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RESEARCH ARTICLE

IMPACTS OF PRODUCTIVE SAFETY NET PROGRAM ON HOUSEHOLD ASSET BUILDING, FOOD SECURITY AND ANNUAL INCOME IN SIDAMA ZONE, SOUTHERN ETHIOPIA

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ABSTRACT

This study was conducted with the aim of identifying the impacts of the Productive Safety Net Program (PSNP) on household food security, asset accumulation and annual income. The intervention areas of the project are in improving the overall livelihood of rural poor households. Even though the project has been implemented since 2005 in Ethiopia, its impact on food security, asset accumulations, and household income have not well studied. Both primary and secondary data were collected and analyzed. The primary data was collected from 154 PSNP beneficiaries and 174 non-beneficiaries. Secondary data was used from previous related literature and office reports. Descriptive statistics and econometric model of propensity score matching (PSM) were used to analyze the collected data. The result of the descriptive statistics showed that there are significant mean differences between PSNP beneficiaries and non-beneficiaries in terms of the number of months with food shortage, educational status, contact with development agents, and family size. Since the project gives priority for female-headed households, more than half of beneficiaries (64.94%) were female-headed households. Moreover, the mean difference of outcome variables for samples before matching the households for daily caloric intake per adult equivalent (t=6.68), asset accumulations (t=7.05) and annual income (t=5.44) was statistically significant between PSNP beneficiaries and non-beneficiary based on the results of t-tests. Similarly, the result of PSM confirmed that the ATT of PSNP beneficiary households increased the total calorie intake per adult equivalent by 738.27 Kcal which was significant at a 1% significance level. Similarly, there was a statistically significant mean difference between the beneficiaries and non-beneficiaries groups regarding asset accumulations and annual income in birr of 29652.7 and 26732 birr respectively. The sensitivity analysis result showed that the impact results estimated by this study are insensitive to the unobserved selection bias of gamma value 3.5. Therefore, since the impacts of the project were found positive, it is better to widen the implementation of the project to other food prone areas of Ethiopia.

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INTRODUCTION

Background of the study: The primary objective of most development interventions including the productive safety net program is to improve the economic status of poor households. These transfers are aimed at ensuring the lowest living standards and temporary damages and reducing long-term poverty (Grosh et al., 2008). Even though several interventions have been made so far, still those peoples who are living in rural areas are in the trap of poverty. The Ethiopian government has considered the problem and developed different intervention programs through different social protection programs. Studies carried out so far have also confirmed that social protection programs have brought a significant change in the livelihoods of poor households (Kassa, 2018). In Ethiopia "the Food Security Program and Productive Safety Net Program (PSNP) was started in 2003 and 2005" respectively to reduce food insecurity in collaboration of government with fund providers. The PSNP is social protection, which makes household and community responses to shock and stress more strongly and progresses food security through provision of financial, educational training, technical and business advice, and connections with microfinance institutions, and a continuous follow-up (Anderson and Elisabeth, 2015). PSNP is the largest social protection program in sub-Saharan Africa to reduce food insecurity.

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In Ethiopia, the PSNP as social protection program is the most inclusive program to tackle food insecurity in the rural poor. The studies conducted in different parts of Ethiopia confirmed that the PSNP program has shown a significant impact (Debela and Holden, 2014, and Welteji et al., 2017). To the best of researcher's knowledge, only a few empirical studies have been done so far regarding the impact of PSNP in the Ethiopian context. Even, thus studies were not comprehensive and focus on a single outcome variable mostly food security and income. To solve the shortage of literature and recommended the results for other parts of a country, this study focuses on three outcome variables; namely food security status measured in calorie intake per adult equivalent, asset accumulations and annual income of PSNP beneficiaries and non-beneficiaries.

Statement of the problem: The Government of Ethiopia has implemented a number of poverty-focused measures to tackle the increasing level of vulnerability in rural areas. However, given the high number of poor and vulnerable in many rural areas, the coverage of the existing support is very limited and insufficient to bring about the required impact at large scale. Several empirical studies have been conducted to examine the effect of social protection programs, such as PSNP, on different outcomes. The study was done by Gilligan *et al.* (2009) on the impact of Ethiopia's Productive Safety Net Program and its linkages show that PSNP had a significant effect on consumption. Slater *et.al.*(2006) also did a study on their productive safety net program; a study on policy and institutional linkages also reported that PSNP improved the consumption status of participants. A recent study has found that the public work component of the PSNP had a significant effect on households' food security status, improved number of children's meals consumed and livestock holdings (Berhane et al., 2011). All these studies lack comprehensiveness in including all sides of livelihoods. Therefore, this study was aimed at applying the propensity score matching mechanisms to identify the impacts of productive safety net program of asset building thorough accumulation, calorie intake per adult equivalent and annual household's income.

Objective of the study: the general objectives of the study was the impacts of productive safety net program on household asset building, food security and annual income in Sidama zone, Southern Ethiopia

The specific objectives were;

- *To analyze the impacts of productive safety net program on asset accumulations, calorie intake and annual income of beneficiaries*
- *To identify the determinants for participation in productive safety net program*
- *To compare beneficiary with non-beneficiaries households by using different parameters.*

MATERIALS AND METHODS

Research Design: A cross-sectional survey research design was implemented which is among non-experimental research designs. Both quantitative and qualitative data types of data were collected from primary and secondary data. The quantitative data was collected from PSNP beneficiaries and non-beneficiaries by focusing on their demographic, economic and institutional services. Qualitative data was also collected from stakeholders and narrated. To triangulate the information obtained from respondents, key informants interview and focused group discussion were analyzed.

Sampling Techniques and sample size: three districts were selected from Sidama Zone, southern Ethiopia. The selected districts were Boricha, Bilate Area and Aleta Chuko. The reason for selecting these districts was a long term implementation of the PSNP program. From three districts the total of 328 of which 154 of beneficiaries and 174 non-beneficiaries were selected.

Method of Data Analysis: The descriptive and econometrics model of propensity score matching (PSM) was implemented. The descriptive statistics used include, mean, standard deviation, minimum and maximum was used. To compare the desired characteristics of households, t-test and chi-square test were used for beneficiaries and non-beneficiaries.

Econometrics model analysis: PSM was chosen among other non-experimental methods because it does not require baseline data, matching estimators highlight the problem of common support, since treatment effects can only be estimated within the common support and matching does not require functional form assumptions for the outcome equation (that is, it is non-parametric) (Dehejia and Wahba, 2002).

Furthermore, the propensity score matching approach aims to only compare households that lie in the common support and exclude others from the analysis. Unlike econometric regressions methods, PSM compares observations and does not rely on parametric assumptions to identify impacts on projects. It attempts to estimate the average impact of treatment on treated/ATT (Haile, 2008). According to Caliendo and Kopeinig (2005), there are five steps in implementing PSM include: estimation of the propensity scores, choosing a matching algorithm, checking on common support condition, testing the matching quality and sensitivity analysis.

Estimation of the propensity scores: The first step in the PSM method is to estimate the propensity scores. As described by Rosenbaum and Rubin (1983) matching can be performed conditioning on P(X) alone rather than on X, where P(X) = Prob (D=1|X) is the probability of participating in PSNP conditional on X. If outcomes without the intervention are independent of participation given X, then they are also independent of participation given P(X). This reduces a multi-dimensional matching problem to a single dimensional problem. A logit model was used to estimate propensity scores using a composite of pre-intervention characteristics of the sampled households (Rosenbaum and Rubin, 1983). In estimating the logit model, the dependent variable was PSNP participation that was users of the beneficiary, which takes the value of 1 and 0 otherwise. The mathematical formulation of the logit model is as follows:

$P_i = (y_i = 1/x) = 1/(1 + e^{(\beta_0+\beta_1 x_i)})$. This equation can be written as:

$$P_i = \frac{1}{1+e^{-Z_i}} \quad (1)$$

Where: P_i is the probability of using PSNP and e represents the base of natural logarithm (2.718) and Z_i is the function of explanatory variables (x)

$P_i = 1/ (1+e^{z_i})$ is the probability of not using PSNP 2

Then, the odds ratio in favor of using PSNP is given by $\frac{P_i}{1-P_i}$By taking the natural log of the equation we get the following

$L_i = \ln[\frac{P_i}{1-P_i}] = Z$ With the error term incorporated, the logit model has the following form:$Z = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \cdots \beta_n x_n + U$

Where x_1, x_2, x_3 ….x_n are the explanatory variables of the model, β_0 is the intercept β_1, β_2

β_3…… β_n are the coefficients to be estimated in the model and U is the error term

Choosing a Matching Algorithm/ matching estimators: According to Caliendo and Kopeinig (2008) there are different matching criteria that can be used to assign participants to non-participants on the basis of the propensity score by calculating a weight for each matched participant and non-participant set. The most commonly applied matching estimators are Nearest Neighbor Matching, Caliper and Radius Matching, Stratification and Interval Matching, Kernel and Local Linear Matching. Therefore, one of the matching algorithms among matching estimators was selected which has high matching sample size, low psedoR^2 value and high matching balance (Dehejia and Wahba, 2002).

Checking on common support condition: The common support region is the area that contains the minimum and maximum propensity scores of treatment and control group households, respectively. The basic criterion of this approach is to delete all observations whose propensity score is smaller than the minimum and larger than the maximum in the opposite group. Observations that lie outside this region were discarded from analysis (Caliendo and Kopeinig, 2005). No matches can be made to estimate the average treatment effects on the ATT parameter when there is no overlap between the treatment and non-treatment groups.

Testing the matching quality: A suitable indicator to assess the distance in marginal distributions of the X variables is the standardized bias (SB) suggested by Rosenbaum and Rubin (1985). It is used to quantify the bias between treated and control groups. For each variable and propensity score, the standardized bias is computed before and after matching as:

$$SB(X) = 100 * \frac{X_1 - X_0}{0.5\sqrt{(V_1(X) + V_0(X))}} \quad (3)$$

Where x_1 andx_o are the sample means for the treatment and control groups, v_1(x)and v_2(x) are the corresponding variances.

The bias reduction (BR) also can be computed as:

$$BR = 100\left(1 - \frac{B(X)after}{B(X)before}\right) \quad (4)$$

Treatment effect on the treated

To estimate the effect of PSNP participation to a given outcome (Y) is specified as:

$$t_{ATT} = Y_i(D_i = 1) - (D_i = 0) \quad (5)$$

Where τ_i is treatment effect (effect due to participation in PSNP), Y_i is the outcome on household i, D_i is whether household i, has got the treatment or not (i.e., whether a household participated in PSNP or not). Two treatment effects are most frequently estimated in empirical studies (Caliendo and Kopeinig, 2005).

The first one is the (population) Average Treatment Effect (ATE) which is simply the difference between the expected outcomes.

$$\Delta Y_{ATE} = E(\Delta Y) = E(Y_1) - E(Y_0) \quad (6)$$

This measure answers the question of what would be the effect if households in the population were randomly assigned to treatment. But this estimate might not be of importance to policymakers because it includes the effect for which the intervention was never intended. Therefore, the most important evaluation parameter is the so-called Average Treatment Effect on the Treated (ATT), which concentrates solely on the effects on those for whom the program/interventions are actually introduced. In the sense that this parameter focuses directly on those households who participated, it determines the realized impact of PSNP usage and helping to decide whether participation on PSNP is successful or not. It is given by:

$$t_{ATT} = E(t/D = 1) = E(Y_1/D = 1) - E(Y_0/D = 1) \quad (7)$$

This answers the question, how much did households participating in PSNP benefit compared to what they would have experienced without participating. Data on E (Y1/D=1) are available from PSNP users. An evaluator's classic problem is to find E (Y0/D=1). So the difference between E (Y1/D=1) - E (Y0/D=1) cannot be observed for the same household. The possible solution is to use the mean outcome of the comparison individuals, E (Y0/D=0), as a substitute to the counterfactual mean for those being treated, E (Y_0/D=1) after correcting the difference between user and non-user households arising from selection effect. Thus, by rearranging, and subtracting E (Y_0/D=0) from both sides of equation (6), one can get the following specification for ATT. The PSM was applied based on two assumptions: first the Conditional Independence Assumption (CIA) and common support or overlap condition.

Conditional Independence Assumption (CIA): This assumption implies that the selection was solely based on observable characteristics, and variables that influence treatment assignment and potential outcomes are simultaneously observed (Caliendo and Kopeinig, 2005). CIA is given as: $y_o \perp D/x$. Where $\perp$ is indicates independence, X is observable characteristics and $Y_0$is non-user.

Common support: This assumption rules out the perfect predictability of D given X. That is: $0 < P(D = 1| X) < 1$. This assumption ensures that the same X values have positive probabilities of being both participants and non-participants. Give the above two assumptions, the PSM estimators of ATT can be written as:

$$t_{ATT} = E(Y_1 - Y_0/D = 0, P(X)) = E(Y_1/D = 1, P(X)) - E(Y_0/D = 0, P(X)) \quad (9)$$

Where P(X) is the propensity score computed on the covariates X. Equation (8) is explained as; the PSM estimator is the mean difference in outcomes over the common support, appropriately weighted by the propensity score distribution of participants.

RESULTS AND DISCUSSION

In this section, the analysis results of both descriptive and PSM models were presented. The section is divided into three parts. The first part deals with presenting the descriptive statists results. The second part described the results obtained through step-wise procedures of the PSM model. The third parts conclude and the recommendation was drawn based on the results. As depicted in Table 1, the mean age of PSNP users and non-users was 43.25 and 41.2 years respectively. The t-test statistic value shows that there is a statistically significant mean age difference between PSNP beneficiaries and non-beneficiaries are 5% level of significance. Regarding the educational status, the average enrollment of beneficiaries and non-beneficiaries was 2.97 and 2.90 schooling years. Household size is one of the criteria to select in the project. The average number of those households who are the beneficiaries and non-beneficiaries of the project were 6.55 and 5.28 respectively. Accordingly, the selection criteria were correctly implemented while selecting the users. The t-test value of 5.46 also more strongly supports the evidence at 1% level of significance.

The frequency of contact of development agents with the households has a contribution to the inclusion of the project. This may be due to the fact that, as farmers do have better contact with the development agents, they can access timely information. There is a statistically significant difference between beneficiary and non-beneficiaries at a 10% level of significance. The number of months that households faced food shortage is an important variable that determines the participating households in the PSNP program. On average, the number of months that households encountered food insecurity for non-beneficiary before inclusion in the project was 7.2 out of 12 months. Whereas, on average the non-beneficiaries faced food shortage for about 4.6 months per year. The statically significant t-test value also confirmed that there is a significant difference between beneficiaries and non-beneficiaries at a 1% level of significance. On the other hand, there was found a non-statistically relationship between the education status of the households and livestock ownership between beneficiary and non-beneficiaries of the project.

The selection process of beneficiaries: to select the relevant households for the program, the severity level of the food security status of each household was identified. In each kebele, there are committees of a productive safety net program formulated to follow up on the progress and to solve if there are any complaints on the sides of the beneficiary. The household economics status is collected by using framed questionnaires. All concerned bodies are involved in the process. Against this, some participants of focused group discussion confirmed that the unfair treatment of household selection has happened on the occasion. Those households with better food security may be selected as a beneficiary.

Impacts of PSNP on household's food security: Daily caloric intake per adult equivalent was calculated by recalling all food items consumed by the households in the past 24 hours and divided to all household members adult equivalent. The medically recommended levels of calories per adult equivalent was used to determine calorie demand for each household; that is 2200 kcal per day according to MoFED (2002) is assumed to be the minimum energy demand enabling an adult to lead a healthy and moderately active life. The result of the study showed that the mean daily caloric intake per adult equivalent for PSNP participants and non-participants households was 2620.27Kcal and 1884.99Kcal respectively (Table 2). The study result also showed that the mean difference in daily caloric intake per adult equivalent between PSNP participants and non-participants was 735.28Kcal. This result revealed that there was a statistically significant difference between the two groups at less than a 1% significant level.

Impacts of PSNP participation on annual income: it was found that the participation of the PSNP program has a significant influence over the income of the households. The mean annual income of the households who participated in the productive safety program was 26,732.88 Ethiopian Birr as compared with 18778.74 Ethiopian Birr of non-participants. The mean annual income difference was significant at 1% in favor of PSNP beneficiaries.

Impacts of PSNP participation on asset accumulation: As a basic objective of a productive safety net program is improving the capacity of the households to retain their assets. With regard, the durable items that household-owned were listed and converted into Ethiopian birr by using the current market price. This was done to compare the asset accumulation between PSNP participants and non-participants. Accordingly, statistically significant differences were found which is in favor of participating in PSNP at a 1% level of significance. The study conducted in Ethiopia, Adami Tulu Jido kombolcha also confirmed that the impact of productive safety net programs on asset accumulation was found positive (Tadele, 2011).

Estimation of propensity scores for the PSM model: For this research, the logistic regression model was used to estimate propensity score matching for PSNPbeneficiary and non-beneficiary households. The logistic regression model is applied when the choice variable is dichotomous. The dependent variable was the participation of households in PSNP which takes the value of 1 for beneficiaries and 0 for non-beneficiary. The likelihood ratio chi-square value was 118.47 which indicates that the overall fitness of the model was found significant at less than 1% significant level. The pseudo R^2 value of the estimated model result was 0.26 which was fairly low. This low pseudo R^2 value shows that the distribution of the program has been fairly random (Pradhan and Rawlings, 2002). After matching there should be no systemic differences in the distributions of covariates between both groups and therefore, the pseudo R^2 should be fairly low (Caliendo and Kopeining, 2008). Among nine variables included the logistic regression model, six of them were found determinants for participation in the PSNP program (Table 3). The significant variables were age($p<0.1$ odds ration=1.03% in favor of older household heads), Sex ($p<0.01$, odds ratio 0.38% in favor of female-headed households to participate in PSNP), Household size ($p<0.01$, odds ratio=1.14% in favor of those households who won large members), number of months households faced food shortage ($p<0.01$, odds ratio=1.39% in favor of more number of months who faced food shortage to participate on the program), and house roof type; corrugated or

Table 1. Summary statistics of sample households

	PSNP Participants	PSNP non-participants	Total	
	Mean	Mean	Mean	t-value/chi2
Age of head	43.25	41.20	42.16	1.93**
Educational status of head	2.97	2.90	2.94	0.22*ns*
Household size	6.55	5.28	5.87	5.46***
Livestock ownership	0.80	0.86	0.83	1.19*ns*
Contact with development agents	1.95	1.69	1.81	1.60*
Months of food shortage	7.20	4.6	5.82	-8.20***
Access to credit	0.35	0.37	0.36	0.17 N, chi2

Source: Own survey result (2019)*ns stands for non-significant relationships*

Table 2. Descriptive result of the outcome variable

Variables	Beneficiary	Non-beneficiary	Difference	t-value
	Mean	Mean		
Daily caloric intake per AE	2620.27	1884.99	735.28	7.97***
Annual income	26732.88	18778.74	7954	7.19***
Asset accumulation	29847.32	19646.55	10200.77	8.29***

*** means significant at less than 1%

Table 3. Household's probability of participation in PSNP

Independent variables	Odds ratio	Coefficient	Std. Err.	Z	P>z
Constant	0.01***	-4.288	0.940	-4.56	0.000
Age of head	1.03*	0.0037	0.014	2.59	0.010
Sex of head	0.38***	-0.956	0.280	-3.41	0.001
Educational status	.94	-0.053	0.050	-1.05	0.295
Household size	1.40***	0.338	0.067	5.02	0.000
Number of moths with Food shortage	1.39***	0.331	0.049	6.67	0.000
Credit access for household	.65	-0.425	0.284	-1.50	0.135
House ownership	0.44***	-0.802	0.294	-2.73	0.006
Contact with DAs	1.08	0.079	0.092	0.87	0.385
Livestock ownership	0.74	-0.288	0.247	-1.16	0.245

Dep. Variable: Participation on PSNP, *** and * and stands for Sig. at 1and 10% respectively DAs= agricultural development agents at kebele administration level Source: Own survey result (2019)

Table 4. Distribution of estimated propensity score of households

Sample	Observation	Mean	SD	Min	Max
All Household	328	0.47	0.29	0.018	0.991
PSNPbeneficiary	154	0.64	0.23	0.064	0.991
PSNP non- beneficiary	174	0.32	0.23	0.018	0.915

Source: Own computed from the data (2019) by using PSM model

Table 5. Chi-square test for the joint significance of variables

Sample	Pseudo R2	LR chi2	p>chi2
Unmatched	0.265	120.08	0.000
Matched	0.030	11.34	0.331

Source: own computation (2019)

Table 6. Impact of PSNP use on calorie intake, asset accumulation, and income

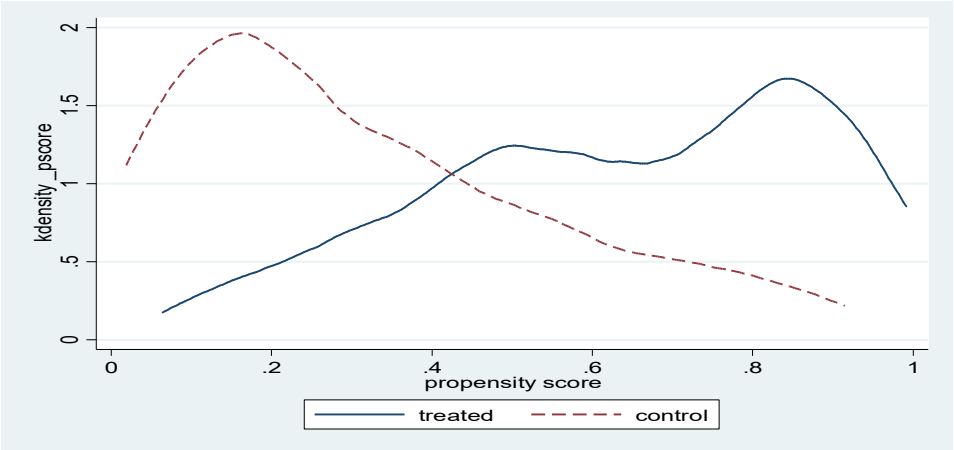
Variable	Beneficiary	Non-beneficiary	Difference(ATT)	t-test
Calorie intake	2615.03	1876.76	738.27	6.68***
Asset accumulations	29652.74	19583.33	10069.40	7.05***
Annual income	*26732.88*	18474.90	8007.43	5.44**

Source: Own computation (2019)

Table 7. Result of sensitivity analysis using Rosenbaum bounding approach

Outcomes	$e^{\gamma}=1$	$e^{\gamma}=2.25$	$e^{\gamma}=3.5$
Calorie intake	$8.4e^{-12}$	0.001	0.090
Asset accumulations	$2.6e^{-09}$	0.017	-
Annual income	$4.6e^{-10}$	0.007	-

Source: Own computation (2019), γ stands for gamma value



Source: Own survey result (2019)

Figure 1. Kernel density of propensity score distribution

Figure 2. Propensity score distribution and common support region for propensity score estimation

grass-roofed (P<0.01, odds ratio=0.44% in favor of those households who own grass-roofed house).

Propensity score value: The p-score graph was used to describe the distribution of PSNP beneficiaries and beneficiaries with respect to the estimated propensity score to know the common support region (Figure 1).

Matching PSNP beneficiaries with non-beneficiaries household: distributions of sample households in estimated propensity score matching were executed then common support condition was imposed on the propensity score distributions of household and then discard observations whose predicted propensity scores fall outside the range of the common support region. Thirdly, treatment effects on treated households were analyzed. Finally, a sensitivity analysis was done in order to check the robustness of the estimation. The result in Table 4 depicted that the distribution of propensity score for PSNP participants varies from 0.064-0.991 with the mean value of 0.64. Similarly, the score varies between 0.018-0.915 for non-participants with a mean of 0.32. The common supports lies between 0.018 and 0.915. This implies that that household whose propensity scores less than the minimum (0.064)and larger than maximum (0.915) were not considered for matching purposes.

According to this reality, a total of 35 households; 17 households from PSNP beneficiaries and 18 households from PSNP non-beneficiary groups were discarded from the study in impact evaluation of three outcome variables (annual income, daily calorie intake and asset accumulations.

Propensity score distribution and common support region: The upper half shows the propensity score distribution of PSNP beneficiaries and the bottom halves of the histogram show the propensity score distribution of non-beneficiaries. The green-colored (treated on support) and pink colored(untreated on support) indicates the observation in the PSNP participation and non-participation that have suitable for comparison respectively, while the yellow-colored(treated off support) and blue colored(untreated off support) indicates the observation in the PSNP participation and non-participation that discarded for comparison respectively.

Choice of matching algorisms: Different matching algorisms were tried to matching PSNP participants with non-participant households in the identification of common support regions. These matching methods were include; nearest neighbor matching, radius matching, caliper, and kernel matching. The final choice of matching algorism was guided by different criteria. These were equal mean test (balancing test), pseudo R^2 value and size of the matched sample (Dehejia and Wahba,

2002). Accordingly, a large number of insignificant variables after matching, low pseudo R^2 value and large matched sample size were selected. After carrying out the analysis based performance criteria of matching algorisms, nearest neighbor 3 found to best matching algorithms. The balance test, pseudo-R2 and matched sample size was found to be 7, 0.030 and 293 respectively. The chi-square test for joint significance nearest neighbor 3 matching algorism was the low pseudo R^2 value and the insignificant likelihood ratio test revealed that both groups have the same distribution in all covariates after matching. This result indicates that the matching procedure was able to evaluate the impact of PSNP participation among a group of the household having similar observed characteristics Table 5.

Impacts of PSNP participation: Three outcome variables were used to identify the impacts of PSNP. These outcome variables were household food security measured in calorie intake/adult equivalent, asset accumulation and annual income.

Impacts on calorie intake: The average treatment effect on treated (ATT) shows that the household calorie intake per adult equivalent was improved as a result of PSNP utilization use (Table 6). The statistical t-test value of t=6.68 showed that there is a significant calorie intake between PSNP beneficiaries and non-beneficiaries.

Impacts on asset accumulations: participation of households shows a significant influence over asset accumulations. The t-test value of 7.05 indicates a significant difference between beneficiaries and non-beneficiaries in terms of accumulating assets at a 1% level of significance.

Impacts on annual income: on the other hand those households who are participated in PSNP have involved in different income-generating activities. Accordingly, annual income differences have observed. The t-test statistics show that there is a significant difference between PSNP beneficiaries and non-beneficiary in the annual income.

Sensitivity analysis: sensitivity analysis was used to address the impact of PSNP on different significant outcome variables with respect to the choice of the balancing scores (Alemu, 2017). Sensitivity analysis was conducted for outcome variable (calorie intake per adult equivalent per day, asset accumulations and annual income).P-critical values or the upper bound of Wilcox on significance level -Sig+ at a different critical value of eγ (Rosenbaum, 2002) is presented in Table 7. The results show that inference for the impact of PSNP use does not change, even though the participant and non-participant households were allowed to differ in their odds of being treated up eγ=2.25for asset accumulations and annual income, and eγ=3.5for calorie intake for unobserved covariates.

Conclusion

Productive safety net program has significant importance in improving the livelihoods of poor households. The identification of its impact over the participants on selected outcome variables was analyzed. The study was carried in two districts of Sidama zone, Southern Ethiopia. The propensity score matching method was implemented to identify the impacts of the program on the beneficiaries of the program. Based on the findings of the study, participation in the productive safety net program has a significant influence on households. Therefore, based on the findings, it can be concluded that the participation of households in the PSNP program has a significant contribution to food security (calorie intake), asset accumulations and annual income.

Recommendation

The objectives of the program were to improve households' food security and retention of assets which was sold during the cash shortage period. As the findings showed that, the participation of households in the program has positive and significant influences. Therefore, it is recommended that the government of Ethiopia shall extend the number of beneficiaries through graduating those households who have maintained the project objective through assuring their food security status. Moreover, the selection process of beneficiaries should be fair and based on the actual economic status of households.

Conflict of interest: I declare that this research work is the result of my own efforts. There are no conflicts of interest. I credited all references used in the production of the manuscript.

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Abbreviations

PSNP Productive Safety Net Program
PSM Propensity Score Matching
ATT Average Treatment effects on Treated
SD Standard Deviation
Mo FED Ministry of Finance and Economic Development of Ethiopia

REFERENCES

Abera A., 2017. Impacts of Microcredit on Selected Livelihood Asset of Rural Households. The Case of Omo Micro Finance Institution of Sidama Zone, SNNPR

Anderson S, Elisabeth F (2015). USAID Office of Food for Peace Food Security Country Framework for Ethiopia FY 2016–FY 2020.Washington, DC: Food Economy Group.

Berhane, G., Hoddinott, J., Kumar, N., &Tafesse, A. S., 2011. The Impact of Ethiopia's Productive Safety Nets and Household Asset Building Program: 2006-2010. International Food Policy Research Institute. Retrieved from: https://www.ids.ac.uk/files/dmfile/Impact_Report_FINAL_JAN2012.pdf

Dehejia, R. and Wahba, S. 2002. Propensity score matching methods for non-experimental causal studies. The Review of Economics and Statistics, 84(1): 151–161.Rosenbaum, P.R., and Rubin, D.B., 1983. The central role of the propensity score in observational studies for causal effects. Journal of Biometrika, 70(1): 41-55.

Debela BL, Holden ST (2014). How Does Ethiopia ′s Productive Safety Net Program Affect Livestock

Accumulation and Children's Education? Centre for Land Tenure Studies, Norwegian University of Life Sciences.

Gilligan, D. O., Hoddinott, J., & Taffesse, A. S., 2009. The impact of Ethiopia's Productive Safety Net Programme and its linkages. *The journal of development studies*, *45*(10), 1684-1706.

Grosh, M., C. delNinno, E. Tesliuc and A. Ouerghi (2008) For Protection and Promotion: The Design and Implementation of Effective Safety Nets. Washington, D.C: World Bank.

Haile Tesfaye. 2008. Impact of irrigation development on poverty reduction in Northern Ethiopia. PhD Dissertation, National University of Ireland, Cork-Ireland, Ireland.

Kassa A.W., 2018. Impact of productive safety net program in the rural community of Ethiopia: A review study. J. Agric. Ext. Rural Dev. P85-88.

MoFED, 2002.Ministry of Finance and Economic Development. Ethiopia: Sustainable Development and Poverty Reduction Program. Addis Ababa: MoFED

Pradhan M., Rawlings LB., 2002. The Impact and Targeting of Social Infrastructure Investments: Lessons from the Nicaraguan Social Fund, World Bank Econ

Rosenbaum P. R., 2002. Observational Studies.2nd edition. New York: Springer. 375p.

Slater, Rechel, Steve Ashley, Mulugeta T, Mengistu B, and Delelegn E., 2006. Ethiopia's Productive Safety Net (PSNP): Study on Policy, Programme, and Institutional Linkages. London and Addis Ababa.ODI, the IDL Group and Idak International.

Tadele Mamo. 2011. Impact of Productive Safety Net Program on Asset Accumulation and Sustainable Land Management Practices in The Central Rift Valley: The Case of Adami Tulu Jido Kombolchaand Meskan Districts (unpublished).

Welteji D, Mohammed K, Hussein K (2017). The contribution of productive Safety Net Program for food security of the rural households in the case of Bale Zone, Southeast Ethiopia. Agric. food security 6(1):53.

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