebeles within a district have more or less similar characteristics and size. Once households are identified, the information was collected from women respondents.

Data collection and analyses

A comprehensive questionnaire and key informant interview checklist was used to generate the required information. The field staffs, who mainly are

the district level government employees and Hawassa University teaching staff, were recruited based on their prior experience. They received two days intensive trainings on research methods and filed management. Once the preparatory activities were completed, the filed data collected was launched for two months.

The data were analyzed using SPSS software version 20. The quantitative analysis employed both percentages and multivariate analysis. The key determinants of membership in MFIs were examined using binary logistic regression. Several household and individual level variables were regressed against the dependent variable (women's membership in MFIs).

3.   Results
Background Characteristics

Table 1 presents the distribution of the respondents by selected background characteristics. It is indicated that female headed households consist of only 22.4% and the great majority (78.6%) are male headed households. More than 72% of respondents were in the age range of 18 and 39, which is the productive age group. With regards to the household size, nearly 50 percent had a size of 5 to 8 and 40 percent were 2-4 sized households. Considerable proportions of the respondents were not able to read and write (41.1%); and 33.9 percent of them completed only primary level of education. Moreover, further crosstab analysis (table not shown) depicted that 53% of the illiterate women's spouses were illiterate themselves. As expected, very small fraction of the respondents (5.9%) were reported to have either diploma or degree level of education.

Table 1: Percentage distribution of respondents by selected background characteristics, SNNPR (n=11,462)

Characteristics	Number	Percent
Sex of the respondents		
Female	2498	22.4
Male	8664	77.6
Total	11162	100.0

Household size		
Live alone	319	2.9
2-4	4464	40.0
5-8	5443	48.8
Above 8	936	8.4
Total	11162	100.0
Age of the respondents		
18-28	3873	34.7
29-39	4176	37.4
40-50	2243	20.1
Above 50	664	7.7
Total	11162	100.0
Education		
Illiterate	4587	41.1
Practical oriented adult education	695	6.2
1-4 grade	1709	15.3
grade 5-8	2072	18.6
grade 9-10	1139	10.2
Grade 11-12 (preparatory)	297	2.7
Above high school	653	6.0
Total	11162	100.0

Source: Own field data

Distribution of Microfinance institutions and membership in the region

The disribution of clients is not evenly distributed across the zones of SNNPR. As can be seen from Table 2, some zones have relatively larger members than others. Gurage, Sheka and Sidama zones have the highest concentration of microfince clients (33.1%, 31.3% and 28% respectively). On the other hand, zones such as Halaba, Hadiya and Basketo have the lowest clients (see Table 2 and Figure 1).

Table 2: Distribution of membership in MFI by zone, SNNPR (n=11,162)

Name of the Zones	Membership in MFI		
	Yes	No	Total
Basketo	42	561	603
Bench Maji	116	493	609
Dawuro	102	494	596
Gamogofa	46	564	610
Gedeo	73	414	487
Gurage	199	403	602
Hadiya	30	569	599
Halaba	24	480	504
Hawassa	110	491	601
Kaffa	86	421	507
Kanbata	103	512	615
Konta	90	511	601
South Omo	122	489	611
Segen	53	550	603
Sheka	185	407	592
Sidama	169	435	604
Silte	110	499	609
Wolayita	146	457	603
Yem	107	499	606
Total	**1913**	**9249**	**11162**

Table 3 further summarizes the distribution of membership by type of institutions. Only 17.1 percent of women were members of the saving and credit institution. Concerning the coverage in the region, OMFI alone covered 80.1%, Sidama Microfinance 1% and the rest 2.2% was covered by the remaining five institutions (Wisdom, Agar, Leta, Metemamen and Meklit Microfinance institutions). About 17 percent of the households live in districts not covered by MFI.

Table: 3: Percentage distribution of respondents by participation in saving and credit organizations, SNNPR (n=11,162)

Characteristics	Number	Percent
Name of credit institution available		
Omo microfinance	8937	80.1
Sidama microfinance	113	1.0
others	243	2.2
Not available in the districts surveyed	1869	16.7
Total	11162	100
Membership in saving and credit org.		
Yes	1913	17.1
No	9249	82.9

Source: household survey data

Participation in income generating activities

Among the borrowers, 75% of the women participate in income generating activities. The rest use it to fulfill their basic needs and for related purposes. This is also manifested in the last money they borrowed. As can be seen from the crosstab analysis, the majority of the women participate in animal fattening and food crop production and the least of all is beekeeping.

Table 4: The percentage distribution of participation rate in income generating activities, SNNPR(n=11162)

Characteristics	Number	Percent
Overall Participation in income generating activities		
NA	9661	86.6
Yes	1125	10.1
No	376	3.4
Main reason for taking the last credit		
NA	9525	85.3
business expansion	1069	9.6
fulfill basic needs	415	3.7
others	153	1.4

Source: Own household survey data

Figure 1- The percentage share of women's income generating activities.

Share of women the business activities

% of Women **in other businesses** 21%

% of Women in **food crops Production** 28%

0%

% **of Women in animal product** 4%

% of Women in **fruit and vegetable trade** 11%

% of Women in **fattening** 35%

% of Women in **beekeeping** 1%
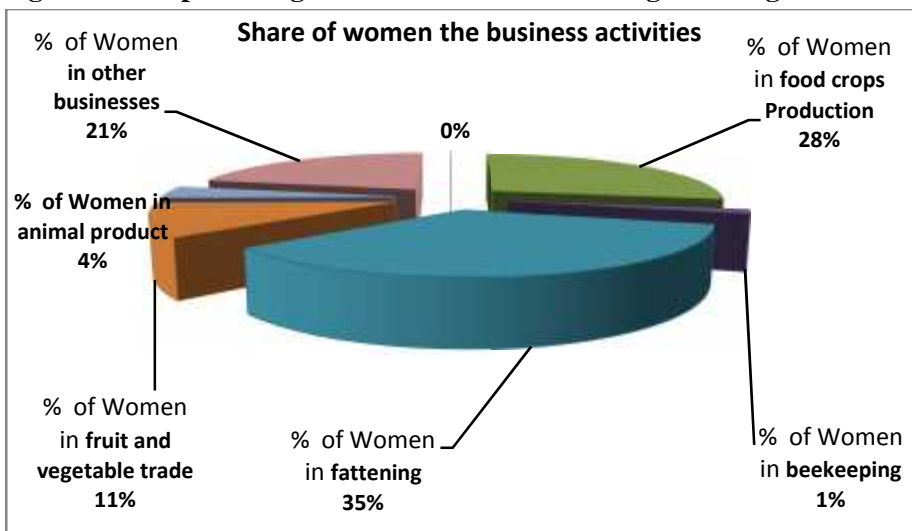
Source: Own household survey data

Decision makings on the benefits

Regarding women's decision making to borrow the money, around 47.3% of the women reported that decisions are taken either by the woman herself or together with husband. Only in 12% of the households do the husbands have exclusive right in making the decision. The rest is made either by the microfinance staffs or in consultation with member friends. On the other hand, concerning the administration of borrowed money, 60% of the administration was either under the wife or the joint consensus of husband and wife. The findings also assert that the influence of family members and siblings is also very high both in the decision to borrow and administration of the money which indicates the strong social ties among the society.

Table 5: Percentage distribution of respondents by reported motivation, decisions and perceived advantages of receiving credit, SNNPR (n=1913).

|	Decision maker on money to be borrowed (%)	Decision maker on administering the money
Self	16.3	26.2
Husband	9.3	9.9
Both husband and wife reaching consensus	31	33.8
Micro finance staff	12.3	-
Other member who is a friend	3	-
Others (like family members)	29.1	30

Source: Own household survey data

Many women borrow from the microfinance institutions because they believe that they can get a start-up capital for their business. However, only few assume the low interest rate and the simple repayment schedule as a motivating factor for borrowing. On the other hand, not every condition is conducive to get the service of microfinance. For instance, 10% of the borrowers reported that they face challenges and opposition from their husband.

Impacts of membership in MFIs on income

As can be seen from the chart, there is a change in the monthly income of the households. Some of the households had uncertain income and they did not know how much they earned. This situation was changed after they start using the saving and credit facility. The percentage of households who earned between Birr 100-300 declined from 30% to 20% after the MFI services. On the other hand, the percentage of households who earn above Birr 2000 increased from 2% to 28% which indicates that the introduction of Microfinance service has in fact improved the living standard of the women significantly.

Figure 2: Reported changes in household income before and after borrowing money, SNNPR(n=11,162)
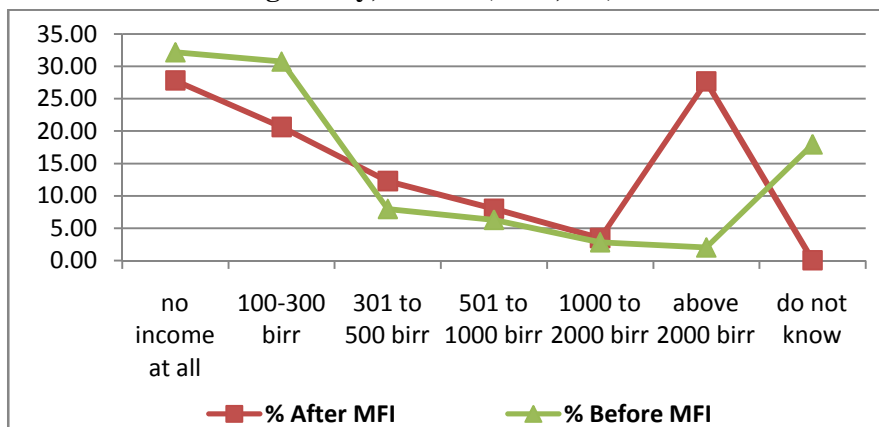
Source: Household survey data

**Opportunities and challenges: Loan disbursement, saving, repayment and withdrawal**

About 20% of the borrowers claimed that they faced the problem of repayment. The main reasons for the failure were low return rate or profit, the use the loan for subsistence, the extravagant characteristics of the husband and usage of the money for family health care and related issues.

However, most of the women, around 75%, tried to repay their loan from the profit enterprise they run and the products they sell. Only 5% of the households sell their property or rent their land in order to repay their loan. The regional analysis of OMFI also indicated that even if there has been increasing trend in repaying the loan, the institution is still facing the repayment challenges. The loan disbursement reached birr 1.1 billion in 2013 which was birr 0.4 billion six years ago. Only 40% of the women were involved in the voluntary saving activities before they start to save in MFIs. Among them, 36.5% were keeping their money at home and the other 18% by lending to others and 27% of the respondents in banks.

On the other hand, withdrawal rate was very high and follows trends of voluntary savings. Net saving, the value we get after we deduct withdrawals

53

from total saving, steadily grew since 2004. For example, in 2013, out of cumulative total saving of birr 2.38 billion, birr 1.6 billion (67%) was withdrawn. Likewise, out of annual total savings of birr 1.4 billion, birr 0.84 billion (60%) was withdrawn. In addition to this, client dropout coupled with stakeholders' reluctance on savings mobilization has also been among major problems facing the institutions.

Figure 3: The disbursement, repayment and outstanding rate of OMFI for the period 2008 to 2013.
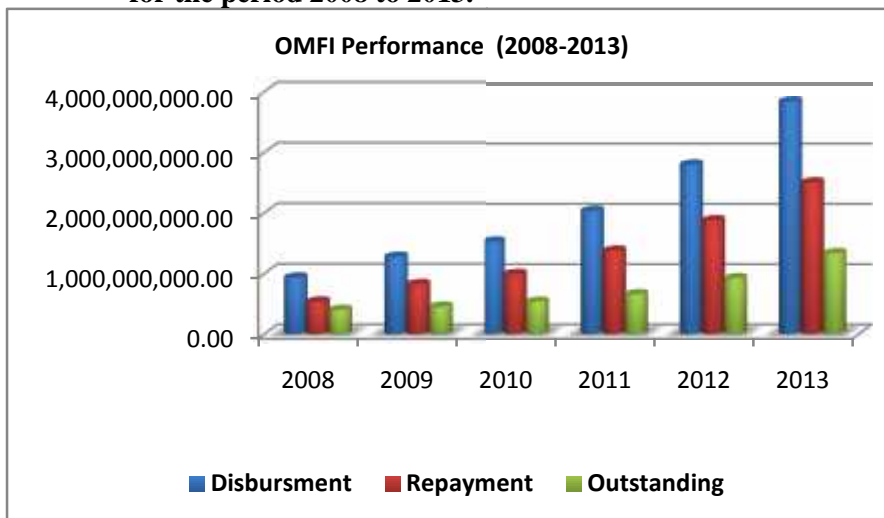
Source: OMFI, 2014

The cumulative performance of OMFI in terms of disbursement, repayment and outstanding balance shows increment throughout the years. Cumulative disbursement reached birr 3.8 billion in 2013 which was birr 0.9 billion in 2008. In the same fashion, repayment also grew from birr 0.5 billion to birr 2.5 billion. On the other hand, the loan disbursement between men and women shows no significant change over the four years period and the share of loan disbursement for women did not exceed 30 percent.

All the loan disbursement, repayment and outstanding showed an increasing trend every year from 2008-2013. The next figure shows how the saving of women changed in the past years taking 2014 as a reference.

Figure 4: Voluntary saving before and after membership in MFIs, SNNPR, Ethiopia
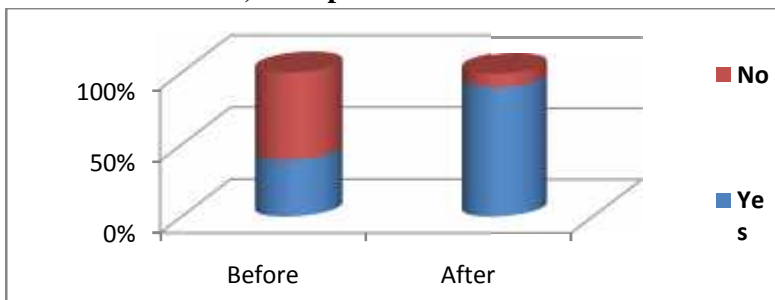
Source: household survey data

Ongoing savings refers to any mandatory deposits that must be paid with each loan repayments. OMFI requires each client to deposit ongoing savings of a minimum amount of birr 10 monthly individual savings with their loan repayment. However, for MSE clients the monthly minimum ongoing savings is ETB 20. Besides, all micro loan borrowers make minimum of 5 birr monthly group compulsory savings. However, the culture of savings is low when compared to the existing potential of the region. Of the total savings, 90% constitutes voluntary saving and the rest 10% constitutes compulsory saving.

**Figure 5: Saving mobilization in SNNPR for the period 2004 -2013**
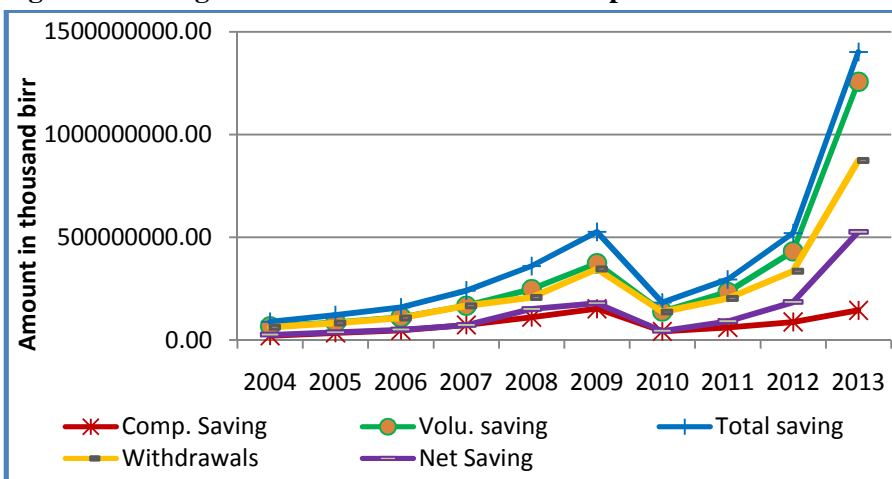
Source: OMFI, 2014

The cumulative performance of OMFI in terms of disbursement, repayment and outstanding balance shows increment throughout the years. Cumulative disbursement reached birr 3.8 billion in 2013 from where it was birr 0.9 billion in 2008. In the same fashion repayment also grew from birr 0.5 billion to birr 2.5 billion. Till now, the institution has mobilized cumulative total saving of birr 2.4 billion of which 1.9 billion (82%) is voluntary saving while 0.5 billion (18%) in compulsory saving.

Figure 6 shows that loan disbursement between men and women had no significant change over the four year period and the share of loan disbursement for women did not exceed 35 percent.

Figure 6: The loan disbursement between men and women in SNNPR, Ethiopia.
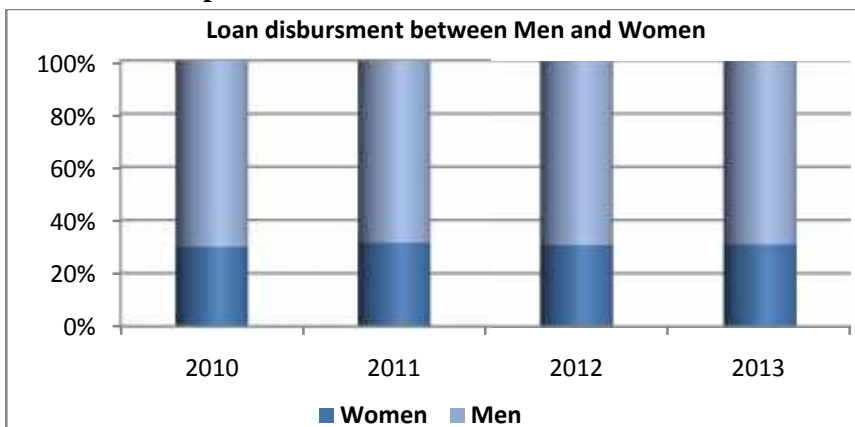
Source OMFI, 2013

Determinants of women's participation in MFIs

In order to understand the factors affecting the membership in microfinance institution, binary logistic regression analysis was used (Table 6). The model included a range of socio economic variables selected based on review of literature. These are, family headship, educational status, size of land holding, Land ownership certificate, age, religion, job status, husband's education level, family size, decision maker on families earning, type of crop

they grow, right to cattle ownership, use of informal credit sources. The result indicates that, except family headship, land ownership right and cattle ownership right, the remaining of the variables were found to significantly determine the likelihood of membership in MFI (5% of confidence interval). Women who are involved in adult education are 0.506 times less likely to borrow from MFI than the illiterate ones. Generally, with a slight swing in pattern, as the education level increases, the likelihood to borrow from microfinance declines which indicates that the target of MFI is the economically lower class of the society.

Regarding the impact of age, younger women (18-25) are more likely to be member of MFI compared to other age groups. From job point of view, the result indicated that private company employees, housewives and farmers were 3, 2 and 1.6 times more likely to be in MFI than government employees. This is an encouraging message for both the government and the MFIs because MFIs are basically intended for the poor. As the size of the family increases, the likelihood of being a member declines. In a similar fashion, the result indicated that women who were in informal credit service (Eqquib) considered the MFI as a substitute. The regression analysis indicates that, those women who were not members in informal credit sectors like "Eqquib" are almost seven times more likely to be in the formal MFI services.

There is no much difference in the membership pattern because of the kind of crops the households produce. However, women who participate in other agricultural activities for instance such as animal fattening and bee hive were 1.5 times more likely to participate in MFI than cash crop producers.

Table 6: Results of logistic regression (odds ratio) for the determinants of participation in MFI in the region (n= 11,162)

	B	S.E.	Sig.	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Family headship	.058	.086	.499	1.060	.895	1.255
Educational status			.000			
Illiterate (RC)						
Adult Education	-.681	.123	.000	.506	.398	.643
Grade 1-4	-.723	.091	.000	.485	.406	.581
Grade 5-8	-.743	.093	.000	.475	.396	.570
Grade 9-10	-.708	.115	.000	.493	.393	.617
Grade 11-12 (Preparatory)	-.783	.181	.000	.457	.321	.651
TVET Diploma	-.529	.182	.004	.589	.412	.842
Degree	.465	.294	.114	1.592	.894	2.833
Above Degree	.239	1.142	.834	1.270	.135	11.917
Size of land holding			.151			
Land ownership certificate			.000			
Husband's (RC)						
Own	-.289	.113	.011	.749	.600	.935
Joint with a husband	-.293	.085	.001	.746	.631	.881
Children's	-.773	.159	.000	.462	.338	.631
Age			.000			
18-21 (RC)						
29-39	-.290	.071	.000	.748	.651	.860
40-50	-.188	.091	.039	.829	.694	.991
51-60	.321	.163	.048	1.379	1.003	1.896
>60	.542	.304	.075	1.719	.947	3.120
Religion			.001			
Orthodox (RC)						
Catholic Christian	-.184	.175	.291	.832	.591	1.171
Evangelical Christian	.009	.068	.892	1.009	.884	1.152
Muslim	.313	.095	.001	1.368	1.136	1.648
Cultural	.138	.266	.604	1.148	.681	1.935
Others	1.276	.467	.006	3.584	1.436	8.943
Job status			.000			
Gov't employee (RC)						
Private company employee	1.163	.426	.006	3.198	1.387	7.376
Private Job	-.010	.163	.953	.991	.720	1.363

Contract employee	.447	.479	.350	1.564	.612	4.000
Farmer	-.273	.222	.219	.761	.493	1.176
Housewife	.758	.178	.000	2.133	1.504	3.026
Both farmer &housewife	.522	.153	.001	1.686	1.248	2.277
Other	.390	.168	.020	1.478	1.063	2.053
Husband's education level			.003			
Illiterate (RC)	-	-		-	-	-
Adult Education	-.221	.172	.198	.802	.573	1.122
Grade 1-4	-.276	.105	.008	.759	.618	.931
Grade 5-8	-.251	.093	.007	.778	.649	.933
Grade 9-10	-.347	.111	.002	.707	.569	.878
Grade 11-12 (Preparatory	-.555	.142	.000	.574	.434	.759
TVET Diploma	-.119	.136	.381	.888	.681	1.158
Degree	-.195	.160	.224	.823	.601	1.126
Total family size			.000			
No family (RC)						
2-4	-.750	.223	.001	.472	.305	.731
5-8	-.969	.226	.000	.379	.244	.591
9-12	-1.202	.244	.000	.301	.186	.485
13-14	-2.465	.444	.000	.085	.036	.203
>15	-.373	.850	.661	.689	.130	3.643
Decision maker on earning			.000			
Own(RC)						
Husband	.471	.115	.000	1.602	1.278	2.009
Joint with a husband	.242	.073	.001	1.274	1.104	1.471
Children's	.743	.214	.001	2.103	1.383	3.197
Type of crop they grow			.002			
Cash Crop (RC)						
Food Crop	.022	.115	.851	1.022	.815	1.281
Both Cash & food crop	.146	.121	.229	1.157	.912	1.468
No Production	.461	.149	.002	1.585	1.183	2.124
Cattle ownership right			.262			
use of informal credit			.000			
Yes (RC)	-1.931	.110	.000	.145	.117	.180
Constant	2.812	.371	.000	16.649		

4.   Discussion

This study has primarily aimed at examining the participation of women in saving and credit schemes, impacts, opportunities and challenges in Southern Nations Nationalities and Peoples Region. The analysis in the result section above were based on primary data collected from all zones in the region and secondary data made available by the concerned regional offices.

It is noted that women's participation in saving and credit through MFI is fairly low in all the zones considered, while the performance of some of the zones (such as Gurage, Sheka and Sidama zones) is encuraging. On top of this, the distribution of the MFIs is uneven. Though about seven institutions are operating in the region, there are still districts where no such scheme exists. Over 16 percent of the respondents reported that they do not have access to the service. This left huge gap between the reality on the ground (17 percent participation rate) and the figures stipulated in the revised Development and Transformation Package of BoWCYA, which planned to attain women's share of 60 percent or more.

Though several human and non human constraints were reported, the most commonly cited problems were more institutional limitations than beneficiary borne gaps. Among other factors, women's lack of capacity to meet the saving requirement, weak support from husbands and other stakeholders were reported by significant proportion of the clients.

In nearly all the focus group discussions held, financial incapacity to save for six consecutive months before they borrow, which is the policy of MFIs, was mentioned as an outstanding reason. This is partly due to the fact that most of them have no any source of income for meeting the continuous saving. It was noted that 20% of the required loan by monthly depositing equal amount of money in six consecutive months prior to receiving loans for urban MSE clients;10% of the required loan if they are first comers and borrow less than 50,000 ETB or 5% if they need more than 50,000 ETB for urban MSE business loans. Agricultural and micro business loan borrower should save 10% of the loan as a group savings for first cycle loans, 8% for second cycle

and 5% for third cycle and above. The absence of a guarantee or a co-guarantee to borrow was another reason reported by clients. Despite this, the initiation of loan taking has steadily increased over the last few years. Previous studies in the two major regions of Ethiopia documented that despite the lack of enforcement in targeting women, the proportion of loans initiated by women increased in villages where micro lending became available, and those in microcredit offer areas reported an average 589 Birr (approximately US$206) in total loans (Tarozzi et al , 2015).

Additionally, the bureaucratic red tapes discouraged many from joining the group and lead to large dropouts from the service. Even if BoWCYA's package stated to help the women in the production of market oriented products and to extend the market and network to reach these poor women, many still complain that after they got the money they use it for consumption purpose partly because of their lack of understanding on what to do with it. The data from OMFI also substantiates the above discussion. Since 2006 client dropout showed sustainable growth over the periods with annual growth rate of -83%, 312%, 5% and 111% in the year 2006, 2007 2008, and 2009 respectively. The number of total dropouts was 3,873 clients in 2004 but has gone up to 27,324 in 2009. Within these six years dropout rate has grown by 605.50% which is too much and needs immediate attention.

Despite the existence of the MFI facilities in many of the zones for longer time, the majority of the MFI clients started to involve in this activity very recently (75% of the users are members with in the past three years, of which 26.5% even joined just a year ago). This may partly inform us the very weak mass mobilization or poor role of media/other partners or both. About 55% of the respondents got their primary information about the microfinance services from these staffs. While clients may get access to comprehensive messages/ information from MFIs staff, one particular problem (which was not reported in this study) is that the staff may not be gender sensitive. A study in Amhara Region (Getaneh, 2005) reported that microfinance staffs are less gender sensitive, and yet only about 20 percent of field-level microfinance staffs in Ethiopia are female. This may limit an important secondary impact of the program wherein women clients view female loan

officers as positive role models for their daughters. Sadly, the media has a very insignificant role in creating awareness and providing relevant information. Only 1% of the respondents claim the media as their prime source when in fact has a potential to reach 45% of the population. On the other hand, the cross tab analysis indicates that women with educated husbands have three times more access to the information from their husbands about MFIs than the illiterate ones.

The poor level of education coupled with cultural pressures has considerably affected women's participation in saving and credit schemes, and hence, diminished the positive impacts such scheme might have brought about in the lives of their households. The FGDs undertaken in districts such as Konta, Segen-Konso and Basketo, indicated that the challenges from their spouses due to some wrong cultural thoughts has hindered them from moving forward and overtake their economic challenges. The experience from these districts showed that women get acceptance and assistance from their husband and the community at large, only if they can practically justify the importance of microfinance service in their life by helping their family and repaying their loan without damaging the family reputation or selling the household's property. This problem was partly caused by the infamous experience of some borrowers using the money for their consumption and ending as a default. Adding an insult to injury, women in these areas are thought as incapable to undertake jobs other than being a housewife in addition to the limited market size that seized many businesses from expansion. However, it is important to note that some educated husbands were reported to have positive impacts on their wives' participation in the MFI.

For instance, 4.3% of the women whose husbands got degree and above were helped by their spouses to participate in MFI while only 1.3% of women with an illiterate spouse got assistance from them.

Off course, household based limitations were also reportedly observed. Further analysis of the data through logistic regression model suggested the net effects of some individual and household variables (age, household size,

husband's education, type of crops grown, etc) on the participation of women in MFI. It is generally noted that those women who are young, with small family size and entrepreneurial mentality have a high likelihood to be in MFI than the rest.

On the other hand, measuring the actual impacts of women's membership in MFIs is somewhat controversial in this study because of three reasons. First, it is already noted that more than 75 percent of those reporting active membership are new members who joined their respective MFI during the last three years. This by itself limits their amount of saving and borrowing capacity. Second, those small segments of the clients who reported taking loan for business expansion and household use, were not able to report the visible or quantifiable changes such loan has brought about on household income, education, wealth and other parts of their livelihood mainly due to poor record of data. Thirdly, if any positive impacts exist, it would be very difficult to determine its sustainability as it is short lived. Thus, the impacts reported by about 14 percent of the clients should be cautiously interpreted in light of the reasons mentioned above.

Finally, this study is not without limitations. One of the limitations worth mentioning is that the study was based on cross sectional data which entails collection of information at a specific point in time in the lives of the respondents, and may also suffer from self-selection bias, omissions and commission errors. Further, the secondary data made available by the concerned authorities had little details to portray the impacts and sustainability issues. On the other hand, because the analyses are based on large scale data collected from all zones in the region, the comprehensiveness and policy relevance of the findings are greater. We suggest future researches to focus on collecting time series data to determine the changes, impacts and sustainability of membership in MFIs.

5.   Conclusion and Policy Implications

The present study had documented women's low participation in saving and credit activities, which of course, is constrained by some institutional and

household factors. It was noted that some institutional challenges (such as poor mobilization, high loan requirements) and household socio demographic variables (such as household size, husbands' education, type of crops grown) have appeared to be significant predictors of membership in MFIs. Further, the uneven distribution of MFIs coupled with bureaucratic red tapes discouraged many from joining the group and led to large dropouts from the service and heavily affected repayment rate. We also noted insufficient provision of entrepreneurial trainings on skill development and financial outlay that exposed them to a mismatch with the existing market demand and the wastage of the financial resource. However, there is some evidence suggesting that those active members (though small in number) have already seen some positive impacts of their membership in MFIs.

In view of the nature of the variables discussed above, we suggest addressing the unreached majority by expanding the service and creating awareness in the community at large to avoid social seclusion is the most important measure the regional government should undertake. Additionally, opening the sub branches in different villages/ districts, promoting the service via both formal and informal mechanisms, encouraging the existing microfinance institutions, facilitating the service by removing institutional and regulatory red tapes, designing mechanisms to ensure women's control over loans and rewarding successful model women entrepreneurs are some measures that can assist the expansion of microfinance services to the larger part of the society.

The development and transformation package should be backed by quantitatively expressed targets to help monitoring and evaluation process. Lastly, Bureau of Women, Children and Youth Affairs, Omo Microfinance, Bureau of Finance and Development, Agriculture and Rural Development Sector, Production Exchange and Unions, and other MFIs should work cooperatively not only to alleviate the aforementioned gaps but also to accomplish the newly designed development and transformation package.

References

Befkadu B. (2007). Outreach and Financial Performance Analysis of Microfinance Institutions in Ethiopia African Economic Conference United Nations Conference Center (UNCC), Addis Ababa, Ethiopia, 15-17 November 2007.

Bureau of Finance and Economic Development (BoFED). (2013). Annual Report on SNNPR Projected Urban and rural Population size by zone, woreda and special Woredas, Hawassa, Ethiopia.

Bureau of Women, Children and Youth Affairs (BoWCYA). (2014). The development and Transformation Package, Hawassa, Ethiopia.

Burjoree, D. M., *et al* (2002). Supporting women's livelihoods: microfinance that works for the majority, a guide to best practices, UNCDF, special unit for microfinance, Retrieved April:2015from:http://www.uncdf.org/english/microfinance/uploads/thematic/gender_supporting.pdf.

Cheston, S. and Kuhn, L. (2002), Empowering women through microfinance, final draft 6/28/02, published by UNIFEM. Retrieved April, 2015 from: (http://www.opportunity.org/files/Empowering%20Women%20Paper%20FINAL.pdf.)

Central Statistics Agency. (2007). National Census Report, Addis Ababa, Ethiopia.

_____. (2011). Regional Report, Addis Ababa, Ethiopia.

Daley-Harris, S. (2007). State of the Microcredit Summit campaign report 2007, Retrieved April, 2014 from: http:///www.microcreditsummit.org.

Dereje Kifle, Yenenesh Tadesse, Jemal Yousuf. (2013). Constraints of Rural Women to Utilize Microfinance Institutions: the case of Members of Microfinance Institutions in Rural Districts of Dire Dawa Administration, Ethiopia. Developing Country Studies Vol.3, No.7, 2013.

Emana, B., et al. (2005). Informal Finance in Ethiopia, Association of Ethiopian MFI Occasional Paper No.13, May, 2005, Addis Ababa: Ethiopia.

Getaneh, G. (2002). Evaluating the potential of microfinance as anti-poverty strategy: a case study of the Amhara Credit and Saving Institution, ACMFI, Microfinance development in Ethiopia: prospects, sustainability and challenges on poverty reduction, Adama (Nazareth),

Hirut B. (2010). Targeting married women in microfinance programs, Weigengen University, Weigengen: Netherland.

Linda Mayoux. (2009). "Reaching and Empowering Women: Gender Mainstreaming in Rural Finance: Guide for Practitioners." IFAD: Rome.

Mayoux, L. (1999). Questioning virtuous spirals: micro-finance and women's empowerment in Africa, *Journal of International Development* 11: 957-984.

National Bank of Ethiopia. (NBE). (2001). The History of Banking and other Financial Institutions in Ethiopia, Retrieved on May, 2014, from http://www.nbe.gov.et/History/history.htm.Omo Microfinance Institution (OMFI), (2015), Annual Performance Report, Hawassa, Ethiopia

Robinson, M. S. (2001). The Microfinance Revolution: Sustainable finance for the poor, Washington, D.C.: The World Bank.

Tarozzi, Alessandro, Jaikishan Desai and Kristin Johnson. (2015). "The Impacts of Microcredit: Evidence from Ethiopia." *American Economic Journal: Applied Economics* 7(1): 54-89.

Tesfaye Belijge. (2012). Microfinance and Rural Household Poverty Reduction: The Case of Omo Microfinance Institution in Southern Nations, Nationalities and People Regional State. M.A Thesis (Unpublished). Hawassa University, Ethiopia.

World Bank. (2001). Engendering development through gender equality in rights, resources, and voice, a World Bank policy research group, A publication of the World Bank and the Oxford University press.

Adoption and Intensity of Row seeding
(Case of Wolaita Zone)

Tadele Tafese[1]

Abstract

In the context of Ethiopia where agriculture and specifically crop production take lion's contribution, supporting the sector through introducing new agricultural technologies, like row planting in the recent times, boosts production. However despite of such services, utilization of improved technologies remained low in Ethiopia. This study looks in to the determinants of adoption and intensity of adoption of row planting using a survey data of 300 farming households in Wolaita zone. The survey indicates that about 87 percent of farmers adopt row planting in 2014/15 production year with mean intensity of use 2.33 Timad (about 56% of their total farm land). A dependent double hurdle analysis reveals that household being headed by Illiterate head, family size, Farm size, Annual off-farm income, Distance to nearest market and Training on row planting significantly influenced adoption and level of adoption of row planting. Moreover, adoption of row planting is significantly affected by Farming experience, No of information sources and Distance to Development Agent whereas level of adoption of row planting by livestock and Number of oxen. The study then concludes that the farmers' adoption and level of adoption of row planting could be improved by raising farm household's education, their off farm income, their endowment and by making them optimally mobilize their labor for agricultural activities and receive extension service. As a result the study recommends local governments to work towards intensifying informal education to farming households in the study area, raising effort of investment to improve market access and enhancing agricultural extension services to farmers.

Key Words: Dependent Double Hurdle, Wolaita Zone, Row Seeding

---

[1] Assistant Prof., Wolaita Sodo University, Department of Economics
tadeleth@yahoo.com/tadeleth74@gmail.com

1.   Introduction

In the wide range of literature, it is well documented that economies of Sub Saharan Africa (SSA) are dominated by persistent agriculture employing about half of the population. However, agricultural production and productivity in SSA is found to be very low [1]. Growth in production and productivity of agriculture, therefore, is crucial given its low production and productivity and the rapid population growth in this region.

Like in any SSA, agricultural sector holds a prominent position in Ethiopia accounting about 41.6% of the total economy in 2010. Gross agricultural production of the country has reached ETB 64.7 billion bulk of which (90%) has come from cultivation of crops [2]. This implies that the development of the Ethiopian economy heavily depends upon the speed with which crop production growth is achieved.

In an effort to increase production and productivity of smallholder farmers engaged in growing crops, the Government of Ethiopia (GoE) has adopted different institutional support services to boost their production. One of the main support services, assigned to take major role in intensifying agricultural growth and specifically aiming at increasing productivity and production of smallholders, is the Participatory Agricultural Demonstration Extension of Technology (PADETS). Adoption of technology is found to be one of the main tools of PADETS. World Bank report [1] emphasis that the adoption of new technologies, such as fertilizer and improved seed is central to agricultural growth and poverty reduction.

In line with this the Government of Ethiopia (GoE) has been working in introducing new agricultural technologies. High-input maize technologies, water harvesting and inorganic fertilizer and row plantation, among others, are introduced in the past decades aiming at increasing agricultural production and productivity [3,4].

Despite of such institutional support services, crop yield in Ethiopia is very low due to low utilization of improved technologies [5]. As a result of the

low productivity of agricultural sector, the country has been faced food crisis and forced to be highly dependent on food import in the previous years. In 2006 alone Ethiopia received 674,000 metric tons of cereals in the form of food aid.

This trend of low adoption of technologies is also true for the Wolaita Zone, one of the zones of Ethiopia. For instance, the amount of improved seed applied in the Meher 2012 cropping season was only about 49 tons. During this Meher 2012, the total area covered with improved seed for all crops was around 7% of the overall cultivated area in the zone [4]. Hence, smallholder farmers in Wolaita zone produce using indigenous seeds with limited adoption of improved technologies. This makes the zone to have low production of 14 quintals per hectare, below national average of 19 quintals per hectare, in the Meher season. In addition to the low production and productivity, about 12.08% of the total Meher production in 2012 is utilized for seed. This shows that a considerable amount of harvest is also lost due to inappropriate seeding[4].

In such difficulties, the GoE, to meet GTP goals, is doing its best to increase production and productivity of smallholder farmers by complementing the existing technologies with new technologies. One of the technologies in crop production introduced in the recent years is row seeding. Compared to the traditional broadcasting, row seeding gives better yield as it allows better weeding and for better branching out and nutrient uptake of the plants and diminish competition between seedlings [3]. According to the Ministry of Agriculture and Rural Development [6]row plantation on average increases production by 30% and reduces the amount of seed to one-fifth of existing seed use.

However, despite its vital role in production improvement, there are no studies focused on its adoption and intensity which could help to broaden the use of technology. Hence, this study is to look in to the factors that affect adoption and intensity of row seeding specifically (i)To identify factors that affect adoption of row seeding technology and (ii)To assess factors that

affect intensity of row seeding technology so as help the zonal government in intensifying the practice with this technology.

2.   Literature Review
2.1   Basic Concepts and Theoretical Foundations of Analysis of Technology Adoption

Technology is assumed to mean a new, scientifically derived, input supplied or introduced to farmers by organizations with deep technical expertise. Majority of the agricultural technology include irrigation, fertilizer use, high yield verity seeds and row plantation that focused on green revolution technologies.

Adoption of Technology, which plays an important role in economic development, describes the decision to use or not to use of a particular technology. Adoption is not a one step process as adopters may continue or cease to use the new technology. The duration of adoption of a technology vary among economic units, regions and characteristics of technology itself. Thus, adequate understanding of the process of technology adoption is necessary for designing effective agricultural extension programs.

The two common approaches of technology adoption of agricultural technology include whole package adoption advocated by technical scientist and stepwise or sequential adoption recommended by farming system and participatory research groups. In the developing world there is a tendency of agricultural extension programmers to promote technology as a package.

Adoption decision involves the choice of how much resources (like land) to be allocated to the new technology and the old technology if the technology is not divisible (like mechanization, irrigation). However, if the technology is divisible (like improved seed, fertilizer, row planting and herbicide), the decision process involves area allocation as well as intensity of use or rate of application[7]. Thus the process of adoption includes the simultaneous choice of whether to adopt or not to adopt and the intensity of its use.

Measurement of intensity of adoption, therefore, needs to identify whether the technology is divisible or not divisible. The intensity of divisible technologies can be measured at the individual level in a given period of time by the share of farm area under the new technology or quantity of input used per hectare in relation to the agricultural research recommendations [7]. On the other hand, the extent of adoption of non-divisible agricultural technologies such as tractors and combine harvesters at the farm level at a given period of time is dichotomous (use or not use) and the aggregate measure of becomes continuous. Aggregate adoption of a lumpy (non-divisible) technology can be measured by calculating the percentage of farmers using the new technology within a given period of time.

After identifying the divisibility or indivisibility of a technology, one can static or dynamic models of technology adoption to answer the question of what determines whether a particular technology is adopted or not and intensity of adoption using maximization of expected utility or expected profit subjected to resource constraints. Static model refers to farmers' decision to adopt an improved technology at a specific place and specific period of time. Such models attempt to answer the question of what determines whether a particular technology is adopted or not and what determines the pattern of adoption at particular pint in time. On the other hand dynamic models allow for changes in farmers' adoption decisions as farmers gain skill in growing or marketing the improved seed from year to year.

2.2   Empirical Review of Technology Adoption

A wide range of literature measuring technology adoption involve factors that are spelled by Feder, Just and Zilberman [7]. These explanatory indicators vary from study to study based on their contextual applicability, but traditionally include farm size, risk exposure and capacity to bear risk, human capital, labor availability, credit constraints, tenure, and access to commodity markets [8].

The effect of farm size vary depending on the institutional setting of the community and type of technology being introduced. For example there may be positive relationship between farm size and adoption if farm size could be taken to proxy socio-economic indicators like credit access as the larger farm has more collateral value [8]. Moreover, human capital such as education, human health indicators, age and gender have mixed effect. Considering human capital as allocative ability, more educated farmers will have higher allocative abilities and able to adjust faster to farm and market conditions[7]. Another important factor which affects adoption is labor. Labor impact may vary depending on the availability of labor (net labor shortage or surplus) in technology target area and on the labor usage of the technology (labor-saving or labor-intensive). Labor-intensive technologies will be easily adopted if there is higher labor supply. However, the dual existence of higher labor supply and associated off farm employment may cause reduction in farm labor that in turn cause adoption of labor intensive technologies to decline [9].

Farmers' technology adoption patterns typically are also affected by their risk preferences and their ability to bear risks related to the new technology. Empirical evidences showed that low return on assets, low asset levels, low ability to diversify and manage risk have a strong and significant impact on income poverty. Such relation between extreme risk aversion and income poverty makes poor farmers to accept any technology for increased future yield [7].

Another important factor that need to be considered while dealing with technology adoption is access to market. Farmers used markets as an outlet for production and as a means of securing inputs. Farmers' investment will be for nothing in cases where they lack market to bear the extra supply without creating a reactionary price decline[8]. Some studies proxied farmers' access to commodity market by farmers' distance to a major road and verified significant negative impact on the farmers' decision to adopt new technology[9]. Some studies also suggested that the probability of adoption of new technologies of farmers depends on the frequency of contact

of farmers with development agents and neighbors using the new technology which is expected to be affected by access to roads [8].

Considering these above stated factors in the empirics, different studies focused on adoption of new agricultural technology has been undertaken in Ethiopia. Most of the studies since the mid 1980 used the conventional static adoption models (logit and probit). In few studies the Tobit model was used to study farmers' extent and intensity of adoption of improved technology. Studies like by Berhanu and Swinton [10], Abay and Assefa [11], Teklewold et al [12], Hailu [13], and Hassen Beshir [5] focused on the adoption of agricultural technologies like fertilizer, high yield verity seeds, soil conservation, using static adoption models. However, none of adoption studies in Ethiopia used dynamic models.

3. Methodology of the Study
3.1 Empirical Framework

Our main concern in this study is modeling technology adoption behavior of farmers. In modeling such decision making behavior of farmers, the two possible questions need to be addressed are first why one decides to adopt a technology and second quantity one decides to apply. Now let us assume we drive an equation which relates the intensity of use of new technology to the explanatory variables from optimization problem of expected utility/profit through the following quantity equation and an observation rule.

$$d_i^* = \quad z_i + v_i \qquad\qquad \textbf{(1)}$$

$$y_i^* = \quad x_i + \quad_i \qquad\qquad \textbf{(2)}$$

Where y_i^* is the value which corresponds to the latent variable, d_i^* is a non-observable variable which determines whether the individual i is adopter or non-adopter of new technology, x_i and z_i are vector of conditioning variables and v_i and $_i$ are non-observable random variables.

Discrete choice models allow us to analyze situations in which only the decision to adopt is considered and the second aspect that we need to consider, quantity of adoption, can be modeled using the Tobit model. The censoring mechanism for an equation such us equation 1 is then $y_i = Max (y_i^*, 0)$ i.e. whenever y_i is not observed it is replaced by zero, otherwise it is observed and replaced by its value. So zero intensity of adoption arise when a farmer does not adopt the technology but we do not know the specific reason for this non adoption[14].

The main sources of non-adoption in technology adoption analysis are infrequency of application of the new technology and non-consideration of the new technology by farmers. Infrequency of application of new agricultural technology mainly arise in situations where markets are imperfect and even missing[15]. In these cases access to input (modern technology) is the key threshold that farmers with positive desired demand for new technology have to overcome.

In situations where some portion of farmers are constrained to access new technology and other portion of farmers are not considering the new technology, Tobit specification is not appropriate as the key underlying assumption of this specification is farmers demanding modern inputs have unconstrained access to the technology[15]. Hence, it is important to treat farmers' decision under equation 1 and 2 by introducing a new scheme of censoring as:

$$d_i = \left\{ \begin{array}{l} 1, \text{ if } d_i^* > 0 \\ 0, \text{ if } d_i^* \ 0 \end{array} \right. \quad y_i = \left\{ \begin{array}{l} y_i^*, \text{ if } y_i > 0 \text{ and } d_i^* > 0 \end{array} \right. \quad \text{..............} (3)$$

Where d_i^* and y_i^* are defined as in equation 1 and 2 respectively. The main reasons for the separation of these decision processes are first a farmer may not consider the new technology at all and the values of exogenous variables determining adoption and intensity of use will therefore do not exist and second a farmer may be potential adopter but for certain level of relevant exogenous variables s/he may decide not to adopt. Thus, it is clear that two hurdles must overcome before observing a positive intensity of use[14].

This structure, which was first proposed by Cragg[16], is called double hurdle model. The first stage of this model is a probit model to analyze determinants of adoption, and the second stage is a truncated model for determinants of the level of adoption [16].Use of Cragg's model for analyzing adoption and intensity of adoption is common in agricultural economic literature [17,18,19,20]. Another alternative here might be the Heckman selection model. According to Jones [21], one of the important differences between these two models concerns the sources of zeros. In the Heckman model, the non-adopters will never adopt under any circumstances. This may contradict with the possibility that improvements in extensive extension programs and changes in input prices may encourage non-adopters to adopt. On the other hand, in a double hurdle model, non-adopters are considered as a corner solution in a utility-maximizing model. In this case, the assumption of Heckman's seems to be too restrictive.

Variety of family of Cragg's models can be derived depending on the type of assumptions on the joint distribution of error terms interring equation 1 and 2. Under the hypothesis of independence between v_i and $_i$, that is $v_i \sim N(0, 1)$ and $_i \sim N(0, {}^2)$, we have an independent double hurdle model applied by Carroll, McCarthy, and Carol. But given the relation which exist between the two processes of decision making undertaken by farmers, it seems adequate to think the unobserved factors in both equation 1 and 2 could generate dependent errors. We can suppose that $(v_i, {}_i)$ is distributed as a bivariate normal random variable with zero means, unit variance and ρ coefficient of correlation i.e. $(v_i, {}_{i,}) \sim BVN(0,)$, $= \begin{bmatrix} 1 & \sigma\rho \\ \sigma\rho & \sigma^2 \end{bmatrix}$. We can write the likelihood function for the dependent double hurdle model as:

$$L_{DDH} = \prod_{y_i=0}[1 - (Z\alpha, X\beta/\sigma, \rho)] \cdot \prod_{y_i>0}\left[\left(\frac{\Phi\left(Z\alpha + \frac{\rho}{\sigma}(Y-X\beta)\right)}{\sqrt{1-\rho^2}}\right)\frac{1}{\sigma}\phi((Y-X\beta)/\sigma)\right]. \quad (4)$$

Where and are the standard normal cumulative distribution function and density function, respectively. The log-likelihood function is estimated using the maximum likelihood estimation (MLE) technique. Assuming no relation

which exist between the two processes of decision making (=0), we can reduce the likelihood function for the independent double hurdle model as:

$$L_{IDH} = \prod_{y_i=0}[1 - (Z\alpha)\Phi(X\beta/\sigma)] . \prod_{y_i>0}\left[\Phi(Z\alpha)\frac{1}{\sigma}\phi((Y - X\beta)/\sigma)\right] .. \quad (5)$$

Furthermore, when $\alpha = \beta/\sigma$, we have Tobit model with likelihood function as:

$$L_T = \prod_{y_i>0}\left[\frac{1}{\sigma}\phi\left(\left(\frac{Y-X\beta}{\sigma}\right)\right)\Phi(-\frac{X\beta}{\sigma})\right] \quad (6)$$

Among the above models we can establish relationships. Tobit and independent hurdle models are nested in the dependent double hurdle model. Hence, it is possible to compare these models through standard tests. When the same set of independent variables are used in the first and second hurdles Green [22], show the Tobit model is a restricted version of the double hurdle model, in which $\alpha = \beta/\sigma$. The appropriateness of the Tobit versus the double hurdle can be tested with likelihood ratio test. The likelihood ration statistic (λ) can be calculated as:

$$\lambda = -2[\ln L_{Tobit} - \ln LF_{Probit} - \ln LF_{Truncated\ regression}] \quad (7)$$

Where lnL represents the maximized log likelihood of function values for the model type indicated in the subscript, each of which estimated independently. The null hypothesis is that the Tobit model is the appropriate specification. i.e. $\alpha_1 = \alpha_2/\sigma$. If the calculated likelihood ratio statistic exceeds the critical chi square value with number of degree of freedom equal to the number of variables in X, the Tobit is rejected in favor of the double hurdle model.

On the other hand, to see if the depend double hurdle model dominate the independent double hurdle model, we use the test procedure developed by Heckman[23]. We treated correlation as an omitted variable in the independent double hurdle specification and introduced using invers mills ratio (the ratio of density function to cumulative density function) as a proxy. Specifically the coefficient of this additional regressor is the covariance

between the two error terms. If the error terms are indeed correlated then, the invers mills ratio from the first hurdle (probit model) must have an explanatory power for the second hurdle (truncated model).

3.2 Definitions and Measurement of variables for adoption

The dependent variable in the first stage (Probit) is dichotomous in value depending on the farmer's decision to adopt row seeding technology. However, in the second stage (truncated model) we have a continuous dependent variable i.e. intensity of use of the technology. In this case, it is the ratio of quantity of land under row planting to total farm land. The same set of independent variables are used in both models (Probit and Truncated models).

As per the wide literature level and intensity of adoption improved agricultural technologies of farmers is influenced by a combined effect of various factors[7]. Explanatory variables used in this study include farm size, exposure to and capacity to bear risk, human capital, availability of labor, credit constraints and access to commodity markets. The set of explanatory variables used to explain the probability of adoption and intensity of adoption of row planting in the study area are summarized in annexed Table 1.

3.3 Study Area, Data and Sampling

The data were obtained from a survey conducted from the residents of rural households in Wolaita zone. Wolaita zone was found in southern nations, nationalities and peoples region. The total population of the zone is estimated to be 1,796,436 (374,258 households). Crop production is the main stay of rural Wolaita.

Primary data on farm household characteristics, crop production (outputs and inputs) and agricultural extension services was collected through a survey from a sample of farmers in Wolaita Zone After the end of crop planting season of Meher 2007 EC. A two-stage sampling technique is used to select the sample. At the first stage, a sample of kebeles are randomly selected. At

the second stage, sample households are selected using systematic random sampling. A sample of 300 households are drawn from the selected kebeles in proportion to the population size in each kebele.

4.   Results and Discussions
4.1   Descriptive Analysis

The rate of adoption of row planting is very high. Out of the sampled households it was only 13 percent that do not adopt row planting in the 2006/7 production year. However, the mean intensity of use of row planting for adopters is only 2.33 *Timad* (about 56% of their total farm land) and for the whole sample is 2.03 *Timad* (about 48% of their total farm land) (annexed Table 2).

According to annexed tables 2 and 3, significant differences exist between the adopters and non-adopters in majority of the variables but farming experience, distance to development agent (DA), soil quality (Vertisol and very fertile soil) and access to credit. The description of continuous descriptors of probability and intensity of adoption of row planting (Table 2) showed that adopting farmers are slightly older, resource endowed (mainly labor, land, livestock and communication equipment like cell phone, TV and Radio) and earn higher off farm income compared to non-adopters. Moreover, adopters have higher number of contacts with DA, have higher no of information sources (like media, farmer association, DA, local government, social networks and family and friends) and reside nearer to market compared to their non-adopter counterparts, but use lower labour per land.

Description of the discrete descriptors of probability and intensity of adoption of row planting (Table 3) also showed that higher number of non-adopter households, compared to adopters, are headed by female and illiterate house heads. Moreover, non-adopters are found lesser to participate row planting training sessions provided.

4.2   Empirical Results

4.2.1   Model Specification Test

According to the survey data conducted for the purpose of this study, there are farmers who do not adopted and farmers who are adopters of row planting. Moreover, adopting farmers are found to use row planting in different levels. Thus, we estimated the rate of adoption using probit model and intensity of use of row planting using truncated regression model. As a result double hurdle model is used to estimate the probability and intensity of adoption of row planting.

The dependent double-hurdle model is tested against two other common models, the Tobit and independent double hurdle models. First we estimated Tobit and independent double hurdle models with different hypothesis and detect which one is the superior model. To do this, we undertake a log-likelihood test taking   = -2[-117.98+42.9+42.8] = 64.56and is well above the tabulated value ^{2} (20) = 10.85 at a 5% level of significance. As a result, it is concluded that Cragg's model better fits the data compared to the Tobit model implying farmer's decision to adopt and level of adoption of row seeding are made in two different stages. Second we estimated the dependent double hurdle model by introducing inverse mills ration as a proxy for the dependency between error terms that enter the first and second hurdles and we found invers mills ratio to significantly affect the intensity of use of row planting at 10 % level of significance. This implies there exist a relation between the two processes of decision making undertaken by farmers and we conclude that depend double hurdle model dominate independent double hurdle model in this study.

4.2.2   Econometric Results

Annexed Table 4 presents the maximum likelihood parameter estimates of the dependent double hurdle model (probit and truncated regression models) identifying factors influencing farmers' adoption and level of adoption of row planting. The dependent variables are *Adoption of Row Planting* for the participation equation and *Proportion of land under Row Planting* for the

quantity equation and we used the same explanatory variables for both participation and quantity decisions. Likelihood ratio tests of all regressions showed that the fitted models are statistically significant. According to the results of the regressions, different factors are found to influence rate of adoption and intensity of adoption of row planting at different levels of significance.

The probability of farmers to adopt and the level of adoption of row planting is positively and significantly affected (at most of 1% level of significant) by family size (in man equivalent) and off farm income but negatively and significantly affected by distance to market (Table 4). These findings are in line with the findings of Teklewold *et al* [20], Hailu [13], Berhanu and Swinton [10] and Hassen B. [5] in their study of different agricultural technology adoption.

According to Table 4, the likelihood of farmers to adopt row planting raises by 4.89 percent when farming households' family size rises by one unit. Such effect of family size is realistic in cases where there is no higher dependency ratio (an average of 1.76 for this study) in which majority of family members participate in farming activities. Farming households also plant a 2.74 percent more of their land using row planting for every unit rise in their size. The probable reason for this significant positive effect of family size was that row planting is labor intensive and hence the household with relatively high size (when dependency ration is low in farming households) uses row seeding technology more compared to others.

Every one percent rise in off-farm income of households induces 0.71 percent and 1.67 percent rise in the likelihood of adopting and intensity of use of row planning respectively (Table 4). This may be due to the fact that financial constraints to hire labor and to purchase farm inputs that complement row seeding can be solved using income from off-farm employment.

Moreover, Table 4 confirms when households' residence is one hour more far from the nearest market, probability and intensity of adoption of row

planting declines respectively by 5.28 percent and 7.51 percent. This may be due to the fact that the furthest residence of farmers is the higher cost of transportation, the limited access to inputs and the lower the output price.

Farm size, as indicated in Table 4, had influenced the likelihood of adopting row planting positively and significantly (at 5% level of significant). This may be because farm size is an indicator of wealth and perhaps a proxy for social status and influence within a community. The result is consistent with the finding of Feder et al [7] and Abara, O.C & Singh, S, [24]. However, in this study farm size had influenced the intensity of use of row planting negatively at less than 1 percent level of significance. This may be due to the fact that there is less potential of expanding farm size in Wolaita (among the most densely populated in Ethiopia) and thus for farmers, the likely option to raise productivity is increase input productivity like row planting productivity by adopting and intensifying use of row planting.

In this study, households headed by illiterate house heads have 9.4 percent lower level of intensity of use of row planting compared to households headed by literate house heads (Table 4). This result is consistent with the general argument that education and adoption have positive correlation [25, 7]. This may be due the fact that more educated farmer is competent, have ability to access and adapt information concerning new technologies, their benefits and costs. However, households with illiterate house heads have 6.46 percent higher probability of adopting row planting compared to households with literate house heads (Table 4). This may be true in cases where literate farmers are aware of agricultural risks like crop failure.

Training of row planting had also significant effect on adoption and intensity of row planting. Farmers who got training on row planting have about 28.3 percent higher probability of adopting row planting compared to those who did not get training. However, training is found to influence the level of adoption negatively and significantly (at 5% level of significant). This unexpected effect of training on intensity of use of row planting may question the type, quality and timing of training provided.

Farmers' probability of adopting row planting significantly raises as farmers have more and more information sources which could reduce doubts about the performance of the technology. But unit rise in distance to DA and farming experience of house head significantly reduces the likelihood of adoption of row planting by 4.87 percent and 0.4858 percent respectively. The negative influence of house head farming experience could be attributed to conservativeness due to the cultural practice.

Livestock had influenced intensity of adoption of row planting positively and significantly (at 1 percent of significant). This may be due to the fact that livestock is taken as sign of wealth and increases availability of cash for adopting technologies. This result is consistent with finding of Abay and Assefa [11] and Hassen, et al., [5]. However, a unit increase in the number of oxen that farming households possess reduces the intensity of adoption of row planting by 4.8 percent. This result may be sensible if we consider the wide spread cattle fattening culture of Wolaita people that makes them to shift from crop production livestock production.

5. Conclusions

In developing economies like Ethiopia which totally depend on agriculture, supporting the sector adopting different institutional support services boosts agricultural production. Considering the lion's contribution of crop production in Ethiopia, the government has introduced different agricultural technologies as a component of institutional support services. Row planting is one of the new agricultural technologies being introduced during recent times. Despite of such institutional support services, utilization of improved technologies remained low in Ethiopia. Hence, this study is to identify factors influencing row planting adoption and optimum intensity use among small holder crop farmers of Wolaita zone. To achieve such goal we analyzed farming households' decision to adopt or no and level of adoption of row planting using dependent double hurdle model. Two stage sampling procedure of sample selection was used to select 300 farmers using systematic random sampling of farm households in eight kebeles previously selected using simple random sampling in the first stage.

Descriptive analysis of decision variables reveal that about 87 percent of farmers adopt row planting in 2006/7 production year with mean intensity of use 2.33 Timad (about 56% of their total farm land). Adopters are slightly older, resource endowed, better use institutional services (DA contact, training) and earn higher off farm income compared to non-adopters. Moreover, large number of non-adopters compared to their adopter counterparts, are headed by female and illiterate house heads.

Econometric analysis also revealed that household being headed by Illiterate head, family size (in man equivalent), Farm size, Annual off-farm income, Distance to nearest market and Training on row planting significantly influenced adoption and level of adoption of row planting. Moreover, adoption of row planting is significantly affected by Farming experience, No of information sources and Distance to DA whereas level of adoption of row planting by livestock (in TLU) and Number of oxen.

This study found that education of farmers (being literate) is important in raising the level of adoption of row planting. Hence, the study recommends local governments to intensify existing informal education for those who adopt the technology. Moreover, considering the finding that illiterate farmers are more ready to adopt row planting compared to literate, decision makers need to orient literate farm households about advantage and disadvantages of row planting and how to mitigate the associated agricultural risks like crop failure which may hider them from adopting the technology.

The fact that farm size negatively impact intensity of use of row seeding may imply that policy makers should give due attention to small farmers while designing technological intervention for increased production. This can be supported by the fact there is less potential of expanding farm size in Wolaita (among the most densely populated in Ethiopia) and thus for farmers, the likely option to raise productivity is increase input productivity like row planting productivity by adopting and intensifying use of row planting rather than expanding farm size.

This may be due to the fact that there is less potential of expanding farm size in Wolaita (among the most densely populated in Ethiopia) and thus for farmers, the likely option to raise productivity is increase input productivity like row planting productivity by adopting and intensifying use of row planting.

In the experience of subsistence farming row planting is found to be labour intensive compared to the traditional broadcasting. Hence, considering the positive influence of both family size and off farm income on adoption and level of row planting, farming households should optimally mobilized their family members to participate in their farming activities and in other off farm income activities to rise adoption and intensity of use of row planting.

The fact that training on row planting and number of information sources about row planting had significant positive effect and distance to DA had negative significant effect on adoption of row plating also signifies agricultural extension service should be given priority and emphasis to fasten the production and dissemination of row planting. However, the unexpected negative significant effect of training on row planting on the level of adoption of the technology urges training implementers to look in to the quality, content and timing of the training they provide.

The Negative significant effect of distance to market on the adoption and level of adoption of row planting shows us enhanced local government effort of investment to improve market access is vital. Moreover, significant negative impact of farming experience on adoption of row planting and significant positive influence of livestock (in TLU) on intensity of adoption of row planting respectively invites extension agents to select younger farmers as models to expand experiences as older once may be found to be conservative to their cultural practice and excel their efforts of introducing row planting to those farmers with higher number of livestock.

Therefore, findings from this study suggest adoption and intensity of row seeding should be improved by raising their education, optimally mobilizing their family members, raising their off farm income, raising farm household endowment and providing extension service.

Annex

Table 1: Summary of Definitions and Measurement of variables used in the study

Definition of Variables	Measurement	Expected Sign
Dependent Variables		
Adoption of Row Planting (first hurdle)	Binary (Yes/No)	
Proportion of land under Row Planting (second hurdle)	Continuous (*Timad*)	
Independent Variables		
Age of house head	Continuous (Years)	+/-
Sex of household head (Male=1)	Binary (Male/Female)	+/-
Illiterate (Yes =1)	Binary (Yes/No)	+/-
Farming experience	Continuous (Years)	+/-
Man equivalent	Continuous (No)	+/-
Farm size (*Timad*)	Continuous (*Timad*)	+/-
Vertisol (Yes =1)	Binary (Yes/No)	-
Very fertile plot (Yes =1)	Binary (Yes/No)	-
Number of plots	Continuous (No)	-
Tropical Livestock Unit (TLU)	Continuous (No)	+
Number of oxen	Continuous (No)	+/-
Log of Value of Communication Equipment	Continuous (Birr)	+
Log of Annual off-farm income	Continuous (Birr)	+/-
No of DA contacts per annum	Continuous (No)	+
Distance to DA	Continuous (Hours)	-
Distance to the nearest market	Continuous (Hours)	-
Trained row planting (Yes=1)	Binary (Yes/No)	+
Access to credit (Yes=1)	Binary (Yes/No)	+
No of information sources	Continuous (No)	+
Labour per Land (Days)	Continuous (Days)	-

Table 2: Continuous Descriptors of Probability of Adoption and Intensity of Adoption of Row Planting

Variable	Adopters		Non Adopters		Total		Ho: diff = 0	
	Mean	SD	Mean	SD	Mean	SD	t-value	P-value
Age of house head	38.67	10.21	34.44	6.625	38.12	9.908	-3.43	0.001
Farming experience	18.37	9.81	17.87	6.109	18.31	9.414	-0.43	0.666
Man equivalent	4.17	1.294	3.26	0.819	4.05	1.278	-5.89	0.000
Farm size (Timad)	4.82	2.762	2.85	1.631	4.560	2.723	-6.31	0.000
Farm size with plantation (Timad)	2.33	1.532	0.00	0.000	2.03	1.631	-24.58	0.000
Proportion of farm with plantation (Timad)	0.56	0.313	0.00	0.000	0.48	0.347	-28.68	0.000
Number of plots	1.36	0.663	1.10	0.307	1.33	0.634	-4.08	0.000
Tropical Livestock Unit	5.67	5.633	2.96	2.326	5.32	5.396	-5.31	0.000
Number of oxen	1.54	2.059	0.69	0.800	1.43	1.962	-4.69	0.000
Value of Communica Equipment (Birr)	190.81	334.049	28.21	102.466	169.67	318.384	-6.16	0.000
Annual off-farm income	2614.1	5242.9	1519.0	2927.3	2471.7	5012.7	-1.921	0.058
No of DA contacts/annur	24.83	17.611	16.46	20.577	23.74	18.206	-2.411	0.020
Distance to DA (Hours)	0.69	0.058	0.803	0.141	0.707	0.054	0.719	0.475
Distance to market (Hou	0.93	0.596	1.13	0.644	0.95	0.606	1.862	0.0687
No of information source	2.19	1.216	1.13	1.031	2.053	0.072	-5.863	0.000
Labor per Land (Days)	22.30	17.804	34.48	19.884	23.88	18.512	3.62	0.001

Table 3: Discrete Descriptors of Probability of Adoption and Intensity of Adoption of Row Planting

Variable	Adopters		Non Adopters		Total		Ho: diff = 0	
	Freq.	%	Freq.	%	Freq.	%	x^2 Value	P - value
Sex of household head(Male=1)	232	88.9	26	66.7	258	86.0	13.917	0.000
Illiterate (Yes =1)	64	24.5	22	56.4	86	28.7	16.873	0.000
Vertisol (Yes =1)	70	26.8	9	23.1	79	26.3	0.245	0.621
Very fertile plot (Yes =1)	34	13.0	4	10.2	38	12.7	0.235	0.628
Trained row planting (Yes=1)	242	92.7	20	66.7	262	87.3	52.668	0.000
Access to credit (Yes=1)	207	79.3	31	79.5	238	79.3	0.001	0.980

Table 4: Maximum likelihood estimates of dependent Double Hurdle models for Adoption and Intensity of Adoption of Row planting among farming household heads in Wolaita Zone

Variable	First Hurdle (Probit) - Participation Eq.				Second Hurdle (truncated model) – Quantity Eq.				
	Coeff.	SD	z - value	P - value	Marginal Effect	Coeff.	SD	t - value	P - value
Constant	-12.8214	4.072223	-3.1485	0.001641		0.954253	0.130468	7.314079	0
Sex of household head (Male=1)	0.696379	0.62181	1.119924	0.262746	0.035925	0.040707	0.053636	0.758961	0.447876
Age of house head	0.023538	0.037376	0.629777	0.528841	0.001214	-0.00377	0.002299	-1.64162	0.10067
Illiterate (Yes =1)	1.252693	0.672449	1.862881	0.062479	0.064625	-0.09405	0.040602	-2.31642	0.020536
Farming experience	-0.09416	0.034634	-2.71883	0.006551	-0.00486	0.000164	0.002318	0.07073	0.943612
Man equivalent	0.948064	0.444916	2.130884	0.033099	0.04891	0.027345	0.014632	1.868854	0.061643
Farm size (Timad)	1.011262	0.415938	2.43128	0.015046	0.05217	-0.06683	0.00827	-8.08108	0
Number of plots	0.236153	1.007502	0.234394	0.814679	0.012183	0.023495	0.029691	0.791324	0.428755
Vertisoil (Yes =1)	1.190357	0.897762	1.325916	0.184868	0.061409	-0.03967	0.049968	-0.79389	0.427258
Very fertile plot (Yes =1)	-1.49587	1.166723	-1.28211	0.199804	-0.07717	-0.08185	0.050862	-1.60917	0.107579
Tropical Livestock Unit	0.20416	0.181575	1.124383	0.260851	0.010532	0.029548	0.008198	3.604403	0.000313
Number of oxen	0.170393	0.468382	0.36379	0.716015	0.00879	-0.04829	0.020243	-2.3853	0.017065
Log Value of Communication Equipment (Birr)	0.189898	0.16126	1.177586	0.238962	0.009797	0.004208	0.006278	0.670222	0.502717
Log Annual off-farm income	0.136916	0.076623	1.78689	0.073955	0.007063	0.016783	0.005086	3.299765	0.000968
No of information sources	1.819245	0.49008	3.71214	0.000206	0.093853	-0.00939	0.015202	-0.61781	0.5367
No of DA contacts per annum	0.012353	0.014808	0.834234	0.404149	0.000637	0.001069	0.000959	1.11421	0.265189

Variable	First Hurdle (Probit) - Participation Eq.				Second Hurdle (truncated model) – Quantity Eq.				
	Coeff.	SD	z - value	P - value	Marginal Effect	Coeff.	SD	t - value	P - value
Distance to DA (Hours)	-0.94389	0.570878	-1.6534	0.09825	-0.04869	0.024556	0.017674	1.389361	0.164723
Distance to nearest market (Hrs)	-1.02453	0.464588	-2.20524	0.027437	-0.05285	-0.07511	0.031358	-2.39527	0.016608
Trained row planting (Yes=1)	5.484458	1.696345	3.233103	0.001225	0.282937	-0.21659	0.072078	-3.00491	0.002657
Access to credit (Yes=1)	-0.12399	0.558785	-0.2219	0.824394	-0.0064	-0.0516	0.046058	-1.12026	0.262604
Labor per Land (Days)	0.007566	0.014181	0.533551	0.593652	0.00039	0.000397	0.001046	0.379187	0.704549
Inverse Mills Ratio						0.144466	0.082595	1.749093	0.080275
SD of error terms (Sigma)						0.25156	0.011284	22.29292	0
^{2} Value (P-value)	172.3893 (0.0000)				162.23145(0.0000)				
^{2} Value (P-value)	175.38635 (0.0000)								
Log likelihood (Truncated)	-41.329551								
Log likelihood (Probit)	-42.886928								
Log likelihood (Separate Tobit)	-117.97504								

References

Abara, O. C. & Singh, S. (1993). Ethics and biases in technology adoption: The small farm argument. Technological Forecasting and Social Chang, Volume 43, pp. 289-300.

Abay A. & A. Assefa. (2004). The role of education on the adoption of. *Agricultural Economics*, Volume 30, p. 215–228.

Andrei, P. (2011). Agricultural Technology Adoption: Issues for Consideration When Scaling-Up. The Cornell Policy Review: *Journal of the Cornell Institute for Public Affairs*, 1(1).

Asif, R. A. Puran, M., Siegfried, B. & P. Michael, S. (2012). Bt Cotton Adoption: A Double-hurdle Approach for North Indian Farmers. AgBioForum, 15 (3), pp. 294-302.

Berhanu G. & S. M. Swinton. (2003). Investment in soil conservation in northern Ethiopia: The role of land tenure security and public programme. Agricultural Economics, Volume 29, pp. 69-84.

Bingxin, Y. & Alejandro, N. P. (2014). Fertilizer Adoption in Ethiopia Cereal Production. *Journal of Development and Agricultural Economics*, 6(7), pp. 319 - 337.

Cooper J. C. & Keim R. W. (1996). Incentive Payments to Encourage Farmer Adoption of Water Quality Protection Practices. *American Journal of Agricultural Economics*, 78(1), pp. 45-64.

Cragg J. G. (1971). Some Statistical Models for limited Dependent Variables with Application to the Demand for Durable Goods. Econometrica, pp. 829-844

CSA. (2013). Agricultural Sample Survey Report on Farm Management Practice, Addis Ababa: Federal Democratic Republic of Ethiopia Central Statistical Agency.

FDRE Ministry of Finance and Economic Development. (2010). Growth and Transformation Plan, Addis Ababa: Ministry of Finance and Economic Development.

Feder, G., Just E., R. & Zilberman, D. (1982). Adoption of Agricultural Innovation in Developing Countries: A Survey. World Bank: Staff Working Papers, Volume No 542, p. 3.

Gebregziabher G. & Holden S. (2011). Does Irrigation Enhance and Food Deficits Discourage fertilizer Adoption in Risky Environment? Evidence from Tigray. *Ethiopian Journal of Development and Agricultural Economics*, pp. 514-528.

Greene, W. H. (2000). *Econometric analysis*. 4th edition ed. Englewood Cliffs: NJ: Prentice Hall.

Hailu B. (2008). Adoption of improved teff and wheat production technologies in crop and livestock mixed systems in Northern and Western Shewa zones of Ethiopia. Pretoria: University of Pretoria.

Hassen, B., Bezabih , E., Belay , K. & Jema, H. (2012). Determinants of chemical fertilizer technology adoption in North eastern highlands of Ethiopia: the double hurdle approach. *Journal of Research in Economics and International Finance (JREIF)*, 1(2), pp. 39-49.

Heckman, J. J. (1979). Sample selection bias as a specification error. *Econometrica,* Volume 47, p. 153–161.

Jaume, G. & Jose, L. (1992). A Cross Section Model with Zeros: an Application to the Demand for Tobacco. Economics Working Series Paper, pp. 1 - 33.

Joachim, V., Mekdim, D., Bart, D. & Alemayehu, S. T. (2013). Scaling-up adoption of improved technologies: The impact of the promotion of row planting on farmers' teff yields in Ethiopia. LICOS Discussion Paper Series, Issue Discussion Paper 344/2013, pp. 1-2.

Jose, A. (1989). A double hurdle model of cigarette consumption. *Journal of Applied Econometrics*, 4(1), pp. 23-39.

Lee, David R. & Neil, Sean. (2001). Explaining the Adoption and Disadoption of Sustainable Agriculture: The Case of Cover Crops in Northern Honduras. Economic Development and Cultural Change, Issue Iss. 49, pp. 793-820.

MoARD. (2012). Crop Production, Addis Ababa: Federal Democratic Republic of Ethiopia Ministry of Agriculture and Rural Development

Shiferaw, K. & You. (2008). Technology Adoption under Seed Access Constraints and the Economic Impacts of Improved Pigeonpea varieties in Tanzania. Agricultural Economics, 39(3), pp. 309-323.

Teklewold H., D. Legesse, Y. Alemu & N. Dana. (2006). Determinants of adoption of poultry technology: a double-hurdle approach. Livestock Research for Rural Development, 18(40).

Teklewold, D. & Yami, &. D. (2006). <u>Determinants</u> of Poultry Technology: A Double Hurdle Approach. Livestock Research for Rural Development, 18(3).

World Bank. (2008). Agriculture Development Report 2008: Agriculture for Development, Washington, DC, USA: The World Bank