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Analysis of Adoption of Improved Coffee Technologies in Major Coffee Growing Areas of Southern Ethiopia

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Abstract
Ethiopia is the birthplace of Coffee Arabica and mostly produces this variety. Coffee is the most significant agricultural produce in the Ethiopian economy that contributes for foreign earning. This paper aimed at analyzing factors affecting adoption of improved coffee varieties in Sidama zone, Southern Ethiopia. In this study a multi-stage stratified sampling technique was employed to select rural kebeles and households. Four rural kebeles from Sidama zone were selected randomly. Structured interview schedule was developed, pre-tested and used for collecting the essential quantitative data for the study from 201 randomly selected households. Descriptive statistics, Tobit models were employed to analyze data. Results of descriptive analysis showed that there were statistically significant differences between adopter and non-adopter households with being a model farmer, owning pruning scissor, and frequency of plough, frequency of weeding and age of household head. Consistent with the findings of previous studies, regression results showed that improved coffee adoption decision of farm households has been determined by age of household head, size of land owned, owning pruning scissor, owning motor pump, Frequency of plough and frequency of weeding.
Keywords: Adoption, improved coffee, Tobit model, Sidama zone

INTRODUCTION

1.1. Background

Agricultural growth is widely considered as the most effective means of addressing poverty in the developing world. Consistent with this notion, the Department for International Development (2003) estimates that a one percent increases in agricultural productivity could reduce the percentage of poor people living on less than 1 dollar a day by between 0.6 and 2 percent and that no other economic activity generates the same benefit for the poor. However, the key challenge in the developing country agriculture is how to increase agricultural productivity to meet food security needs for the growing population and to also reduce poverty and malnutrition, and to do it in a sustainable way. As reported by de Janvry *et al* (2001) the growth in production cannot come from area expansion since that has already become a minimal source of output growth at world scale and negative source in India and Latin America. Thus growth in the production will have to come from growth in yields emanating from scientific advances offered by biotechnology and other plant breeding initiatives.

In most of the sub-Saharan Africa, agriculture remains large and the bulk of the poor are smallholders who benefit from it directly (. e.g., through increased agricultural profits) or indirectly (e.g., through increase in nominal income from other sources other than own agricultural production).Driven by hopes of a possibility of achieving an Africa Green Revolution through technological change, Research and Development efforts in Africa have led to the development and release of a number of improved crop varieties. It is widely believed that this led to substantial yield gains observed in the 1980s through to the 1990s As expressed by Evenson (2003)1980s and 1990s were the decades of high productivity growth in crop agriculture most of which came from yield gains resulting from crop genetic improvement, including both the diffusion of existing varieties and the development of new varieties. Evenson notes that three key successes have been reported along the path of achieving a Green Revolution in Africa in the last four decades and they include

An increase in the number of new released varieties, A positive and increasing trend in the rate of adoption of modern varieties, and while yield increases may not wholly be attributed to varietal improvement, their steady increase in the past four decades provide further evidence that there is potential for further improvement in productivity.

Ethiopia is the birthplace of Coffee Arabica and mostly produces this variety. Coffee is the most significant agricultural produce in the Ethiopian economy that contributes for foreign earning. Ethiopia is the world’s fifth largest coffee producer next to Brazil, Vietnam, Colombia, and Indonesia, contributing about 4.2 percent of total world coffee production and Africa’s top producer, with estimated 500,000 metric tons in 2012/2013 (Abu and Teddy, 2014.). Coffee production is almost exclusively concentrated in the two regions of Ethiopia, Oromia and the Southern Nations, Nationalities, and People Regions (SNNPR). Smallholder farmers produce 95 percent of Ethiopia’s coffee (Abu and Teddy 2013). More than 15 million people grow the crop for a living, hundreds of thousands of middlemen are involved in the collection of the crop from farmers and supply to the export and domestic market. It is produced under several types of production systems, including forest, semi-forest, garden, and plantation coffee (Abu and Teddy 2013).

Coffee has economic and social significance to the country. Coffee is the leading export items and as source of foreign earning, however its average share slightly declined from 35% to 30 % between 2004/05 - 2008/09 and 2009/10-2013/14, (UNDP, 2014). Coffee remains central to Ethiopian culture and heritage and is shared with family and friends through coffee ceremonies. Hence, coffee plays an important role in social gatherings and is important in local consumption, as more than half of Ethiopia's coffee production is consumed locally (CSA, 2013).

Ethiopian coffee production is predominantly characterized by traditional farm management system, limited use of improved coffee technology, fertilizers and pesticides coupled with a manual coffee cultivation system and drying method. In spite of its contribution to export earnings and social significance coffee production only increased by .07% and 0.3% in 2012 and 2013, respectively (Abu and Teddy, 2014.) Coffee yields are very low in Ethiopia compared to other countries (Minten *et al*., 2014) and this study highlights some significant opportunities for accessing improved coffee technologies that to contribute to productivity growth.

Abu and Teddy (2014) indicated the major reasons for the low coffee production (in quality and quantity) that the Ethiopian coffee farm management system and agronomic practices are traditional failing to inject new technologies into the country's coffee production system. Besides, extension services provided to small holder farmers are inadequate. The other reason they mentioned was inadequate use of improved seeds as the supply of improved seed is only limited to areas located around coffee research stations in the country. Different coffee technologies developed in research centers and coffee growers has not yet maximize technologies; therefore assessing adoption practice of improved coffee technology of farmers is important. Also, enhancing farm production through an adoption of modern coffee technologies to the existing farm system is relevant to improving the lives of coffee grower farmers.

1.2. Objectives

The main objective of the study is to assess the role of improved coffee technology adoption on coffee growers. The specific objectives are:-

Identify the determinant factors of technology adopters and non-adaptors of improved technologies of coffee.

1.3. Farmers' preferences for attributes, crop diversity and variety adoption

When local variety attributes satisfy farmers' concerns, their *de facto* conservation is easily realized. Thus, the level of *de facto* conservation that occurs in a particular area is mainly a function of the capacity of farmers' variety (ies) to satisfy farmers' economic and non-economic concerns. In essence, farm household characteristics and variety attributes translate to preferences for variety attributes and land allocation decisions. Farmers have multiple concerns and no single variety satisfies their concerns (Brush, 2000; Bellon, 1996). They can therefore be grouped by the concern profiles they share, which, in turn, are related to the environment in which they farm and the degree of market integration. For instance, Bellon (1991) grouped farmers' concerns into three: *agro-ecological* (rainfall and soil type); *technological* (response to fertilizer, labor and cultural practices); and *use* (performance of the variety for the purposes and uses of the output such as food taste, market price, yield, and production of fodder).

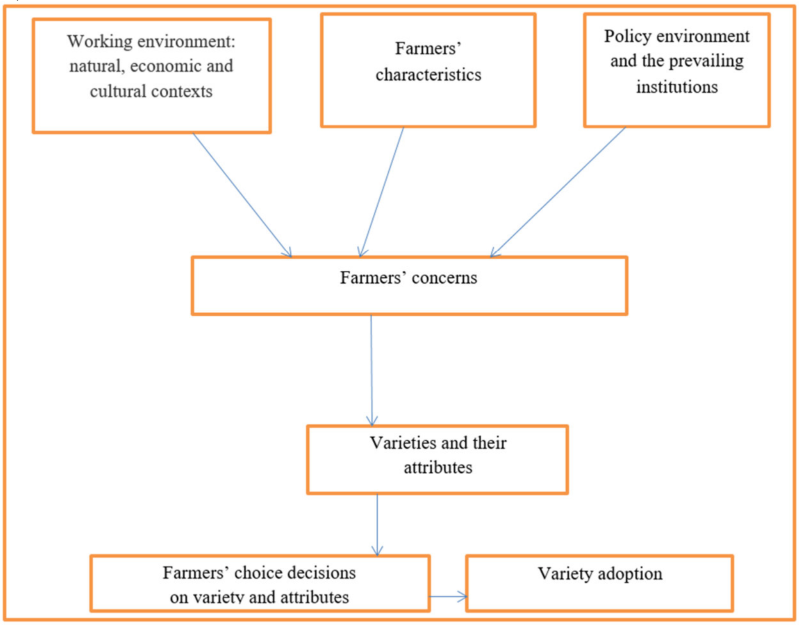

Figure 2. Farmers' concerns, variety attributes and crop variety adoption (conceptual frame work of the study)
Source: own estimation (2017)

The schematic presentation in figure 1 depicts the relationships among the characteristics of farmers' working environment, farm household characteristics, farmers' concerns and the outcome variables: crop diversity and variety adoption. As it can be seen from this figure, farmers' concerns are the outcomes of the interaction of farmers' contextual characteristics (e.g., farm size, family structure and gender, resource endowment, risk aversion, market opportunities, etc.) the policy environment and the natural environment (soil structure and fertility, water conditions, pests, diseases, weeds, etc.) in which they are operating. Subject to the influence of these factors, and the supply of varieties and their attributes, farmers will prefer variety attributes that address their concerns. Farmers' preferences for variety attributes result in their variety choice decisions since they value varieties by considering the attributes they embed. Ultimately, farmers' decisions for variety choice will determine the level of crop diversity. If breeding has to address farmers' concerns, variety development will have to target farmers' attribute preferences since variety adoption decisions are also based on these linkages.

The probability of the existence of a variety on farmers' fields is a function of the extent to which it embeds the important attributes preferred by the farm households. Thus, the question boils down to the fitness of the variety attributes with households' concerns. The survival of a variety is contingent on its capacity to supply the variety attributes that receive more weight by the farm households.

Most crop improvement work has so far been done considering crop yield as the major, if not the only, criterion for germplasm selection (Ceccarelli *et al.*, 1992). Often these varieties have either not been adopted or were used only for a short period. With the exception of participatory plant breeding, breeding programs have rarely exploited small farmers' traditional knowledge of difference between cultivars and farmers' use of these differences in cropping strategies (Haugerud and Collinson, 1990). Thus, integrating farmers' attribute preferences is of great importance not only to on-farm conservation but also to variety development and use.

Farmers adopt a variety much easier if it satisfies a need that is not currently met by the existing varieties) (Louette et al., 1997). Researchers must, therefore, carefully consider the costs and risks farmers face before investing time and money in developing particular types of new cultivars (Haugerud and Collinson, 1990). Since the conditions prevailing in farmers' working environment cannot be captured by breeders working on-station, participatory plant breeding needs information on farmers' attribute preferences reflecting farmers' concerns.

2. METHODOLOGY

2.1. Survey Design

The sampling was carried out using a multiple stage process. In the first step, major coffee producing areas were classified into three categories namely, high medium and low coffee growing areas based on area devoted to coffee interest production and production potential. Following the stratification of production areas, two coffee grower zones (Sidama and Gedeo zones) which have the highest acreage or production were identified based on latest available figures form SNNPS regional state. From each zone based on proportion of area coverage, intensity of extension effort and accessibility by a motor vehicle two coffee grower Districts were selected. Stratification at the level of a district is crucial to identify homogenous groups (strata) in order to increase accuracy of the sample estimates. Then, three PAs, one from each stratum, representing low, medium and high intensity of extension efforts, were randomly drawn from each category. Finally, at the level of the household a simple random sampling technique was used to identify respondents from the selected PAs.

A sampling frame consisting of lists of farm households (male and female headed) was solicited from the respective district level finance offices. The list was then be reviewed for its comprehensiveness and was updated to include recent household dynamics in the selected PAs. In all cases the sampling scheme need to ensure the collection of gender disaggregated data.

2.2. Data type and Data collection

The core materials of this research was consist mainly of the information gathered through a questionnaire filled out by face to face interviews with a random sample of coffee farmers operating on the study areas. In this research, participants were asked questions surrounding the matters relating to

1. Production characteristics such as size of operation, type of ownership, crop yields, improved technology and land characteristics.
2. Farmer characteristics such as age, family size, farming experience, education etc. The primary data collection was included consultations with research and extension experts using non-structured discussion guidelines.
3. The information from expert consultations was expected to provide insights to questionnaire preparation, administration and conducting of the survey at a household level.

To collect the necessary information, the questionnaire was pre-tested in pilot study areas. Primary data was supplemented by key informant interview, focus group discussion (FGD) and secondary data from the regional/zonal/District bureau of agriculture and finance and economic development. To identify the gender gap in the study areas, the FGD was conduct men, women or mixed (men and women) group separately.

2.3. Methods of Data Analysis

2.3.1. Descriptive and inferential statistics

Descriptive statistics such as mean, standard deviation, percentages, frequency, charts, and graphs, used to describe different categories of sample units with respect to the desired socioeconomic characteristics. Moreover, inferential statistics such as chi-square test (for categorical variables) and t-test (for continuous variables) were used to compare and contrast different categories of sample units with respect to the desired characters so as to draw some important conclusions.

2.3.2. Econometric analysis

Tobit model is differing in mapping of the latent variable in to unobserved variables that is, extension of probit model and it is one of the approaches dealing with the Problem of censored data (Johnston and Dandiro, 1997). Some authors call such model Limited dependent variable model, because of the restrictions put on the values taken by the regress and (Gujarati, 1995). Tobit model is superior over other dichotomous regression models in that not only attempts to explain factors influencing the probability of adoption technologies by the farm households rather it determine also the intensity of adoption of technology. Strictly dichotomous variable often is not sufficient for examining intensity of adoption (Feder *et al*, 1985). In such cases, Tobit model, which has both discrete and continuous part, is appropriate because it handles both the probability and intensity of adoption at the same time. Some adoption studies in Ethiopia used the Tobit model to identify determinants of probability and intensity of different technologies in different locations. (e.g.: Derege, 2006; Taha, 2007; Rahemato, 2007; Abebaw *etal., 2011*). Following Maddala (1992),Amemiya (1985) and Johnston and Dandiro (1997), the Tobit model can be defined as:

$$Y^* = \beta_0 + \beta_i + U_i$$
$$Y_i = y^* \; if \; \beta_0 + \beta_{ixi} + U_i > 0 \qquad (1)$$
$$Y_i = 0 \; if \; \beta_0 + \beta_{ixi} + U_i < 0$$

Where: yi= is observed adoption improved of maize for ith farmer, is a continuous variable measured in proportion of land allocated for improved maize seed. y*= is the latent variable and the solution to utility maximization problem of adoption improved maize seed subjected to a set of constraints per household and conditional on being above Certain limit, it is unobserved variable Xi= Vector of factors affecting of improved maize seed adoption, Bi= Vector of unknown parameters, and Ui= is the error term which is normally distributed with mean 0 and variance σ2. The model parameters are estimated by maximizing the Tobit likelihood function of the following form (Maddala, 1997 and Amemiya, 1985).

$$L = \Pi_{y^*} => 0 \frac{1}{\delta} f\left(\frac{yi-xi}{\delta}\right) \Pi_{y^*} \leq F(-\frac{\beta ix}{\delta})$$

Where f and F respectively are the density function and the cumulative function of y* Πy*≤0 means the product over those of i for which y*≤0 and Πy* >0 means the product over those of i for which y*>0.

It may not be sensible to interpret the coefficients of a Tobit in the same way as one interprets coefficients in an uncensored linear model (Johnston and Dinardo, 1997). The significant variables do not all have the same impact on the adoption of improved maize seed. Hence, one has to compute the derivatives of the estimated Tobit model to predict the effects of changes in the explanatory variables. That is probability and intensity of the adoption of improved maize seed. As cited in Maddala (1997), Johnston and Dinardo (1997) and Nkonya *et al.* (1997), McDonald and Moffit (1980) proposed the following techniques to decompose the effects of explanatory variables into adoption and intensity effects. Thus; change in Xi (explanatory variables) has two effects. It affects the conditional mean of yi in the positive part of the distribution, and it affects the probability that the observation will fall in that part of the distribution. Similarly, in this study, the marginal effect of explanatory variables will be estimated as follows.

1. The marginal effect of an explanatory variable on the expected value of the dependent variable is:

$$\frac{\partial \mathrm{E}\ (\mathrm{Yi})}{\partial \mathrm{Xi}} = \mathrm{F}\ (\mathrm{Z})\ \mathrm{B}$$

Where $\frac{\mathrm{BiXi}}{\partial}$is denoted by Z, following maddala (1997)

3. The Change in the probability of adopting a technology as independent variable Xi change is:

$$\frac{\partial \mathrm{F\ Z}}{\partial \mathrm{Xi}} = \mathrm{f}\ (\mathrm{Z} \frac{Bi}{\partial}$$

4. The change in the intensity of adoption with respect to a change in an explanatory variable among adopters is:

$$(\partial \mathrm{E}\ (\mathrm{yi/yi}\ i^* > 0)/\partial \mathrm{xi} = \mathrm{B}_i \left[1 - \frac{\mathrm{zf}\ (z)}{f(z)} - \left[f\left(\frac{zf(z)}{F(z)}\right)\right] 2\right]$$

Where, F (z) is the cumulative normal distribution of Z, f (z) is the value of the derivative of the normal curve at a given point (i.e., unit normal density), Z is the z-score for the area under normal curve, β is a vector of Tobit maximum likelihood estimates and σ is the standard error of the error term. Where, F (z) is the cumulative normal distribution of Z, f (z) is the value of the derivative of the normal curve at a given point (i.e., unit normal density), Z is the z-score for the area under normal curve, β is a vector of Tobit maximum likelihood estimates and σ is the standard error of the error term.

Table 1. Definition and units of measurement of the variables in the logistic regression

Variable	Type and definition	Expected sign
dependent variable		
Adoption	Dummy, adoption of Improved coffee	1 if yes,0 otherwise
Covariates		
AGESQUR	Continuous, Age of household head	Year
CREDIT	Dummy, Availability of credit source	1 if yes , 0 otherwise
Sex	Dummy, Sex of household head	1 if male, 0 otherwise
EDUCHH	Continuous, years of schooling	Year
BENGORG	Dummy, Being member of organization	1 if yes , 0 otherwise
OWNPRNSCR	Dummy, Owning pruning scissor	1 if yes, 0 otherwise
OWNMPMP	Dummy, Owning motor pump	1 if yes, 0 otherwise
LNDHECTR	Continuous, amount of land owned	Hectare
TRNGCOF	Continuous, number of coffee training trained	Number
FREQWD	Continuous, number of coffee weeding	Number
FREPLOGH	Continuous, number of coffee farm ploughing	Number
MRTLST	Categorical, Marital Status	1 if Married, 2 Single,3 Divorced

3. RESULTS AND DISCUSSION

This chapter mainly presents the findings of the study with an appropriate level of discussion. It is divided in to two sub-headings that could give a brief account of the subjects that were being investigated by the study. The first sub-heading presents descriptive analysis of sample households. The second sub-heading is econometric model for adoption and intensity of adoption of improved coffee varieties by sample households.

3.1. Descriptive Analysis

In this section of analyses descriptive statistics such as mean, standard deviation, percentage, t-test and chi-square test were employed using STATA 13 software programs. In this study, adopters of a technology refer to farmers who used improved coffee varieties by allocating proportion of their land and those farmers who experienced growing of local variety considered as non-adopters.

3.1.1. Adoption status and major constraints in coffee production

In the area, the average farm size of sample grower households was 1.86ha, and the maximum farm size was 10 ha and the minimum was 0.25 ha. From the sample of the population 74.5% are adopters and the rest 25.5% of them are non-adopters. Improvement in production and productivity of a given crop depends, among other things, on presence and use of better and improved varieties.

On average sample households taken 122.56 *birr* per year and the minimum credit borrowed was 0 birr which shows there are sample households who do not take credit at all and the maximum credit taken per year was 7000 *Birr* in the study area.

3.1.2. Descriptive statistics for socioeconomic variables in the study

A combination of different descriptive, the means and standard deviation and inferential, the t-test and X^2-test, statistics for explanatory variables of sample households were performed on the household level data to inform the subsequent empirical data analysis.

The descriptive and inferential results presented on Table 3 show that there was statistically significant difference between adopters and non-adopters in terms of age of household head, frequency of plough and frequency of weeding.

Table 2. Descriptive statistics of continuous independent variables

Variables	Mean across adoption categories		t-test	P Value
	Adopter	Non-adopter		
Age of household head	46.49	43.54	1.66*	0.0976
Land in hectare	1.28	1.38	1.60	0.1101
Education level	7.50	7.55	0.0901	0.9283
Frequency of plough	3.05	5.79	3.80***	0.0002
Frequency of weeding	3.17	5.87	4.20***	0.0000
Number of Oxen own	08	086	0.10	0.9156

Source: own survey, ***and * indicates that at 1% & 10 significance level respectively

Descriptive statistics of dummy/categorical independent variables

The descriptive and inferential statistics results presented in Table 3 show that 98.67% of adopters were male headed households. Regarding to owning pruning scissor only 24.16% of adopters were own pruning scissor and 63.32% of them were model farmers. On the other hand, 94.03% of adopters and 76.22% of non-adopters participated in demonstration in 2014/2015 cropping season

Table 3. Descriptive statistics of dummy/categorical independent variables

	Percentage of adoption category			
Variables	Adopter	Non-adopter	χ2 value	p-value
Sex of household head			0.12	0.720
-Male	98.67	97.95		
-Female	1.33	2.04		
Owning pruning scissor			3.94**	0.047
-Yes	24.16	73.46		
-No	75.83	26.53		
Owning Radio			0.0000	1.000
-Yes	70.00	70.00		
-No	30.00	30.00		
Owning motor pump			0.71	0.399
Yes	0.58	0.58		
No	99.32	99.32		
Being a model farmer				
Yes	63.34	78.00	3.64**	0.056
No	36.66	32.00		

Source: own survey, ***and * indicates that at 1% & 10 significance level respectively

3.2. Econometric Analysis

3.2.1. Determinants of adoption of improved coffee variety

Before running Tobit model all the hypothesized explanatory variables were checked for existence of outliers by box plot. The normality of the continuous explanatory variables was checked by using "ladder" and "gladder" commands of STATA 13 software. The variables were transformed in appropriate form when needed based on the above commands. The model was statistically significant at 1% level indicating the goodness of fit of the model to estimate at least one of the explanatory variables. Based on the above test, both the hypothesized continuous and dummy/categorical variables were included into the model.

Estimates of the parameters of the variables expected to determine the adoption of improved coffee production package are displayed in Table 4. A total of 12 explanatory variables were included into the econometric model out of which seven variables were found to significantly influence adoption of improved coffee production package. These are age of household head, distance to nearest market, size of land own, owning pruning scissor, owning motor pump, Frequency of plough and frequency of weeding.

Age of household head: -Age of household head was one explanatory variable in this analysis. It is assumed those farmers who have high age will accumulate good experience and can adopt new technology faster than their youngsters. It is significant estimated coefficient at 5% for this variable from the Tobit regression, giving evidence that shows age of household head was one among the possible factors in influencing adoption of improved coffee varieties in the study area.

Land owned: -Land owned to household has positively and significantly affected at 5% significance level on the adoption of improved coffee variety as indicated in Table 4.Land owned result indicated that as land owned increases adoption among the household will increase. This may be farmers having higher hectare of land they may get higher chance to try improved varieties then has higher chance to adopt improved varieties.

Distance to the market (DISMARKT): Market distance has negative relation and significantly affected at 5% significance level on the adoption of improved coffee varieties as indicated in Table 4. Market access result indicated that as market distance decrease, adoption among the household increase. This indicates that farmers nearer to the input and output markets have more access to input, technology and output market and also getting information about improved technologies than those who are in distant areas and can make early decision of adoption. Similar finding was identified by Debelo (2015) shows that distance from household residence to market center affect adoption decision of *Quncho tef* negatively and significantly.

Owning pruning scissor:-Owning pruning scissor is crucial for coffee farming activity. Those farmers who have pruning scissor had higher probability to prune the coffee cultivation which increases the vegetation of the crop. The probability of adoption of the package significantly and positively affected by owning pruning scissor at 5% significance level (Table 4).

Owning motor pump: - As the model result indicates, the variable owning motor pump had negatively and significantly influenced the likelihood of adoption of improved maize production at 5 % significance level. This explanatory variable accounts for 15.1% of the variation in adoption of improved coffee varieties. From this result it can be stated that those farmers who have access to and use motor pump are more likely to not-adopt improved coffee technology than those who have no motor pump for irrigation. This may be a farmer who has motor pump for irrigation purpose had higher probability to produce vegetables and annual crops and use their land for this crops by reducing the land for coffee cultivation.

Frequency of plough: - As the model result indicates, the variable frequency of plough had negatively and significantly influenced the likelihood of adoption of coffee seed production at 5% significance level. This explanatory variable accounts for 7.0 % of the variation in adoption of improved coffee production. The characteristics of coffee production may not need high frequency of ploughing instead it needs shedding effect.

Frequency of weeding is One of the significant variables in influencing adoption of improved coffee in the study area is the frequency of coffee farm weeding. This variable has an important effect on the adoption of improved coffee production and the result was significant at less than 1% probability level. This variable is negatively correlated with adoption of improved coffee varieties. This may be the nature of the crop does not need high frequency of weeding and need shed to be more successful

Table4. Econometric Analysis of Factors Affecting Adoption of Improved Coffee Varieties

VARIABLES	Adoption of improved coffee varieties
Age of household head	0.656**
	(0.277)
Distance to Nearest Market	-0.572**
	(0.245)
Amount of coffee production	0.205
	(0.143)
Average selling price	-0.00305
	(0.00449)
Amount of land own (Hectare)	-0.533**
	(0.237)
Education of household	0.0638
	(0.0508)
Availability of credit source	-0.268
	(0.255)
Owning pruning scissor	0.847**
	(0.354)
Owning Radio	-0.0444
	(0.267)
Owning Oxen	-0.645
	(1.019)
Owning Shovel	0.0255
	(0.277)
Owning saw	-0.114
	(0.259)
Owning motor pump	-1.510**
	(0.750)
Number of oxen owned	0.292
	(0.745)
Frequency of plough	-0.0786**
	(0.0353)
Frequency of weed	-0.260***
	(0.0959)
Constant	-4.012*
	(2.398)
Observations	201

Robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1

4. SUMMARY CONCLUSION

Agricultural growth is widely considered as the most effective means of addressing poverty in the developing world. Consistent with this notion, the Department for International Development (2003) estimates that a one percent increases in agricultural productivity could reduce the percentage of poor people living on less than 1 dollar a day by between 0.6 and 2percent and that no other economic activity generates the same benefit for the poor. Adoption of improved variety is one of the major means of agricultural growth.

Based on this notion, in Ethiopia diffusion of different improved varieties which are released in different research centers or taken from different countries started many years ago. One of improved variety which is diffused in the country is improved coffee varieties.

The objective of this study was to asses factors affecting adoption of improved coffee varieties in Sidama Zone, SNNP of Ethiopia. To meet the above objective multi stage stratified sampling method was used and to analyze descriptive such as t-test and chi-square test was used and to observe the normality of the selected variables different graphic methods was used and when it is appropriate transformations were done. Finally Tobit econometric methods was used to analyze factors that affect adoption of improved varieties.

From incorporated factors which are hypothesized to affect adoption of improved varieties six variables were significantly affect adoption of improved coffee varieties at different significant level with some of them negatively and others positively. Based on theoretical and the characteristics of the plant discussion were given which are open for comments on the completed research review.

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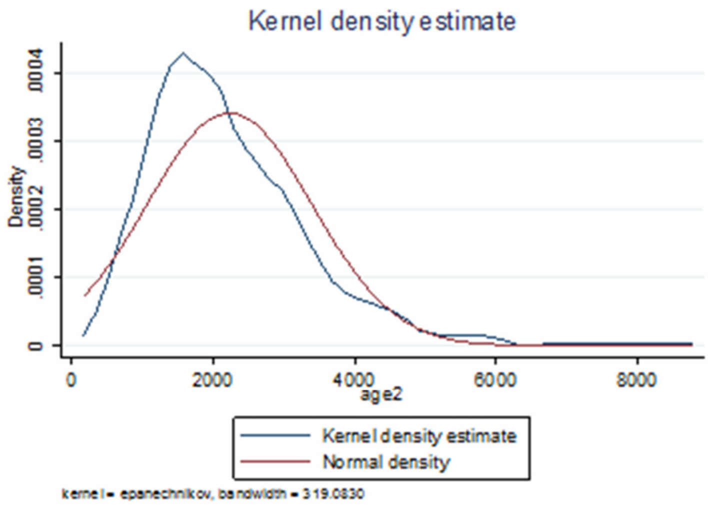
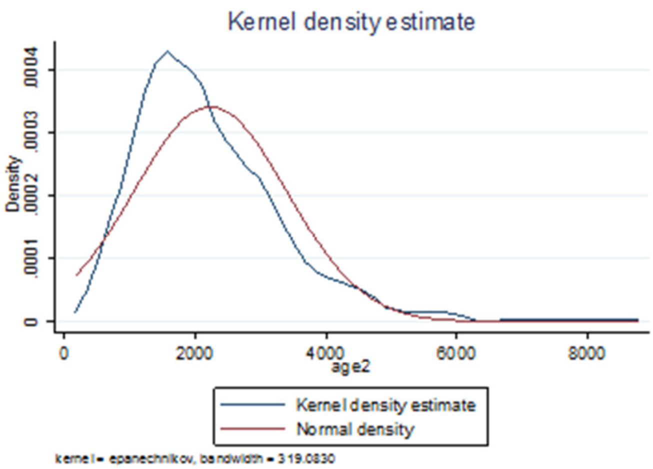
Appendix





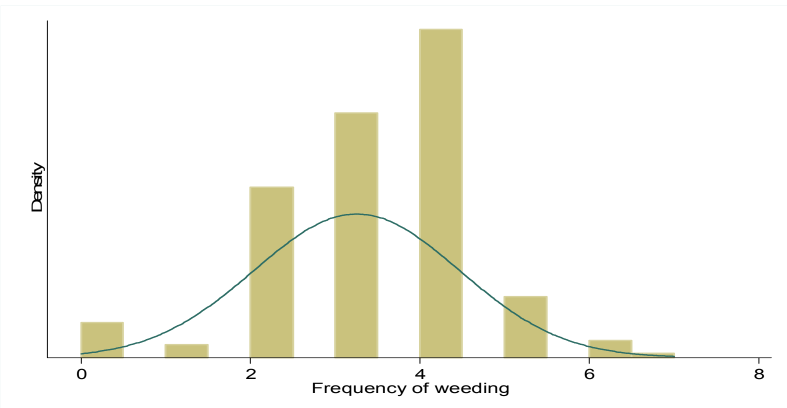
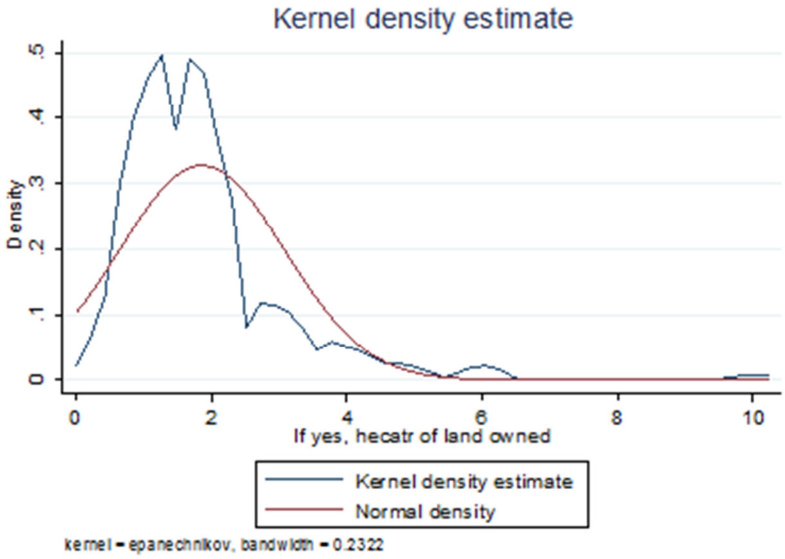


Figure 2. Normality Test for frequency of weed after transformation.



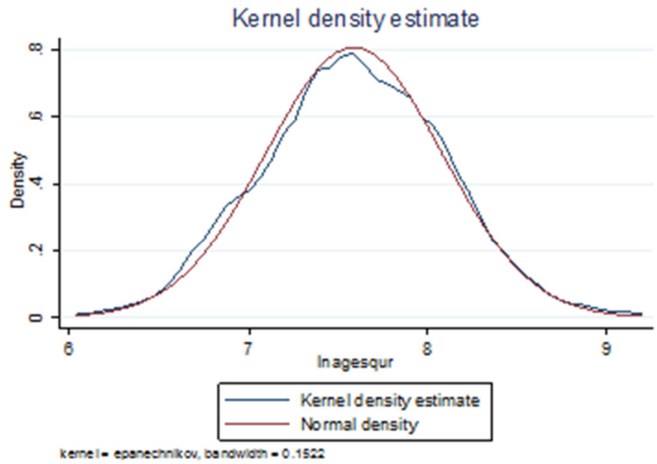


Figure 3. Kernel density of age square before and after log transformatio

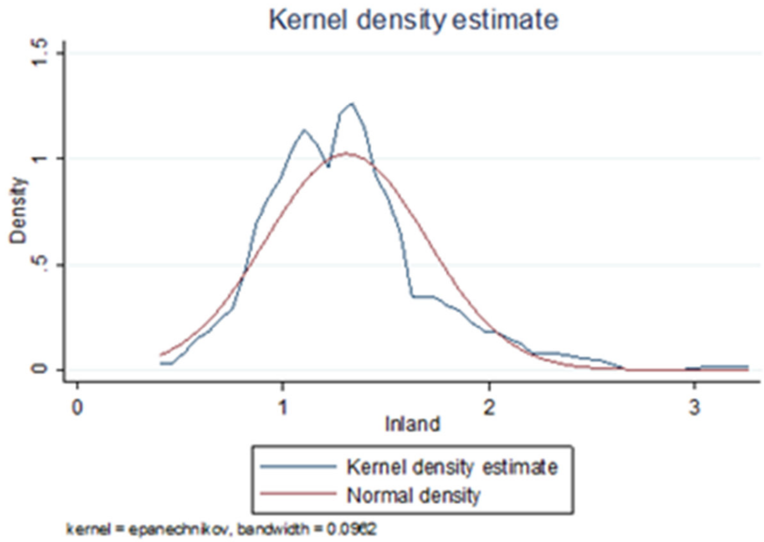


Figure 1. Kernel Density of log of land owned before and after transformation.