Investigation of Role of Microcredit in Enhancing Food Security of Rural Households in Ethiopia: The Case of Eastern Zone of Tigray

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Abstract: *The aim of this paper is to investigate the role of micro credit services, particularly DECSIs, in enhancing income diversification and food security of rural households in Ethiopia in the case of Eastern Zone of Tigray. Three woredas (kilitawulalo, Saesi Tsadamba and Atsbi Wonberta) are taken as a target area and a sample of 80, 81 and 76 clients of DECSI, from the respective woredas, were taken randomly as a representative units. Tobit and Logit regression models were employed to estimate income diversification and food security models, respectively. The result shows that age of the household is non-linearly related with income diversification and food security. The additional household labor, number of livestock and size of farm land does matter to diversify the household sources of income and to enhance food security. However, educational status and marital condition of household head have no any contribution for diversifying income sources as well as insignificant to affect food security. Micro credit services have a significant positive impact on the diversification of income. It is also evidenced that microcredit is more powerful in enhancing food security of households through diversification of income sources. The current emphasis on micro credit is not misplaced and a continued innovation and improvement of rural micro credit schemes help to promote diversified income sources and hence reduce poverty.*

Keywords: Microcredit, Income Diversification, Food Security and Rural Households

1. Background and Justification

Most developing countries record high poverty index in which majority of the poor people live in rural and remote areas as well as live in informal settlement in urban areas. Accordingly, in one way or other round, food security has become one of the major areas of interest for researchers and policy makers and what strategies should a nation pursue to pull out its people from this problem. This is because of the fact that significant proportion of the world's population still lives under the situation of varying level of food insecurity. For instance, 23% of food insecure people live in Sub Saharan Africa.

Ethiopia is among the countries in Sub Saharan Africa whose name has been mentioned repeatedly in connection with this problem. The country has experienced sever famines, whose causes are both natural calamities and human failures, many times in its history (Degefa, 2005). Moreover, inadequate socio-economic services, lack of infrastructures, and high human population pressure with scarce resources have caused many pastoral households to become food insecure in Ethiopia. As indicated in food security program monitoring and evaluation plan document of FSCB (food security coordination bureau of FDRE) (2004), a combination of factors has resulted in serious and growing food insecurity problem in Ethiopia, affecting as much as 38% of the population in 2004. Over the past decade, more than five million people on average have required food aid each year, even during years of seemingly normal weather and market conditions (MOFED, 2008). Poverty in this country is still a critical problem as the proportion of poor people in the country is about 29.6% in 2010/11 (MOFED, 2010/11).

However, the severity of this problem is unevenly distributed among different regions in Ethiopia for example in 2010/11, poverty head count index is the highest in Afar (36.1%) followed by Somali (32.8%) and Tigray (31.8%), while poverty estimates are lowest in Harari (11%) followed by Addis Ababa (28.1 %) and Dire Dawa (28.3 %). In terms of food poverty, the highest poverty is observed in Amhara (42.5 %) followed by Tigray (37.1%) and Benehsangul Gumuz (35.1%). The lowest food poverty is found again in Harari (5%) followed by Dire Dawa (21.7%) and SNNP (25.9%)(MOFED, 2010/11).

Understanding the nature and seriousness of the problem, the Ethiopian government has designed various strategies and has taken various measures that are believed to contribute towards ensuring food security. For example, the economic reform program initiated in 1992/3, Disaster Prevention and Preparedness Strategy of 1993, Participatory Demonstration and Training Extension System (PADETS) of 1994/5, the national food security strategy (FSS) of 1996, and the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP) of 2002 as some of such measures and strategies having both direct and indirect positive effect on overcoming food insecurity (Adane A. 2010). Moreover, the growth and transformation plan for a five year plan, currently on the way of implementing, gives an emphasis in eradicating the incidence of poverty. The implementations of these strategies have brought remarkable changes by making the country to register an impressive economic growth, and a remarkable gain has been achieved over food poverty.

Though this progress is something to be welcome, the proportion of the total population living under poverty and poor food security situation is still too big to undermine and hence poverty and food insecurity remains area of major

concern both at national level as well as for the regional state.

It is obvious that the poor well recognize the importance of saving, paying for insurance etc. It is also true that financial institutions (and related knowledge and technology) as well as an enabling policy environment was not in place in the past. Because this gap was not given due consideration in central and commercial banks, the poor were simply deemed to be unbankable. This is evidenced in a research work of Manohar S. (2000) on the demand for financial services points out that product innovation that responds to the food security motives of households can lead to higher outreach and higher impact on the poor. However, policy also needs to recognize that while the poor are creditworthy and able to save and insure, financial institutions may still fail to cover their costs, even with improved products. Many of the poor, particularly in remote areas having high transaction costs, still cannot be served by financially sustainable institutions (Manohar S. 2000).

Thus, the microfinance revolution taught that institutional innovations in the legal and regulatory policy framework could extend the feasibility frontier of sustainable finance to reaching the poor. Microfinance service is one of the entry points to increase household asset and income diversifications. These institutions are expected to play significant role in improving access to financial services and encourage pastoral enterprises like cattle fattening, livestock marketing, meat processing, and tanneries to build pastoralists' private capital.

Most scholars and development practitioners believe that microfinance, in 1980s, has evolved as an economic development approach intended to benefit low-income women and men. Thus, microfinance by definition is the provision of financial services to low-income clients including self-employed (Ledgerwood, 1999).

Thus, it is among the intervention mechanisms currently in use across the country with the objective that it contributes to food security ensuring effort of both the urban and the rural poor by providing microcredit and other financial services and related assistances.

Since microfinance involves provision of multidimensional financial services such as deposits, loans(credit), insurance and money transfers to the poor and low-income households (Asian development bank 2000).

Literatures like the work of Manfred Z. (1999) reveals that improved access to micro credit is a means for increasing the poor's income. While Savings services seem to be promoted for the sake of mobilizing capital, disregarding potential role of households for smoothing consumption (Manfred Z. 1999).

Moreover, Wenner (1995) argued significant and sizable benefits of credit access on income and household food security. Moreover, Sharma and Zeller (1997) found a considerable importance of credit for productive investment and income generation in farm or non-farm micro-enterprises.

Households who are users of microcredit services appear to have been better able to maintain their levels of income diversification. It is because of the fact that poor households manage risk by having several sources of income (Murdoch, 1995).

Micro-credit contributes to mitigating a number of factors that contribute to vulnerability as well as reduces income-poverty; such as by smoothing consumption, building assets, providing emergency assistance during natural disasters, and contributing to female empowerment. The provision of micro-credit also strengthens crisis coping mechanisms and diversifies income-earning sources (Zaman (2000).

However, there are some scholars, like Elizabeth D. and J. Gordon A. (2001) and Nilufa A. (2005), argued that micro credit services may have negative effects on borrowers. Accordingly, it may have negative impacts on client self-esteem, which may stem from stress relating to the pressure to repay loans.

Still it seems inconclusive about the importance of micro credit services as some scholars argued the positive contribution of credit whilst others argued the negative influence of credit for long run progress of households. Moreover, writers like Hulme and Mosley (1996) suggested the insignificant effect of micro credit on consumption and income smoothing. Similarly, Karlan and Zinman (2009) and Banerjee (2009) also found insignificant contribution of the program on poverty alleviation. It may be due to the fact that the amount and form of credit, the interest to be charged, which farm households to target, and repayment performance, may be some factors that hinder not to bring the intended purpose of poverty reduction.

Moreover, there are some literatures which show though credit services have bring improvement in income yet there are arguments that clearly show the improvement in income doesn't mean reduction in poverty. For instance, Hulme and Mosley's (1999) concluded that the impact of a loan on a borrower's income is related positively. It is also seen in the study of Dreze and Sen, (1989), who are arguing that a focus on "income poverty" is usually associated with seeing poverty-reduction as a process of moving households from a stable "below poverty line" situation to a stable "above poverty line" situation. Thus they give due emphasis that the provision of credit for income-generation through self-employment. Moreover, Sharif (1997) evidenced that the aim of microcredit programs to increase the income of the target group.

However, Bamlaku A, (2006), argued that removal or reduction of poverty must be a continuous process of creation of assets, so that the asset-base of poor person becomes stronger at each economic cycle, enabling him or her to earn more and more." Although the main objective of development programs is raising income of households' there is a significant difference between reducing poverty and raising income. This evidenced in the study of Graham A. (1999) that clearly shows the improvement in income doesn't mean reduction in poverty as poverty is neither static nor linear.

Therefore, it is not easy task to decide about the exact impacts of microcredit services on poverty alleviation in advance. Dedebit credit and saving institutions (DECSIs) microfinance is established to achieve the objectives of poverty alleviation and diversifying incomes sources of households and working with the banner of helping the poor in Tigray region. It was established and legally registered by the National Bank of Ethiopia in January 1997 according to Proclamation No.40/1996. So far it has opened 142 branches in the region. Currently it is providing such loan products as agricultural, petty trade, handcrafts, and service loans.

Moreover, there are some other private owned microfinance institutions in the region like Lideta and Adeday Microfinance institutions which are established 2009 and 2014 respectively. The former targets the urban poor while the latter focuses on women clients only. Thus, these are limited in scope to reach the rural poor.

The Eastern Zone of the region is crop dependent area with the most fragmented land, which is highly degraded. In addition to the frequent shortage of rainfall, the soil is also less fertile. Consequently, the Eastern zone is among the priority list that deserve intervention by the regional government and other nongovernmental organizations. Thus, DECSI has established to provide intensive microfinance programs in eastern zone of the region (Tesfay A, 2003).

In this regard, DECSI is taken our target financial institution as it is better to be accessible for rural poor households. DECSI has been operating for the last 16 years, however, as far as the knowledge of the writers, no sufficient studies have been conducted in the eastern zone of the region particularly on the rural households on whether it is playing the intended role or not, particularly on income diversification, food security status and role of DECSI on food security status through income diversification channel (whether it is supporting the food security ensuring efforts of households). Hence this study is the one intended to assess and examine its role in improving rural household income diversification and on food security of rural households in eastern zone of Tigray region.

2. Results and Discussion

This study is aimed at investigating the contribution of micro credit service of DECSI in strengthen the effort while struggling against poverty and in diversifying income sources of rural poor in the study area. The descriptive and inferential statistics models are shown, respectively, to analyze the data obtained from primary sources via structured questionnaires and interviews.

Table 1: Demographic Characteristics of Households*

Variable	Mean	Std.dev.	Median
Adult equivalent (AEQ)	4.978	3.422	4.75
Age of household head (AGEHH)	46.98734	10.90773	46
Gender of household head (HHSEX)	0.86	0.35	1
Marital status of head	0.89	0.32	1
Household education level (HHEDU)	2.2	1.3	2
loan delivered to household (Credit)	11,870.83	7,917.23	10,000
Food security status of households (FS)	0.38	0.48	0
Farm size	0.64	0.25	0.7
Diversification index	0.63	0.35	0.65
Tropical livestock unit (TLU)	3.23	2.03	3.16

The amount of loan obtained is used in the most recent consecutive periods (terms) as a proxy for micro credit services of DECSI.
 Source: Authors' Survey Result

There appears variation among households (with standard devotion of 3.4), on average, they have about five members (AEQ) (see table 1). However, majority of clients are male headed households (with mean and median of 0.86 and 1 respectively) and hence it may not mean that women are denied from the services rather majority of household heads are of engaged in marriage (mean; 0.89, median; 1) and men are mostly considered as head of the household.

Household heads on average can write and read and the average credit received from the institution, in the recent consecutive two periods, is above 11,000 though we observed a significant variation among them (standard deviation of about 8000). It may be due the fact that some of respondents may be new comers to the members and hence may take only once yet 50% of them are taking about 10000 Ethiopian Birr.

The result also indicate that still majority of rural poor household members are living below poverty line or unable to meet the conventional per day calories of 2200. Moreover, their sources of income is not well diversified and hence to enable them secured from unforeseen shocks and ultimately making them out of poverty line.

Measurements of Poverty in the Study Area
This section examines the extent of poverty in the study area using most commonly applicable indices of poverty such as; the incidence of poverty (headcount ratio), the poverty gap and severity of poverty which are from the Foster Greer Thorbeke (FGT) indices (Foster et al. (1986)). Accordingly, we have used the formula:

$$P_\alpha = \frac{1}{N} \Sigma \left(\frac{Z - Y_i}{Z} \right)^\alpha \ldots\ldots\ldots\ldots 2.0$$

Where, α≥0, indicates inequality aversion parameter, which assigns varying weights to the difference between the per capita consumption of the poor household and the poverty line (it assumes 0, 1 and 2 values to measure head count index, poverty gap and severity of poverty respectively); Z is the poverty line and we have taken international poverty threshold level of 2200 kilocalories as a poverty line and Y_i

is the intake calories of households (per capita consumption).We report poverty levels for households, not at the level of the individual.

The table below (table 2) reveals that the proportion of the households under food poverty is about 38% (head count index). The poverty gap reflects the total deficit of all the poor households relative to the poverty line. It is, therefore, a much more powerful measure than the head count ratio. Because it takes into account the distribution of the poor below the poverty line.

The overall poverty gap of 0.03195 shows that if the country could mobilize resources equal to the 3.2% of the poverty line for every household and distributes these resources to the poor in the amount needed so as to bring each household up to the poverty line, then at least in theory, poverty could be eliminated.

Table 2: Poverty Measurements (Index) in the Study Area

Headcount index (p_0)	0.38026
Poverty gap index (p_1)	0.031949
squared poverty gap (p_2)	0.021150

Source: Authors' Survey Result

Descriptive analysis is supported with inferential statistics to diagnose the power of credit in enhancing income diversification and food security of households. The more diversified source of income of small holder farmers, the lower they affected by unforeseen shocks and hence it may enhance their food security status. Therefore, via creating an interaction variable of income diversification index and credit, the statistical package is expected to reveal the existence of such a relation or absence of it. Hence, diversification index and food security models are shown in the following consecutive tables (table 3 and table 4) with their diagnostic tests.

Income Diversification Model: The dependent variable (income diversification index) is a continuous variable but with a limited range between zero and one. Income diversification index of one mean the household is dependent up on a single income sources and zero has economic terminology of perfectly diversified income sources which cannot be achieved. Moreover, there is a large share of observations with one value meaning that households do not participate in non-farm activities and that they derive their income from one source only. Therefore, we apply Tobit model, which has been originally developed for censored data, but which are also used for corner solution models (Wooldridge, 2002).

Table 3: Tobit Regression Model Result

Tobit estimates of the model: dependent variable; income diversification index				
Variable	Coefficient	Std.err	T- ratio(probability)	Marginal effect
AEQ	-0.35	0.061	-5.7 [0.000]***	-0.35
HHAGE	-0.51	0.28	-1.877 [0.063]*	-0.51
HHAGE2	0.08	0.033	2. 42 [0.0208]**	0.08
HHSEX	5.06	7.02	0.72 [0.330]	5.06
Marital Status	1.30	7.87	0.17 [0.868]	1.30
HHEDU	-1.60	1.55	-1.04 [0.301]	-1.60
CREDIT	-0.08	0.024	-3.45 [0.001]***	-0.08
FARMSIZE	-1.22	0.340	-3.60 [0.000]***	-1.22
TLU	-1.74	0.93	-1.87 [0.063] *	-1.74
Constant	47.65	31.38	1.52 [0.130]	-
LR chi2(9) = 28.52(0.0008)				
Pseudo R2 = 0.45				

Note *that it* is the belief of authors that age household head may have non-linear relationship with diversification index. It is likely to expect up to some turning point the higher the age of household head, the more he/she is able to diversify their income sources. Thus,   here we include square of **household head's age (Hhage2)** as explanatory variable.   And *, ** and *** indicates significance at 10%, 5% and 1% level of significance, respectively.

The diagnostic test of likelihood ratio test (LR = 28.52) and pseudo R squared reveals that though there appear some insignificant variables independently, yet all them jointly are powerful and significant to determine dependent variable (income diversification index). Therefore, we can make sure that the model is quite good in explaining the endogenous variable and also about 45% the variation in the dependent variable is well explained by the variables involved in the model jointly.

The result confirms that the larger number of household members (AEQ), the lower the diversification index and hence the more they are able to diversify their sources of income. For our case, the lower diversification index indicates the more diversified income sources and vice versa. On average and at normal condition, an additional labor force in the household lowers the index by about 0.35 units. Hence, a small farm household will get the chance to use the household labor for different production purposes and will enhance the number of income origins.

It is not surprising to observe non-linear relationship between age of a household head and diversification index. That is a household head found in the working age group is capable of diversifying his/her income sources and as age goes to old age level, he/she may relay on other household members and less likely to be powerful enough to diversify the sources of incomes. Accordingly, a negative and a significant, at the conventional level of significance, coefficient for household age (Hhage) implies the higher age of household head, up to some turning point, lower the diversification index and hence the more diversified his/her

sources of income (household head with less age) vice versa at higher age level.

The result also confirms difference in gender of households and being heterogeneous in marital status doesn't matter while diversifying the income sources. That is being man or woman headed household is not a challenge phenomenon rather our attitude towards small agribusiness and diversifying the base of income origins. Moreover, education is not powerful in improving the income diversification issues in the study area. However, here it is better to understand that; it does not mean that education has no role for improving income diversifications rather the result is outcome of a survey of small holder farmers where majority of them are not attending modern education centers and hence only few of them are capable of write and read their mother tongue. Thus, in the study area, households are running their daily business activates based on their custom practices and hence education has little role.

Microcredit services rendered to households is still playing crucial in the making them to diversify their source of income. The result confirms our hypothesis that the greater the amount of credit, the more they are likely be able to enhance the number of their income sources. That is the sizes of loan, to some extent, do matter in diversifying the sources of income like in petty trade, bee keeping, dairy farming, husbandry, etc. This is because Dedebit micro finance has played a significant role in reducing the financial constraints that challenges the smooth running of economic activities of small farm holders and hence become a good fortune in helping the rural poor household to have more than one sources of income. Since, the more diversified sources of income, they become better off and the less likely be affected by some unforeseen shocks and events.

Therefore, improved access to credit is seen as an effective means for increasing the poor's income and the bases of income sources besides it smoothes consumption and household savings. Accordingly, the result ensures that on average households diversifying their sources of income by about 8% as amount of loan provided increases by a unit. Moreover, the larger the size of households' farm land and the greater the number of livestock (measured by tropical livestock unit (TUL)), the more likely they improve and diversifies sources of income.

Households Food Security Status Model: Since the explained variable is a binary outcome, we used a logistic cumulative distribution function (logit model) which is presented in the following table (table 4).

Table 4: Logistic Regression Result of Food Security Status of Households

Logit estimates: dependent variable; household food security (FS)			
Variable	Coefficient	Std. err	Z. stat. (probability)
AEQ	0.34	0.10	3.28 (0.001)***
HHAGE	0.21	0.12	1.79 (0.074)*
HHAGESQUARED	-0.0021	0.001	-1.88 (0.063)*
HHSEX	-1.18	0.65	-1.80 (0.072)*
Marital Status	0.60	0.90	0.086 (0.401)
HHEDU	0.035	0.12	0.27 (0.786)
CREDIT	0.54	0. 221	2.44 (0.010)**
FARM SIZE	-0.08	0.031	-2.63 (0.008)***
Diversification Index	0.023	0.012	1.85 (0.064)*
Credit*Diversification	0.21	0.103	2.037 (0.03)**
TLU	0.06	0.036	1.872 (0.058)*
Constant	-2.39	3.22	-0.743 (0.412)
LR chi2(11) = 65.23 (0.0000)***			
Pseudo R2 = 0.4170			

However, it is evidenced in some literatures including econometrics text books (Gujarati, 2004) that a logistic cumulative distribution functions posses a non-constant variance over the sample observations. This is because of the fact that the theoretical mean and variance are function of probability of success (probability of the occurrence of dependent variables for which our case probability of being secured) and in turn it is a function of all explanatory variables. Therefore, a weighted logit regression has been undertaken to solve the problem of heteroskedasticity as it may make the regression result biased and inefficient estimates.

Table 5: Weighted Logistic Regression Result of Weighted Food Security Status

Variable	Coefficient	Marginal effect (dY/dX)	Std. err	T. ratio (probability)
AEQ	0.34	0.060	0.104	3.28 (0.001)***
HHAGE	0.212	0.037	0.054	1.79 (0.074)*
HHAGE2	-0.0017	-0.0003	0.0005	-3.51 (0.001)***
HHSEX	-0.990	-0.209	0.827	-1.19 (0.312)
Marital Status	0.0266	0.460	0.383	0.07 (0.945)
HHEDU	0.081	-0.006	0.049	1.66 (0.101)
CREDIT	0. 1672	0.023	0.0422	3.96 (0.000)***
Farm Size	0.013	0.014	0.012	1.96 (0.0291)**
Diversification Index	0.027	0.004	0.006	4.14 (0.000)***
Credit*Diversification	0.0512	0.0813	0.0213	2.403 (0.03)**
TLU	0.214	0.012	0.098	2.17 (0.045)**
Constant	2.92	-	2.580	0.85 (0.68
F(10, 81) = 8.67 R-squared = 0.5169				

Note that *, ** and *** indicates significance at 10%, 5% and 1% level of significance respectively. CREDIT*DIVERSIFICATION- implies an Interaction variable to show whether credit   and   income diversification are complementary in improving food security of rural households or not. Or at the same time it may show really credit follows diversification of income sources while enhancing household food security status.

The result reveals that the higher the number of household members, the better the probability of being secured (see table 5). It seems quit paradox because the higher the size of a household is expected to be in need of more nutrients and likely be below the poverty line. However, our result considered adult equivalent index as a proxy variable for household members and hence it shows that on average, larger number of workforce group are better to generate additional income sources and hence the more likely be secured.   It may be due to the fact that Small land holders' family producers are more productive and more competitive.

The finding also reveals the non-linear relationship between age of the household head and food security of rural poor. Accordingly, up to some age level, the probability of being above the conventional poverty line is positively and significantly influenced by household head age (HHAGE) and at significantly old age (HHAGE2), probability of being secured is inversely correlating with age of household head.

Like in the diversification model, gender, education level and marital status of household head do not have any significant contribution for food security. It is not surprising to observe a positive and significant coefficient for both farm size and number of livestock that is measured by tropical livestock unit (TLU). Because, the larger number of livestock and size of farm land, the more probability of the household for smoothing consumption and hence more likely is secured.

Though, there appears sound progress in the expansion of food production, but food insecurity is still a major problem. Various development strategies aimed at eliminating poverty, are combining microcredit as one of the key sectors. Accordingly, the result presents convincing evidence that microcredit has a positive and significant impact on food security.

The result reveals that microcredit can enhance household's capabilities in achieving food security by offering them diverse economic and social solution of their vulnerability. Thus, although microcredit is certainly not a magic formula for poverty alleviation, however, it is a tool while fighting against poverty and food insecurity. Therefore, a sufficient and sustainable microcredit services provided for agriculture can rise food production and create a favorable condition of food security.

A positive and significant coefficient on the interaction term (CREDIT*DIVERSIFICATION) indicates that microcredit is more powerful in enhancing food security of households through diversification of income sources.   That is micro credit can help the poor to build feasible businesses, diversify their income sources and reduce their vulnerability to external shocks. It enables the household to improve agricultural production and other incomes, improve household nutritional status and create small shops and stocks in the community. Moreover, it may have a significant contribution in enhancing knowledge and skills in the families to resolve problems, manage projects and group works.

A diverse economic activity contributes to the sustainability of a rural livelihood because it improves its long-run resilience in the face of adverse trends or sudden shocks. Increased diversity promotes greater flexibility because it allows more possibilities for substitution between opportunities that are in decline and those that are expanding.

Thus, diversifying income sources enables households to solve seasonality problems which create food insecurity due to the mismatch between uneven farm income streams and continuous consumption requirements. Diversification can contribute to reducing the adverse effects, by utilizing labor and generating alternative sources of income in off-peak periods.

Moreover, Cash resources obtained from diversification may be used to invest in, or improve the quality of assets. For example, sending children to school or buying equipment like a agricultural machines that can be used to enhance future income generating opportunities. In turn, increased

income sources indirectly develop the level of education of the borrowers and create awareness about consumption and sanitation needs.

Thus, we can conclude that DECSI's microcredit service is playing pivotal role in eradicating poverty and bring people above the poverty line by increasing consumption capacity and income diversification of rural households. It increases household's per capita calorie consumption and raises food security.

3. Conclusion

The paper is aimed at investigating the role of micro credit services, particularly DECSIs, in enhancing income diversification and food security of rural households in Ethiopia in the case of Eastern Zone of Tigray. We have taken three woredas (kilitawulalo, Saesi Tsadamba and Atsbi Wonberta) as our target area and a sample of 80, 81 and 76 clients of DECSI, from the respective woredas, were taken randomly as a representative unit.

Moreover, we took the sum total of loan amount that clients of the target population have taken in two most recent terms as a proxy for microcredit services. Because credit may have a lag effect on livelihood, we consider the two successive credit terms. Tobit and Logit regression models were used to estimate income diversification and food security models respectively. We have used Tobit model to estimate the role of microcredit, along with other explanatory variables, in enhancing the number of income sources because the dependent variable is censored between 0 and 1. The food security model assumes a categorical variable as dependent variable that is if a household is secured, we assigned 1 and 0 otherwise and hence we take a Logit probability model for the second model.

The result confirms that age of the household is non-linearly related with income diversification index. That is up to some level, a rise in household head's age lower the income diversification index and hence the lower the index value, the more the income sources diversified and vice versa.

We can conclude that the additional household labor, number of livestock and size of farm land does matter to diversify the household sources of income. However, educational status and marital condition of household head have no any contribution for diversifying income sources.

Micro credit services have a significant positive impact on the diversification of income. Households that received a formal loan have diversified their income. It is for this reason that the poor place so much emphasis on diversifying their sources of income as it reduces their exposure to catastrophic income loss.

Logit model indicates that still household's workforce, their farm size and number of livestock they possessed have a significant contribution in improving the probability of food security. The result confirms a sufficient and sustainable microcredit services provided for agriculture can rise food production and create a favorable condition of food security. Moreover, the probability of being secured is positively and significantly affected by diversified income sources as it enables households to solve seasonality problems.

It is also evidenced that microcredit is more powerful in enhancing food security of households through diversification of income sources. That is micro credit can help the poor to diversify their income sources and reduce vulnerability to unforeseen shocks. We can reach at a conclusion that 'a sustainable provision of credit, a more degree of diversified income sources and a high probability of food security'.

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