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Impact of productive safety net program on household food security in Southern Ethiopia: Propensity score matching results

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The study analyzed the impact of productive safety net program (PSNP) on household food security in drought-prone areas of Southern Ethiopia. A cross-sectional survey data were collected from 180 randomly sampled households. The study analyzed descriptive and logit econometric model data results. A propensity score matching (PSM) technique was used to estimate the inferential data results. The study findings show that the PSNP improved the food consumption status of beneficiary households as compared to that of the non-beneficiaries by improving food availability and stability of access and utilization of food. However, the impact varied with the PSNP intervention's the household accessed. Those who participated in household asset building programs besides transfer significantly improved their food security status and assured food consumption over the drought years. Also, these households' food stock and stability over time improved. The study concludes that the delays in resource transfers, lack of tailored support and limited coverage of households were the drawbacks to the effectiveness the program. Thus, timely transfer of safety net resources, targeting more households and locations are needed to scale up the program's impacts in the future. Also, broader country level study is required to document PSNP impacts.

Key words: Household food security, PSNP, PSM, droughts, Ethiopia.

INTRODUCTION

Meeting food requirements of the growing population is one of the major policy concerns and challenges in contemporary Ethiopia. Despite government efforts, and the flow aid from global actors on household food security, especially in drought affected areas, food insecurity is persistent problem (Birhanu, 2009; Tasew and Tariku, 2022). In resource scarcity, and growing impact of droughts and climate change, households spend 72 – 75% of their income on food, and the remaining portion of income is not enough to build assets or recover from shocks (UN, 2010, Pradhan and Rawlings, 2002; Tareke, 2022). Because of the recurrent

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drought shocks, and inability to recover from, households in drought-prone areas live in vicious circle of poverty, and undoing the vicious cycle has been problematic for households (Haan et al., 2006; Zerhun, 2020). According to UN OCHA and World Bank situation reports, every year, not less than 7 million live in food aid in Ethiopia, and more than 10 million benefits from safety net related programs (UN, 2010; Pradhan and Rawlings, 2002; Tasew and Tariku, 2022) and such context is exacerbated by influx of refugees, internal displacements, conflicts and wars in Ethiopia (Abdi et al., 2023).

Starting in 2005, the Government of Ethiopia and a consortium of donors implemented a new form of safety net that is the PSNP. It reaches more than 7 million people and operates with an annual budget of nearly 500 million USD (Gilligan et al., 2008; Gashaw and Seid, 2019; Abdulhakim et al., 2022). According to Gilligan et al. (2008), the PSNP is complemented by a series of food security activities, collectively referred to as the Other Food Security Program (OFSP) (Abdi et al., 2023; Abraham, 2020; Ahmed and Burhan, 2018). Beneficiaries of the OFSP receive at least one of several productivity-enhancing cash transfers or services, including access to credit, agricultural extension services, technology transfer (such as advice on food crop production, cash cropping, livestock production, and soil and water conservation), and irrigation and water harvesting schemes. While the PSNP is designed to protect existing assets and ensure a minimum level of food consumption, the OFSP is designed to encourage households to increase income generated from agricultural activities and build assets. Drought-affected areas of Southern Ethiopia have been the beneficiaries PSNP from starting February 2005, yet studies on the evaluation of the impact of PSNP focused on Northern and Eastern Ethiopia (Kaleab et al., 2014; McLaughlin et al., 2023; Paulos and Melese, 2018). This study aims to fill both the empirical and policy practice gaps related to PSNP intervention impacts in Southern Ethiopia.

LITERATURE REVIEW AND ANALYSIS FRAMEWORK

Food security is conceptually understood at the global, regional, national, sub-national, community, group and household levels, and the concept is widely used since early 1970s (Gilligan et al., 2008, Tefera, 2009; Diriba et al., 2017; Feyisa, 2022). The study of food security focused on food supply-demand factors, and has been conceptualized as the achievement of 'national food self-sufficiency', and this conceptualized was rooted on the concept of food availability (Bonfiglioli, 2009; Hailu and Amare, 2022). However, the concepts of food access (including entitlements), utilization (nutrition) and food stability (sustainability) were included in the conceptualization equations (UN, 210; Rivera and Qamar, 2003; UN, 2010, Pradhan and Rawlings, 2002; Zerhun, 2020). Overtime, studies indicated that food availability without entitlements (Devereux, 2000; Del-Ninno et al., 2004), food access and utilization without nutrition (FAO, 2009; Tareke, 2022), and instability of the food in the continuum do not necessarily ensure food security at all levels (Khasnobis et al., 2007; Dagne, 2010; Haan et al., 2006; Tasew and Tariku, 2022). Also, food self-sufficiency at all levels was not possible due to contextual and institutional factors, and food security of households could be attained from production, exchange, and aid, that expand entitlements at diverse states of food demand and the leverage to ration food in the context of supply constraints (Tirame, 2008; Paulos and Melese, 2018). Thus, in terms of entitlement factors, studying food security at household level is argued to generate useful policy information on this critical unit of production and consumption, and a unit target for food aid, transfers and support for recovery from shocks such as droughts (Bonfiglioli, 2009; Hoddinott, 1999a, 1999b; Birhanu, 2009; Raisin, 2003; Feyisa, 2022). The government of Ethiopia, with its development partners, initiated the PSNP with aim of achieving poverty reduction through redistribution (transfer of resources), and mitigating shocks such as droughts and ensure recovery by asset building and create a fallback in the context of unforeseen consequences of shock dynamics of rural farm livelihoods (Besley et al., 2003; Gilligan et al., 2008; FAO, 2009; Shimelis, 2009; Hailu and Amare, 2022).

PSNP is also aimed to respond to chronic hunger through emergency appeals towards a more predictable response with predictable resources for a predictable problem (Andersson, 2009; Abdi et al., 2023), and providing smallholder farmers with greater flexibility over consumption decisions and stimulate the development of rural markets (Mendola, 2007; Abraham, 2020). Thus, the rationale of the PSNP was to bring smallholder farmers in shock and crisis contexts to recovery, and the gradual shift of the country's system dominated by emergency humanitarian aid to a productive and protective safety net system through multi-year resourcing framework (FAO, 2009; Tirame, 2008; Ahmed and Burhan, 2018) and through collective engagement and cooperation of development actors including donors (Haque and Andrew, 2004; Haan et al., 2006; Mendola, 2007; Gashaw and Seid, 2019).

The program addresses immediate human needs while simultaneously, according to Abdulhakim et al. (2022): (i) supporting the rural transformation process, (ii) preventing long term consequences of short-term consumption shortages, (iii) encouraging households to engage in production and investment, and (iv) promoting market development by increasing household purchasing power (Guo et al., 2004; Andersson et al., 2011; Girmay, 2020). By integrating with food security programs, PSNP targeted chronically food insecure households in Southern Ethiopia (Andersson, 2009; Sharp et al., 2006; Sarah et al., 2011; Gilligan et al., 2008; Devereux and

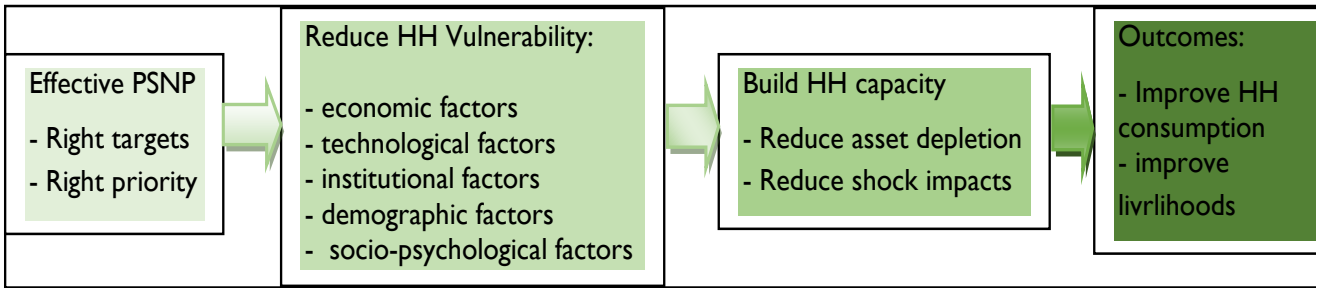

Figure 1. Conceptual framework of the study.
Source; Author's own sketch from review literature (2023).

Guenther, 2007; Shimelis, 2009; Andualem, 2020). As empirical studies show the PSNP saved assets and lives of millions of households in drought prone areas of Ethiopia though the expected outcomes of the intervention were not fully achieved (Tirame, 2008; Gilligan et al., 2008; Azadi et al., 2017; Bahru et al., 2021). From theoretical, policy and empirical literatures reviewed above, the analytical lens is framed (Figure 1).

The PSNP aims to provide „predictable transfers to meet predictable needs". Chronically food insecure households should receive support for six months each year for up to five years, bridging their annual food consumption gap, protecting their assets against „distress sales" and building their resilience against shocks. Transfers are delivered through two components. The Public Works Program" provides temporary employment to the majority of PSNP participants (84% in 2008), on rural infrastructure projects such as road construction. „Direct Support" delivers unconditional transfers to the minority of participants (16% in 2008) in households with no able-bodied members. Complementary programs such as "livelihood packages" should generate secondary streams of income, until the household is assessed as "food sufficient" and ready to "graduate" from dependence on transfers. In this respect, PSNP, according to Kaleab et al. (2014) and McLaughlin et al. (2023) serves multiple policy and social protection as well as environmental objectives (Andersson et al., 2011; Girmay, 2020; Gashaw and Seid, 2019; Abdulhakim et al., 2022).

Although emergency relief would continue to be required in years of severe shocks, if the PSNP is successful, then, millions of people would be removed from the annual emergency appeal process, and there would be a gradual shift towards a flexible multi-year safety net that expands and contracts according to need (Tirame, 2008; Paulos and Melese, 2018).

As indicated in the framework above, effective implementation of the PSNP was affected by economic, institutional, technological, socio-psychological, demographic and vulnerability factors, which will further impact the dynamics in household food availability, access, utilization and its stability over time while also improving food consumption.

MATERIALS AND METHODS: PSM ESTIMATION

The research approach, design and methods

The study employed quantitative approach, and an experimental research design. The quantitative data were analyzed using both descriptive statistical tools and econometric models. The descriptive statistics analyzed included mean, variance, standard deviations, percentages and chi-square test results. These data sets were used to assess the socio-economic situation of the respondents in regard to benefits from the PSNP, including targeting.

The inferential statistics analyzed in the study was estimated by PSM model. The motivation to use the PSM methods emanated from the dimensionality of the variables observed in this study. With a small number of characteristics (for example, two binary variables), matching is straight forward (one would group units in four cells). However, when there are many variables, it is difficult to determine along which dimensions to match units or which weighting scheme to adopt. Propensity score-matching methods, as we demonstrate, are especially useful under such circumstances because they provide a natural weighting scheme that yields unbiased estimates of the treatment impact (Shimelis, 2009; Raisin, 2003; Wooldridge, 2016). PSM could also give unbiased evidence and policy information, in the context of impact evaluation and will better inform policy decisions (Shimelis, 2009; Wooldridge, 2016).

Using PSM constructs a statistical comparison group by matching non-beneficiaries to beneficiaries using observable characteristics from before the program that are correlated with the probability of being in the program and with the outcome variables of interest. The method better estimates impact and predict the probability of each household receiving the PSNP on a sample of PSNP beneficiaries and non-beneficiaries. Each beneficiary household is then matched to one or more non-beneficiary households based on having a similar estimated probability of being in the program, or "propensity score." Using this sample of matched beneficiaries and non-beneficiaries the impact estimate is then constructed as the average difference in beneficiary outcomes and a weighted average non-beneficiary outcome, using the propensity scores to construct the weights (Gilligan et al., 2008; Wooldridge, 2016).

This PSM also 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 has (almost) the same likelihood of participating into the PSNP (Rosenbaum and Rubin, 1983; Wooldridge, 2016). In this study, the PSM is estimated as follows.

The first step in PSM method is to estimate the propensity scores. 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. If outcomes without the intervention are independent of participation given X, then they are also independent of participation given P(X) (Shimelis, 2009; Wooldridge, 2016). In other words, PSM matches each participant household with a non-participant household that has (almost) the same likelihood of participating into the program. This reduces a multidimensional matching problem to a single dimensional problem. In the case of the study in hand, control groups (non-users) are those who pass the criteria to be chosen or eligible for the program.

A logit model was used to estimate propensity scores using a composite of pre-intervention characteristics of the sampled households (Rosenbaum and Robin, 1983; Wooldridge, 2016) and matching was then performed using propensity scores of each observation. In estimating the logit model, the dependent variable is participation in PSNP, which takes the value 1 if the household participated in the program and 0 otherwise. The mathematical formulation of logit model is as follows:

$$\mathrm{pi} = \frac{e^{zi}}{1+e^{zi}} \quad \text{.......................} \quad (1)$$

Where, Pi is the probability of participation,

$$Zi = a_0 + \sum_{i=1}^{n} \mathrm{aiXi} + \mathrm{Ui} \quad \text{.......................} \quad (2)$$

Were,

i = 1, 2, 3, - --, n
a0 = intercept, ai = regression coefficients to be estimated, Ui = a disturbance term, and Xi = pre-intervention characteristics.

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

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

The logit model via the PSM generates better estimation results including in the case of predictor/explanatory variables, that is, the participation in the PSNP and the outcomes (Rosenbaum and Robin, 1983; Bryceson et al., 2002; Niguse, 2010; Wooldridge, 2016). Though several factors affect the selection of predictor variables, this study identified explanatory variables of the logit model and data from the program document and field observation. The study included as many explanatory variables as possible to minimize the problem of unobservable characteristics in evaluation of the impact of the program.

The matching estimators, region of common support condition and balancing tests

In this sub topic, the matching estimators, the region of common support condition and balancing tests were presented. Regarding matching estimators, all matching estimators analyze the outcome of a treated individual with outcomes of the comparison. In this respect, the PSM estimators differ: (1) in the way the neighborhood for each treated individual is defined and the common support problem is handled, and (2) in respect to the weights assigned to these neighbors (Chen and Krissey, 2008; Wooldridge, 2016). A major task of program evaluator after estimating the propensity scores is seeking the appropriate matching estimator. Out of the matching estimations available in existing theories, Nearest Neighbor (NN), the Caliper Matching, and the Kernel Matching, including the justifications, were selected as follows.

The nearest neighbour matching

The NN matching is the most straightforward matching estimator (Caliendo and Kopeing, 2008; Wooldridge, 2016). It considers a matching partner for a treated individual that is closest in terms of propensity score. In this matching, the participants and non-participants are randomly ordered in line with the closest propensity score (Guo et al., 2004; Dehejia and Wahba 2002). The result in increased quality of matches and decreased precision of estimates depend on NN matching without replacement, a comparison individual can be used only once. In cases where the treatment and comparison units are very different, finding a satisfactory match by matching without replacement can be very problematic (Dehejia and Wahba, 2002; Shimelis, 2009). Therefore, by matching without replacement, when there are few comparison units similar to the treated units, the match is conducted among the treated units to comparison units that are quite different in the estimated propensity score.

Caliper matching

The NN matching faces the risk of bad matches if the closest neighbor is far away (Caliendo and Kopeinig, 2008; Wooldridge, 2016). In this case, by imposing a tolerance level on the maximum propensity score distance (or calipers), the caliper matching is used as one form of imposing a common support condition. Applying caliper matching considers a matching partner for a treated individual that lies within the caliper ('propensity range') and is closest in terms of propensity score. However, it is difficult to know *a-priori* what choice for the tolerance level is reasonable (Suresh, 2009; Caliendo and Kopeinig, 2008). A benefit of caliper matching is that it uses only as many comparison units as are available within the calipers, allowing for the use of extra (fewer) units when good matches are (not) available (Dehejia and Wahba 2002;) and the smaller the size of the neighbourhood the better is the quality of the matches (Besley et al., 2003; Niguse, 2010).

Kernel matching

The Kernel matching considers all treated units matched with a weighted average of all controls with weights which are inversely proportional to the distance between the propensity scores of treated and controls (Besley et al., 2003; Wheeler-Sabates and Devereux, 2009; Wooldridge, 2016). Kernel weights the contribution of each comparison group member so that more importance is attached to those comparators providing a better match. In this matching, the use of the normal distribution (with a mean of zero) as a kernel weight is attached to a particular comparator, and is considered proportional to the frequency of the distribution for the difference in scores observed (Bryceson et al., 2002). The drawback of this method is that bad matches could be used as the estimator includes comparator observations for all treatment observation (Caliendo and Kopeinig, 2008; Wooldridge, 2016). Thus, a proper imposition of the common support condition is of major importance for kernel matching and a practical objection to its use is that it will not be obvious how to set the tolerance. According to Mendola (2007), a kernel with 0.25 band width is most commonly used.

Regarding the region of common support condition, according to Bryceson et al. (2002), imposing common support condition ensures that any combination of characteristics observed in the treatment group can also be observed among the control group. The common support is the region where the balancing score has positive density for both treatment/beneficiary and control/non-beneficiary units. No matches can be formed to estimate the TT parameter (or the bias) when there is no overlap between the

Table 1. Variable definition and measurement.

Definition of factors	Types and definition	Measurement	Hypothesis
Dependent variable (PSNP positively impact on participant, and no for none participant of PSNP)			
Participation in PSNP	Dummy, participation in the PSNP	1 if yes, 0 otherwise	**+/-**
Vulnerability factors (HH capacity/buffer shock impacts and recover)			
Sex of HHH	Dummy, sex of household head	1 if male, 0 otherwise	**+/-**
Family size of participant HH	Numerical, household size	Number, family members	**-**
Land size of participant HH	Numerical, landholding size	HH land size in hectares	**+**
Participant HH dependency ratio	Numerical, in-active vs. active labor	Ratio	**-**
Participant HH access to credit	Dummy, participation in credit	1 if yes, 0 otherwise	**+**
Participant HH access to farm extension	Dummy, extent of participation	1 if yes, 0 otherwise	**+**
Participant HH use of improved seed	Dummy, use of improved seed	1 if yes, 0 otherwise	**+**
Participant HH use of inorganic fertilizer	Dummy, use of fertilizer	1 if yes, 0 otherwise	**+/-**
Food consumption assuring outcome variable			
Household's food secure months	Numerical, i food secure months	Number of months	**+**
Household's secure child monthly meal	Numerical, in number of children meal	Number of months	**+**
Household's food transfer from relatives	Numerical, food from relatives	in category	**+**
Household's wage/job employment	Dummy, wage/job in pick farm seasons	1 if yes, 0 otherwise	**+**

Source: Researcher's hypotheses summary, 2023.

treatment and control groups. The author defines the region of common support by dropping observations below the maximum of the minimums and above the minimum of the maximums of the balancing score. The overlap condition for persons with the same x value in X are allowed to have a positive probability of being in treated and control group. The inferences were made based on sufficient data. Unlike ordinary regression, we don't extrapolate outside the range of the observed data points (Chen and Krissey, 2008).

Regarding the balancing test, the two-sample t-test can be used to check if there are significant differences in covariate means for both groups. Before matching, differences between the groups are expected; but after matching, the covariates should be balanced in both groups and hence no significant differences should be found. The t-test might be preferred if the evaluator is concerned with the statistical significance of the results (Caliendo and Kopeinig, 2008; Wooldridge, 2016). Finally, using predicted probabilities of participation in the program (that is, propensity score) match pairs will be constructed using alternative methods of matching estimators. Then the impact estimation is the difference between simple mean of outcome variable of interest for beneficiary and non-beneficiary households. In this case, the mean stands for household asset protection in birr and changes in food consumption six years. The mean impact of PSNP on asset prevention and food consumption assurance of household is given by;

$$\Delta C = \frac{1}{N_T} \sum_{i \varepsilon \{D=1\}} \left[y_1, i - \sum_j w(i,j)\, y_0, j \right] \quad \ldots\ldots\ldots\ldots \quad (4)$$

Were,

ΔC is average mean of the treatment of treated, y is out come variables $0< w(i,j) \leq 1$ and $\{D=1\}$ is the set of treated individuals, j is an element of the set of matched comparison units, N_T is the number in the treated group, i is treated individual. Thus, different matching estimators are generated by varying the choice of $w(i,j)$. The independent variables were identified as a combination of vulnerability, economic, demographic, institutional, technology, and socio-psychological factors. The dependent variable is the participation of households in the PSNP. The outcome variables identified were improvements in household food consumption and prevention of asset depletion in the context of droughts and shocks in the study area. The variables were presented in Table 1.

DATA RESULTS

Descriptive data results and analysis

The data results are presented in two sections. The first section provides descriptive statistics and analysis, which were computed from responses of PSNP beneficiaries over the last six years, along with a comparison to non-beneficiary households. This descriptive statistics section primarily focuses on respondent characteristics. Descriptive statistical methods were employed to analyze program performance in accordance with the program implementation manual and to assess the achievements in community asset development. In this study, various descriptive statistics were utilized to analyze the household data. Table 2 presents the means and standard deviations of sample households' characteristics. This section of the analysis was conducted based on the pre-intervention characteristics of the households.

In this sub section, the first set of data results were

Table 2. Descriptive analysis of sample household pre-intervention characteristics.

Pre-interv. variable	Sample HH (N=180)		PSNP HH (N=120)		Non-PSNP HH (N = 60)		Difference in		T
	Mean	STD	Mean	STD	Mean	STD	Mean	SE	
SEXHH	0.94	0.22	0.95	0.21	0.93	0.25	0.016	0.036	-0.45
LITERHHH	1.68	0.69	1.6	0.61	1.85	0.81	0.25	0.10	2.29**
HHTARG	2.38	0.73	2.35	0.78	2.46	0.62	0.11	0.11	1.00
FAMSIZEHH	7.56	3.02	7.19	2.70	8.3	3.5	1.10	0.47	2.34**
HHACRED	0.5	0.50	0.52	0.50	0.45	0.50	-0.075	0.07	-0.94
HHIFETUSE	0.75	0.43	0.78	0.41	0.7	0.46	0.08	0.068	-1.22
HHISDUSE	0.5	0.51	0.49	0.50	0.51	0.53	0.025	0.08	0.30
HHLDSIZE	1.36	0.89	1.09	0.65	1.59	1.17	0.50	0.13	3.66***
HHAEXSERV	3.63	0.88	0.72	0.75	3.45	1.08	-0.27	0.13	-1.98**
DEPRHH	1.23	0.94	1.26	0.99	1.17	0.86	0.91	0.15	-0.61

*** and ** means significant at the 5 and 10% probability levels, respectively.
SEXHH = Age of household head, LITERHHH = Literacy of household head, FAMSIZEHH = Family size of the household, HHTARG = Household targeted by the PSNP, HHACRED = target household's access to credit, HHIFETUSE = Household's inorganic fertilizer use, HHISDUSE = Household's use improved seed, HHLDSIZE = Household's farm land size, HHAEXSERV = Household's access to extension service, DEPRHH = Dependency ratio in the household.
Source: Own survey data, 2023.

presented and analysed on the pre-intervention characteristics of sample households. As stated in the Table 2 the descriptive results show that there were presented and analysed on the pre-intervention characteristics of sample households. As stated in the Table 2 the descriptive results show that there were statistically significant differences between PSNP beneficiary and non-beneficiary households before intervention. The number of pre-intervention characters which show no statistically significant difference were; sex, age, family size, dependency ratio, use of fertilizer and improved seed. This indicates that most households were in the similar demographic and technology use status before program intervention in the study area. The main differences between the two groups of households were observed with respect to land size, Literacy level and extension service before the intervention. Compared to non-beneficiary households, beneficiary households have smaller size of land, law level of education and have got better access to the extension service.

The analysis shows that, beneficiary respondents were less educated than non-beneficiaries. As indicated in Table 2, the beneficiary households were more illiterate than non-beneficiary households. These implies that due to their education status, non-beneficiaries were in better food security level which made them to not be included in the program during targeting was carried out. Crop production requires primarily the availability of sustainable land. The total cultivated land of beneficiary and non-beneficiary households ranges from 0.13 to 4.5 ha. The land holding of beneficiary respondents ranges from 0.13 ha to 4.0ha and non-beneficiaries ranges from 0.25ha to 4.5 ha. Mean land holding of total respondents, beneficiaries and non-beneficiaries was 1.36ha, 1.09ha and 1.59ha respectively. It indicates that the average land holding difference in between two groups is 0.5ha. This indicates that, the average land size of beneficiary respondents was smaller than non-beneficiary groups. Large land size favored crop production of non-beneficiaries before program intervention which made them better-off during targeting. The analysis also declared that beneficiary households were more accessible to extension service than non-beneficiaries. The continuous contact to extension workers made the beneficiary group to be known as food insecure households since these development agents were constant members and main actors of the beneficiary targeting in PSNP implementation.

The second set of data results presented and analysed in the sub section are the impact of PSNP on asset building (protection of household asset depletion from the droughts and related shocks) The PSNP intervention outcomes were classified in to two categories for the purpose of this study. Household asset prevention and assurance of household food consumption were major outcomes studied and also of the program. Household asset prevention was measured by using four major outcomes namely, livestock holding, farm income, expenditure in housing and expenditure on farm tools and equipment. Assurance of food consumption of household was measured using outcomes: decrease in food insecure months, change in number of children meal per day, wage employment in peak farming season by adult members of family and decrease in food transfer from relatives. The descriptive statistics analysis declared that as there is statistically significant difference in between beneficiary and non-beneficiary groups in three outcomes namely livestock holding, farm income and expenditure in housing. According to the result, there is difference in expenditure on farm tools and equipment with mean

Table 3. Current asset prevention and food consumption situation of sample households.

Outcome variable	Sample HH (N=180)		PSNP HH (N=120)		Non-PSNP HH (N = 60)		Difference in Mean		
	Mean	STD	Mean	STD	Mean	STD	Diff	SE	T
HHLOTLU	3.35	2.16	4.09	2.13	1.87	1.26	2.21	0.29	7.40***
HHEXPH	5206	9086	6375	10324	2868	5212	3507	1416	2.47**
HHEXPEQ	1847	2384	1870	2350	1800	2471	70	378	0.18
HHTFI	3647	5108	4539	5873	1863	2181	2675	784	3.40***
HHWE	0.30	0.46	0.29	0.45	0.33	0.47	0.04	0.07	0.56
HHFTR	1.39	0.65	1.22	0.41	1.73	0.88	0.50	0.09	5.25***
HHCHM	2.15	1.11	1.75	0.93	2.95	1.03	1.19	0.15	7.78***
HHFIM	0.68	0.46	0.75	0.43	0.55	0.50	0.2	0.7	2.76***

*** and ** means significant at the 1 and 5% probability levels, respectively.
HHLOTLU = Household livestock ownership in TLU, HHFT = Household's food transfer from relatives, HHEXPH = Household expenditure on housing, HHCHM = Household's child food secure months, HHEXPEQ = Household's expenditure on equipment, HHFIM = Household's food insecure months, HHTFI = Household's Total farm income, HHWE = Household's wage employment.
Source: Own survey data, 2011.

difference of 70birr but not statistically significant. It means that, beneficiary households expended more in farm tools and equipment even though it was not statistically significant.

The data in Table 3 presents descriptive statistics results of sample households based on their livestock holding, farm income, expenditure in housing and equipment. The survey results show that program and non-program households had mean livestock holding of 4.09 TLU and 1 and 7 TLU with mean difference of 2.21 TLU, respectively. This means that households in the program are better off in livestock holding than those of non-beneficiaries. Expenditure in housing was significantly different in between two groups. According to the result of descriptive analysis, the mean expenditure of beneficiary households was 6375.83 and 2868.35birr with mean difference of 3507.48birr respectively. This means, beneficiary households expended more money to improve their house and at the same time established their asset.

The mean farm income of program and non-program respondents was 4539.12 and 1863.3 birr with mean difference of 2675.82 birr respectively. This declares that farm income of the beneficiary households of the PSNP beneficiaries is more than non-beneficiary household. This implies that, the intervention of the program made difference in between two groups even though if requires further computation. In other hands the result of descriptive statistics indicated that there is difference in between two groups in terms of expenditure on farm tools and equipment. The computational result shows that beneficiary household expended more on buying farm tools and equipment even though it is not statistically significant. However, this descriptive result cannot tell us whether the observed difference is exclusively because of the program. Therefore, the program impact on asset prevention and food consumption outcomes was further analysed by using PSM econometrics model to detect the result whether it is exclusively due to the program intervention or not.

The third set of data results presented and analysed on the sub section were the impact of PSNP on the improvement of household food consumption, measured in increased number of food secure months in the year. According to the program implementation manual of the PSNP, assuring food consumption of food insecure households was primary issue to be addressed by the intervention. For this study outcomes surveyed to measure food consumption assurance were change in food insecure months, change in number of children meal, change in food transfer from relatives and change in wage employment during peak farming season.

The descriptive analysis result indicated that, there is statistically significant difference in between PSNP beneficiary and non-beneficiary respondents. The computational result of change in months of food insecurity, change in children meal per day and food transfer from relatives declared significant difference but, the result of wage employment indicated no significance. Children meal per day is sensitive to food shortage, it will increase when availability of food increases and vice versa. The analysis result indicates that the children meal of beneficiary household consumes better number of meals per day and it is statistically significant. This means that there is increase in children meal per day in beneficiary households than non-beneficiaries. In other hands, change in months of food insecurity indicated the mean of 0.75 and 0.55 with mean difference of 0.20 respectively. To clarify it, change in food insecure months for non-beneficiary households was smaller than the beneficiary group. Most non beneficiary households responded no change that resulted in less value and most beneficiaries responded as there is change.

As depicted in Table 3, food transfers from relatives to

Table 4. Contingency coefficient among discrete explanatory variables.

Variable	VIF	R^2
AGEHHH	1.36	0.0019
LITERHHH	1.43	0.0288
HHLANDSIZE	1.07	0.0702
HHDEPR	1.00	0.0021

Source: Own estimation result.

Table 5. Contingency coefficient among discrete explanatory variables.

Variable	SEX	FAMSIZE	TARG	CRED	FERTUSE	SDUSE	EXSER
SEXHHH	1	0.208	0.106	0.097	0.031	0.142	0.216
HHFAMSIZE		1	0.386	0.279	0.218	0.352	0.492
HHTARG			1	0.110	0.329	0.279	0.225
HHACRED				1	0.340	0.391	0.144
HHIFERTUSE					1	0.335	0.154
HHISDUSE						1	0.112
HHAEXSER							1

Source: Own estimation result.

beneficiary households were smaller than those to the non-beneficiary group. This implies that non-beneficiary households receive more food transfers from their relatives to sustain themselves. The mean food transfer for beneficiaries was 1.22, while for non-beneficiaries, it was 1.73, resulting in a mean difference of 0.50 between the two groups. Regarding wage employment during the peak farming season, there was no statistically significant difference between the two groups, even though participation was lower in beneficiary households compared to the non-program group. The descriptive analysis alone cannot exclusively determine the impact of the program on food consumption assurance and asset prevention outcome variables. To discern the results attributed solely to the program intervention, further analysis was conducted using the PSM econometrics model. The results of the PSM technique analysis are presented following the descriptive analysis.

Inferential data results on the impact of the PSNP: The PSM estimation

The second part of this section presents the PSM results. The PSM estimate of the impacts of PSNP was conducted using two categorical variables: improvements in household food consumption and asset protection/ building. This section describes how the propensity scores matching was estimated provides the results of the common support region analysis, and discusses the balancing test. Additionally, explanations are provided regarding the treatment effect of PSNP participant households.

In this subsection, data on propensity scores are presented. Propensity scores are obtained as the probability scores of individuals from the fitted simple logistic regression model. Logistic regression is typically applied when the dependent variable is dichotomous. The model was estimated using STATA 10 software, utilizing the propensity scores matching algorithm developed by Leuven and Sianesi (2003) and Wooldridge (2016).

In the estimation process data from the two groups, (PSNP participant households and non-participant households) were pooled such that the dependent variable takes a value 1 if the household was a PSNP participant and 0 otherwise.

Before running the regression model, the explanatory variables were checked for the existence of multi-collinearity and heteroscedasticity. The VIF, as presented in Table 4, indicates the contingency coefficient and collinearity coefficient values of the variables in the model shows that there is no problem of serious collinearity. To tackle heteroscedasticity problem in the data robust methods were used.

Table 5 presents the estimation results of the logit model, which demonstrates its effectiveness in estimating matching scores. The pseudo R-square value, at 0.09, indicates the extent to which the regressors explain the probability of participation. After matching, there should be no systematic differences in the distribution of covariates between both groups. Therefore, the pseudo

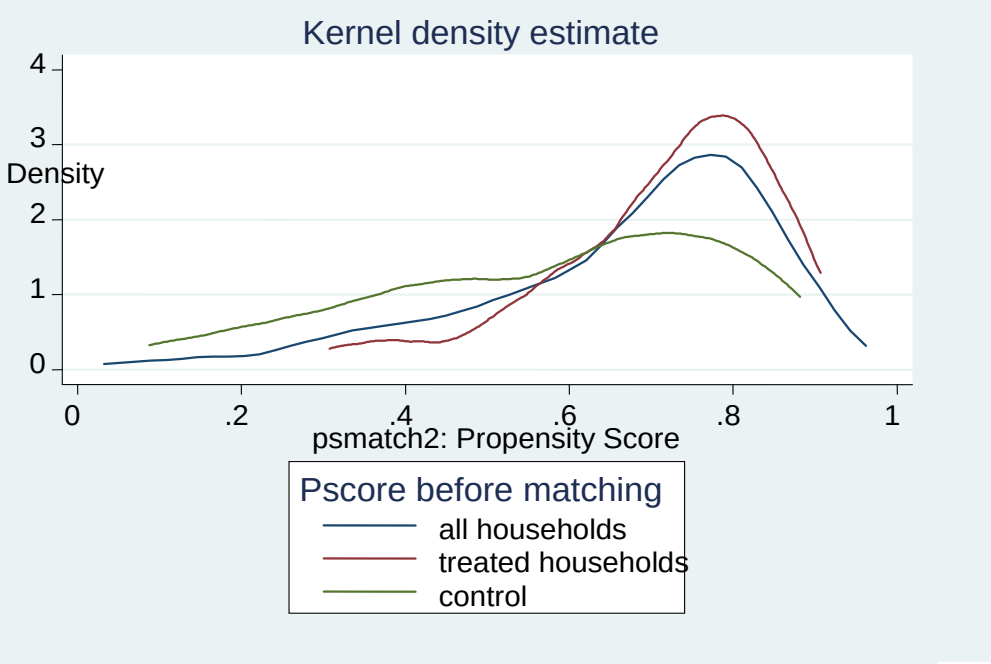

Figure 2. Kernel density of propensity scores.

Table 6. Results of the logistic regression model.

Variable	Coef.	Robust Std.Err.	Z
SEXHHH	1.140388	0.8256221	1.38
AGEHHH	0.0246988	0.0221227	-1.12
LITERHHH	-0.7234534	0.3222893	-2.24**
HHFAMSIZE	-0.0988882	0.0673103	-1.32
HHTARG	0.0271462	0.2434719	0.11
HHACRED	0.1734162	0.399316	0.43
HHLDSIZE	-0.4807804	0.2066548	-2.33**
HHIFERTUSE	0.4662242	0.5178497	0.90
HHISDUSE	-0.0672806	0.3923967	-0.17
HHAEXTSER	0.285944	0.2025059	1.41
DEPRHH	0.1204276	0.1661363	0.72
cons	1.574166	1.747851	0.90

Sample size= 180, R = 20.1, LR X^2 (11) = 27.12 Prob> X^2 = 0.0044, Log likelihood = -101.37823, ** and * means significant at the 5 and 10% probability levels, respectively.
Source: Own estimation.

R-square value should be relatively low, as suggested by Caliendo and Kopeinig (2008), Yibeltal (2008) and Wooldridge (2016). A low R-square value indicates that program households do not exhibit significantly distinct characteristics overall, making it easier to find a good match between program and non-program households, as noted by Pradhan and Rawlings (2002) and Wooldridge (2016). Figure 2 shows the kernel density of propensity scores.

As the estimated coefficients show that of the eleven explanatory variables, participation in PSNP was significantly influenced by three explanatory variables. As indicated in Table 6, the literacy level of household head, land holding and extension service. Among these three variables, literacy level and size of land holding affected the outcomes of the PSNP negatively. In other words, there is significant difference in between beneficiary and non-beneficiary households in land holding and literacy

Table 6. Distribution of sample households by estimated propensity scores and household type.

Group	Observations	Mean	Std Dev	Minimum	Maximum
Total households	180	0.6424764	0.17653985	0.087711	0.9066306
Treatment households	120	0.7150471	0.1365633	0.3074773	0.9066306
Control households	60	0.5699054	0.2145164	0.087711	0.8816158

Source: Own estimation result.

level thus affected participation in the program negatively. The negative term indicates that, households relatively with large land size were not included in the program and those having small land size were targeted in the program. Large land holding is found to influence amount of farm product positively and food security status of household which is directly related with the objective of PSNP. Households included in the program were more illiterate than non-beneficiaries according to the estimation of coefficient. The pre-intervention explanatory variables indicates that, households with better literacy level were found to be better off and not included in the program. On the other hand, extension service provided by extension institution affected positively and significantly related to the targeting of the beneficiaries. This means that, before targeting there was continuous visit of extension workers to poor households to rank their food security status in the community. All households are skewed to one direction. In case of treatment households, most of them are found in the middle of the distribution. On the other hand, most of the control households are partly found in the centre and partly in the left side of the distribution.

The second issues presented and analysed in the sub section were the data results on the matching of PSNP beneficiaries and non-beneficiary households. Before implementing the matching task, three main steps were followed and these are; predicted values of propensity scores should be estimated for all treated and control households, a common support condition should be imposed on the propensity score distributions of household with and without the PSNP intervention and observations whose predicted propensity scores fall outside the range of the common support region should be discarded.

In this study, as indicated in Table 7, the estimated propensity scores vary between 0.9066306 and 0.3074773 (mean = 0.71) for PSNP beneficiaries (treatment) households and between 0.8816158 and 0.087711 (mean = 0.56) for non-beneficiaries (control) households. The common support region would then lie between 0.3074773 and 0.8816158. This means, households whose estimated propensity scores are less than 0.3074773 or greater than 0.8816158 were not considered for the matching exercise. Therefore, one treatment household was discarded. This shows that the study does not have to drop many PSNP households from the sample in computing the impact estimator in Table 8.

Table 9 declares that the estimated results of tests of matching quality were based on the selected best estimator. The best estimator which matches more, have list pseudo-R-square and with more statistically insignificant mean differences was selected. After looking into the results, it has been found that Kernel matching with a band width of 0.25 is the best estimator for the data we have. Based on the selected best estimator, beneficiary and non-beneficiary households were significantly different in terms of certain pre-intervention characteristics (literacy level of household head, land holding and extension service). However, these differences were removed after the matching was conducted.

The third issue presented and analysed in the section is data results on treatment effect on the treated in terms of assuring food consumption status of beneficiary and non-beneficiary households. In this section, the thesis provides evidence as to whether or not the PSNP has brought Significant changes on household food consumption assurance.

This part is further categorized in four outcome variables namely, decrease in months of food insecurity, change in number of children meal per day, wage/jobs in peak farming season and change in food transfer from relatives.

Decrease in months of food insecurity; the estimation result presented in Table 10 provides supportive evidence of statistically significant effect of the program on decreasing in months of food insecurity at household level. The result indicates that decrease in food insecure months mean difference is 0.29 which is significant at 1% level of probability. The larger mean indicates that the response to change in food insecure months is “Yes” and the minimum average indicates “No” with its value 0. It means that the intervention of PSNP decreased food insecure months of beneficiary households and it is part of consumption assurance.

Regarding food transfer from relatives, the estimation results presented in Table 10 indicate a statistically significant difference between beneficiary and non-beneficiary groups. This significance is observed at the 1% probability level, implying that food transfer from relatives to beneficiary households decreased significantly as a result of the program intervention. In other words, the impact of PSNP led to a reduction in food transfer

Table 7. Comparison of the three matching estimates by performance criteria.

Matching estimator	Performance criteria		
NN Matches	**Balancing test***	**Pseudo R^2**	**Matched sample size**
1st neighbors	10	0.034	165
2nd neighbors	10	0.044	146
3rd neighbors	9	0.037	165
4th neighbors	10	0.032	165
Caliper matches	**Balancing test***	**Pseudo R^2**	**Matched sample size**
0.01	10	0.049	146
0.25	11	0.026	165
0.5	10	0.048	65
KM Matches	**Balancing test***	**Pseudo R^2**	**Matched sample size**
With no band width	10	0.026	165
Band width of 0.1	10	0.024	165
Band width of 0.25	11	0.024	165
Band width of 0.5	10	0.048	165

*Number of explanatory variables with statistically no significant mean differences between the matched groups.
Source: Own estimation result.

Table 8. Results of the balancing tests of covariates using the kernel matching.

Variable	Before matching (180)			After matching (179)		
	Treatment	**Control**	**T-value**	**Treatment**	**Control**	**T-value**
	N = (120)	**N = (60)**		**N = (113)**	**N = (52)**	
SEXHHH	0.95	0.93333	0.46	0.9469	0.91362	0.98
AGEHHH	41.8	42.83	-0.59	41.86	42.31	-0.30
LITEHHH	1.6	1.85	-2.30**	1.6195	1.6244	-0.06
HHFAMSIZE	7.19	8.3	-2.34	7.32	7.37	-0.13
HHTARG	2.35	2.4667	-1.00	2.3805	2.4671	-0.92
HHACRED	0.525	0.45	0.95	0.50442	0.41785	1.30
HHLDSIZE	1.0978	1.599	-3.66***	1.1381	1.0512	0.93
HHIFERTUSE	0.78333	0.70	1.22	0.76991	0.69519	1.27
HHISDUSE	0.49167	0.51667	-0.31	0.49558	0.46203	0.50
HHAEXTSERV	3.725	3.45	1.98**	3.708	3.6157	0.82
HHDEPR	1.2641	1.1722	0.61	1.2333	1.2783	-0.39

***and** means significant at 1 and 5% probability levels.
Source: Own estimation result

from relatives to beneficiary households during food gap months.

Change in children meal per day; size and number of children meal is very sensitive to the food gap season. There is mean difference in between two groups in terms of this outcome variable. The difference strongly declares that there is increase in number of children meal per day in beneficiary households to three times and above per day than those of non-beneficiary groups. The value of survey response for above 3 and 3 per day was 1 and 2 respectively. The mean children meal response for beneficiary and non-beneficiary was 1.78 and 2.92 indicates the majority response of beneficiaries lies in between 3 and above 3 meals per day and the non-beneficiary's response lies under 3 meals. The result of the analysis indicated that there is statistically significant difference in between two groups at 1 percent probability level.

Table 9. Average treatment effect on the treated (ATT) for food consumption outcomes.

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HHLOTLU	ATT	0.292035	0.358477	0.066442	0.083832	-0.79
HHEXPH	ATT	1.2389	1.7398	-.5009	0.138295	-3.62***
HHEXPEQ	ATT	0.7522123	0.4535271	0.29868524	0.085904	3.48***
HHTFI	ATT	1.787610	2.9265282	-1.13891758	0.181205	-6.29***

*** and ** means significant at 1 and 5% probability level.
Source; Own estimation result.

Table 10. Average treatment effect on the treated (ATT) for food consumption outcomes.

Variable	Sample	Treated	Controls	Difference	S.E.	T-stat
HHLOTLU	ATT	4.12	1.56	2.56	0.2782	9.22***
HHEXPH	ATT	6434.51	3439.16	2995.34	1289.63	2.32***
HHEXPEQ	ATT	1925.90	1283.60	642.29	445.24	1.44
HHTFI	ATT	4730.48	1484.48	3246.00	658.39	-4.93***

*** means significant at 1% probability level.
Source; Own estimation result

Wage employment in peak farming season; as shown in the statistical estimation result, this outcome variable (wage employment at peak farming season) was influenced by the program intervention. The mean difference between two groups was 0.06 which indicates beneficiary household participation in wage employment in peak farming season was decreased by the program impact but, it is not statistically significant. In other words, even though there was PSNP intervention employment in other wage employment schemes was not decreased significantly or the difference was not significant between two groups. In general, the effect of the PSNP intervention increased children meal per day, decreased food insecure months of the household and also decreased transfer of food from relatives which indicates the assurance of food consumption.

The fourth issue presented and analyzed in the section is on the treatment effect on the treated groups in terms of the PSNP outcomes on asset prevention from depletion in the shock contexts by households. The second objective of PSNP intervention was to prevent asset of food insecure households. The estimation result presented in Table 11 provides evidence of statistically significant effect of the program on household asset prevention measured in tropical livestock unit (TLU), expenditure in house improvement, total farm income and expenditure in farm tools and equipment. After controlling for pre-intervention differences in explanatory characteristics of the PSNP and non-PSNP households, it has been found that, on average, the program has increased livestock holding, farm income, and expenditure to improve housing at statistically significant level. There was also change in expenditure on farm tools and equipment even though it is not statistically significant at the required level. As presented on Table 11 the outcome variables of asset prevention were; livestock holding, farm income, expenditure in housing and expenditure in farm tools and equipment.

The data sets in Table 11 shows that livestock holding of household; the mean livestock holding of beneficiary and non-beneficiary households was 4.12 and 1.56 respectively with mean difference of 2.56 TLU. There is statistically significant difference in livestock holding in between beneficiary and non-beneficiary categories. The result indicates that, on average the PSNP intervention increased livestock holding of beneficiary households by 2.56 TLU. It means that the impact of PSNP intervention increased total livestock in TLU of beneficiaries on average by 2.56 animals.

Total farm income; there is statistically significant difference in between treatment and control groups in terms of farm income as stated in Table 11. The analysis result declared that the average total farm income of beneficiary non beneficiary groups was 4730.48 and 1484.48 birr respectively with mean difference of 3246.00birr. According to the survey result, the better increase in farm income observed on PSNP beneficiary households than non-beneficiary groups. On average the PSNP intervention increased total income of beneficiary households by 3246 birr.

In terms of expenditure on housing, this outcome variable signifies the establishment of assets within households. According to the estimation results presented in Table 11, there is a statistically significant difference between participants and non-participants in the program. The analysis reveals that the average expenditure to

improve the housing of households in the beneficiary and non-beneficiary groups was 6431.51 and 3439.16 birr, respectively, resulting in a mean difference of 2995.34 birr. This matched mean difference of 2995.34 indicates that the effect of PSNP intervention increased expenditure on housing among beneficiary respondents.

Regarding expenditure on farm tools and equipment, the estimation results after matching indicate that the difference in expenditure is not statistically significant at the required probability level. However, despite the lack of statistical significance, the effect of PSNP intervention increased expenditure on farm tools and equipment on average by 642.29 birr. The estimation of household asset prevention outcomes reveals that the PSNP intervention both prevented and increased assets among beneficiary households.

DISCUSSION

First, from the matching results, the PSNP improved the smoothening of food consumption of households. This result is consistent with the findings documented on improvements of PSNP beneficiary households in livelihoods, social welfare and food (nutrition) in northern and central Ethiopia (Tareke, 2022; Tasew and Tariku, 2022; Zerhun, 2020). As expected, the participation in the PSNP was determined by a combination of factors. Treatment households were more likely to have smaller land size, more illiterate than control households and were in better contact with extension agents. Finding a reliable estimate of the PSNP impact thus necessitates controlling for all such factors adequately. In doing so, PSM has resulted in 119 treated households to be matched with 60 controlled households. In other words, a matched comparison of food consumption assurance outcomes was performed on these households who shared similar pre-intervention characteristics except the PSNP. The resulting matches passed a variety of matching quality tests and were fit to address the objectives of the study.

After controlling for other characteristics, it was been found that PSNP intervention had significantly increased children meal per day, decreased food insecure months and decreased food transfer from relatives. Even though the decrease in wage employment during peak farming season is not statistically significant, there is change due to the intervention.

More particularly, PSNP assured beneficiary households food consumption. The food consumption was not measured in calorie but the study was interested by the trend of food consumption. Therefore, the study result declares that the impact of PSNP decreased food insecure months increased children meal per day and decreased food transfer significantly whereas non beneficiary households receive more food transfer, have less children meal per day and face more food insecure months in crop failure years. To evaluate the impact of PSNP exclusively, PSM technique was employed.

Second, from the matching, the PSNP had impact on prevention of household assets from depleting. This finding is also consistent with the findings of studies conducted in Eastern and northern Ethiopia (Kaleab et al., 2014; McLaughlin et al., 2023; Paulos and Melese, 2018). In this respect, the PSNP intervention had significantly increased live stock holding, farm income and also increased expenditure in house improvement. Even though the increase in expenditure on farm tools and equipment was not statistically significant, there is increase in expenditure due to PSNP intervention.

More particularly, PSNP intervention prevented household asset from depletion and increased asset of the program beneficiaries significantly. Therefore, the study result declares that the impact of PSNP increased asset prevention outcomes; livestock holding, increased farm income and increased expenditure to improve the house of beneficiary households significantly where as the result of non-beneficiary households indicates that, least farm income, small expenditure on house improvement and small number of livestock holding.

Third, there were constraints in the implementation of the PSNP program, and the achievements did not meet the expected outcomes. This finding aligns with empirical evidence documented on the challenges to the effective implementation of the PSNP program in evolving contexts, as reported by Andualem (2020), Azadi et al. (2017), Bahru et al. (2021), Diriba et al. (2017), Feyisa (2022), and Hailu and Amare (2022). Assessing community asset development required descriptive statistics. Qualitative data were collected from focus group discussion and secondary data from Southern Ethiopia Regional Agriculture Bureau. The response from sample households and focus group declares that the intended target of PSNP intervention succeeded by establishing different infrastructures in the target kebeles which were basic for rural transformation. According the secondary data, farmers training centres were built in all kebeles, primary schools, health posts, spring development and water shed management practices upgraded the community asset tremendously which was according to the program implementation manual and the objective of the project. In this respect, there were delays in resource transfers; problems in targeting households and the coverage were limited in time/geography.

In general, the studies on PSNP impact on household food security in Zambia, Ghana, Nepal and Ethiopia confirm that PSNP smoothens food consumption in shock seasons and prevent households from depleting their asset (Abdi et al., 2023; Abraham, 2020; Ahmed and Burhan, 2018; Azadi et al., 2017; McLaughlin et al., 2023). Whereas other studies shows that additional food security programs in the PSNP package impacted in communal and household assets, and improved land restoration, including infrastructure development

(Andersson et al., 2011; Girmay, 2020; Gashaw and Seid, 2019; Abdulhakim et al., 2022). In sum, ninety seven percent Households participated in HABP were on the track towards food security and towards graduating from aid dependence. However, the program implementation has got insignificant deviation from the project implementation manual (PIM). Thus, precisely targeting of beneficiaries and integrating the program with other food security programs and resource transfer requires need further improvement.

Conclusions

In this study cross sectional data from Southern Ethiopia were used to evaluate the impacts of PSNP on household asset prevention, food consumption assurance, community asset development and to identify constraints in implementing the program. The main question that this research attempted to answer was “what would the food consumption, asset prevention and protection status of households if they were not engaged in PSNP?” Answering this question requires observing outcomes with-and-without participation in PSNP for the same household. However, it is impossible to observe the same object in two states simultaneously. To assess the impact of program intervention, it requires base line data to take pre intervention as control and intervention as treatment group with in the same household but there was no intended data.

This study used descriptive statistics to analyze the community asset development and to identify the constraints in program implementation. The PSM technique was used to evaluate the PSNP impact in asset prevention and food consumption of households to eliminate the possible sample selection bias since the data were from a survey study. To overcome this beneficiary and non-beneficiary selected as a sample respondent from survey kebele's assuming they were under the same situation before the program intervention.

The primary data for this study was collected from 180 beneficiary and non-beneficiary households in the same kebele's and a structured questionnaire was administered to the study. The availability of baseline data were examined, and found that baseline data were not available. The study emphasized; selection bias is to be expected in comparing a sample from the population of PSNP beneficiaries with a sample of non-beneficiaries. To pin out the outcome exclusively due to program intervention, simply comparing by using descriptive statistics can make bias. Every micro econometric evaluation study has to overcome the fundamental evaluation problem and address the possible occurrence of selection bias. The first problem arises because we would like to know the difference between the participants’ outcome with and without treatment. Clearly, we cannot observe both outcomes for the same individual at the same time. Taking the mean outcome of non-participants as an approximation is not advisable, since participants and non-participants usually differ even in the absence of treatment (Caliendo and Kopeinig, 2008; Wooldridge, 2016).

In both cases, issues such as self-selection and endogeneity of program placement would create serious problems when using these kinds of impact evaluation exercise. Hence, the study has applied a PSM technique, which is capable of extracting comparable pair of treatment-comparison households in a non-random program setup and absence of baseline data (Dehejia and Wahba, 2002; Wooldridge, 2016; Addisalem et al., 2023).

RECOMMENDATIONS AND FUTURE AREAS OF RESEARCH

PSNP is important development efforts to ensure food security at household level if implemented properly. Based on the empirical findings reported in this thesis, the following policy recommendations are forwarded. The recommendations are that:

1) The study finding indicates that those beneficiary households participated in HABP were better used the PSNP intervention to increase their assets and assure their food consumption even the participation in program years was not more than 58%. The annual inclusion of PSNP beneficiaries in HABP should increase to fasten graduation of beneficiaries from PSNP and food security programs. Thus, Regional executive bodies (government, non-state actors and donors) should maximize livelihood options by maximizing intervention packages.
2) Most beneficiary households cannot read and write which has negative relation with technology adoption and graduation from both PSNP and FSP. Thus, adult education should be part of the PSNP package to tackle and enhance the potential of households to adopt technologies, secure information and enhance farm productivity.
3) The land holdings of most beneficiary households are small which cannot afford large family size even though the productivity of land per unit area has increased because of the PSNP intervention. It is better to look for open cultivable land including the potential for resettlement. Thus, cash crops that can be produced twice or three times a year should be introduced, specifically focusing on households with less than 0.5ha holdings. Such intervention should be supported by technology and extension services, and includes family members that are excluded from the PSNP targeting.
4) Further research at broader regional and country level is required to generalize the impact of PSNP on household food security (consumption) and asset building (prevention of household assets from depletion).

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CONFLICT OF INTERESTS

The author has not declared any conflict of interests.

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