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Impact of Productive Safety Net Program on Households' Food Security: The Case of Zuway Dugda District Oromia National Regional State

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Abstract
Food insecurity is a major problem in developing countries and undermines people in various regions of the world. Productive Safety Net program is one of the largest social protection programs operating in Ethiopia. This study evaluates the impact of productive safety net program on households' food security and asset building in Zuway Dugda District. The study employed random sampling to draw 2 rural kebles that are participating in the programme. Data was collected from 180 sampled households. The sample respondents were drawn from both program beneficiary and non-beneficiary households (90 each) randomly. The required data was generated from both primary and secondary sources. Primary data was collected from household heads through structured interview schedule that was administered by trained enumerators. Pre-tested and validated questionnaire was also used. Pilot testing was conducted with 30 non-sample respondents assumed to have homogeneous characteristics. The study employed Descriptive statistics and econometric model to analysis data. Results from Descriptive statistics indicate that program beneficiary households' asset and calorie intake have increased. Applying a propensity score matching technique to estimate the econometric result; the study examined the independent effect of 12 variables and it was found out that 7 of them were important to characterize the participation. The study found that the program beneficiaries have more or less the same calorie intake to non-beneficiaries group. Concerning household asset the program beneficiary and non-beneficiary households have statistically significant difference after matching. The impact of the program on calorie intake and household asset on participating households create a great change regarding to food security. The program has promising impact on participants' livelihood. It seems that the program establishes better future for participants and alleviates poverty. Hence, this has an encouraging message for program designers, implementers, and funding agents to take proper action to achieve the intended goals.
Keywords: Productive Safety Net Program, Propensity Score Matching (PSM), Household Asset

1. INTRODUCTION

1.1. Background of the Study

Ethiopia has faced challenges in food insecurity, as one of the defining features of rural poverty, particularly in drought-prone areas. The root causes of poverty and chronic food insecurity in rural areas are complex and various. These include factors such as rapid population growth, declining land size per households, land degradation, deforestation, low productive but risk averse traditional technologies, insufficient resources to invest in new technologies, poor access to Off-farm Income Generating Activities (OIGA's), limited access to services, lack of employment opportunities, low input subsistence agricultural practices, recurrent drought and rainfall dependent agriculture. As a result more than 38% of rural households fall below the food poverty line and 47% of children under five suffer from stunting (MOARD, 2009).

Food insecurity is the most important human deprivation in the country and is related to lack of access to adequate food that manifests itself in its extreme form as hunger and famine. In Ethiopia food insecurity affects particularly people in moisture deficit highland and in the lowland pastoral areas. Even in years of adequate rainfall and good harvest, the people, particularly in low land agro-pastoral areas, remain in need of food assistance. This clearly reflects the deeply entrenched poverty and food insecurity situation in the country irrespective of adequate rainfall (Workneh, 2004).

Government and its partners have mobilized enormous resources and implemented various programme related to food security throughout the country to help the nation break-out of the widespread suffering caused by food insecurity. Productive Safety Net Program (PSNP) is one of the huge program. The PSNP provides transfers to food insecure populations in a way which prevents asset depletion at the household level, creates assets at the community level and stimulates markets. The overall objective of the program, to ensure that food security status for male and female members of chronically food insecure (CFI) households in CFI woredas enhanced. However, the achievements gained in terms of graduation of the households from chronic food insecurity have been limited due to several problems. Government of Ethiopia and donors recognized that these interventions have not produced the expected changes. As a result, they decided to initiate a review of the food security program (FSP) implemented between 2005 and 2009, in order to design the new Food Security Program for five years 2010-2014 (MoARD, 2010).

The purpose of the programme is to improve the efficiency and productivity of transfers to food insecure households, thereby reducing household vulnerability, improving resilience and promoting sustainable community development. This relates directly to the Government of Ethiopia's (GoE's) goal of reducing vulnerability and attaining food security through replacing emergency responses to chronic food insecurity with a multi-annual, predictable resource framework to protect households from shedding assets and eroding their chance of escaping poverty in the longer-term. As designed, the programme will address not only immediate food insecurity, but also contribute to addressing the underlying causes of food insecurity. Through the provision of cash transfers rather than food, it is intended that the programme will provide smallholders with greater flexibility over consumption decisions and stimulate the development of rural markets (Slater *et al*., 2006).

Despite some positive impacts of the program discussed above, past impact evaluation studies on PSNP did not provided workable and sound conclusion at the grass root level. Therefore, to reach on a workable and sound policy conclusion at local, zonal, regional and national level targeted intervention measures needs impact evaluation study at the grass root level. The output of this study expected to bridge the information gap that is crucial to improve households' food insecurity. This research was focused on assessing the impact of productive safety net programme in addressing household food security in Zuway Dugda district of Arsi zone Oromiya National Regional State.

1.2. Objective of the Study

1. To examine the household food security status in study area.
2. To assess the impact of productive safety net program on households food security

3. RESEARCH METHODOLOGY

3.1. Sampling Method and Sample Size Determination

The District was purposively selected then three stage sampling procedure was applied to select the required number of sample units. First, the district was purposively selected as it represents the productive safety net woredas and due to its accessibility. From this woreda, three kebeles were chosen randomly from the total number of PSNP kebeles. Finally the respondents were selected from beneficiaries and non-beneficiaries groups with equal proportion. The total sample size of the respondents was 180 households. From this 90 respondents were beneficiaries and other 90 were non beneficiaries groups were drown with probability proportion to size from the three kebele administrations

As far as beneficiaries group is concerned, the program beneficiaries are classified into two; namely, public work (for able body) and direct support (disabled body). The study focused on public work based safety net beneficiaries; because the program impact in terms of asset protection is expected for achieving the intended goal based on this group.

3.2. Data Types, Sources and Method of Data Collection

The study made use of qualitative and quantitative data from primary and secondary sources. For primary sources; data on the household's food insecurity and food security programme which was productive safety programme was collected from household heads and individuals in selected areas through structured interview schedule that was administered by trained enumerators. Pre-tested and validated questionnaire was also used. Pilot testing was conducted with 30 non-sample respondents assumed to have homogeneous characteristics. In order to generate adequate data and examine the socio-cultural practices/attitudes, the study was supported by the qualitative data that obtained from Key informants interview and focus group discussion.

The study used various secondary sources to augment the findings from the primary data. These include Federal, Regional level, review of related literature and district level information on food security situation of the study area.

3.3. Methods of Data Analysis

3.3.1. Descriptive analysis

Descriptive and inferential statistics such as percentages, ratios, mean values, frequencies, chi-square analysis, and t-test was used for comparison of factors between beneficiary and non-beneficiary households in the study area based on the socio-economic, institutional and demographic situations. Similar method was also employed to assess the impact of programme on household food security and asset building.

3.3.2. Propensity score matching (PSM) method

This study applies a propensity score matching technique, which is a widely applied impact evaluation instrument in the absence of baseline survey data for impact evaluation. The technique attracted attention of social program evaluators. The PSM technique enables us to extract from the sample of non-participating households a set of matching households that look like the participating households in all relevant pre-intervention characteristics. In other words, PSM matches each participant household with a non-participant

household that is (almost) the same likelihood of participating into the program.

This study attempts to estimate the average impact of treatment on treated (ATT). In this case "treatment" implies participation in the program, which is a Productive safety net Program, and "impact" is meant for the change of food security. On the other hand, "control" stands for non-participant/non-treated households used for comparison. According to Caliendo and Kopeinig (2005), there are steps in implementing PSM. These are estimation of the propensity scores, choosing a matching algorism, checking on common support condition and testing the matching quality.

3.4. Definition of Variables and Hypothesis

A combination of socioeconomic, demographic, institutional and location factors were used to explain household participation in the integrated food security program as well as the resulting wellbeing outcomes in terms of food security.

The dependent variable of the model: the dependent variable is participation in PSNP; it is discrete variable with a value of 1 for beneficiary and 0 for non-beneficiary.

Outcomes Variables: the variable which shows the program impacts. These are food security and total household asset as defined below.

Food security: according to UN (1990) household food security defined as "The ability of household members to assure themselves sustained access to sufficient quantity and quality of food to live active and healthy life."It was the impact of the PSNP on household food security which was measured by using seven days recall method. It was continuous variable.

Total household asset (HHA): It was the variable representing the household asset as the main indicator of the program impact, which shows what extent to which the household asset level change in birr. Household assets which are measured in birr such as farm tools, household durables goods, house constructed for rent serve as source of saving and as a hedge against food insecurity in most rural farm households of the survey area. Households with high asset value are less food insecure than those who do not. Hence, as the total asset of a household increases the likelihood of participating in the program decreases.

The independent variables of the model: The independent variables which are expected to have association with participation in the program are presented below:

Family Size (HHFS): This variable refers to the size of household member. The existence of large number of family members which was measured in terms of adult equivalent (AE) was hypothesized to have positive impact on household participation in programme.

Sex of Household Head (HHS): Male-headed households are in a better position to pull labour force than the female headed ones. Due to lack of labor for female headed household, they are forced to rent their land for share cropping. Moreover, with regard to farming experience males are better than the female farmers. Therefore, the female-headed household is hypothesized to have positive impact on household participation in programme.

Size of Cultivated land (HHCLND): This variable represents the total cultivable land size of the house hold which is measured in hectare. As the cultivated land size increases, provided that other production factor remains constant, the livelihood that the holder gets more output. Therefore, it is hypothesized as; having large cultivable land have negative impact on household participation in programme.

Livestock Holding (HHTLU): It refers to total livestock holding of the farmer measured in terms of tropical livestock unit (TLU). Theoretically, livestock can support households in two ways. First, livestock is used as a source of cash to purchase inputs such as fertilizer. Second, they provide farmyard manure and compost for fertilizer. In this regard, livestock ownership has positive impact on fertilizer use and manure application (Croppendstedt *et al*., 2003; Fitsum, 2003; Pender and Berhanu, 2004; Chilot, 2007). Therefore, livestock production constitutes a very important component of agricultural economy, a contribution that goes beyond direct food production to include multipurpose use such as skins, fiber, fertilizer, and fuel, as well as capital accumulation. Possession of large livestock size was hypothesized to have negative impact to household participation in programme.

Number of Oxen owned (HHNOX): Oxen are the most important means of land cultivation and it is the basic farm asset. Household who own oxen have better chance to produce more. Oxen possession allows undertaking farm activities on time and when required. So, it is hypothesized to have negative impact on house hold participation in programme. The variable was measured in numbers.

Distance from market (HHDFM): It is the distance between the nearest market and village in which household resides. Proximity to market centers creates access to additional income by providing off-farm/non-farm employment opportunities, easy access to inputs and transportation. It was, therefore, hypothesized that households near to market center have better chance to improve food security status and asset than those who do not have a proximity to market centers. This in turn implies the likelihood of participating in the program was less as compared to the counterparts. As a result, it was hypothesized to have negative impact to house hold participation in programme. Proximity to market centers was measured in kilometer.

Off and Non-farm activities (HHONA): This refers to activities undertaken away from the household's own farm, and some authors (Ann and Craig, 2001) use it to refer exclusively to agricultural laboring on someone else's land, so 'off-farm' used in this sense would not fall within the normal definition of 'non-farm'. Other authors (Barrett *et al*., 2001) stated off-farm activities as "activities that are taken place away from home .i.e. all activities away from one's own property, regardless of sector or functional classification; can be wage or self-employment. They also used to classify off-farm activities as formal and informal activities. The former stands for wage labor and the later stand for activities like hunting and gathering. Nonfarm activities refer to those activities that are not primary agriculture or forestry or fisheries. However, non-farm does include trade or processing of agricultural products (even if, in the case of micro-processing activities, they take place on the farm). Barrett and Reardon (2001) stress that this definition is sectoral, i.e. it follows the convention used in national accounting systems where a distinction is made between primary production, secondary (manufacturing) activities, and tertiary (service) activities). It does not matter where the activity takes place, at what scale, or with what technology. Thus, the overall income generating activities (on/off/non-farm) which takes the value of 1 if households have participation in Off and Non-farm activity and 0 otherwise. It was hypothesized to have negative effect house hold participation in programme.

Access to Credit Service (HHCRDS): This refers to access of households to different sources of finances. It is dummy variable that takes a value of 1 if a household has an access to credit services and 0 otherwise. It helps to solve liquidity constraints of the household to purchase fertilizer and has a positive effect (Croppenstedt *et al.,* 2003; Pender and Berhanu, 2004; Chilot, 2007; Maiangwa *et al*. 2007). Therefore, this study hypothesizes positive association between access to credit and program participation.

Education status of household head (HHEDS): Education equips individuals with the necessary knowledge of how to make living. It is a continuous variable measured in maximum grade attended. Empirical Studies show the presence of positive relationship between chemical fertilizer use (Dereje *et al*., 2001; Chilot, 2007; Maiangwa *et al*., 2007) and manure use (Dereje *et al*., 2001). Therefore, education of the household head is hypothesized to have negative relation with participation in the program

Extension Contact (HHEC): It is continuous variable measured in number of days visited extension agent per year. Visit of development agent (access to extension services) has a positive influence on different farm activities because farmers who have access to extension services get training that enhance their knowledge. Studies show that access to extension services has a positive effect on fertilizer use (Chilot, 2007; Maiangwa *et al*., 2007). Moreover, technological advances attained through agricultural research and developments have made substantial contributions to the spectacular increase of food production. Farm households who use advisory services provided by development practitioners are more likely to adopt better technologies and improve production. Therefore, it was hypothesized that the frequently in which household head contact and get extension services or advisory services was negatively related with household participation in program.

Access to Irrigation (HHIA): In agriculture, water is the prime source of livelihood of the people. Where a climatic condition is conductive, irrigation could be used to increase output. Hence, it was hypothesized that access to irrigation has negative correlation with household participation in programme. The variable took a value of 1 if the household had access to irrigation activities, 0 otherwise.

Age of Household (HHAGE): rural households mostly base their livelihoods on agriculture. The older the household head, the more experience he/she had in farming and weather forecasting. Moreover, older person are more risk averters and mostly they identify and diversify their production activities. Hence, the likelihood of being program participant would decrease with the age increase. It is continuous variable which is measured in terms of years of age.

Table1. Variable definitions and measurement

Variable	Type and definition	Measurement
Dependent variables:		
Participation	dummy, participation in the PSNP	1 if yes, 0 otherwise
Outcomes variables:		
Food security status	continuous, calorie intake	Kilo Calorie
Household asset	continuous, asset level	asset in birr
Independent variables:		
Age of Household head	Continuous, age of household head	years
Education status	Continuous, education of household	Years of schooling
Household Size	Continuous, family size	number of household members
Cultivated land	Continuous, cultivate land size	Hectare
Number of livestock	Continuous, livestock holding	tropical livestock units
Credit service	Dummy, access to credit services	1 if yes, 0 otherwise
Extension contact	Continuous, frequency of contact	frequency of contact
Off/non-farm activities	Dummy, access off/non-farm activities	1 if yes, 0 otherwise
Distance from market	Continuous	In km
Irrigation	Dummy, access to irrigation utilization	1 if yes, 0 otherwise
Number of oxen	Continuous, number of oxen	In number

4. RESULTS AND DISCUSSION

4.1. Socio-demographic characteristics

Sex of the household head: Out of the 180 respondents, 71.1 percent are male-headed and 28.9 percent are female-headed households. About 24.4 and 75.6 percents from beneficiaries were female and male headed households respectively. About 33.3 and 66.7 percents of non-beneficiary households were female and male headed households respectively. However, the statistical test analysis shows that there is no statistically significant difference in the sex of the household head between beneficiary and non-beneficiary households (see Table 2).

Age of the household head: The mean age of the sampled household heads was 40.55 years with the maximum age of 67 and the minimum of 20 years. The mean age of beneficiary households was 39.88 years and that of non-beneficiary households was 41.21 years. As the t-test result reveals, there is no significant difference in age of the household head between beneficiary and non-beneficiary groups (see Table 3).

Family size: The result in Table 3 shows that the average family size of sample households was 4.36 with the maximum family size of 10 and the minimum of 1. The mean family size of beneficiary was 4.22 and that of non-beneficiary was 4.5. Even though, it seems that non beneficiaries' households have larger family size than beneficiaries' households, the t-test shows that there is no significant statistical difference in family size between two groups (see Table 3).

Educational Level: The survey result shows that, the mean educational level of sampled households was 5 with the maximum Educational Level of 12 and the minimum of 1. The t-test for the equality of mean of education level shows statistically significant mean difference between beneficiaries and non-beneficiaries at less ten percent probability level. The mean educational level is 4.62 and 5.38 for beneficiaries and the non-beneficiaries' households respectively (see Table 3).

Table 2. Description of sex of household head

Variable	**Category**	**Participant (N=90)**		**Non-participant (N=90)**		**Total (N=180)**		**χ2**
Sex	Female	22	24.4	30	33.3	52	28.9	0.188
	Male	68	75.6	60	66.7	128	71.1	

Source: Own calculation based on household response

Table 3. Mean of demographic characteristics of sample household head

Variables	Total sample Households N=180	PSNP households .N=90	Non PSNP households N=90	Mean difference	t-value
Age	40.55	39.88	41.21	1.32	0.9649
Family Size	4.4	4.22	4.5	.3	0.9272
Education	5	4.62	5.38	0.76	1.68*

Source: Own calculation based on household responses

*, significant at 10% probability level

4.1.1. Livelihood characteristics

Cultivated land: Crop production requires primarily the availability of suitable cultivable land. The mean land size of the beneficiary and non-beneficiary is 1.47 and 1.78 respectively in hectare. The mean comparison of the two groups in terms of mean cultivated land size reveals that there is significant difference between the groups at one percent probability level.

Distance from Market: Table 4 depicts the statistical results of the mean distance of the total respondent from market center which is 10.68km. The results show that the mean distance is 11.77 km and 5.88km for beneficiary and non-beneficiary households respectively. The comparison of the mean distance of the two groups seems that non beneficiary households are living nearer to the market center than beneficiary. However, the mean distance of the two groups is not statistically significant.

Extension Contact: According to results in Table 5, the mean extension contact of the surveyed households was 2.04. The results also show that the mean extension contact was 1.98 and 2.11 for beneficiary and non-beneficiary households respectively. The comparisons of the mean extension contact of the two groups may seem that non beneficiary households have more extension contact than beneficiary. However, the statistical test for the equality of the mean extension contact of the two groups shows no statistical significant difference.

Access to Irrigation: About 27 percent of the total sampled households have access to irrigation. With regard to access to irrigation within the groups, about 26.7 percent were from the beneficiaries whereas 28 percent were from non-beneficiaries households. The chi-square test shows no statistical significant difference between beneficiaries and non-beneficiaries' households in their access to Irrigation (see table 4).

Access to credit: In the study area, out of the total sampled respondents, 35 percent have access to credit. The result also shows that from the total beneficiary respondents26, 7 percent and from the non-beneficiary respondents, 43. 3 percent have access to credit service. The statistical test shows that there was statistically significant difference between beneficiary and non-beneficiary households in accessing credit service at less than five percent probability level. (See Table 5).

Access to off/non-farm Activity: In the study area, out of the total sampled respondents, 43.9 percent have access to off and nonfarm activities. The result also shows that from the total beneficiary respondents 43.3 percent and from non-beneficiary respondents 44.4 percent have access to off and nonfarm activities. The chi-square test shows no statistical significant difference between beneficiary and non-beneficiary household in their access to off/non-farm activities.

Table 4. Description of cultivated land and crop production

Variables	Total sample Households N=180	PSNP households N=90	Non PSNP households N=90	Mean difference	t-value
Cultivated Land	1.61	1.43	1.78	.35	5.47***
Distance to Market	10.68	11.77	5.88	-2.19	-3.44
Extension contact	2.01	1.98	2.11	0.13	1.16

Source: Own calculation based on household responses
*** Significant at 1% probability levels

Table 5. Description of access to irrigation, credit, and off and farm activities

Variable	Category	PSNP HH (N=90)		Non-PSNP HH (N=90)		Total (N=180)		$\chi 2$
		N	%	N	%	N	%	
Access to irrigation	Yes	24	26.7	25	28	49	27	0.03
	No	66	73.3	65	72	131	73	
Access to Credit	Yes	24	43.3	39	26.7	63	35	5.50**
	No	66	56.7	51	73.3	117	65	
Access to off and on-farm	Yes	39	43.3	40	44.4	79	43.9	2.69
	No	51	56.7	50	55.5	101	56.1	

Source: Own calculation based on household responses
**, significant at 5%, probability levels

4.1.2. Livestock holding, Oxen owned and household asset

Livestock holding: Livestock provide milk, meat, traction power, income and transport. Moreover, they are sold as one of the coping mechanisms during food shortage. The main Livestock owned by the sample households include cattle, sheep and goat, and poultry. The numbers of livestock owned by the beneficiary and non-beneficiary groups of households before and after the implementation of the program were converted into tropical livestock unit (TLU) see (Appendix 3). Average TLU of the beneficiary group was 2.14 TLU before the implementation of the program which was increased to 2.96 TLU after the implementation of the program.

Similarly, for the non-beneficiary group the average TLU of 3.86 before the program was increased to 4.52 TLU after the implementation of the program. This shows the increment of TLU for beneficiary households is greater than that of non-beneficiaries. Consequently, the difference between the two groups in terms of livestock holding decreased from 1.72 TLU to 1.56 TLU. It is possible to say that beneficiary group's had better rate of change in livestock's holding. The statistical test for the equality of the mean of TLU shows statistical significant difference between beneficiaries and non- beneficiaries' households at less than one percent probability level both before and after program intervention.

Oxen owned: Oxen provide traction power and income. Moreover, they are sold as one of the coping mechanisms during food shortage. Average number of oxen owned by the beneficiary households increased from 1.19 to 1.81. Similarly, average number of oxen owned by the non-beneficiary households increased from 1.01 to 1.59. This shows that an increment in number of oxen for beneficiary households was greater than that of non-beneficiaries. Consequently, the difference between the two groups in terms of number of oxen owned increased from 0.18 to 0.22. It is possible to say that beneficiary group's had better rate of change in oxen holding. The statistical test for the equality of the mean of number of oxen owned shows statistical significant difference between beneficiaries and non- beneficiaries' households at less than one percent probability level after program intervention.

Table 6. Mean of TLU, Oxen and household asset in 2005 and 2012

Variables	Total sample Households N=180	PSNP households N=90	Non PSNP households N=90	Mean difference	t-value
TLU Before	3.00	2.14	3.86	1.72	9.21***
TLU After	3.740	2.96	4.52	1.57	7.08***
Household asset Before	3015.14	1903.42	4126.87	2223.44	42.68***
Household asset After	3679.18	2712.07	4646.28	1934.2	30.56***
Oxen Before	1.1	1.19	1.01	-0.07	-1.31
Oxen After	1.7	1.81	1.59	.22	1.78*

Source: Own calculation based on household responses

*** And *, significant at 1% and 10% probability level respectively.

4.1.3. Household income, expenditure and calorie

Table 9 presents' descriptive statistics results of sample households based on their calorie intake, food consumption, expenditure and income. To examine the level of total household annual income between the two groups, households were asked about agricultural products and by products primarily produced for sale, as well as farm and non-farm wage labor. Total income is therefore the sum of all agriculture income and non-agriculture incomes. The mean income of the sampled respondents was 11,251.32 birr per household per year. Similarly the mean income of beneficiary and non-beneficiary households were birr 10,639.34 and 11,863.3 respectively. The statistical test of the mean difference in incomes of beneficiary and non-beneficiary groups shows statistical significant difference at less than five percent probability level.

The mean annual expenditure of the beneficiaries and the non-beneficiary households were birr 9,107.11 and 10,942.67 respectively. There was statistically significant difference between beneficiaries and non-beneficiary households at less than one percent probability level.

As the survey results in Table 7 shows, beneficiary and non-beneficiary households have an intake of 2,286.333 and 2,447.01 kilo calories respectively. This indicates that households in the non-beneficiary have better calorie intake than beneficiary households. The average kilo calorie intake of the households in general is 2,366.67. The comparison of calorie intake of the households in the district with the nation's minimum requirement (kilo calorie per AE per day is 2200 for the nation (MoFED, 2008)) shows the household calorie intake in the district is above the national level.

Although the mean kilo calorie intake of the beneficiary and non-beneficiary groups are above the minimum requirement of national level, there is significant number of households who are still food insecure and below the national food security line (2,200 kilo calories/AE/day). As far as calorie intake is concerned, there is statistically significant difference between the two groups at less than ten percent level of probability.

Table 7. Mean of household income, expenditure and calorie intake

Variables	Total HH N=180	PSNP HH N=90	Non PSNP HHN=90	Mean difference	t-value
HH income(birr)	1,1251.32	10,639.34	11,863.3	1,223.96	2.862**
HH expenditure(birr)	10,024.89	9,107.111	10,942.67	1,835.556	4.502***
K/calorie/AE/day	2,366.672	2,286.333	2,447.011	160.6778	2.0951*

Source: Own calculation based on household responses
***, ** and *, significant at 1%, 5% and 10% probability levels, respectively

Table 8. Logit results of household program participation

Variables	Coef.	Std. Err.	Z	P>z
Sex of household	.9281905	.5620146	1.65	0.990
Age of household	-.0116978	.0521407	-0.22	0.822
Education Level	-.059169	.0965836	-0.61	0.540
Family Size	.1668229	.2362122	0.71	0.480
Distance from market	-.1300329	.0555699	2.34**	0.019
Cultivated land	- 2.160599	.5901848	- 3.66***	0.000
TLU	-1.148127	.1921555	-5.97 ***	0.000
Oxen	-.6673744	.2889959	-2.31**	0.021
Access to Irrigation	-1.201784	.6178148	-1.95*	0.052
Extension Contact	-.579778	.3397334	-1.71*	0.088
Access to off-farm	-.0981776	.4554147	-0.22	0.829
Access to Credit	-1.46482	.4703401	-3.11**	0.002
_cons	-2.968315	1.800771	-1.65*	0.099
Number of obs	180		Pseudo R^2	0.4552
LR $chi^2(12)$	113.59		Log likelihood	-67.9727
Prob > chi^2	0.000			

Source: Own calculation based on household responses
***, ** and * significant at 1%, 5%and 10% probability levels, respectively

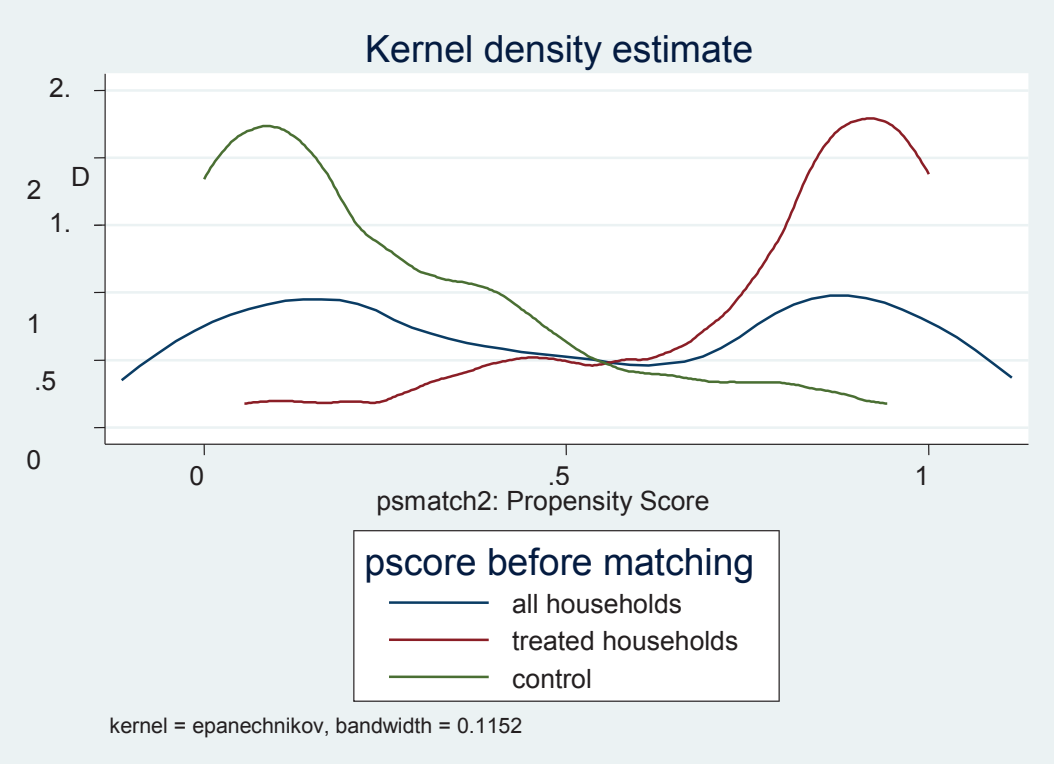

Figure 1 Kernel density of propensity score distribution

4.1.4. Matching program and non-program households

As shown in the table 9, the estimated propensity scores vary between 0.054 and 0.967 (mean = 0.996) for program or treatment households and between 0.003 and 0.967 (mean = 0.274) for non-program (control)

households. The common support region would then lie between 0.054 and 0.967. In other words, households whose estimated propensity scores were less than 0.054 and larger than 0.967 are not considered for the matching exercise. As a result of this restriction, 34 households (13 program and 21 control households) were discarded. This shows that the study does not have to drop many PSNP households from the sample in computing the impact estimator.

Table 9. Distribution of estimated propensity scores

Groups	Obs	Mean	Std. Dev.	Min	Max
Total household	180	0.500	0. 333	0.003	0.996
treatment household	90	0.726	0.241	0.054	0.996
control household	90	0.274	0.246	0.003	0.967

Source: Own calculation based on household responses

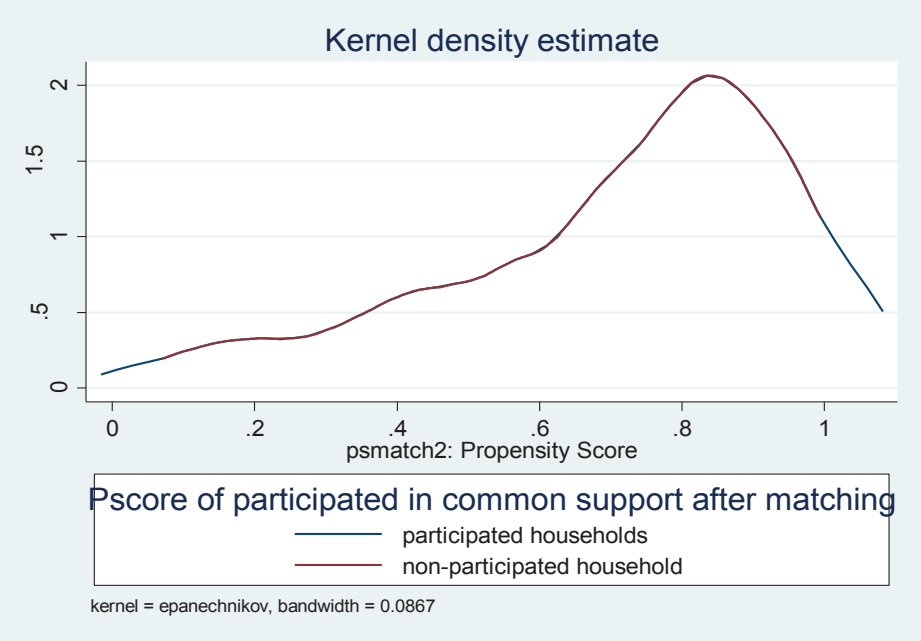

Figure 2. Kernel density of propensity scores of participant households

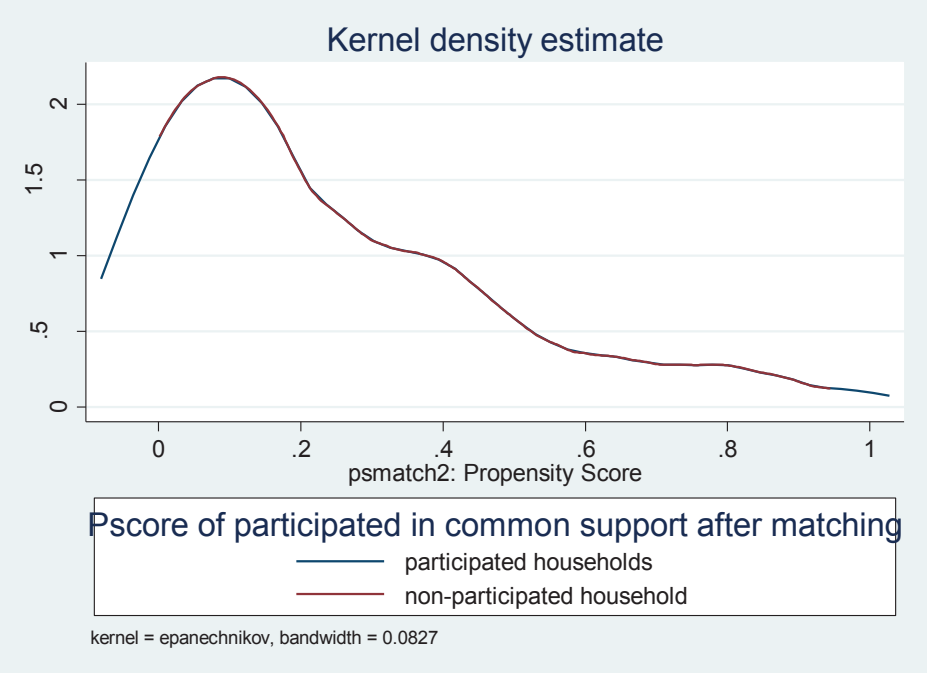

Figure 3. Kernel density of propensity scores of non-participant households

4.2. Choice of matching algorithm

Different alternative matching estimators were tried in matching the treatment and control households in the common support region. The final choice of a matching estimator was guided by different criteria such as equal means test referred to as the balancing test (Dehejia and Wahba, 2002), pseudo-R^2 and matched sample size. Specifically, a matching estimator which balances most explanatory variables (i.e., results in insignificant mean differences between the two groups), bears a low pseudo R^2 value and results in large matched sample size is preferable. Table 10 shows the estimated results of tests of matching quality based on the performance criteria mentioned above. After looking into the results, it was found that kernel (0. 5) was the best estimator for the data at hand. Therefore, the following estimation results and discussion are the direct outcomes of the kernel matching algorithm based on a band width of 0.5.

Table 10. Performance of matching estimators

Matching Estimator	Performance Criteria		
	Balancing test*	Pseudo-R2	Matched sample size
Nearest Neighbor			
1 neighbor	8	0.410	146
2 neighbor	6	0.411	146
3 neighbor	7	0.347	146
4 neighbor	6	0.342	146
Caliper			
0.01	10	0.164	72
0.1	8	0.410	146
0.25	8	0.410	146
0.5	8	0.410	146
Kernel Matching			
With no band width	7	0.316	144
Band width of 0.1	8	0.295	146
Band width of 0.25	9	0.215	146
Band width of 0.5	**12**	**0.059**	**146**

Source: own calculation result

* Number of explanatory variables with no statistically significant mean differences between the matched groups of program and non-program households.

Kernel matching associates the outcome of the treated household with the matched outcome that is given by a kernel-weighted average of all control groups for PSNP participated. Since the weighted averages of all non-participant households in the control group are used to construct the counterfactual outcome, kernel matching has an advantage of lower variance because more information is included in the analysis (Heckman *et al.,* 1998).

4.1.5. Testing the balance of propensity score and covariates

The mean standardized bias before and after matching are shown in the fifth columns of Table 11, while column six reports the total bias reduction obtained by the matching procedure. In the present matching models, the standardized difference in X before matching is in the range of 2.5 percent and 81.5 percent in absolute value. After matching, the remaining standardized difference of X for almost all covariates lies between 0.6 percent and 17.3 percent, which is much below the critical level of 20 percent suggested by Rosenbaum and Rubin (1985). In all cases, it is evident that sample differences in the unmatched data significantly exceed those in the samples of matched cases. Unmatched sample size was 180 households but after matching it reduced to 146 households. Thus 34 sample households were discarded from the sample (see Table 11). The process of matching thus creates a high degree of covariate balance between the treatment and control samples that are ready to use in the estimation procedure. Similarly, t-values in Table 11 show that before matching six of chosen variables exhibited statistically significant differences while after matching all of the covariates are balanced.

Table 11. Propensity score and covariate balance test

Variables	Sample	Mean		%reduction		t-test	
		Treated	Control	%bias	Bias	T	p>t
PSCORE	Unmatched	0.72632	0.27368	185.5		12.45	0.000
	Matched	0.68299	0.54421	56.9	69.3	-1.51	-1.51
Sex of household	Unmatched	0.66667	0. 75556	-19.6		-1.31	0.190
	Matched	0. 71429	0. 77408	-13.2	32.7	-0.11	0.913
Age of household	Unmatched	41.211	39.889	14.4		0.96	0.336
	Matched	40.909	41.429	-5.7	60.6	0.49	0.622
Education level	Unmatched	4.6222	5.3778	-25.1		-1.68	0.094
	Matched	4.7403	4.8469	-3.5	85.9	0.12	0.904
Family size	Unmatched	4.5	4.2333	13.8		0.93	0.355
	Matched	4.4545	4.4668	-0.6	95.4	0.55	0.580
Cultivated land	Unmatched	1.7889	1.6741	81.5		5.47	0.000
	Matched	1.7403	0.42435	1.6741	81.2	-0.82	0.411
TLU	Unmatched	4.5188	2.9623	-43.4		7.08	0.000
	Matched	4.4068	3.7976	-3.7	60.9	-1.20	0.230
Oxen	Unmatched	1.5889	1.8111	-26.5		-1.77	0.078
	Matched	1.6623	1.8078	-17.3	34.5	-0.05	0.959
Distance to market	Unmatched	9.5889	11.778	-51.3		-3.44	0.001
	Matched	10.065	9.4935	13.4	73.9	0.54	0.587
Access to irrigation	Unmatched	0.26667	0. 27778	-2.5		-0.17	0.868
	Matched	0. 2987	0. 29758	0.3	89.9	-0.49	0.624
Access to extension	Unmatched	1.9778	2.1111	-17.2		-1.15	0.250
	Matched	2.039	2.039	4.3	75.1	0.20	0.838
Access to off-farm	Unmatched	0. 44444	0.56667	-24.5		-1.64	0.102
	Matched	0. 49351	0.43753	11.2	54.2	0.58	0.563
Access to credit	Unmatched	0.56667	0.73333	-35.3		-2.37	0.019
	Matched	0.5974	0. 59316	0.9	97.5	0.34	0.738

Source: Own calculation based on household responses

Table 12. Chi-square test for the joint significance of variables

Sample	Pseudo R^2	LR chi^2	$p>chi^2$
Unmatched	0.394	98.29	0.000
Matched	0.059	11.99	0.528

Source: Own calculation based on household responses

All of the above tests suggest that the matching algorithm that has been chosen is relatively best with the data at hand. Thus, it is possible to precede estimation of ATT for households.

4.1.5.1. Impact estimation of PSNP on household food security and asset building

The estimation result presented in Table 13, provides supportive evidence that the program brings significant effect on food security. After controlling for pre-intervention differences in demographic and asset endowment characteristics of the beneficiary and non-beneficiary households, it has been found that, on average, the non-beneficiaries' food consumption has a bit increased. But the mean difference between beneficiary and non-beneficiary households' calorie intake is not statistically significant after matching. It is possible to say that even non beneficiaries were used better consumption, even though beneficiaries were fulfilled their basic needs. This narrow gap between two groups indicates the improvement of participant household livelihood and this improvement was an impact of the program. It covers the six month food gap and encourage they produce more through giving credit and other facilities.

As the estimation result presented in Table 13 shows, there is supportive evidence on the effect of the program on household asset protection and building. After controlling for pre-intervention differences, it has been found that, on average, the program beneficiaries have fewer assets than non-beneficiaries. However, the mean difference of asset between beneficiary and non-beneficiary households was statistically significant after matching.

Table 13. Average treatment effect on the treated (ATT) for food security in calorie intake and asset in birr

Variable	Sample	Treated	Controls	Difference	S.E.	T-value
KCALOR	ATT	2289.06494	2288.50612	0.558811628	103.203915	0.0054
HHASSET	ATT	4632.14286	2644.08402	1988.05883	84.0835237	23.64***

Source: Own calculation based on household responses

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

This research was carried out to examine the impact of PSNP on household food security and asset building. In order to gather available information for this study, both primary and secondary data collection methods were used. The primary data source was gathered from 180 households using structured questionnaires. The sample respondents were taken from both program beneficiaries and non-beneficiary households. It was also tried to examine different documents to support the primary sources.

As the result from descriptive analysis shows, majority of beneficiary households own less cultivated land compared to non-beneficiary households. The result shows that there was significant difference on possessing cultivated land. Similarly, most of beneficiary households do not have better access to irrigation. However, majority of beneficiary households have better access to credit compared to non-beneficiaries. On the other hand, the result indicated that relatively small number of respondents participates in off farm activities. Because of less access to irrigation and owning less cultivated land, they produced less crop yields than non-beneficiary group.

As far as livestock holding and asset creation is concerned, on average, there was a sign of increment in both sides. The average TLU owned by beneficiary households indicates that there was better increment on livestock holding compared to other. In addition, the beneficiary group shows promising improvement on asset creation. Thus, the difference they had before and in the program reduce livestock holding and asset creation. Even if there was an improvement on beneficiary households' livestock holding and asset creation, there was a significant difference on annual income, expenditure and calorie intake. Non beneficiary households had better annual income and expenditures. Although both beneficiary and non-beneficiary household's calorie intake was above the minimum requirement index at national level, non-beneficiary group had better calorie intake than beneficiaries.

The main research question of the study was "To what extent did the program improve beneficiary households' food security and could the beneficiaries become capable of building asset?" Answering these questions requires with-and-without comparison for program households and non-program households which might be biased. In addition, the data gathered from households by simply asking about changes the program brings in their life would be ambiguous or misleading. In order to avoid confounding data, the study applied a propensity score matching technique, which was capable of extracting comparable pair of treatment-comparison households in a nonrandom program setup and absence of baseline data.

Looking into the estimated coefficients, the result indicates that program participation was significantly influenced by seven explanatory variables. Cultivated land and TLU are found to have strong negative relationship to participation. Oxen, and distance from market center irrigation have also negative relationship. On the other hand, access to credit has positive relationship with household participation in the program. As the regression in logit model shows it was likely to say that majority of households who were involved in program possess small cultivated land, and less TLU. They also have less access to irrigation.

5.2. Conclusions

As propensity score matching estimation shows, it was possible to conclude that participation on the program was determined by seven major factors. Participants' who were involved in the program were likely to have small cultivated land, less access to irrigation and have less participation in off and non-farm activities. They have also possessed fewer livestock's.

The program also covers six months basic food needs gap and it enables them to keep and build their own assets. Concerning this, there was no significant difference between participants and non-participants. The program possibly created a way for participant to cope up with others. On the other hand, PSNP likely brings improvement in terms of calorie intake. As the result shows, on average, participants' calorie intake increases. It was above the minimum requirement of the national level and there was significant difference comparing to non-participants. The participant's better calorie intake and asset preservation manifests that the program acts to brought an impact on household food security.

5.3. Recommendations

Ministry of Agriculture should create options to ensure household food security, work on different household asset creation program and plan alternative food security programs in addition to the existing one to detach from this foreign dependency.

On a positive note, this study had found evidence that the PSNP in the study area has worked in PSNP beneficiaries and non-beneficiaries have more or less the same calorie intake and household asset. This has an encouraging message for program designers, implementers, and funding agents to take proper action to achieve the intended goals.

In order to bring significant economic change and thereby positively contribute to meet country's poverty reduction objective, financial institutions needs to scale up their outreach through delivering sufficient credit to farmers. As they were confirmed to have positive impact on households' income diversification, build assets, and reduce vulnerability to food insecurity. Oromiya credit and saving share company (OCSSCO) has to made available credit to farmers at grass root level with necessary follow up.

The Productive Safety Net Programme (PSNP) should expand the opportunity of off-farm and non-farm activities through investments that generate employment and increase the wages to attract rural households in order to diversify their income sources thereby reduce their vulnerability to food insecurity and asset depletion.

The district could maximize livelihood options by maximizing intervention packages. The findings indicate that irrigation access is an important factor of crop production and livelihood improvement. Concerned bodies should give attention for promoting access to irrigation.

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