Ethiopian Economics Association (EEA)

PROCEEDINGS OF THE EIGHTH REGIONAL CONFERENCE ON THE AMHARA REGIONAL STATE ECONOMIC DEVELOPMENT

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Published: September 2018

ISBN 978-99944-54-66-2

FOREWORD

The Ethiopian Economic Association (EEA) and its Bahir Dar Chapter are happy to issue the proceeding of the Eighth Annual Conference on the Amhara Regional State Economic Development which was organized on September 23, 2017 at the Homeland Hotel Conference Hall, Bahir Dar. 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 Bahir Dar 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 Eighth Annual Regional Conference on Amhara Regional State Economic Development has contributed towards a deeper understanding of the regional economy and the complex challenges it faces. It attracted about 80 participants including higher officials and expertise from Bahir Dar City Administration, Amhara Regional State, Universities of Bahir Dar, Debre Markos, Debre Tabor, Wollo and Gonder, Amhara Agricultural Research Institute, Amhara cooperative promotion Agency Amhara Planning Commission and Amhara Bureau of finance and Economic Development, NGOs, private sector representative and EEA members in the Bahir Dar. 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, all papers which were presented at the Eighth Annual Conference reviewed by external reviewers and comments and suggestions including editorial comments were communicated to authors for improvement. Finally, those papers which passed all the review and editorial process published in the Proceeding of the Amhara Regional State Economic Development.

At this juncture, I would like to take this opportunity to express my heartfelt gratitude, on my own behalf and on behalf of the Ethiopian Economic Association, to the many people and organizations that made the conference resounding success. First and foremost, I thank the authors of the papers and the audience whose active participations made the Conference meaningful. The staffs of the Economics Department of the Bahir Dar University which runs the EEA Bahir Dar Chapter, participants and the staff of EEA Secretariat deserve a special recognition for their passion and perseverance in managing the conference from inception to completion. Bahir Dar University also deserves appreciation for hosting EEA Chapter by providing office.

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 and the Think Tank Initiative of International Development Research Center (IDRC) of Canada.

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

Tadele Ferede (PhD)
President of the Ethiopian Economics Association

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The Determinants of Technical Efficiency of Manufacturing Firms in the Amhara National Regional State, Ethiopia

Alemzewud Melsew Mihretie[1]

Abstract

The general objective of this research was to investigate the determinants of technical efficiency of the manufacturing firms operating in the Amhara national regional state, in Ethiopia. The descriptive and econometric results were based on a five year unbalanced panel data collected from the survey of the Ethiopian Central Statistics Agency. In this study two hundred ninety four firms are included. The study employed the stochastic frontier production model which is modified by Battese and Coelli in 1995 to estimate the efficiency and the determinants of the firms in the study area. Both input and inefficiency variables were estimated simultaneously using a one stage procedure in STATA 13. This study investigated the determinants of technical efficiency and the score of technical efficiency of those firms. The empirical results indicate that the mean technical inefficiency score of the manufacturing industries was 13.97%, which deviates from the frontier by a range of 13.77% to 14.73%. The inefficiency effect has increased slightly over the year. With regards to the determinants, the labor-capital mix appeared significant on with a negative relationship. Among the manufacturing sub-sectors, the highest inefficiency was registered by textile and garment sub-sectors, while the lowest inefficient was the nonmetallic and mineral manufacturing sub-sectors. Hence, the attention should be given towards improving the level of efficiency among those important firms.

Key words: Ethiopian manufacturing, stochastic frontier analysis, technical efficiency

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1 Introduction

Manufacturing is the production of goods using various inputs (machines, tools and labor). Those produced goods of the firms may be completed, that they are ready for consumption, or they may be semi processed to become inputs for other establishments engaged in further manufacturing and then sold to wholesalers, retailers and consumers. This manufacturing sector comprises establishments engaged in the chemical, physical or mechanical conversion of materials, substances or components into new products (ISIC Rev.4 2016). The establishments are often described as plants, factories, or mills and typically use power driven machines and materials handling equipment. It refers to those firms which involve in the manufacturing and processing of items, creation of new commodities or value addition for the firm (Ibid).

The manufacturing sector is one of the industry sectors in the economy. The sector is considered as the core engine of the economic growth and structural transformation of the economy (Singer et al. 1950). The sector has a capability to enhance the economic growth and transform the economy by providing new technologies for other sectors, the material basis for wealth, stimulates other economic activities through forward and backward linkages, and stimulates the development of technological and managerial knowledge (Ibid). This indicates the vital role of the firms to the economy transformation.

Even though, in developing countries the growth of those firms is extremely affected by various factors, especially; bad management practice, financial constraints, inability of firms to successfully decentralize decision making, ownership and others. Those determinants influence the productivity of the firms in developing countries which appears to be extremely low (Bloom et al. 2007). By considering these, many countries in the developing world and especially in Africa have shown a renewed interest and started to reintroduce industrial policy to improve their efficiency including Ethiopia.

Ethiopia is one of the African countries that has developed and implemented through an industrial development policy since the early Imperial regime. In the country, the manufacturing firms established since in 1920 (MOI 2014).

But the country is in need of transforming the agriculture to the industrial economy to become developed. This transformation should be realized through expansion and establishment of multipurpose manufacturing firms to produce goods for export and domestic use. However, the industry sector has registered an average growth rate of 20 percent in the period of GTP I which is low (MOFED 2015). The average growth rate of the large and medium manufacturing firm's value added registered was 19.2%, while at the end of the GTP I period the share of the industrial sector has increased to 15.1% (manufacturing 4.8%, construction 8.5% mining 0.8%). This contribution to the national GDP is very low (Ibid). The share of the manufacturing sub sector is below 5%, while the export share of this sector to the total merchandise export has remained at about 10% on average (Ibid). One of the factors for this slow growth of those firms in Ethiopia is the lack of competitiveness of those firms. The competitiveness of the firms is influenced by different factors both internal and external such as government policies &incentives, international trade law and regulations, the management practice and technical inefficiency which have an ability to influence the performance and competitiveness of those firms (Birhanu and Kibre 2002). Therefore, firms are a major intervention areas that have to be given due attention to increase the production of the county as well as the study area that alleviate poverty and provide sufficient goods for export and domestic use.

The study area (Amhara region) is located in the north- western parts of Ethiopia, and it is one of the nine regions of the country. According to the Ethiopian National Census Statistics Authority (2014), the region is the second highest populous which accounts 27.12% of the country's population. The region's real gross domestic product has increased from Birr 62 billion in 2006 to Birr 126.7 billion in 2014. On average, the GDP has grows by 9.4 percent per year (BOFED 2015).The share of the agriculture, industry and the service sector of the regional GDP have been 57.32, 15.46, and 27.73 percent respectively (Ibid). This revealed that the industry sector contribution for economic transformation was low.

In this area, the manufacturing firms were established since 1962; Even though, their contribution to GDP, employment and export share is low (BOFED 2015). However, in the past four years (Growth and Transformation

Plan I period 2010 to 2015), the sector has enhanced its contribution to 20 percent. The share of this sector to the GDP has been 1.93% in 2006 to 5.52% in 2014 with an annual growth rate of 2.44%. The share of the manufacturing firms sub-sectors LMSM, SSM and cottage have been 0.3%, 0.68% and 0.99% in 2006 to 4.21%, 0.61% and 0.70% in 2014 with an average annual growth rate of 0.99%, 0.63% and 0.84%, respectively (Ibid). The large and medium scale manufacturing firms had contributed an average of the 4.21 percent to the regional real GDP (Ibid). The growth rate of those firms varies from -1.2% in 2008 to 228.3% in 2014 (Ibid). Though, the sector has low contribution to the economy because of determinants. Enhancing the firm's efficiency is one of the essential issues to improve their performance (Ibid). However, there is no empirical studies evidence on whether or not these firms are technical efficient or not; that is, there is no study that has been done to examine the technical efficiency of the firms in the study area.

The motivation is to find the score of the technical efficiency and the determinants that hinders the technical efficiency of those firms. Identifying these problems and putting the solution can enhance the performance of the firms. The researcher tried to put possible strategies for the increment of the efficiency of the firms and identifies its efficiency determinant factors in the area which is relevant, to enhance their technical efficiency and overall economic contribution to the GDP.

The overall objective of the study is to investigate the determinant of the technical efficiency of the large and medium scale manufacturing firms using econometric models. Regarding with the specific objectives;

- To determine the factors of technical efficiency of the large and medium scale manufacturing firms.
- To estimate the score of the technical efficiency of the large and medium scale manufacturing firms.
- To examine whether the large and medium scale manufacturing firm's efficiency is time variant or invariant.

2. Literature Review

2.1 Theoretical literature

2.1.1 Concepts of efficiency and productivity

Production is the process of producing yields or products through the process of using inputs to produce the output. From this point of view the production function is represented algebraically by using F (L, K) to denote the highest level of output that can be produced by using L workers and K capitals. The production function is the function of inputs such as labor, capital, and other raw materials (Katz and Rosen 1994).

The main goal of the firms is maximizing profit or minimizing the cost or maximizing the output of the firms to be profitable through different mechanisms. The performances of the firms are conventionally judged through whether the firms used the concept of efficiency and productivity analysis or not. Efficiency is the core point of the firms or industries to maximize the profit or revenue to get more benefit to keep its financial sustainability. Efficiency in production is usually referred to as economic or productive efficiency of the firms which means it is successful in producing as much output as possible from a given feasible set of inputs. Production efficiency is concerned with the relative performance of the process used in transforming inputs to outputs (Coelli et al. 2005).Following this concept, the efficiency and productivity measurement of firms became developed through time. Debreu (1951) and Koopmans (1951) set the origin of the concept, how to measure the efficiency and productivity of firms. Farrell (1957) was extended their work in order to perform better measurement of efficiency and productivity. Productivity and efficiency are not synonymous words in the economics world (Coelli 2005).

Let's discuss their definitions one by one:

A. Productivity: is the measure of the ratio of the firm's output to the firm's inputs. There are two types of productivity measures called total factor productivity and partial factor productivity. Total factor productivity is a type of productivity measure by involving all factors of production. The partial factor productivity is the traditional type of measurement method which uses

inputs one by one like, labor productivity, capital productivity, etc. This leads to mis-conclusion when compared to total factor productivity (Coelli 2005).

B. Efficiency: According to Farrell (1957), the maximum attainable output of the firm that is produced within the given combination of inputs and technology of the firms. On the other hand, to obtain the efficiency measure of the firms, the distance from the observed data point to the frontier point which is the maximum point of producing within a given technology and feasible set of inputs. The measurement of a modern, efficiency methodology was provided by Fare, Grosskopf, and Lovell (1985, 1994) and Lovell (1993). Based on the previous work of Debreu (1951) and Koopmans (1951); the Farrell (1957) was defining the simple measure of firm efficiency with regard the multiple inputs and also proposed that the efficiency of the firms comprises two elements or components known as allocative and technical efficiency. The combination of these two basic efficiency measures provides the measure of total economic efficiency (Coelli, 2005).

Technical efficiency:

As aforementioned the production frontier composed of those parts of the firms production function that yield the maximum output for a given combination of inputs. It is possible that firm's scale of operation may not be able to accomplish the frontier production function for the firms. There may be firms whose outputs are closer to the frontier given their level of inputs. The degree of how close the individual, firm production plans are close to the maximum level of defined by the frontier, given input level, is the measure of the technical efficiency of each firm. Hence, For a firm using x inputs (x_1,x_2,…..x_n) to produce a single output, y, the efficient change of inputs into outputs is characterized by the production function, f (x) which reveals the maximum output obtainable from various input sector (Coelli et al. 2005). The technical efficiency is measured in two ways, i.e. input-oriented measures and output –oriented measure (Coelli et al. 2005).

I. Input –oriented measure

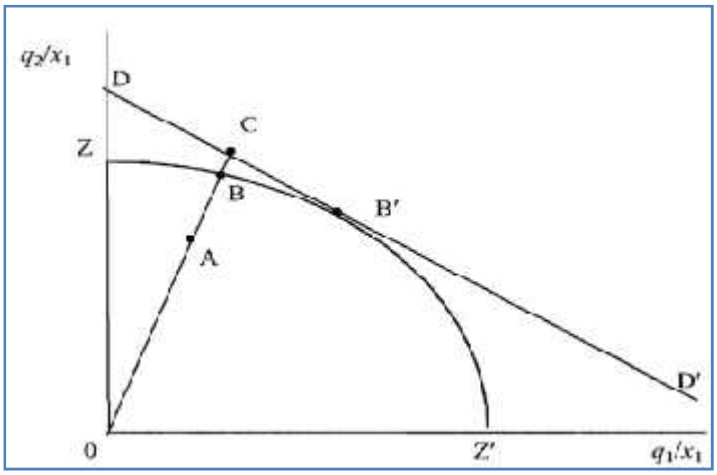
The input oriented measure answers the question of how much can input quantities is proportionally reduced without changing the output quantities be

produced. This idea was explained with a simple example in which the firms involving two inputs (x_1& x_2) to produce one output (q) with the assumption of constant return to scale.

II. Output oriented measures

This output oriented measure focus on the question of how much can output quantities can proportionally expand without altering the input quantities used. The Farrell output-oriented efficiency measures are defined as follows in the figure. The distance AB represents technical inefficiency, which the amount by which the outputs could be increased without requiring extra input (Coelli et al 2005). Then, a measure of output oriented technical efficiency is the ratio: TE=OA/OB=d_o(x,q) Where: d_o(x,q) is the output distance function at the observed input vector x and the observed output vector q.

Figure 2.3 Technical and allocative efficiencies from an output orientation



Source: (Coelli et al. 2005)

Now revenue, efficiency can be defined for any observed output price vector p represented by the line DD'. If q, q' and q* represent the observed output vector of firm associated with point A, the technically efficient production vector associated with B and the revenue efficient vector associated with the point B', respectively then revenue efficiency defined as:

RE= p'q/p'q*=OA/OC

It is possible to draw the iso revenue line if the price information is available, DD' and then can be defined the technical and the allocative efficiencies as follows:

AE=p'q^/p'q*=OB/OC
TE=p'q/p' q^/OA/OB

This has a revenue increasing interpretation. Additionally, it is possible to define the overall revenue, efficiency as the product of these two measures.

RE= (OA/OC)=(OA/OB)*(OB/OC)=TE*AE

All these three measures are bounded by zero and one and also the output oriented technical efficiency measure is exactly equal to the output distance function. Hence, these measures hold the relative proportions of inputs or outputs. The main advantage of this radial measure efficiency is that it is unit's invariant meaning changing the units of measurement doesn't make any change in the value of efficiency measure (Coelli et al. 2005).

2.2 Empirical literature

A degree of efficiency in production is one of the most important economic aspects in ensuring the competitiveness of the firm. The empirical evidence revealed that gains in productivity, and hence in competitiveness, depends on both technical progress and gains in efficiency (Gambau and Maudos 2003). The determinants of the efficiency are factors that affect the efficiency of those firms such as firm size, location, type of ownership, intensity of investment and others (Ibid). To investigate the differences among the firms it is necessary to estimate the production frontier at which the efficient firms are located.

According to Lovell (1993), to improve the efficiency of the firm, identifying the efficiency difference factors is essential unfortunately, economic theory doesn't supply theoretical model of the determinants of efficiency. The efficiency achieved in different angles; when the firm size larger the unit cost

lower in terms of the firm's management meaning the cost is not proportional to the economic agent's output (Caves 1992). The literatures show investigating the technical efficiency of the economic agents with the determinant factors plays a crucial role to put a solution for the problem. Improving the technical efficiency of the firms could strengthen the achievement of the total factor productivity of those firms.

Faruq and Yi (2010) employed the panel data and data envelopment analysis econometric model to estimate the six manufacturing industries in Ghana for a time period of 1991 to 2002. The investigation revealed that the Ghana's manufacturing industries were significantly less efficient than other countries (China 82.5, Chile 65). The firm characteristics such as size foreign ownership, age of the firm and the mix of labor, capital used during the study have positive effects on firm efficiency. The mean efficiency of the Ghana's manufacturing industries was 54.5 percent.

Nebyou 2011, judged five Ethiopian Brewery factories over the period of 2006-2010 by using the firm level panel data to estimate their technical efficiency and the determinants of the inefficiency of the firms. He used the SFA model in the translog functional form with the maximum likelihood estimation method and the result of the study of the average technical efficiency of the firms was 80%. The rest twenty percent in efficiency determinant was available inputs, technology, and efficiency improvement, thereby reducing the cost of production. The study further identifies that the mean efficiency of brewery industries varies among the industries and the mean fluctuates over the year.

Most of the Ethiopian manufacturing industry technical efficiency is time invariant except tanning & dressing and beverage groups (Melaku 2013). This shows the technical efficiency improvement over the period is fixed which leads to no improvement of technical efficiency. The sector has various problems, especially total factor productivity problems as literatures revealed (Melaku 2013, Dilbetigle 2012). A possible cause of this problem is an unwise use of resources such as labor, capital, land water and other factors of production.

3. Research Methodology

3.1 Types and Sources of Data

The study employed the panel data which revealed both the time trend and the cross sectional cases in the study for detail analysis. The panel data have advantages over the other data structures; it investigates technical efficiency change, explore technical change, better quality estimates when it uses more data, and less chance of one event (factor) influencing results and express the time trend (Karagiannis 2009). The study used firm level unbalanced panel data for large and medium scale manufacturing industries. The data used for this research was secondary data which has been collected and compiled by the Ethiopian Central Statistics Agency (CSA).

Table 3.1: Number of manufacturing sub-sectors in the study period

R.No.	Industry	2010	2011	2012	2013	2014
1	Food products and beverages	45	81	53	60	65
2	Pharmaceutical and medicine	-	-	-	-	-
3	Textile and garment	5	10	10	6	8
4	Furniture and wood products	26	30	80	68	35
5	Chemical and chemical products	-	-	1	2	2
6	Machinery and equipment's	2	-	6	5	-
7	Basic iron and steel	12	-	12	9	8
8	Rubber and plastic products	-	-	2	2	-
9	Non-metallic and mineral products	105	50	124	126	158
10	Leather and shoe products	6	5	4	5	3
11	Paper products, publishing and printing services	3	8	2	4	3
	Total	204	184	294	287	282

Source: Own aggregation CSA data, 2017

All operating firms (two hundred ninety four) data was collected. These data includes both public and private firms with the period of five years (2011/12-2013/14). Each and every firm's level survey comprises the data items such as the total value of production, the value of fixed capital, wages and salaries of labor, cost of raw materials, cost of fuel and energy, age, ownership status, investment intensity, labor capital mix and firm size. Prior to using the data, a

series of data consistency and data availability checks were performed and inconsistency data is left out. Quantitative methodologies are applied to explore more findings since this approach has its own quality to explain quantitative based studies.

The table above revealed, the number of manufacturing firms by sub sector regarding their observation during the data collection. Each respective firms covered in this study used their own respective inputs and technology to produce their own products.

3.2 Variable definition and hypothesis

The study included the dependent and independent variable because of the causal nature of the study. Therefore, the study used the following variables which can have an ability to explore the technical efficiency score and to investigate the determinants of the inefficiency of those firms.

A. Dependent variable

1. Total value of production (Y_{it}); Output is the total value of the firms or industry total products sold within a given time frame using resources in the market price. So, to measure the technical efficiency of the firms using the output method is advisable. Hence, the total value of the production of the firm's is used as a dependent variable valued in Birr.

B. Independent variable

1. Fixed capital (X_{1it}); it represents all assets of the establishments with a productive life of one year or more. It shows the net book value at the beginning of the reference year plus new capital expenditure minus the value of sold and disposed machineries and equipment and depreciation during the reference period.
2. Wages and salaries (X_{2it}): is one of the expenses of the firms in the process of producing products which are paid for both the permanent and temporary hired laborers termed as labor cost. Every labor cost included in this variable was valued in Birr.
3. Value of total raw materials (X_{3it}); all costs incurred for both imported and local input materials in the production process of the firm's. It is measured in

Birr. This cost excludes the cost of fixed capital, wages and salaries and, fuel and energy inputs.
4. Fuel and energy (X_{4it}); it is an input used in the production process which affects the efficiency of the firms and taken as in a monetary value (Birr).

Inefficiency determinant factors

The literature has examined various determinants of technical efficiency, including firm specific characteristics such as age, size, ownership, labor capital mix, and others. Understanding the firms' technical inefficiency might not be important by itself unless the sources of the inefficiency are identified for decision and management practices (Admassie et al. 2002). So, the following variables are the inefficiency determinants selected for estimation and analysis.

1. Firm age: The relationship between firm age and efficiency are mixed based on the findings of the empirical. The relationship between the firm age and the efficiency is found positive among Kenyan textile industry (Lundvall & Battese 2000). However, other studies raise the older firms less efficient than the new once unless, the older firms improved to new technology and adopting new marketing conditions (Little & Mazumdar 1987). The age is measured by the number of years of the firm, started with the period of commencement to at the end of the study period in Gregorian calendar.

2. Ownership: is measured as a dummy variable. The indicator variable takes the value of 1 if the firm is owned by the individuals (private firms) and takes the value of 0 otherwise (public). Like that of other variables empirically found that the ownership difference has its own effect on the efficiency of the firms, owners of the firms can have an impact on the domestic firms (Gumbau and Maudos 2003).

Firm size: The measure taken as a firm size is the number of labor hired at the firm (Badunenko and Stephan 2006). According to, Oczkowski and Sharma (2005) and Lundvall and Battese (2000) found a strong support for the hypothesis that there is a positive relationship between efficiency and size of the firm. Even if the large firm size has a positive effect on the firm efficiency (wider market power, economies of scale effect), for some firms an increase in

size may lead temporary coordination and other problems within the firm, resulting in less efficiency. Hence their relationship is not necessarily always straight forward.

Investment intensity: It is measured by the ratio of net capital additions of the firm to the total employment during the given period. The measurement can describe the capacity of the firm that invests to increase the performance of the firm through fulfilling the equipments (fixed capital).

Labor-capital ratio: It is also one of the determining factors of the firm inefficiency which is measured the ratio of labor cost to fixed capital. Developing countries may have a comparative advantage in labor intensive products due to the abundance of labor and scarcity of capital. Consequently, firms using a high labor-capital ratio are likely to be more efficient (Oczkowski & Sharma 2005).

3.3 Model Specification

The two core types of efficiency measuring econometric models are the DEA and SFPA. The SFPA model is selected based on the facts of the model's behavior. DEA has different drawbacks such as it doesn't allow for estimating the measurement error because of its deterministic nature, the full distance of a brand to the efficiency frontier is interpreted as inefficiency but a measurement error or other noise and outliers may influence the position of the frontier, the exclusion of a relevant input or output can result in biased results, the efficiency measurement can differed depending on the model specifications (input VS output oriented models) and variable specification, the efficiency score is only relative to the best DMU (decision making unit) or firms in sample, statistical hypothesis test is difficult since it is nonparametric technique, not accounting for environmental differences may provide misleading indications of relative managerial competence (Kalirajan and Shand 1999). Therefore, the stochastic frontier production approach has been selected for this study, since it covers the drawbacks of this non-parametric approach.

The stochastic production frontier model integrates the usual stochastic error term which is exogenous to the system and the firm level effects to be distributed as truncated normal random variables which are assumed to vary overtime systematically (Battese and Coelli 1995).The study employed the Battese and Coelli, 1995 production function model which is fitted as an output function to estimate the technical efficiency of firms. It specified the production frontier proposed by Battese and Coelli (1995) which defines output as a function of a set of inputs together with technical inefficiency of production. In the model, these inefficiency effects are modeled in terms of other observable explanatory variables and all parameters are estimated simultaneously using maximum likelihood. This model allows inefficiency to depend on some exogenous variables so that one can investigate how exogenous factors influence inefficiency. The panel data model of Battese and Coelli (1992) is somewhat restricted because it only allows inefficiency to change over time exponentially but Battese and Coelli (1995) includes the exogenous determinants in the inefficiency model. In this model each firm has its own frontier during estimation. Lastly the model used the maximum likelihood simultaneous estimation of the two models in one stage to overcome the drawback of a two stage model developed by Pitt and Lee 1981. The stochastic frontier production function assumes the presence of technical inefficiency in the production. According to Kumbhakar *et al*. (2012), the inefficiency specification used by Battese and Coelli (1995) is most frequently used in empirical studies.

The general representation of the panel data, stochastic frontier production model employed in the study is as follows:

$$\mathbf{ln(Y_{it})=X_{it}\beta+V_{it}-U_{it}For i=1,2,3,\ldots..N \text{ and } t=1,2,3\ldots\ldots\ldots T} \quad \mathbf{(3.1)}$$

Where; $Y_{it=}$is the output of the i^{th} firm with cross sectional unit (i=1, 2,…N) at the time period of t^{th} observation (t=1,2,..T);
$X_{it=}$denotes a (1xk) vector of log of input values of i^{th} firm at time t;
β=is a (kx1) vector of unknown scalar parameters to be estimated;
$V_{it=}$are the usual random errors measuring the positive and negative effects of exogenous shocks assumed to be identically and independently distributed with mean zero and constant variance independently of the U_{it};

$U_{it=}$are non-negative random variables which are assumed to account for technical inefficiency in the model. The summation of the two random variables V_{it} and U_{it} is expressed as $\mathbf{e}_{it}$ in which

$$\sigma^2_e=\sigma^2_v+\sigma^2_u \text{and } \gamma=\sigma^2_{u/}\sigma^2_e \qquad \textbf{(3.2)}$$

Where; γ is the variance ratio that explaining the total variation from the frontier level of output attributed to technical efficiency. This parameter lies between 0 and 1, if the parameter equal to zero, hence all deviations from the frontier is due to noise, while if the parameter is equal to one, it implies that all the deviations from the frontier are due to the technical inefficiency (Battese and Coelli 1992). The firm level technical efficiency becomes the ratio of observed output to the stochastic frontier or potential output and the firm efficiency has been viewed as the average of the efficiencies of all firms in the industry, i.e. The natural predictor of the industrial efficiency is the average of the predicted efficiencies of the firms in the sample (Battese and Coelli 1992). Hence, the technical efficiency of the firm is defined by: The technical efficiency of an individual firm is defined interms of the corresponding frontier output, given the existing technology. Then, technical efficiency;

$$\begin{aligned}(TE) &= Y_{it}/Y_{it}^* \\ &=f(x_{it},\beta)\exp(V_{it}-U_{it})/f(x_{it},\beta)\exp(V_{it}) \\ &=\exp(-U_{it})\end{aligned}$$

Where, Y_{it} is the observed value and Y_{it}^* is the frontier output.

It measures the degree to which a certain firm operates beneath the frontier drawn by the amount the most efficient firm among the sample firms produces given the similar operational conditions and nature of input variable use. If the study focuses on the time the technical inefficiency effect can be assumed to be constant over time or can vary over time. The assumption of time invariant inefficiency considers that inefficiency of the firm has a persistent nature, so, not responding to time. However, this study assumed that the technical inefficiency changes over time. The technical inefficiency effects as a function of time are defined as;

$$U_{it}=\{\exp[-\eta(t-T)]\}U_{it} \quad \textbf{(3.3)}$$

Where i=1,2,…..294 and t=1,2…..5

U_{it} is non negative random variables associated with the technical inefficiency of production. Eta (η) is an unknown scalar parameter to be estimated, which determines whether inefficiencies are time varying or not. U_{it} is assumed to be i.i. truncated at zero of the N (μ, σ^2_u) distribution.

If η is positive, then–η(t-T)=η(T-t)is positivefort<Tandsoexp[–η(t-T)]>1, which implies that the technical inefficiencies of firm decline overtime. If η is zero, then the technical inefficiencies of firms remain constant. However, if η is negative, then–η (t-T) <0 and thus the technical inefficiencies of firms increase over time.

The stochastic frontier production function can be specified as Cobb-Douglas, or Translog functional form. The Cobb-Douglas functional form is defined as:

$$y_{it}=\beta_0+\sum_{j=1}^{4}\beta x_{jit}+V_{it}-U_{it}..... \quad \textbf{(3.5)}$$

The translog stochastic frontier production function can be specified as:

$$\ln q = {}_0 + \sum_{n=1}^{N} {}_n \ln x_n + \frac{1}{2}\sum_{n=1}^{N}\sum_{m=1}^{N} {}_{nm} \ln x_n \ln x_m + u \quad \textbf{(3.6)}$$

After LR hypothesis test, the study conducted translog production functional form. Therefore the translog stochastic frontier production function of the firms for this study is;

$$\ln y_{it}=\beta_0+\beta_1\ln x_{1it}+\beta_2\ln x_{2it}+\beta_3\ln x_{3it}+\beta_4\ln x_{4it}+\beta_{11}1/2(\ln x_{1it})^2+\beta_{22}1/2(\ln x_{2it})^2+\beta_{13}\ln x_{1it}\ln x_{3it}+\beta_{14}\ln x_{1it}\ln x_{4it}$$
$$\beta_{33}1/2(\ln x_{3it})^2+\beta_{44}1/2(\ln x_{4it})^2+\beta_{12}\ln x_{1it}\ln x_{2it}+$$
$$+\beta_{23}\ln x_{2it}\ln x_{3it}+\beta_{24}\ln x_{2it}\ln x_{4it}+\beta_{34}\ln x_{3it}\ln x_{4it}+V_{it}+U_{it}.. \quad \textbf{(3.7)}$$

Where;
y_{it}= total value of production in Birr for the i^{th} firm, (i= 1,2,3,….294) in the t^{th} observation period (t=1,2,3,4,5);
x_{it} are vectors of inputs such as fixed capital in Birr, labor in terms of wages and salaries paid in Birr, value of raw materials in Birr and cost of fuel and energy for the i^{th} firm and t^{th} year of observation respectively;
β's and β_{ij}'s are unknown parameters to be estimated;

The technical inefficiency effect, U_{it}, in the stochastic frontier model defined as;

$$U_{it}=Z_{it}\delta+W_{it} \qquad \textbf{(3.8)}$$

Where;

$Z_{it=}$ a vector of explanatory variables associated with technical inefficiency of the firm i^{th} at time t and δ is unknown parameter or vector of coefficients and the random variable.
W_{it} is defined by to have a normal distribution truncated at $-Z_{it}\delta$, i.e. $W_{it} \geq -Z_{it}\delta$, and it is consistent with the assumption that U_{it}, has the normal distribution, $N(Z_{it}\delta, \sigma^2_u)$ (Battese & Coelli 1995).

To investigate the technical inefficiency factors of the firms, the following technical inefficiency model is used. The model is defined as:

$$U_{it}=\delta_0+\delta_1Z_{1t}+\delta_2Z_{2t}+\delta_3Z_{3it}+\delta_4Z_{4it}+\delta_5Z_{5it}+W_{it} \qquad \textbf{(3.9)}$$

Where: δ_0 is the intercept term;
$\delta_{j=}$ (j=1,2,3….6) are the parameters for the j^{th} explanatory variable and W_{it} is defined by the truncation of normal distribution with mean and variance, i.e consistent with the assumption of U_{it}.

Where;
Z_1=firm age,Z_2=ownership,Z_3=firm size, Z4= investment intensity, Z_5=labor-capital mix.

3.4 Estimation Procedure

Coelli (1995) suggested that the maximum likelihood estimator significantly outperforms than the corrected ordinary least square estimator when the contribution of the technical efficiency effects of the total variance is relatively large. Based on this and Battese et.al (1995), the maximum likelihood estimation method is employed for stochastic frontier model. The method of MLE is selected for the simultaneous estimation of the parameters of the stochastic frontier and the model of the technical inefficiency effects in one stage procedure. The estimated parameters in the stochastic frontier models were $\beta's$, η, σ^2 and σ^2_u industry efficiency was computed as the average of the technical efficiencies/ inefficiencies of the firms. For estimation to explore the technical efficiency of the firms for the analysis of the econometric models the STATA 13 software program is used.

4. Results and Discussions

4.1 Econometric Results

The comprehensive unbalanced dataset comprising a total of one thousand two hundred fifty one observations with a cross section of two hundred ninety four firms over a period of five years is used to estimate the technical efficiency besides with the parameters that determine the technical efficiency of the firms.

Thus, the hypotheses concerning more than one coefficient are usually tested using likelihood ratio (LR) test and this test is convenient for the estimators of maximum likelihood estimator, hypothesis test (Coelli et al. 2005).

The log likelihood ratio statistics is given by; $LR= -2[LLF_o-LLF_1]$

Where:
LLF_o is the value of the likelihood functions for the frontier model in which the null hypothesis are imposed (Restricted model) and;
LLF_1 is the value of the likelihood functions of the alternative function for unrestricted model
Reject the null hypothesis when LR> chi-square (r). Where; r is the number of restrictions.

The LR method has taken for the test and the results are mentioned below in the table.

Table 4.1: Summary of the hypothesis tests using log likelihood ratio statistics

S. No	Null hypothesis	LR test statistics	X^2 critical value (a=0.05)	Decision
1	The Cobb Douglas(C-D) production function is appropriate Ho: $\beta 11= \beta_{12}= \beta_{13}= \beta_{14}= \beta_{22}= \beta_{23}= \beta_{24}= \beta_{33}= \beta_{34}= \beta_{44}=0$	76.6312	18.31	Reject Ho (Meaning Use translog production function)
2	No technical inefficiency effect $\gamma=z_1=z_2=z_3=z_4=z_5=0$	14.11	11.07	Reject Ho (there is technical inefficiency)
3	TE is time invariant $\eta=0$	24.66	18.31	Reject Ho (TE is time variant)

Source: own computation

4.2.1 Interpretation of the stochastic frontier production model estimation results

As estimated aforementioned, the functional form that best fits with this study is the translog functional form regarding with time varying decay model to investigate the technical inefficiency and the determinants of the technical efficiency. Before estimation all the continuous variables are transformed into the logarithm to keep the normal distribution of the function. All the coefficients of the input variables and the parameters (μ, η, γ, and δ) were estimated.

Table 4.2 Estimation results of the variables

Time-varying decay inefficiency model Number of obs.=1250
Log likelihood= -1866.1511 Wald chi2(14)=3711.52
Prob> chi2= 0.0000

S. No	Variables	Coef.	Std. err.	Z	P>|z|
	β_o	4.741235	1.324044	3.58***	0.000
1	X_1	0.3388119	0.1388373	2.44***	0.015
2	X_2	0.6005555	0.1793354	3.35***	0.001
3	X_3	0.3874365	0.1411326	2.75***	0.006
4	X_4	-0.0396804	0.126807	-0.31	0.754
5	$½*X_1^2$	-0.0068603	0.0121041	-0.57	0.571
6	$½*X_2^2$	0.0109278	0.0264008	0.41	0.679
7	$½*X_3^2$	0.1122482	0.0132046	8.50***	0.000
8	$½*X_4^2$	0.0290537	0.0159499	1.82*	0.069
9	X_1*X_2	0.0148568	0.0118763	1.25	0.211
10	X_1*X_3	-0.0202693	0.0096061	-2.11**	0.035
11	X_1*X_4	-0.0046979	0.0091634	-0.51	0.608
12	X_2*X_3	-0.0713699	0.0146955	-4.86***	0.000
13	X_2*X_4	0.0314296	0.0154856	2.03**	0.042
14	X_3*X_4	-0.0325398	0.0117732	-2.76***	0.006
15	Age	-1.198553	0.8691822	-1.38	0.168
16	Ownership	1.919515	2.122142	0.90	0.366
17	Firm size	.0005904	0.0001944	3.04***	0.002
18	Invest. Intensity	-.0349897	0.1052431	-0.33	0.740
19	Labor-capital ratio	-.0040506	0.0016256	-2.49***	0.013
	Mu(μ)	.0366251	0.1381624	0.27	0.791
	Sigma square(σ^2)	2.480154	0.0467008		
	Gamma(γ)	0.576584	2.961006		
	Sigma u^2	1.430018	.0000105		
	Sigma v^2	1.050136	0.0466902		

***, **, *=*significant at 1%, 5%, 10% level of significance*

Table 4.3: Output elasticity for manufacturing firms (the marginal effect of four major input variables)

S.No	Variables	dy/dx	Std.err.	Z	P >|z|	X
1	Fixed capital	0.312678	0.13869	2.25**	0.024	12.343
2	Labor cost	0.6231359	0.18217	3.42***	0.001	11.7147
3	Cost of raw material	0.3874365	0.1411326	2.75***	0.006	12.9297
4	Cost of fuel & energy	-0.0202218	0.12712	-0.16	0.874	9.71093

***, **, *=*significant at 1%, 5%, 10% level of significance*

Source: own estimation

The variables relationship is interpreted below based on the result of the marginal effect.

The coefficient of fixed capital has a positive sign and significant at the 1 % level of significance in which a one percent increase in the fixed capital expenditure leads to 0.313% increase in the output of the firm, when other variables constant. This implies that fixed capital was the core causal variable for production efficiency of the manufacturing firms during the study period. This result is consistent with the literatures (Dilbetigle 2012, Habtamu 2010 and Yibeltal 2016).

The labor has a positive sign and significant at 1% of level of significance. The positive relationship of the labor and the output is consistent with the literature, while it is significant and by one percent increase in labor can increase the production amount by 0.623%. This implies that the manufacturing firms are labor intensive which is compatible with developing countries labor intensive theory. This result is consistent with the findings of Melaku (2013), that studied for Ethiopian industries of the textile (0.517), chemicals (0.620), publishing and printing (0.419) and fabricated metal products (0.603) manufacturing groups which exceeds the coefficient of the raw materials. The result is quite different from Yibeltal (2016); found this result in the metal manufacturing industries were capital intensive.

The cost of raw materials is significant at 1% significance level, which has a positive relationship with the efficiency of the firms. A one percent increase in the cost of raw material expenditure leads to 0.387% increase in total output keeping other variables constant. This finding is consistent with the finding of

Habtamu (2010) who studied the pasta and biscuit industries in Ethiopia. The square of the cost of the materials variable also has the positive sign and significant at 1% significance level. This means when the cost of the raw material doubled its relationship with the technical efficiency or production of the firm remains significant. It indicates, the firms were not used maximum amount of input to produce the maximum attainable input during the study period.

The inconsistency of the unexpected and insignificance of some of the estimated variables might be due to the nature of the translog functional form which is exposed a multicollinearity problem occurring from the inclusion of the square of the variables and the cross product of the input variables. Even though, the purpose of the study is to estimate efficiency of firms, tolerating and assuming the existence of some degree of multicollinearity is possible (Maddala 1992).

4.2.2 The Interpretation of the determinant's and parameters

Based on the result the determinants are interpreted below.

Age of the firm: This variable has a negative value and insignificant at 5% significance level. This finding is consistent with the leather and leather product industry studied by Dilbetigle (2012). But it is inconsistent with Amaechi E.C.C. et al. (2014) study, in Nigeria's oil palm producing mill industry's result. This might be a result of low upgrade performance of the firms and low investment intensity of the firms to renew industries. When investment increases significantly and they practice the new management, the firms may increase their performance or efficiency and vice versa.

Firm size: is significant at the 1 % significance level and has a positive relationship with the technical inefficiency. As the firm size increases the inefficiency of the firms' increases, on the other hand it decreases the technical efficiency of those firms. This might be rise from the firm's capacity to manage the production process as the size of the firms increases goes beyond the threshold level. It implies that large firms were less efficient than the smaller. Some literatures ensured that the firm size increases the efficiency of the firm also increases (Alvarez and Crespi 2003), Torii 1992) even though,

some literatures contradict or inconsistent with this result (Badunenko et al. 2006). This indicates the positive relationship and the sign of this determinant is depending on the wise use of the firm size proportionality in the firms.

Ownership: The sign of the ownership dummy variable is positive and insignificant. This means, there is no technical inefficiency difference among the privately owned and government owned firms significantly as that of Nebyou's study (2012) in Ethiopian brewery firm. In this context, it implies no special management practice among the owners which is relatively the same. One stream of the literatures ownership has a positive and significant influences on the technical efficiency of the manufacturing industries (Bottasso and Sembelleni 2004) while other states that it is unimportant (Orazem and Vodopivec 2003).

Labor-capital ratio: This determinant variable is significant at 5% significance level with a negative relationship with the technical inefficiency of the firms. This implies the labor-capital ratio decreases the technical inefficiency of the firms. When it is negatively related with the inefficiency, the determinant has an ability to increase the technical efficiency of the firm. This result is consistent with the Oczkowski and Sharma (2005), a higher labor-capital ratio indicates the firms are more likely to be operating close to its efficient or frontier level of production. This finding is consistent with the developing countries labor intensive theory including Ethiopia. Thus, the investment in labor intensive activities may have led to higher technical efficiency which may actually have a comparative advantage in labor intensive activities. In developing countries labor is abundant than the capital, so using the labor intensive industry policy has a comparative advantage (Krugman et al. 2003).

The parameter gamma (γ) indicates the ratio of the variance of the firm specific variability, i.e. stochastic frontier inefficiency output to the estimation of the output variability (V_{it}, U_{it}). From the time varying decay model, the value of gamma (γ) is 0.576 which indicates 57.6% of the observed output variability is due to the firm specific performance, whereas the rest 42.4% variability is due to other random shocks. The value of the gamma (γ) result for previously studied Ethiopian industries such as pasta and biscuit, brewery

and leather and leather products' gamma value was 16%, 86%, and 94%, respectively (Habtamu 2010, Nebyou 2011, and Dilbetigle 2012). This result is also consistent with the findings of Melaku (2013) in which the value of gamma ranges from 14.3% (Rubber and plastic) to 55% (Beverage). To compare the observed output variability due to firm specific performance of those firms with this paper, the variation is better than the brewery and leather industries. This variation may generate from two factors infrastructural and institutional. On the infrastructure side; poor power supply and interruption for firms, a poor road network and other communication facilities were also challenges for industries. The other institutional factor such as lack of foreign currency, poor service provision from concerned government sectors, and lack of scientific management practice of the firms may be causes of variation.

The other parameter is the eta (η) which shows a value of -0.34 meaning that the degree of the inefficiency increases over time. When the value of eta (η) is negative, it indicates that the technical efficiency of the manufacturing industries decreases over time.

4.2.3 The technical inefficiency of the manufacturing industries

The mean technical inefficiency of the manufacturing firms in the study time period was 13.97% in which the minimum was 13.77% and the maximum inefficiency was 14.73% over time. At the firm level the minimum and maximum inefficiency score was 10.44% and 47.33% respectively which is a wide variation. As explained earlier, there are ten manufacturing industries (sub-sectors) in the study area. Among those, the lowest and the highest mean technical inefficiency was 13.09% and 17.1% respectively. The annual average mean technical inefficiency growth of the manufacturing industries was varied from 13.09% to 17.10%, which is a low variation when compared to other previous studies; i.e. the variety of brewery manufacturing industries in Ethiopia were between 11% and 41% (Nebyou 2012).

Table 4.4: The inefficiency score of the manufacturing firms by sub sector (in percent)

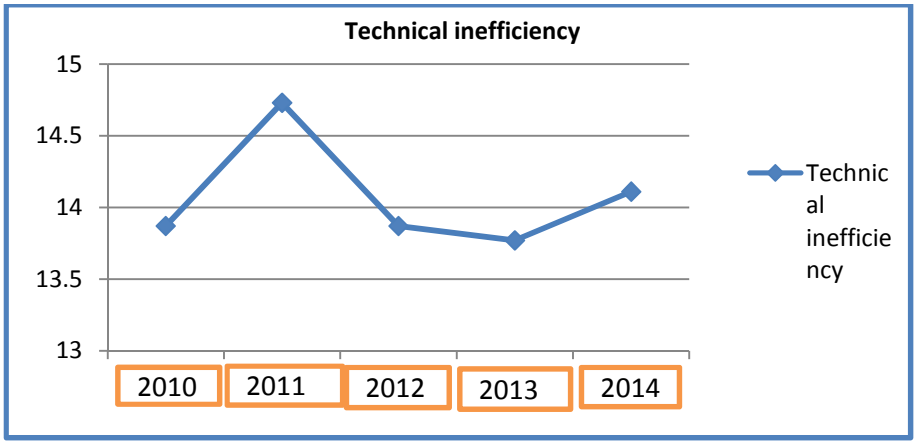
S. No.	Name of industries (Sub-sector)	2010	2011	2012	2013	2014	Average
1	Food & beverage	15.23	15.27	14.89	15.38	16.18	15.39
2	Textile &garment	17.25	14.84	17.31	18.45	17.67	17.1
3	Furniture &wood products	13.11	15.91	13.22	13.16	13.34	13.75
4	Chemical &chemical products	-	-	17.12	13.61	14.15	14.96
5	Machinery &equipment	14.83	-	16.87	13.25	-	14.96
6	Basic iron &steel	14.7	-	12.74	14.21	14.87	14.13
7	Rubber &plastic products	-	-	-	16.14	-	16.14
8	Other non- metallic &minerals	13.01	13.19	13.21	12.96	13.08	13.09
9	Leather &leather products	16.03	16.02	15.56	15.97	16.72	16.06
10	Paper products, printing & publishing services	15.92	13.41	15.42	15.01	15.27	14.78
	Min	10.98	11.71	10.44	10.7	10.95	
	Max	20.03	19.43	20.78	20.33	47.33	
	Overall mean inefficiency	13.87	14.73	13.77	13.97	14.87	

Source: own computation

Among the sub-sectors, the lowest inefficient is the non-metallic mineral industry (13.09%) and the highest of all is textile and garment industry (17.10%) which is consistent with Melaku (2013) (the technical efficiency score of tanning and leather industry was 88% and the score of textile was 86%). The variation of the technical efficiency of the sub-sectors over the years was seems like sluggish i.e. 1% variation. There is no any industry that outshines or goes down in its technical efficiency. Generally, the

manufacturing sub-sector's technical efficiency swims between 86.91% and 82.9% for five years. This may be a consequence of firm's determinants. This period was GTP I period in which the government provides a good emphasis for the sector, though, the technical efficiency not significant over the year.

Figure 4.1: The annual mean technical inefficiency of the manufacturing firms



Source: own computation

In general, the mean technical efficiency score (86.03%) of the manufacturing industries (sub-sectors) is nearly consistent with the findings of the Nebyou (2011) for brewery factory (80%) and higher than the Habtamu's (2010) finding of the pasta and biscuit firm's score of 0.12%.

The findings of the Faruq and Yi (2010) in the Ghana manufacturing industries were 54.5%, which is lower than findings of this study. This difference may arise from the trade policy difference that the Ghana followed, i.e. import substitution industrialization policy which may result in the injection of additional physical capital into firms that have a labor intensive in nature because this industry may not in need of physical capital unless it is complemented by additional human capital. In addition to this the cause of the efficiency score difference may occur from tariff variation within the manufacturing industries Ghana (Faruq and Yi 2010).

In the Nigeria palm oil produce mill's studied by Amaechi (2014) the mean technical efficiency was 70.62%. The causes for this inefficiency were traditional practice without mechanical aid, seasonal shortage of inputs, the importation problem of vegetable oil, empowering human capital which should get emphasis from the government for policy formulation (Amaechi 2014).

The score of the technical efficiency of the industries was 86.03%, which was higher than the Ghanian and Nigerian manufacturing industries technical efficiency, this may be a result of the policy of the countries. The export orientation import substitution policy provides a privilege for the investors (both domestic and foreign) to encourage, the productivity of firms by allowing duty free import capital goods, five to fifty years free business income tax, a priori for hard currency and supply of power and water with less cost, loan provision as well as the domestic market opportunities both for input and output.

5. Conclusion and Recommendations

5.1 Conclusions

The mean technical efficiency of the firms was 86.03%, while the individual firm's efficiency varies between 89.02% and 52.67% which was large variation. The mean technical efficiency score variation among the industries was small. The mineral and non-metallic industries scored the highest efficient industry (86.91%), while the textile and garment manufacturing industry took the lowest position (82.9%).

The mean technical efficiency of the private and the government manufacturing industries was 85.95% and 86.04%, respectively, which revealed that the variation between private and public firms was low and insignificant.

The estimation result revealed, technical inefficiency of the firms increased over time. Besides this, the value of gamma (γ) was 57.6% meaning the observed output variability is due to the firm specific performance, while the rest 42.4% variability is due to the random shocks out of the control of the firm.

5.2 Recommendations

To improve the efficiency of the firms, the following recommendation is given based on the findings.

The result revealed, the output is highly influenced by the labor cost followed by the cost of raw materials and fixed capital, respectively. This result indicates 0.623% of the output is influenced by the one percent increments of the labor, hence labor is the engine of those firms, and therefore the government should encourage the labor intensive strategies for those industries.

The study found 57.6% of the technical inefficiency arises from the firm specific performance, which indicates the firms should assess their overall management practice, the technology and other issues to minimize the inefficiency pace of the firm. While, the 42.4% of the inefficiency variation is out of the control of the industries therefore the government should amend the infrastructure, the import procedures, the bureaucracies, consistent energy supply and other related issues for strengthening the industries. Besides, the firms technical inefficiency increases over time therefore to regulate it, an emphasis should be given to enhance the technical efficiency of the sector.

The study period was a period of GTP I (the manufacturing sector got special attention by the government), even though, the technical efficiency of the sub-sectors seems slightly stagnant no one outshine or goes down. During this period the number of firms raises significantly, but not their efficiency so, the efficiency is in need of attention to be productive. The firm's inefficiency increases slightly over time, hence the remedies should be taken to encourage and to foster their efficiency.

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Why Children of Excess Food Crop Producers' Suffer from Under-nutrition in Ethiopia? The Case of Amhara National Regional State

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Abstract

Studies done before identified that children in developing countries suffered from consistent undernutrition problem. Contrary to the potential of produce diversified crops and livestock products, but children in African countries including Ethiopia are suffering from severe problem of under-nutrition. Smallholders in Amhara national regional state are facing similar situations. Thus, this study tried to examine why households that are capable to produce different crops especially cereals suffer from severe child under-nutrition. The study considered the four(2000, 2005, 2011 and 2016) nationally representative demographic and health survey data collected by the World Bank from Amhara national regional state of Ethiopia. The child undernutrition problems (stunting, underweight and wasted) computed based on the standardized index developed by the World Health Organization. About 55%, 38% and 12% of the children in the regional state were stunting, underweight and wasted, respectively. Compared to the proportion of the national level (49%, 33% and 11%, respectively) the problem was severe in the region.

The regional state has relatively normal income and wealth distribution as compared to the other regions. The logit model result revealed that experienced and educated mothers have significant effect of reducing the prevalence of child under-nutrition in the regional state. Children from mothers with age interval of 30-50 years and graduated from secondary and/or high school have strong probability of being free from stunted and underweight. The model result also shows that children with an average or more birth weight have lower probability of suffering from childhood under-nutrition. Finally, the study recommended that the concerned part should work on expanding mother's education, prenatal care, availing information, infrastructures and clean drinking water for households to reduce the regional level child under-nutrition problems.

Keywords: Under-nutrition, Prenatal care, Wealth, Education, Amhara

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1 Introduction

1.1 Background of the Study

Currently, the global nutrition situation is a picture of extremes fasting and feasting, and wasting and obesity. Under-nutrition, and more specifically, deficiencies in essential nutrients, is the underlying cause of an estimated 3.5 million deaths each year (Chan, 2016). Undernutrition is the outcome of insufficient food intake and recurrent infectious diseases (Ahmed, 2017). According to recent comparative risk assessments, under-nutrition is becoming the leading contributor to the global burden of disease and death (Olalekan, 2009) mostly in developing countries. Undernutrition contributes to nearly half of all deaths for children below 5 years and it is widespread in Asia and Africa (UNICEF, 2017). The problem puts children at greater risk of dying from common infectious diseases, increases the frequency and severity of such infections, and significantly contributes to delayed recovery. Interaction of undernutrition and infection create a potentially disastrous sequence of worsening illness and deteriorating nutritional status. UNICEF reported that poor nutrition in the first 1,000 days of a child's life could result in stunted growth, which is irreversible and associated with impaired cognitive ability and reduced school and work performance.

Food and Agriculture Organization ((FAO), 2015) estimated that about 795 million of the 7.3 billion people in the world were suffering from chronic undernourishment in 2014-2016. Almost all the hungry people live in developing countries, representing 12.9%of the population in those countries. Based on the institution's report there are 11 million undernourished people in developed countries. There was about 42% reduction in the proportion of undernourished people between 1990–92 and 2012–14 in developing countries. Despite this progress, around 14% of the overall population remains chronically undernourished in the developing world. There has been least progress in the sub- Saharan Africa (SSA), wherein more than one in four people remain undernourished implies that the region has the highest prevalence in the world. Nevertheless, undernourishment in SSA has declined from 33.2% in 1990– 92 to 23.2% in 2014–16, but the number of undernourished people has actually increased.

Undernourished children are highly susceptible to common childhood illness like diarrhea, respiratory infections and worm infestations. Global statistics for surviving undernourished children indicate that approximately 171and 100 million children are stunted and underweight, respectively (de Onis and Borghi, 2011). The United Nation report in 2013 estimated that 165 and 101 million children from developing countries were stunted and underweight, respectively. More than 25% of all under-fives in the developing world are underweight, wherein nearly three quarters live in just 10 countries (Olalekan, 2009). In SSA more than one-quarter of children under five are underweight wherein Nigeria and Ethiopia alone account for more than one-third of all underweight children in the region. This circumstance shows severity of child undernutrition problem in many developing countries. The problem remains persistent in most of SSA countries (Ahmed, 2017).It contributes importantly to child mortality and carries long-term consequences of malnourishment that reduced cognitive development and lower economic contribution. Household food insecurity is associated with higher odds of stunting and underweight in Bangladesh, Ethiopia, and Vietnam (Ali *et al*, 2013).

The income inequality-health hypothesis postulates that population health and mortality are importantly influenced by income distribution within the country (Lynch *et al*, 2004). Income inequality increment raises mortality at birth and up to age of 15 (Roberta, 2011). This indicates that to manage both prenatal and post-natal care properly the households should have the required income level. Child malnutrition is one of the parameter to measure health status of a society wherein World Health Organization (WHO) recommends for health equity among nations. Undernutrition reflects lack of income, not enough food, and unhygienic surroundings situations that affect all members of the household (James, 2006). However, some argued more broadly that undernutrition mainly attributed to household's asset, education, antenatal care, and birth intervals in addition to accessing potable water and modern toilet facilities.

The recent statistical reports in Ethiopia show that 28% of the population is under absolute poverty, which implies that more than 28 million people have income of below one US dollar per day. Undernutrition is an underlying cause (53%) of infant and child deaths in the country(USAID, 2006). There is a

substantial undernutrition variation in Ethiopia among different regional states and city administrations. For instance, the prevalence of child stunting is above the national average (40%) in Affar (49%), Tigray (44%), Southern Nation and Nationalities People (SNNP) (44%) and Amhara (42%) regional state(CSA, 2014). Undernutrition problem remains so high in the country and it needs continuous substantial effort to examine the factors that aggravate the problem(Ahmed, 2017).Thus, this study tried to investigate the paradox of better production and severe child under-nutrition in Amhara national regional state considering the pooled from DHS.

1.2 Statement of the Problem

Different statistical reports revealed that more than 50% of the total area of Amhara regional state is potentially arable to practice the different agricultural production activities. About 48 of the 105 districts of the Amhara region are drought-prone and suffer from frequent food shortages in which most of the households fulfil their basic requirements from their production for less than six months of the year. There has been no single year since 1950 where there was no drought in the eastern part of the region. However, much of the western half of the region has better soils and adequate rainfall that could enable surplus agricultural produce (USAID, 2000).

Cereals account for more than 80% of cultivated land and 85% of total crop production in the regional state. The principal cereals in the region are *teff*, barley, wheat, maize, sorghum and finger millet. Additionally, about 28% of the livestock, 30.7% of the poultry, and 18.5% of the beehives in Ethiopia are from Amhara regional state (USAID, 2000).About 94% of households in the regional state have insufficient land to meet their food needs. This circumstance forced smallholders in the rural area of Amhara regional state to clear and cultivate marginal lands on steep hillsides. Crop yield of the regional state is estimated to decline by 1-2% per year due to soil erosion. In general, increasing populations and continuous crop production reduction finally result in chronic net decline in nutrients stocks for households of the regional state. Individuals, in particular children, may suffer from vitamin and protein deficiencies even when they have an adequate level of total caloric intake. Diversification of agricultural

production and off-farm income for food purchase are proven means to enable individuals to obtain a more balanced diet.

Finally, this study tried to investigate the paradox of better production and severe child under-nutrition in Amhara national regional state considering the pooled from DHS.

2. Materials and Methods

2.1 Type and Source of Data

The study used Demographic and Health Survey (DHS) data collected from the regional state (Amhara National Regional State)of Ethiopia considering sample households from both the rural and urban areas in 2000, 2005, 2011 and 2016. This regional state is second most populous and productive in the country. The four round surveys consider 5,348 households (1619, 1458, 1294 and 977 households in 2000, 2005, 2011 and 2016 surveys, respectively) from this regional stat

2.2 Method of Data Analysis

The study used descriptive and econometric tools to analyze the pooled data. Simple mathematical tools like percentage, mean, ratio, frequency, tabulation as well as statistical tests like t-test and $\chi 2$-test were used to substantiate the description analysis.

Additionally, the study utilized logit regression considering the core independent explanatory variables and other supportive explanatories. The regression model predicted the probability of having undernourished child for the given set of independent variables. The three types of child undernutrition problems constructed as binary variables, in which children of below -2 standard deviations of the WHO median reference for **height-for-age**, **weight-for-age** and **weight-for-height** are stunted, underweight and wasted, respectively (WHO, 2010). The binary version of a logistic regression model best fits, when the dependent variable in question has two categories that are mutually exclusive and cannot be ordered in any meaningful way. The binary logit model for identifying the determinants of child under-nutrition prevalence is:-

$$P\ X\ = \frac{\exp(\alpha+\beta X)}{1+\exp(\alpha+\beta X)} \quad \textbf{(1)}$$

The log of odds ratio can take the following form:

$$\log^{\left(\frac{P_i}{1-P_i}\right)} = \sim + \ X_{\ i} \quad \textbf{(2)}$$

log odds (P)= α + β for X_i =1, log odds (P)=α for X_i =0.
The marginal effect of X_i on the dependent variable could be measured as:

$$(P_i(1-P_i))_{\ i} \quad \textbf{(3)}$$

The unknown parameters β_i are typically estimated by maximum likelihood estimation.

3. Results and Discussion

3.1 Household Characteristics and Child Undernutrition

Table 1 shows that the wealth quintile distribution of households in Amhara regional state is relatively normal in which the percentage of households in each quintile is proportional. Relatively small proportion (10.58%) of the sampled households was in the highest quintile, while 25.73% was in the middle. The distribution of households in each wealth quintile is relatively proportional in the regional state compared to the national level, wherein the distribution is skewed towards the lowest quintile. More than one-quarter (27.30%) of the households in the country are in the lowest wealth quartile. More than half of the children in all the quintiles (except for the highest wherein 48.41%) suffer from stunted.

Table 1: Household wealth quintile distribution

Quintile	Amhara (in %)	National (in %)	Undernourished children in the region%		
			Stunted	Underweight	Wasted
Lowest	20.27	27.30	58.46	40.71	14.43
Second	22.81	18.00	54.35	37.73	12.58
Middle	25.73	18.71	55.31	38.68	12.17
Fourth	20.61	17.18	54.29	34.86	9.02
Highest	10.58	18.81	48.41	34.54	13.61
Corrugated iron house	37.64	34.21			

About 83% of the mothers in the region were illiterate, which is more than the national level (76.73%) in the four round surveys of DHS (Table 2). However, 13.43% of them were primary school graduate as to the four round survey data, which was also lower to the national level 19.72% (Table 2). The prevalence of children from the three dimensions of under-nutrition was high for households with no formal education. The proportion of stunted and underweight child from households with no formal education was the highest, which implies that the problem was severe for children from those households (Table 2). Table 2 shows that there is inverse relationship between maternal education level and child under-nutrition problem in the study area. Children from households with better education have lower prevalence to child under-nutrition problem. The stunting and underweight problems of children from mothers with primary and secondary school graduate were lower than the illiterate ones.

Table 2: Maternal educational level prevalence to child under-nutrition

Education	No Household	Percentage	Stunted (%)	Underweight (%)	Wasted (%)
Illiterate	4,453	83.26	56.22	39.08	12.19
Primary	718	13.43	52.09	34.08	13.09
Secondary	134	2.51	33.68	19.19	9.47
Higher	43	0.80	29.41	14.71	11.77

Table 3 shows that children with very large birth weight have lower probability (9.70%) of being stunted in their childhood in Amhara regional state. However, children with smaller than average and very small birth weight have 57.90% and 58.91% probability of suffering from the problem of stunting, respectively. In the same fashion, children with birth weight of smaller than average and very small have 44.51% and 47.85% probability of suffering from underweight in their childhood. Thus, it is possible generalize that the prenatal care could have strong correlation with the childhood under-nutrition in Amhara regional state of Ethiopia. Children with very small birth weight have 18.52% probability of being wasted in their childhood (Table 3).

Table 3: Birth weight and under-nutrition prevalence in Amhara region

Child birth weight	Proportion	Stunted	Underweight	Wasted
Very large	9.70	40.51	21.00	9.03
Larger than average	12.03	52.70	32.22	8.78
Average	41.18	55.14	34.89	11.13
Smaller than average	18.38	57.90	44.51	12.42
Very small	18.72	58.91	47.85	18.52

3.2 Access to infrastructure and child undernutrition

Significant proportions of the household in Amhara regional state have no access to electricity, clean drinking water and radio. The percentage of households with access to radio was larger than electricity in the regional state (Table 4). The survey data revealed that 16.96% of the households have access to listening of radio less than once in a week. Additionally, 5.55% of them have access to this facility at least once in a week, and only 3.09% of them have access to listen radio every day. About 74.4% have no any access of listening radio. As compared to the national level, households in Amhara regional state have lower access to infrastructure facilities and devices, which can be source of information about how to manage their family health and nutrition level (Table 4). It is easy to generalize, households in the regional state lag behind the national level in accessing infrastructural facilities. This lower access to facilities may be one reason for the severe child under-nutrition in the regional state.

Table 5 shows that access to radio and electricity has positive effect on reducing child under-nutrition in Amhara regional state, since the proportion of undernourished children are below half, even though the number of households with the access to those facilities are very few. More than half of the sampled households that have access to radio and electricity have lower prevalence to child under-nutrition. From households with access to radio and electricity only 48.56% and 41.35% have stunted children, respectively. Since the percentages are below half, access to those facilities has positive effect on reducing the under-nutrition problem in Amhara regional state of Ethiopia. Similarly, households with access to flush or pour flush toilet have better probability of child under-nutrition (stunting, underweight and wasted) in the regional state. It is already expected fact that households with open

deification, which means they have no clean environment, would severely suffer from child under-nutrition.

Table 4: Percentage of households with access to infrastructures

Type of facility		Percentage of households		Deviation
		Amhara regional state	National level	
Electricity		6.71	16.88	10.17
Radio		19.47	30.73	11.26
Television		1.92	8.37	6.45
Motorcycle		0.08	0.46	0.38
Toilet	Flush or pour flush	0.67	2.26	1.59
	Pit latrine	27.09	36.10	9.01
	No facility	72.23	61.64	10.59
Water	Piped water	15.27	24.15	8.88
	Dug well	21.70	19.82	-1.88
	Spring and/or river	63.02	56.01	-7.01

Table 5 also revealed that households with access to piped water have lower probability of prevalence from child under-nutrition while households who use spring and/or river water, which have higher probability of contaminated drinking water, have high probability of child under-nutrition in Amhara regional state of Ethiopia. Children from households who use spring and/or river water have 57.29% probability of suffering from under-nutrition. Table 5 has strong implication that children from households with lower access to infrastructural facilities have strong probability of suffering from under-nutrition in the regional state.

Table 5: Interaction of access to facilities and child under-nutrition

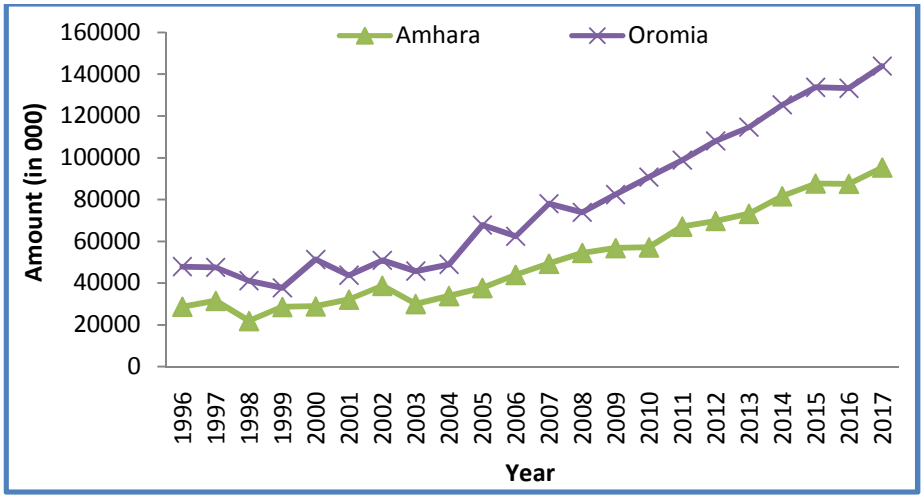
Access to facilities		Stunted	Underweight	Wasted
Radio		48.56	30.01	10.85
Electricity		41.35	21.11	8.65
Toilet	Flush or pour flush	37.93	29.03	10.35
	Pit latrine	46.78	29.62	10.96
	Open deification	58.09	40.84	12.75
Water	Piped water	43.69	28.57	12.10
	Dug well	55.94	37.82	12.33
	Spring and/or river	57.29	40.04	12.37

3.3 Crop production trend and child feed habit of the regional state

About 36.04% of the national level grain produced in the country is produced in Amhara regional state of Ethiopia (CSA, 2017), which implies that the region has immense potential and actual production capacity. However, the people especially children are suffering from continuous and persistent under-nutrition problem. Why this paradox is there?

The trend of grain crop production shows a tremendous increment in Amhara region for the last ten-production years (CSA, 2015). The increment in production was almost in double after ten later in the regional state. It increases from 43,854,714 quintal in 2006 to and 87,637,545 quintals by the year of 2015. Except Oromia regional state all the others including SNNP and Tigray regions the grain production was growing at a very low rate in the same production year. However, the child under-nutrition problem in Amhara regional state was severe compared to the other regional states of the country. Why this happen if the region is better in productivity?

Figure 3: Total grain production in the two dominant regional states of Ethiopia



Additionally, vegetables production shows an increasing trend up to the year of 2013 and it starts declining for the next two production years in all regions

of Ethiopia. Oromia and SNNP regions take a lead in vegetable production and Amhara takes the third position. Moreover, Oromia and Amhara regions are the second and the third largest fruit crop producer regional states following SNNP, which is the lead in Ethiopia. Nevertheless, more than 91.8% of the households in the regional state do feed vegetables/fruits to their children within seven consecutive days (Table 6).

Table 6 revealed 49.76% and 65.81% of the households in the regional state commonly feed their children legumes and grain crops for the whole days. The frequency of feeding meat, fish and/or egg is better than fruit and vegetables in Amhara regional state, which implies that access and awareness may be core issues for the lower diversification of feeding children in the regional state. Children of the regional state do not have access to root crops and fruits/vegetables, which may be one critical reason for the extreme under-nutrition. Table 6 also shows that more than 92% of the children do not have access to root crops/tubers followed by fruits/vegetables. It is easy to generalize about child feeding habit of the households in the regional state. Households only feed their children what they do have around, easy access. Inaccessibility may not be the critical issue for the lower diversified food to the child rather it may be awareness about benefit of diversified food for child health.

Table 6: Frequency of diversified food for children in the regional state

Type of food for 7 consecutive days	Frequency within a week							
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Fruits/vegetables	91.84	3.44	1.69	0.88	0.2	0.27	0.2	0.81
Meat, fish, egg	80.98	4.52	3.91	3.24	1.62	2.16	1.01	1.89
Legumes	34.46	1.28	2.09	2.97	2.36	3.71	2.49	49.76
Grain	27.98	0.13	0.13	1.28	1.08	1.82	1.08	65.81
Root crops/tubers	92.38	1.69	1.08	1.35	0.2	0.34	0.47	1.82
Oil/fat	69.44	2.10	1.56	2.91	1.28	1.96	1.15	18.93

3.4 Trend of Child Under-nutrition Problem in Amhara Regional State

About 55% and 38% of the sample children from the regional state were stunted and underweight, respectively (Table 7). This indicates that more than

half of the sample children from Amhara regional state were stunted. This circumstance has implication that the problem is severe in the region as compared to the others. Relatively smaller proportions of the sample children were wasted, which indicate the co-existence of stunting and underweight was low in the regional states.

Table 7: Overall proportion of undernourished children in the four dominant regions

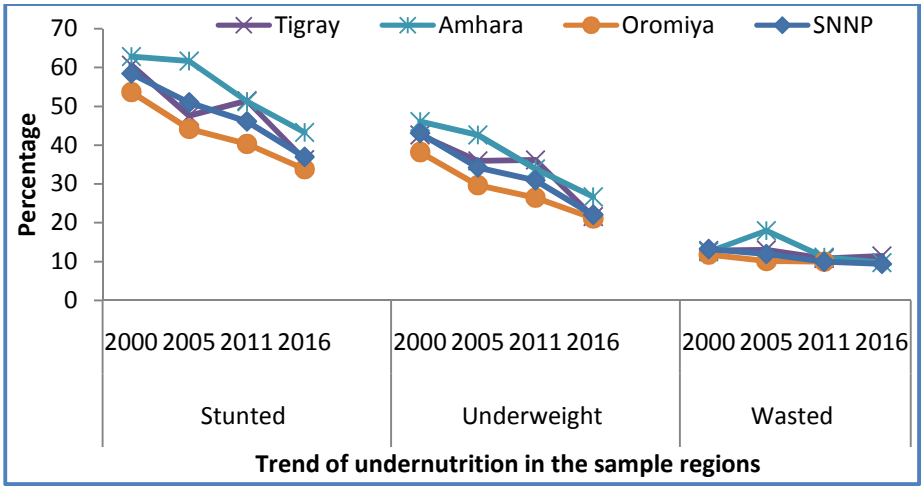
Regional state	Stunted	Underweight	Wasted
Amhara	54.86	37.69	12.24
Tigray	49.40	34.01	11.86
Oromiya	43.62	29.43	10.75
SNNP	47.80	32.62	10.14
Average	48.35	33.01	11.14

Note: *Percentage from the total sample households of the regions

Figure 2 below revealed that the three child under-nutrition problems showed continuous reduction in the four regional states from the initial to the last survey (2000) to the last (2016). The trend is smooth for Oromia and SNNP, but it exhibits oscillatory movement for Tigray. There is decreasing trend in recent survey years (2005, 2011 and 2016) in the proportion of stunted child than what it was in the initial survey year (2000). The proportion of stunted children in Amhara regional state (62.81%) was highest in 2000 followed by Tigray (60.20%) regional state (Figure 2), wherein more than half of the sampled children suffer from the problem. The proportion of children with the problem was highest in Amhara regional state for the four consecutive sample surveys 2000, 2005, 2011 and 2016. More than half (54.39%) of the sample children were stunted in 2000 while the percentage reduced to 38.76% in 2016 after 16 years, which showed 15.63% reduction. Similar circumstance exhibited in Amhara and SNNP regional states in which there was reduction by 19.52% and 22.65% in 2016, respectively from what they had in the initial survey year (2000). However, the reduction was not large, enough like the previous regions, but Oromia regional state exhibited 19.84% reduction in the percentage of stunted children from 2000 to 2016. There was relative disparity among underweight children in 2005 as compared to the situation in 2000, 2011 and 2016 for the four dominant regional states sampled in this research.

Though the trend was not sharp, but there was reduction in the proportion of underweight children from 2000 (47.04%) to 2016 (31.47%). Children from Oromia regional state had better nutritional status wherein the percentage of underweight children was lower as compared to the other regional states. Children from Amhara regional state suffer the most from the problem of underweight in 2000 and 2005 even though there was significant improvement in 2011 and 2016 after five years. The proportion was severe in Amhara regional state in 2000 (48.25%) followed by SNNP (47.11%), in which there was continuous reduction for the former region showing 21.02% reduction from 2000 to 2016. Percentage of underweight children in Oromia regional state also shows continuous reduction from the initial survey year (2000) to the last (2016). The trend was not consistent for Tigray and SNNP regional states.

Figure 2: Trend of child undernutrition in the four dominant regional states of Ethiopia



The overall percentage of wasted children showed continuous reduction from the initial survey in 2000 to the last in 2016 for the sampled regional states (Figure 2). In most of the survey years the percentage of wasted children was more than 10% in Tigray regional state. The trend of wasted children was rewarding for Oromia as compared to the other regional states wherein continuous reduction exhibited from the initial to the last survey year. This implies that, there is subsequent reduction in the prevalence to under-nutrition

problems in Ethiopia. The percentage of children with under-nutrition decreased from the first (2000) to the last survey (2016), which is a consistent result with the Global Nutrition Report (GNR) of the country in 2014. Report of the institution shows that the prevalence of stunting for children under five in 1992, 2000, 2005 and 2011, respectively were 67%, 57%, 51% and 44%[15].

3.5 Model Result and Discussion

The folowing model result shows that many of the variables considered in the regression have significant effect in affecting child undernutrition problem of the study area. Some of the demographic characterstics of the household significantly reduced the probability of suffering from child undernutrion. Increment in the age of the mother significantly reduces the probability of children undernutrition problem (stunting). The negative and significant effect of the age group 30-34, 35-39, 40-44 and 45-49 show that increment in age of the mother has postive effect of reducing child stunting in Amhara national regional state of Ethiopia. The magnitude of the coefficient for the different mother's age groupexhibited increasing trend, which implies that children from relatively more experienced mothers have better probability of being free from stunting. The covariate indicates that more experienced mothers have postive effect on reducing child undernutrition problem as compared to the youngest ones, but she must not be old enough. The model result revealed that children from younger mothers have insignificante effect on prevalence to child undernutrition problem in Amhara regional state.

Additionally, the study considered effect of child birth weight on the prevalence to child undernutrition problems in Amhar regional state. The model result shows that child birth weight has significant effect on their future fate. Children with an average or more birth weight has positive effect of reducing childhood undernutrition. Children with very large weight at birth have 77.3%, 123.6% and 76.0% probability of being free from undrnutrition problems (stunting, underweight and wasted) in their childhood as compared to those children with smaller birth weight (Table 8). The model result revealed that children with average and below birth weight have positive prevalceto stutnting in their childhood. Effect of the covariate on reducing undernutrition increases with increment in child birth weight as to the model result (Table 8).

Table 8: Logit regression model result

Explanatory variables		Stunting		Underweight		Wasted	
		Coeficient	R. Std. Err.	Coeficient	R. Std. Err.	Coeficient	R. Std. Err.
♥Age group	20-24	-0.204	0.174	0.103	0.175	0.007	0.258
	25-29	-0.223	0.177	0.241	0.178	-0.131	0.265
	30-34	-0.435**	0.199	0.192	0.200	-0.148	0.293
	35-39	-0.543**	0.221	0.129	0.222	-0.401	0.331
	40-44	-0.700**	0.253	0.301	0.252	-0.260	0.377
	45-49	-0.530*	0.296	0.033	0.299	-0.719	0.464
◙ Birth weight	Below average	-0.091	0.110	-0.210*	0.108	-0.480***	0.151
	Average	-0.136	0.097	-0.556***	0.095	-0.587***	0.132
	Above average	-0.285**	0.125	-0.696***	0.128	-0.862***	0.196
	Very large	-0.773***	0.144	-1.236***	0.161	-0.760***	0.224
♣Maternal Education	Primary	-0.087	0.101	-0.071	0.104	0.120	0.149
	Secondary	-0.599**	0.241	-0.555**	0.293	-0.090	0.395
	Higher	-0.849*	0.437	-0.610	0.516	0.312	0.595
Rural residence		-0.416*	0.235	-0.052	0.243	0.070	0.375
♦Wealth quintile	Second	-0.141	0.102	-0.060	0.103	-0.139	0.147
	Middle	-0.080	0.101	-0.001	0.102	-0.150	0.146
	Fourth	-0.017	0.108	-0.052	0.111	-0.469***	0.170
	Highest	-0.084	0.146	0.235	0.152	0.174	0.213
Age of the head		0.039*	0.021	0.008	0.023	0.004	0.037
Age^2		-0.004*	0.002	-0.001	0.003	-0.001	0.004
Access to electricity		-0.387*	0.222	-0.625**	0.237	-0.509	0.362
Access to radio		-0.168*	0.092	-0.260**	0.097	-0.103	0.144
Access to water ‡	Dug well	0.395***	0.122	0.226*	0.128	-0.037	0.186
	Spring & river	0.417***	0.112	0.258**	0.118	-0.1498	0.168
Children under 5 year	2	-0.141*	0.075	0.037	0.077	-0.034	0.116
	3	-0.126	0.138	-0.230	0.141	-0.190	0.208
	4	-1.012**	0.440	-0.414	0.488	0.077	0.557
Total children per mother		0.040*	0.024	0.025	0.024	0.066*	0.036
Constant		-0.061	0.503	-0.516	0.536	-1.441*	0.822
Pseudo R^2		0.0213		0.0332		0.0201	
Prob > χ^2		0.000		0.000		0.000	
Number of observation		3732		3856		3726	

Note: ♥ The base age group is 15-20 ◙ The base is birth weight was very small
♣ The base is illitrate ♠ The base is Tigray regional state was the base
♦ The base first quantile is the base ‡ The base is piped water
***, ** and * represent 1, 5 and 10% level of significance, respectively.

The other variable of interest in this study, metarnal education, has sigificant effect of reducing the prevalence of child stunting in Amhara region. Children from mothers who are secondary school graduate have better probability of being free from child stunting and underweight problems. There would be 59.9% and 55.5% probability of being free from stunting, and underweight problems, respectively if the child is from a secondary school graduate mother as compared to the illitrate ones (Table 8). In the same fashion children from mothers who are higher school graduate have strong probability of being free from stunting problem in study area. The coefficient of the varaibles under maternal education increase with the education level, which implies that increment in mother education level have significant effect of reducing child undernutrion especially stutnting. Children from high school graduate mothers have strong probability of being free from children undernutrition as compared to the others with lower education level. These all implies that increment in educational attainment of mothers would be one solution to reduce the serious problem of the regional state, child undernutrition.

Households head age has significant effect of reducing the prevalence to child under-nutrition in the regional state as to the model result (Table 8). The younger the household the postive and siginificant effect of increasing the prevalence of children to stunting problem. The model result revealed that households headed by older individulas do have better child nutritional stutes compared to younger ones. This circumstance may be due to experience in managing the household properly and fulfilling all the required by the family.

Additionally, the regression consider access to infrustractures to examine their effect on child under-nutrition in Amhara regional state. Household's access to both electricity, radio and clean drinking water have significant effect of reduce the child prevalence to stunting and underweight. This situation implies that enhacing access to electricity and radio may improve households' awareness about well management of the family, which would finally reduce child under-nutrition. In connection to this, households with no access to piped water do strong prevalence child stunting and undeweight. Children from households who use dug well, and spring and river for drinking have strong prevalence to stunting and underweight as compared to those with access to clean drinking water source, piped water.

4. Conclusions and Recommendations

4.1 Conclusions

Households in Amhara regional state have proportional wealth distribution and better crop productivity compared to the other regional states of the country.

More than 78% of the children in the regional state have average and below birth-weight, which result in significant prevalence to child under-nutrition problem.

Majority of the households have lower access to electricity, clean drinking water and radio.

There is tangible paradox between crop productivity and child under-nutrition problem for smallholders in the regional state.

Children from the regional state have larger prevalence from under-nutrition compared to other regional states in each survey years. Child stunting problem is most common and severe compared to underweight and wasted among in Amhara region, which is the second most populous regional state in the country.

Experience in motherhood and household headinghave significant effect of reducing prevalence to child stunting problem in the study area.

Maternal education has significant effect of reducing child stunting and underweight problems in the regional state. Increasing mothers' education level has positive and significant effect on reducing prevalence of child under-nutrition.

The child birth-weight has significant effect of reducing the probability of childhood under-nutrition in Amhara regional state. The prenatal care has significant effect of reducing the child under-nutrition problem in their childhood.

Access to infrastructural facilities such as electricity, radio and clean drinking water has significant effect in reducing child prevalence to under-nutrition problems in the regional state.

The study finally concluded that awareness and access to facilities are critical issues than household wealth in reducing child under-nutrition in Amhara regional state of Ethiopia.

4.2 Recommendations

Infrastructural accessibility and awareness should be enhanced to improve the child under-nutrition problems from the regional state.

Smallholders should get all the necessary mechanisms that enhance information about how to diversify child food sources that would reduce prevalence of under-nutrition.

Experiences and learning by doing should be shared by youngsters to reduce the prevalence of child undernutrition problems in Amhara regional state.

The maternal education coverage should be expanded to reduce prevalence to child under-nutrition problems in the regional state.

The concerned party should work hard not only on the post-natal care, but also on prenatal to reduce prevalence of childhood under-nutrition in Amhara regional state.

Attention should be given to enhance awareness and enhance access to infrastructural facilities that directly and indirectly improve smallholders' knowhow about household management.

Finally, the study recommended that to achieve sustainable human and economic growth of the region, special attention must be given to maternal education, early stages of life (both prenatal and post-natal care), and accessing infrastructural facilities like electricity, communication devices, clean drinking water and hygiene to smallholders.

Limitation of the Study

The study was based on secondary data from the World Bank, but not from primary data about extent of the problem based on laboratory work from hospitals and clinics. Thus, this may be technical limitation of this study.

Funding

Since the research was based on secondary data collected by the World Bank from the different regions of the country, then it had not research fund spent for it.

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Measuring the Economic Values of Protected Forests in Amhara Region of Ethiopia: The Case of Alemsaga Protected Forest

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Abstract

This study analyses the economic value of Alemsaga protected forest in Amhara region of Ethiopia by eliciting households' willingness to pay (WTP) by using contingent valuation method in the form of double bounded dichotomous choice model followed by an open-ended question. A total of 350 sample households were selected using a multi-stage sampling technique, and structured and pre-tested questionnaires were used to collect data from the sample households. Recursive bivariate probit econometric models were applied to determine the factors affecting WTP for forest conservation. The estimated result revealed that the majority of the local communities are willing to protect the forest resources. The Recursive bivariate probit estimated result shows that the annual per household WTP for conservation is about 58.83 ETB and the aggregate WTP for the conservation of Alemsaga protected forests was estimated to be 5, 657, 563.46 ETB per annum. The findings of this study calls for the integration of the surrounding rural community for the sustainable and long lasting conservation and management of Almsaga protected forests in Amhara region and in Ethiopian at large.

Key words: Forest, Contingent Valuation, Willingness to Pay (WTP), Alemsaga

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1. Introduction

Forest resources are recognized to have a number of values, timber and non-timber forest products (Adger et al, 1994). In addition, forests provide many services to humans in terms of climate regulation, air purification, recreation and tourism, fresh water supply, soil protection; (Quintano and Barredo, 2015); maintenance of biological diversity, environmental protection, broader life support functions and so many (Pearce, 1996).

Ethiopia is among those countries known for their rich biodiversity and natural resource. The country is known for its diversified and unique flora and fauna, but losing its environmental assets at an alarming rate (Zewdu and Yemesrach, 2003).Deforestation and habitat fragmentation due to the conversion of forests to other agricultural land use types and over utilization of forest resources to satisfy the food and energy requirements of the increasing population are major environmental concerns in Ethiopia (Paul *et al*., 2011). Amhara region has also wide biodiversity composition of flora and fauna species. However, due to high population and livestock pressure, long use agriculture, etc are causing significant depletion of forest resources, which results in high rate of soil erosion, loss of soil fertility and degradation of water resources (BOA, 2012).

Alemsaga forest, which is one of the few remaining forests in Amhara region, has received long years of attention and protection, which goes back to the 1978 (Getinet, Teshome and Ensermu, 2015). It has providing numerous economic, social and environmental benefits to the rural community. Despite these realities, reports indicated that, Alemsaga forest is highly subjected to exploitation by local community around the forest (Organization for Rehabilitation and Development in Amhara [ORDA], 2011). Due to high population pressure and the increasing demand for agricultural land, the forest resource is on the verge of complete depletion. Encroachment of forestland and illegal cutting of trees are rampant and consequently the most valuable indigenous tree species as well as wild animals are becoming severely affected in the area.

ORDA (2011) also stated that Alemsag forest, invariably, is under extreme pressure from land use conversion for farming and grazing, excessive extraction, and neglect in terms of forest management and protection. This might be due to the negligence of the surrounding community and other stakeholders during the establishment of Alemsaga forest as a protected area. The decision made on the protected areas do not give due consideration to the interests of stakeholders, especially communities who are dependent on the local resources. To alleviate such losses, generation of scientific knowledge through the studies of economic valuation of forest resources could be one of the intervention mechanisms to contribute towards the conservation of forest resources and the associated biodiversity. Therefore, in view of the need to develop more effective approaches to conservation and sustainable utilization of the forest resources, an investigation of the economic value of forest is required.

2. Motivations of the Study

Policymakers receive a large number of indicators on the economic benefits generated by various sector of an economy. But these indicators are problematic on several grounds (Pagiola *et al,* 2004): First, they are *incomplete* in that many ecosystem benefits go completely un-measured; second, they often *mis-attribute* ecosystem benefits to other sectors (this is particularly true of indirect use values: the water regulation benefits of wetlands, for example, do not appear as benefits of wetlands but as higher profits in water using sectors). In the last, they are often *misleading* in that certain benefits may appear exaggeratedly high while others do not appear at all. As a result, existing indicators tend to vastly undervalue the benefits provided by natural ecosystems; economic valuation can help to develop better indicators that provide a more accurate picture of how ecosystems, individually and collectively, contribute to the economic welfare of society.

Protected areas are typically a low priority in macroeconomic and sectoral decision-making. Allocation of government budgets is biased towards sectors and economic activities that make a demonstrable contribution to national income, output and employment. Because protected areas are seen as having

little economic or development value, and generate few obvious financial benefits or public revenues, they receive low budget allocations from central government, and low investment in the human resources, capital and infrastructure necessary to maintain them. At worst, macroeconomic and sectoral economic policies can harm protected areas through promoting more "valuable," yet environmentally unsustainable, uses of land and natural resources (Ritter, 2005). Undervaluation of these welfare enhancing services introduces inherent distortions to efficient resource allocation. Failure to account for; the numerous functions and economic uses of forests have led to patterns of global forest use with many detrimental environmental consequences (Adger et al, 1994). Therefore, management of environment and natural resources is one of the most important inputs for sustainable economic development (Abdul, 2005). In order to effectively manage a country's or region's use of its natural resources decision makers may attempt to take in to account the values for all aspects of the natural resources and understand how those values interrelate (Solomon, 2003).

In general the application of economic valuation in developing countries is clearly in its infancy. Many developing countries have informal or subsistence economies, in which people may have little or no experience of dealing with money. The consequence of this is that they would find it extremely difficult to place a monetary value on a complex environmental good (Pascual *et al*, 2010). Some research works have been done in Ethiopia by using contingent valuation methodology (Habtamu, 2009; Befikadu *et al* 2008) and there is too few research on valuing the multipurpose urban forests and community forest, and national parks in Ethiopia (Tilahun, *et al.*, 2011; Carlsson, Köhlin, and Alemu, 2004; Solomon, 2003 and Zewdu and Yemesrach, 2003). However, based on our own literature review, no study has ascertained the willingness of the rural population to pay for systematic management of protected forest in Ethiopia. In addition, the flora, vegetation and the inherent treats of Alemsag forest was studied by ORDA (2011). But, there has been no study carried out on the economic values of Alemsaga forest. This has become a serious handicap to the management and rational utilization of the forest resources of the area. Therefore, valuation of use and non-use benefits of this forest resource is urgent to tackle the problems associated with it and to bring sustainable ways of conserving the forest.

3. Objectives of the Study

The overall objective of this study is to measure the economic value of Alemsag protected forest.

The specific objectives of the study are:
To estimate the willingness to pay of the rural households for the conservation of Alemsag protected forest.
To identify the factors that affect communities' willingness to pay.
To develop the ways of integrating the rural community in the conservation of the Alemsaga protected forest.

4. Related Literature Review

4.1 The Concept of Economic Value

Value is a cultural concept, and is related to how human beings perceive things. Something has a value if it contributes to the welfare of someone, and it has more value as it contributes more to welfare. Therefore, "value" does not exist unrelated to people. Things do not have value *per se*. (Riera, 2000). An economic value is the worth a product or service has (Gardei, 2006).

Valuation can simply be defined "*as an attempt to put monetary values or to environmental goods and services or natural resources"*. It is a key exercise in economic analysis and its results provide important information about values of environmental goods and services. This information can be used to influence decisions about wise use and conservation of forests and other ecosystems (Diafas *et al*, 2005).

4.2 The Rationale for Economic Valuation of Ecosystem Services

An integrated approach across all sectors is required such that the natural environment is fundamental to decision-making rather than simply being viewed as a necessary trade-off for economic development and growth. Underpinning these frameworks is the need for a combined scientific and economic evidence base that supports understanding of the linkages between

biodiversity, the structure and function of ecosystems and the consequent contributions to social wellbeing. It is recommended that understanding of the full range of values that are derived from the provision of ecosystem services is a vital component of the evidence base that should inform national and local decision-making (eftec, 2011).

Valuing non-market functions and services of the environment ecosystem services and incorporating those values into decision-making processes has many advantages (Mansouri *et al*, 2014).Some of the benefits are; first, valuing ecosystem services can help in evaluating the impacts of development policies and policy interventions that alter the condition of an ecosystem and consequently in human well-being. Second, it can serve to compare the real cost-effectiveness of an investment or project. Third, it can have the benefits of evaluating trade-offs between different ecosystem management options and choosing between competing uses, e.g. of land use. Fourth, valuation helps in assessing liability for damage to the environment and creating markets for ecosystem services in order to mobilize financial resources, e.g., global carbon market and payments for ecosystem services. Fifth, valuation benefits in awareness building and communication to the public on the overall contribution of ecosystem services to social and economic well-being (GIZ, 2012). Finally, it is also used for determining damages for loss of biodiversity, limiting or banning trade in endangered species; choosing economic instruments for saving biodiversity (e.g. taxes, subsidies) (Diafas *et al*, 2005).

4.3 Total Economic Value of Forestry Resources

Within the neoclassical economic paradigm, ecosystem services that are delivered and consumed in the absence of market transactions can be viewed as a form of positive externalities. Framing this as a market failure, the environmental economics literature has developed since the early 1960s a range of methods to value these “invisible” benefits from ecosystems, often with the aim of incorporating them into extended cost-benefit analysis and internalizing the externalities. In order to comprehensively capture the economic value of the environment, different types of economic values neglected by markets have been identified, and measurements methods have been progressively refined. In fact, valuation of non-marketed environmental

goods and services is associated with a large and still expanding literature in environmental economics (Pascual *et al,* 2010).

The commonly used tool for assessing the overall economic value of an ecosystem service is the Total Economic Value (TEV) framework. It is a framework for organizing different types of value that people might associate with an ecosystem service. The framework comprises use and non-use values. Use values are further broken into direct use, indirect use and option values (GIZ, 2012).

Direct use values of forests relate to goods and services that are used directly by human beings. They include the value of *consumptive uses* such as harvesting of food products, timber for fuel or construction, and medicinal products and hunting of animals for consumption; and the value of *non-consumptive uses* that do not require harvesting of products such as opportunities for recreation, aesthetic beauty, science, and education. Direct use values are most often enjoyed by people visiting or residing in the ecosystem itself (Pagiola *et al,* 2004; Pascual *et al,* 2010; GIZ, 2012; Nahuelhual *et al,* 2006).

Indirect use value is associated with benefits that individuals experience indirectly, or as a consequence of the primary function of a given resource which can be seen as public services which are generally not reflected in market transactions (Pascual *et al,* 2010; Torras, 1999). For example, the forest's ability to sequester carbon from the atmosphere yields positive externalities by helping to regulate the global climate; forests are an effective defense against soil erosion, consequences of which include reduced soil fertility and downstream siltation; the storm protection function of coastal mangrove forests, which benefits coastal properties and infrastructure and drinkable water production and hydroelectricity generation (Torras, 1999; Pagiola *et al,* 2004; GIZ, 2012; Nahuelhual *et al,* 2006).

Option values is values reflecting a willingness to pay to conserve the option of making use of the forest even though no current use is made of it (GIZ, 2012). Option values refer to all use values (both direct and indirect) that can be realized at some point in the future. The definition adopted here is limited

to uncertain benefits, i.e. already-ascertained benefits merely postponed for future use (such as in the case of commercial timber) are not considered (Torras, 1999). Option values estimate the price that people are willing to pay for an un-utilized asset, simply to avoid the risk of not having it available in the future (GIZ, 2012).

Non-use values typically refer to existence and bequest value. These values reflect a willingness to pay for the forest in a conserved or sustainable use state; but the willingness to pay is unrelated to the current or planned use of the forest (GIZ, 2012).It is simply refers to the enjoyment people may experience simply by knowing that a resource exists even if they never expect to use that resource directly themselves (Pagiola *et al*, 2004).

Existence value arises from the satisfaction of merely knowing that ecosystems and their services continue to exist, even if the person will never visit or use it (GIZ, 2012). Existence value is without a doubt the most elusive among the types of value noted (Torras, 1999). *Bequest value* is associated with the knowledge that the natural environment will be passed on to future generations (GIZ, 2012).Surveys are used to estimate non-use or existence values, such as consumers' stated WTP for the conservation of endangered species or remote ecosystems which they themselves do not use or experience directly (Pagiola *et al*, 2004).

4.4 Non Market Valuation Techniques

A variety of economic valuation approaches have been developed that aim to quantify all or parts of the TEV of an ecosystem service. The choice of valuation method generally depends on the type of service, availability of resources, time and data for the study as well as its purpose (GIZ, 2012). Valuation results will be also heavily dependent on social, cultural and economic contexts, the boundaries of which may not overlap with the delineation of the relevant ecological system (Pascual *et al*, 2010).Broadly there are two ways of estimating the economic value of non- marketed goods- revealed preference and the stated preference techniques (Abdul, 2005; Mullan, 2014).

4.4.1 Revealed Preference Approaches

Revealed-preference methods infer the values held by individuals for non-market goods based on observations of their choices in other existing markets (Mullan, 2014; Pascual *et al,* 2010), that are related to the ecosystem service that is subject of valuation. In this case it is said that economic agents "reveal" their preferences through their choices. The two main methods within this approach are:

Travel cost method (TC), which is mostly relevant for determining recreational values related to biodiversity and ecosystem services. It is based on the rationale that recreational experiences are associated with a cost (direct expenses and opportunity costs of time) (Pascual et al, 2010). In travel cost method, the cost of enjoying the environmental amenity is used as a proxy to value it (Abdul, 2005).

The hedonic pricing (HP) approach utilizes information about the implicit demand for an environmental attribute of marketed commodities (Pascual et al, 2010). It use regression analysis to estimate how prices of market goods vary as environmental attributes associated with those market goods vary (Mullan, 2014).For instance, houses or property in general consist of several attributes, some of which are environmental in nature, such as the proximity of a house to a forest or whether it has a view on a nice landscape. Hence, the value of a change in biodiversity or ecosystem services will be reflected in the change in the value of property (either built-up or land that is in a (semi-) natural state). By estimating a demand function for property, the analyst can infer the value of a change in the non-marketed environmental benefits generated by the environmental good (Pascual et al, 2010).

4.4.2 Stated Preference Approaches

Stated-preference methods estimate values using responses to questions about hypothetical markets or scenarios (Mullan, 2014). Stated preference approaches simulate a market and demand for ecosystem services by means of surveys on hypothetical (policy-induced) changes in the provision of ecosystem services (Pascual et al, 2010). Stated preference methods can be

used to estimate both use and non-use values of ecosystems. The main types of stated preference techniques are:

Contingent valuation method (CVM): Contingent valuation (CV) has become one of the most widely used non-market valuation techniques. CV's prominence is due to its flexibility and ability to estimate total value, including passive use value (Carson, Flores and Meade, 2000).

The method uses questionnaires to ask people how much they would be willing to pay to increase or enhance the provision of an ecosystem service, or alternatively, how much they would be willing to accept for its loss or degradation (Pascual *et al*, 2010). The question may be open-ended, or presented as a choice of whether or not to pay a fixed amount. The environmental resource is described in detail, along with a payment mechanism such as a tax increase or donation to pay for its protection (Mullan, 2014).

Choice modeling (CM): Under this approach individuals are faced with two or more alternatives with shared attributes of the services to be valued, but with different levels of attribute (one of the attributes being the money people would have to pay for the service) (Pascual *et al*, 2010). In a CM study, respondents within the survey are given a choice between several options, each consisting of various attributes, one of which is either a price or subsidy. Respondents are then asked to consider all the options by balancing (trading off) the various attributes (Pascual *et al*, 2010).

4.5 Theoretical Framework of Contingent Valuation Approach

CVM is defined as a technique used for the valuation of nonmarket resources and in fact the commonly used technique for valuing both the use value and non-use values/passive values of the environment. CVM is a survey based method, where people are asked directly how much money they would be willing to pay (or willing to accept) to maintain the existence of (or be compensated for loss of) some environmental feature such as biodiversity. The technique is called contingent valuation method (CVM) because people are asked to state their willingness to pay, contingent on specific hypothetical

scenario and description of the environmental service (Abdul, 2005).This method uses a survey to determine the willingness to pay (WTP) for a particular environmental good or willingness to accept compensation (WTA) for a loss of a particular environmental or public good. It provides a direct method of measuring the value of natural resources without resorting to the market-valuation method (Chukwuone and Okorji, 2008).

Contingent valuation does have its peculiar advantages as compared to the other valuation techniques. First, it is analytically much simpler. Second, if the goal of the study is to produce a single valuation estimate for a program, then it is more appropriate than choice modeling. Third, it is generally easier to use for valuing particularly complicated goods (choice modeling requires that goods be separated into attributes and that levels be assigned to each of these attributes; this is often quite difficult). Fourth, there is empirical evidence that suggests contingent valuation produces valuation estimates that are either equal to or more conservative those from choice modeling. Thus, there are a number of good reasons to consider using contingent valuation if it is appropriate for the valuation task at hand (Morrison, 2009).

5. Research Methodology

5.1 Description of the Study Area

Alemsaga forest is found at the border point of Farta and Fogera districts with area coverage of about 548 hectares. Within Alemsaga forest, more than 21 forest species and many kind of wild animal species are found (ORDA, 2011). The area is protected starting from 1978 with the objectives of providing seed source, conserving the remnant natural forests and rehabilitating the degraded area. The forest has elevation range between 2202 - 2426 meters above sea level and located at $11^{o}54'$-$11^{o}56'$N and $037^{o}55'$- $037^{o}57'$E. The mean annual temperature of the forest is between 15 ^{0}C and 30 ^{0}C, while average annual rainfall is ranges from1300 mms - 1800 mms (Getinet, *et al*, 2015, ORDA, 2011).

5.2 Sampling Techniques and Sample Size

The National Oceanic and Atmospheric Administration (NOAA) panels argued that probability sampling is essential for a survey used for damage assessment *(*Arrow *et al*, 1993). Thus, to draw representative samples, households living around the forest area were selected by simple random sampling technique.

In practice, most CVM studies choose the largest sample size possible given the available budget. Selection of a sample size is a matter of choosing an acceptable level of precision (Mitchell and Carson, 1989). Sample size selection also involves consideration of the expected response rate; the expected item non response to the contingent valuation question and other covariates that will be used to analyze contingent valuation responses (Boyle, 2003). Equivalently, it is also good to know that as the sample size increases too much non-sampling errors become higher (Abdul, 2005). By considering the explained justifications, in this study, a total of 350 households were selected being as a representative sample.

5.3 Questionnaire Design and Value Elicitation Format

5.3.1 Questionnaire Design

The data source for contingent valuation method is the direct responses given by individuals and questionnaires are the main tool for data collection (Abdul, 2005). The NOAA panel recommend that besides to the willingness to pay questionnaires the survey should include a variety of other questions(Arrow *et al*, 1993) like income, age, prior knowledge of the site, prior interest in the site (visitation rates), attitudes toward the environment, attitudes toward big business, distance to the site, belief in the scenarios etc.

5.3.2 Value Elicitation Format

Within the contingent valuation literature, a variety of response formats have been used to identify respondents' willingness to pay (Welsh and Poe, 1998). One of the earliest approaches was open-ended questions, where respondents are asked 'What is the highest amount you would pay for program X?'

Another approach is the use of payment cards where respondents circle the highest amount they would be prepared to pay from a list of payment amounts. A third commonly used approach is dichotomous choice questions framed as referendum votes in which the sample is split into sub-samples, each with a different cost or bid. For each sub-sample, the percentage of people voting in favor is calculated, and these data are used to calculate mean willingness to pay (Morrison, 2009). Theoretically, the referendum format (dichotomous choice) has the best properties and is the approach recommended by the NOAA panel (Arrow *et al.* 1993). This approach has become the presumptive method of elicitation for CV practitioners. The other methods have been shown to suffer from incentive compatibility problems in which survey respondents can influence potential outcomes by revealing values other than their true willingness to pay (Haab and McConnel, 2002).

5.4 Preliminary Survey and Selection of Bid Vectors

Choosing the offered bid prices can improve the efficiency of dichotomous choice parameter and welfare estimates. In order to choose the appropriate bids, some information is needed about the distribution of bids prior to the main survey, which can be obtained through a pre-test survey of 50 to 100 observations or focus group discussion (Morrison, 2009). Accordingly, here in this study, to determine the starting bid vectors which bring efficiency of estimates and to test the reliability and consistency of the questionnaire, a pre-test pilot survey was conducting among 50 randomly selected households.

The information generated from the pre- test survey shows that, the range of response varied between birr 0 and 130. Based on the pilot results, the starting bid vectors for WTP were 5, 15, 25, 30, 45 and 55 birr per year. Consequently, for the final survey six bid amounts were selected and used as initial values. By using these initial bid vectors, set of follow-up bid prices were determined by doubling and halving the initial bid amount.

5.5 Methods of Data Analysis

5.5.1 Modeling Framework

The basic model for analyzing dichotomous CV responses is the random utility model (Haab and McConnel, 2002). In the random utility model, the

observed discrete choice response of each individual is assumed to reflect a utility maximization process. Let us assume that, the representative household gains utility from the conservation of Alemsaga protected forests and the two possible levels of environmental quality involved are the status quo $q^0$and a specific level of improvement, q^1. Hence, each household's utility function at status quo (no conservation) is:

$$U_{0i} = U(y_i, z_i, q^0, \varepsilon_{0i}) \quad \textbf{3.1}$$

Each household's utility function with conservation is:

$$U_{1i} = U(y_i, z_i, q^1, \varepsilon_{1i}) \quad \textbf{3.2}$$

By combining equation 3.1 and 3.2, we can find:

$$U_{ji} = U_j(y_i, z_i, q^i, \varepsilon_{ji}) \quad \textbf{3.4}$$

where j = 0; 1 refers to the two different states of the environment; i = 1,2,…, n refers to individual households; $U_{0i}$and U_{1i} represents indirect utilities at the status quo and the hypothetical improved scenario respectively; $y_i$is the i^{th} individual household consumer discretionary income; $z_i$represents a vector of household socioeconomic, demographic, environmental, and design variables (initial bid levels) etc ; q^irefers to the quality of the forest being valued and ε_{ji}represents other variables known to the utility maximizer, but not observed by the researcher and assumed to be identically and independently distributed with a mean of zero.

Note that when the quality of environmental good q changes from $q^0$to q^1 (as the result of a change in policy), the household's utility also changes from $U_{0i} = U(y_i, z_i, q^0, \varepsilon_{0i})$ to $U_{1i} = U(y_i, z_i, q^1, \varepsilon_{1i})$. Here $q_1 > q_0$which shows the fact that the proposed scenario/conservation of forests has a higher non market benefit than the status quo. Economic theories argued that the objective of a rational consumer is maximization of utility given budget constraints. Utility is assumed to arise from income, the absence of conservation and other socio-economic and demographic factors. If the household accept the offered bid its income is reduced by the bid amount (Hanemann, 1984). Therefore, the

condition that utility maximize individual *i* answers yes to the offered bid t_i is given by:

$$U(y_i - t_i, z_i, q^1, \varepsilon_{1i}) > U(y_i, z_i, q^0, \varepsilon_{0i}) \quad \text{- - - - - - - - - - - - - } \mathbf{3.5}$$

However, because we typically do not know the random preferences and can only make probability statements about yes or no responses. The probability of a yes response is the probability that the respondent thinks that he is better off in the proposed scenario, even with the required payment, so that $U_1 > U_0$ (i.e., the utility maximizer is better at q^1, even with the required payment t_i.
For individual i, the probability of answering yes for utility maximizer *i* is given by:

$$Pr(yes) = Pr(U(y_i - t_i, z_i, q^1, \varepsilon_{1i}) > U(y_i, z_i, q^0, \varepsilon_{0i})) \quad \text{- - - - - } \mathbf{3.6}$$

According to Haab and McConnel, (2002), for parametric estimation of the above model, two modeling decisions are needed. First, we need to choose a functional form for $U(y_i - t_i, z_i, q^1, \varepsilon_{1i})$. Second, distribution of the error term ε_{ji} must be specified. Generally, most applied empirical research, whether it employs a random WTP model (Cameron and James 1987) or a utility differential model (Hanemann, 1984), begins specification by assuming a utility function that is additively separable in systematic and stochastic components of preferences:

$$U_j(y_i, z_i, \varepsilon_{ji}) = V_j(y_i, z_i) + \varepsilon_{ji} \quad \text{- - - - - - - - - - - - - - - - - - - } \mathbf{3.7}$$

Given the specification in equation (3.7), the probability of utility maximizer *i* giving a positive response to the valuation question become:

$$\begin{aligned} \Pr(\text{yes}) &= \Pr(v_1(y_i - t_i, z_i, q^1) + \varepsilon_{1i} > v_0(y_i, z_i, q^0) +, \varepsilon_{0i}) \\ &= Pr(v_1(y_i - t_i, z_i, q^1) - v_0(y_i, z_i, q^0) > \varepsilon_{0i} - \varepsilon_{1i} \quad \text{- - - - - - } \mathbf{3.8} \end{aligned}$$

Note that the probability of the utility maximizer *i* giving a negative response (i.e., rejects the improvement) is given by:

$$pr\ no = 1 - pr\ yes \quad ---------- \quad 3.9$$

This equation is still too general for parametric estimation. However, when the systematic component of the preference function is assumed to be linear in income and other covariates, the model can be simplified as:

$$v_{ij}(yi) = \alpha z_i + \beta(y_i) \quad ---------- \quad 3.10$$

Where $y_i$represents the individual consumer's discretionary income; $z_i$represents an *m*-vector of household socioeconomic, demographic, environmental, and design variables; and $\alpha$is an *m*-dimensional vector of parameters. For the new scenario, in which the dichotomous choice question will require a yes or no response to some offered bid price t_i, the probability that respondent *i* will answer yes to the valuation question is given by:

$$P(yes) = Pr(\alpha z_i + \beta t_i + \varepsilon_{ji} > 0) \quad ---------- \quad 3.11$$

To estimate equation (3.11), we assume that the error term is normally, independently, and identically distributed with mean zero and variance 1 (Haab and McConnel, 2002).

If we assume that $\eta = \varepsilon_{0i} - \varepsilon_{1i}$and that $F_\eta(\ )$ is the cumulative distribution function of η, then the probability that the household is willing to pay for the conservation of Alemsaga protected forest is given by:

$$Pr(\text{yes}) = F_\eta\ \Delta V \quad ---------- \quad 3.12$$
$$Pr(no) = 1\text{-}F_\eta(\Delta V)$$

Where $\Delta V = (v_1(y_i - B_i, z_i, q^1) - v_0(y_i, z_i, q^0)$
Note the main purpose of the analysis is to estimate WTP and drive a WTP function from the assumed utility function. Assuming that $W_i^*$is the household's unobservable actual WTP for the conservation of Alemsaga protected forests, then:

$$W_i^* = \alpha z_i + \beta(y_i)$$

$$\alpha_0 z_i + \beta(y_i + \varepsilon_{0i} = \alpha_1 z_i + \beta(y_i - t_i + \varepsilon_{1i}$$
$$= \alpha_1 z_i + \beta(y_i - WTP_i + \eta_i \quad \text{----------} \quad \mathbf{3.13}$$

By solving equation (3.13), household *i*'s WTP can be expressed as:

$$WTP_i = \frac{\alpha z_i + \eta_i}{\beta} \quad \text{----------} \quad \mathbf{3.14}$$

In the probit model, F_η (…) is the normal cumulative distribution function. As define it above, the unobservable individual visitor's actual WTP for improved conservation service is W_i, with linear relation to the initial bid $t_i$and the covariates, and the actual WTP for an individual can be presented as:

$$WTP_i = 1 \; if \; WTP_i > W_i \text{ and } WTP_i = 0 \text{ if } WTP_i < W_i \quad \text{------} \quad \mathbf{3.15}$$

With dichotomous choice contingent valuation, the i^{th} household (utility maximizer) is asked if it would be willing to pay the initial bid (t_i) to get a given improvement in conservation of the forests (both quality and quantity). The probability of yes or no response can be presented as:

$$Pr \; yes \; to \; t_i = pr \; W_i \geq t_i \; and \; Pr(no \; to \; t_i) = pr(W_i < t_i) \quad \mathbf{3.16}$$

Having the above theoretical background of the model, we can specify the empirical model for SBDC and DBDC in the following section.

5.5.2 Econometric Models

The dichotomous choice contingent valuation method (DC-CVM) is increasingly used as a method to value nonmarket goods (Calia and Strazzera, 1998) because of its simplicity of use in data collection. This procedure is certainly easier for respondents than other methods requiring long adjustment processes, like the bidding game; or a precise assessment of the individual's own reservation price based on introspective analysis, as it happens in the open ended elicitation method (Calia and Strazzera, 1998). The dichotomous choice contingent valuation method is used in two variants: the single bound, if only one question is posed to each individual; and the double bound, where

a second bid is offered, higher than the first if the answer was positive, and lower otherwise.

5.5.2.1 Single-Bounded Model

In the single-bound dichotomous choice CVM, only one dichotomous choice question is asked, and the dollar amount is treated as a threshold. If the good is valued more highly than the threshold dollar amount, the person answers "yes" otherwise "no" (Hanemann, Loomis, and Kanninen, 1991). In this model the interval is bounded by the bid and the limit of the WTP distribution (the upper limit if the answer was positive, the lower limit otherwise (Calia and Strazzera, 1998).

For this study we assumed normality of the error terms with homoscedastic variance, for the single bounded dichotomous contingent valuation, we used probit model. Therefore, following Cameron and Quiggin (1994), the probit model was specified as:

$$y_i^{*} = x_i'\beta + \varepsilon_i \quad \text{---------- 3.17}$$

$$y_i = 1, if\ y_i^{*} > t_i$$

$$y_i = 0, if\ y_i^{*} < t_i$$

Where, β = vector of unknown parameters of the model

x_i= vector of explanatory variables

y_i^{*}= unobservable households' actual WTP for the conservation of protected forests.

y_i= discrete response of the respondents for the WTP

t_i = the offered initial bids assigned arbitrarily to the ith respondents

ε_i= unobservable random component distributed (NIID 0, σ)

The log likelihood function of single bounded survey response is:

$$lnL\ \theta = \sum_{i=1}^{N} d_i^{Y} ln\Pi^{Y}\ t_i + d_i^{N} ln\Pi^{Y}\ t_i$$

$$= \sum_{i=1}^{N} d_i^{Y} lnG\ t_i, \theta + d_i^{N} ln\ 1 - G\ t_i, \theta \quad \text{---------- 3.18}$$

Where d_i^{Y} = 1, if ith response yes and 0 otherwise, d_i^{N} = 1 if ith response no and 0 otherwise.

$G\ t_i, \theta$ and *1-G* t_i, θ are the cumulative distribution function for the probability of yes and no responses; and θ represents the vector of parameters that index the distribution of WTP. Therefore, Maximum likelihood (ML) estimates of the parameters can be obtained by maximizing equation 3.18.

5.5.2.2 Double-Bounded Models

Carson, Hanemann, and Mitchell (1986) had developed double bounded dichotomous choice model. They advocate introducing a second offered threshold in a "follow-up" dichotomous choice CV question which elicits a second discrete response. The double bound dichotomous choice model bases on the two observed dichotomous variables that are the first bid price answer and following follow up question. In this model, given two bid prices, the level of the second bid is contingent upon the response to the first bid (Hanemann, *et al,* 1991). If the individual responds "yes" to the first bid (T_i), the second bid (to be denoted T_i^u) is some amount greater than the first bid ($T_i<T_i^u$); if the individual responds "no" to the first bid, the second bid (T_i^L) is some amount smaller than the first bid ($T_i^L< T_i$).

Thus, there are four possible outcomes: (a) both answers are "yes"; (b) both answers are "no"; (c) a "yes" followed by a "no"; and (d) a "no" followed by a "yes." The likelihoods these outcomes are π^{YY}, π^{NN}, π^{YN} *and* π^{NY} respectively.

Under the assumption of a utility- maximizing respondent, the formulas for these likelihoods are as follows:

In the first case, we have $T_i^u > T_i$

$$\pi^{YY}\ T_i, T_i^u = pr\ T_i \leq \text{maxWTP and } T_i^u \leq \text{maxWTP}$$
$$= \text{pr}\ T_i \leq \text{maxWTP} / T_i^u \leq \text{maxWTP}\ \square \text{pr}\ T_i^u \leq \text{maxWTP}$$
$$= \text{pr}\ T_i^u \leq \text{maxWTP} = 1 - G\ T_i^u, \theta \quad - - - - - - - - (3.19)$$

since $T_i^u > T_i$, pr $T_i \leq$ maxWTP $|T_i^u \leq$ maxWTP $= 1$.

Similarly, with $T_i^u < T_i$, pr $T_i \leq$ maxWTP $|T_i^u \leq$ maxWTP $= 1$

$$\pi^{NN}\ T_i, B_i^d = \text{pr}\ T_i > maxWTP\ and\ B_i^d > maxWTP$$
$$= G\ T_i^L, \theta \quad - - - - - - - - - - - - - - - - - - - (3.20)$$

When YES followed by NO, we have $T_i^u > T_i$ and

$$\pi^{YN}\ T_i, T_i^u = \text{pr}\ T_i \leq maxWTP \leq T_i^u = G\ T_i^u, \theta \quad (3.21)$$

And when NO is followed by YES, we have $T_i^L < T_i$, and

$$\pi^{NY}\ T_i, T_i^L = \text{pr}\ T_i \geq maxWTP \geq T_i^L = G\ T_i, \theta - G\ T_i^L, \theta \quad (3.22)$$

In (3.21) and (3.22), the second bid allows the researcher to place both an upper and a lower bound on the respondent's unobserved true WTP, while in (3.19) and (3.20) the second bid sharpens the single bound-it raises the lower bound or lowers the upper bound.

Given a sample of N respondents, where T_i, T_i^u, and T_i^L will be the bids use for the i[th] respondents, the log-likelihood function takes the form

$$lnL^D\ \theta = \sum_{i=1}^{N} d_i^{yy} ln\Upsilon^{yy}\ T_i, T_i^u + d_i^{nn} ln\Upsilon^{nn}\ T_i, T_i^L + d_i^{yn} ln\Upsilon^{yn}\ T_i, T_i^u + d_i^{ny} ln\Upsilon^{ny}\ T_i, T_i^L \quad (3.23)$$

Where d_i^{yy}, d_i^{nn}, d_i^{yn}, d_i^{ny} are binary valued indicator variables.

5.5.2.2.1 The Bivariate Probit Model

The use of dichotomous choice questions with follow-up bids implies that the response for the second question will be endogenous to that of the first. This means that the model cannot be estimated using the ordinary probit/logit model. Thus, bivariate probit model, which simultaneously estimate the two equations, will be used in order to minimize the distortions that might be created due to the endogeneity of the second response (Zewdu and Yemesrach, 2003).

The above log-likelihood function (3.23) for the responses to a CV survey is estimated by using bivariate probit model as follows:

$$y_{1i}^{*} = x_1' \beta_1 + \varepsilon_{1i} \quad (3.24)$$

$$y_{2i}^{*} = x_2'\beta_2 + \varepsilon_{2i} - (3.25)$$

In the data $y_{1i} and\ y_{2i}$ are only observable through the two discrete choice responses such that:

$$y_{1i} = 1, if\ y_i^{*} > bid1\ and\ 0, oterwise$$
$$y_{2i} = 1, if\ y_i^{*} > bid2\ and\ 0, oterwise$$
$$E\ \varepsilon_1|x_1, x_2 = E\ \varepsilon_2|x_1, x_2 = 0$$
$$\varepsilon_1|x_1, x_2 = Var\ \varepsilon_2|x_1, x_2 = 1$$
$$Cov\ \varepsilon_1, \varepsilon_2|x_1, x_2 = \rho$$

5.5.2.2.2 Recursive Bivariate Probit Model

If anchoring effect is assumed to be present in the follow up responses, then one must account for the endogeneity of the WTP derived from the first response equation. To model the follow up response, WTP estimated from the first equation is included in the second equation. Thus, the recursive system can be derived from (3.26) below where the first equation is the usual reduced form equation:

$$y_{1i}^{*} = x_1'\beta_1 + \varepsilon_{1i} - (3.26)$$

But the second equation is replaced by the structural equation:

$$y_{2i}^{*} = x_2'\beta_2 + \widehat{WTP}_{ij} + \varepsilon_{2i} - - - - - - - - - - - - - - - - - - (3.27)$$

Where, $\widehat{WTP}_i$ is the WTP estimated from the first response equation for the j[th] respondent. The system of equations (3.26 and 3.27) can be estimated by a two -stage maximum likelihood procedure.

6. Results and Discussion

The sampled households' socio economic and demographic characteristics are presented via statistical tools like mean, standard deviation and percentages. Single bound and double bound econometric models have been also employed to estimate the mean/median willingness to pay of the rural communities for

the conservation of conserving Alemsaga protected forests. Furthermore, Tobit is model is used to analyze the determinants of maximum willingness to pay.

6.1 Descriptive Statistics Results

6.1.1 Socio economic characteristics

The descriptive statistics results of our respondents are presented in Table 4. 1. As shown in the Table 4.1 below, out of the total 350 respondents, only 332 farm households are valid and used for analysis for this study purpose. Responses are collected from the household heads. Of the total of the valid respondents, 80.8% are male headed households and 19.2 % are female headed. From the chosen respondents, 50.3 % are from Farta district. The average ages of the respondents are 46.4 years with a minimum of 18 and a maximum of 81 years respectively.

The average family size and labor force size of the sample households are 6 and 2.4 with a minimum and a maximum of 2 and 12 and 1.3 and 8 respectively. The averages total income and off farm income of the households are birr 7474.9 and 2151.7 per year respectively and the households have on average of 7.2 total livestock holdings measured in total livestock units.

On average, the households walk 3.3 kilometers to reach the periphery of Alemsaga protected forests. The mean household sizes of the respondents are 6 persons with 0.81 hectares of land holding.

Table 4.1: Socio-economic characteristics of the household

Variables	Observations	Mean	Std. Dev.	Min	Max
Location	332	0.497	0.501	0	1
Sex	332	0.81	0.395	0	1
Age	332	46.42	12.65	18	81
Marital status	332	0.892	0.312	0	1
Total Family	332	6.04	2.15	0	12
Force Labor	332	3.63	1.69	0	8
Dependent family	332	2.41	1.39	0	8
Land holding in hector	332	0.817	0.523	0	3.25
Livestock in TLU	332	7.23	5.659	0	37
Total income in birr	332	7474.94	10998.32	25	116200
Income from trees in birr	332	704.24	1774.09	0	13500
Distance	332	3.31	4.7	0	25.02

Source: Authors computation from the survey, 2017

6.1.2 Educational Attainment

Nearly half (49.7%) of the total sample households are illiterate. Of the total, one fourth of the respondents are able to read and write from informal education (e.g religious education, vocational education etc) and, 24.4% of household heads are literate by attending formal education.

Table 4.2: Educational attainment of household heads

Educational attainment	Frequency	Percent
Illiterate	165	49.7
Literate (from informal education)	86	25.9
Literate (from formal education)	81	24.4
Total	332	100

Source: Authors computation from the survey, 2017

6.1.3 Causes for the Degradation Alemsaga Protected Forest

In an attempt to know respondents' awareness about the possible main causes for the degradation of Alemsaga protected forests, we have asked to state the possible reason for the degradation of forests. Table 4.3 below lists the main causes of the problem as frequently identified by the respondent. Of the

mentioned reasons, population growth (55.1%), deforestation (53.55) and resettlements (47.3%) accounts the first, second and third frequently mentioned reasons for the deforestations of the forest resources respectively.

Table 4.3: Causes of Degradation for Alemsaga Protected Forests

Factors for the degradation	*Frequency*	*Remark*
Population growth	*183*	*55.1%*
Deforestation	*177*	*53.5%*
Resettlements	*157*	*47.3%*
Agricultural land expansions on forest resources	*148*	*44.6%*
Climate change/global warming	*142*	*42.8%*
Free grazing	*117*	*35.2%*
Other factors	*40*	*12%*

Source: Authors computation from the survey, 2017

6.2 Econometric Estimation Results

In this part of the study, results of econometric estimation were presented and discussed. In order to model willingness to pay for the conservation of Alemsaga protected forests, both single bounded and double bounded contingent valuation method were used. These econometric methods are employed to estimate the mean WTP of the respondents using CVM, which would help to find the total economic value of the protected forests.

6.2.1 Single-Bounded Model

Table 4.4 shows the single bounded probit regression estimation results of the willingness to pay for the conservation of Alemsaga protected forests. Most of the explanatory variables hypothesized to affect WTP are as expected in sign, except income from plantation source. The estimated regression result shows that the probability of paying the offered bid for the conservation of the forest is significantly and negatively affected by the bid price, income from plantation and the number of dependent families. Likewise, it is positively and significantly affected by total income of the household and sex of the head.

The estimated coefficient of bid is found to be statistically significant at the 1% probability level with the expected negative sign. The result is in line with the economic theory. Higher bid value lowers the households willing to pay for the conservation of Alemsaga protected forest in terms of money. This implies that the probability of accepting the offered bid price for the conservation of Alemsaga protected forest is decreases/ increases as the bid price increases /decrease under the hypothetical market scenario.

Table 4.4: Probit Regression Model

Dependant variable (Answer 1)	**Coefficients**	**Robust Std. Err.**	**Z-value**	**dy/dx +**
_cons	0.209	0.873	0.24	-
Bid Price_1	-0.018	0.0057	-3.21*	-0.007
Location +	-0.119	0.22	-0.54	-0.042
Sex of head+	0.60	0.245	2.45 **	0.222
Age head	0.023	0.037	0.59	0.0076
Livestock in TLU	-0.024	0.015	-1.18	-0.006
Income from plant	-0.0002	0.000042	-3.72*	-0.00006
Distance in km	-0.0045	0.0196	-0.23	-0.0016
Labor force	0.0418	0.0453	0.92	0.015
Dependent family	-0.095	0.0557	-1.73***	-0.033
Education of head+	0.4372	0.356	1.23	0.15
Total income	0.00003	08.87e-06	2.81 *	8.59e-06
Land holding in ha	-0.0033	0.15451	0.02	-0.0012
Education* Sex of head+	-0.483	0.4012	-1.20	-0.168
Age square	-0.0002	0.00038	-0.50	-0.00007

Number of obs. = 332
Wald $chi^2(14)$ = 52.72
Prob> chi^2 = 0.0000
Log pseudo likelihood = -182.08693
Pseudo R2 = 0.1211
Percents correctly predicted values = 73.49%

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

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

Source: Survey Estimation result, 2017

The yearly total income of the respondents is positively and significantly (1% probability level) related to the households' WTP to the offered bids, indicating that respondents with higher incomes were either more likely to be willing to pay than those with lower incomes because conservation of the environmental goods are considered as normal goods i.e. as the income increases, spending for the conservation will be increases.

The estimated coefficients of sex of the respondents are found to be significant and positively affecting the wiliness to pay for conserving the sight. This implies that male headed respondents were more willing to contribute to conserve Almsaga protected forests than their female counterparts. This might be due to the fact that, in terms of resource ownership (like land, livestock etc) male headed households are better than female headed households.

Likewise, the estimated coefficient of number of dependent family is negative and significant. The more the households have large number of dependent, the more the burden to the economically active family members to sustain the life of the dependents. Households having high dependent family members are less likely to pay the offered bid price.

6.2.2 Recursive Bivariate Probit Model

Similar to the SBDC model results, among the variables expected to influence WTP, only the first offered bid price, income from plantation, sex of the farm household heads, total income and number of dependent family were significant in the first equation. Total income, sex of respondents, bid prices and dependent family have the expected sign. While in the second equation except first bid price and location of the respondents, all varaibles are not significantly different from zero even the second bid price. The estimated effects of the first bid price and location on the second WTP answer is significant at 10% and 5% level respectively. Even though the second bid price produces insignificant effect on the second WTP answer, the estimated cofficent produces the expected sign.

Table 4.5: Estimated Results of Recursive Bivariate Probit Model

Dependant variable(*Answer1*)	**Coefficients**	**Robust Std. Err.**	***Z-value***
_cons	.266	.88	0.30
Bid Price_1	-.018	.0057	-3.23*
Location	-.124	.221	-0.56
Sex of head	.612	.244	2.51**
Age head	.0197	.038	0.53
Livestock in TLU	-.0174	.0148	-1.18
Income from plant	-.00016	.000041	-3.82*
Distance in km	-.0048	.0195	-0.25
Labor force	.0412	.0453	0.91
Dependent family	-.0933	.0556	-1.68***
Education of head	.422	.348	1.21
Total income	.00003	9.01e-06	2.88**
Land holding in ha	-.0189	.155	-0.12
Education * Sex of head	-.48	.395	-1.21
Age square	-.0002	.00039	-0.44
Dependant variable (*Answer 2*)			
_cons	-.231	.852	-0.27
Bid Price_2	.0068	.0059	1.16
Location	.497	.212	2.35**
Sex of head	-.022	.257	-0.09
Age head	.0069	.036	0.19
Livestock in TLU	-.0018	.0151	-0.12
Income from plant	8.97e-06	.000042	0.22
Distance in km	-.0127	.0174	-0.73
Labor force	.0725	.046	1.58
Dependent family	.034	.0564	0.60
Education of head	.372	.371	1.00
Total income	-2.90e-06	6.85e-06	-0.42
Land holding in ha	-.0576	.1436	-0.40
Education * Sex of head	-.4178	.409	-1.02
Age square	-.00007	.000368	-0.18
Bid_1	-.015	.00915	-1.63***
/athrho	.227	.193	1.18
rho	.223	.1829	
Number of obs = 332		Number of obs = 332	
Wald chi2(29) = 85.33		Wald test of rho=0:	
Log pseudo likelihood = -384.78331		$Chi^2(1)$ = 1.38299	
Prob> chi2 = 0.0000		Prob> chi2 = 0.2396	

Remark:*, ** and *** indicates significant at 1%, 5% and 10% significance levels, respectively.
Source: Source: Survey Estimation result, 2017

6.2.3 Estimation of the Mean WTP and Aggregate WTP

To find out whether utilizing follow up responses provides more efficient and robust estimates of WTP or not this section reports the estimates of WTP from SBDC and DBDC (recursive bivarate probit) models. The comparison can be made from the perspective of efficiency in estimating welfare among different estimation models. The precision estimates of welfare measures computed from Krensky-Robb procedure can serve as main criteria for judging efficiency of these models.

As can be seen from the result, the recursive bivarite probit model is relatively more efficient than the other because recursive bivarite probit model gives tighter confidence interval. Thus, the double-bounded dichotomous choice CV model is asymptotically more efficient than the single-bounded model.
Finally, the welfare estimates constructed using the Krensky-Robb procedure reveals that the mean/median WTP model gives a better mean WTP (58.83ETB) estimates than the SBDC probit model, as it has a tighter confidence interval (a range of *59.89* ETB). Therefore, we have chosen the estimated results from the recursive bivariate probit for welfare aggregation in the study area.

Table 4.6: Comparison of alternative estimates of mean/median WTP

Models	Mean/ Median	Confidence Interval 95% Krinsky Robb		ASL*	Range (UB-LB)	CI/ Mean
		LB	UB			
SBDC	58.83	46.21	106.8	0.0008	60.59	1.03
Recursive Bivariate Probit	58.83	46.28	106.17	0.0008	59.89	1.02

*: Achieved Significance Level for testing H0: WTP<=0 vs. H1: WTP>0
LB: Lower bound; UB: Upper bound
Source: Survey Estimation result, 2017

The key objective of this research was to estimate the aggregate WTP for the conservation of Alemsaga protected forests. Since Alemsaga protected forest is found between Farta and Fogera districts of Amhara National Regional

State, the population of interest to this study is the total number of household heads in these areas. According to South Gondar Agricultural Office (2017) report the total number of household heads with in two districts were estimated about 101, 658. After accounting for expected protest zeros with a total of 96, 168 households were taken to estimate aggregate mean WTP. Therefore, using the maximized bid value of 58.83birr per year, the expected aggregate WTP to manage and conserve the forest resources are estimated to be 5, 657, 563.43 birr per year.

7. Conclusion and Recommendations

7.1 Conclusion

In this study, a double bounded elicitation method of contingent valuation technique was used to elicit farmers' willingness to pay for conservation of forest resources. Recursive bivariate probit model was preferred as compared to another variant CVM mean WTP estimation models because the estimated mean WTP of recursive bivariate probit model is more efficient and robust than those obtained from the SBDC models. Therefore, the welfare estimates of the study are based on recursive probit model. On average, WTP for conservation of forests is about *58.83* ETB and the aggregate WTP is around *5,6575,63.43* ETB per annum.

7.2 Recommendation

Based on the findings and general observations in this study, the following recommendations are suggested.

- Degradation is a serious problem of Alemsaga protected forest and hence immediate intervention involving the participation of the local community is needed.
- The study result proved the support for the establishment of community based conservation management program. Thus, efforts should be made to improve the management and conservation strategies of the forest resources by local, regional, and federal authorities through integrating the local communities.

- Stakeholders have to incorporate the primary roles of the community for determining the feasibility and sustainability of conservation plans and strategies of the forest resources.
- In sum, the results of the study shows that farm households are fully aware of the degradation of the forests and willing to contribute for the restoration and conservation of the forest. Therefore, policy makers and planers should fully participate local households at all levels to design and implement and forest conservation strategies. Furthermore, setting appropriate management plan is required to maximize long run benefit generated from the resource at hand.

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Child Poverty in Amhara Region[1]

Getachew Yirga[2] and Surafel Melak[3]

Abstract

The paper analyses child poverty in Amhara region primarily using multidimensional approach. Disaggregation is made at zonal, rural-urban, sex as well as sectoral levels. Data from Ethiopian Socio-economic Survey (ESS), Household Consumption and Expenditure Survey(HCES) and Ethiopian Demographic and Health Survey(EDHS) are employed in addition to information from Focus Group Discussions(FGDs) and Key Informant Interviews(KIIs). Dimensions and indicators used are purposefully selected to match the rights of children as in the CRC, MDGs and national targets. The findings show that the region's child deprivation headcount rates remain high with substantial variation across zones and rural-urban settings. About 80 percent of the children suffer from simultaneous deprivations. Intensity of poverty is also deep since poor children are on average deprived in over 70 percent of the indicators. All in all, adjusted multidimensional poverty index indicates that children are still deprived by 60 percent of the weighted indicators out of the potential deprivations they could experience overall. Household level dimensions, rural areas and three zones (North Gondar, East Gojjam and West Gojjam) are the largest contributors to this. Multidimensional poverty has reduced with time. Money-metric child poverty headcount ratio is about 34% which is higher than the rate for the region's entire population (31%) while extreme child poverty is 4%.The findings call for multidimensional development interventions that integrate institutional and legal frameworks with social transformation efforts. Awareness creation about child rights per se does not guarantee that duty bearers (including parents) do understand and practice proper child care and development principles.

[1] This project was financed by UNICEF Ethiopia. We are very grateful to all individuals and organizations who contributed all forms of inputs for the betterment of this report. Since the inception of the project, UNICEF and its staffs both at regional and country level had due engagement in capacity building, guiding and facilitating the whole span of the project. The former Bureau of Finance and Economic Cooperation all along its lowest structure played significant role for the realization of the assessment report. We thank you all.

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1. Introduction

The future of any country is highly dependent on its children's living conditions. Investments on educating, nourishing, caring and generally keeping the welfare of the present-day children results in a better nation in the future. Looked from the perspective of child rights, satisfying children's has a direct impact on the future pace with which all rights, not just children's rights, can be realized (Plavgo et al, 2013). Ethiopia is one of the countries having high proportion of younger population. Out of its projected population in 2015 of over 90 million, 52 percent were aged 19 years or below (CSA, 2014). Amhara region is estimated to have its 53 percent (of 20.4 million) who are children under the age of 19. Nationally, the economy has been making progress especially over the past decade. Monetary poverty headcount ratio in 2011 was 29.6% nationally and 30.5% in Amhara region (MoFED, 2012). Although such a uni-dimensional approach can tell households'/children's poverty showing their ability to meet basic needs in aggregate terms, it fails to reveal whether the available households' means are equally distributed to meet the needs of household members including children, for which further data and analyses are needed (Plavgo et al, 2013).

Ethiopia ratified several core international conventions prescribed to address the rights of children. The most notable is the CRC which the country ratified in 1991. Others include: the African Charter on the Rights and Welfare of the Child (ACRWC), the Convention on the Elimination of all Forms of Discrimination against Women (CEDAW), the Convention on the Rights of Persons with Disabilities (CRPD). The essence of these conventions is reflected in article 36 of the FDRE constitution. Institutionally as well, since 2006 the government has shown its political commitment by restructuring the former Ministry of Women Affairs into Ministry of Women, Children and Youth Affairs (MoWCYA) and very recently it is again restructured as the Ministry of Women and Children where youth matters are singled out and taken into another institute. The Directorate of Child Rights, Promotion and Protection is the main responsible department to address child related matters. There are also other government institutions which play pivotal roles for children including the ministries of Education, Health and Justice, the Human Rights Commission, the police, the courts and Institute of the Ombudsman.

Structurally also, almost all of those institutions are cascaded down to regional, zonal and *woreda* levels.

Amhara region's GTP-1 [2010/11-2014/15], like the national plan, set goals related to child rights including creation of awareness and movements on the rights of children as well as working jointly with stakeholders. Specifically, it vowed to create institutional arrangements that help implement national, continental and international policies, laws and agreements. Vulnerable children were promised to receive support and care to make them productive citizens.

A recent study by Plavgo et al (2013) shows that in all of the six dimensions (water, sanitation, housing, information, nutrition and health) Amhara region registered a declining trend of deprivation though it remains with higher rates compared to the national average.

What makes poverty of children different from poverty of adults is that poor children are more likely to be poor in adulthood as well (Plavgo et al, 2013). It traps children in a vicious circle from their birth onwards (Roelen and Gassman, 2008). Ratification of the CRC, therefore, is a step forward towards the breaking of the circle. Ethiopia, and hence Amhara region, have agreed that children have the right to survival (the right to adequate food, clean water, health care, shelter, etc.), development (the right to education, leisure, cultural activity and information), protection (the right to be protected from all forms of abuse and exploitation), and participation.

This study aims to provide evidence on child poverty in Amhara region using an approach that takes into account various dimensions related to children, sidelining the consumption/monetary approach.

2. Brief Review of the Literature

2.1 The Multidimensionality of Poverty and Vulnerability

Traditionally, a single monetary indicator – income – has been used as a standard indicator of wellbeing. After fixing a threshold level of income or

poverty line, such as $1.25 a day, households getting income below that line are identified as poor (Sen, 1976). Aggregate indices (such as those in Sen (1976), Foster et al. (1984), Atkinson (1987) and Foster and Shorrocks (1991)) which measure the incidence, depth and severity of poverty are then computed. Such an approach, also called unidimensional approach, is still in use by many, including the World Bank.

However, there is an almost unanimous agreement among economists that poverty is a multidimensional phenomenon. The multidimensionality of poverty gained momentum following the seminal works of Sen (1985, 1999). The United Nations acknowledges this by defining absolute poverty as a condition characterized by severe deprivation of basic human needs, including food, safe drinking water, sanitation facilities, health, shelter, education and information (UN, 1995). The notion is that poverty is a lack of capabilities, including, for instance, the choices of being healthy, literate; being able to live longer and to be well-nourished; etc. In short, poverty is the lack of what one needs to live within a society. Among the multidimensional poverty indices (MPIs), the Alkire and Foster (2009) index or AF is relatively simpler and popular.

Children's needs and values, and their levels of autonomy relative to adults, differ according to their life stage (Sabates-Wheeler and Roelen, 2011) and this needs to be reflected in measures of poverty, vulnerability and wellbeing. Even where households' income and wealth status is improving, there is no guarantee that intrahousehold consumption will be evenly distributed or that children's time will be protected. Moreover, Plavgo et al (2013) noted that the reasons for which children are deprived of their rights vary greatly, ranging from income poverty in their families, to discrimination, disease, geographic location, lack of information, and lack of access to services, among others. Another important justification for measuring child poverty multidimensionally is that it helps to evaluate the performance of a state vis-à-vis policies it has implemented and/or agreements it has ratified. For example, it makes it suitable for monitoring certain children's rights according to the CRC (Plavgo et al, 2013). Also, it enables researchers to fit to local contexts and data availability. It is argued that child poverty should not be assessed only by the incidence of poverty, but also by the intensity of simultaneous

deprivations that negatively affects poor children's lives (Alkire and Roche, 2011). Although having these qualities, the Alkire and Foster (2009) method is criticized on grounds related to difficulty of interpreting the complex index compared to the unidimensional index. Moreover, neglect of available market prices and tradeoff among the dimensions as well as use of arbitrary weights, which do not provide ample room for cross-country comparisons, sparked further criticism (see for instance Ravallion, 2011; Thorbecke, 2011; Ferreira, 2011).

Very few attempts have been made so far to measure poverty multidimensionally in Ethiopia. Brück and Kebede (2013) applied the AF framework on data from a sample of about 1050 rural households in Ethiopia. They estimate multidimensional headcount poverty and intensity rates of 47% in 2009 with adjusted poverty rate of 0.22. However, the rate for the national data in 2011 for headcount was estimated shockingly at 87% and intensity at 65% giving an adjusted poverty rate of 0.56 (UNDP, 2013). This headcount rate is more than double when compared with the 39% headcount rate based on the $1.25 per day poverty line. According to Brück and Kebede (2013), multidimensional rural poverty in Ethiopia is primarily driven by deprivations in housing and access to water as well as morbidity while UNDP (2013) estimations show that deprivations in living standards take a lion's share at national level.

In a preliminary region-wide urban poverty assessment, Berihun et al (2014) estimated a multidimensional poverty headcount ratio of 37.2%, average intensity of deprivations ratio of 56.4% and adjusted multidimensional poverty rate of 0.21 in urban Amhara region. The major source of total deprivations is deprivation in standards of living followed by deprivations in health and education. This is also the case in the national estimates by UNDP (2013). Clearly, when the average household is deprived, the average child will be more deprived. This is because child poverty, as against to adult poverty, has different causes and effects and the impact of poverty during childhood can have detrimental effects on children which are irreversible (UNICEF, 2011).

Plavgo et al (2013) made a national child multidimensional deprivation assessment for 2000 and 2011 and disaggregated by region. According to their findings, the multidimensional headcount ratio of children deprived in two or

more dimensions did not show large disparities across regions. In all regions except Addis Ababa, Dire Dawa and Harari, 90 to 95% of the children in 2011 were deprived in two or more dimensions. And sadly, no or very small changes were registered since 2000. The top four regions with deprivations in 2-6 dimensions in 2011 are Benishangul-Gumuz (95%), Oromiya (95%), SNNPR (95%) and Amhara (94%). Only Amhara (98% in 2000 to 94% in 2011) and Afar exhibited a statistically significant decrease in the percentage of children deprived in two or more dimensions.

2.2 Urbanization and Poverty

Many factors may be held responsible for worsening the situation of the poor which have repercussions to children. For the first time in the history of mankind, more people worldwide have started to live in urban than in rural areas since 2008. According to the prediction by UNFPA (2007), the 2007 world urban population (3.3 billion) will almost double to 6.4 billion in 2050, and by 2030, 60 percent of the world's population will live in cities. Developing countries, especially those in SSA, register the highest recent urban growth rates. East African countries, for instance, had 6-8 percent of urbanization rates during the last four decades (Mireri et al, 2005). Urbanization in these countries has been viewed by some development theorists, going as back as Arthur Lewis and Simon Kuznets, as an integral part of economic growth and distributional change, including poverty reduction (Ravallion et al, 2007). These, however, are not supported by the facts and empirical findings.

The problem with urbanization is that the urban growth trend is alarming in areas with limited resources for providing the necessary urban services (Cofie et al, 2003). Against the expectation, the urbanization of SSA has resulted in more poverty, food insecurity, inflation, food shortage, urban violence, etc. In most cities and towns of SSA, urbanization has become virtually synonymous to slum growth. The slum population in these countries doubled in the period 1990 to 2005 and reached 200 million (UNFPA, 2007). Increasing urban poverty and vulnerability go hand in hand with growing food insecurity, which is often overlooked since at aggregate level the economic and social conditions in urban areas are better than those in rural areas (de Zeeuw and Dubbeling, 2009).

3. Methodology

Our research approach employed mixed type of research (Roelen et al, 2011; Davis et al, 2011).We used quantitative data from ESS. We also support our analysis with qualitative data from KII with officials of selected regional bureaus and FGDs at lower levels.

3.1 The Quantitative Data and Unit of Analysis

In this study, children are the unit of analysis. Data are obtained from the ESS, panel data survey collected by the CSA in collaboration with the World Bank and conducted in 2011/12 (wave 1) and 2013/14 (wave 2). The first wave of the survey covered all regions of the country except Addis Ababa, which was included in the second wave. The sample design provides representative estimates at the national level for rural-area and small-town households. It is also representative at the regional level for the most populous regions of Amhara, Oromiya, SNNP and Tigray. In wave 1, a total of 290 rural enumeration areas and 43 small towns were randomly selected nationwide. In the second wave, in addition to rural and small town areas, medium and large towns were sampled. In general, it covered a total of 3969 and 5262 households in the first wave and second wave respectively. All zones of Amhara region were included in the both waves. We extracted the data of 1472 children (18 years old and under) from 2011/12 and 2086 children from 2013/14.

3.2 Measuring Multidimensional Child Poverty

3.2.1 Dimensions, indicators and deprivation thresholds

For measuring child poverty, we used the general methodology outlined in Alikre and Foster (2009). The choice of dimensions and their respective indicators is motivated by targets of MDGs, child rights in the CRC, the literature and data availability. We use indicators that are specific to children and those that are common to all household members but still having huge impacts on children. The dimensions, indicators and deprivation cut-offs are summarized in *Table 1*.

Table 1: Child poverty dimensions, indicators and deprivation thresholds

(1) **Dimension**	*(2)* **Indicator**	*(3)* **Cut-off (Child is deprived if...)**	*(4)* **Related to**
Child level:			
Child education	*Child school attendance*	*Any school-aged child (5-18 years) is not attending school.*	*MDG2*
Child health	*Child sickness*	*Any child was sick during the past two months before the survey.*	
	Child nutrition	*Child's weight for age is below minus two standard deviations from the international median (WHO).*	*MDG1*
Household living standards:			
Water	*Access to improved water source*	*Child lives in a house where the main source of drinking water is unimproved (WHO).*	*MDG7*
Sanitation	*Access to improved sanitation*	*Child belongs to a household which uses unimproved toilet facility (WHO).*	
Electricity	*Access to electricity*	*Child lives in a house having no access to electricity.*	
Cooking fuel	*Access to improved cooking fuel*	*Child lives in a household without improved cooking fuel (UN MDG).*	*MDG7*
Housing	*Floor and roof material*	*Child lives in a house where floor or roof or both are made of natural, non-permanent material (UN-HABITAT).*	
	Overcrowding	*Child lives in a household having more than three people on average per sleeping/living room (UN-HABITAT).*	
Information	*Availability of information source*	*Child lives in a household not having TV, radio, mobile phone or fixed line phone.*	*MDG8*

Notes: MDG1 is *Eradicate Extreme Poverty and Hunger*; ***MDG2*** is *Achieve Universal Primary Education*;
MDG7 *is Ensure Environmental Sustainability;* ***MDG8*** *is Develop a Global Partnership for Development.*
Source: Modified based on Plavgo et al (2013) and Apablaza and Yalonetzky (2012).

Three of the ten indicators, grouped under two dimensions, are child-level indicators. These indicators - school attendance, sickness and nutrition - measure human-capital functionings, which in turn affect future human capital. Seven of the ten indicators are household-level indicators. These provide information on the children's capability to live in a household with adequate and safe drinking water, electricity, cooking fuel, toilet, space and information. Whether a child is deprived in a certain indicator is decided based on international standards. The indicators are related to at least four MDGs. An important step in multidimensional poverty index estimation is weighting of dimensions and indicators. We opt to provide equal weight to each of them.

3.2.2 Estimation of poverty ratios and decomposition

We adapt the procedures of Alkire and Foster (2009) for computing relevant poverty indices and decompositions. The single or raw deprivation or headcount ratios (H_j) for each indicator are computed as follows:

$$H_j = \frac{1}{N}\sum_{i=1}^{N} I_{[0,1]}(y_{ji} \leq z_j) \qquad \textbf{(1)}$$

Where $I_{[0,1]}(y_{ji} \leq z_j)$ is an indicator function taking 1 if the expression in parenthesis is satisfied and 0 otherwise; y_{ji} the attainment of child *i* in indicator *j;* z_j is the cut-off in indicator *j*, also called indicator/dimension-specific poverty line (in line with column 3 of *Table 1*); and *N* is the population of children.

The sum of weighted deprivations (C_i) for each child *i*, also called deprivation count, is simply:

$$C_i = \sum_{j=1}^{D} w_j I_{[0,1]}(y_{ji} \leq z_j) \qquad \textbf{(2)}$$

Where w_j is the weight given to indicator *j*; and *D* is the total number of indicators.

Now, censoring at a given number of C_i (taking into account multiple deprivations) helps find the multidimensional poverty headcount ratio (H) just as:

$$H_j = \frac{1}{N}\sum_{i=1}^{N} I_{[0,1]}(C_i \geq k) \qquad (3)$$

where *k* is the multidimensional poverty cut-off or poverty line.

Also important is the average intensity of deprivations (A) (number of deprivations as a proportion of the maximum number of possible deprivations) suffered by the multidimensionally-poor children, A:

$$A = \frac{1}{N \cdot H_j \cdot D}\sum_{i=1}^{N} I_{[0,1]}(C_i \geq k) \cdot C_i \qquad (4)$$

where *k* is the multidimensional poverty cut-off or poverty line.
The adjusted multidimensional poverty headcount ratio (MPI) is simply given by the product[4]:

$$MPI = H \cdot A \qquad (5)$$

The percentage contribution (P_j) of dimension *j* to the overall multidimensional poverty (MPI) is calculated using:

$$P_j = \frac{1}{N \cdot D \cdot MPI}\sum_{i=1}^{N} I_{[0,1]}(y_{ji} \leq z_j) \cdot I_{[0,1]}(C_i \geq k) \qquad (6)$$

where the terms at right hand side of the equation are as defined previously.

The contribution of population sub-group *s* (such as zones) to the (regional) child MPI is extracted from the following identity:

$$\frac{MPI_1(\frac{N_1}{N})}{MPI} + \frac{MPI_2(\frac{N_2}{N})}{MPI} + \ldots + \frac{MPI_S(\frac{N_S}{N})}{MPI} = 1 \qquad (7)$$

[4] Since the indicators in this study are ordinal variables, measurement of poverty headcount suffices and it is meaningless to consider further levels (gap and severity) on such variables.

where MPI_s and N_s are multidimensional poverty ratio and number of children in each sub-group *s* respectively for *s=1, 2, …,S.* Each element at the left hand side of the equation is, therefore, the contribution of a sub-group.

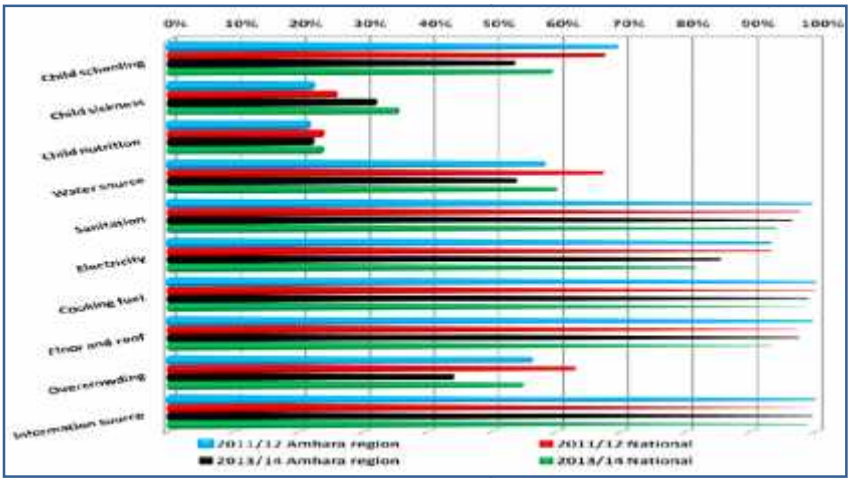
4. Child Poverty in Amhara Region

This section presents findings of multidimensional and monetary child poverty in Amhara region. In all except for monetary poverty, disaggregation by geographical areas (such as zones and rural/urban) and sex as well as a trend analysis over 2011/12 and 2013/14 is made in order to have an in-depth look into the conditions of children.

4.2 Single Deprivation Analysis

The deprivation of children in Amhara region in child-specific indicators compared to household-specific indicators is generally low. For instance, closer to one in five children fell sick over the past two months and failed to get the necessary nutrition in 2011/12 (*Figure 1*). However in 2013/14, as many as a third of the children fell sick while their nutrition deprivation increased marginally (22%) relative to 2011/12.

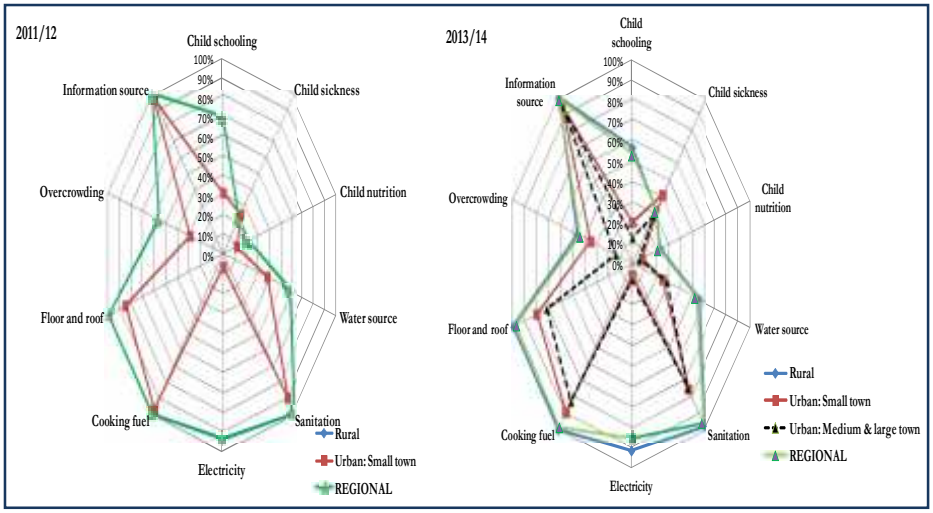
Figure 1: Deprivation headcount rates (%) among children by indicator in Amhara region and Ethiopia, 2011/12 and 2013/14



Source: Computed based on ESS (2011/12 and 2013/14)

Looking at the deprivation of children from the point of view of their households is quite frustrating. This is because almost all of the sample households in which children live had deprivations in sanitation, cooking fuel, floor and roof, and information in 2011/12 and only infinitesimal reductions have been seen in 2013/14. If we compare the single deprivation headcount figures of the region with the national ones, we notice that the region has lower rates in five of the ten indicators in both periods, with slight variations in the type of the indicators. For instance, in 2013/14 it had lower incidence rates than the country-wide rates in all child-level indicators (schooling, sickness and nutrition) and in two household-level indicators (water source and overcrowding).

Figure 2: Rural-urban disaggregation of deprivation headcount rates (%) among children by indicator in Amhara region, 2011/12 and 2013/14



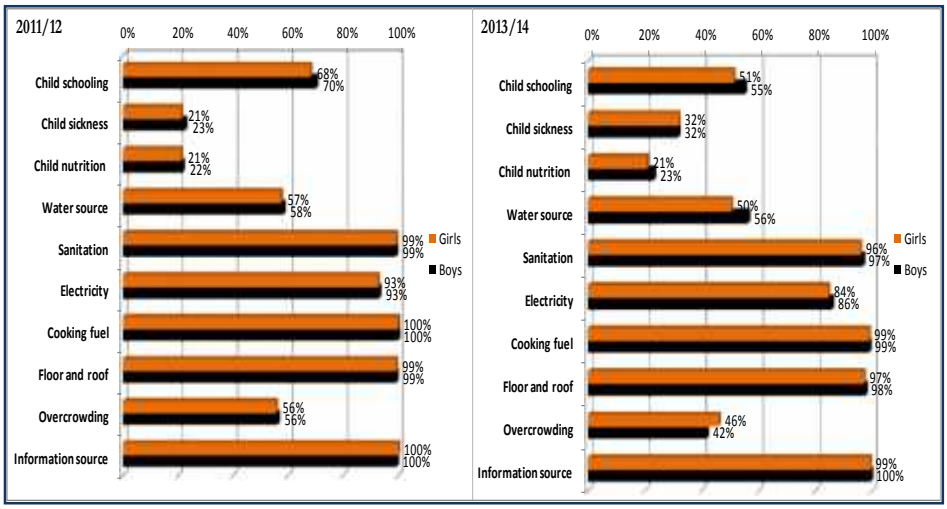
Source: Computed based on ESS (2011/12 and 2013/14)

With regard to deprivation incidence in the urban-rural divide, as shown on the left panel of *Figure* 2, the rural and region-level deprivation incidence rates of each dimension perfectly overlap. Even then, there exist clear variations between rural areas and small-town areas. Except in child sickness, cooking fuel and information, children in small-town areas were less deprived than those in rural areas both in 2011/12. The 2013/14 wave provides better

freedom to draw more comparisons. During that period, living in medium- and large-sized towns meant lower deprivation for children in almost all indicators compared to rural and small-town areas. The deprivation incidence rates of rural areas engulf all other rates except child sickness (see the right panel of *Figure 2*) means that children in rural children are more deprived than their urban counterparts.

Disaggregation of single deprivation incidences by sex of children generally shows that there were no sizeable disparities between boys and girls during 2011/12. In other words, girls were as much deprived as boys during the first wave. However, minor inequalities in favor of girls (such as in child schooling, child nutrition, water source and electricity) and in favor of boys (in the housing condition indicator of overcrowding) came out in 2013/14 (*Figure 3*). Such a finding is less popular given the historically high gender discrimination against women (and girls).

Figure 3: Gender disaggregation of deprivation headcount rates (%) among children by indicator in Amhara region, 2011/12 and 2013/14



Source: Computed based on ESS (2011/12 and 2013/14)

The finding is also consistent with the FGD outcome summarized in *Box 1*

Box 1: FGD outcomes on child education equality

"These days both boys and girls have an equal opportunity for education. There are even cases where girls dominate boys at primary education".

Parental FGD participants in Finoteselam, 25 November 2015

"Usually, at primary level there are more boys than girls however, dropout rate of girls outweighs after they complete grade eight. The reasons are two- financial burden against parents along with displacement in search of secondary education nearby and marriage".

Parental FGD participants in Mender 6,7 & 8, Metema, 4 December 2015

"Considerable size of urban girls' dropout of school after they complete grade ten and the majority of rural girls' dropout after grade four. For the rural girls the key problem is limited access to second cycle primary and secondary education. Nevertheless, urban girls are enforced to go to Middle East countries and the pressure comes from their families. There was a time at which being emigrant to the Middle East was considered to be criteria to get married".

In school and out of school youth FGD participants around Hara, North Wollo, 30, November, 2015

4.2 Multidimensional Child Poverty

4.2.1 Multidimensional poverty indices

In this paper, we fix the deprivation count at 6 indicators. So, the upcoming presentations and subsequent discussions refer child multidimensional headcount rate (H) as the proportion of children deprived in 6-10 indicators simultaneously. Accordingly, we find that 90% of children aged 18 or below were multidimensionally poor in 2011/12 (see *Table 2*). This figure fell by only a little above 9% to reach 82% in 2013/14. And both values were slightly lower than the national averages of the respective years. Using EDHS data, Plavgo et al (2013) estimate the region's multidimensional under-five child poverty as 98% and 94% in 2000 and 2011 respectively. They also found that only Amhara and Afar regions exhibited a statistically significant decrease in the percentage of children deprived in two or more dimensions.

There is also evidence of zonal disparity in the incidence of multidimensional poverty. This ranges from 72% in South Wollo zone to 100% in Argoba

special *woreda* in 2011/12 and from 68% in Oromiya zone to once again 100% in Argoba special *woreda* in 2013/14. Encouraging, however, is the finding that the number of zones (including Argoba) that had an incidence rate of 90% or above decreased from 7 to 2 over the two years. Though the proportion of children deprived in 6 or more indicators reduced by a quarter in Oromiya zone, it increased in South Wollo by about 8% during the same period. Huge variations exist in the rural/urban disaggregation. 86% of rural children are multiply-poor compared to 28% in small towns and 25% in medium and large towns in 2013/14. Gender-wise, although the incidence of multidimensional poverty ratio for girls and boys was the same (90%) in 2011/12, there appeared some difference in 2013/14 (80% for girls and 83% for boys).

In terms of average deprivation intensity (A), in 2013/14, the region's figure stood at 7.3, which shows that those multidimensionally-poor children (deprived in 6-10 indicators) were deprived on the average by over 7 indicators (*Table 2*). The average child deprivation intensity fell only slightly over the surveyed years was almost similar to the national average in during those periods. A spatial variation is also observed, with Waghimra zone having the maximum of 8.2 average deprivations and East Gojjam and Oromiya zones registering 6.9 average deprivations in 2013/14. While in the majority of the zones average intensity of deprivation decreased over time, in some others it increased beyond expectation including Waghimra, South Gondar, West Gojjam and Oromiya. Thought breadth of deprivation among girls and boys was almost the same, there existed evidence inequality between rural and urban areas. Average intensity of deprivation by poor rural children was 7.4 but stood only at 6.7 in small towns and 6.4 in medium and large towns in 2013/14.

A society may have a high multidimensional poverty headcount ratio (H) and yet a low average deprivation intensity (A). Hence, there should be a measure that provides the overall multidimensional poverty situation of children and enables to assess progresses made in poverty reduction. This is simply done by multiplying these two measures and it is called adjusted multidimensional poverty ratio or multidimensional poverty index (MPI). We estimate the child MPI in Amhara region in 2011/12 at 0.67 which fell by more than 10% to

reach 0.60 in 2013/14. This last figure shows that poor children are still deprived by 60 percent of the weighted indicators out of all potential deprivations they could experience overall. The ratios of respective years were slightly below the national averages. The reduction in child MPI in the region was primarily attributed to reduction in the mere multidimensional headcount (H) (90%) (see last two columns of *Table 2*). Our findings may to some extent be comparable to those by Plavgo et al (2013) which estimated the under-five child MPI for the region as 0.79 in 2000 and 0.61 in 2011.

Table 2: Multidimensional headcount ratios and average deprivation intensity among children deprived in 6-10 indicators in Amhara region by zone, 2011/12 and 2013/14

Zone	*Multidimensional headcount ratio [a] (H)*			*Average deprivation intensity (A)*			*Adjusted multidimensional headcount ratio [b] (MPI = H*A*1/10)*			*% Contribution of H & A to reduction in MPI*	
	2011/12 (%)	***2013/14 (%)***	***%a***	***2011/12 (%)***	***2013/14 (%)***	***%a***	***2011/12***	***2013/14***	***%a***	***From H (%)***	***From A (%)***
Waghimra	*93.9*	*99.2*	*5.6*	*7.7*	*8.2*	*5.7*	*0.72*	*0.81*	*11.6*	*48*	*49*
Argoba	*100*	*100*	*0.0*	*7.8*	*7.7*	*-1.3*	*0.78*	*0.77*	*-1.3*	*0*	*100*
N. Gondar	*97.7*	*89.1*	*-8.8*	*7.85*	*7.84*	*-0.1*	*0.77*	*0.70*	*-8.9*	*99*	*1*
S. Gondar	*88.0*	*89.4*	*1.6*	*7.3*	*7.6*	*4.6*	*0.64*	*0.68*	*6.3*	*26*	*73*
N. Wollo	*86.3*	*83.8*	*-3.0*	*7.5*	*7.4*	*-0.8*	*0.65*	*0.62*	*-3.8*	*79*	*22*
Awi	*95.6*	*81.2*	*-15.0*	*7.6*	*7.3*	*-3.9*	*0.73*	*0.59*	*-18.3*	*82*	*21*
N. Shewa	*94.6*	*80.7*	*-14.7*	*7.5*	*7.2*	*-4.3*	*0.71*	*0.58*	*-18.4*	*80*	*23*
E. Gojjam	*89.2*	*83.0*	*-7.0*	*7.3*	*6.9*	*-6.4*	*0.65*	*0.57*	*-13.0*	*54*	*49*
S. Wollo	*71.6*	*77.2*	*7.8*	*7.2*	*7.0*	*-1.9*	*0.51*	*0.544*	*5.7*	*136*	*-34*
W. Gojjam	*92.2*	*74.8*	*-18.9*	*7.1*	*7.2*	*2.2*	*0.65*	*0.54*	*-17.1*	*110*	*-13*
Oromiya	*90.3*	*67.9*	*-24.8*	*6.87*	*6.94*	*1.0*	*0.62*	*0.47*	*-24.0*	*103*	*-4*
REGIONAL	***89.9***	***81.5***	***-9.3***	***7.4***	***7.3***	***-1.2***	***0.67***	***0.60***	***-10.4***	***90***	***10***
NATIONAL	***92.0***	***83.2***	***-9.6***	***7.5***	***7.5***	***0.0***	***0.69***	***0.63***	***-9.6***	***100***	***0***

[a] a *refers to relative change;* [b] *1/10 is the equal weight given to each of the 10 indicators used;*

[c] *The sums may not be equal to 100% due to approximation error; and a negative value implies a counter-reduction to MPI.*

Note: The zones are ranked from the largest to the smallest adjusted multidimensional headcount ratios of 2013/14.

It was not possible to compute these multidimensional measures for Bahir Dar due to lack of variation in the data.

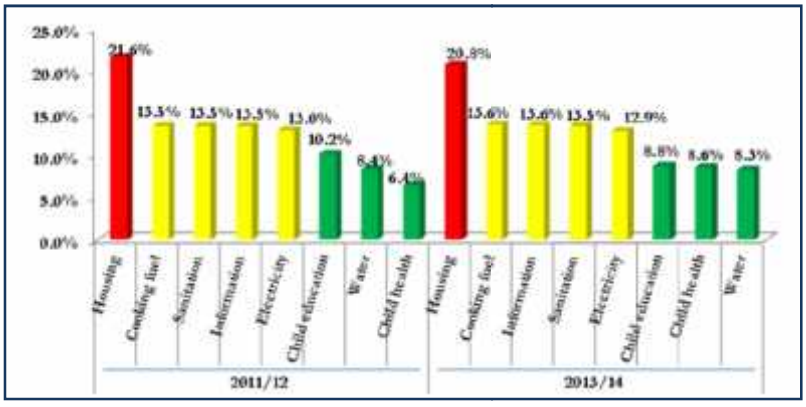
Source: Computed based on ESS (2011/12 and 2013/14)

Like in its components, adjusted multidimensional poverty is not distributed evenly across zones of the region. The variation is huge, ranging from 0.81 in Waghimra to 0.47 in Oromiya zone. Argoba special *woreda* and North Gondar zone trail Waghimra at the top of the list. The zonal variation in the percentage contribution of poverty headcount ratio and deprivation intensity to MPI reduction is particularly huge. For the two zones that host the relatively least MPI-poor children (Oromiya and West Gojjam) in 2013/14, the reduction in adjusted multidimensional poverty is entirely due to large falls in (unadjusted) multidimensional poverty while deprivation intensity played an undesired counter-poverty reduction role.

4.2.2 The contribution of dimensions to multidimensional poverty

The question of which indicator/dimension contributes most to overall poverty helps in the efforts of prioritizing sectoral interventions. Accordingly, we compute the contribution of dimensions to the regional and zonal adjusted multidimensional child poverty indices. We may classify the dimensions into three groups depending on their size of contributions. The largest contributor is the housing dimension. A fifth of the overall multidimensional child poverty in the region is attributed to housing deprivations of households in which children live and this large contribution persists over the two years, 2011/12 and 2013/14 (*Figure 4*).

Figure 4**: Contribution of dimensions to the regional adjusted multidimensional poverty among children deprived in 6-10 indicators, 2011/12 and 2013/14**



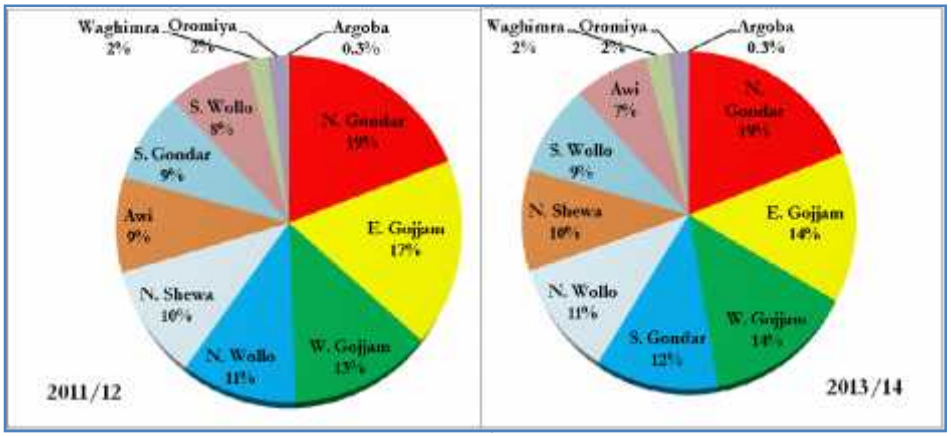
Source: Computed based on ESS (2011/12 and 2013/14)

In the second group are dimensions of cooking fuel, sanitation, information and electricity, each of which contributed 13-14% consistently over the same periods. The third group, primarily composed of child-specific indicators, is formed by dimensions of child education, child health and water. Each of them had a share of 10% or lower over those years. It is, therefore, simple to deduce that children of the region become highly multidimensionally-poor primarily because the living standards of their households are so poor.

4.2.3 Contribution to multidimensional poverty by zone

Having seen the zonal and dimensional disaggregation of multidimensional poverty of children, the next logical question would be about the contribution of each zone to the region's average. *Figure 5* summarizes data on the contribution of zones to the adjusted multidimensional poverty among children deprived in 6-10 indicators. The zones were weighted by their child population to calculate their contribution and their ranking is made. As can be seen, this ranking goes from North Gondar zone (the most contributor) to Argoba special *woreda* (the least contributor). The result shows that one in five multidimensionally-poor children in the region came from North Gondar during both years. East Gojjam and West Gojjam zones remained other top suppliers of MPI-poor children over the periods.

Figure 5: Contribution of zones to the regional adjusted multidimensional poverty among children deprived in 6-10 indicators, 2011/12 and 2013/14



Source: Computed based on ESS (2011/12 and 2013/14)

The experience of South Wollo could be an exemplary one as it was reflected by an informant (see *Box 2*).

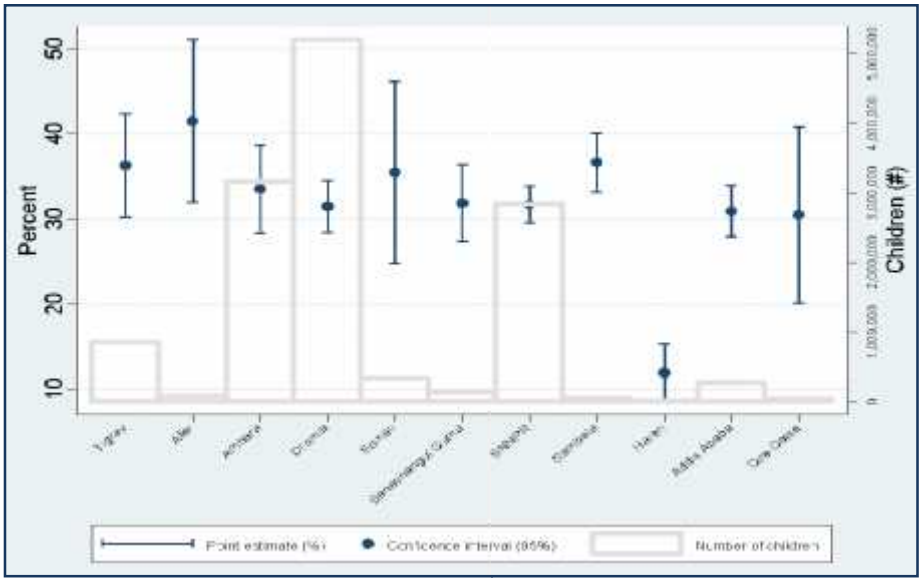
Box 2: Experience of South Wollo on linking health extension and children

> "South Wollo zone used schools to bring about behavioral change in rural households in built traditions about hygiene, health and sanitation. They have used the green, yellow and red flag to queue students at the morning flag event. Students are allowed to queue on the green flag if their families practiced the health extension package fully, queue on the yellow flag if their parents practiced partially and queue on the red flag if their families do nothing."

4.3 Monetary Child Poverty

In order to complete the child poverty analysis, let us borrow money-metric estimates of CSA, UNICEF and OPM (2015) which has used data from the 2010/11 HCES and Welfare Monitoring Survey (WMS). Adult equivalent consumption levels of children are first aggregated. The national poverty line of birr 3,781 per adult equivalent per year and extreme poverty line of birr 1,985 per adult equivalent per year are then used to estimate poverty headcounts. Accordingly, child poverty headcount ratio at national level is estimated at 32.4% (representing 13 million children) which is significantly higher than the ratio for the whole population (29.6%). The extreme poverty headcount of 5.2% for children (representing 2 million children) can also be contrasted with 4.5% for the entire national population. When disaggregated, the highest poverty rates are found amongst children living in very large households with more than 9 members. Interestingly, no significant difference in the poverty headcount between girls and boys is observed. This last finding is in solidarity with our previous multidimensional child poverty estimates in Amhara region.

Figure 6: Monetary child poverty by region



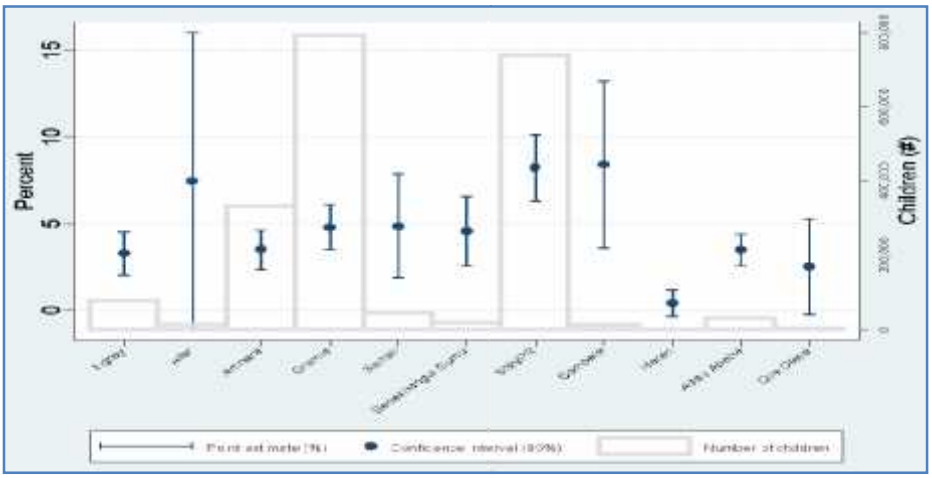
Source: CSA, UNICEF and OPM (2015), Table 6, based on HCES (2010/11) data

Regional estimates of child consumption poverty headcount and absolute number of poor children are summarized in *Figure 6*. In Amhara region, the prevalence rate of poverty among children stands at about 34%. This figure is higher than the rate for the region's entire population of about 31% estimated by MoFED (2012) using similar HCES data. The incidence rate of child poverty seems similar with other regions, except Harari region which reduced the rate by half between 2004/05 and 2010/11 (MoFED, 2012). Given its child population, Amhara region hosts about 3 million absolute consumption-poor children, which is only next to Oromiya region with over 5 million and followed by SNNP region. The three regions are home to more than 85% of all consumption-poor children in the country (CSA, UNICEF and OPM, 2015).

In terms of extreme child poverty (consuming at below birr 1,985 per adult equivalent per year), Amhara region's rate is estimated at about 4% (amounting to 200,000 children), as depicted in *Figure 7*. This is better than the country-level extreme child poverty rate of over 5% and half of the worst affected regions, SNNP and Gambella, at close to 8%. The estimates show that Oromiya and SNNP, each having over 700,000 extremely poor children,

account for close to 75% of all extremely poor children in Ethiopia (CSA, UNICEF and OPM, 2015). The low number of extremely poor children in Amhara region is due to the region's low rate of extreme poverty.

Figure 7: Extreme monetary child poverty by region



Source: CSA, UNICEF and OPM (2015), Table 6, based on HCES (2010/11) data

5. Summary and Action Points

5.1 Summary

We initially looked at the situation of child poverty in terms of deprivation in each of the 10 indicators used. We estimate that the proportion of children who fell sick two months before the survey increased from one-fifth to one-third between 2011/12 and 2013/14. And over one-fifth of them were deprived in nutrition in both years. The deprivation of children from the point of view of their households is even more frustrating. Almost all of the sample households in which children live had deprivations in sanitation, cooking fuel, floor and roof, and information in 2011/12 and only infinitesimal reductions have been seen in 2013/14. Even if the region's deprivation headcount rates in many indicators were a little better than the national averages and some other regions, the high deprivation rates by themselves have a lot to tell about the required hard work that still waits.

This is aggravated by zonal and rural/urban inequalities in deprivation. The three most deprived zones in 2013/14 in some indicators in their order include: child education (Waghimra, Argoba, East Gojjam); child sickness (Waghimra, North Gondar, North Shewa); child nutrition (South Gondar, North Shewa, North Gondar); water source (North Wollo, North Gondar, Waghimra); and room overcrowding (Argoba, Waghimra, North Gondar). It was not possible to notice sizeable variation among zones in terms of such household-level indicators as electricity, sanitation, cooking fuel, floor and roof and information since they all were almost equally and completely deprived. Living in medium- and large-sized towns meant lower deprivation for children in almost all indicators compared to rural and small-town areas.

It is revealed that all children were deprived in at least one indicator at regional level and at all disaggregation levels. The proportion of simultaneous deprivation was high as over 80 percent of children aged 18 years or below were multidimensionally poor (deprived by 6-10 indicators at a time) in 2013/14 which dropped from 90 percent in 2011/12. Disaggregation shows evidence of disparity in the incidence of multidimensional poverty across zones and residence types.. The intensity of deprivation also looks high as poor children were deprived on average by 7.3 indicators out of 10 in 2013/14 which only marginally fell overtime. Disaggregation shows evidence of disparity across zones and rural-urban residence types.

The adjusted child multidimensional poverty index in Amhara region is estimated at 0.60 in 2013/14 which fell from 0.67 in 2011/12. The majority of the multidimensional poverty among children was due to poor living standards of households. Three zones (North Gondar, East Gojjam and West Gojjam in that order) were estimated to contribute most in both years. Children in rural areas had the lion's share in 2013/14 relative to their urban counterparts.

Money-metric estimates from CSA, UNICEF and OPM (2015) show that the prevalence rate of poverty among children in Amhara region stands at about 34% (3 million absolute children) which is higher than the rate for the region's entire population (31%). In terms of extreme child poverty, the region's rate is estimated at about 4% (amounting to 200,000 children).

5.2 Action Points

Generally, we call for multidimensional development interventions that integrate institutional and legal frameworks with social transformation efforts. More specifically, the following are suggested as future points of action:

(i) The study's results are loud at the pointer that multidimensional poverty reduction should not stop only by reducing the number of multiply-poor children. Actions are equally important on reducing the number/depth of deprivations from which poor children suffer.

(ii) There is variation in the sectoral contribution to child poverty. This sectoral variation coupled with the identified huge zonal disparities in child deprivations and multidimensional poverty give the regional government a pointer to look in to the budget allocations.

(iii) Health education is widely practiced specially after the introduction of the HEP in Ethiopia. However, in many outcome indicators (example, water, toilet, child feeding, housing etc), the fruition of the health education is not satisfactory. It is dominated by information giving at public gatherings, health facilities and door to door visits. Its impact to ensure sustainable behavioral change is infinitesimal. Hence, we recommend re-examination of the architectural design of the HEP specially the health education communication strategy.

(iv) As a key poverty eradication tool, the regional government is advised to implement its monitoring and regulatory scheme of sanitation and toilet conditions in urban areas stringently. This requires the revisit of duties, responsibilities and autonomy of key stakeholders.

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Impact of Small Scale Irrigation on Farm Technical Efficiency and Household Income in Amhara Regional State: A Stochastic Approach

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Abstract

Agriculture is the main stay of Ethiopian population with a significant contribution to GDP. More recently the quest for more enhanced production and productivity has become an urgent issue of importance in the agriculture sector. The use of yield improving technological innovations is paramount importance towards this goal. As the potential to increase production and productivity by bringing more resources in to use is limited, the efficiency in which the farmers use available resources has received the utmost attention. This being the case, in this study effort has been made to assess the impact of small scale irrigation on farm technical efficiency and household income. The study was conducted in Amhara regional state. The survey data was collected from four kebeles in Sekela woreda of west Gojjam administrative zone in the year 2014/15 from 119 households. The data collected considered two groups of farm households, irrigation users and non-user households. Stochastic production frontier function with inefficiency variables had been applied to estimate technical efficiency. The finding of income variables indicate that land, access to irrigation, credit, education, labor, total livestock unit, and ox have significant contribution to household income. Among the input variables land and ox have positive and significant contribution to farm production whereas labor has negative contribution to farm production. The coefficient of land and oxen is 0.9 and 0.28 for irrigation users and 1.56 and 0.46 for irrigation non users respectively indicating greater marginal contribution of input variables when irrigation technology is in place. The inefficiency variables, age square , access to irrigation and land are found to improve farm efficiency while age of the household, gender, and dependency ratio have negative contribution to farm

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technical efficiency. Distance of the farmer's house from development center and extension participation is not statistically significant. The mean technical efficiency of the whole sample was found to be 71% indicating that there is a possibility of improving the farm output on average by 29% if the technical efficiency of less efficient households could perform better to obtain the maximum attainable level of output.

Key words: Technical efficiency, Stochastic production frontier, Sekela woreda, Irrigation user and non-user.

1. Introduction

1.1 Background

Ethiopian agriculture is largely small scale, subsistence oriented, and crucially dependent on rainfall. The highlands of Ethiopia, which most of the country's agricultural potential, suffer from massive land degradation due to soil erosion caused by heavy runoff and deforestation and the low productivity of peasant agriculture. These trends, combined with repeated drought over the years, have substantially eroded the productive assets of communities and households. A loss of community assets (e.g. pasture and forest) has in turn led to increasing environmental degradation and it also increased the pressure on farm, leading to declining investment in soil and water conservation practices. More importantly, households have become less capable to cope up shocks because they cannot accumulate saving (e.g. livestock holdings and food stores) (MoFED, 2002).

The country continues to face difficulty in meeting the food consumption needs of its increasing population (Lire, 2005). Farmers in Ethiopia have to work an ever-smaller plot of over worked land to produce their food. The per capita cultivated land for food grain has declined from 0.4 hectare in the early 1960s to 0.1 hectares in the mid-1990s (Debebe, 2000). Although, the percapita cultivated land is becoming lesser and lesser, the production system is highly dependent on rain fed too and produces once annually that farmers lack production intensification using different irrigation schemes to produce more than once a year and a look towards improving this backward farming

practice needs the integrated movement of the government and the people altogether to create sustainable food production.

Being dependent on rain fed agriculture coupled with the erratic nature of rainfall distribution is the major factors blamed for the poor performance of the agricultural sector and main cause of widespread food insecurity in the country (FAO 2008). Though the country has 4.5 million ha of irrigable land, irrigation covers only 0.7 million ha or about 18 percent of the total irrigable land. The dependence of most of the farmers on rain-fed agriculture has made the country's agricultural economy extremely fragile and vulnerable to the impacts of weather and climatic variability leading to partial or total crop failure, which in turn resulted in food shortages (MoWE,2011).

Therefore, small scale irrigation development is the major intervention areas that has to be given due attention to increase agricultural production in the country that supports the farmers to alleviate poverty and provide sufficient food by strengthening the base for sustainable agriculture and secure food and improvement of human nutrition(FAO, 2003).

1.2 Statement of the Problem

Agricultural productivity and production can be increased either by increasing necessary inputs or by introducing modern agricultural technologies. Given agricultural technologies and input level, agricultural productivity and production can be increased through improvement in efficiency of production. Hence, irrigation is a power full instrument for poverty reduction through direct impact of increasing the yield per se and indirect impact like rural employment, lowering the cost of food items, the feedback and multiplier effect associated with the provision of irrigation infrastructure. Besides this, one can also sense that there is an observable income gap between farmers of irrigation users and non-users.

Although small scale irrigation is assumed to improve the livelihood of farmers in the research area, the income gap between irrigation user households and non user households due to irrigation technology is not well addressed and also it is least known that whether irrigation creates variability

in technical efficiency among farmers or not. Therefore, this study analyzes the impact of small scale irrigation on farm technical efficiency and house hold income.

1.3 Objective of the Study

The general objective of this study is to analyze the impact of small scale irrigation on farm technical efficiency and household income and;
The specific objectives are:

- To analyze factors that determines house holds' income
- To compare and analyze the income differentials' of irrigation users and irrigation non user house holds
- To analyze the marginal effects (marginal contribution) of explanatory variables of farm production
- To compare the technical in/efficiency differentials and possibility of increasing technical efficiency potentials of irrigation users and non-user farmers

2. Literature Review

According to FAO(2008), Ethiopian irrigated agriculture covers only 3% of the total national crop production that increases agricultural production by 5%. Even by the low standard of African countries, its irrigation performance is less than 5% of its irrigable land. In contrast the three countries in Sub-Saharan Africa with the largest irrigation are Sudan (2.2 million ha), Madagascar (1.00 million ha) and Nigeria (0.9 million ha). In Sudan, 14 percent of the country's cropped land is under irrigation, while in Madagascar, the figure is 32 percent. In contrast, almost all the cropped land in Egypt is under irrigation. For comparison, irrigation in Ethiopia covers 0.7 million ha (18% of the country's cropped land).

The current irrigated land covers only 0.7 million ha of the total potential of 5.3 million in which 3.7 million ha can be developed by surface water and 1.6 million ha can be developed by ground water of the estimated potential land area(AQUASTAT, 2015). These traditional small-scale diversion structures

are rudimentary and subject to frequent damage by flood and wastage of water available for irrigation, while modern irrigation started by the commercial irrigated sugar estate established in the early 1950's by the Imperial government of Ethiopia the Dutch company known as HVA- Ethiopia followed by private investors in the middle awash for sugar cane, fruit and cotton production in the early 1960's. Following the 1975 rural land proclamation, the large irrigated farms were placed under the responsibility of the Ministry of State Farms but small scale irrigation was given little attention.

It is quite evident that irrigation development in Ethiopia did not attempt to involve the farming population both in planning and construction phases (Desta, 2004). Modern irrigation by and large bypassed the peasant, and the technology involved and the operation and management of irrigation schemes was entrusted a small technical and managerial elite working for large-scale investors interests in the past and later for state or parastatal enterprises. On the other hand, there is a long tradition among peasant farmers of water management for small-scale irrigation agricultural use. More than 40 percent of the irrigated land in the country is served by traditional small scale irrigation (Desalegn, 1999).

Ethiopia cannot meet its large food deficits through rain-fed agricultural production alone. Cognizant to this fact, the government has taken initiatives towards developing irrigation schemes of various scales. This will continue and be further strengthened during the coming years. The maximum area quoted to be currently under irrigation is estimated at about 5 percent of the potential, accounting for merely 3 percent of the country's total food production. Various sources give different estimates of irrigated area, but recent sources indicate that the area equipped for irrigation was nearly 700,000 ha in 2008 which is 18% of the economic irrigation potential of 3.5 million ha from which 39% of the irrigated area is in Oromia in central parts of Ethiopia, followed by 24% in Amhara in the north, 15% in Afar in the north east and 12% in SNNP which the remaining 10% is in the other parts of the country(FAO,2008).

In the short-term, however, the irrigation development program gives emphasis to the development of small-scale irrigation in which capacity

building in the study, design and implementation of irrigation projects are the forefront.

2.1 Irrigation Development in Amhara Region

Amhara national regional state is one of the largest regions in Ethiopia. It occupies a territory extended within a geographical coordinate between 9° 29'-14° 0 \ N latitude and 36° 20' -40° 20' E longitude. The total area of the region is estimated to be 170152 square km with ten administrative zones, 106 rural woredas, 12 urban administrations and 3231 kebeles. The region is endowed with four river basins with net potential area of 0.57 million hectares. Modem small-scale irrigation development in the country as well in the region began after the establishment of the irrigation development department within the MoA at the end of 1984.However, the progress was slow. Moreover; most of the modem schemes were poorly operated, managed and under-capacity. At tradition schemes peasant farmers were utilizing irrigation schemes date back to the last century.

According to the MOA(2005), and Awualachew et al. (2007), Amhara region has 770,000 hectares of irrigation potential. Different development activities have been underway to utilize these resources. Currently, there are 311 irrigation schemes operating in the Amhara region and these irrigation schemes developed covers an irrigated 13 areas which covers of 8468 hectares in which from these total irrigated areas 5,719 hectares is from small scale and 2,751 from medium scale irrigation schemes.

According to Yacob et al (undated), the region has a total irrigated land of 223593 ha, out of which 5,908 traditional schemes that has the capacity to irrigate a total of 208,928 ha and also it has 311 modern schemes that has the capacity to develop 19669 ha. The total beneficiaries in Amhara region are 334,824 households and 1,930,249 families.

At tradition schemes peasant farmers were utilizing irrigation schemes date back to the last century. Lately in 2003, in the national regional food security program, one of the strategies envisaged was the introduction of small-scale water harvesting systems. As a result there was big attempt to introduce small-

scale irrigation and house Hold Water Harvesting Scheme (HHWHS) in all parts of the region. A number of different structures were built all over the region. The number of structures built in the same year outstripped those built before.

To identify and know the size and distribution of the structures in the year 2005, the Bureau of Water Resources Development (BoWRD) undertook an exploratory study on the region's irrigation land and water resources. The region has four major river basins with small tributaries which are part of Abay, Tekeze, and Awash river systems; Danakil depression with a total estimated annual renewable potential of 35 billion meter cube fresh water (CoSAERAR,2002). Lakes act also as sub basin of major river basins. The catchment area of the region that contributes for the renewable potential surface water is more than 134,056km^2 (MoWR, 2003).

An indicative point of the wealth of region's underdeveloped water resource was thought that most of the renewable water resources constitute surface water rather than ground water although the understanding and quantification of the latter is rather limited. As stated in the MoWR 15 years water sector development program, availability of ground water in Ethiopia in hard rock formation shows great variability from location to location, depending on recharge, degree of fracture, permeability, obstacle to water movement , concentration and nature of chemical in water depth of ground water level, the case is true for the region as well (Muluken,2005).

The potential land for large and medium scale irrigation of the region is about 650,000 to 700,000 ha and for small scale irrigation is about 200,000 to 250,000ha (of which less than 10% has been developed), indicates that the magnitude of water resources available for development but the region has not yet utilized the resource potential efficiently or insignificant portion of the potential has been used in the region (BCEOM,1999).

2.3.1 Theoretical measures of technical efficiency

Farrell (1957) was a famous scholar who introduces the first analyses of efficiency measures after dividing it into two components: technical and

allocative/price efficiency. Technical efficiency shows firm's ability to produce a maximum level of output from a given level of inputs, whereas allocative /price efficiency presents the ability of a firm to use inputs in optimal proportions, given their prices and existing technology. The sum of the two yields the level of economic efficiency (overall efficiency).

According to Farrell(1975), technical efficiency can be obtained by using input and output quantity. Accordingly, observation P utilizes two inputs to produce a single output i.e one-output, multi input.SS' is the efficient isoquant estimated with an available technique of production. Now point Q on the isoquant represents the efficient reference of observation P. The technical efficiency of production unit operating at P is commonly measured by the ratio (Farrell, 1975).

$$TE = \frac{OQ}{OP} \qquad \textbf{2.1}$$

Technical efficiency value will take a value between zero and one showing the extent of technical in/efficiency of the production unit. As value approaches to one, the firm will approach to technically efficient point. from the above figure point Q is technically efficient since it lies on the efficient isoquant. If planned expenditure for the firm is shown by the slope of the isocost line AA' (Figure 1), then allocative efficiency (PQ') of a Production unit operating at P is defined as the ratio.

$$PQ = \frac{OR}{OQ} \qquad \textbf{2.2}$$

The distance between R and Q on the above figure (i.e. RQ) shows reduction in productions costs. This cost reduction would occur when production was to occur at the allocatively and technically efficient point Q' instead of only the technically efficient point Q. The total economic efficiency (EE) is also defined as the ratio (ibid)

$$EE = \frac{OR}{OP} \qquad \textbf{2.3}$$

The distance between point R and P can also be interpreted in terms of cost reduction. The product of technical efficiency and allocative efficiency s provides the overall economic efficiency.

$$EE = TE \square AE = \frac{OQ}{OP} * \frac{OR}{OQ} = \frac{OR}{Op} \quad \textbf{2.4}$$

Generally, the concept of the production function (or frontier) of Farrell is presented in x-y plane axis where the horizontal axis represents the (vector of) inputs X, and the vertical axis represents the resulting output Y is depicted in the following figure. The observed input-output values are below the production frontier implying firms don't attain the maximum output for the inputs involved, given the technology. Technical efficiency for the firm operating at point A can be measured by taking both the actual observed output and the frontier output associated with the level of inputs, X (i.e. Y/Y*), where Y* is the "frontier output". This is an input-specific measure of technical efficiency.

The existence of technical inefficiency of firms engaged in production has been a subject of considerable debate in economics. Some economists argue that given all available inputs to produce certain output for all firms equally, they can produce their output optimally which is identical with frontier output. For example, Muller (1974) states;

"However, little is known about the role of non-physical inputs, especially information or knowledge, which influence the firm's ability to use its available technology set fully .... This suggests how relative and artificial the concept of the frontier itself is.... Once all inputs are taken into account, measured productivity differences should disappear except for random disturbances. In this case the frontier and the average function are identical. They only diverge if significant inputs have been left out in the estimation".

But other economists criticized the aforementioned idea saying that managerial ability of the firm can result in inefficiency in production provided that all required inputs available to them. Upton (1979) was one among such economists who raised basic problems related with empirical production function analysis.

2.4.3 Empirical studies of technical efficiency on farm-level

Ethiopian agriculture is dominated by smallholders. Increasing productivity of smallholders is crucial for the country's economic development. There are two schools of thought regarding development strategies for small-scale farmers in developing agriculture. The first one states that there are few inefficiencies that exist in allocation of factors of production in peasant agriculture. The second school of thought states that there exist inefficiencies among small scale farmers. The first, view the problem that to increase productivity, the development and introduction of new technology is required. Whereas, the second school of thought put an emphasis on increasing efficient use of existing technologies and resources which, on the other hand can increase productivity (Farrell, 1957; Schultz, 1964). Several empirical studies conducted at different times in different parts of the world supported this view (Assefa and Franz, 1996; Getu et al., 1998; and Mohammed et al., 2000).

Getu et al. (1998) estimated farm specific technical efficiency using survey data collected from sample farmers at Babile, Ethiopia. They used a stochastic production frontier model and the major finding of the study supported the existence of overall technical inefficiency as well as variations in technical efficiency levels among individual farmers. The farm level technical efficiency ranged from 20% to 91% in 1993 and from 30% to 100% in 1994, and the mean technical efficiency was found to be 61% and 69% in 1993 and 1994, respectively. Their results imply that the total output of the sample farmers in the study area could have been increased by 30-40 percent above the actual output levels attained.

Mohammed et al. (2000) have reported that the average technical efficiency of barely production in Asasa district of southern Ethiopia is 0.55, indicating that the farmers are only producing on the average 55 percent of their maximum possible output level, given the state of technology at their disposal.

Similar studies conducted in developed countries showed technical efficiency variations between farms. In a study aimed at estimating technical efficiency in Swedish crop farms, following a pseudo panel data approach, Heshmati and kumbhakar found that the largest concentration of farms have got the

efficiency interval between 75-80 percent. The sample mean of persistent technical efficiency was found to be 76 percent with the standard deviation of 12 percent (Heshmati and kumbhakar, 1997). Tzouvelekas et al. (2001) analyzed the technical efficiency of organic and conventional olive growing farms in Greek and found that the organic olive-growing farms exhibited a higher degree of technical efficiency (relative to their production frontier) than the conventional olive growing farms. There is also a considerable scope for cost reducing and farm income improvement in both farming modes.

Kalirajan and Shand (2001), estimated the technical efficiency of irrigated and non-irrigated farms in Thamil Nadu, India, using stochastic production frontier. They reported that the mean technical efficiency showed increase trend over time for the irrigated sample. From an initial sample average around 68 percent technical efficiency increased season by season with few fluctuations but slowly over 9 years period to around 75 percent giving 7 percent point rise over the period considered. In the non-irrigated sample, the increase over the 9 years was even slower, from 63 to 66 percent, or only 3 percent points for the period. The difference may well reflect the greater production risks in the absence of irrigation and therefore the greater the difficulties for farmers in selecting optimum technical practices.

Desta(2004), conducted a research using the stochastic frontier production function with farm specific production inefficiency variables was used to estimate technical efficiency. The findings indicate that farm size, amount of credit received, education level of household head and access to irrigation have got significant influence on household income. Among the input variables, farm size and capital were found to significantly influence agricultural output, access to irrigation was found to significantly improve the technical efficiency of household. The whole sample mean technical efficiency of irrigation user and irrigation non-user households was 78%. This implies that agricultural output can be increased on the average by 22 percent if technical efficiency of farming households improved to obtain the maximum attainable level of output.

A research conducted by Bekele A. (2013), on technical efficiency variation on small holder farmers irrigated maize production using a stochastic

production model to estimate the level of technical efficiency and determinants of inefficiency for maize production. The descriptive statistics of his research found that the mean of maize yield per hectare was 38.4 quintal for non-irrigation user households and 48 quintal for irrigation user households.

The classical test of one-sample mean-comparison test conducted for the production variables used in the estimation of stochastic production function indicates that they are not used at the plot level agronomic standard of the project. The technical efficiency of irrigation user maize producer farmers ranges from 54% to 98% with a mean of 91.6%. The study finds that older age of household head, low levels of education for household heads, lack of credit services and limited livestock holding are found to have a positive effect on technical inefficiency

3. Methodology

3.1 Data Type, Data Source and Data Collection Method

In this study, both primary and secondary data were employed. A multi-stage random sampling procedure was employed for the selection of sample respondents. Four Kebeles were stratified into two strata: irrigation user and non-user farmers.

3.2 Method of Data Analysis

3.2.1 Econometric model of data analysis

It is hypothesized that farmers using irrigation have immediate effect on crop intensity then these farmers who have irrigation schemes have larger productivity and production than farmers that are irrigation non users. Although irrigation users have larger income than non user farmers, income of a farmer is determined by various factors. Therefore, all factors that determine income may not be included because of data availability problems rather some of them were considered in the analysis.

Thus the income analysis of this study was analyzed in the following multiple linear regression technique:

$$Yi = B_O + B_1D_1 + B_2X_2 + \text{------} + B_nX_n + U_{i-} \quad \textbf{(3.1)}$$

where, Y_i is the annual house hold income of the farmer,
$X_2, X_3, \ldots\ldots, X_n$ are the explanatory variables;
D_1=1 if the house hold has irrigation, 0 otherwise;
B_o - is the intercept, U_i - is the error term.

Economic efficiency can be categorized in to technical efficiency and allocative efficiency. The ability to obtain the highest amount of output with given amount of factor of production is called technical efficiency whereas allocating the resources in the profit maximizing sense is called allocative efficiency. Empirical measurement of the unobservable frontier has two techniques to measure efficiency; those are parametric and non-parametric approaches. The difference between the two lies in the way in which the production possibility frontier is estimated. The non-parametric approach does not require an explicit specification of its functional form, however, the parametric frontier does require an explicit specification of its functional form and it is either deterministic or stochastic depending the modeling of the random noise which ignored in the deterministic model but explicitly accounted for the stochastic.

Technical efficiency is determined by the factors such as demographic factors (age, gender, family size, etc), socioeconomic factors (land holding size, livestock ownership, off-farm income, etc), institutional factors (access to credit, membership of social organization, contact with extension worker, etc), education, geographical distribution, specialization, etc(Bummer, 2001).

The Cobb- Douglas production function was employed to estimate the average production function. The estimated average production function was compared to all observations and deviations from the average production function are a measure of technical inefficiency (Brummer, 2001).

Obviously, random deviations (white noise) can significantly affect the degree of deviation of each observation from the average production frontier and thereby affect the measure of technical efficiency (Brummer and Loy, 2000).

Stochastic frontier production models are designed to overcome the noise problem and it uses a composed error structure with a one-sided component and a two-sided symmetric term. One sided component indicate technical inefficiency effect associated with technical inefficiency of a firm while the two sided component accounts the measurement errors in production and other random effects which are not under management control (Aiger et al, 1977). Therefore, the stochastic production function is specified as:

$$Y = f(Xi, \beta)\, e^{\phi} \qquad \textbf{(3.2)}$$

Where, Yi is the annual total agricultural output of the household in monetary terms (in birr); f(Xi , β) is deterministic part of the production function; ϕ represent random error term, e^{ϕ} is stochastic parameter to be estimated. But ϕ is decomposed in to two components, because the stochastic frontier model acknowledges that the contribution of random shocks outside the control of the farmer can affect output. Therefore, at least it has to be separated from the contribution of the technical inefficiency variations (Kumbhagar, 2000).

$$\phi = Vi + Ui- \qquad \textbf{(3.3),}$$

Where; V_i is symmetric error term accountable for random variation in output due to factors outside the control of the farmer, whereas U_i represent technical inefficiency related to stochastic frontier assumed to be positive.

The distribution of the symmetric error component V is assumed to be independently and identically as $N(0, \sigma^2_V)$. The normal error term provides the production frontier to be stochastic and, hence, allows the frontier to vary across or over time for the same producer. However, the distribution of the one sided component U is to be half- normal. That is it assumed to be identical and independently distributed as $N^+ (0, \sigma^2_U)$ and it follows that:

$$\sigma^2 = \sigma^2 v + \sigma^2 u \qquad \textbf{(3.4)}$$

Considering that f(Xi, B) takes the log-linear Cobb-Douglas form, then the stochastic production frontier model in equation (4) could be rewritten as follows:

$$\ln Y = \ln f(X_i, \beta) + V_i - U_i \quad \textbf{(3.5)}$$

Taking the natural logarithm of the already specified Cobb- Douglas production function, we can reach the following linear production function which is easily estimable:

$$\ln Yi = \beta o + \sum_{j=1}^{n} \beta j \ln Xji + Vi - U \quad \textbf{(3.6)}$$

where, ln is the natural logarithm and j= 1, 2, 3, ...,n; Yi- is amount of output of the household in monetary terms (in birr); X,s are independent variables (deterministic variables); β's are vector of parameter to be estimated; V_i represents factors outside the control of the farmer; Ui is the non-negative random variable which are $U_i \sim N^{+}(0,\sigma_u^2)$ reflecting the technical efficiency relative to the production function. But the objective of the study is not simply knowing the inefficiency of productivity variability among farmers of irrigation and non irrigation users in Sekela Woreda rather exploration of the determinant factors which are the sources of technical inefficiencies of the farmer and farm specific attributes. Thus, the second stage was identifying the farm and farm specific attributes that have impact on farmers technical efficiency variation, The inefficiency function can be written as;

$$U_i = \sigma_o + \sum_{j=1}^{n} \sigma jZj + \epsilon i \quad \textbf{(3.7)}$$

where, U_i is inefficiency scores for the i^{th} farmer; Z_i is variables of inefficiency; σ_i is vector of unknown parameters to the inefficiency variables; ϵ_i the disturbance term included in the model.

Therefore, the final version of the Cobb- Douglas functional form which include both indigenous and exogenous factors to be believed to affect efficiency in the study area will be estimated as;

$$\ln Y = \beta_o + \beta_1 \ln L + \beta_2 \ln H + \beta_3 \ln OX + \sigma_0 + \sigma_1 AGE + \sigma_2 GEN + \sigma_3 EDD + \sigma_4 DR + \sigma_5 L + \sigma_6 IRR + \sigma_7 DFP + \sigma_8 FAM + \sigma_9 EXT + \epsilon \quad \textbf{(3.8)}$$

where, Y_i represents the monetary value of annual total output of a farmer; β1 to β4 are coefficient of parameter estimates of input variables; L represents total cultivated land holding of the household in hectares; H is total human labor in man-days utilized; OX represents total oxen power (oxen-days) utilized; AGE represents age of the house hold head; EDD dummy variable representing education level of the house hold having value = 1 if house hold head attends formal education, 0 otherwise; DR represents the ratio of the total number of dependent household numbers to the independent household members (active labor force) of the family; GEN is gender of the household head entered as a dummy variable in the model where the value of 1 is if the household head is male, and 0 otherwise; IRR is a dummy variable having the value 1 if household participate in irrigation, 0 otherwise; DFP represents distance of the plot from the farmer's house in (km); FAM is family size of the household; EXT is also a dummy variable having the value 1 if the house hold participate in extension package, 0 otherwise; σ_1 - σ_9 are the coefficient of parameter estimates of inefficiency variables of the model and ϵ - is disturbance term included in the model.

4. Result and Discussion

4.1 Descriptive Result

The average family size of the sampled households in the study area is 5.91 persons, with the maximum of 9 and minimum of 2 family size. The number of family members participated in agricultural and off-farm activities ranges from 0.7 to 6.8 person days with the average of 3.51. Moreover, the mean ratio of inactive labor force to active labor force of the family indicating dependency ratio is 1: 0.77, implying that there is a relative high dependency in the sampled households. The age of the sampled households ranges from 25 to 80 years of minimum and maximum respectively with mean age of 47.14 years. The total livestock owning is a minimum size of 0 and maximum of 12.1 TLU with average 4.35 TLU and the oxen power is 0 and 4 oxen of minimum and maximum respectively. The land holding of the household varies from 0.25 hectare to 3 hectare with the average being 1.23 hectare of cultivated land per household. The family labor participated in income generating activity is a minimum of 0.7 and 6.8 person-days per household and mean of 3.5 person-days. The mean ratio of a full time agricultural labor

to the total land holding was found to be 1: 0.5 indicating that there is high labor accumulation. The result clearly depicts that there is a relatively high labor disguised employment there in the study area that can diminish labor productivity. This does not consider the occasional supply of inactive labor forces (child and aged persons), which is a usual circumstance to use these labor especially during the peak agricultural times.

Table 1: Households socio economic characteristics and resource endowment

	Irrigation user households		Irrigation non-user households		Total respondents			
	N	mean	N	Mean	Minimum	Maximum	Mean	Std. Deviation
Age of HH head	60	45.53	62	48.89	25	80	47.14	11.86
Family size the HH	60	6.03	62	5.79	2	9	5.91	2.01
Labor in the family	60	3.94	62	3.08	0.70	6.80	3.51	1.46
Dependency	60	0.66	62	0.88	0.00	4.7	0.77	0.71
Land in (hectare)	60	1.24	62	1.22	0.25	3.00	1.23	0.57
Live stock(TLU)	60	4.90	62	3.81	0.00	12.10	4.35	2.63
Capital	60	1322.58	62	933.03	0	4673	1124.61	980.2
Ox in oxen-days	60	1.57	62	1.12	0.0	4.0	1.34	1.00

Source: *Own survey Data Result (2016)*

The irrigation user households ranges from a minimum annual income of 6500 birr to 58644 birr with mean average income of 24395.67 birr while for those households that are not irrigation technology users annual income ranges from 3271 birr to 43417 birr of minimum and maximum respectively and average mean of 13234.65 birr, implying that irrigation has positive contribution to household income. Credit received by irrigation user households and irrigation non user households ranges from 0 to 5000 and 0 to 3500 birr respectively, and the mean credit received is 909.17 and 800.04 for irrigation users and non user households respectively.

Table 2. Household income, credit received and distance of the HH from dev. center

	Irrigation user households				Irrigation non-user households			
	N	Minimum	Maximum	Mean	N	Minimum	Maximum	Mean
Income of HH in birr	60	6500	58644	24395.67	62	3271	43417	13234.6
Distance in kilometers (farmer house to DC)	60	0.25	15.00	3.8717	62	1.75	15	3.87
Credit received in birr	60	0	5000	909.17	62	0	3500	800.04

Source: own survey data (2016)

From the total respondents 67% have not taken different credit either in financial or in kind from any source and only 33% of the respondents get credit finance from different sources. The reason behind is no government organization had given any kind of credit particularly credit in kind for farmers like fertilizer, improved seed, farm implements, etc. From those who get credit, only 26% of the respondents took credit from Amhara Credit and Saving Institution and less than 1% of the respondents got credit from local lenders with the amount of money less than 1000 birr because of high interest rate levied on and are not willing to take more money from these local lenders.

Table 3: Sources of credit for households and amount of credit received

	Number of households at a given source of finance		Neither of the two Credit sources
	ACSI	Local lenders	
No credit received households	-	-	82
Households received credit of below 1000birr	-	7	
Credit received above 1000 birr	32		

Source: Own Survey Data (2016)

4.2 Econometric Model Results

4.2.1 Determinants of household income

The income of the household is determined by various factors both technically and socially. Besides the descriptions given above, the income analysis was estimated by using the linear regression model. The study has tried to address

the objective and give empirical analysis. The preposition that stated there exists no significance income differentials between the irrigation user households and non-user households was tested against the alternative preposition. A multiple linear regression analysis was carried using the software called Statistical Package for Social Scientists (SPSS). The dependent variable considered in the analysis was the total annual household income obtained from both agricultural and non-farm income (off farm) activities. The result is depicted in Table 4.

Depending on the model, gender of household head, educational level of the household head, cultivated land size, access to irrigation technology, amount of capital used to purchase agricultural inputs, family labor, livestock ownership, credit availability, oxen power and extension participation are the independent variables assumed to explain the dependent variables. Depending on econometric theories and the data availability, the above variables were believed to influence the income of the farming households. However, it does not mean that the variables included in this model are exhaustive. Moreover, at the initial step the amount of capital used to purchase agricultural inputs were included in the model, but during the time of analysis, the variable was found to have multicollinearity with credit received and total livestock unit. This is because of the major proportion of credit received by the rural households is allocated/ spent to purchase agricultural inputs and the total livestock unit is one of the major source of capital to purchase agricultural inputs that the more livestock unit the household has, the more amount of capital is allocated to purchase agricultural inputs. Hence, the variable was excluded from the model.

The coefficient of the explanatory variables which are educational status, access to irrigation, cultivated land size, family labor, livestock ownership and oxen power have positive sign and significant. However, gender has a negative sign but insignificant and extension participation has positive sign although insignificant. The positive sign of the coefficients indicate that the explanatory variables estimated influenced the dependent variable positively as far as the variables are significant. However, the level of significance differs from one independent variable to the other, but extension participation and gender are insignificant implying that the variables have no contribution

to income which is not different from zero. In testing of the hypothesis Ho: b=0 against the alternative H_1: b is different from zero; land, access to irrigation credit availability are significant at 1% confidence interval while education, labor livestock and oxen power are significant at 5% significance level. Moreover, the coefficient of land, irrigation, ox and education have depicting the significant contributions to household income.

Table 4. Output of the regression model of income determination

Model		Unstandardized Coefficients		Standardized Coefficients	t-ratio	Sig.	95% Confidence Interval of B		
		B	Std. Error	Beta			Lower Bound	Upper Bound	VIF
	Constant	3967.308	2626.762		-1.510	0.134	-9171.900	1237.285	
	Gender	-893.946	1582.933	-0.023	-0.565	0.573	-4030.326	2242.433	1.190
	Education	2298.613	1113.297	0.084	2.065**	0.041	92.758	4504.467	1.154
	Irrigation	6463.110	1066.979	0.264	6.057***	0.000	4349.028	8577.191	1.336
	Land	7028.835	1259.152	0.316	5.582***	0.000	4533.986	9523.683	2.245
	Labor	775.223	385.913	0.090	2.009**	0.047	10.586	1539.860	1.393
	Stock	819.232	381.625	0.170	2.147**	0.034	63.091	1575.374	4.412
	Credit	2.989	0.443	0.299	6.752***	0.000	2.112	3.867	1.372
	Ox	2020.920	907.086	0.160	2.228**	0.028	223.646	3818.194	3.599
	Extension	28.416	1200.174	0.001	0.024	0.981	-2349.574		
	R^2 value			0.84					1.448
	Adjust. R^2			0.828					

****, **, * significance level at 1%, 5%, and 10% respectively*

Source: Own computation from survey data (2016)

As indicated in Table 5, the coefficient of determination and the adjusted R^2 values are 0.84 and 0.83 respectively implying that 83% of the variation in the dependent variable is explained by the independent variables, indicating relatively high explanatory power of the model.

In testing the hypothesis that Ho: b_1, b_2, b_3, b_4, b_5, b_6, b_7,b_8, b_9 =0, against the alternative hypothesis H_1: b_1, b_2, b_3, b_4, b_5, b_6, b_7, b_8, b_9 is different from zero, the F statistic was employed and found that F_{cal} = (RSS/(k-1))/((ESS/(n-k))= 55.28 is by far greater than F-tabulated (1.96) and the F value obtained is significantly different from the critical value 9 and 112 degree of freedom for numerator and denominator respectively at significance level of 5%. This can entail that the explanatory variables included in the model jointly influenced total household income and the model output revealed that the null hypothesis is rejected. Hence, the regression result in the study area shows that in rural areas household income is more significantly affected by total cultivated land, credit availability and access to irrigation. The result conforms with the finding of Desta (2004) and Quasam (1994). Education status of the household head, total livestock unit has a positive contribution to household income and this result strengthens the finding of Desta (2004). The amount of family labor and number of oxen utilized in farming activity has also contribution for farmers' income but all these factors have a differential level of contribution to household income. Sex of the household head and extension package participation has no significant contribution to household income.

4.2.2.1 Production Frontier and Technical Efficiency Estimates

The maximum likelihood estimate of the Cob-Douglas stochastic frontier model with the distributional assumption half-normal depicted in Table 6, is evident that the estimates of λ(2.0343) and σ(0.73) i.e $\sigma = \sqrt{\sigma^2} = \sqrt{0.543}$, are large and significantly different from zero, indicating a good fit and the correctness of the specified model and distributional assumption. The observed significance of σ at the 5% significance level suggests that the conventional production function (OLS) is not adequate representation of the data that is the variables have significant contribution to inefficiency and the result is consistent with Tewodros (2001), Hjalmarson et al. (1996), and Sharma et al. (1997).The estimate of γ, which is the ratio of the variance of

farm-specific technical efficiency to the total variance of output is 0.80. This would mean that about 80% of the variation in output among farms is due to the differences in technical efficiency and therefore, the stochastic frontier model is different from the OLS indicating there is inefficiency in the production function. The result conforms with Sharma *et al.* (1997), Hjalmarson et al. (1996), Ali and Flinn (1989).

The input variable total cultivated land of the production function is significant at 1% confidence interval and have positive sign as of my expectation and parameter coefficient is 0.317. This result is in conformity with similar studies conducted by Abay and Assefa (1996), Getu et al.(1998), Desta (2004), except the parameter coefficient of this study(0.317) is less than the previous studies.

Oxen power of the production function is significant at 1% confidence level and positive sign, whereas, the coefficient of labor is significant but negative sign indicating the negative contribution of the input variable to the farm output depicting that the existing farm activity is more focused on light technology utilization such as using of herbicides to remove weeds than using human labor, using of zero tillage by applying chemicals not to plough the farm frequently and remove weeds perhaps it demands high labor force if and when the work is done by human labor.

In Cob-Douglas production function the parameter estimates measure the elasticity of production which imply that keeping other variables constant, a one percent increase in cultivated land input shall increase a 0.317 percent in agricultural output. Given the current prevailing condition in the study area, the marginal productivity of oxen power, keeping all other factors constant, is the highest followed by cultivated land to increase farm output. The bigger marginal productivity of ox with respect to agricultural output reflects the greater need of oxen power by farmers.

Table 6: MLE production frontier and inefficiency variables of irrigation user and non-user HHs

variables	Cob Douglas		Translog		
	Parameter	ML estimates	OLS estimates	ML	OLS
Constant	β_0	1.32(8.32)***	0.61(2.77)***	0.39(0.7)	0.38(1.12)
Lnlabor	β_1	-0.6(-4.3)***	-0.54(-3.5)***	-1.09(-2.24)***	-1.08(-2.18)**
Lnland	β_2	0.32(2.96)***	0.72(7.26)***	2.28(10.1)***	2.28(9.8)***
Lnox	β_3	1.70(4.46)***	0.94(1.96)***	0.99(2.4)***	0.99(2.34)**
$(Lnland)^2$	β_4			-1.01(-7.3)***	-1.01(-7.14)***
$(Lnlabor)^2$	β_5			0.33(1.77)	0.33(1.73)
$(Lnox)^2$	β_6			0(omitted)	0(omitted)
Inefficiency					
Intercept	σ_0	-4.14(-1.27)		-11.84(-0.61)	
Age	σ_1	-0.135(-3.32)***		0.26(0.25)	
Age square	σ_2	0.01(4.41)***		-0.004(-0.35)	
Gender	σ_3	5.36(4.23)***		6.15(1.65)	
Education	σ_4	-1.04(-1.84)		-2.28(-2.44)***	
Irrigation	σ_5	1.11(2.23)**		0.71(1.19)	
Family size	σ_6	0.16(1.54)		0.2(1.36)	
Land	σ_7	0.76(2.54)**		-3.14(-2.82)***	
Dependency	σ_8	-2.15(-3.49)***		-0.15(-0.2)	
Extension	σ_9	1.17(1.09)		5.13(1.47)	
Distance	σ_{10}	-0.05(-0.66)		-0.06(-0.05)	
Log likelihood		-56.2204		-37.53	
Sigma square	σ^2	0.543		0.18	
Gamma	γ	0.80**			
Lambda	λ	2.034		0.02	
Mean effi.		0.71			
Households		119		119	

Note: figures in the parenthesis are z-value, T-ratio, and standard errors for ML,OLS and inefficiency variables respectively. ***, **, * *indicate significant level at 1%, 5% and 10% respectively*

Although it is less importance for comparison of the level of technical efficiency of the two groups of households, some useful generalizations can be drawn from the model output depicted in Table 7. The table show that the input variables using the maximum likelihood estimation of the Cob-Douglas result of irrigation users and non-user households. The purpose of this decomposition of production frontier in to two categories estimation is that it can show the marginal contribution of each input variable to households of irrigation users and non-users but technical inefficiency is measured in terms of the deviations of farm output from the maximum attainable output that each observation is compared from common reference point. Hence, each farm's output is measured against the fitted regression line. Moreover, the regression line fitted for the two groups of sampled households are different, so that; comparison of inefficiency of households belonging to different group with different regression line or reference point is extremely difficult and misleading. Therefore, the combined result of ML estimation of the technical efficiency for the two groups is presented to indicate how much each group is efficient or inefficient compared to the overall mean technical efficiency value. However, the result of the maximum likelihood estimate input variables using frontier production function analysis for the sampled households of the two groups are presented in Table 7.

In Table 7, the maximum likelihood estimate of the variables included in the model output depicted that varying degree of relative importance between the two groups. Despite the fact that, the coefficient of land is significant and positive for both irrigation users and non-user households. The estimated coefficient of land was found to be 0.901 and 0.286 for irrigation users and non-user households respectively, indicating a one percent increase in cultivated land increases the income of the household by 0.90 percent and 0.29 percent for irrigation user and non-user households respectively. Therefore, the marginal contribution of land to agricultural output that increases households' income is greater when irrigation technology is in place. The result strengthens the finding of Desta (2004) in Ethiopia, Tewodros (2001) in Nepal China on small holder rice producer farmers.

Table 7: Maximum likelihood estimation of the Cob-Douglas production frontier

Variables	Parameters	Estimated value of	
		Irrigation users	Irrigation non-users
		ML OLS	ML OLS
Constant	β_0	1.95(0.29)***	-2.14(-9.3)***
		0.75(0.43)	0.55(0.16)***
Lnland in hectares	β_1	0.9(0.12)***	0.28(4.2)***
		0.96(0.16) ***	0.08(0.5)***
Lnlabor man-days	β_2	-1.05(0.3)***-	-2.35(-2.5)*** -
		0.67(0.3)**	0.4(0.12)***
Lnox in oxen-days	β_3	1.65(0.4)***	0.46(1.74)***
		0.823(0.8)	1.51(0.5) ***
Log likelihood function		-38.509	-4.710
$\sigma = \sqrt{\sigma^2 u + \sigma^2 v}$		0.91(0.154)	0.523(0.05)
$\gamma = \sigma^2_u / \sigma^2_u + \sigma^2_v$		0.999	0.998
$\lambda = \sigma_u / \sigma_v$		6.33	1.55
Mean efficiency		0.76	0.66
Number of households		60	59

Note: *The figure in parenthesis are standard errors.*
, **, * indicate 1%, 5%, 10% significance level
Source: Own computation from survey data (2016)

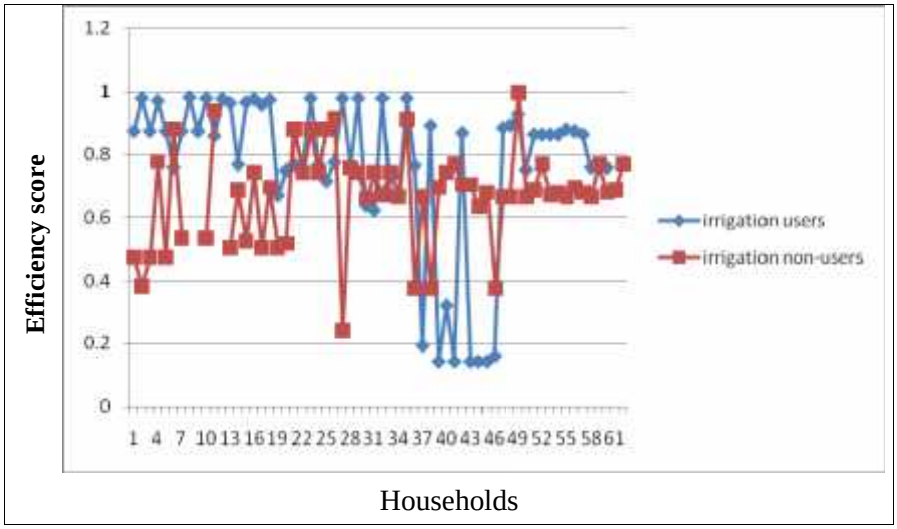
Moreover, the estimated coefficient of ox was found to be 1.654 and 0.462 for irrigation users and non-users in their respective order. Furthermore, the estimated coefficient of oxen power is larger for irrigation user households than non-user households implying that the marginal productivity of ox is greater for irrigation than rain fed agriculture. The result conforms with Bekele (2013) and Tewodros (2001). The positive coefficient shows that an increase in the number of oxen-days in the course of land preparation through threshing by one percent will tend to increase income of irrigation user households by 1.654 percent and 0.462 percent for irrigation non-users, keeping all other variables constant in the model. Therefore, it can be observed that the use of irrigation technology has improved the marginal productivity of input variables to agricultural outputs and hence increased the efficient utilization of land and ox.

The variable estimate of labor is significant at 1% confidence interval level in both irrigation users and non-users although the negative sign of the parameter is unexpected implying that family labor participated in agricultural activity has negative contribution to farm technical efficiency. This is because, as the size of land is not increasing leading to labor congestion that a larger amount of labor perform relatively lesser amount of agricultural activity but consumption is higher that deteriorates household income leading to labor productivity on agriculture to diminish; and the other reason is perhaps because of the restrictive condition of the Cob-Douglas specification of the model.

The mean technical efficiency of irrigation users and non-user households is 76 percent and 66 percent respectively. Inefficiency were mainly due to poor farm management and lack of technology. There can be potential for efficiency improvement with in irrigation users and irrigation non-user households. On average the respondents were able to obtain 76% and 66% of the potential income from a given mix of inputs for irrigation user and non-user households respectively. This implies also that 24% irrigation users and 34% irrigation non-users farm output was foregone due to technical inefficiency which reflects the inefficient use of the factors of production that were within the control of the farmers. Although there is inefficiency in both groups, we can infer from the model output that the use of irrigation has significant impact on households' farm technical efficiency.

The mean efficiency of the respondents was found to be 71% with a maximum of 99% and minimum of 14%. This disparity shows either there exists the room for improving the current production performance or achieving the current performance with a lesser input. If we decompose the achievements of technical efficiency by irrigation users and non-user household groups, about 21% of irrigation users and 65% of irrigation non-users are operating below the mean technical efficiency. On the other hand, only 35% of irrigation non-users and 79% irrigation user are performing above the mean technical efficiency indicating that there exists considerably high technical inefficiency in the non-user households.

Table 9: Efficiency score distribution of irrigation user and non-user households



Source: Own computation from survey data(2016)

4.2.2.2 Sources of Inefficiency among the Farm and Farm-specific Attributes

Understanding the sources of technical inefficiency and its extent is very important for policy making to address the problem of farmers. In this regard, demographic, socioeconomic, farm and farmer-specific, and institutional variables were hypothesized to affect level of technical efficiency of irrigation user and non-user households in the study area. Accordingly, the inefficiency model parameter was estimated by using the maximum likelihood estimate of the Cob-Douglas production frontier made on half-normal distributional assumption. The mean efficiency tells us that the level of irrigation user and non-user households output of the sample respondents can be increased if appropriate measure is taken to improve the level of efficiency of the farmers. Nine inefficiency variables were estimated of which six were found to be statistically significant at one percent and five percent significance level with their expected signs. These are age of the household head, age square(a proxy variable of farm experience), gender of the household head, and dependency ratio are significant at 1% significance level and access to irrigation and cultivated land size of the household are significant at 5% level of confidence.

But other inefficiency variables such as family size, distance and extension participation are insignificant.

i. Age of the household (σ_1)

Age of the household head shows a negative effect on technical efficiency of the farm and significant indicating that an increase in farmer's age by one year reduces the level of technical efficiency by 0.135%. This implies that aged farmers were less technically efficient when compared to their counterparts because it is believed to be reluctant to change their traditional method of production system as age of the farmer increases and the result concurred with the priori hypothesis. This result contradicts with the finding of Kidanemariam (2013), Shumet (2011) and Haileselasie (2005) in Ethiopia, but it is conveyed with the findings of Bekele (2013) in Ethiopia, Bernadette (2011) in Zambia, and Ahmed et al (2002) in Pakistan. However, the impact of age on technical efficiency turned out non-linear which have been captured by the quadratic variable (age square which is a proxy variable for experience). The coefficient of age square was positive and significant at 1% level. This indicates that technical efficiency first decreased with age up to a certain level beyond which it had positive impact on technical efficiency. This may attributed to the fact that farmers with more years of experience are aged people that have better efficiency because they capture better farm technical efficiency learning-by-doing. Therefore, as age coefficient was negative, experience was positive and this result substantiates the findings of Padilla-Fernandez and Nuthall (2009), and Mohhamed et al (2014). Hence, we can conclude that experience is better predictor of farm technical efficiency than age of the household head.

ii. Gender of the household head (σ_3)

Gender is included in the model as a dummy variable that it has positive contribution to efficiency and the result shows that being male headed household increase efficiency by 5.36% and statistically significant. This is because of the fact that, most of agricultural activities like ploughing of the farm, sowing, protecting the farm from flooding, threshing of crops and irrigating their farms when their share of time is at night and protect from destruction by wild animals especially during the night time is unusual farming activities to females (even they don't have a motive to practice) and done by males and these challenges pushed the female households to share-out

their land to other farmers leading the female headed efficiency to contribute negatively. The result conforms to the priori hypothesis but contradicts the finding of Tewodros (2001).

iii. Education level of the household head (σ_4)

Education is a dummy variable that is expected to equip farmers with the necessary skill to allocate their scarce resources in optimal way by adopting appropriate technologies that shift their production function outwards. Educated farmers have strong desire to get information and use it than their counterparts. The finding of this variable is statistically insignificant which contradicts the findings of Bekele (2013), Kidanemariam (2013), and Haileselasie (2005).The possible reason for this finding being insignificant was, those farmers who attend formal education are young and lack farming experience that makes them risk averts, and fears their decision to take farm risks, however, farmers that are not attending formal education are mostly aged people. Therefore, aged people (but illiterate) are rich in farming experience that can make the best mix of input variables over the literate farmers. Therefore, the variable education was insignificant. The sign of the variable has no any economic interpretation (which is not different from zero) as far it is insignificant. The result is similar with the findings of Taller and Balbase (1987) that attending formal education has no relationship with efficient use of inputs.

iv. Access to irrigation (σ_5)

Households that have access to irrigation technology are expected to have higher farm technical efficiency scores and the result of the model approves this hypothesis. The result shows that if a household have access to irrigation, the technical efficiency of the farm will increase by 1.114% that leads higher output with a given input variables. This result is also substantiated in the income analysis part of this research (Table 5) that a one hectare increase in irrigable land of the farmer had had increased the household income by 6463.11 birr annually. Therefore, irrigation has a positive contribution to farm technical efficiency and the model output depicts this fact. The result is in conformity with the findings of Desta (2004).

v. Family size (σ_6)

Family size is one important variable for agriculture during the previous times in the study area because it is the major source of family labor. But the model result shows family size is statistically insignificant for contribution of farm efficiency. The result contradicts to the findings of Mbanasor et al (2008), Mohammed et al (2014).The plausible reason for this contradiction result in which family size becomes insignificant was as time gone, the land size of the household share decreases from time to time because of increased population and took a parcel of land and as a result more labor is employed on small plot. Hence, the abundant labor force (especially active labor) had searching for other job opportunities migrating to other regions and engaged on other non-farm activities and the remaining family members left in the family are more of inactive labor force that increases dependency ratio of the household and has lesser contribution to agricultural activities and those family members who are active labor force left in the family are engaged in caring of the children and old ages. Therefore, family size has no contribution to efficiency improvement.

vi. Size of cultivated land (σ_7)

Size of cultivated land was found to be positive and significant at 5% level on technical efficiency. The result indicates that farmers with large farm size are technically efficient because land is the major resource for the farmer and the more the farmer has land, the more the output the farmer would have and the economic capability to purchase more inputs for farm production increase that leads to increase farm efficiency. This finding strengthens the findings of Bravo-Ureta and Pinheiro (1997). However, some studies such as Tchale (2009) and Mohhamed (2014) don't agree with these findings.

vii. Dependency ratio (σ_8)

Dependency is one of the variables assumed to significantly affect farm technical efficiency of the farmer and found that highly significant at 1% confidence level and affect efficiency negatively. High dependency ratio with in a family increases the demand for resources for feeding and as the number of dependent with in a family increases, then the demand for basic necessity especially for food, clothing will increase. Hence, the presence of large dependents in the family reduces the amount of family labor and resources

available for agricultural production forcing them to allocate more money for their health care, education and more time to care their children and old ages by diverting more resource from production activity to consumption and care of economically inactive people. Therefore, households with high dependency ratio would contribute negatively for efficiency of the farm. This result substantiates the finding of Bekele (2013), Mohhamed (2011), Shumet (2011) in Ethiopia; and Bernadette (2011) in Zambia.

viii. Distance of the farmer's house from development center(in kilometer) (σ_9)

Distance is the magnitude of space between the home of the farmer and the development agent's dwelling center in kilometers to get frequent support and practical training on different technological packages on farmer's own farm from the agent. Therefore, households nearer to development agent center are expected to get frequent support on different technologies and practical trainings at the farm level than those who are located at the periphery. But the result is different from the priori expectation because of the reason that practical training on different technologies is given for farmers not on individual farmers plot level rather it is given in centralized form at the farmer training center (FTC) and each farmer is getting the skill based on the schedule set by the consensus of the farmer and the DA(development agent) on the package that the farmer is going to be equipped the practical training. Hence, the variable is insignificant and the result is in conformity with the findings of Bekele (2013).

xi. Participation in extension packages (σ_{10})

Participation in different packages has positive contribution to efficiency of the farm by adopting new technologies and farming practices. Hence, it is expected to affect efficiency positively but the result is insignificant because most of the existing extension packages such as fertilizer application, improved variety seed, compost preparation, pesticide and herbicide application are started before 15 years ago and are old aged and adopted by all farmers with a similar fashion and the new entrant technologies (sowing teff in line) face failures that most farmers are in dilemma to adopt and participate. Therefore, the variable became insignificant for farm technical efficiency and the result concurs the finding of Desta (2004).

5. Conclusion

The output of econometric analysis indicated that size of cultivated land, amount of family labor, access to irrigation, total livestock unit, amount of credit received, number of oxen are significant and have positive contribution to household income. Estimation of the production frontier of input variables included in the model indicated that the parameter estimates of cultivated land size and oxen power were found to be significant whereas family labor was found to be significant but the sign of the parameter coefficient is negative. The maximum likelihood estimation of Cob-Douglas stochastic frontier production function coefficient were used to predict the technical efficiency of individual farmers. The mean technical efficiency for the total sample was found to be 71.

Agricultural output can be increased on average by 29% with the current level of resource utilization if technical efficiency of the farming households is improved to obtain the maximum attainable output.

Agricultural productivity varies due to differences in production technology, differences in which production occurs and differences in the efficiency of production process. Based on the findings of the study, the following policy implications or concluding remarks can be drawn for further consideration and improvement of irrigation development in the region in particular and in the country at large.

The study revealed that access to irrigation has significant contribution to improve income of the household, implying that countries like Ethiopia affected by climatic variability and recurrent drought, irrigation development is crucial in improving the livelihood of population. Specially, small scale irrigation that can increase farm efficiency by producing more than once a year and multiple cropping system that can intensify production has to be center of gravity for the government policy makers to overcome the prevailing challenges that face agricultural output growth over the years. Moreover, the amount of credit was found to be significantly influence household income. This implies that households largely need external financial source but those institutions that offer financial credit are very few. Therefore, to fill the capital

deficiency, the recently emerging rural financial institutions should be encouraged and strengthened in terms of number and way of credit delivering modality to reach the needy households.

The frontier output depicts that production frontier input variables affect agricultural output significantly. The land holding and oxen power are highly significant variables to improve the farm households income and attention had to be given to hold the land as productive by applying different technological interventions that can increase production and productivity and changing of the cultural practices and subsistence mode of agricultural practices enhancing labor absorption outside of agriculture because less productivity of land made the labor force out of agriculture and create unemployment in the rural area that created migration to urban areas for seeking of better job and wage but uncertain to get.

The study also highlighted a considerable potential of increasing technical efficiency of the farmers using the current level of agricultural inputs and production technology. Particularly the result suggests that at the given level of fixed and variable inputs level, the output can be increased by 29% if less efficient farmers were pushed to the level of efficiency achieved by the best farmers. The result clearly showed that there are technical efficiency differences across farmers and, consequently there is a possibility to increase output without major increase in input.

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Determinants of Household Saving Behavior: Case of East Gojjam Zone, Amhara Region, Ethiopia

Tarekegn Tariku Ebissa[1] and Geremew Worku Kassie[2]

Abstract

Resource accumulated in the form of capital and available for current and future investment is the foundation of economic growth. Saving is one of the best mechanisms of accumulating capital. The main purpose of this study is to investigate determinants of household saving behavior living in rural and urban areas. The study was conducted in East Gojjam Zone of Amhara regional state, Ethiopia. Respondents were selected through two stage-sampling techniques, and 250 rural households and 150 urban households were participated in the study. Primary data was collected from household heads by implementing household survey with in similar time interval. The collected data was analyzed using descriptive statistics and odd ratio logistic regression model. The findings of the study show that most households save their income, and personal saving habits of household head, the existence of financial planning and annual income of household determine the saving behavior of households. Furthermore, households' saving awareness and access to saving and credit institutions are now better than before in the study areas. The households are using modern saving style than traditional form and most households save just to meet short-run motives than long-run goals. Households should give more emphasis for minimization of worthless and extravagant socio-cultural events like exaggerated holidays celebration and marriage event. To improve the saving practice of household continuous training should be delivered concerning how to develop and implement financial planning, adopt positive personal saving habits and effectively manage earnings.

Key words: Saving, logistic model, East Gojjam Zone, Ethiopia.

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1. Introduction

The motive of many countries' economic policy is maintaining stabilized and sustainable economic growth. The Ethiopian government has been undertaking different actions to ensure the country's economic growth. For instance, the first and second five years growth and transformation plans (GTP) are mentionable. The ultimate goals of these plans are to transform the agriculture sector leading economy in the country to industrialization in coming decades. The transformation, however, requires intensive capital accumulation and capital investment in infrastructures, educations, agriculture, science and technology, business and financial institutions.

Resources accumulated in the form of capital available for current and future investment are the foundation of economic development. Saving is one of the best mechanisms of accumulating capital. A farmer with good capital accumulation or saving can access modern farming technology and inputs, employ improved farming methods, could increase his/her production and income. Saving is among important ingredients for economic success of a country especially in an economy dominated by agriculture (Girma *et al.*, 2013; Kifle, 2012; Chenge *et al.*, 2006). There is strong connection between saving (household saving and public saving) and economic development particularly in countries where agriculture takes dominant share.

In Ethiopia like other developing countries, households are prone to adverse shocks such as bad weather events, pest and downward in the price of agricultural output compared to the expenses of agricultural inputs. In addition, economic fluctuations, climate risk, small credit and insurance market, and weak social security coverage leave households vulnerable to severe hardship in developing countries (Abdelkhalek, *et al.*, 2009). In this context, a household saving is a crucial means of providing an insurance against the economic and social shocks. Likewise, savings at the household level are important for the welfare of family members in the course of economic development as a means to smooth income, to fund education and health for old age support when members become non-earners, and to leave as bequests to children. Additionally, a better practice of households saving

behavior could develop the potential to finance investments (Girma *et al.*, 2013; Kifle, 2012; Abdelkhalek, *et al.*, 2009).

Despite the important roles of saving in economic development process at a country level or household level in developing nations in general and in Ethiopia in particular, very few studies have been conducted on saving behavior. In line with this, the motive of this study was to investigate the factors that determine the saving behavior of urban household and rural households (here after referred to as households).

The definition of saving across authors is different, even if, it holds similar concepts. According to (Amu and Amu, 2012) saving is simply means of putting something aside for future use or what will be considered as deferred expenditure. Similarly, Girma *et al.*, (2013) has defined household saving as it is part of current income which is not expensed in the current period (or foregone consumption) after direct taxes paid from the earned income. Furthermore, researches including (Aktas *et al.*, 2012; Smith, 1991) mathematically defined saving as the difference between current income and current consumption when their difference is positive. The alternative definitions of saving include expenditure on durable goods, human capital investment such as education, health and insurance expenditures (Aktas *et al.*, 2012). (Lim *et al.*, 2010) share the alternative definitions of saving, an expenditure made for purchasing of a home or automobile, or spend for any investment, is regarded as saving.

The study came with new micro households' variables that affect households saving behavior. The study's results provide additional inputs for decision makers like policymakers, financial institutions, communities and to fill literature gap. The study identified the capacity and motives of households to save, form of saving and factors inducing them not to save. To come up with these objectives and benefits, data was obtained from selected individual households head by administering questionnaire. The collected data was analyzed and interpreted using different statistics tools. For comparison purpose, descriptive statistics was implemented whereas to investigate the relationship between households' savings behavior and the proposed explanatory factors, logistic regression model was used.

2. Statement of the problem

Saving is a driving force of economic success and stability. Domestic household saving have become a major contributor to a country's economic success (Chenge *et al.,* 2006). However, household saving practice and culture in Ethiopia is very low and found at worst level as compared to the saving rate of developed countries households (Aron *et al.,* 2013; Girma *et al.,* 2013). A public characterized by little or no saving behavior cannot bring radical change on its living standards and economic goals. Radical economic change would be maintained with high public or household saving rate, high investment rate, and healthy government policy. Saving is an important source of funds for domestic investment and economic growth, and thus the question of what determines its level and rate remains a crucial research and policy agenda. As per our knowledge, no adequate researches have been made in this area to teach the public, even though there is full consideration of domestic savings contribution to economic reform. This was happened due to lack of adequate empirical data about the public savings practice; factors hindering the public to save and inadequacy of empirical result on cultural and traditional events influencing saving practices.

Regarding to empirical studies in this area (Girma *et al.*, 2013) analyzed the determinants of the saving behaviors among rural households in East Hararghe Zone using 700 sample households, and (Kifle, 2012) has investigated the determinants of saving behavior of 120 cooperative member households in Tigray region of Ethiopia. A common characteristic of these empirical studies is their employment of data obtained from rural households and cooperative members only. The saving practices of urban households and non-member of cooperatives were not addressed by these studies. Furthermore, (Tsega and Yemane, 2015;) assessed the knowledge, practice and factors affecting households saving behavior in north Gondar zone using survey data obtained from three districts and (Aron *et al.*, 2013) examined households' saving culture in Ethiopia taking 544 households sample from three towns. These empirical researches have similar characteristics of using simple descriptive statistics analysis. Simple descriptive statistics might fail to find out the complete attributes of households saving behavior due to its complexity.

Therefore, this research filled the previous literatures gap by employing inclusive sample size and more advanced data analysis tool- the logistic regression model.

3. Research Questions

There are many questions concerning household saving behavior, which remains unclear yet. This research was conducted to answer the following basic questions in the study areas.

- How socio-demographic variables affect household saving behavior in East Gojjam zone?
- Does household living area matter household saving practices?
- Does sound financial plan determine household saving practice?
- How household head work type determines household saving practice?
- What are the motives of households to save?

4. Objectives of the Study

The general objective of this study was to investigate the basic determinants of household saving behavior living in rural and urban areas of East Gojjam zone of Amhara region. Specifically, the research was conducted to achieve the following objectives.

- Analyzing the effect of socio-demographic variables on household saving behavior.
- Investigating the consequence of living area on households saving practice.
- Analyzing the effect of financial planning on household saving behavior.
- Investigating the consequence of work type on household's saving rate.
- Identifying the motives of households to save.

5. Significance of the Study

This research has far-reaching significances in empirical investigation of household saving behavior. The research findings and conclusions will:

- Help to understand the saving behavior of households.

- Provide empirical evidence about households saving behavior that can be used to design policy and teach the community.
- Contribute to pervious literature gap by developing a conceptual understanding of saving behavior of households.

6. Related Literature Review

To identify the major determinants of household saving behavior, this study focused on four comprehensive independent variables. The socio-demographic characteristics of household head were the first variable. Household's head age, marital status, educational level, dependency ratio, gender of the household, and personal saving habit of the household head were considered in this variable. Various studies have been conducted in developed economy to understand the effects of socio-demographic variables on saving behavior of households. According to (Gedela, 2012; Callen and Thimann, 1997) males have better saving behavior than females because males have a higher level of financial knowledge, financial skills, and perceived earlier childhood consumer practices than females. To the contrary, (Abdelkhalek *et al.*, 2009) concludes Moroccan women were more savers than Moroccan men were. Aktas *et al.*, (2012) suggest that female labor participation on household's working activities can significantly affects the household's saving rate and a household with greater share of working female has higher saving rate. Regarding education status an individual with a higher education level is twice more likely to be saving money than an individual with a secondary education level (ACT Research, 2011). According to this research report, variables such as age of the household and marital status have no significant statistical effect on the decision to save or not to save. In contrast to this finding, (Gedela, 2012), concludes the saving behavior of household is not affected by educational status of the household head.

In addition to the above demographic variables, personal saving habits of households were also studied. Personal saving habit of a particular household can be positive or negative. Positive personal saving habit by far includes manner of regularly managing income by putting money aside from the monthly income, spending money in systematic manner through planning,

designing the means of managing unexpected expenses, feeling about family future and shield him/herself from adduction and so on. Whereas negative personal saving habit includes not regularly manage money or earned income, spending the major part of income as it is obtained, not taking in account of unforeseen expenses, spending money without plan, not feeling about family future and so on. These concepts reflect the personality of individual household head. Personality refers to the characteristics of a person that account for consistent patterns of feelings, thinking, and behaving (Pervin *et al.*, 2005, p. 6). In this study, personality was used in terms of saving habit. ACT Research (2011) suggests unsystematic and unplanned saving behavior significantly hinders the motive to save.

On the other hand, the saving behavior of a particular household can be affected by the dependency ratio of that household. Dependency ratio refers to the proportion of number of individuals living without any source of income with particular household to the total number of member of that household. A household with lager family size or dependency ratio saves less amount of its income due to higher household consumption (Gedela, 2012; Aktas *et al.*, 2012; Rick, 2010; Abdelkhalek *et al.*, 2009).

Income and work type of household head are the second independent variable. The study conducted by (Abdelkhalek *et al.*, 2009), in its first estimation took into account the income and household size as explanatory factors. As expected, income was the important determinant of household saving behavior. They found that saving rate depends positively on household income in rural and urban areas. Furthermore, the study conducted in Tribal concluded that income is the crucial determinant of household saving. The saving level of household increases as the percentage of income amount increases (Gedela, 2012).On the other hand, when individual income decreases it tends to decrease both current consumption and saving (Rehman *et al.*, 2011). Furthermore, the work status of household also determines its saving level. An employed individual saves more likely than an unemployed individual does (Aktas*et al.*, 2012; ACT Research, 2011). Thus, saving is the function of income.

The third important factor that could determine the saving behavior of household would be household living area-either in urban or rural area of the country. Explicitly, distinguishing the saving style and behavior between urban and rural area is very important, because the access to formal financial institution, living style, ownership of particular thing that has market value, access to information, and the access to take saving advantage have significant difference between rural and urban area. While the determinants of saving behavior are compared across rural and urban area, the factor, which is statically significant in rural area, does not work similarly for urban area (Abdelkhalek *et al.*, 2009).

Financial plan of household to match consumption with saving was the fourth factor. Financial planning is the process of making a reasonable decision about effective use and management of income in the future. According to the inter-temporal income-smoothing motive of savings, people want to smooth their income and consumption over their lifetime (Arent, 2012). The concern about smoothing the earned income across consumption and saving requires sound financial plan and people plan about future expectations or actions. Therefore, the plan and awareness about future expectation may influence the decision of people to save or not to save. In addition, (Lim *et al.*, 2010) concluded that the attitude or life expectation and planning horizon of household affect the level of their saving. Accordingly, those respondents who are optimistic about their life expectancy and those who have longer or more than one-year planning horizon was more saver than those pessimistic about their life expectancy and have short term planning horizon.

7. Research Design and Methodology

Research Design

The major objective of this study was to identify determinants of household saving behavior. In order to achieve the intended objectives of the research, it is necessary to plan and formulate research design, and use appropriate research tools and methods that highlight the reliability and validity of their outcome. Additionally, it is essential that the collected data should be analyzed and examined using appropriate statistical tools. Therefore, the research

design for this study was quantitative strategy. The use of quantitative design is important when the researcher wants to deeply analyze and investigate the relationship between predicators and outcome(s) (Creswell, 2003).

Sampling Design

The study was held in East Gojjam Zone, Amhara Regional State of Ethiopia. Its total land area is 14,009.75 km^2. It has four administration towns and sixteen rural districts (Weredas). The proposed total population size living in the zone is 2,494,324 of which 14.21% are living in urban areas and 85.79% are living in rural districts (Amhara Nation Regional State (ANRS), 2014).
Sampled households were identified by implementing two stage-sampling techniques. First, households living in rural and urban districts were included in the research after the study areas were purposively selected based on their population size. Accordingly, three most populated rural districts (Weredas[3]) (such as Hulet Eju Enesie, Enarji Enawga & Goncha Siso Enesie) and two most populated urban administrations (namely Debre Markos, & Mota) were selected.

The number of population living in these selected areas is about 782,361 people (ANRS, 2014). Using the average family size of Ethiopian households as indicated by the Central Statistics Agency (CSA) (2010), which stands at five members per family, the total number of households in the selected study area is estimated to be 156,472 households. This number was arrived by dividing the total population of the study area (782,361) by the average household size, which is five, and it was the target population of the study.

Second, the specific dwelling areas of each respondent were also purposively selected based on their access to transportation facilities and easiness for data collection. Accordingly, fifteen provinces (Kebele[4]) were purposively sampled from the rural districts (Wereda) whereas five provinces were selected from the urban administrations. The numbers of kebeles taken from each selected

[3] Wereda is a government administration unit collection of different Kebeles.
[4] Kebele is the smallest government administration unit.

weredas were determined based on the proportional number of kebeles of each weredas.

The next step had to do with the selection of respondent households from the sampled provinces. In each selected provinces, simple random sampling technique was employed to select respondent households. The number of respondent household heads taken from each sampled provinces were determined based on proportion of provinces of sampled areas.

Regarding to the sample size of respondents, 400 households were sampled from both areas (such that 250 households from rural districts and 150 households from urban areas). The sample size was determined using (Yemane, 1967) simplified sampled size determination formula at 95% confidence level. Therefore, the sample size of this research was,

$$n = \frac{N}{1 + N(e^2)}$$

$$n = \frac{156{,}472}{1+156{,}472(0.05)^2} = 399.80 \approx \mathbf{400} \text{households.}$$

For each selected study areas, the number of respondents to be taken was distributed based on the proportional number of selected Kebeles. Accordingly, 100 (40%), 68(27%) and 82 (33%) households (respondents) were taken from Hulet Eju Enesie, Enarji Enawga and Goncha Siso Enesie Wereda respectively. On the other hand, 90 (60%) and 60 (40%) respondents were taken from Debre Markos and Mota towns respectively.

Dependent and Independent Variables

Dependent Variable

This research provided an analysis of microeconomic factors, which explain the household savings behavior in East Gojjam Zone by using survey study. Household saving behavior was the dependent variable for this study. The household saving behavior was a dummy variable with binomial outcomes-yes or no. Respondent's opinion was represented by binary options such that it

takes "1" if the respondent saves from his/her income and "0" if the respondent does not save from his/her earnings.

Independent Variables

This study was focused on four comprehensive independent variables that might affect the saving behavior of households. The independent variables investigated in this research were:(1) social-demographic characteristics of household that includes household head's age, marital status, educational level, gender, personal saving habit, and family dependency ratio, (2) income and working type of household head, (3) household living area, and (4) financial planning of household to match consumption with saving. It should be noted that the data for both independent variables and dependent variable were acquired from households included in sample through questionnaire.

The Research Instrument (Questionnaire)

Questionnaire was employed for data collection purpose. For each household included in the research sample, one questionnaire was administrated after the items in questionnaire were translated into local language (that is Amharic).The questions (items) were adopted and modified in line with the research environment from prior period literature review. The instrument (questionnaires) consists of two parts. The first part comprised the demographic questions about the respondents. The demographic questions was designed to gather information related with household head's gender, age, marital status, level of education and other important data. The second part contains items formulated to obtain data related with other independent and dependent variables.

Methods of Data Analysis and Model Specification

The collected data were analyzed using simple descriptive statistic and logistic regression model run on STATA 12. The simple descriptive statistics was used to analysis the socio-demographic characteristics of respondents and used for comparison purpose. To identify major determinants of household saving behavior (HSB) logistic regression model was implemented. It is obvious that logistic regression model is used when the dependent variable is a binary

variable type. It is used to predict the likelihood of whether a dependent variable is present or not through logistic transformation. The following logistic regression model was formulated after dependent variable measure probability is restated into odd ratio and then the ratios are transformed into logit value using the maximum likelihood method. In this study, the dependent variable was a binary variable with "1" if the household does save or "0" otherwise. Thus,

HSB= $\mathbf{1}\ if the household does save his/her income, \mathbf{0}\ otherwise$

Mathematically the probability of household head to save (p_{HSBi}) in logistic regression is defined by odd ratio as:

$$Odd_{HSBi} = \frac{p_{HSBi}}{1 - p_{HSBi}}$$

$$= e^{\beta_0 + \beta_1 HAGE + \beta_2 AGESQ + \beta_3 HGEN + \beta_4 MART + \beta_5 EDU + \beta_6 DPEN + \beta_7 PSON + \beta_8 INCO + \beta_9 WORK + \beta_{10} LIVE + \beta_{11} PLAN}$$

Where,

HSB_i = A binary variable assessing whether the respondent does save from his/her income with 1 for yes, and 0 for no.

HAGE = Household head's age

AGESQ = Household's age square- is used to check the rate of change of saving with respect to increasing age of household.

HGEN = Household head's Gender (0 = Male, 1 = Female)

MART = Marital status (1= Single, 2 = Married, 3= Divorced/widowed)

EDU = Educational level of household head (1= Illiterate, 2 = 1-12th grade, 3 = Diploma, 4 = 1stdegree, 5 = Above 1st degree).

DPEN = Dependency ratio (= number of dependent (without any earnings)/total number of family).

PSON= Personal saving habit of household head (1 = Positive, 0 = Negative)

INCO = Annual income of household

WORK = Work type of household head (1 = self employed, 2 = government employee, 3 = Private org. employee, 4 = NGO employee, 5 = Farmer, 6 = Retired, 7 = Engaged on more than one).

LIVE= Living area of household head (1 = Urban, 0 = Rural)

PLAN = The existence of household financial planning to match saving with its consumption (1 = Yes, 0 = No)

e = Exponential function

β_i = Coefficient of independent variables

8. Research Findings Analysis and Discussion

Socio-demographic Characteristics of Respondents

In this study, 400 household heads were participated of which 21% were women and 79% were men. These figures show low participation of female household heads in the study as compared to male household heads since they have less opportunity to become household head in the study areas. The average age of household head was 37 years with 20 minimum and 70 maximum years, however, larger share of household head found in between 20 - 30 years that is 40%. This implies most respondents were at their young age followed by 31 - 40 years that is 24%. Regarding to respondents' annual earnings, almost all household heads (87%) had less than Br. 50,000 annual income. The average annual income of household head was Br. 33,697 with Br. 3,160 minimum and Br. 240,000 maximum annual income. The variation of household head's annual income from the mean was Br. 23,496. Most household heads were married (77%) followed by unmarried household head which was 19% of the total. Almost half of the respondents did not attend formal education at school. About 48% household heads were illiterate followed by 20% household heads having first degree and the rest have below first degree. Concerning the respondents' work type, all household heads included in this study had their own work at the time of data collection and most of them were farmers-share about 55% followed by government employees which were 31% of respondents.

In addition, the level of saving awareness and access to financial institutions of households were assessed in this study. The current level of households saving awareness and access to financial institutions is better than before in the study areas. However, the level of households saving awareness and access to financial institutions is not in similar position among rural and urban households. Urban households have better awareness and access than rural

households. According to the survey result of this study, more than half of rural household respondents (about 58%) have good saving awareness and access to financial institutions but 80% of urban household respondents do. Even though the current level of households saving awareness is better than before in the study areas, more work should be done particularly on rural households to create strong saving awareness.

Two financial institutions- Amhara Credit and Saving Institution (ACSI) and Commercial Bank of Ethiopia (CBE) are playing main role in improving saving awareness of households and accessibility to saving institutions. These institutions are now very close especially to rural households through opening their branch at rural district level where it is appropriate to run financial activities except in very remote areas. Therefore, the level of households saving awareness and accessibility to financial institution are now not the main problem to save. The problem is the ability to save. As income is one of possible determinants of household saving behavior, those households with high annual income have higher probability to save. However, most respondents (88%) in the study areas have no adequate annual income to save. Even most households were financing their activities and life through debt before saving.

On the other hand, the impact of socio-cultural activities on household saving behavior was also assessed particularly focusing on the frequency of ceremonial celebration of holidays and marriage. On average particular household held celebration for holiday 5 times per year and spent 4,255 Ethiopian Birr. The maximum frequency and annual expenditure for holiday celebration was 10 times and 21,000 Ethiopian Birr per year respectively. The minimum was one times and 300 Ethiopian Birr per year in the study areas. Unfortunately, most households even purposively save their income to finance holiday expenditures rather than for future investment.

Regarding to marriage celebration, in the study areas organizing and financing exaggerated marriage ceremonial give higher recognition to households than investing on business. It is a competition among households and considered as their cultural responsibility. Even household finance it by debt borrowing from relatives or financial institutions. If the household head unable to finance

marriage, other person specially his/her relatives support to finance by finding funds. As result, the extravagant may reach at other households than the household undertaking marriage ceremonial. Thus, exaggerated socio-cultural events are harming the saving behavior of each household.

Saving forms and motives of households to save

Previously the country particularly the region was very rich in various traditional forms of saving. Households were using different forms of saving like burying money underground, keep at home, put with relatives, Ekub, Edir and Mahiber. Currently, however, it seems these traditional saving styles were forgotten in the study areas. Most respondents were not using the traditional system of savings specially burying the money underground, keep at home, put with relatives, and Ekub. Those able to save are using modern financial saving institutions like banks and, credit and saving institutions. They knew saving at modern financial institutions is more secure and provide interest income advantage than using traditional means of saving. Thus, households have good saving awareness where to save than before for using secured saving form than unsecured one.

Savers do have their own motives of saving. In case of this study, most households save their income to meet future needs (64%), for unforeseen contingencies (51%), to cover future expenditures (48%) and to finance children education fees (45%). However, very a small number of respondents had motive to save to carry out business and undertake investment opportunities (15%),earn interest income (13%) and buy plant assets (11%). This indicates most households were save their income for purpose of financing short-run or day-to-day activities.

Assessment on Logistic Regression Assumptions

The very advantage of logistic regression over other types of regression is its less exposure to many assumptions such as heterogeneity, autocorrelation, normality, and linearity (Johnston, 2013; Joseph et al., 2010). However, the existence of high correlation among independent variables (multicolinearity) can impair the accuracy and efficiency of logistic regression outcomes (Johnston, 2013). As a result, assessment for multicolinearity was conducted using a pair - wise correlation and severe multicolinearity (about 0.997) was

found between household heads age and age square. In order to solve the severity, household age square was excluded from logistic regression model.

Logistic Regression Output Analysis

As it was mentioned in research methodology section, logistic regression model was employed and log likelihood odd ratio used to identify the determinants of households' saving behavior. The household saving behavior was dependent variable and binary variable with two response options. Logistic regression is the appropriate statistical tool to analyze binary dependent variable and it was run on STATA 12. The model is sufficiently very significant in general (p-value = 0.0000) and the outputs are presented in Table 8.1.

Table 8.1: Household Saving Behavior Logistic Regression Output

Independent variables	Odd ratio	Std. err.	p-value
HAGE	0.993	0.1392	0.649
HGEN	1.000	0.3211	0.998
MART	1.140	0.3917	0.702
EDU	1.077	0.1700	0.636
LIVE	1.024	0.4880	0.960
DPEN	0.667	0.4090	0.510
PSON	5.104	1.4598	0.000**
WORK	0.885	0.1340	0.422
PLAN	8.100	3.7158	0.000**
INCO	1.000	0.000	0.000**
Constant	0.061	0.0759	0.024
No. of obs. = 400	Psuedo R^2 = 0.2508		
LR $Chi^2(10)$ = 128.29	Log likelihood = -192.59		
Prob > chi^2 = 0.0000	**Significant at p < 0.05		

Household Saving Behavior and Socio-demographic Characteristics

Socio-demographic variables of respondents were one of the proposed independent variables as determinant of household saving behavior. Unfortunately, none of these variables determines household saving behavior except personal saving habit of household head. Thus, household head's age, gender, marital status, educational level, and dependency ratio do not determine household head to save or not to save his/her income in the study

areas. This conclusion contradicts the findings of previous studies (Gedela, 2012; Aktas *et al.*, 2012; ACT Research, 2011;Rick, 2010; Abdelkhalek *et al.*, 2009; Callen and Thimann, 1997) but it is consistent with (Gedela, 2012) conclusion regarding to educational level.

Personal saving habit of household head, however, significantly affects the household saving practices. As presented in Table 4.2, there is positive and significant ($p > 0.05$) relationship between personal saving habit and saving practices of household. The probability of household head with positive personal saving habit is very high (0.84) to save than with negative personal saving habit. This finding supports the conclusion of previous study (ACT Research, 2011). Lack of positive personal saving habit significantly harms the desire of households to save by engaging them in extravagant events. Because household head with positive personality regularly manages income, spends reasonably through planning, rigorously manages unexpected expenditures, thinks about family future, and protects himself/herself from adductions.

Household Saving Behavior and Living Area

The household head living area was other independent variable expected to affect its saving behavior. The living area was categorized as rural and urban districts. According to the result of this study, there is no significant relationship between household saving behavior and household head living areas. As a result, household head living area does not determine the household saving behavior in the study areas. In other words, the desire either to save or not to save is not affected by the living areas of particular household head. This finding is inconsistent with the preceding research findings (Abdelkhalek *et al.*, 2009). The reasons for these contradictory conclusions might be due to the current similar awareness of saving and better access to financial institutions between rural and urban households in the study areas.

Household Saving Behavior, and Household Income and Work type

The other important independent variables of this study were household head's annual income and work type. Household heads participated in this study were engaged in different work type and they had different work status. The work type was analyzed in terms of seven aspects of household heads such as self-

employed, government employee, non-governmental organization (NGO) employee, private organization employee, farmer, retired, and engaged on more than one work type. Even though, data were obtained from households engaged on each work type, the work type of households has no significant effect on their saving behavior. Households working type does not determine households saving behavior.

On the other hand, the significance of household heads' annual income for saving behavior was investigated and it has statistically positive significant effect on saving behavior. As indicated in logistic regression output, income of household was significant ($p > 0.05$) with somewhat greater that one odd ratio reflects its positive effect on saving behavior. As a result, household head's annual income determines household decision either to save or not to save. Thus, household with high annual income saves more than household has less annual income. This finding is consistent with previous studies (Gedela, 2012; Abdelkhalek *et al.*, 2009).

Household Saving Behavior and Financial Planning

This study was designed to analyze also the effect of financial planning on household saving behavior. Households those have annual plan were more saver than those do not. Financial planning has positive and significant ($p > 0.05$) effect on households saving behavior. The probability of household to save with financial planning is much higher (0.89) than household without financial plan.

Financial planning is one of the important aspects of household saving behavior in which the household draws a roadmap for implementation of various activities in the future. At household level, financial planning may encompasses various future family decisions such as how to finance day-to-day activities and life, assure family security and health, improve living standard, take investment opportunities, acquire basic needs, respond to unnecessary expenditures, and so on. It leads household in appropriate manner of money utilization by keeping them away from unreasonable expenditures. Households with a good financial plan have less chance of exposure to extravagancy. It is possible to reduce household's day-to-day expenditures through well developed financial planning. Thus, if expenditures are reduced

at constant earnings, there is good possibility of saving earnings. Financial planning enables households to improve saving possibility by reducing extravagancy through appropriate and effective management of earnings. Good household saving behavior requires the existence and implementation of well designed financial planning.

9. Conclusions and Recommendations

Conclusions

Based on the study's findings, the following conclusions were drawn to household saving behavior in the study areas.

- The socio-demographic characteristics of household head, its living area, and the work types the household head engaged on did not determine saving behavior of the household. The socio-demographic characteristics of household were involved household head's age, gender, marital status, educational level, and dependency ratio of the household. Furthermore, household's living area either urban or rural did not significantly affect the saving behavior of the household in the study areas. The work type household head engaged on was categorized as self-employed, government employee, NGO employee, private organization employee, farmer, retired and engaged on more than one jobs. However, work type and saving behavior had no significant relationship in the study areas.
- The desire of household to save was significantly determined by the personal saving habits of the household head; existence of financial planning; and annual income of the household. Household head with positive personal saving habits has more probability to save than household head with negative personal saving habits. In addition, the existence of financial planning significantly increases the desire of households to save. Given the household head's personal saving habits and existence of financial planning, household with high annual income has high probability to save than household with low annual earnings.
- Furthermore, saving awareness of household and accessibility to saving and credit institutions is currently higher than before. As a result,

households were using modern forms of saving like bank than traditional forms of saving.

- Households in the study areas save their income to meet their future needs, for unforeseen contingencies, to cover children tuition fees and day-to-day activities expenditures. However, very less number of households saves their income to take investment opportunities, carry out business activities, and purchase long-term assets like house, land, vehicles, or modern agricultural technologies.
- Finally, socio-cultural activities specially frequent holiday celebration and extraordinarily marriage events were harming the saving motives of households in the study areas.

Recommendations

In order to improve the saving behavior of households in the study areas, the concerned bodies including the household head should take measures on the following recommendations.

- ✓ Households should able to avoid negative personal saving habits that may impair its saving behavior and able to adopt good saving practices even at small amount of income.
- ✓ Each household should develop and implement financial planning each year for its day-to-day activities. There should be financial planning extension program as the government and other bodies are designed and implementing agriculture and health extension programs.
- ✓ More work should be done on the manner of increasing households saving awareness and access to saving institutions.
- ✓ It is better to continue using modern financial institutions for saving purpose, if there is access to them otherwise each household should use traditional means of saving particularly Ekub and Edir.
- ✓ Each household should overcome extravagant or unreasonable socio-cultural activities such as frequent holiday celebration and exaggerated marriage events.

Means for Intervention

To put the findings of the study on ground, different bodies should share their respective responsibilities. The implementation of the findings requires the concerns of four different bodies. These are:

(a) Governmental sectors (like public banks, and credit and saving institutions, public universities, the country's regional and zonal finance and economic development offices and associations, etc);
(b) Non-governmental organizations (NGOs);
(c) Private organizations (like private banks, credit and saving institutions, and education centers, etc); and
(d) The communities in general and each household specifically.

In order to improve saving behavior of each household, continues education and training should be delivered to the households concerning how to:

- ✓ Develop and implement financial planning each year.
- ✓ Adopt positive personal saving habits and behave accordingly.
- ✓ Overcome socio-cultural extravagant events and overblown ceremonial activities.

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