

# The Impact of Microfinance on Multidimensional Poverty Status of Rural Households in Gozamen District, East Gojjam Zone, Ethiopia

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## Abstract

Microfinance aimed at breaking the vicious circle of poverty in Ethiopia mainly by providing loan service for rural households. The main objective of this study is to examine the impact of microfinance loan service on multidimensional poverty status of rural households by taking evidence from Amhara Credit and Saving Association. To attain this objective, the researchers collect primary data by using household survey from the total of 290 sample sizes 145 from treated group and 145 from non treated group respondents by using quasi experimental design. To analyze the data, the researchers employed descriptive statistics and inferential statistics. The propensity score matching model result revealed that microfinance loan service has a negatively impact on the multidimensional poverty status of rural households. It is also found that microfinance loan service has reduced standard of living, health and educational dimensions of poverty respectively for rural households of the study area. It is recommended that government should give special attention to support microfinance's who support the rural poor household heads and improve the awareness level of farmers about its role towards poverty reduction.

**Keywords:**-Microfinance loan, Multidimensional poverty, Impact, Propensity score matching model, Gozamen district

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## 1. Background of the study

Microfinance revolution has got considerable impetus in the region of the globe in the last twenty five years. The prospective of microfinance as a successful practices and serves millions of rural and urban households around the world instrument to shatter through the vicious circle of poverty has been broadly spoken. Consequently, different type of financial service has come in to and hence, following this schemes, many studies were conducted to measure the impact of microfinance financial service on poverty status of rural households. Let us see the summery of their finding in bird view as follows;

A study done in Nigeria using the probit model findings revealed that access to micro-credit significantly influencing the probability of households' existing chronic poverty in small holder farmers of Nigeria (T.G .Apata et al., 2010).

A study conducted in Ethiopia using four round panel data by using the fixed and random effect model showed that microfinance financial service improve the consumption and housing improvements of households (Guush Berhane and Cornelis Gardebroek, August ,2012) .

Although the objective of microfinance is to get better the standard of living for the poor and thereby decrease poverty, many critics still question with regard to its significant impact (Adams & Von Pischke, 1992; Coleman, 1999; Schicks & Rosenberg, 2011, Asad K.Ghalib, I. M.,2011, Antawi, B. D. 2015).

Numerous studies have been carried out to measure the impact of microfinance service on poverty across developing countries for the past two decades. The results of the studies have been varied, to say the least. Even tests performed on the same data by different researchers yield contradictory results (Murdoch, 1998; Pitt & Khandker, 1998).

Yet, to what extent microfinance loan service brought reduction in poverty status of rural beneficial household compare to that of non beneficial rural households were not clearly investigated in Gozamen district. Cognizing these facts, the researchers are interested to examine the impact of microfinance loan service on multidimensional poverty of status of beneficial rural households compare to that of non beneficial households in Gozamen district.

## 2. Research Method

### 2.1 Research Design

Gozamen district is situated in East Gojjam zone of Amhara regional state of Ethiopia. It is located in the south west part of the zone between 37<sup>o</sup>23'50'' E latitude and 37<sup>o</sup>55 '03 '' 10 E and 10<sup>o</sup>00'50'' N and 10<sup>o</sup> 41'10'' N, longitude. Gozamen is surrounded Machakel in the West, Debre Elias in the West, Bso Libes in the South East, Aneded in the East, Sinan, and Debaye Tilategen in the North. According to the Amhara bureau of finance and economic development, Gozamen district has a total population of 145,023 of which 71,339 are male and 73, 683

are female. The total number of households accounts about 30,146. It has a total area of 1281,065,863 with a population density of around 119 per square kilometer. Gozamen district has different landscapes, most of which are mountainous. The altitude ranges from 800m- 2400m above sea level. This makes the district to have kola, Woyina Dega and Dega climatic regions. The majority of the populations' economic activity depends on agriculture. Around 97% of the population is dependent on agriculture. Only few have additional source of income from weaving, poetry and small business. Gozamen district is dominantly a food crop producing area of which Teff, Wheat and Maize are the most common outputs (Amhara bureau of finance and economic development, 2012).

The study followed quantitative research approach since the nature data for this study is quantitative nature. This study also investigates the poverty status of rural households and the extent of microfinance loan service on poverty status of rural household by taking evidence from Amhara credit and saving association and hence, the researchers follow descriptive research design.

## 2.2 Data Types, Sources and Methods of Data Collection

The study employed primary data and the method of data collection was household survey collected by structured questioners.

## 2.3 Sampling Techniques and Sample Size Determination

The population refers of the study were all household who are registered as a user of Amhara Credit and Saving Association in Gozamen district. The populations at which the samples were drawn are mostly located in rural areas. Probability sampling technique was used in the process of data collection. The population of Gozamen wereda is homogenous in many aspects except agro-ecological difference. Gozamen wereda has three climatic regions; Dega, Woina Dega and Kola agro-ecological zones. Based on this difference a stratified sampling technique was used to group the sample kebeles. There are 5 Dega, 2 Kola and 18 Woina Dega kebeles.

A total of four kebeles were selected from the total kebeles of 25 using simple random sampling method, randomly drawn from a complete list of kebeles. One kebele each was selected from Dega and Kola areas while two kebeles were selected from the Woina Dega area with the principle of proportional representation. A complete list of microfinance users and non-users was collected in each kebele and a proportional sampling was taken from both users and non users. The sample size was determined in proportion with the agro-ecological zones and the number of microfinance services user and non-user households.

Once the sample kebeles are identified, a sampling frame which contains a complete list of households (3202) was prepared and the sample determined using a simple formula (Cochran 1977).

$$n_0 = \frac{pqz^2}{e^2}$$

P is the estimated proportion of an attribute that is present in population which is incidence of poverty. q is 1-P, e is significance level (5%), Z is standard normal distribution ( $z^2=3.8146$ ) and n is sample size. According to Tsegaye (2014) incidence of poverty in Gozamen wereda (p) is 0.31 and q will be 0.69.

Based on this, we have got 327 households. But when the sample size is more than 5% of the sample fame, Cochran (1977) suggested correction mechanism as;  $n = \frac{n_0}{1 + n_0/N}$

N is sample frame and  $n_0$  is sample size in the original equation. By the correction mechanism, we have got 290 households. The sample for each kebele is obtained by using;  $nk = \frac{Nk}{Nt} * 290$  and the kebele sample is divided between microfinance service users and non-users in the same procedure.

The sampling procedure and sample size is seen in the following table.

**Table 3.1:- Sampling procedure and sample size**

Agro-ecological zone	Number of total kebeles	Number of selected kebeles	Name of selected kebele	Number of households of by microfinance		Number of sample		total sample size
				User	non-user	user	non-user	
Dega	2	1	Enerata	355	511	36	40	76
			Addisnagulit	352	474	36	38	74
Woina dega	18	2	Yebo	309	396	36	30	66
Kola	2	1	Chimet	400	405	37	37	74
Total	25	4		1416	1786	145	145	290

Source, 2017.

From the above table 290 households are used as part of the sample size. From this, a total 145 of them were users of microfinance loan service and the remaining 145 were taken from non-users.

## 2.4. Methods of Data Analysis and presentation

The study used both descriptive statistics, and inferential statistics. The descriptive statistic was summarized using average, and percentage to show the multidimensional poverty index, head count and intensity poverty. The data is presented in the form of table. For inferential statistics, propensity score matching model is used to examine the impact of Amhara credit and saving Association loan service on multidimensional poverty status of beneficial rural households compare to that non beneficiaries in Gozamen district since the microfinance loan service were non randomly assigned for users.

## 2.5. Variable Selection and Model Specification

### 2.5.1 Variable selection

To measure the multidimensional poverty status the researcher use three dimensions of poverty such as education, health and standard of livings and ten indicators of poverty as listed below ;

#### Depended variable

**Head count of Mutidimestion Poverty (H):-**multidimensional poverty head count status of each household as dummy dependent variable or outcome variable. It can be labeled 1 for poor 1, other wise 0. The cut off head count is determined by when MPI equal to 0.33 and above the household considered as poor and other wise non –poor adopted from (OPHI, 2017). Additionally, for the dimension of deprivation health, education and standard of living dimension is taken as outcome variables.

**Treatment Independent Variable:** Amhara credit and Saving Association loan service as dummy; 1 for users and zero other wise.

**The independent variable or matching covariates are the followings;**

**Land size:-**Cultivated land in hectare as continuous variable.

**Family size:** - number of peoples with the households as discrete variable.

**Marital status:** - categorical variable

**Sex:-**as dummy variable 1 for male and 0 otherwise.

**Age:** - It is a continues variable

**Education status of household heads:** measured by year of schooling.

The study uses ten indicators of deprivation as follows;

**Adult education deprivation:** - Education Indicator-Years of Schooling, dummy variable (0=ND,1=D).

**Child education deprivation:-**Education Indicator–School attendance, dummy variable (0=ND,1=D).

**Nutritional deprivation:-**Health Indicator–Adult malnutrition (0 =ND, 1=D), nutritional status is taken from the computation by using direct calorie intake of households. If the household takes less than the standard per capital nutritional requirement 2,100 calorie per adult per day set by the Ethiopian government the household is deprived(D), otherwise non- deprived(ND).

**Child mortality:** - Health Indicator – Child Mortality, (0=ND,1=D).

**Floor Derivation:-**Standard of Living Indicator – Flooring or roof dirty material like grass (0=ND,1=D)

**Sanitation deprivation:-**Standard of Living Indicator–improved sanitation (0 =ND,1=D).

**Access for clean water deprivation:-**Standard of Living Indicator–Access for clean water (0 =ND, 1=D).Given that less than 30 minute walk fetch and come to home.

**Energy deprivation:-**Standard of Living Indicator–Cooking Fuel (0 =ND, 1=D)

**Electric city deprivation:-**Standard of Living Indicator–Electricity (0 =ND,1=D).

**Asset deprivation:-**Standard of Living Indicator–Assets (0=ND, 1=D). Asset deprivation represents absence of least the following assets such as; television, Animal cart, and bicycle and farming tools

The weight of the above three dimensions and ten indicators will be adopted from OPHI 2017.

The methodology of computing MPI can be done as follows;

1. To choose the poverty deprivation cut off (identify which household is poor). Each person is assigned a deprivation score according to his or her deprivation in the component indicators which lie between 1 and 0. It can be expressed as;  
$$c_i = W_1I_1+W_2I_2+W_3I_3+W_dI_d$$
, where I=1, if the person is deprived in indicator “i”, and I=0, otherwise and  $w_i$  is the weight attached to indicator “i” with sum of weight equal to 1. With any combination of the indicators any one will be multidimensional poor if and only if; MPI is greater than or equal to 0.33, multidimensional poor.
2. Computing the MPI (aggregation).
  - i. Calculate the multidimensional poverty **Head count (H):** the percentage of people who are poor

which shows the incidence of poverty. It can be expressed using the formula:  $\frac{q}{n}$  where “q” is the number of people who are multidimensional poor and “n” is total population.

- ii. Calculating the Intensity or **Breadth of poverty (A)**:- It is the average deprivation score of multidimensional poor people or the average percentage of dimension in which the poor people are deprived. It can be expressed as;

$$A = \frac{\sum_{i=1}^q ci(K)}{q}$$

Where ci(K) is censored (for those whose deprivation score is below poverty cut off, even it is non-zero this is replaced by zero) deprivation score of individual ( i), and q is the number of people who are multidimensional poor .

- 3. The Calculated **multidimensional poverty index (MPI)** for the study area measures the proportion of weighted that the poor experience in a society out of all the total deprivation that the society could experience. The MPI can also be broken down by indicators, which is a useful tool for public policy. It means that MPI itself is simply the percentage of people who are poor and deprived in each indicator multiplied by the weight on that indicator. it can be expressed as;

MPI =H×A, where “H” is head count ratio, and “A” is intensity ((OPHI), 2017).A person identified as poor if he /she is deprived in at least one third (33.33 percent) of the weighted indicators ((OPHI), 2017).

### 2.5.2 Model specification

The dependent variable is a dummy that takes a value of 1 when a household is multidimensional poor and 0 otherwise by using 0.33 as a cut off adopted from OPHI, 2017. To examine the impact of Amahara Credit and Saving Association loan service on multidimensional poverty status of rural households the propensity score matching model estimated with logit model is used.

Estimating the average treatment effect can be as follows;

$$ATE = \frac{1}{N_1} \sum_{i=1}^{N_1} (y1i - \sum_{j=1}^{N_0} wijy0j)$$

Where,  $w_{ij} \in [0,1]$  and  $\sum_{j=1}^{N_0} wij = 1$

$N_1$  is number of participants and  $N_0$  is number of nonparticipants

i index of participants and j index of nonparticipants

$W_{ij}$  weights.

## 3. RESULT AND DISCUSSION

### 3.1 Descriptive statistics

#### 3.1.1 Multidimensional poverty status of Rural Households in Gozamen District

This study found that 73.81 percent of rural peoples in Gozamen district are multidimensional poor, on average the poor people are deprived in 49.18 percents of the weighted indicators and the society is deprived in 36.30 percent of the total potential deprivation it could experience over all. Rural households in Gozamen district are deprived at least either all indicator of a single dimensions or a combination across dimensions such as being in a household with a malnourished person, no electricity, no access for clean water, shared sanitation .This result shows that the poverty status of rural households in Gozamen district is moderately poor. However in rural Ethiopia 96.30 percent of peoples are multidimensional poor, on average, the poor people are deprived 66.20 percents of the weighted indicators and the society is deprived in 63.7 percent of the total potential deprivation it could experience over all and hence, the multidimensional poverty status of rural Ethiopia is classified under extremely poor ((OPHI), 2017).

Table 3-1: Contribution of each dimension to multidimensional poverty

<b>Dimension of deprivations</b>	<b>Total</b>
Education deprivation	0.2624
Heath deprivation	0.1249
Standard of living deprivation	0.6127
Total	1

Source: own survey, 2017.

The above table shows that the highest contribution to multidimensional poverty status of rural households in Gozamen District is standard of living deprivation which accounts 61.27 percent followed by education deprivation 26.24 percent and health deprivation 12.49 percent respectively. The data shows that standard of living take the largest domain of multidimensional poverty status of rural households in the sampled area of Gozamen district .The finding of the study confirm with (Andualem, 2016).

Table 3-2: Contribution of indicator to multidimensional poverty status

Indicators of deprivations	Total
Adult education deprivation	0.253
Child education deprivation	0.00937
Child mortality deprivation	0.03592
Nutrition deprivation	0.08902
Sanitation deprivation	0.1052
Energy deprivation	0.113
Clean water deprivation	0.1041
Floor deprivation	0.113
Assets deprivation	0.06767
Electricity deprivation	0.1098

Source: own survey, 2017.

From the above table the highest share of multidimensional poverty highly comes from adult education, energy and floor having equal share, electricity, asset, clean water, sanitation, nutrition, child mortality and child education deprivation respectively.

### 3.1.2 Decomposition of multidimensional poverty by access for microfinance service

Table 3-2-2: Decomposition of multidimensional poverty by micro finance service beneficial status

Poverty status	Microfinance loan service Non-Beneficiaries	Microfinance loan service Beneficiaries
H	0.8216	0.5963
A	0.504	0.4632
Mo	0.4141	0.2762
Pearson $\chi^2(1) = 18.0088$ Pr = 0.000		

Source: own survey, 2017

The above that show that in Gozamen district 82.16 percent of microfinance non- beneficiaries and 59.63 Microfinance loan service beneficiaries' peoples are multidimensional poor and the intensity of multidimensional poverty for microfinance loan service beneficial and non users of micro finance loan service were 46.32 percent and 50.4% respectively.

The research result also shows that the non users of microfinance loan service beneficial were moderately poor i.e deprived in 41.41 percent and the member's society was deprived while users of microfinance loan service 27.62 percent deprivation of the total potential deprivation it could experience overall which shows that the users of the service were vulnerable to poverty or at risk of poverty. The  $\chi^2$  test shows that there is an association between multidimensional poverty status and microfinance loan service at 1% significance level.

Table 3-2-3: Contribution of domain to poverty status by microfinance service beneficial status

Dimension of deprivation	Microfinance loan service Non- beneficiaries	Microfinance loan service beneficiaries
Education deprivation	0.3028	0.1938
Health deprivation	0.1489	0.08425
Standard of livings deprivation	0.6891	0.483
Total	1.141	0.761

Source: own survey, 2017.

The above table shows that the highest contribution to multidimensional poverty index is standard of living for both microfinance loan service users and non users in Gozamen district which accounts about 68.91percent for microfinance loan service non users and 48.30 percent for microfinance loan service users.

The second highest contribution domain to poverty status of rural household in the study area is Education which accounts 30.20 percent for microfinance loan service non users and 19.38 percent for users.

The third contribution domain to poverty status of rural household is education which accounts 14.89 percent for microfinance loan service non users and 8.425 percent for microfinance loan service users. The data shows that standard of living is a serious problem for both in the sample of rural households. However, relatively the in all domains of multidimensional poverty the users of microfinance loan service is relatively lower than non- users.

Table 3-2-4: Contribution of indicator to poverty by membership status

Indicators of deprivation	Microfinance loan service Non-Beneficiaries	Microfinance loan service Beneficiaries
Adult education deprivation	0.2929	0.1853
child education deprivation	0.009927	0.008425
Nutrition deprivation	0.09927	0.07161
Child mortality deprivation	0.04964	0.01264
Floor deprivation	0.1257	0.09127
Sanitation deprivation	0.1175	0.08425
Clean water deprivation	0.1175	0.08144
Energy deprivation	0.1257	0.09127
Electricity deprivation	0.1233	0.08705
Asset deprivation	0.07942	0.04774
Total	1.141	0.761

Source: own survey, 2017.

The highest indicators of multidimensional poverty were adult education for both microfinance loan users and non users followed by floor. However, the lowest indicators of deprivation are child education for both microfinance loan service users and non -users. Despite these facts, the score of indicators of deprivation were relatively lower for users compare to that of non users.

### 3.2 Inferential statics

Before estimating the average treatment on the treated as a pre- requisite the common support assumption were checked by kernel density plot, which ensures that there was a sufficient overlap in the characteristics of treated and non treated units to find adequate match which shows a lots of support between red and blue line (see appendix 2). Furthermore , the pstest were checked for balancing before trusting the ATT estimation and after matching, it was non-significant, so that the balancing was good for this study in building the good control group. The average absolute bias before matching was 8 and after matching it becomes 2.4 and hence the overall matching performance is good for all covariates ( see appendix 3).

Furthermore, Mantel Haenszel test statistics (MH) sensitivity analysis for average treatment effect were checked and there are no unobserved variable that affects treatment and the outcome variable simultaneously and hence, matching estimators are robust(see appendix ,4) .

#### 3.2.1 The impact of microfinance loan service on poverty status of rural households in Gozamen District

Table 4.2.2.1: The average treatment effect on treated multidimensional poverty head count

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Headcount	Unmatched	.593103448	.882758621	-.289655172	.048935018	-5.92
	ATT	.593103448	.770497457	-.177394009	.054530891	-3.25

Source: own survey, 2017.

The above output shows that negative treatment effect on their multidimensional poverty head count of rural households(-0.177394009) difference is brought due to Microfinance loan service for users compare to that of non users and statistically significant at 1 percent level of significance. Alternatively, rural household of the treatment group, the treatment has reduced their multidimensional poverty head count by 0.177394009 on average.

The explanation is that microfinance loan service in Gozamen district allows them to purchase farm inputs, pity trade, animal fattening, current consumption, irrigation and horticulture activities which in turn leads to reduction on multidimensional status of household. This finding confirms to (Tsgay, 2014), (Adekola, G. and Dokubo,Chidinma, 2017) and (Eleuter Atilio Kihwele and Raphael Gwahula , 2015, Adams & Von Pischke, 1992; Coleman, 1999; Schicks & Rosenberg, 2011).

#### 1) Standard of Living Dimension

Table 4.2.2.2: The average treatment effect on treated standard of living dimension

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Standard of living	Unmatched	2.8424827	3.01627579	-.173793087	.044951596	-3.87
	ATT	2.8424827	2.97566064	-.133177934	.052135009	-2.55

Source: own survey result, 2017.

As clearly shown in the table above the impact of microfinance loan service for standard of living is statistically significant that the individual of the treatment group, the treatment has reduced standard of living deprivation by -0.133177934 on average. The explanation is that the rural household who are users of microfinance loan service for the purchase of radio, television, and car and creates access for electricity, other assets and few energy sources which is a means for future production as well as raises their current consumption and their by reduce the standard of living dimension of poverty .

#### 2) Educational Dimension:-It consists of child education and adult education indicators of poverty.

Table 4.2.2.3: the average treatment effect on treated educational dimension

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Education	Unmatched	.065648274	.125537928	-.059889654	.00964557	-6.21
	ATT	.065648274	.08004803	-.014399756	.011337335	-1.27

Source: own survey result, 2017.

Note: ATT is average treatment effect on the treated

The output shows that for the individual of the treated group, the treatment has reduced the educational deprivation by -0.014399756 on average. The explanation is that the availability of microfinance loan service allow the users to cover the costs of education and their by rise year of schooling and school attendance and their by reduce child education and adult education indicator of multidimensional poverty status of rural households.

**3) Health Dimension:**-It consists of two indicators of poverty i.e nutrition and child mortality.

Table 4.2.2.4: The average treatment effect on treated health dimension

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Health	Unmatched	.027641379	.063344826	-.035703447	.009112258	-3.92
	ATT	.027641379	.070831489	-.04319011	.011223225	-3.85

Source: own survey result, 2018.

The output shows that for the households of the treated group, the treatment has reduced the health dimension of poverty by -0.04319011 on average. The explanation is that the prevailing loan service for users of the programme allows reducing child death and increasing expenditure on food, which in turn prevent infectious disease as well as improving nutritional status of children's and their by reduce the health dimension of poverty. The finding confirms (Nuredin Mohammed, Byeong Wan Le, 2015).For the validity of the average treatment effect.

#### 4. SUMMARY, CONCLUSION AND RECOMMENDATION

##### 4.1 Summary and Conclusion

This study found that 73.81 percent of rural peoples in Gozamen district are multidimensional poor, on average the poor people are deprived in 49.18 percents of the weighted indicators and the society is deprived in 36.30 percent of the total potential deprivation it could experience over all. Rural households in Gozamen district are deprived at least either all indicator of a single dimensions or a combination across dimensions such as being in a household with a malnourished person, no electricity, no access for clean water, shared sanitation however ,the poverty status of Gozamen district is classified as moderately poor.

The highest contribution to multidimensional poverty status of rural households in Gozamen District is standard of living deprivation which accounts 61.27 percent followed by education deprivation 26.24 percent and health deprivation 12.49 percent respectively. The data shows that standard of living take the largest domain of multidimensional poverty status of rural households in the sampled area of Gozamen district. The finding of the study confirm with Anduaem, 2016; Obadia,2014;Oluyombo,2013;Adekola,G.and Dokubo,Chidinma ,2017etc. The propensity score matching model result reveled negative treatment effect on their multidimensional poverty head count of rural households(-0.177394009) difference is brought due to Microfinance service intervention for users compare to that of non users and statistically significant at 1 percent level of significance.

It is also found that microfinance service has reduced standard of living deprivation by -0.133177934, health deprivation by-0.04319011 and education deprivation by 0.014399756 on average for treated compare to that of non treated group in Gozamen district. This finding confirms to (Odoyo, 2012),(Obadia, 2014),(Oluyombo, 2013) and (Adekola, G. and Dokubo,Chidinma , 2017)etc.

##### 4.2 Recommendation

Based on this research finding, the researcher forwards the following recommendations;

Microfinance loan service has a negatively impact on the multidimensional poverty status of rural household and hence, the government should give special attention to support microfinance those who support the rural poor household heads and improve the awareness level of farmers about it. Additionally, the microfinance financial institution expert should give attention for health, education and standard of living respectively to improve the dimension of deprivation multidimensional poverty. Furthermore, the rural households shall use microfinance loan service for health improvement, education improvements and standard of living improvements so as to reduce their multidimensional poverty in Gozamen district.

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**Appendix 1: Average treatment effect on the treated**

. psmatch2 Micservi Land Age Famsize Hhedu Marstau SEX ,kernel outcome ( \_H )common

Probit regression	Number of obs	=	290
	LR chi2(6)	=	34.34
	Prob > chi2	=	0.0000
Log likelihood = -183.84389	Pseudo R2	=	0.0854

Micservi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
Land	.0940718	.100921	0.93	0.351	-.1037297 .2918733
Age	-.0069391	.0082831	-0.84	0.402	-.0231738 .0092956
Famsize	.1057193	.0516705	2.05	0.041	.0044469 .2069916
Hhedu	.6429208	.1352434	4.75	0.000	.3778486 .907993
Marstau	-.1198202	.3183492	-0.38	0.707	-.7437731 .5041327
SEX	.1667389	.4174704	0.40	0.690	-.651488 .9849658
_cons	-.6432936	.9296273	-0.69	0.489	-2.46533 1.178742

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
_H	Unmatched	.593103448	.882758621	-.289655172	.048935018	-5.92
	ATT	.593103448	.770497457	-.177394009	.054530891	-3.25

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support	
	On suppor	Total
Untreated	145	145
Treated	145	145
Total	290	290

```

Probit regression                               Number of obs   =       290
                                                LR chi2(6)      =       34.34
                                                Prob > chi2     =       0.0000
Log likelihood = -183.84389                    Pseudo R2      =       0.0854
    
```

Micservi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Land	.0940718	.100921	0.93	0.351	-.1037297	.2918733
Age	-.0069391	.0082831	-0.84	0.402	-.0231738	.0092956
Famsize	.1057193	.0516705	2.05	0.041	.0044469	.2069916
Hhedu	.6429208	.1352434	4.75	0.000	.3778486	.907993
Marstau	-.1198202	.3183492	-0.38	0.707	-.7437731	.5041327
SEX	.1667389	.4174704	0.40	0.690	-.651488	.9849658
_cons	-.6432936	.9296273	-0.69	0.489	-2.46533	1.178742

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
heath	Unmatched	.027641379	.063344826	-.035703447	.009112258	-3.92
	ATT	.027641379	.070831489	-.04319011	.011232225	-3.85

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support	
	On suppor	Total
Untreated	145	145
Treated	145	145
Total	290	290

```

Probit regression                               Number of obs   =       290
                                                LR chi2(6)      =       34.34
                                                Prob > chi2     =       0.0000
Log likelihood = -183.84389                    Pseudo R2      =       0.0854
    
```

Micservi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
Land	.0940718	.100921	0.93	0.351	-.1037297 .2918733
Age	-.0069391	.0082831	-0.84	0.402	-.0231738 .0092956
Famsize	.1057193	.0516705	2.05	0.041	.0044469 .2069916
Hhedu	.6429208	.1352434	4.75	0.000	.3778486 .907993
Marstau	-.1198202	.3183492	-0.38	0.707	-.7437731 .5041327
SEX	.1667389	.4174704	0.40	0.690	-.651488 .9849658
_cons	-.6432936	.9296273	-0.69	0.489	-2.46533 1.178742

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
Educ	Unmatched	.065648274	.125537928	-.059889654	.00964557	-6.21
	ATT	.065648274	.08004803	-.014399756	.011337335	-1.27

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support	
	On suppor	Total
Untreated	145	145
Treated	145	145
Total	290	290

```

Probit regression
Log likelihood = -183.84389
Number of obs = 290
LR chi2(6) = 34.34
Prob > chi2 = 0.0000
Pseudo R2 = 0.0854
    
```

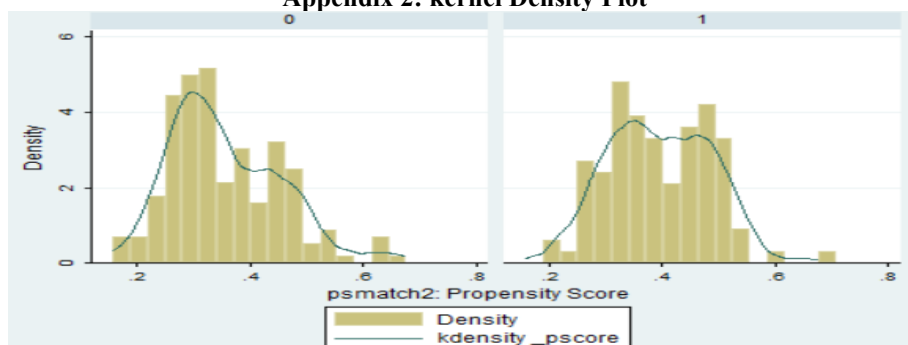
Micservi	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Land	.0940718	.100921	0.93	0.351	-.1037297	.2918733
Age	-.0069391	.0082831	-0.84	0.402	-.0231738	.0092956
Famsize	.1057193	.0516705	2.05	0.041	.0044469	.2069916
Hhedu	.6429208	.1352434	4.75	0.000	.3778486	.907993
Marstau	-.1198202	.3183492	-0.38	0.707	-.7437731	.5041327
SEX	.1667389	.4174704	0.40	0.690	-.651488	.9849658
_cons	-.6432936	.9296273	-0.69	0.489	-2.46533	1.178742

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
stand	Unmatched	2.8424827	3.01627579	-.173793087	.044951596	-3.87
	ATT	2.8424827	2.97566064	-.133177934	.052135009	-2.55

Note: S.E. does not take into account that the propensity score is estimated.

psmatch2: Treatment assignment	psmatch2: Common support On suppor	Total
Untreated	145	145
Treated	145	145
Total	290	290

Appendix 2: kernel Density Plot



### Appendix 3: PS Test Result

Variable	Mean		%bias	t-test		V(I)/ V(C)
	Treated	Control		t	p> t	
Land	1.4838	1.4626	2.6	0.19	0.850	1.18
Age	44.472	44.593	-1.2	-0.09	0.927	1.31
Famsize	5.8981	5.9559	-3.6	-0.28	0.783	1.02
Hhedu	.58333	.54359	6.5	0.49	0.622	0.94
Marstau	2.0185	2.0184	0.1	0.01	0.996	0.79
SEX	.97222	.97195	0.1	0.01	0.990	.

\* if variance ratio outside [0.68; 1.46]

Ps	R2	LR	chi2	p>chi2	MeanBias	MedBias	B	R	%Var
0.001		0.34		0.999	2.4	1.9	8.0	0.83	0

\* if B>25%, R outside [0.5; 2]

### Appendix 4: Sensative (MH) test Result

```
. mhbounds _H ,gamma(1(0.05)1.50)
Mantel-Haenszel (1959) bounds for variable _H
Gamma      Q_mh+      Q_mh-      p_mh+      p_mh-
-----
1          .898944     .898944     .004341     .004341
1.05       1.01389     .786831     .02531      .00056
1.1        1.12281     .679158     .430759     .01519
1.15       1.22736     .576557     .402843     .00009
1.2        1.32793     .478546     .400921     .00002
1.25       1.42487     .384705     .277098     .000228
1.3        1.51846     .294671     .064449     .004123
1.35       1.60898     .208125     .05381      .007566
1.4        0.99667     .124786     .04488      .000347
1.45       0.98171     .044404     .037398     .002291
1.5        .864320     .033242     .031139     .000259

Gamma : odds of differential assignment due to unobserved factors
Q_mh+ : Mantel-Haenszel statistic (assumption: overestimation of treatment effect)
Q_mh- : Mantel-Haenszel statistic (assumption: underestimation of treatment effect)
p_mh+ : significance level (assumption: overestimation of treatment effect)
p_mh- : significance level (assumption: underestimation of treatment effect)
```