THE IMPACT OF PRODUCTIVE SAFETY NET PROGRAM (PSNP) ON HOUSE-HOLD POVERTY REDUCTION : THE CASE OF KUYU WOREDA, NORTH SHEWA ZONE OF OROMIA REGIONAL STATE, ETHIOPIA

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Abstract

This study evaluated the impact of Productive safety net Program on household poverty reduction in Kuyu Woreda North Shewa zone of Oromia regional state in Ethiopia using cross-sectional survey data collected from 260 households selected through a multi stage sampling procedure. The survey respondents were drawn from both program and non-program areas of Kuyu District. The major research question of the study is 'what would have been the annual income of household per AE had the program not been implemented?' Applying a propensity score matching technique, the study found that the program has increased participating households' annual income per AE by 1,164 birr compared to that of non-participating households. The result from the multiple regression analysis revealed that education status, family size, dependency ratio, land size, and distance from development agency had significant effect on the household annual income per AE. The study concluded that controlling for all other factors, the productive safety net tends to result in reduced income benefit for the households that have more number of family size, high depedency ratio, and high distance from development agent office while it results in increased income for households that have more land size and educational status. Most of the program participants were male-headed households. Hence, the program should include more female-headed households or at least in the same proportion as that of the male-headed households.

Key words: Key Words: Impact, Safety Net Program, Poverty Reduction, Propensity Score Matching, And Ethiopia

INTRODUCTION

Among the different factors, the major challenges of poverty in Ethiopia are backward agriculture, unstable weather, price fluctuation, drought, pests and disease, population pressure, weak institutional capacity, inadequate infrastructures and social services, environmental degradation, shortage of farmland, lack of productive assets, low input and subsistence agricultural practices in rural areas of Ethiopia. Consequently, less than 30 percent of the population were below the poverty line in Ethiopia reporting that they experience a food gap of more than four months (World Bank, 2015). In Ethiopia, households that are often exposed to poverty due to the above factors are those that have inadequate or no land and oxen, have many children, are female-headed, reside in drought affected areas, and are located farther from market places.

In this respect, the key interventions designed to attain household poverty reduction over the period of PASDEP include building household assets through on-farm activities, supporting voluntary resettlement to more productive areas, a productive safety net program which helps bridge famine gaps while building community assets, and introducing non-farm activities. In order to find a longer term solution to the problem, the government of Ethiopia, with the active collaboration of a range of donors, has designed a PSNP within the framework of Ethiopia's Poverty Reduction Strategy in 2005.

Different studies have been carried out on different issues regarding PSNP in Ethiopia. Anwar (2015) conducted a study on the impact assessment of PSNP on house-hold food security by using propensity score matching by logit model.The study concluded that there is a significant difference in the PSNP beneficiary and non-beneficiary households. He also concluded that there is a positive and statistically significant impact of the project on participants and that efforts of such kind play vital roles in making the participant households improve their household food security status. Yibah (2014) conducted a study on the economic impact of PSNP on poverty.The study found out that the impact of productive safety netprogrm has positive and statistically significant effect on poverty reduction by increasing households' overall family consumption expenditure and protecting assets of the rural households. Yibah conducted his study using the expenditure approach known as FGT index, the one developed by Foster, Greer, and Thorbecke, and commonly

applied for poverty analysis and propensity score matching model of the productive safety net program. The other studies are based on recall data to construct the baseline data set and were conducted at the early stage of the program. Gilligan et al (2009), for example, used recall data to fill the gap of lack of pre-intervention data.

However, there is no empirical study done in the current study area, which measures the impact of the program on the household poverty reduction has not been yet evaluated and remains untouched. Some of these studies used qualitative analysis (Million, 2013). Therefore, answering the question whether households who participated in the program have benefited from these interventions or not by using proponsity score matching and logit model to estimate the ATT and evaluate the impact of the program on poverty reduction is important. Kuyu is one of the highly drought and famine affected woredas in North Shewa zone with higher number of case load 22,509 targeted by the safety net program. This woreda has been supported by PSNP program for over 12 years. The PSNP program planned to target the chronically food insecure and poverty affeted households. For implementation of this program, government and non-governmental organizations including donors have been actively engaged by allocating ahuge amount of resources. This study, therefore, attempts to fill this gap by conducting an empirical study on the impact of PSNP on poverty reduction in Kuyu Woreda of north shewa zone of Oromia regional state.

METHODOLOGY

Research Design

Research design is used for fulfilling research objectives and answering research questions (Creswell, 2009). From the types of research design this research employed descriptive and empirical research design. Moreover, the study utilized cross-sectional data in the sense that all relevant data were collected at a single point in time. The reason for preferring a cross-sectional study is because getting organized long year data was difficult in the area. Obtaining information from a cross-section of a population at a single point in time is a reasonable strategy for pursuing many descriptive researches (Janet et al, 2006).

Description of the study area

Kuyu District, which is the study area, is one of the 13 districts in North Shewa admnistrative zone of Oromia region. (BoFEC, 2016).The district is located between longitude 38°03' 38031' East and latitude 9° 35' 9049' North. The capital city of the district is Garba Guracha which is situated 156Kms far away from the national capital, Addis Ababa and 42Km away from the zonal capital Fitche. Kuyu district has 23 rural Kebeles and 3 kebeles are urban administrative units. The 2007 national census reported a total population of 144,049 for this woreda and the ratio of male to female was almost 1:1. 81.07% of the total population are rural dwellers who are totally engaged in agriculture. Kuyu district has an area of 982 km2 with a population density of 151/km2 and the agro ecology of the district includes Dega (50%), Woina Dega (40%), and Kolla (10%) (BOFED, 2016).

Sampling techniques and Sample size

North Shewa zone of Oromia regional state has 13 Woredas and five (Kuyu, Wuchale, Jida, Abbichu Gna, Kimbibit) are addressed by safety net program. Kuyu Woreda is one of the highly affected areas targeted by a PSNP (BOFEC, 2016). Kuyu Woreda has a total of 23 rural kebeles of which 20 rural kebeles are where the PSNP has been operational. Thus, Kuyu Woreda was selected purposefully due to its higher number of people affected by poverty. From these figure, 4297 total household were identified and 260 sample households are selected for this study's purpose.

A multi stage sampling procedure was applied to draw samples for the study. For the purpose of this study, the 20 kebeles where PSNP program is operational were divided in to three based on the three agro ecology of the woreda (Dega, Woina dega and Kola). From the total 120 program participator Kebeles, 6 were selected according to agro ecology of woreda such as 3 kebeles from 10 kebeles of Dega (Amuma Wucale, Biriti, Sombo Ceka), 2 kebeles from 8 Woina dega kebeles (Dire Haco, Halelu Cheri) and 1 kebele from 2 kebeles of kola (Jelisa Lutu) using a multi stage sampling tecnique. The sample size from the six selected kebeles is determined through applying required sample size (n) to estimate a population proportion (p) procedures using the PSNP master list for program participant and by registering the list of non-program participants. Finally, based on sample size, 260 sample respondents were selected randomly using the random sampling method in total 130 from PSNP and the rest 130 HHs from Non-PSNP.

Table 1

Sample size of households from PSNP and Non-PSNP HHs

S/N	Sample Kebeles	Total PSNP HHs	PSNP Sampled HH	Total Non PSNP HHs	Non PSNP Sampled HHs	Total sampled HHs
1	Jelisa Lutu	96	29	515	17	46
2	Halelu Cheri	102	30	890	30	60
3	Amuma Wucale	72	21	536	18	39
4	Biriti	58	17	644	22	39
5	Dire Hacoo	56	17	784	26	43
6	Sombo Ceka	53	16	491	17	33
	Total	437	130	3860	130	260

Source:Woreda Agricultural and Rural Development Office, 2018

The sample size was determined using sample size formula

$P \pm ME$ ---------- (1)

CI for P: $P \pm Z\sqrt{\frac{pq}{n}}$

When $Z\sqrt{\frac{pq}{n}}$ = ME and solve for n

$n = \frac{z^2 pq}{ME^2}$ ---------- ---------- (2)

$\frac{(1.96)^2 * .19 * .81}{0.05^2}$ + 10%(NRR) = $\frac{0.591}{0.0025}$ + 10% =236.4+23.6=260

Where, n = sample size z = linked to 95% confidence interval (use 1.96) p = expected prevalence (as fraction of 1) 81% of rural population and q = 1- p (expected non-prevalence) 19% Urban population ME= Margin of error or relative desired precision in cluster sampling the sample size calculated for simple or systematic random sampling is for the heterogeneity between clusters (Dawson, 2009).

Data Type and methods of data collection

Data was collected from both primary and secondary sources. The collected data would be both qualitative and quantitative in nature. The primary data will be collected from the select 260 sample respondents, WFSTF, KFSTF and key informants. Secondary data relevant to the research work will be collected from different stakeholders particularly from Woreda and zone agriculture and rural development office, non-governmental organizations operating in the Woreda, published and unpublished documents, and other sources supposed to have relevant information for this particular study.

Methods used to collect data for the study are survey questionnaire through interview and focused group discussion. The survey questionnaire was designed to elicit information on a variety of topics including demographic characteristics, socio-economic factors and institutional factors of the respondents both at the time of the survey as well as before-intervention of the program using recall methods. Pre-testing of the questions was undertaken on 26 randomly selected non sample households similar to the selected Kebeles in Kuyu woreda before conducting the survey with sample respondents to make necessary modification. The questionnaire was modified based on the pre-test feedback and it was translated to the local language (Afan Oromo) for the simpled respondents' understanding of it.

Methods of Data Analysis

The empirical data was analyzed using both descriptive and inferential statistical tools. In what follows, these tools are outlined and discussed.

Descriptive statistics

Descriptive statistics which was applied for analyzing data for this study include mean, standard deviation, percentages, graphs and tables.

Econometric Models

Propensity score matching (PSM) method: - Participation in PSNP is none randomized and lacks baseline survey. That is, households which are eligible to the selection are purposively selected based on their asset holding, exposure to shocks and problem of food security. In addition, the baseline survey was not conducted prior to the intervention of the PSNP in the study area. Therefore, propensity score matching, which is usually used to assess the impact of a program is used in this case to address the first objective. PSM is preferred to the traditional regression method in several ways. Among others, PSM compares outcome for observations that share similar observable characteristics. Moreover, PSM only compares households in the common support and excludes others from the analysis.

Procedures of propensity score matching estimation: - The first step in PSM method is estimation of the propensity scores. To get this propensity scores, any standard probability model can be used (for example, logit, probit or multi-nominal logit). 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 the program conditional on X. In estimating the logit model, the dependent variable is Participation in PSNP which takes the value of 1 if a household is participated and 0 otherwise. The mathematical formulation of logit model is as follows:

$$P_i = \frac{e^{zi}}{1+e^{zi}} \quad \text{----------(3)}$$

Where, pi - is the probability of participation

$$z_i = a_o + \sum_{i=0}^{n} a_i x_i + u_i \quad \text{---------- (4)}$$

Where, *i* = 1, 2, 3, - --, n

a_0 = intercept, a_i = regression coefficients to be estimated, u_i = a disturbance term, and x_i = pre-intervention characteristics.

The probability that a household belongs to non-participant is:

$$1- \quad p_i = \frac{1}{1+e^{zi}} \quad \text{---------- (5)}$$

Matching Estimators: - After estimation of the propensity scores, seeking an appropriate matching estimator is the major task of a program evaluator. There are different matching estimators in theory. Below, only the most commonly applied matching estimators are described. These are Nearest Neighbor matching, Caliper Matching, and Kernel Matching.

Region of common support condition: - Common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group (Bryson et al, 2002).The common support region is the area which contains the minimum and maximum propensity scores of treatment and control group households. It requires deleting of all observations whose propensity scores is smaller than the minimum and larger than the maximum of treatment and control, respectively (Caliendo and Kopeinig, 2005).

Testing the matching quality: - The core important point that should be taken care of while doing PSM is balancing test. While differences in covariates are expected before matching, these should be avoided after matching. The primary purpose of the PSM is to serve as a balancing method for covariates between the two groups. Consequently, the idea behind balancing tests is to check whether the PS is adequately balanced. In other words, a balancing test seeks to examine if at each value of the propensity score, a given characteristic has the same distribution for the treatment and comparison groups. The propensity scores themselves serve only as devices to balance the observed distribution of covariates between the treated and comparison groups.

The mean impact of the PSNP program on household Poverty Reduction is given by: -

$$A = \frac{\sum_{j=1}^{p}(y_{ij_1}) - \sum_{i=1}^{np}(y_{ijo})}{p} \text{ ---------- (6)}$$

Where, the post intervention outcome variable of partipant household ***j*** (annual income in Birr per adult equivalent), is the outcome variable of the i^{th} non-participant matched to the j^{th} participant household, P is the total number of participants and NP is the total number of non-participants. Additionally, household total annual income value expressed in Birr per AE was used to measure the change brought by the program on the beneficiary households and P is denomenator because we want to see the impact brought on participants of the program per AE.

Examining treatment effect on the treated: - In addressing the second objective, this study applied a multiple linear regression technique. This is the question of identifying factors that bring heterogeneity in impact of the treatment on the treated. In other words, it would be important to further analyze data to answer the question "why impact of the program varies, if any, among the PSNP households?" The idea is that the effect of the program varies among households due to the beneficiaries own and other characteristics.

The effect of the treatment on the treated was explained by using a standard multiple linear regression model, which is specified as follows:

$$y_i = \beta 0 + \beta_i x_i + U_i \text{ ---------- (7)}$$

Where, yi is magnitude of the impact of the program on beneficiaries expressed in adult equivalent interms of income, β0 is the regression intercept, βi is a vector of regression coefficients to be estimated, Xi is pre-intervention independent variables and Ui is an error term.

RESULT AND DISCUSSION

Estimation Results

This section describes the whole process to arrive at the impact of the program. It explains the estimation of propensity scores, matching methods, common support region, balancing test and sensitivity analysis. It also explains the treatment effect of the program across the participating households.

Propensity score

Propensity score matching (PSM) was applied to deal with the first objective (examine the impact of PSNP on household poverty reduction) of the study. This part presents the results of the logistic regression model employed to estimate propensity scores for matching treatment household with control households. As specified earlier, the dependent variable in this model is binary indicating whether the household was a participant in the PSNP which takes a value of 1 or 0 otherwise. The model is estimated with STATA 14 computing software using the propensity matching algorithm; psmatch2 was used for the estimation purpose. Heteroscedasticity test was conducted using Breusch-Pagen/Cook-Weisberg test before proceeding to impact estimation. Heteroscedasticity problem between variables were checked and the result showed that there is no any problem (see Appendix 3). Similarly, Variance Inflation Factor (VIF) was applied to test for the presence of strong multicollinearity problem among continuous variables (See Appendix 4) and multicollinarity test was done among dummy variables using contingency cofficient (See Appendix 5). The result shows there were no explanatory variables dropped from the estimated model, since no serious problem of multicollinearity were detected from both the VIF and Contigency coefficient results. As indicated in Table 2, out of the fourteen explanatory variables selected, the program participation is significantly influenced by ten explanatory variables such as sex, education, family size, farm size/land size, total livestock unit, fertility, house type, and distance to the extension office, durable assets, and credit. Family size and accessibility of credit had positive and highly significant effect on the decision to the participate in the PSNP program. On contrary, there is a negative relationship between sex, education, land size, livestock, fertility, house type, distance to the extension office and durable assets. Based on the analysis result presented in Table 2, beneficiary households who have relatively large farm size, durable assets and

number of livestock donot have a chance to be targeted by the safety net program. Besides, community members that are literate and have zink sheet house have less chance to be targeted by the program. This is mainly due to the nature of the program in addressing impoversished and disadvantaged members of the society who have less access to the service of extension agent, are illiterate and are living a lower living standard than others.

Table 2

Results of the Logistic Regression Model

Participation	Coefficient	STD Err	Z Values	P≥ (Z) Value
PAGE	.0140134	.02456	0.57	0.568
PSEX	-1.062039	.39387	-2.70	0.007***
PEDU	-.8955187	.38783	-2.31	0.021**
PFAMSIZ	.2485221	.09606	2.59	0.010 ***
DEPRAI	-.4691596	.41186	-1.14	0.255
PLAND	-.7752544	.22415	-3.46	0.001***
PTLU	-.2191548	.10351	-2.12	0.034**
PRFERU	-.721293	.37213	-1.94	.053**
PRINSED	.5571626	.42993	1.30	0.195
PRTYRO	-1.118019	.37008	-3.02	0.003***
DISMAKT	.164132	.09077	1.81	0.071
ES	-.2914086	.10954	-2.66	0.008***
PHDURA	-.0004431	.00017	-2.58	0.010***
CREAC	.8643005	.35544	2.43	0.015***

Cons	2.087235	1.22094	1.71	0.087

Number of obs = 260

LR chi2 (14) = 66.76

Prob > chi2 = 0.0000

Log likelihood = -113.8824

Pseudo R2 = 0.3681

***, ** and * means significant at the 1%, 5% and 10% probability levels, respectively

Source: Own estimation result, 2018

Matching the beneficiary and non-beneficiary households

Before implementing the matching task, the following three steps need to be followed as noted earlier. The first step is to predict the values of propensity scores for all treated and control households. The second step is that a common support condition should be imposed on the propensity score distributions of households with and without the program. As shown in the following Table 3, observations of predicted propensity vary between 0.0534387 and 0.9860659 (mean = .7220052) for the treatment households and between 0 .0056933 and 0.969724 (mean = 0 .2779948) for control households. The common support region would then lie between 0.0534387 and 0.969724. This means, households whose estimated propensity scores are less than 0.0534387 or greater than 0.969724 were not considered for the matching exercise. Before matching the sample size of 260 household were taken (130 from participant and the rest 130 from non-participants). Based on the estimated propensity score, from 260 sample households, only 233 (107 non participant and 126 participant) households were considered in the estimation process. This shows that the study dropped (4 PSNP and 23 non PSNP) more non beneficiary households from the sample in computing the impact estimator.

Table 3

Distribution of Sample Households by Estimated Propensity Scores

Group	N	Mean	STD	Min	Max
Treated households	130	.7220052	.2356543	.0534387	.9860659
Controlled households	130	.2779948	.255367	.0056933	.969724
Total households	260	.5	.3310833	.0056933	.9860659

Source: Own estimation result, 2018

Figure 1

Kernel density of propensity scores

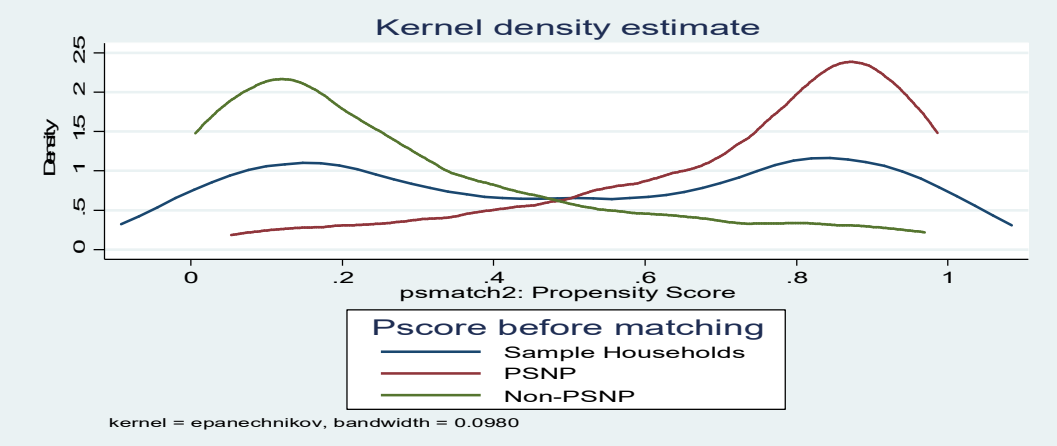

Figure 1 shows propensity score of treated and controlled households. The propensity score of treated households tails to the right of distridution because the probability of those treated into the program is high. Reversely the propensity of controlled houselds tails to the left (Zero) because the propability of being treated into the program is low.

Choice of matching algorithm

Different alternatives of matching estimators were tried to match the treatment program and control households falling in the common support region. The decision on the final choice of an appropriate matching estimator was based on three different criteria First, equal means test (referred to as the balancing test) which suggests that a matching estimator which balances all explanatory variables (i.e., results in insignificant mean differences between the two groups) after matching is preferred. Second, looking into pseudo-R2 value, the smallest value is preferable. Third, a matching estimator that results in the largest number of matched sample size is preferred. Table 4 shows the estimated result of tests of matching quality based on the above mentioned three criteria. Looking into the result of the matching quality, Kernel with band width 0.5 was found to be the best for the outcome indicators for the total annual income per AE. Hence, the estimation results and discussion for this study are the direct outcomes of the Kernel with band width 0.5.

Table 4

Comparison of Performance of different matching estimator for annual income per AE

	Performance criteria		
Matching estimator	Balancing Test*	Pseoudo-R2	Matched Sample
Nearest neighbor			
NN (1}	11	0.064	231
NN (2)	12	0.056	23
NN (3)	11	0.067	231
NN (4)	13	0.069	231
Radius Caliper			
0.1	14	0.041	100
0.25	14	0.052	115

0.5	13	0.117	163
Kernel Match			
Band Width 0.1	12	0.088	233
Band Width 0.25	12	0.080	233
Band Width 0.5	14	0.074	233

Source: Own estimation result, 2018

Testing the Balance of propensity score and covariates

Table 5 shows the balancing test of covariates, before and after the matching. As the Table indicates, program and non-program households were significantly different in terms of certain pre-intervention characteristics. However, these differences were removed after the matching was conducted. By using kernel matching with band width of 0.5 all variables are insignificant. Because of after matching the significance mean difference between treated and controlled households before matching become insignificant (See Appendex 6).

Table 5

Balancing tests of covariates

Variable	Before match (260)			After Match (233)		
	Treatment	Control	T-Value	Treatment	Control	T-Value
	(N=130)	(N=130)		(N=126)	(N=107)	
PAGE	41.15	42.28	0.48	41.15	39.67	1.51
PSEX	0.64	0.81	-2.88***	0.66	0.70	-0.73
PEDU	0.2	0.37	2.32**	0.21	0.25	-0.78
PFAMSIZ	6.25	5.97	2.70***	6.21	6.09	0.53
DEPRAI	0.79	0.76	-0.90	0.79	0.90	-1.87

PLAND	1.21	1.93	-3.80***	1.23	1.42	-1.75
PTLU	1.97	3.46	-2.42**	1.98	2.10	-0.57
PRFERU	0.49	0.80	-2.21**	0.51	0.61	-1.65
PRINSED	0.19	0.16	1.41	0.20	0.23	-0.52
PRTYRO	0.22	0.56	-3.22***	0.22	0.28	-1.00
DISMAKT	4.47	4.49	2.21	4.44	4.16	1.07
ES	3.18	3.98	-2.88***	3.20	3.29	-0.43
PHDURA	615	1411.55	-2.52***	629	811.73	-1.53
CREAC	0.68	0.49	2.81***	0.67	0.64	- 0.53

Source: Own estimation result, 2018

***, ** and* means significant at 1%, 5% and 10% probability levels, respectively.

Treatment effect on the treated

In this section, evidence is provided as to whether or not the PSNP has brought significant changes on household poverty reduction. The estimation result presented in Table 6 provides a supportive evidence of statistically significant effect of the program on household poverty reduction measured in total annual income households per AE. It has been found that, on average, the program has increased annual income of the participating households by 1,164 annual income hhs per AE. Stated in other words, the program has increased annual income per AE of the participating households nearly 7%.

Table 6

Average treatment effect on the treated (ATT)

Variable	Sample	Treated	Controls	Difference	S.E	T-Stat
Annual income						
HHs per AE	ATT	8,269.50	7,105.78	1,163.72	580.06	2.01**

Source: - own estimation result, 2018

** Significant at 5% probability level

Factors influencing treatment effect on the treated

In this section, the project‘s impact on the outcome variables annual income of households per AE is evaluated for their significant impact on participant households after the pre-intervention differences were controlled. Factors influencing the treatment effect on the treated were identified using multiple regression models and the main objective here is to examine if the effect of the program varies among the households in the treatment group. Before estimating the model, data was checked for occurrence of strong multicollinarity problem (see Appendix 6) as it was described earlier; there were no strong multicollinarity problems existing among the explanatory variables. The dependent variable of the multiple regression models was the amount of additional annual income for the beneficiary households compared to their comparable households in the non-beneficiary households. In other words, 126 beneficiary households were used in the analysis estimation of the multiple regression models.

The estimated multiple regression results suggest that the effect of PSNP on the treatment households is not uniform and this suggested that the effect of the treatment appears to have a strong relationship with education, family size of the households, dependency ratio, land size of the households, fertilizer use and distance from the extension service office.

Education level attained is significant and has a positive relationship with annual income per adult equivalent (AE). The positive relationship of education level shows that the change of education level from illiterate to literate households would increases annual income per adult equivalent by 1,423 birr. The plausible reason is that households with better level of education are more active in accepting new technologies, have better capacity to manage own resources, and can allocate and use them properly. The results of this study agree with the findings of Ayalnah et al. (2012).

The result of study shows that household family size in adult equivalent has negative impact on annual income per AE. The estimated coefficient shows that an increase in one family size households per AE leads to decrease of the annual income per AE by nearly 275 birr. The possible reason is that the large family size of household members are children and high dependency ratio in the household implies more mouth to fed leading to decrease of annual income per AE and increased poverty (Anwar, 2015).

Dependency ratio of households has significant and negative impact on annual income per adult equivalent. Controlling for all other factors, an increase in one dependency ratio of households per AE leads to decrease of the annual income of households per AE by 905 birr. A household with more economically inactive labor force consuming more available resources is more likely to be in poverty (Mequanent, 2009).

The model result on table , shows that the size of land cultivated has a significant and positive influence an annual income per AE. The estimated coefficient for size of cultivated land by households implies that other things kept constant, increasing land size by one hectare per AE increases annual income per AE by nearly 646 birr. The reason why increasing land size leads to increase of income is because it results in flexiblity in their production patterns, diversification of crops and increased capacity to bear risks increaseing the annual income of the households and reducing poverty. The same finding was obtained by Abiyot (2012).

The result of study shows that Fertilizer use has significant and positive impact on annual income. The result of the study shows that the increasing fertilizer usé per unit hectare leads to increasing annual income per AE by 1062 birrs. The reason why using fertilizer increases incomeof households per AE is because

fertilizer makes cultivated land rich in mineral leading to high production yields per unit of hectare.

Table 7 indicates that distance from extension service has significant and negative impact on income of households per AE. The increment of one Km distance from extension service, leads to decrease of the household annual income of households per AE by 414.50 birr. Households that are far from extension service become influenced more than those households which live nearest to extension service in getting better extension service to increases annual income of the households. The possible reason might be that households that live nearest to development agency have better chance to adopt technology and get better skill on how apply and can get additional income. This finding of the study similar with Berhane et al. (2011).

Table 7

Results of the Multiple Linear Regression Model for Annual income hhs per AE

Variables	Coef.	Std. Err.	T
PAGE	-37.57	27.88	-1.35
PSEX	-315.54	465.49	-0.68
PEDU	1423.20	500.79	2.84***
PFAMSIZ	-274.71	126.50	-2.17**
DEPRAI	-905.09	429.96	-2.11**
PLAND	645.75	295.29	2.19**
PTLU	-300.32	186.42	-1.61
PRFERU	1061.55	489.92	2.17**
PRINSED	220.98	588.18	0.38
PRTYRO	425.05	575.34	0.74
DISMAKT	115.56	128.12	0.90

ES	-414.46	207.69	-2.00**
PHDURA	-0.396	0.2694	-1.47
CREAC	-178.88	520.15	-0.34
Cons|	12,411.99	1457.64	8.52

Sample size	126
R2	0.30
Adjusted-R2	0.22
F (14,111)	3.47***

Source: Own estimation result, 2018

*** And ** means significant at 1% and 5% probability levels, respectively.

Conclusions and Recommendations

Conclusions

In this study the impact of PSNP on household poverty reduction has been studied using cross-sectional data from kuyu District of Oromia Regional State. The main research question of the study was "what would the poverty reduction status in annual hhs per AE of households have been, had the program not been implemented?" Answering this question requires observing outcomes with-and-without the program of the household.

Finding a reliable estimate of the program impact thus necessitates controlling for all such factors adequately. In doing so, propensity score matching has resulted in 126 program households to be matched with 107 non-program households using Kernel bandwidth 0.5 and a matched comparison of outcomes was performed on the households that shared similar pre-intervention characteristics except the program participation effect. The result showed that, the PSNP has significantly raised annual income of participating households per AE by 1164 birr in the study area.

The empirical analysis confirmed that, there is significant difference in the level of impact among the beneficiaries and household with educated household, with better land holding size, location near extension agent office, Low dependency ratio and low family size benefiting more from the programs impact on household poverty reduction.

Recommendations

Based on the empirical findings of the study, the following policy recommendations are forwarded. First, the finding in this study provide evidence that PSNP played a key role in improving household annual income in rural areas. Policy makers can encourage and support interventions like this. Policy makers' incorporation family planning program into PSNP is crucial because having small family Size and dependency ratio increases impact of the program on household poverty reduction. Increasing level of education of households makes them more active in accepting new technologies, effective better in managing their own resources, and allocating and using them properly. Hence, the program should include education to enhance income of the households and household poverty reduction. Most of the program participants were male-headed households. Hence, the program should incorporate more female-headed households or at least in the same proportion as that of the male-headed households. Provision of improved agricultural extension should also be considered because better access to agricultural extension service results in better tendency for the program participants to utilize the provided information to enhance production and productivity that has impact on household poverty reduction.

Area of future research

This study is a cross sectional study which is a one-time snapshot and did not enable us to see the dynamics of the impact of the PSNP. Hence, studies using propensity score matching data of sample households are recommended to show the impact of the program. So, further research using much larger sample size (more than one cross sectional data) and qualitative data in addition to the quantitative one are recommended to provide further insight into the impact of the program.

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APPENDICES

Appendix 1: Conversion factor of Tropical Livestock unit (TLU)

Livestock categories	TLU	Livestock categories	TLU
Ox	1	Horse	1.1
Cow	1	Sheep (Adult)	0.12
Woyefen	0.34	Sheep (Young)	0.06
Heifer	0.75	Goat (Adult)	0.13
Calf	0.25	Goat (Young)	0.06
Donkey (Adult)	0.7	Hen/Chicken	0.013
Donkey (Young)	0.35	Camel	1.25

Source: Storck, et al., 1991

Appendix 2: Conversion Factor for Adult-Equivalent (AE)

Age Group	Male	Female
<10	0.6	0.6
10-13	0.9	0.8
>13	1	0.75

Source: Storck, et al., 1991

Appendex 3: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
        Ho: Constant variance
        Variables: PAGE PSEX PEDU PFAMSIZ DEPRAI INCOMEAE PLAND PTLU PRFERU PRINSED PRTYRO DISMAKT ES
                   PHHDURAB CREDACC

        chi2(15)     =    18.10
        Prob > chi2  =   0.2572
```

Source:Own estimation result, 2018

Appendex 4: Multicollinearity test for countinuous explanatory variables

Variable	VIF	1/VIF
PLAND	1.45	0.689021
DEPRAI	1.43	0.698699
PTLU	1.40	0.712285
PAGE	1.35	0.739978
DISMAKT	1.31	0.764760
ES	1.27	0.785399
PHHDURAB	1.21	0.828026
PFAMSIZ	1.17	0.851540
Mean VIF	1.33	

Source:Own estimation result, 2018

Appendex 5: Contigency coefficient among Dummy explanatory variables

e(V)	PSEX	PEDU	PRFERU	PRINSED	PRTYRO	CREDACC	_cons
PSEX	1.0000						
PEDU	-0.0094	1.0000					
PRFERU	-0.1670	-0.0401	1.0000				
PRINSED	0.0633	-0.0886	-0.0713	1.0000			
PRTYRO	0.0616	-0.0981	-0.2595	0.0120	1.0000		
CREDACC	-0.0093	0.0712	0.0077	-0.0893	-0.0688	1.0000	
_cons	-0.5600	-0.2016	-0.3371	-0.1213	-0.1621	-0.4342	1.0000

Source:Own estimation result, 2018

Appendex 6:- Results of the Balancing tests of Covariates Using Kernel band width 0.5 Estimator after matching (Source: own estimation result 2018)

Variable	Mean Treated	Control	%bias	t-test t	p>|t|	V(T)/ V(C)
_pscore	.71376	.58896	50.8	4.03	0.000	0.84
PAGE	41.151	39.665	18.0	1.51	0.133	1.06
PSEX	.65873	.7019	-9.8	-0.73	0.464	.
PEDU	.20635	.24754	-9.3	-0.78	0.437	.
PFAMSIZ	6.2143	6.0864	6.8	0.53	0.596	1.07
DEPRAI	.78889	.90102	-23.5	-1.87	0.062	0.96
PLAND	1.2292	1.4199	-23.4	-1.75	0.081	1.12
PTLU	1.9857	2.1027	-6.1	-0.57	0.567	0.70*
PRFERU	.50794	.61091	-22.7	-1.65	0.100	.
PRINSED	.19841	.22551	-7.1	-0.52	0.600	.
PRTYRO	.22222	.27699	-12.0	-1.00	0.317	.
DISMAKT	4.4444	4.1647	13.1	1.07	0.285	0.78
ES	3.1984	3.285	-4.7	-0.43	0.670	1.16
PHHDURAB	629	811.73	-17.4	-1.53	0.128	0.91
CREDACC	.6746	.64278	6.5	0.53	0.596	.