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Article

Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia

Cogent Economics & Finance

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Suggested Citation: Belete, Belainew; Genet, Tadele Bayu (2023) : Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 11, Iss. 1, pp. 1-12, <https://doi.org/10.1080/23322039.2023.2210854>

This Version is available at:

<https://hdl.handle.net/10419/304081>

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To cite this article: Belainew Belete & Tadele Bayu (2023) Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia, Cogent Economics & Finance, 11:1, 2210854, DOI: [10.1080/23322039.2023.2210854](https://doi.org/10.1080/23322039.2023.2210854)

To link to this article: <https://doi.org/10.1080/23322039.2023.2210854>



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Received: 17 November 2021
Accepted: 02 May 2023

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DEVELOPMENT ECONOMICS | RESEARCH ARTICLE

Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia

Belainew Belete¹ and Tadele Bayu^{1*}

Abstract: Though social protection in sub-Saharan Africa is intensive to alleviate food insecurity of the vulnerable group such as women, its impact on the food security status of female-headed rural households has not been well documented. Accordingly, the present study aims to evaluate the effect of the Productive Safety Net Program (PSNP) on the food security of female-headed farm households. The study employs the Propensity Score Matching (PSM) method to identify the comparable beneficiary and non-beneficiary sample households. The study finding indicates that PSNP improves the food security status of female-headed farm households. Moreover, the study suggested that the food security status of the beneficiary household is better than the non-beneficiary household even after controlling the potential heterogeneity. Based on the findings of the present study, we recommend that PSNPs should focus on building a sustainable income-generating livelihood system.

Subjects: Agriculture and Food; Economics; Statistics for Social Sciences



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PUBLIC INTEREST STATEMENT

The purpose of this study was to evaluate the impacts of social protection on rural female-headed farm households. The major highlights of the findings are:

Female-headed farm households have a higher tendency to experience food shortages during the months from June to September.

The widely used coping strategies to manage food access problem were skipping meals, eating less food, and seasonal migration.

PSNP beneficiary female-headed farm households enjoy higher energy intake and lower coping strategy than non-beneficiary female-headed households.

PSNP beneficiary female-headed farm households adopt lesser mechanisms to cope with reduced or declining access to food.

Food insecurity is severe in PSNP non-beneficiary female-headed farm households.

Productive safety net program improves the food security status of the female-headed farm households

Keywords: Food security; impact analysis; propensity score matching; Productive Safety Net Program

JEL classification: H55; H84; I39

1. Introduction

Globally, over 820 million people suffer from hunger, while undernutrition is about 22.8% in the sub-Saharan African region (FAO, IFAD, UNICEF, WFP, W, 2020). Food insecurity and undernourishment are severe in developing countries where women are a significant part of the total population (Asrat et al., 2020; IFAD et al., 2019, 2020). Though undernourishment and food insecurity are reduced in some developing countries, because of the rise of staple food prices and depletion of food stock created a shortage of food access for food buyers and rural dwellers. As such, food insecurity is still prevalent in smallholder rural farm households in Ethiopia. In this regard, children, pregnant women, and lactating women are more vulnerable to food insecurity since such groups have limited access to health, and education, and due to some cultural norms (Khanam et al., 2020; Mota et al., 2019; Tebeje et al., 2020).

Historically, food insecurity and famine are deeply rooted in rural Ethiopia, which brings several hardships and death to the rural community (Mekonnen & Gerber, 2017; Melese et al., 2021). In the year 2016, 20.5% of the population was food insecure and lived below the food poverty line. About 31% of the population have inadequate caloric consumption (<2550 kJ per adult equivalent per day), and 54% consume below four food groups out of seven food groups (WFP & CSA, 2020). Further, the report confirms that calorie deficiency is more intense in rural areas with a lower-income quintile. Around 30% of the population in Ethiopia suffers from persistent food insecurity and malnutrition, from which 25% of them needs urgent assistance (Peng et al., 2021). The severity of food insecurity is intense in the dryland of Ethiopia, which consists of 13% of the population and 63% of the geographical area of the country (Asrat & Anteneh, 2019; Peng et al., 2021).

In addition, access to sufficient nutritious food consistently remains a challenge for the poor due to recurrent droughts, low productivity, political instability, and social turmoil such as war and other shocks (Desalegn & Ali, 2018; FAO, IFAD, UNICEF, WFP, W, 2020; Mota et al., 2019; Peng et al., 2021). Empirical findings also show that food insecurity in Ethiopia might be exacerbated by risk factors such as drought, widespread of coronavirus, war crimes, cost of staple foods, knowledge of nutritious food, and low household income (Asrat & Anteneh, 2019; Mota et al., 2019).

The political and economical factors contribute to sustainable food insecurity in Ethiopia and are reliant on international food aid since 2017 (Peng et al., 2021). Ethiopia received food aid since December 2016 to date to alleviate food insecurity and try to reduce hunger because of the crisis of internal conflict, rise in food prices, ELINO in eastern Ethiopia, severe drought and flood in East Africa, disease outbreak, desert locust, and war crimes in northern and southern Ethiopia (Peng et al., 2021).

Persistent poverty and poor nutritional statuses are common manifestations of the nation in general and women in particular (Holmes et al., 2011; Kebed, 2009; Muleta & Deressa, 2014). Female-headed households are more food insecure and non-self-sufficient in food requirements and production relative to the male-headed households in the Mesken district of Ethiopia (Kebed, 2009). A family headed by a female is vulnerable to limited access to resources to carry out agricultural tasks that affect their food security level (Holmes et al., 2011; Kebed, 2009; Muleta & Deressa, 2014). A study conducted by Holmes et al. (2011) and Practices et al. (2014) revealed that female-headed households are more vulnerable to food insecurity due to gender inequality in families, communities, and society as a whole.

The food security strategies of Ethiopia include improved food availability through domestic production, providing access to food for insecure households, building the capacity of emergency response, providing improved preventive and curative health services, and carrying out voluntary resettlement programs (Ansah et al., 2014; Asefefa Kisi et al., 2018; Melese et al., 2021; Sani & Kemaw, 2019; Siyoum et al., 2012; Tebeje et al., 2019). For the chronically food-insecure household, a Productive Safety Net Program (PSNP) and social protection program emerged in 2005 to assure food consumption and prevent asset depletion in drought-prone areas of Ethiopia (Andersson et al., 2011; Lemma & Cochrane, 2020; Weldegebriel, 2016). The program aims to protect household assets and build community assets through timely and consistent safety net resource transfers for chronically food-insecure households.

Social protection, a Productive Safety Net Program, is increasingly recognized as an indispensable tool for poverty eradication and welfare security in developing countries (CARE, 2010; Kebed, 2009; Lemma & Cochrane, 2020; Schüring, 2012). Such a social protection program as a response to chronic food insecurity faced by vulnerable people to enable benefit from economic activities (Abdulahi Mohamed, 2017; Nigussa & Mberengwa, 2009) through food aid has been used to fight hunger, address humanitarian emergencies, and survive and supplement food for pregnant and breastfeeding women and children. Irrespective of this massive aid, a high percentage of the population, particularly female-headed families, remained chronically food insecure and highly vulnerable to livelihood shocks (Harris-Fry et al., 2017).

Similar social protection programs, such as cash and material transfers, have expanded remarkably in sub-Saharan Africa (Niño-Zarazúa et al., 2012). Despite this expansion, women got scant benefits which are insufficient to move out of poverty.

Empirical findings show that social protection such as cash transfers significantly contributes to the educational and cognitive development of children attending the correct class for their age and high verbal and non-verbal intellectuality in South Africa and Malawi (Sherr et al., 2021). Studies evaluating the impacts of PSNP on food and nutrition security in Ethiopia in four regions (Oromia, Amhara, SNNP, and Tigray) found that participation in PSNP programs enables households to improve their food security and increase livestock holding (Desalegn & Ali, 2018), but this study failed to account for potential confounders. The finding of Baye et al. (2014) shows that food insecurity in food-recipient households is significantly higher than in cash-receiving households.

Scholars such as Abdulahi Mohamed et al. (2018) stated that PSNP has a positive impact on beneficiaries, yet the achievements made so far were not adequate to ensure food security at the household level. Likewise, Gilligan et al. (2011) in their evaluation of the effectiveness of PSNP in sub-Saharan Africa found that PSNP showed a modest impact in improving food security, raising livestock holding, and enhancing the resilience ability of the household to cope with vulnerability to food insecurity. However, this study overlooked its contribution to female head households' food security and social status in the community. Care (2021) assesses the implication of graduation on household food security and found that 75% of graduated beneficiaries reported food shortage even after graduating from the program. Nevertheless, this study did not explore how food shortage exacerbated female-headed households' food insecurity and their confidence level not to backslide into the program. Ansah et al. (2014) also examined the impact of PSNP and found that the program has impacted consumption smoothing and prevented asset depletion. But, this research did not explore the level of consumption smoothing and asset holding of female-headed households.

Although numerous studies investigated the impacts of social protection (Abdulahi Mohamed et al., 2018; Andersson et al., 2011; Araya, 2020; Desalegn & Ali, 2018; Ismael, 2012; Marzo & Mori, 2012; Weldegebriel, 2016; Wondim, 2018), the studies overlooked its contribution to female head households' food security and social status in the community. Literature on gender impacts of

implementation of social protection such as rural PSNP is scant since most of the investigations were not gender-disaggregated (Holmes et al., 2011; Ministry of Agriculture, 2014).

This study aimed to contribute to filling such literature gaps by evaluating the impacts of the rural PSNP on female-headed households' food security in the Ebinat district, Ethiopia.

2 Methodology and materials

2.1 Data

This study is based on the primary data collected from 228 randomly selected female-headed farm households using a multistage random sampling technique from Ebinat Woreda, Ethiopia (Figure 1). In the first stage, three kebeles were randomly selected. Second, disaggregation into PSNP beneficiary¹ and non-beneficiary² households using the list of female-headed farm households in the selected kebeles has been applied. Finally, using the proportional random sampling method, 228 female-headed farm households were selected. Of the total sample households, 115 farm households were beneficiaries of PSNP.

2.2 Methods of data analysis

This study evaluates the impacts of social protection on women-headed farm households' food insecurity using the quasi-experimental method (PSM) method. The propensity score matching (PSM) method identifies the counterfactual group with the same observable characteristics as users of the PSNP based on the probability of participating in the treatment using apparent features. The likelihood of households participating in the intervention is estimated using binary logistic regression since the dependent variable is dichotomous (Baum, 2006). In this study, the dependent variable is participation in the social protection program (PSNP) with a value of 1 if the household benefits from the social protection program and 0 otherwise. *The latent (index) model:*

$$y^* = X_i\beta + u \quad (1)$$

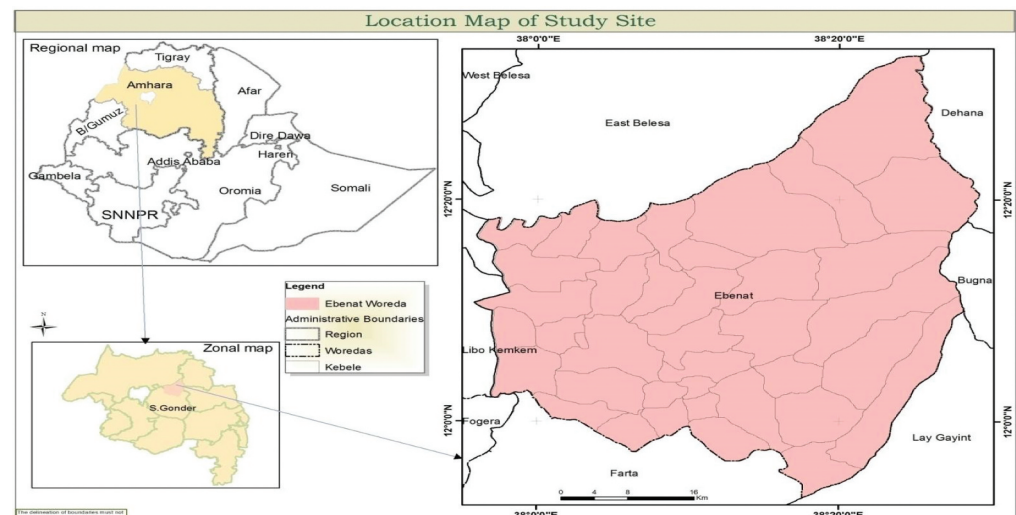
where y^* is latent variable, $x\beta$ is index function and u is the error term; $u \sim I\left(0, \frac{\pi^2}{3}\right)$

If $y^* > 0$, $Y = 1$ and $y^* \leq 0$, $Y = 0$

the treated model of estimating the propensity score is

$$\ln(L) = x_i\beta'_j + U \quad (2)$$

Figure 1. Map of the study area.



where $\ln(L)$ is the log of logit model odds ratio, $\Lambda(x\beta)$, where β 's are the coefficient of the regression which are estimated through the maximum likelihood estimation technique and x_i' vector of covariates that determine participation in social protection.

The impact is measured by the difference in outcomes of the control and treatment groups through the average treatment effect on the treated (ATT) (Khandker et al., 2010).

$$ATT = E(\tau_i/\varphi = 1) = E[(Y_1 - Y_0)/\varphi = 1] \quad (3)$$

where φ is an indicator of treatment with a value of $\varphi = 1$, $\varphi = 0$ if the household participates in the social protection and $\varphi = 0$ if the household did not participate in the social protection $E(Y_1/\varphi = 1)$ is an average outcome of households who are treated, $E[Y_0/\varphi = 1]$ is an average outcome of treated households if they were not participating in the social protection program. In this study, the outcome variable is food security measured by dietary intake and coping strategies of the household (CSI). The outcome variables are described as follows.

(1) Household average dietary consumption (Kcal) is a food security indicator, which estimates the calorie consumption of the household (Pérez-Escamilla et al., 2017). Food dietary consumption measured in kilocalories per adult equivalent indicates the warning for the problem of undernutrition or obesity (FAO, 2016). (2) The Reduced Coping Strategy Index (RCSI) is also an indicator of food insecurity. It composes the frequency of each strategy, and their severity for households reporting food consumption problems (Sassi, 2021). RCSI is calculated based on the food-related coping strategies applied during the last 7 days before the survey. Higher CSI indicates a worse food security situation, no or low coping (0–3), medium (CSI = 4–9), and high coping (CSI \geq 10) (CARE, 2010; Maxwell, 2008).

For the matching quality test, the neighbor matching algorithm with bandwidth two estimators fits all good matching qualities implying a high balancing of the covariates. Using minimum and maximum propensity scores, the common support region is determined. In this study, we used the t-test as it is preferred if the evaluator is concerned with the statistical significance of the results (Khandker et al., 2010).

Finally, sensitivity analysis was employed to verify the existence of hidden bias using the Rosenbaum test (Becker & Caliendo, 2007).

3. Results and discussion

3.1 Household food consumption shortage experience

The bar graphs in Figure 2 represent the farm households that experienced food shortages during the survey year. Overall, female-headed farm households have a higher tendency of experiencing food shortages during the winter season, June to September, above 50% of the sample, facing food consumption shortages. This might be attributed to the fact that during the winter season farm households do not harvest. Besides, about one in five sample households (20%) failed to feed their family from May to July, a period when farmers were ready to sow and cultivate the early matured crops. In contrast, a small proportion of the farm households experience food shortages from December to February, followed by September to November, the season of harvesting early mature crops.

The survey result shows that the failure of the PSNP beneficiary household to feed their member is relatively lower than non-beneficiary farm households during the months of June to September, May to July, and December to February. Specifically, PSNP non-beneficiary farm households fail to feed their members more than beneficiary farm households (from March through May).

Figure 2. Household food shortage experience.

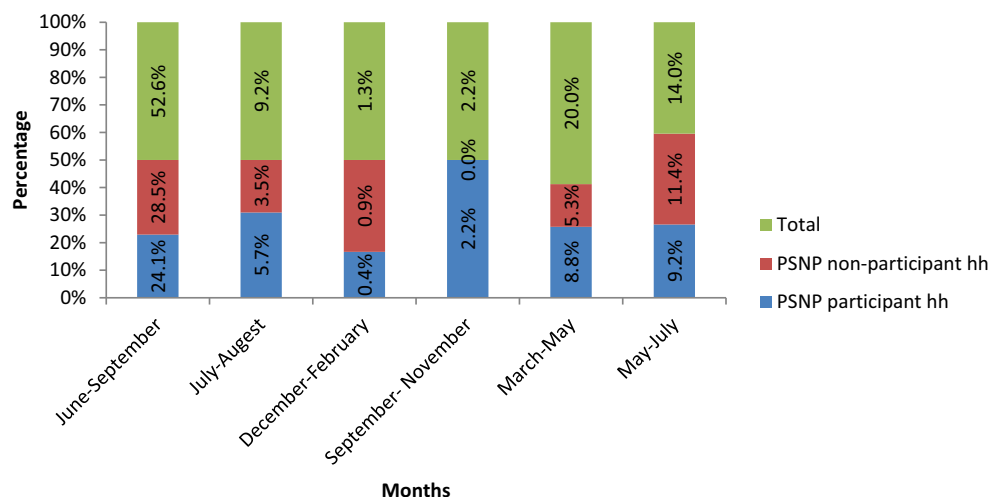
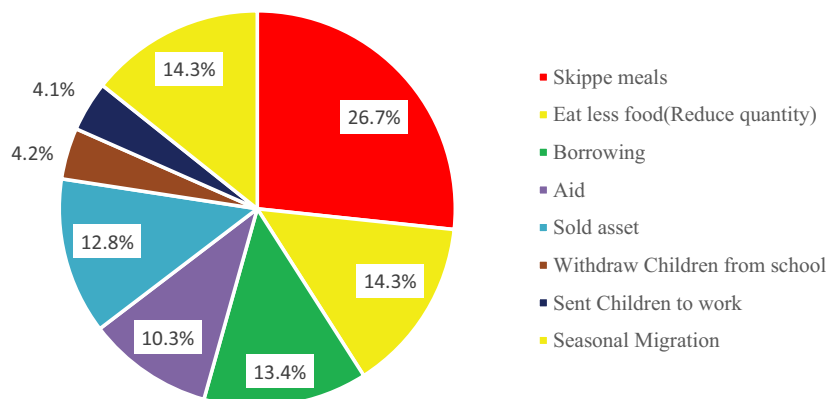


Figure 3. Coping strategy for food insecurity.



3.2 Coping strategies of the households

The pie chart in Figure 3 illustrates, in percentage terms, the farm households set the strategies for coping with their consumption in the Ebinat district of Ethiopia. The dominant tactic that the farm household uses to cope with consumption stress is skipping the meal by the farm household which accounts for 26.7%. The widely used coping strategies to cope with the food consumption problem were eating less food and seasonal migration at 14.3%. In contrast, the household rarely uses sending children to work and withdraws children from school to cope with food consumption strain.

3.3 Estimation of propensity scores

The result in Table 1 indicates that, jointly, all estimated coefficients are statistically significant with LR statistic p-value less than 1% and pseudo-R² value is 50.81%, which is high for cross-sectional data.

The estimated result revealed that factors such as spouse status of the head, age, education level of the household head, farm experience, agricultural training, saving experience, distance from the center of the city, dependency ratio, and per capita income are significant predictors of participation in the PSNP program. On average, female-headed households with spouses have a 70% greater chance to participate in social protection (productive safety net) programs. The reason might be because the family led by the couple has the potential power to make a reliable decision and have an opportunity to diversify agricultural risk by engaging in heterogeneous

Table 1. Logistic regression result for propensity score estimation

PSNP	Coef.	MEF (dy/dx)
Spouse status	0.705	−0.084
age	0.143	0.04*(0.01)
Education level	−2.172	−0.4185
Farm experience	−0.067	−0.0002
Agricultural training	2.38	0.53*(0.1)
Petty trade	0.29	0.07(0.45)
Land size	−0.93	−0.23**(0.14)
Extension service	−0.42	−0.1(0.18)
Distance from health center	−0.07	−0.02(0.11)
Saving experience	1.62	0.38*(0.1)
Distance from city center	0.1	0.02**(0.01)
Dependency ratio	−0.42	−0.11**(0.05)
Per-capita income (PCI)	0.004	0.004**(0.0)
_cons	−6.147	
Number of observations	227	
LR chi2(13)	135.61	
Prob > chi2	0	
Pseudo R2	0.4309	
Log likelihood	−89.535869	

Remark: ++ indicates dy/dx is for discrete change of dummy variable from 0 to 1; and *, and ** indicates significant at 1%, 5%, and 10% significance levels, respectively

farming activities. Thus, they tend to be food secure with a low likelihood of participating in safety net programs and become lower relative to women who live with a spouse.

The result also shows that the age of the household head is positively associated with the likelihood of being a PSNP program participant, and it is significant at 1%. The higher age of the household indicates the low working capacity of the farm household head (quality of household labor), which exposes them to farm risk and being self-insufficient in food. The estimation result shows that other things remain constant, one additional year on the household head age increases the probability to participate in the PSNP program by 19.6%.

The results also show that the education level of the household head negatively affects the probability of participating in rural PSNP. A household with a more educated head tends to improve living standards with better smoothing consumption. Thus, literacy enables the household to foresight the economic situation and diversify farming activities. The estimation result shows that, ceteris-paribus, additional years of schooling of the household head decrease the probability of participating in the Rural Productive Safety Net Program by 44%.

Moreover, farming experience owned by the farm household negatively affects the likelihood of participating in the safety net program and is significant at 1%. Higher farm experience of farm households enables them to set coping strategies for farm risk and is able to adopt technology for improving their food security status as a result of increasing farm productivity because of learning by doing. Other things remain constant; increasing farm experience by 1 year deteriorates the probability of farm households participating in the safety net program by 11.4%.

The result also found a positive relationship between distance to the health center and the probability of participating in the safety net program at a 5% significance level. The lack of a health center and distance from it hamper the health status of the household. The result implies that those farm households far from the health center are more likely to participate in the safety net program. Thus, a one more kilometer distance of a health center from the household's home increases the likelihood of participating in the PSNP program by 20.5%.

3.3.1. Distribution of Propensity Score Matching

Even though the propensity score distribution of PSNP participants and non-participants is skewed, it is possible to see a substantially wider distribution of propensity scores of both group shares in common (Figure 4).

The mutual support region ranges between 0.0316412 and 0.9773354 and deviates out of the matching sample observations with the propensity score matching below 0.0316412 and above 0.9773354. Based on the min-max criterion for determining the common support region, out of 227 sample households, only 197 (100 controlled and 97 treated) samples were on the support region from the analysis (Table 2).

3.3.2. Matching Algorithm

The matching algorithm, nearest neighbor matching with two distances from the propensity score values, fits the entire three criteria of an insignificant mean difference of covariates and low pseudo-R2 with the large-matched sample. Hence, for this study, nearest neighbor with two distances is the best matching algorithm with 197 matching observations from 227 observations.

Therefore, the estimated results of this study use the nearest neighbor matching algorithm with two distances from a propensity score of 197 matching individual household samples out of 227 observations.

3.3.3. Balancing Test of Propensity Score and Covariates

Before matching, all the standardized bias difference in covariates is above 20, which indicates differences in this covariate between the treatment and control group. But, there is no significant difference in covariates and propensity scores between treated and control groups after matching.

Figure 4. Kernel density distribution of propensity scores.

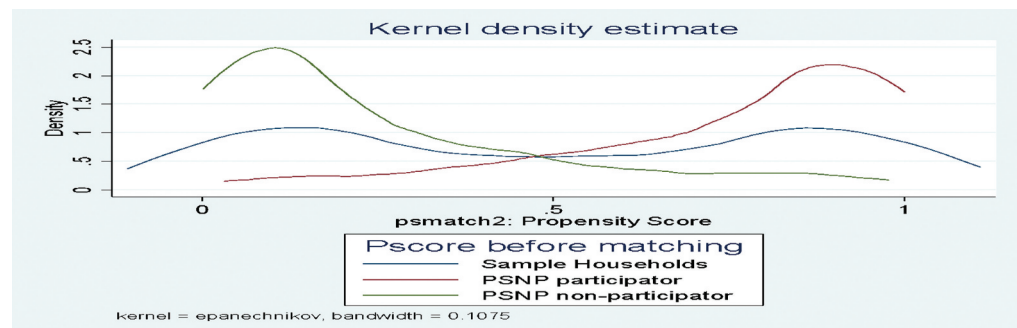


Table 2. Distribution of estimated propensity scores

Groups	Obs.	Mean	Sta.dev.	Min	Max	Off support
All sample	216	0.5022026	0.3534908	0.001778	0.9999067	30
Treated	110	0.7549754	0.2450988	0.0316412	0.9999067	17
Control	106	0.2471929	0.2467538	0.001778	0.9773354	13

Table 3. Impacts of Program Safety Net Program on beneficiary households

Outcome variables	Treated	Controls	Difference	S.E ^B	T-value
KCal	2027.01	1685.86	341.15	24	14.21
RCSI	31.26	37.79	-6.52	2.2	-2.98

^BStandards for bootstrapped error which is obtained after 100 replications.

Matching quality was checked using a standard bias test, t-test, pseudo-R², and insignificant likelihood ratio test. All these tests confirm that both groups (i.e., treated and monitored treated) have the same covariates after matching. Hence, based on the partial and combined test of covariate and propensity score balance, there is no significant mean difference between beneficiaries and non-beneficiaries. Hence, it is trustworthy to estimate treatment effects based on the available data and the chosen matching algorithm (nearest neighbor distances from propensity score).

3.3.4. Impacts of Program Safety Net Program on Female-Headed Household Food Security

The propensity score matching result in Table 3 shows a significant difference in food security status between the beneficiary of rural PSNP and non-beneficiary female-headed farm households. For instance, looking at food energy consumption, on average, the adult daily calorie intake of PSNP beneficiary female-headed farm households is higher than non-beneficiary households by 341 kilocalories per adult equivalent per day. Even though the average energy consumption of both groups is by far lower than the daily calorie minimum requirement of 2500 kilocalorie intake per day (IFAD et al., 2019), calorie deficiency is severe among non-beneficiary female-headed farm households. The reason might be that PSNP beneficiary households can safeguard their food consumption by producing more by using a productive network. Hence, PSNP enables the reduction of food insecurity (energy intake) problems in the study area. The result is in line with the findings of Azadi et al. (2017), which study on the impact of the food aid program in Tigray, Ethiopia, but contrary to the findings of Del Ninno et al. (2003) that study the impact of the food aid program in Bangladesh and the findings of Adugna et al. (2020) that explore the impact of PSNP on food and nutrition security.

The result also shows that the coping strategy (i.e, the frequency and severity of coping strategies like relying on less preferred and less expensive food, borrowing food/relying on food to help limit portion size at meal time, restricting consumption, and reducing the number of meals that the household used in the 7 days prior to the survey) between PSNP beneficiary and non-beneficiary female-headed households is significantly different. The coping strategy index of PSNP beneficiary female-headed households is lower than non-beneficiary households by about 6.52 units. The result implies that, compared to its counterpart, PSNP-beneficiary female-headed farm households adopt lesser mechanisms to cope with reduced or declining access to food. Thus, the coping strategy index of the non-beneficiary female-headed farm household is higher, which shows food insecurity is severe in PSNP non-beneficiary female-headed farm households and they are struggling to reduce their vulnerability due to food shortage. The possible explanation for this might be that PSNP beneficiary households tend to receive productive assets further they gear to produce more and cope with their food decline via consumption and smooth their consumption by retaining their assets for further production.

The estimation result of sensitivity analysis shows that the upper-bound significance level (p-value) is significant ($p < 0.05$) at different sensitivity parameters Γ , which shows that the estimated result is insensitive to selection (hidden) biases. Hence, the sensitivity analysis result shows that the inferences on the impacts of PSNP program participation on female-headed households' food security are insensitive to hidden bias (unobservable characters).

4. Conclusion

Food insecurity and malnutrition remain the main policy challenges in Ethiopia. This study evaluates the impact of a Productive Safety Net Program (PSNP) on female-headed household food security using a propensity score matching method on 227 female-headed households (112 controlled and 115 treated) in Ebinat district, Amhara National Regional State of Ethiopia.

The econometric result shows that the likelihood of the household to participate in PSNP is influenced by covariates such as spouse status of the head, education level of the household head, farming experience, training on agricultural activities, distance from the health center, saving experience, distance to the city center, and dependency ratio.

Although PSNP beneficiary and non-beneficiary households have the same socioeconomic characteristics, the food security status of PSNP beneficiary households was found to be better than their counterparts. On average, PSNP-beneficiary female-headed farm households enjoy higher food security status (higher energy intake and lower coping strategy) than non-beneficiary female-headed households by about 16.8 and 24.74%. Hence, the propensity score matching result shows that the PSNP plays a vital role in improving the food security of female-headed households in the study area. The sensitivity analysis test result shows that treatment effects were insensitive to the hidden biases.

Since participating in PSNP improves the food security of female-headed farm households, policies, and interventions of development agency quest to eradicate poverty in a rural area should incorporate strategies of expanding productive assets to female-headed farm households as part of their aim. Further research should consider the cost-effectiveness of the impact.

Acknowledgments

We would like to extend our heartfelt gratitude to respondent farm households for their kind cooperation in providing data for our study.

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Citation information

Cite this article as: Does Social protection improve female-headed households' food security in Ebinat district, Ethiopia, Belainew Belete & Tadele Bayu, *Cogent Economics & Finance* (2023), 11: 2210854.

Notes

1. Beneficiary (treated) households are female farm households who receive the PSNP Benefit package..
2. Non- beneficiary (control) households are female-headed farm households that don't receive any social protection grant..

Disclosure statement

No potential conflict of interest was reported by the authors.

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