The Impact of Micro-Credit Intervention on Female Labor Force Participation in Income-Generating Activities in Rural Households of North Wollo, Ethiopia

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Abstract

We examined the impact of micro-credit on female labor participation in income-generating activities in rural households of North Wollo, Ethiopia. The study employed selection and average treatment effect models to determine the effect and impact of credit intervention on the decision of women to participate in income-generating activities and their level of engagement. A total of 460 households, participants and nonparticipants of the credit scheme, from three woredas of North Wollo Administrative zone was selected using systematic random sampling. Using the primary data, the study found that micro-credit has positive and significant effect both on women's decisions to participate in income-generating activities, and the magnitude of time spent on such activities. In particular, the study showed that, on average, women who had access to credit facilities spent 4.45 more hours of time on income-generating activities than the control group. The average time spent by women in the control group in income-generating activities was 1.39 hours. The average treatment effect (ATE) was found to be considerably greater than the average treatment effect among the treated (ATET) implying that poor women with less entrepreneurial capabilities had been targeted for credit participation. Future policies in micro-credit should consider targeting women with better potential for succeeding in business despite their initial income status. The majority of credit participant women

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were found to be engaged in better and newly developed income-generating activities such as animal fattening and rearing, poultry, bee-keeping, vegetable cultivation and business-related activities. However, a considerable number of women were also engaged in traditional activities such as fire-wood collection and weeding to generate income. Such activities are borderline cases to influence the status of women in intra-household resource allocation: the study noted that where women engage the choice of economic activities needs consideration.

Key Words: women labor, micro-credit, income-generating activities, Ethiopia
JEL Classification: J22

1. Introduction

International comparisons reveal that women take on a disproportionate share of unpaid work at home. In some developing countries, they spend five additional hours per day on unpaid work activities than men while the average gender gap has been narrowed to three hours of unpaid work per day in most developed countries (Gauthier et al., 2004; Antonopoulos, 2007). In rural economies which are strongly characterized by distinct gender roles, those roles which are typically designated as female roles are reproductive and almost invariably less valued than those designated as male roles which are productive. Empirical studies show that in a number of African countries, women are less likely to be in paid jobs, they are disproportionately concentrated in informal and precarious employment, and they are paid less (Appleton et al., 1999; ILO, 2002; Fafchamps et al., 2006; Nordman and Wolff, 2009).

One of the segregation of work in developing countries is reflected in the form of gender division of labor in which women are confined to unproductive activities. This traditional segregation of jobs by gender hides women's talents and potentially leads to misallocation of resources, in turn resulting in a sub-optimal level of output and household welfare. One line of argument for the apparent lack of appreciable participation of women in income-generating activities (IGAs) in developing countries is the limited access to investable resources of the household (Jones et al., 2010; Stokes et

al., 2015). This has much to do with the long-held belief that male members of a household, most importantly, the male head of the household, are the breadwinners of the household and therefore investable resources are exclusively controlled by them (Fafchamps and Quisumbing, 2005; Shambel, 2012; Bekele et al., 2013).

The traditional division of labor between partners may serve as an explanation for the existing differences in income earning opportunities between men and women. Literature on women in agricultural societies generally exhibits wide-ranging gender inequalities in terms of possession of key resources and factor inputs, which limit women's opportunities to generate income (Blackden and Bhanu, 1999). Women are restricted in their access to productive resources such as land, agricultural inputs, credit and extension services (Agarwal, 1994; Deere and Leon, 2001; Quisumbing et al., 2004). Limited access to investable resources is thus the major constraint of rural women to participate in IGAs and to generate their own income.

Similar to other developing countries, the historical segregation of men and women in their activities in Ethiopia has had a long-lasting effect on the participation of women in the market-oriented labor market. Rural employment opportunities in Ethiopia range from household-based farm and non-farm activities to participating in the labor market as a wage laborer or through self-employment-based activities. However, in the absence of access to institutional capital, the labor market in rural Ethiopia seems to be segmented across gender lines. Women's activities tend to be limited to home-based agricultural or other traditional works, while men mostly get involved in on-farm or other off-farm income-generating activities. Even when women are willing to participate in off-farm non-agricultural activities, the opportunities are limited due to the socio-cultural barriers that dictate their inheritance and participation in the labor market. Women in this male-dominated society are excluded from inheriting the family's productive assets, mainly arable land, and as such accessing credit from formal institutions without providing credible material possessions as collateral is difficult for them. Socially secluded and culturally separated, they have been restricted to household-based agricultural work, therefore naturally playing a "secondary role" in the household decision making.

Though gender division of labor in rural Ethiopia varies in terms of farming systems, cultural settings, location, ethnicity, income and the

different wealth categories (Mollel and Mtenga, 2000), women are invariably responsible for reproductive tasks and household activities such as gathering fuelwood and fetching water, cooking, washing and cleaning (Frank, 1999; Gemechu et al., 2009). Men are the key players in crop and livestock production, and are, therefore, the principal decision makers and beneficiaries in terms of control over the income generated from the sale of produce (Gemechu et al., 2009; Lemlem et al., 2010).

This article examines the impact of micro-credit intervention on gender division of labor in income-generating activities vis-à-vis traditional household activities in rural households of North Wollo Administrative Zone of Amhara Regional State. Women in this Zone and in the Amhara Region at large, though not acknowledged, primarily participate in agricultural activities such as land preparation, weeding, harvesting, threshing and storing, and in livestock production such as herding, tending sick animals, watering, milking and milk processing in addition to in-house routine activities (Frank, 1999). The major argument of this study is that augmenting investable resources of rural households using micro-credit intervention would enhance women's decisions to participate in, and increase time spent on, income-generating activities.

Like many developing countries, Ethiopian rural households, especially women, have been suffering from lack of access to capital. While Ethiopia is one of the biggest countries in terms of the rural women population in Africa, previous studies have not focused on the impact of micro-credit on rural household gender division of labor in the form of female labor force participation in income-generating activities. There are related empirical studies on Asian countries, where microfinance flourishes, which have analyzed the impact of micro-credit on creating opportunities to women to start up self-employment (Bennett,1992; Menon and Rodgers, 2009, 2011) and diversify their economic activities (Hashemi et al., 1996; Lanjouw and Murgai, 2009). Similarly, studies focused on Ethiopia also deals with the impact of micro-credit to enhance women's self-employment (Asmamaw, 2014), creation of non-farm business (Tarozzi et al. 2015) and capitalization of women's existing businesses (Belwal et al., 2012). However, these studies have not addressed the impact of micro-credit on women's decisions to participate in income-generating activities nor the time spent on such activities.

To fill the gap, using survey data, this study has examined the impact of micro-credit on women's participation in income-generating activities. A total of 460 sample households from 3 woredas of North Wollo Administrative Zone have been considered using systematic random sampling techniques. This paper consists of five sections with the remaining parts organized as follows: Section two provides theoretical perspectives and covers related empirical literature; section three deals with the data and methodology, and section four reveals the results of the study and our accompanying discussion. The final section presents conclusions and implications.

2. Theoretical Perspectives and Related Empirical Literature

Modern labor economics argues that individuals are endowed with their own specific talents which usually are revealed through education and job participation. According to Becker's theory of the allocation of time (Becker, 1965), such specialization of the partners within one household is efficient, as private households represent economic institutions that maximize their utility by optimizing the members' time of allocation to market and household production. Hence, the household's decision about its members' time in paid and unpaid work is defined taking the relative productivity of the household members into account, i.e. the partner that can offer a higher potential income specializes in market work, while the partner with a lower potential income specializes in non-market work. The implication of this theory on traditional household gender division of labor is however debatable. In the structure of the traditional gender division of labor, men (the husband) are pre-assigned to most of the paid work and women (the wife) to most of the unpaid housework, thus leaving no opportunity for women to specialize in market work. In such a context, Becker's theory would thus be consistent only if the husband and wife persist in their pre-existing gender-based tasks resulting in household efficiency in terms of increased household output.

However, feminist economists such as Boserup (1970) did not agree with Becker's argument of household efficiency in division of labor by gender, because they believed that it implies exploitation of women. Their main argument is that although such specialization based on gender might be

efficient for the household as a whole, the partner who specializes in non-market work may suffer from a disadvantage in terms of future labor market opportunities. In most instances, it will be the wife who specializes in housework and child care, while the husband concentrates on market work. While withdrawing from the labor market and specializing in housework, the wife's marketable human capital stays constant or even decreases, so that her chances to get back into the labor market are reduced. Hence, this traditional division of labor between partners may serve as an explanation for remaining differences in labor market opportunities and wages between men and women. The consequences of such specialization of the partners with women withdrawing from the labor market become even more serious if the household breaks apart at any time, necessitating the wife making a living from being gainfully employed. This, indeed, might be one of the reasons why women are affected by old-age poverty more than men (Bredtmann, 2011).

There are also numerous reasons why female specialization in unpaid domestic work may be the subject of concern in a gender equity sense. For example, domestic human capital may be of little value relative to market human capital outside a specific relationship, and so lead to less bargaining power within the relationship (via a lower external threat point) and poorer outcomes in the event of relationship breakdown. Moreover, women's education, employment, and earnings are essential in the fight against poverty, not only because of the direct and interrelated contribution they make to household welfare, but also because of the personal power they provide for women in shaping and making family decisions and in redirecting household spending on essential needs, especially in favor of children's health and education (UNICEF, 1999; Gichuru et al., 2019).This suggests, firstly, men and women have systematically differing preferences over the way in which household income should be allocated, and secondly, that an individual's income contribution to the household plays a role in family bargaining, over and above its implications for external threat points (Washbrook, 2007).

As much as a lack of education hides potential talents within a population, traditional segregation of jobs by gender can equally disguise talents and potentially lead to misallocation of resources. The segregation of work in the form of gender division of labor forces women to be confined

with some 'unproductive' activities (Sen, 1990) which are not regarded as contributing to output and are often classified as 'unproductive' labor. An important economic outcome of such traditional division of labor is thus a lower output and less favorable level of welfare of a household.

The type of activities members of the household is involved in has impacts on their decision-making participation and contribution to household welfare. Change in traditional gender division of labor through involvement in activities that confer more income earning power on women tend to increase their participation in decision-making (Ngome, 2003) and increase their contribution to welfare within the household (Sikod, 2007). Related to this, Gichuru et al. (2019) state that a source of income can increase woman's bargaining power in household decisions if it is available primarily to the woman. Literature on intra-household allocation of time has established that men's work is highly associated with paid market work while women devote the majority of their time performing unpaid work (Gershuny, 2000; Beneria, 2003). Gender differences in allocation of time between paid and unpaid work have important implications in terms of well-being (Floro, 1995; Antonopoulos and Hirway, 2010). Increased segregation of unpaid work and paid work by sex pushes women particularly into social and income poverty (Elson and Cagatay, 2000), as well as, time poverty (Folbre and Bittman, 2004; Antonopoulos and Memis, 2010).

The argument of the present study is that reorienting the traditional gender division of household labor in the way it provides opportunities to women to participate in paid/ market work could increase women's time spent on income-generating activities over household routines.

The perspectives of gender based inequalities and differences in task allocation and in task type have been outlined in a number of studies covering the relative resources perspective (Mannino and Deutsch, 2007; Knudsen and Warness, 2008; Brines,1994), time availability perspective (Davis et al., 2007; Artis and Pavalko, 2003) and gender ideological perspective (Arrighi and Maume, 2000; Fuwa, 2004; Parkman, 2004; Davis et al., 2007; Knudsen and Warness, 2008). These make it clear that women in developing countries are most likely exposed to undesirable housework. In Ethiopia, relative to men (husbands), rural women (wives) are less educated (CSA, 2012a) and do not have access to, or control over, resources (Frank, 1999; Jones et al., 2010), resulting in less power to bargain their

(her) way out of routine housework. Their time is also considered as available for house work and child caring activities because most of the women do not participate in paid/market work (Ferrant and Thim, 2010; CSA, 2012b). Moreover, as members of a male dominated society, women in Ethiopia who hold more traditional attitudes behave in a more traditional manner and spend almost all of their time on housework (Bekele et al, 2013). On the basis of all these perspectives, there is no favorable socio-economic background for rural women to participate in paid/ market work or to reduce the time spend on housework. The stagnant structure of the traditional division of labor in rural households in effect demands a positive shock to provide women with the possibility of participation in income-generating activities.

The representative (sampled) woman in a typical agricultural household faces a number of activities. Arising from the inseparability of production and consumption decisions in agricultural households (Singh et al., 1986), the woman's choice of economic activities is simultaneously made with maximization of the utility of the household (assuming that overall welfare of the household can be represented by a joint utility), and is subject to different constraints. One such constraint in the production process is the traditional restriction of women to participate in particular economic activities (henceforth activity constraint). It can be hypothesized that relaxing the resource constraint faced by women through availability of micro-credit would at the same time relax the activity constraint.

As noted in Bennett (1992), credit is the gateway to productive self-employment for women. Access to micro-credit can provide the opportunity for women to start up self-employment activities and undertake more profitable work, thus facilitating moves toward poverty reduction. According to Menon and Rodgers (2011), the targeted use of small loans can support and incentivize women's labor market activities and promote economic welfare. In another study, Menon and Rodgers (2009) state that women's likelihood of engaging in self-employment is substantially stronger than men in response to a loan. Regarding women's activities, Hashemi et al. (1996) suggested that loan recipients in Bangladesh used credit primarily for self-employment in small-scale activities ranging from animal husbandry to artisan crafts.

Evidence in Menon and Rodgers (2011) indicated that India's rural banking reform program increased the likelihood of women to engage in

gainful self-employment beyond unpaid family work. Moreover, an increase in women's self-employment in India's rural sector appeared to have occurred in more productive economic activities. The same study reported that increased access to credit facilitated the shift of women workers out of cultivation into other entrepreneurial activities, including more capital-intensive livestock and dairy farming. More broadly, the move into more productive economic activities was one possible channel through which India's social banking program worked to reduce poverty. In support of this argument, Lanjouw and Murgai (2009) found that diversification of economic activities in India's rural sector, and the growth of non-farm employment including other types of self-employment endeavors, contributed to poverty reduction. Asmamaw (2014) stated that in Ethiopia small loans provided by micro-finance programs were enhancing self-employment projects generating income to improve the living conditions of the poor and alleviate poverty. Similar evidence in Tarozzi et al. (2015) indicates that the micro-credit treatment has increased the prevalence of new non-farm business creation for both men and women program participants in Ethiopia. Additionally, Belwal et al. (2012) noted that micro-credit helps women small-scale entrepreneurs to finance and maintain established businesses in Addis Ababa, implying that the credit incentivized women to stay in income-generating activities.

This paper has the aim of investigating the impact of augmenting the investable resources of households, using micro-credit intervention, on gender division of labor, targeting the typical treatment of women in rural Ethiopia. Employing standard treatment effect models, the study examines the effect of micro-credit on women's decision to participate on income-generating activities and the impact on the time they spent on such activities. Given the fact that there are limited or non-existent sources of capital to create and start up new economic activities for rural women, it should be expected that micro-credit would have a positive impact on women's participation and time spent in income-generating activities.

3. Data and Methodology

3.1 Data

This study utilized data from a household survey, collected from November to December 2017, of 460 households drawn from three woredas of North Wollo Administrative Zone (NWAZ) through a systematic random sampling technique. North Wollo is one of the 11 administrative zones of Amhara Regional State of Ethiopia. In the 2007 population and housing census, it had a total population of 1,500,303 persons in an area of 12,172.50 km2 (CSA, 2007). The larger portion of the Zone is mountainous and characterized by steep slopes which are unsuitable for agriculture. This severely limits the cultivated area. According to the World Bank (2004), the average rural household has 0.7 hectare of land (compared to the national average of 1.01 hectare of land and a regional average of 0.75 for the Amhara Region), and the equivalent of 0.7 head of livestock. About 13.2% of the population are involved in non-farm related jobs, compared to the national average of 25% and a regional average of 21%. The Zone also has a high drought risk and all of its rural woredas are included in the 48 woredas identified as the most drought prone and food insecure in the Amhara Region.

A number of governmental and nongovernmental organizations based in the zone have been making different interventions to tackle the above mentioned problems. Of which the Amhara Credit and Saving Institution (ACSI) provides micro-credit services to alleviate financial constraint both at zonal and regional level. Credit services of this institution have reached rural households in all North Wollo woreda administrations, targeting 60% participation of women clients. So, to examine the impact of credit schemes on women labor force participation in NWAZ, clients of the Amhara Credit and Saving Institution (ACSI) have been considered as treatment group.

Multi-stage sampling procedures were employed to draw up the target sample households of the study. In the first stage, North Wollo Administrative Zone (NWAZ) was selected deliberately for the reasons of the zonal background mentioned above and the authors' familiarity with the area. In the second stage, to capture women's different working cultures

existing in NWAZ, all districts of the zone were classified into three strata along the existing major agro-ecological zones (dega (highland), woina dega (temperate zone) and kolla (lowland)). Three districts, one from each stratum, were selected using a random selection method. In the third stage, seven kebeles, two kebeles each from the dega and woina dega strata, and three from the kolla, were selected randomly. In the fourth stage, households in each kebele were stratified into two groups based on wives' involvement in microcredit programs. Sample households of microcredit participants (wife participation) and non-participants (wife non-participation) in each kebele were identified using random sampling with probability proportional to sample size.

All respondents were women, and among them 172 were credit participants and 288 were non-participants. Interviews were conducted with each respondent woman to gather time use-data using semi-structured questionnaires. Activity-specific recall questions were designed to list the daily activities of women and the time spent on each activity. Women's daily activities, were categorized into six groups: income-generating activities, household routine activities, traditional agricultural activities (helping in agriculture), social activities, community activities and personal care. The total time to perform all of these activities was calculated at fourteen hours. Finally, one-week (the last seven days from the interview day) time-data was collected from each woman through diary method. Women noted the time spent for all their daily activities over the total of 14 hours. In addition to the time use-data, household demographics, credit participation, household income, land and livestock holding data were also collected. The authors initiated, organized and supervised the collection of the data.

3.2 Methods of Analysis

The study employs descriptive statistics and econometric models to analyze the impact of micro-credit provision on women's labor force participation in income-generating activities. Descriptive statistics were applied to characterize the sample households' social, economic, demographic and institutional factors. The Heckman selection model was employed to identify the determinants of women's participation in income-generating activities. The presence of a considerable number of women who

had never spent time in income-generated activities might suggest using corner solution outcome models (Tobit) over Ordinary Least Squares (OLS) but the expectation, verified by tests, that selection bias would threaten the validity of the Tobit model as a result of women's self-selection into the participation in IGAs, encouraged the use of the Heckman procedure. Standard average treatment effect models were used to analyze the impact of credit schemes on women's participation decisions and level of engagement in income-generating activities. Tests on selection bias for participation in the credit scheme or on the endogeneity of credit participation required the use of a control function approach that took account of the endogeneity problem. Other methods, including Propensity Score Matching (PSM), Augmented Inverse Probability Weights (AIPW) and Inverse Probability Weighted Regression Adjustment (IPWRA) estimation, are utilized for comparison purpose.

The Model

A woman is assumed to participate in income-generating activities when she is convinced that spending additional time in such activities pays off more in return in the form of welfare as compared to the status quo. The status quo in this context is that a woman is traditionally assigned to perform unproductive and reproductive activities such as household chores and childcare which are not acknowledged as economic activities and are not considered in measurements of household economic welfare. Let the return from participation of a woman in income-generating activity requiring a certain level of time spent on such activity be denoted by L_i. As expected, and observed in the data there are women who never spent time in income-generating activities, and the decision of participation of women in income-generating activities is one of a corner solution outcome. Let L_i^* represent the time that would have been spent in the continuous net benefit of participating in the program of IGAs. With no self -selection problem, the model of female labor participation on income-generating activities would be given by:

$$L_i = x'\beta + \epsilon \qquad \textbf{(1)}$$

where

$$L_i = \begin{cases} L_i^* \; if L_i^* > 0 \\ 0 \; if \; L_i^* \leq 0 \end{cases} \quad \textbf{(2)}$$

x =vector of covariates including a dummy for credit participation, β = parameters, and ϵ = error term.

This model would be estimated using Tobit. Nevertheless, there is good reason to believe that participation of women in income-generating activities in rural Ethiopia is also the result of self-selection. In a culture dominated by decisions of labor participation with gender segregation between income activities and traditional household activities, it takes extra inherent courage for a woman to break the inertia of segregation. A decision to participate in income-generating activities by women is assumed to be affected by an intrinsic factor other than observed variables and the failure to account for any such unobserved variable leads to an error term correlated with important covariates in the model. In such circumstances, estimation of the corner solution outcome model using Tobit would result in inconsistent estimates of the major covariates in particular credit participation (Wooldridge, 2002). The alternative for this is the selection model which accounts for problems of incidental truncation as one cannot observe the level of time that would have been spent on income-generating activities had they decided to participate.

Let M be a binary choice representing women's participation decision in income-generating activities, taking on 1 if a woman participates and 0 otherwise. The regression and selection models are, respectively, given by:

$$L_i = x'\beta + \epsilon \quad \textbf{(3)}$$

$$M_i = z'\delta + \upsilon \quad \textbf{(4)}$$

where z = a set of instruments in such a way that $x \subset z$ and $cov(\epsilon, \upsilon) \neq 0$.

This model can be estimated using the Heckman procedure (Heckit) or the full information maximum likelihood estimation technique.

The standard regression model or the more advanced selection model is employed to capture the effect of credit on the level of time spent on income-generating activities by women along with other covariates. The model can be specified to identify the determinants of time spent on income-generating activities by women and seen as a simple average treatment effect model under an ignorability assumption accounting for possible selection problem in the outcome variable.

Nevertheless, the impact of credit participation needs to be determined in a more formal way. In principle, there are three cases under which average treatment effect can be estimated for cross-sectional data: difference in mean estimator, OLS estimation under ignorability or unconfoundedness assumption, and instrumental variable estimation.

Let L_i represent time spent on income-generating activities, and w_i represent participation in a credit program. The generic model for the outcome is given by:

$$L = (1 - w)L_0 + wL_1 = L_0 + w(L_1 - L_0) \qquad \textbf{(5)}$$

Where L_0 is the time spent by women in income-generating activities if they were not in general to participate in credit program ($w = 0$) and $L_1$is the amount of time spent by women if they were to participate in credit program ($w = 1$).

Assuming that participation in the credit program is random so that w is not in any way related to the expected outcome of participation in the credit programs, $L_1 - L_0$, the average treatment effect (ATE), and the average treatment effect on the treated (ATET) can be estimated using difference–in–mean method:

$$ATE = ATET = E(L_1 - L_0) = E(L_1 - L_1 | w = 1) \qquad \textbf{(6)}$$

Under the assumption of randomness in participation, a difference-in-mean estimator of the difference in time spent on income-generating activities between the participants and non-participants in micro-credit

schemes would be unbiased and consistent. This can econometrically be estimated by running a regression of time spent on income-generating activities on the dummy of credit participation:

$$E(L_i|w_i) = \gamma + \alpha w_i + \epsilon \qquad \textbf{(7)}$$

Here, α measures the difference in average time spent on income-generating activities between participants and non-participants in the population and $\hat{\alpha}$ is the difference–in–mean estimator.

It is generally believed that neither eligibility nor participation in a credit program can be randomized as potential credit participants are usually targeted resulting in systematic selection of participants in a program. The ACSI credit program targets poor women for participation and initially the criterion for admission into the program was that woman should be in a household having either none or owning only one ox. In recent years, this criterion has become less binding as women in some households who owned more than one ox have had access to credit. Women might also self-select themselves to participate in the credit scheme. Women who had applied to participate but failed would be an ideal control for the study. However, there is no information available for unsuccessful women applicants for the credit program. Invoking from Wooldridge (2010), let in Equation (5), $L_0 = E(L_0) + \upsilon_0$ and $L_1 = E(L_1) + \upsilon_1$, where υ_1 and $\upsilon_0$are random individual specific attributes under the two states (states of participation and non-participation), Equation (5) can be rewritten as:

$$L_i = E(L_0) + \big(E(L_1) - E(L_0)\big)w + \upsilon_0 + w(\upsilon_1 - \upsilon_0) \qquad \textbf{(8)}$$

The case that participation depends on (L_0, L_1) implies that υ_0 and $\upsilon_1$are not mean independent of participation in credit activity (w). Under such cases the difference–in-mean estimator does not yield a consistent estimate of the ATE and ATET, and the ATE and ATET differ by the magnitude of $(\upsilon_1 - \upsilon_0)$.

There are two major frameworks under which Equation (8) can be estimated. The first framework assumes that participation may depend on

observables in which case ignorability assumption (confoundedness or conditional independence assumption) would lead to estimation of the average treatment effect by controlling for observable covariates (Wooldridge, 2010). The more common propensity score matching method falls in this category.

Given that L_0 and L_1 represent outcomes (time spent on income-generating activities) without and within participation in a credit program, respectively, let x represent a set of observable covariates which help control dependence of the outcome and participation variables, L_i and w_i. According to Rosenbaum and Rubin (1983), the correlation between the outcome and participation variables depends on a set of observables x and controlling the latter would help estimate ATE appropriately. The population is thus defined by (L_0, L_1, w, x); average treatment effect can be estimated by using regression adjustment methods or propensity score matching methods using sample data.

There is however a possibility that selection for participation into the credit scheme depends on an unobservable factor such as ability or the special courage of women, among those targeted for participation, or alternatively, women with less abilities might be pushed into a credit program. That is, the outcome variable (time spent on income-generating activities) and participation in credit are jointly determined so that the latter becomes endogenous. Statistically, the error term of the outcome regression model and the decision regression model should be correlated. In such cases, instrumental variable estimation would be appropriate (Wooldridge, 2010).

There are a variety of approaches of estimation to address the selection issue based on the assumptions of Equation (8). If there is a good reason to believe that $\upsilon_1 = \upsilon_0$, the instrument exogeniety or exclusion assumption holds i.e. $L(\upsilon_0|x,z) = L(\upsilon_0|x)$, and the instrument relevance condition holds i.e. $L(w|x,z) \neq L(w|x)$, where z stands for a set of instruments in addition to covariates x, Equation (8) can be rewritten as:

$$L_i = \delta_0 + \tau w + u_0 \qquad \textbf{(9)}$$

where $\tau = ATE$, $u_0 = v_0 - L(v_0|x,z)$. Even though the interaction of participation w and $(v_1 - v_0)$vanishes following the assumption, w is still correlated with u_0 through the stochastic component of L_0 which is v_0.

In this case, standard 2SLS can be used to consistently estimate ATE and ATET. With stronger assumptions on the functional form of instrument relevance, a non-linear prediction of the participation equation such as fitted values of a probit model can be used as an instrument to consistently estimate the ATE and ATET.

If $v_1 \neq v_0$, the IV estimator using the standard instruments (z) or predicted values of the participation model cannot consistently estimate the ATE and ATET.

Two competing methods of estimating the ATE and ATET in this case are the correction functions and control function approaches suggested by Wooldridge (2008).

The correction function approaches estimate the model:

$$L = \gamma + \tau w + x\beta + w[x - E(x)]\delta + \varphi\phi(\theta_0 + x\theta_1 + z\theta_2) + error \quad \textbf{(10)}$$

using the predicted cumulative density function of a probit model of participation $(\widehat{\Phi})$, the interaction term $\widehat{\Phi}_i(x_i - E(x))$, the estimated probability density function $\hat{\phi}_i$ and covariates x, as instruments. According to Wooldridge (2008), the extra term $\hat{\phi}_i = \phi(\hat{\theta}_0 + x\hat{\theta}_1 + z\hat{\theta}_2)$ is a correction function that directly accounts for the distribution of part of the error terms v_0 and v_1 instead of assuming they do not cause inconsistency. The control function estimates the model:

$$E(L_i/W,X,Z) = \gamma + \alpha w + x\beta_0 + w(X - E(x))\delta + \rho_1 w[\phi(q\theta)/\Phi(q\theta)] + \rho_2(1-w)\{\phi(q\theta)/[1-\Phi(q\theta)]\} \quad \textbf{(11)}$$

where $q\theta \equiv \theta_0 + x\theta_1 + z\theta_2 + \cdots$, and $\hat{\rho}_1$and $\hat{\rho}_2$ are parameters that can be used to directly test for the existence of endogneity caused by self-selection.

Test results showed that this last model is appropriate in this study while estimates using other methods discussed are reported for comparison purpose.

3.3 Definition and Description of Variables

The major dependent variable in this study is the average time spent by women on income-generating activities, measured by hours spent on specific activities categorized as income-generating. With a total daily time for all activities of 14 hours, the time spent on IGAs had a range of 0 to 14 hours. As indicated in Table 1, the mean time spent is 1.54 hours per day. Another related variable used in the model is participation decision variable which takes on 1 if a woman participates in income-generating activity and 0 otherwise.

The major target variable for this study is credit participation. The variable takes on 1 if a woman participates in ACSI credit program, 0 otherwise. There is no alternative micro-credit or other form of institutional credit service in the study area. Other covariates included can be described shortly. Household land holding refers to total land size currently possessed by households including rented-in and shared or other land use arrangements by household. Household livestock holding refers to the total number of animals possessed by the household measured in tropical livestock units (TLU). Household total income is the total earning of the household from both farm and non-farm activities through self-employment and wage labor, and includes all transfers including aid and credit. On the other side, remittance refers to the amount of money in birr transferred to a given household from another person, household or institutions; if the source of the money is a person, she/he should not be a member of a currently sampled household. Dependency ratio refers to the ratio between the number of household members who do not work and the total household size. As it happened that all respondents in the sample were either Orthodox Christians or Muslims, the “religion of respondent” has a value of 1 if a woman was Muslim and 0 if Orthodox Christian. Extent of micro-credit clients in the village indicates the proportion of women clients in the microcredit program in a given village. Other control variables indicated in Table 1 are straight forward and need no further description.

Table 1: Definition and description of variables used in analysis

Variables	Mean	Standard deviation	minimum	maximum
Average time of women spent on IGAs per a day in hour	1.54	1.6	0	8.13
Age of the respondent (years)	37.20	10.98	18	70
Dependency ratio	0.35	0.24	0.00	1.00
Total income of the household in Birr	35139	33560	0.00	273990
Landholding size of the household in hectare	0.59	0.50	0.00	3.25
Number of livestock of the household in TLU	2.14	2.22	0	21.43
Remittance in Birr	3124	16849	0	250000
Distance to the nearest market in kms	10.44	6.32	2	23
Distance to the nearest micro-credit office in kms	13.47	4.8	6	23
			Proportions (%)	
Woman's participation in IGAs (= 1 if woman participate)			67.6	
Credit participation (= 1 if woman borrowed money)			37.39	
Level of education of the woman (class years)				
Woman has no education /illiterate/			63.9	
Woman has basic education			4.2	
Woman has primary education			19	
Woman has secondary education			12	
Woman has tertiary education			0.9	
Respondent/ woman is Orthodox Christian			94.35	
Respondent/ woman is Muslim			5.65	
Marital status of the respondent (=0 if married)			79.35	
Dummy kolla (=1 if kolla) **Dummy dega (=1 if dega)**			76.30	
Extent of micro-credit client in the village				

4. Results and Discussion

4.1 Descriptive Analysis

A total of 460 sample households were selected through a systematic random sampling technique for this study. All respondents in the sampled households were women, with 172 (37.39%) participating in a credit scheme, and 288 (62.61%) being non-credit participants. Among all respondents 365 (79%) were married and the rest, 95 (21%), divorced and/or widowed. Of the 172 credit participants, 131 (76%) were married and 41(24%) divorced and/or widowed. The average and median ages of all respondents were 37.2 and 35 years respectively. The average and median ages of women who participated in the credit scheme were 37.44 and 36 respectively. The minimum and maximum ages of the participants were 19 and 70 years, respectively. The majority, 64%, of respondents were uneducated and another 23% only attended primary education. Of the 172 credit participants 63.74% were uneducated and 25.73% had attended primary education. In terms of religion, the majority of the respondents (94.35%) were Orthodox Christians and the rest, 5.65%, Muslims. About 51% of the Orthodox Christians and 11.54% of Muslims in the sample were credit participants.

Time spent on income-generating activities across credit participation, marital status of women and agro-ecological zone is shown in Table 2. Among women who participated in the credit scheme, 77% participated in income-generating activities with an average participation time of 2 hours and 31 minutes (2.52 hours) a day. On the other hand, 62% of non-participant women respondents participated in income-generating activities with an average time of 2 hours and 5 minutes (2.08 hours) per day. As it stands, the less than an hour difference in time spent on income-generating activities between participants and non-participants in credit program appears to be small. Nevertheless, this figure is likely to be biased as participation in credit program is not expected to be random, implying that time spent on income-generating activities by women and decision to participate in credit programs could be endogenous. Econometric analysis in the next section will address the issues of selection and endogeneity to estimate a plausible figure.

Given the cultural inertia that segregates activities between men and women in rural communities of Ethiopia such as those considered by this study, the amount of time women spent on income-generating activities with respect to their marital status deserves investigation once the decision of women to participate in such activities had been made. Accordingly, the average time of women of different marital status spent on income-generating activities was computed. In general, it was found that participation in micro-credit program positively affected the average time women spent on IGAs irrespective of their marital status. Married credit participant women spent 25 minutes more per day than non-client married women. Similarly, under the widowed/divorced women category, credit participant women spent 30 minutes more on IGAs than non-credit participants.

Participation of women in IGAs also tends to vary across agro-ecological Zones. The rate of participation in income-generating activities for credit client women in kolla, woina dega and dega zones were 75%, 87% and 74% respectively; and the average time of participation in IGAs by the respondents in these zones was 2.07, 3.51and 2.43 hours per day respectively. However, the daily average time of non-credit participant women in IGAs across the agro- ecological zones was 1.99, 2.03 and 2.26 hours per day in the kolla, woina dega and dega woredas respectively; and their rate of participation in IGAs was 55%, 70% and 65%. The result revealed that irrespective of differences in agro-ecological zones both the proportion of participants in IGAs and the amount of time spent on such activities was higher for credit participants than for non-participants. The highest proportion of IGA participants (87%), with the longest time spent on IGAs (3.51 hours per day), was recorded for credit participants in woina dega areas. One possible explanation for this is the fact that there are more choices of economic activities in this agro-ecological zone.

Table 2: Participation on credit scheme and Income-generating activities

Women's participation in microcredit and time spent on IGAs		Credit Participant (observation = 172)			Noncredit participant (observation = 288)		
		Participants in IGAs (%	Time spent on IGAs		Participants in IGAs (%)	Time spent on IGAs	
			Mean	Std. dev		Mean	Std. dev
Proportion of women participate in IGAs and time spent	Both Married and Widowed/divorced women	77	2.52	1.59	62	2.08	1.33
	Married women	78	2.49	1.42	62	2.07	1.29
	Widowed/divorced women	76	2.62	2.06	63	2.12	1.49
	Women in kolla/Raya Kobo	75	2.07	1.11	55	1.99	1.27
	Women in woina dega/Lasta	87	3.51	2.15	70	2.03	1.26
	Women in dega/Wadela	74	2.43	1.33	65	2.26	1.47

Source: Author's computation from sample survey data (2017).

Women in the research area are used to participation in some types of traditional economic activities such as collection of firewood and weeding for the purpose of both house consumption and to generate income. However, such activities are no more than borderline cases to influence the status of women in intra-household resource allocation and women empowerment. In contrast, engagement of women in economic activities such as animal fattening and raising, growing vegetables for market and other business-related activities, are recent developments. As Table 3 indicates, 54.35 % of credit participant women were engaged in such new economic activity ventures compared to only 42.34% of non-credit participants. By contrast, only 9.78% credit participants (compared to 17.12 % of non-credit participants) were engaged in more traditional economic activities such as firewood collection. Table 3 gives a list of categories of IGAs based on their economic importance, with the least valued at the top. The proportion of women credit participants engaged in high valued IGAs is higher than non-credit participants, implying the credit scheme might help its clients to become involved in high valued IGAs.

Table 3: Categories of income-generating activities and women participation

Categories of Income-generating activities	Participation of women in IGAs in percent	
	Credit participant women (observation = 172)	Credit non-participant women (observation = 288)
Daily labor, fire wood collection, safety- net, hairdressing	9.78	17.12
Local drink and food, small shops	15.22	20.72
Handicrafts and cloth making	2.17	1.80
Animal fattening and rearing, poultry, bee keeping, vegetable cultivation	54.35	42.34
Trade and other professional work	18.48	18.02
Total	100	100

Source: Author's computations based on own survey data (2017)

4.2 Econometric Analysis

4.2.1 Modeling determinants of time spent by women on income generating activities

The main purpose of this subsection is to empirically verify that access to credit increases the time spent by women on income-generating activities. A significant number of women respondents did not spend time on IGAs. While the Tobit estimation methods would be appropriate to handle such a corner solution outcome model, the suspicion that participation in the IGAs could be a result of self-selection leads to a need to address such issues.

The regression model of interest relates time spent in hours by women in IGAs with the dummy of credit participation along with other control variables. The unobserved factor that might have led some women to decide to participate in the IGAs was found in the decision model or selection equation where the dependent variable is binary (taking on 1 if a woman spent time in IGAs) and a set of explanatory variables. It is required that all covariates which appear in the regression equation should also appear in the selection model while the later model should include at least one variable which does not appear in the regression equation (Wooldridge, 2010).

The Heckman method estimates both the regression and selection models simultaneously. Testing for the correlation of the error terms of the two equations (regression and selection equations) indicates whether there is a selection bias if the model was estimated using other standard models such as Tobit.

Table 4 shows results of Heckman estimation of both regression and selection models. The STATA output also reports the result for the test of selection bias. The null hypothesis that the regression and selection equations are independent or that the correlation coefficient between the error terms of the two equations (ρ) is zero, is rejected at 1% level of significance. This justifies the appropriateness of the use of the Heckman procedure instead of other standard models such as the corner solution outcome model (Tobit model).

The result shows that credit participation was significant at 1% significance level and had positive impact on the amount of time spent by women in income-generating activities. Size of land owned by the household, dependency ratio and the agro-ecological zones (kolla and dega) were statistically significant in affecting women's time spent on IGAs at 1% significance level. The implication of the negative relationship between kolla and dega agro-ecological zone with IGAs was that women living in these agro-ecological zones spent less time on IGAs than those living in the third agro-ecological zone (woina dega). Another variable that had significant effect on the amount of time spent by women in IGAs was age of the respondent. Other control variables were not statistically significant.

On a passing note, religion as an instrument in the selection equation significantly affecting women's decision to participate in IGAs, was assumed to affect participation directly but only affect the amount of time spent indirectly.

Table 4: Heckman selection model estimation of hours spent on Income-generating activities by women

	Regression Model Dependent Variable: Hours spent on income-generating activities		Selection Model M = 1 if a woman participated in IGAs, 0 otherwise	
	Coefficient	**Std. Err.**	**Coefficient**	**Std. Err.**
Dummy women credit participation (= 1 if participated)	0.944	(0.200)***	0.393	(0.131)***
Age of the respondent	-0.0002	(0.0001)**	0.0002	(0.000)***
Level of education of the respondent	0.006	(0.031)	-0.033	(0.019)*
Marital status of the respondent (=1 if single)	-0.369	(0.441)	0.238	(0.286)
Sex of the household head (=1 if female)	0.201	(0.409)	-0.045	(0.257)
Dependency ratio	-1.080	(0.398)***	-0.288	(0.257)
Religion (=1 if Muslim)			-1.000	(0.350)***
Size of landholding of the household	-0.130	(0.043)***	0.009	(0.032)
Number of livestock of the household in TLU			-0.029	(0.031)
Remittance in Birr	-0.004	(0.006)	-0.003	(0.003)
Distance to the nearest micro-credit office			0.0004	(0.012)
Extent of micro-credit client in the village			-0.291	(1.536)
Dummy kolla (=1 if kolla)	-0.668	(0.267)***	-0.446	(0.202)**
Dummy dega (=1 if dega)	-0.810	(0.264)***	-0.380	(0.452)
Constant	2.847	(0.367)***	1.282	(0.299)***
/athrho			2.281	(0.480)***
Lnσ			0.566	(0.057)***
Number of observations: 403				
Test of independent equations (ρ= 0): $\chi^2(1)$ = 51.71, P-value > χ^2 = 0.0000				

Note: Robust standard errors in parentheses; the signs ***, ** and * indicate level significance at 1%, 5% and 10% respectively

4.2.2 Measuring the impact of credit on women's time spent on income-generating activities: the average treatment effect

A more formal method of estimation of the impact of participation in credit programs by women on the amount of time spent in income-generating activities is an average treatment effect. As noted above, subsection 3.2, there are at least three issues under which average treatment effect is estimated. Under ideal circumstances, an assumption of random selection of women into the credit program would entail comparing the mean time spent in income-generating activities by women who participated in credit schemes and those who do not. The average treatment effect can be estimated under the assumption that participation in the credit scheme by women may not be random but can depend on factors that are observable. In this case, providing controls for the direct and indirect effect of such variables in the average treatment effect model would allow estimation of the impact of credit participation on time spent in IGAs by women. The third fact is that participation in the credit scheme could be a result of self-selection where such selection depended on factors that are not observable; that is, the outcome and selection model might not be independent. In this case, instrumental variable estimation becomes relevant to deal with the risk of inconsistency in the results (Wooldridge, 2010).

In this particular study, women's participation in the credit program was not expected to be random for two reasons: first there was targeting by credit facility officers or operators where poverty was considered as one criterion. Second, in a society where segregation of activities by gender is rife, participation in the credit program by women might well be the result of special attributes of some women. This would justify the relevance of testing for the existence of selection bias in the model of the average treatment effect.

Estimation showed the null hypothesis, that outcome and participation equations were independent, was rejected at 1% level of significance. As a result, instrumental variable estimation was used to estimate the impact of credit participation by women on the time spent on income-generating activities. A STATA output of the estimation of Equation 11 is shown in Table 5. Results under the assumption of ignorability (standard estimates and PSM) are reported for comparison. Under

ignorability assumptions, regression adjustment (RA) estimators, inverse probability weights (IPW) estimators, augmented inverse probability weights (AIPW) estimators, and inverse probability weighted regression adjustment (IPWRA) estimators, give a variety of options to estimate ATE, ATET, and potential outcome means (POMs). The AIPW and IPWRA estimators have efficiency advantages over RA and IPW estimators because they combine the models for both outcome and treatment probability and have a double robust property (it requires that only one of the two models - the outcome and treatment probability – needs to be correctly specified) (StataCorp., 2015).

The method that accounts for the endogeneity problem extends the regression adjustment estimator under the ignorability assumption. In this case, the outcome model is assumed to be linear and the treatment follows a probit model (results are indicated on the last column and row of Table 5).

In augmented inverse probability weights (AIPW) estimation, level of education of the respondent, size of landholding of the household, remittances in thousand Birr, age of the respondent, dependency ratio, dummy kolla and dummy dega variables are, used in regression model. On the other hand; the number of livestock of the household in TLU, distance to the nearest micro-credit office in kms, extent of micro-credit clients in the village, marital status and age of the respondent are used in the participation model. Except for dependency ratio, included in the participation model of the inverse probability weighted regression adjustment (IPWRA) estimation, similar variables are used both in AIPW and IPWRA. The covariates used in propensity-score matching (PSM) are dummy credit, remittances in thousand Birr, level of education of the respondent, size of landholding of the household, age of the respondent, gender of the household head, and dummy kolla and dummy dega. In the endogenous treatment-effects estimation (IV estimation) control variables are level of education of the respondent, size of landholding of the household, age and marital status of the respondent, remittances in thousand Birr, distance to the nearest market in kms, dependency ratio, dummy kolla, and dummy dega; and religion as an instrumental variable.

Table 5: Treatment effects estimation of hours spent on Income-generating activities by women

	Hours spent on Income-generating Activities							
	augmented IPW		IPW regression adjustment		propensity-score matching		Endogenous treatment-effects estimation	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
ATE								
Credit participation (1 vs 0)	0.750	(0.158)***	0.752	(0.158)***	0.919	(0.189)***	4.445	(1.098)***
Potential outcome means								
Credit participation 0	1.270	(0.093)***	1.271	(0.093)***	-	-	1.394	(0.445)***
ATET								
Credit participation (1 vs 0)	-	-	0.711	(0.156)***	0.902	(0.187)***	0.420	(1.013)
Potential outcome means								
Credit participation 0	-	-	1.247	(0.096)***	-	-	1.539	(1.006)
Observations	403		403		403		403	
Outcome model	linear by ML		linear		matching		linear	
Treatment model	Logit		logit		logit		probit	
Test of endogeneity	Ho: treatment and outcome unobservables are uncorrelated $\chi^2(2) = 16.37$ [0.0003]							

Note: Robust standard errors in parentheses; the signs ***, ** and * indicate level significance at 1% , 5% and 10% respectively

As it can be seen from Table 5, the coefficients of ATE and POMs of credit participation in AIPW estimates are statistically significant at 1% level. The result shows that the identified group (participant women in credit programs) spend 0.75 hours or about 45 minutes longer in income-generating activities than the non-participant group. The average time spent by women who did not participate in credit program is 1.27 hours or an hour and 16 minutes. So, the average time spent on IGAs, if all women were participated in micro-credit, would be 45 minutes greater than the average of an hour and 16 minutes that would be spent on income-generating activities if none of the women had participated in micro-credit. The results of the IPWRA estimators are similar to that of AIPW, and the result of the PSM estimator is not significantly different from these, showing that credit participant women spent more than 0.92 hours or 55 minutes per day on IGAs than non-participant women.

At the same time, the rejection of the test for independent outcome and treatment models imply biased and inconsistent AIPW, IPWRA and PSM estimates. The alternative model that accounts for the endogeneity (selection) problem is the instrumental variable estimation. In this case, the control function approach which is suggested by Wooldridge (2007, 2010) is employed. That is, the residual in the treatment model is included in the potential outcome models to estimate the ATE. The results of this later method of estimation show a significant coefficient for both ATE and POMs, and the coefficient is much improved compared to the results under the previous three estimates. According to the estimate using the control function approach, on average, treated women (women who participated in credit program) spend 4 hours and 28 minutes more than the untreated women on credit. This is a quite significant difference given the 1 hour and 23 minutes average time spent in IGAs by women who did not participate in IGAs. In other words, the average time spent on IGAs if all women were to participate in micro-credit would be 4.45 hours (or 4 hours and 28 minutes) substantially greater than the average of 1.39 hours (an hour and 23 minutes) time that would be spent if none of the women had participated in micro-credit program.

Results in ATET estimation revealed that the effect of credit among the credit participants is very low, even insignificant in the control function estimation where endogeneity due to selection bias is not an issue. Based on

the second model in Table 5, when all women in the sub-population (credit participants only) participated, the average time spent on IGAs per day is estimated to be 0.71 hour (4 5 minutes), more than when no women in the sub-population of interest participated. If no women in the sub-population of interest participated, the average time spent in IGAs amounted to 1.25 hours (an hour and 15 minutes) per day.

Despite the fact that the alternative average treatment effect models showed that the impact of women credit participation result in different magnitudes of time spent on income-generating activities, they invariably confirmed the positive impact of credit schemes. The implication of these results is that micro-credit intervention in rural Ethiopia can be seen as one of economic versus gender development strategy through reorienting the traditional gender division of labor in rural households.

5. Conclusion and Implications

Using primary data, the study has investigated the impact of participation in micro-credit on women's engagement in income-generating activities, and also identified other important factors which determine the time spent by women on such activities. To examine the issue, 460 households, drawn from 3 woredas of North Wollo Administrative Zone, were chosen, using a systematic random sampling method. All respondents in the sampled households were women, of which 172 participated in a credit scheme and 288 were non-credit participants.

The impact of participation in credit schemes on women's time spent on IGAs was assessed by using average treatment methods considering women who participated in activities financed by Amhara Credit and Saving Institution (ACSI) as a treated group and other women who did not participate as a control group. The statistical methodology used for this assessment was chosen on the basis of the high likelihood of prevalence of self-selection or targeted selection in a credit program resulting in an endogeneity problem. While the most appropriate and robust model was employed to account for selection problems on the basis of unobserved heterogeneity, other intermediate models, such as AIPW, IPWRA and PSM,

which assume selection to depend on observables were employed to estimate the treatment effect for comparison purposes.

The study found that women's participation in IGAs had a positively significant effect on the time women spent on income-generating activities. Based on estimates of the control function approach of Wooldridge, it was found that women who participated in credit schemes spent 4 hours and 28 minutes (4.45 hours) longer per day than non-participants. In addition, a large number of participant women spent their time on more productive and formal economic activities in comparison with non-participants who tend to engage in less formal economic activities. The more formal activities include animal fattening and rearing, poultry, bee keeping and vegetable cultivation. The descriptive analysis also found that irrespective of the marital status of women, micro-credit had a positive impact on the time women spent on IGAs.

The study identified important factors which determine women's participation in IGAs other than access to credit. Age and dependency ratio were consistent demographic factors which negatively affected women's IGAs time. The most important economic variable which affected women's participation in IGAs was the size of landholding of the household. Households which own more land resource (farm land) were expected to spend their time on farming activities, and thus women's time spent on IGAs, as a member of the household, tended to be low. Agro-ecology was another factor which determined the amount of time spent on income-generating activity by women. Among the three agro-ecological zones, women who lived in the woina dega (temperate) zone tended to spend more time on IGAs. One possible reason could be the fact that the temperate climate is suitable for many alternative IGAs; dega and kolla zones offer more limited opportunities for rural-related economic activities.

Empirical findings suggest that Ethiopia can promote women's self-employment in productive activities using intervention that can enhance and improve women labor force participation in IGAs. This study concluded that rural women's participation in micro-credit schemes has a significant impact on women's participation on IGAs and the time spent on such activities. It is, therefore, possible to reallocate rural women's labor from traditional household activities with low returns to productive activities through various policy interventions that target reducing women's financial constraints. To

this end, policies and interventions of development agencies should consider strategies of expanding micro-credit schemes focusing on the self-employment of women. The fact that the average treatment effect (ATE) was found to be higher than the average treatment effect among the treated (ATET) is consistent with targeting of women for credit participation based on their level of poverty. There is the possibility to enhance rural women labor force participation in IGAs through properly designed policy interventions that can target more productive women despite their initial income status.

This study offers conclusive additional evidence to the existing literature on the role of micro-credit in improving women's economic participation in the form of labor force participation in rural settings.

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