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The Socio-Economic Impact of Commune Programs in Ethiopia: The Case of Gambella Regional State

Belay File[1] Aklilu Amega[2] Zekarias Minota[3]

Abstract

The government of Ethiopia has been executing a number of development programs under the umbrella of a medium term strategy called Growth and Transformation Plan geared towards transforming the economy towards an industry led one. Development of pastoralist and semi-pastoral areas is one of the key elements of the agriculture sector under this pillar. It has been emphasized that unlocking the potential of these fertile but remote and underdeveloped areas in the country could add up to enhanced production and productivity in the agriculture sector. However, with a scattered settlement and poor living conditions transforming the pastoralist and semi-pastoralists would proof difficult. Villagization program is assumed to remedy this problem. The study was aimed to understand the socio-economic impact of such a program through impact evaluation methodology. A quasi-experimental design approach (specifically the propensity score matching method) has been used to analyze the impact of the program on the socio-economic conditions of the settlers. A multi-stage cluster sampling method was used to obtain a representative sample of 120 program participants and 120 non-participants. Results of the study reveal that villagization has a positive impact on the income of participants, access to services and enhancing consumption. This was significant for income and access to service outcome variables. As revealed by average treatment effect of treated (ATT) estimation, the mean difference of annual income of participants and non-participants vary by about 12,000 birr, which is indeed a significant figure, and justifies the program intervention. Participants have also enjoyed a higher probability (at least 32% higher chance) of accessing infrastructure and services, compared to non-participants.

Key Words: **Villagization, Impact Evaluation, PSM**

1. Introduction

Even with its present pace of economic growth, Ethiopia is dubbed among poor nations, dominated by an agrarian economy and a subsistent farming largely dependent on rain fed agriculture. Every strive by the government and development agents these days is largely aimed to transform the economy from Agriculture Led Economic Development to an industry Led

[1]Corresponding author at: Belay File (PhD), Assistant Processor, Department of Development Economics, Ethiopian Civil Service University. Email : belayfile2007@gmail.com or belay.file@ecsu.edu.et

[2] Lecturer, Department of Development Economics, Ethiopian Civil Service University. Email: aklilu77@yahoo.com

[3] Lecturer, Department of Development Economics, Ethiopian Civil Service University. Email: zms.ethiopia@gmail.com

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Economic system through both intensive and extensive agriculture. The first GTP has witnessed that such a transformation is possible in not too far time. This can be evidenced by the declining trend in the share of Agriculture to about 40% and a surging share of industry and services (both together accounting to about 60% of the GDP) according to MoFEC (2014). Recent data also show that the total population living below the poverty line has gone down to 22.9 percent indicating that poverty headcount index is declining. Although poverty is higher in rural areas recent study indicates promising decline in both rural and urban areas (MoFEC 2014).

Nevertheless, the role that agriculture plays in transforming the economy is still so significant that it has been mentioned as key pillar to GTP II as well. It has been envisaged that surplus agriculture feeds into the industrial sector through the process of economic transformation and creating surplus demands increased production and productivity in the agriculture sector. Moreover the pace of economic transformation did not seem to go hand in hand with the pace of labor transformation in the country. The share of labor force working in the agriculture sector still remains at high of about 80% despite agriculture's declining share in GDP. This implies that much more is expected of the agriculture sector not just in economic transformation but also in labor transformation and boosting industrialization efforts in the country. The dismal situation in the agriculture sector would therefore have bad repercussions for the whole economic system in the country. And it is not uncommon in the country to see recurrent drought and untimely rain fall both affecting the livelihoods of the rural community and exposing them to famine.

The vast majority of poor households that live in rural areas are engaged in subsistence rain fed agriculture on small fragmented plots of degraded land, a livelihood increasingly subject to weather fluctuations as a result of climate change and thus, in years of poor rainfall, the threat of widespread starvation is high. As in many other African countries, there is a pressing need to improve household food security and improvement in the livelihood of people in Ethiopia. An emerging consensus suggests that this is most easily accomplished through investments that facilitate income generation and asset accumulation through infrastructural development, improved technologies for agriculture and interventions that protect the poorest from hunger. It has been argued that Villagization Program adds to these efforts. Remote and emerging regions with poor practices in modern farming are most affected by these abnormal weather changes and erratic rain fall. The scattered settlement system has also made it difficult to provide socio-economic and administrative services badly needed to enhance the living standards in the rural sector. It is with this very goal that villagization has been underway in Ethiopia. With a scattered settlement and poor living conditions, transforming the pastoralist and semi-pastoralists would proof difficult. It could be a challenge to provide adequate and safe drinking water, road infrastructure and utilities when people are scattered. Provision of social services such as health and education would also be a costly business unless people come together and reduce the cost of diseconomies of scale.

Frequent changes in the weather conditions and erratic rain fall have had strong adverse impacts on the livelihood of the community as they largely rely on livestock and agriculture. Strengthening the resilience of pastoral and semi-pastoral community will therefore remain a key challenge of the government's development effort. Villagization is hence aimed to enhance resilience to the climatic changes and sustainable life to settlers through provision of infrastructure and social services and helping them achieve increased production and productivity. The question that remains unanswered is whether the programs executed so far have achieved these planned goals. This study has a general objective of investigating the program impact in a sense that if villagization in Gambella Regional State has brought about a

significant change on the socio-economic living of the settlers since the program started in 2010. Specifically, this study will investigate: a) The pattern of villagization in the region; b) The impact of the program on the income consumption expenditure of the households; and c) The impact of the program on access to social and infrastructure services.

The next part of the paper is organized in to five sections. Section two reviews related literature (theoretical and empirical), section three presents methodology, and section four deals with results and discussion, section five concludes the study with some policy implications.

2. Literature Review

In this part, some theoretical and empirical evidence of villagization are reviewed. Emphasis is given to experiences of some countries on villagization and empirical evidence.

2.1.Arguments for Villagization

Theoretically, villagization enhances economic development either through establishing new development areas or expanding already existing development processes. In this case, development involves optimal utilization of productive resources such as land, water, forest, and wild animals without causing damage to environment as well as equitable distribution benefits and/ or costs among particular population. The principal objective of the villagization program is to ensure the right of citizens to development (EHRC 2013). Development often provides equal opportunity for the entire population to share wealth, build enabling environment for citizens to create wealth, and give the right to possess and use from the benefits. The right to development in essence, stood against the disparity in income and poverty and enables citizens to enjoy ever-increasing benefits (EHRC 2013). In addition, it can reduce income inequality and provides the livelihood of the affected people (Cernea 1994). Similarly, villagization is helpful in creating new growth centers and reducing regional imbalances (Helena and Henriques 1988).

Besides improved access to services, villagization can also be justified in terms of agricultural production. The effects of villagization on agricultural production are therefore not clear-cut. While the long-term impact of villagization on agricultural production is difficult to measure, its short-run impact is usually negative. This is because villagization disrupts work in the fields when it is implemented, and the long distances from their fields for many of the villagized households undermines their production. The outcome of the program may be different for different crops and in different regions (Bryceson 1990).

Villagization schemes may have serious impact on the environment. Land becomes seriously degraded due to over-concentration of people in a new area when a number of resettles gathered to a particular area (Kikula 1997). This potentially may cause environmental degradation, which in the long run leads to a systematic desertification, which in turn deteriorates agricultural production and livelihood over time. The challenge of African countries in this case is identifying policy issues which can harmonize the villagization model with environment.

2.2.Empirical Literature Review

In 1997, Tanzania had initiated a villagization program with an objective of achieving food self-sufficiency and extending access to basic services and amenities to the rural citizens while maintaining their tradition, culture and model of communal life. Initially, the program had received willingness and acceptance of the citizens; however, latter the implementation process

did not commence as expected, thereby leading the government to introduce pressure and coercion, actually to defend the delays (EHRC 2013). At the same time, the unwilling communities in the original settlements had been demolished to prevent a return on the part of the disaffected members. As a result, the village centers which were constructed in haste failed to provide the planned socio-economic benefits to the citizens. Furthermore, displaced people with their household assets to new centers, with unfinished infrastructure and services, particularly women and children and the other vulnerable section of the communities suffered without shelter for days until houses were built.

Although villagization had managed to provide the attendant benefits, the settlement of large numbers of people in one center had damaged effective protection of the environment. The fact that villagization was carried out under circumstances of unplanned and hastily built infrastructures remained life challenging and difficult for the settled citizens and thus the program was arrested at some stage away from the plan (EHRC 2013)

Mozambique had initiated villagization program in 1976, after independence from Portugal colony, aiming to bring together the farmers and rural communities living in scattered areas and settle them in centers as part of rehabilitating the country. These centers were planned to distribute the benefits of diverse basic services, including markets, health care amenities, education and other infrastructural networks. Furthermore, effort was made to accelerate development and introduce the citizens to modern urban life (Lorgen 1999). These new village centers were able to provide education opportunities, closer access to information and health care services, enhance participation of women in social and economic roles and remove harmful practices (Ibid).

The fact that the villages were established without pre-studies; and that the citizens had not participated in the process, the supervision and control of the program was in the hands of external experts unacquainted with the living traditions and needs of the communities; the inability to provide sufficient water supply and necessary construction materials, the long distances between the residential centers of the villages and the farm areas; and the general incompatibility of the program with the objective realities of the country, were major problems that led to its failure (EHRC 2013). Generally, the experience on villagization revealed mixed results. The major limiting factors identified were implementation without preliminary study, poor plan, failure to provide basic services, and lack of commitment from citizens as well as executing bodies.

3. The Methods

3.1.Sampling Design

A multi-stage cluster sampling method was used to obtain a representative sample. Gambella region is divided into 3 zones, 13 woredas and 94 commune centers, having population size of 450,000. In this study, both the probability and non-probability sampling methods were applied. Random sampling technique was used to choose representative communes and sample households. Here, it is assumed that the commune centers experience similar socioeconomic characteristics. Thus, 12 communes (about 13% of the total commune), four from each zone, were randomly selected. Further, 20 household heads from each village were selected randomly. This adds up the total sample size of the study to 240 respondents. On the other hand, purposive sampling was applied to choose the concerned officials, experts, focal persons who have adequate information about the program. Survey questionnaire was prepared and administered on

these respondents, and those data were mainly used for econometric analysis. This was complemented by data from secondary sources and key informant interviews as well as focus group discussions.

3.2.Econometric Model Specification

3.2.1.Propensity Score Matching (PSM)

Propensity score matching (PSM) is a quasi-experimental option used to estimate the difference in outcomes between beneficiaries and non-beneficiaries that is attributable to a particular program. PSM reduces the selection bias that may be present in non-experimental data. Selection bias exists when units cannot or have not been randomly assigned to a particular program, and those units which choose or are eligible to participate are systematically different from those who are not. It is an alternative method to estimate the effect of receiving treatment when random assignment of treatments to subjects is not feasible. PSM refers to the pairing of treatment and control units with similar values on the propensity score, and possibly other covariates, and the discarding of all unmatched units (Ronsenbaum and Rubin, 1983). In the study, the participants of the settlement program are considered as the *"treatment"* group and non-participants of the settlement program are considered as *"control"* group**.** The untreated group is taken as comparison group. For our consumption, villagization and settlement can be used interchangeably.

3.2.2. How does PSM Work?

PSM constructs a statistical comparison group that is based on a model of the probability of participating in the treatment, using observed characteristics. Participants are then matched on the basis of this probability or propensity score to non-participants. The average treatment effect of the program is then calculated as the mean difference in outcomes across these two groups. After finding the Logit estimate of propensity score for covariates, matching qualities for treated and non -treated groups was tested. Then, the impact of settlement on outcome variables of household income was analyzed .The outcome variable was captured by average annual income per household or per adult equivalent. The analysis was made using psmatch2 command of Stata 13. In our case, the impacts of settlement program on households' welfare was analyzed using propensity score matching econometric technique due to its theoretical and empirical relevance for intervention analysis.

3.2.3.Designing PSM Model

In this sub-section, we have discussed how the operational PSM model is designed.
The basic elements of this model are individuals (sample households), treatment (villagized households) and potential outcomes (consumption expenditure, access to services and income of household) represented by Y.

As Ronsenbaum and Rubin (1983) state, the conditional probability of receiving a treatment given pre-treatment characteristics is:

$P(X) = P_{\tau}[D=1/X] - E[D=0/X]$……...……...(1)

Where; D= [0, 1] is the indicator of exposure to treatment and X is multidimensional vector of pre-treatment characteristics.

More formally, in a binary treatment, the treatment indicator is represented by D_i; if D is one an individual receives the treatment and zero if otherwise. In our case:
D=1, represents individuals who participate in the settlement program.
D=0, represents individuals who do not participate in the settlement program.

The treatment effect is the difference between the well-being of program participants and non-participants. The treatment effect for an individual i can be written as:

$\tau_i = Y_{i(1)} - Y_{i(0)}$ …… (2)

Where, τ_i is the treatment effect.

$Yi_{(1)}$ is the outcome of the treatment group (consumption, access to services and income of i^{th} household).

$Yi_{(0)}$ is the outcome of non-treatment group (consumption, access to services and income of i^{th} household).

The potential outcomes for each individual i, can be defined as:

$Y_i (D_i)$ ..... (3)

Where, i = 1. . . N, N denote the total target population

As stated above, the fundamental impact evaluation problem arises because only one of the potential outcomes is observed and the other outcomes may not be observed for each individual i. The unobserved outcome is called the counterfactual outcome. As a result, complete estimation of the individual treatment effect τ_i is not possible simultaneously and we have to concentrate on the average treatment effects in the population (Caliendo et. al., 2008, Heinrich et. al., 2010).

Therefore, the most prominent evaluation parameter is the so-called *average treatment eff*ect on *the treated* (ATT), which focuses on the effects of the intervention on those for whom the program is actually intended, in this study commune program participants. This is given by:

$\tau ATT = E[Y_{(1)} | D = 1] - E[Y_{(0)} | D = 1]$ …… (4)

Where;

τATT is the average treatment effect (average effect of settlement on participants).

$E[Y_{(1)} | D = 1]$ is the expected outcome of program participants (consumption expenditure, access to services, and per capita income of i^{th} household).

$E[Y_{(0)} | D = 1]$ is the expected outcome of program participants if they hadn't participated in the program.

The expected value of ATT is defined as the difference between expected outcome values with and without treatment for those who actually participated in the program. This parameter focuses directly on the actual program participants and determines the realized gross gain from the program, and compares it against its costs; to conclude whether the program is successful or not (Heckman et. al., 1999 as cited by Caliendo et.al., 2008).

As the counterfactual mean for those being treated; $E[Y_{(0)} | D = 1]$ is not observed, one has to choose a proper substitute for it in order to estimate ATE. The outcomes of individuals from the treatment and control groups will differ even in the absence of treatment leading to a "selection biase". Hence, the average treatment effect (ATE) can be given by:

$E[Y_{(1)} | D = 1] - E[Y_{(0)} | D = 0] = \tau ATT + E[Y_{(0)} | D = 1] - E[Y_{(0)} | D = 0]$ …… (5)

Where;

$E[Y_{(0)} | D = 0]$, is the expected outcome of control groups or non-villagized households (consumption expenditure, access to services, and per capita income of i^{th} household).

The difference between the left-hand side of equation (5) and τATT of equation (4) is called "selection bias". The true parameter, τATT is only identified if:

$E[Y_{(0)} |D = 1] - E[Y_{(0)} |D = 0] = 0$…….…..……. (6)

To address the problem of selection bias stated in equation (6) one has to apply some identifying assumptions: unconfoundedness or conditional independence assumption (CIA) and 0verlap assumptions (Rosenbaum and Rubin, 1983, Caliendo et. al., 2008 and Heinrich et.al., 2010).

Given that CIA holds and also assuming that there is an overlap between both groups, the PSM estimator for ATT can be written in general as τPSM:

$ATT= EP(X) |D=1\{E[Y_{(1)} |D = 1, P(X)] - E[Y_{(0)} |D = 0, P(X)]\}$……..…… (7)

In other words, the PSM estimator is simply the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants. With this brief sketch of the matching estimator, the procedure to estimate the propensity score matching is explained just below.

3.2.4.Implementation of PSM

PSM consists of four phases*: estimating the probability of participation,* that is the propensity score, for each unit in the sample; *selecting a matching algorithm* that is used to match beneficiaries with non-beneficiaries in order to construct a comparison group; *checking for balance/common support* in the characteristics of the treatment and comparison groups; and *estimating the program effect and interpreting the results as well as sensitivity analysis.*

3.2.5.The Treatment (Dependent) Variable

Our treatment variable also known as dependent variable is the *participation status of households in the villagization program*. It is explained by the probability of households' decision either to participate or not to participate in the program. In other word, it is a dummy variable which takes 1 for participation and 0 otherwise. Thus, the ***treatment variable (D)*** has a binary response given as:

$$D = \begin{cases} 1, & if\ the\ household\ participate\ in\ the\ villagizationprogram \\ 0, & if\ the\ household\ do\ not\ participate\ in\ the\ villagization\ program \end{cases}$$

3.2.6.Independent Variables

The independent or explanatory variables of the study are the pre-intervention characteristics by which both settlers and non-settlers are explained. These variables are listed and defined as follows.

Sex of Household Head (SEX): this variable is dummy variable, 1 for male and 0 for female. Male has more exposure than female to participate in any social interaction outside home. But females are passing most of their time in home routine activities. Therefore, male headed household has higher probability to generate revenue from agricultural and non-farm activities.

Age of Household (AGE): it is a continuous variable and measured by number of years. The literature states the issue of age differently. Some scholars argue that age helps people to accumulate more experiences to act perfectly and analyze better. Others argue that more aged people may be change resistant and may retreat from participating in such settlement program due to social and historical reasons as well as fear of expected risks and failures. Given these two contradictory ideas, since the program is not totally displacing households from their original places and resources and even provide additional services, age may have positive effect on the

household outcome variables. On the other hand, it can have negative effect as well, because some older people don't want to leave their original places due to socio-cultural factors.

Dependency Ratio (DR): is a continuous variable which includes the sum of household members below 15 and above 64 divided by total family members. This variable affects household income negatively if its ratio is high.

Size of Household (SIZ): is a continuous variable describing the size of family members living or supported by the household, measured in adult equivalent. The size of family could have both positive and negative (Malthus hypothesis) effect on income distribution among the household. A family with large numbers is assumed to have more income relative to few families when every member is active labor.

Education Level of the Household Head (EDU): education increases people's knowledge and skills which help them to do things in multiple ways. Literate farmers are expected to do agricultural activities; adopt new technologies, follow scientific farming practices, and searching relevant timely agriculture information especially about marketing of products. Therefore, literate farmers generate more income than illiterate ones. Education affects the likelihood of villagization program participation positively. They can earn more income due to settlement. this sentence is vague

Size of Land holdings of the HH (LAH): availability of land resource is mandatory for crop production. The farmers with fertile large land size are more advantageous in producing more production. Farmers who have enough plots of cultivated irrigation land can intensify and diversify crops which increase their production.

Non-farm Income (NFI): Non-farm income is income earned from any source other than agriculture. It may be petty trade, support or something else. When the program provides improved access to social services, the households would generate more income with low cost. not clear. Therefore, it will have a positive effect on households' wealth.

Livestock Ownership (LTO): in Ethiopia livestock are useful in implementing agricultural activities. Livestock can be source of pulling power, source of income, source of supplementary food, and as a means of security and means of coping during crop failure and other calamities (Haile et al 2005). A hosehold which has many livestock can immediately invest in agriculture inputs and produce more than others. Also it is assumed that access to facilities would provide improved conditions for livestock holdings. The variable is continuous measured in Tropical Livestock Unit (TLU) and positive sign is expected in outcome.

Access to Basic services (ACS): refers to the provision of social services which are decisive factors for effective economic activities to enhance productivity and production of individuals and the region. It will have multiple effects on the commune, ranging from social to economic and environmental. These may include school, health centers, water, electricity, market, etc. Access to such services often improves market access thereby increasing production, and consumption with lesser transaction cost, thus would lead to improved social welfare than otherwise. These services will take 1 if available and 0 if otherwise; finally their weighted mean will be considered.

Access to Mass Media (ACM): Not clear. Radio/TV ownership is useful to capture update information about market, new methods and technologies. It is also useful to get information on price, major types of crops and the current government priority areas. It is hypothesized that access to mass media has positive relationship with program participation.

4. Results and Discussion

In this section, both descriptive and econometric results are presented and discussed. Econometric analysis was conducted in order to analyze if there are significant changes in the livelihood (access to services, income, consumption, etc) between participants and non-participants and to identify the factors that affecting participation.

4.1. Descriptive Results

Descriptive results of continuous variables for program participants, non-participants households and mean difference test were presented in a table below. Results of the descriptive statistics show that there is no significant difference between participants and non-participants in terms of income from livestock products, and income from livestock and non-farm income but there is a sharp difference in total income between participants and non-participants in terms of total income. Participants on average exceeded non-participants with about 2,100.00 birr on average and this was statistically significant.

The mean age difference between participants and non-participant households was 40.633. As the data obtained from the survey result indicated the mean age of program participant households was 44.21 and non-participant households was 37.05. The result indicates households with higher mean age not clear than the nonparticipant households in the program. This indicates there is a significant difference in the mean age between the two groups at 1% significant level.

Table 1: Summary Descriptive Statistics for Continuous Variables

Variable	Participants		Non-participants		Mean Difference	t-value
	Mean	SD	Mean	SD		
Age	44.21667	10.89382	37.05	12.40889	40.63333	**4.7544*** **
Family size	6.633333	3.449353	4.341667	2.277016	2.291667	**6.0738*** **
Land size	2.053417	1.600441	1.194	.6168644	0.8594167	**5.4888*** **
Income from crops	1172.995	2104.611	1553.846	2015.602	619.1486	**1.8628***
Non-farm income	1000.526	1589.054	1813.957	2252.573	813.4308	1.4747
Income from livestock products	993.443	5336.429	780.5	723.8956	1212.943	0.6385
Income from livestock	18765.29	9780.28	17921.923	14231.96	844.37	1.0850
Total Income	24684.85	7952.94	22,584.918	6095.429	2100.93	**2.6862*** **

Source: Field Survey Result, 2015

Regarding the family size, land size, income from crops and total income from the results of the study indicated that the mean family size was 6.63, land size was 2.053417, mean income from crops were 2172.995 and 24684.85the comparison is not clear. Regarding land holding on average total land holding of households is 2.0534ha for program participants and 1.194 ha for non-participants households with the mean difference of 0.8594167ha at 1% significant level. The annual mean total income for participants' households is 24,684.85birr which is

3042.918birr for non-participants having the annual total income of mean difference of 21641.93birr and significant at 1% level.

4.2. Regression Results

This section discusses the econometric result of the model used to analyze the impact of the program on socioeconomic and livelihoods in the study area. To measure the average treatment effect on the treated (ATT) for intended outcome variables, a Logit model was estimated in order to get the propensity scores. This was followed by estimation of propensity scores; the matching methods, the common support region, the balancing test and sensitivity analysis were discussed. Also matching between participants and non-participants was done to find out the impact of the program on the mean values of the outcome variables or average treatment effect on the treated are illustrated to calculate and identify the impact of the program.

4.2.1 Estimated Propensity Scores

Key identification tests were made to see the robustness of the model and the results thereof for coefficients. This was made on a pre-defined model for program participation using a logistic regression model. The model to be tested was: ***Logit (participation): f (hh sex, hh age, hh marital status, hh education level, hh occupation, hh*** *religion****, family size, land possession, land size, livestock rearing, access to road, perception impact of the program, Benefit of private investment, source of food required)***

These tests include variance inflation factor (VIF) tests for variable identification, Jerquer-bera test for normality, hetroscedastity test for constant variance, and link test for model specification tests. These tests were carried out and the model was well identified. The results indicate that the model is fit and robust for statistical regressions.

Factors affecting probability of program participation is predicted by binary logistic regression model. Propensity score was also estimated by logistic regression based on the assumption of conditional independence, where matching algorithms were used to match the treatment and control groups. The Chi- square result, 184.64(0.0000) showed that the parameters are different from zero at p- value of less than 1% significance level. Among the independent variables, marital status, household head education, household head occupation, household head religion, family size, land possession, livestock rearing, access to road, private investment and source of food required are significant at 1%, 5% and 10% significance levels. The result (see Table 2) indicated that married households showed negative tendency to participate in the program as opposed to unmarried individuals.

This is expected because married couples seem relatively settled and tend less to resettle. Likewise, better educated, and households with jobs tend less to participate in villagization program in Gambella. Households with larger family size tend more to participate in the program as this could arise from higher demand for more farmland owing to family consumption needs. Households with more access to road and livestock rearing tend less to participate in the program as expected. It is surprising to see why households which possess land tend more to participate in the program. It was observed that households which have ever benefited from private investment in their localities tend less to participate as they may think that their benefits could be eroded by such actions. The binary Logit regression is presented in the Table above, which shows the determinants of program participation.

Table 2: Logistic Regression Results for Participation

Participation	Coefficient	Std. Err.	Z	P>|z|
HH sex	.084414	.5346703	-0.16	0.875
Age	-.042704	.0225684	-1.89	0.058
Marital status	**-.6514414**	.2562113	-2.54	**0.011**
HH education	**-.8116421**	.1579318	-5.14	**0.000**
HH Occupation	**-.6230773**	.2583292	-1.96	**0.050**
HH religion	**.4729497**	.2259075	2.09	**0.036**
Family size	**.350413**	.0966867	3.62	**0.000**
Land possession	**3.990491****	.8336451	4.79	**0.000**
Land size	.332055	.1912117	1.74	0.082
Livestock rearing	**-1.06069***	.4552672	-2.33	**0.020**
Access to road	**-1.432361****	.4657373	-3.08	**0.002**
Program impact perception	-.5408848	.3191594	-1.69	0.090
Private investors benefit	**-3.354419***	1.691871	-1.98	**0.047**
Source of food required	**.4483043****	.1580533	2.84	**0.005**
Cons	**8.100607****	3.968351	2.04	**0.041**

Source: Own Survey Data, 2015
***, ** & * -significance at 1%, 5% & 10% respectively

Figure 1 portrays the distribution of households with respect to the estimated propensity scores before matching. The histogram shows that most of the treatment and comparison households were found in the middle.

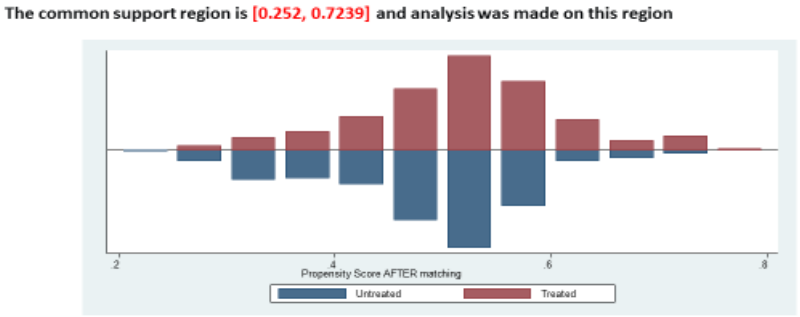

Figure 1: Common Support Region
Source: Adapted from Survey Data, 2015

The graph also indicates that there is a wide area in which the propensity score of both the treatment and the comparison groups have similar and enough overlapping areas. Thus, it fulfils the assumption that the common support condition (CSC) that claims for each value of covariate, there is a positive probability of being both treated and untreated. Rosenbaum and Ruben (1983) referred to this as the overlap condition that is ensuring that there is sufficient overlap in the characteristics of the treated and untreated members to find adequate matches.

As stated before there are four important tasks that must be pursued before embarking on the matching work. First, estimating the predicted values of program participation (propensity scores) should be estimated for all households in the treatment and outside the treatment group as conducted in the previous section. Second, a common support condition should be imposed on the propensity score distributions of household with and without the program. Third, observations whose predicted propensity scores fall outside the range of the common support region must be discarded. Finally, sensitivity analysis should be done in order to check the robustness of the estimation, whether the hidden bias affects the estimated average treatment on treated or not.

4.2.1. Choice of Matching Algorithm

Dehejia and Wahba (2002) suggested that the decision to choose best matching estimator in PSM technique is decided based on three criteria, insignificant mean difference after matching all covariates, smallest pseudo-R and large number of matched sample size. Thus, using the Stata command "pstest" balancing was conducted using the three commonly used estimators: neighbour, kernel and radius and the result revealed insignificant mean difference for all covariates and same pseudo-R value (0.005) after matching. Accordingly, both Kernel and Radius calliper algorithms matched about 208 (98 VS 110) observations, (larger than the NN which matched only 180 (92 Vs 88) observations) and hence are chosen for further analysis. Therefore, based on the result of matching quality and higher sample size both kernel and radius were used to assess the ATT of villagization on the outcome indicators.

4.2.2. Impact of Villagization on Household Income

Average treatment of treated (ATT) of villagization was done based on selected two matching algorithms (radius caliper and kernel band width matching). The comparison and analysis of treated and untreated groups were done in the range of common support and caliper using the ***Psmatch2*** command.

Table 3: Impact of Villagization on Household Income

Outcome	Estimator	Participants	Non-participants	ATT (birr)	t-value
Total Income (Birr)	Kernel	98	110	12,150	1.98*
	Radius	98	110	11,600	1.92*
	Mean of mean	**-**	**-**	**11,875**	

***Source*:** Computed from Survey Data, 2015 *statistically significant at 10%

The above Table summarizes the average treatment effect (ATT) of villagization on household income in Ethiopian birr by different matching methods. The intervention of villagization leads to an increase in income of household by about 12,150 using kernel approach, and it leads to an increase in income of about 11,600 birr using the Radius method. Moreover, the program participants gain an average income of about 11,875 birr more compared to non-participants. This difference accounts that villagization program participants earn about what ? more income compared to non-participants. Thus, it is evidenced here that intervention in terms of villagization increases household incomes in Gambella, justifying government efforts. In

general, all the matching methods show commune participation creates the opportunity to produce more than once per year and creates diversification to marketable crops, leading to more source of income.

4.2.3. Impact of Villagization on Household Consumption

Consumption is another impact indicator used to evaluate the average treatment effect of the program participant. For this particular study, the impact of Villagization on consumption expenditure was evaluated using a self-reported daily expenditure per adult equivalent and then converted to annual values. Accordingly, the results revealed that on average, program participants have higher aggregate expenditure, as estimated using kernel and radius matching. But, the difference was statistically not significant between the treatment and control group with bootstrapped standard error. Despite this, the total expenditure per adult equivalent of the participant households was positive and higher than that of non-participants.

Table 4: Impact of Villagization on Household Consumption

Outcome	Estimator	Participants	Non-participants	ATT (birr)	t-value
Total Consumption (birr)	Kernel	98	110	450	0.95
	Radius	98	110	860	0.96

Source: Computed from Survey Data, 2015

Table 4 shows that self-reported total expenditure for commune program participants is higher by about 450 birr using Kernel approach while it was about 860 birr using Radius Caliper method.

4.2.4. Impact of Villagization on Service Accessibility

The estimation result presented in Table 5 provides evidence for the impact of commune program in improving access to services. As presented in the Table, the participants have about 32% higher chance using Kernel method and about 46% higher chance using Radius method in accessing to the service.

Table 5: Impact of Villagization on Household Consumption

Outcome	Estimator	Participants	Non-participants	ATT (birr)	t-value
Service Access Score	Kernel	98	110	0.32	2.4**
	Radius	98	110	0.46	1.96*

Source: Computed from Survey Data, 2015
** Significant at 5% level *significant at 10% level

4.2.5. Sensitivity Analysis

According to Rosenbaum (2002), the goal of sensitivity analysis is to provide a sense of how large an effect (an) omitted variable(s) would have in order to invalidate a finding. That is, sensitivity analysis provides a quantitative statement that in order to explain away a particular

association; one would need a hidden or unobserved bias of a certain size. Since it is not possible to estimate the magnitude of selection bias with non-experimental data, we address this problem with the bounding approach proposed by Rosenbaum and Rubin (1985). Accordingly, sensitivity analysis was implemented using r-bound procedure and the result is shown in the Table below. When we see the Rosenbaum bound sensitivity analysis results, by kernel band width (0.25) matching algorithm estimator r-bound showed that the impacts of commune program on income of households is not sensitive to some extent. Even when we differentiate participants and non-participants by 10–30% in terms of unobserved variables the result does not change significantly. This is true even when we use the Kernel band width (0.1).

This analysis provides evidence that the impact evaluation assessments that we carried out is robust to changes in variables and estimation bounds implying its less sensitivity and hence consolidating on the findings of the study.

5. Conclusions and Recommendations

5.1 Conclusions

Ethiopia is currently dubbed among the very few rapidly growing non-oil economies in Sub-Saharan Africa. Villagization program has been implemented in Ethiopia following the 1984-1985 famine as food security strategy although it failed later. Even after 1990s, the current government has launched commune programs with new modality especially in four emerging regions: Gambella, Afar, Somali, Benishangul Gumuz. The purpose was to gather the isolated rural people from unproductive and harsh areas to productive and favorable sites so as to provide improved social services, economic opportunities, and ultimately enhance development. But, some studies & reports showed mixed results about the contribution of the program. Particularly, in Gambella, the program was strongly criticized by international media and institutions (human rights watch) saying that Ethiopian government is displacing the rural poor from their land to shift the lands to private investors. Thus, this study assessed the socioeconomic impact of villagization program in Gambella region for the period between 2010 & 2015 by using propensity score matching econometrics method.

Indeed, comprehensive analysis was done from qualitative (KII& FGD) and quantitative data with the help of 240 sample respondents (120 treatment & 120 control groups). The three key outcome variables were estimated: access to services, income, and consumption level of households. Generally, the inferential statistical results found positive and significant impact of the program on access to service and income in the region. However, the consumption level of households is not statistically significant between the participants and non-participants. The result is mixed for some explanatory variables.

Villagization program provides basic social services to the villagized community; where improved health, education, extension services, clean water, grinding mail and others enhanced the living condition of participants. It also facilitates awareness creation on the people about the method of production and input utilization, diversifying transactions and income towards transforming individuals, the region and the country.

The descriptive results showed that program participants have gained fairly equal land holding, and more input utilization skills, have access to market, access to extension services, and better crop diversification practice. The mean income of the program participants exceeds that of non-participants in the post intervention period, but during pre-intervention period, the

mean income of non-participants exceeds that of participants. The result revealed that program participants have better exposure to services as compared to non-participants.
In addition, the study showed that there is no shortage of land in the region either for cultivation or investment purpose. The question of land graving posed by some Media and reports were more of political issues than that of economic. However, planning and implementation gap as well as lack of ownership and political commitment put strong challenge on the success of the program as expected. something is missing here

According to the result of propensity score matching technique, villagization has positive impacts on the income of participants, access to services and enhancing consumption. This was significant for income and access to service outcome variables. As revealed by average treatment effect of treated (ATT) estimation, the mean difference of income of participants and non-participants vary by about birr 12,000 birr, which is indeed a significant figure, and justifies the program intervention. Participants have also enjoyed a higher probability (at least 32%) higher chance of accessing infrastructure and services, compared to non-participants. Further, almost all newly villagized households got 3 ha of land for different farm activities other than the land given to homestead. This conforms to the results obtained from the key informant interviews and focus group discussions.

5.2 Recommendations

Villagization has the power to reduce poverty through increasing households' access to services, income and consumption in Gambella. To reinforce the agricultural production through irrigation technology to produce surplus and commercial oriented products which may enhance country's GTP the program needs to be strengthened further. Strong public relation works should be done to lift up public trust by disclosing the importance of the program to the community.
The descriptive analysis made it clear that access to electricity has been a challenge for program participants. This would adversely affect the participants in terms of processing their agricultural produce to add value and gain better from enhanced productivity. Much more effort therefore needs to be exerted to provide electricity to these communes.

Market plays a key role in absorbing the excess products of farmers for their return at reasonable price. In this case, strong market encourages program participants to produce and supply more. Farmers who enjoy enough market for their products become visionary to produce market oriented out puts. The consequence of villagization accompanied by fair market price may change the life of a household by increasing their income. The dominant crops cultivated in the area are maize, which needs post-harvest management. Since the area is very hot, the cereal can easily be damaged and may easily be exposed to rodents and pests. Thus, the crops need immediate market and careful post-harvest management.

Besides crop production, livestock rearing is observed to be the major means of livelihood in the study area than any other occupation. So, providing trainings on controlled livestock feeding management would help boost productivity in livestock production. The evidence shows that villagization has a positive and strong impact on the society. We strongly recommend that this has to be told to the public through awareness creation. Media need to play its role in advocating the importance of such a program in enhancing service provision, enhanced capability and ultimately improved productivity of program participants. This could attract other non-participants to the program with the ultimate impact of reducing poverty in the region.

However, critical quality problem was observed under infrastructure and other facilities like grinding mill in the new communes. Thus, corrective measures need to be taken during the

purchase of raw materials and equipment and during construction as it diverts huge scare public resources from other sectors. Extension services are among new channels to transfer technology to the community. Development agents have to be more equipped with knowledge, skill and material facilities (transportation, housing, networks, and the likes) to enable the rural households more productive.

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